PRESENTER: All right. Let's go ahead and kick this off. We've got a lot to cover. Hi. My name's Scott DeWoody. I'm the Firmwide Creative Media Manager at Gensler. I oversee all of our rendering technologies at the firm.

And today we're talking about Substance Designer. Anyone use it? Ooh. All right. Anyone not know what it is? Never seen it, never heard of it? OK.

So I had a hard time making this presentation just because there's a lot of information to cover. It's a very complex program.

I will say it does have a bit of a learning curve, which is not a bad thing. Just realize that when you kind of start wrapping your head around this thing it's a challenge. But once you get it it's so worth it because what we're going to be able to do with Substance Designer is-- this is now the start and end of your material creation pipeline.

No longer are the days that you need to photograph a material, scan it into a flatbed scanner, and then go into Photoshop and tweak and make it tile, and yeah. Who does that anyways?

Know the pain I'm talking about, right? That's not just fun. So with Substance Designer, what we can do is we can procedurally create realistic-looking materials like seen in this rendering.

The bricks, the concrete-- this projector is blowing that out like no one's business. Take my word for it.

Let's go to another rendering. Hold on. I've got more. That looks a little better.

OK. So the concrete here, the paint, the fireproofing on the ceiling, the metal air conditioning insulation-- all of that was generated procedurally. I didn't have to do any photo scanning. I just looked at some reference images and I was able to create these.

And the beautiful thing is when you're creating these, you're also creating all the additional maps that go with it. Bump map, normal map, reflection map, a glossy map. I mean, you can control all of these dynamically, and then you can even expose parameters for gaming engines if you want to have users be able to change colors on the fly. Or if you want to make things dry and wet-- I mean, the possibilities are endless.

Now, I'm not going be able to cover all of that today because, I'm telling you, it's a pretty complex program. But I want to give you a nice taste of what Substance can do, and then I'm going to show you how to move it into ray trace engines because although Substance is really, really great for video games-- and I'll touch Unity real quickly and the workflow for the game engines are relatively the same at that point-- but I'm going to show you how to go to things like metal ray, eye ray, V ray.

In my handout, I cover corona, redshift, and f storm as well. I'll even touch on the new Autodesk ray trace engine that ships with Max 2017.

Once we do one or two or three rendering engines, it's relatively the same process. So I didn't want to do all of them because it would just get way too redundant.

But check out the handout because I did do step-by-step step for all the engines that I just listed. So let's see. Here's a few more. More concrete. The wood.

I mean, who likes making wood tiles like that? That is the bane of my existence. When you get a little wood sample and they're like, make this everywhere. And you're like, I can't do that. That never looks good.

So just some examples. And this is a new rendering. This is a draft of mine right now, but what we're going to do is we're going to make that travertine stone on the wall over there. That's what we're going to do today.

But even this marble floor-- and I'll show you that material as well-- that's Substance. I haven't done the leather yet, but we're getting there. The wood that wraps around the top there. That's Substance. And this was all rendered in V Ray.

And so let's just go ahead and jump right in because, like I said, there's a lot to cover today. In also the Classic Downloads, you're going to get all of these templated scenes for each rendering engine that I talked about as well.

So you're to get this shader ball with a few textures. You're going to get the travertine texture as well, so you can take a look at that and download it, play with it, do whatever you want. Make your own substances. Try and load it into the rendering engine of your choice. Like I said, though, it's relatively straightforward.

And then if we have time, I'm going to go and cover a few other little technical things that are

actually all covered in the handout. If we don't get to those last slides, they're given to you as well so you're going to have all this information if we get to it or not.

Usually, you might have heard me earlier, I typically don't do live demos. So I don't quite know how this is going to go just yet. So everyone's in the ride with me today.

So when you open up Substance Designer, this is the UI. You've got to have your graph here, and these are the nodes that we're going to be creating today.

And you link them together-- if anyone's done any kind of visual programming, that's what it is. Dynamo. Grasshopper. It's the same concept. And then eventually we get to the very end of the chain, and we'll have our base color maps, our metallic roughness, and so forth.

You've got your File Explorer here on the left, and then also there is a Library. And this is where all the content sort of exists at ship. So you're going to have all your nodes, functions, HDRs that you can then click and drag into this view port here. And you can change your lighting dynamically like that.

You can also load your own HDRs in. You can create your own tools. There's a ton of free resources online to download.

They have Substance Share, Substance Store, Substance Source, which just came out. Substance Source is now their premium material library that you can subscribe to and have curated content that these guys have created themselves, and they look fantastic.

They are here at the show on the expo floor. So go check them out and say hi. They can show you a ton of other cool things that I'm not even going to touch today because like I said, this application is great.

And they've got two others as well. They've got an application called Bitmap to Material 3. So if you do have existing textures already, that's essentially you can drag those photographs and those textures and it'll generate normal maps, reflection maps, and everything for you based off the existing texture.

And then Substance Painter is taking substance files and you can dynamically paint on a 3D model. So if you're doing asset creation, that's a great tool for that as well.

All right. So you've got-- and we can take a look. So we'll just go through some filters.

There's tons and tons of nodes in here. Like I said, learning curve. Playing with all of these is really the best way. That's how I learned.

In the handout as well, I give you a ton of resources from other artists, and tutorials that you can either watch for free or purchase. They're the ones that I've purchased myself to learn a lot of this stuff. And then again, a lot of it has just been experimentation, downloading other people's Substance files, and trying to reverse engineer a lot of the effects that they've done.

And so this is where you'll find everything. But during the process of this, you're going to see me hit the spacebar a lot. And this is a really nice shortcut.

So once you get really familiar with Substance Designer, I can hit this. These are what they call the atomic nodes. This is all core the core nodes of Substance Designer.

So everything that you've seen make, like, this cloud noise here, for instance, they were all made with these nodes. So these are your core functions that you're going to use religiously.

If you want to find anything else in the library, you just have to start typing for it. So if I do, like, base material, I can pull in a material file like that.

So during this demo, I'm going to be hitting the spacebar a lot to do a lot of this, so I'm not going to go back to the library. But just realize everything that I'm pulling out here is located over here.

And then you've got the nodes again up top. There's a few more UI features. And then what we've got down here is the 3D viewport, so you can load any custom FBX object in here that you want.

And then there are a few preset ones, like this render cube. I can do a cylinder if I want. And you can see that just changes pretty quickly. There's a plane.

And they also have their purposes, and you'll see me-- I'll probably toggle through these a couple of times. It's a good way to check your material a lot.

Let's see. We've got a 2D viewport over here. So if I just double-click a node, you'll see that this is where that bitmap comes up.

So that's a normal map. So here's the rough map. And if I hit spacebar-- and this is a really cool thing-- if you hit spacebar in this view, you can see how it tiles.

So if you need to see how the repeat as going, you can quickly toggle that on and off, which is really nice. And then this last window over here-- this is the Properties window.

If a node has certain properties like this blend node, I can change the opacity on this. So this is where all your settings for certain nodes in the substance itself will come from.

By double-clicking the graph here, I get a base setting where I can add in certain parameters. If I expose anything, those parameters will be located here and then I can change the resolution dynamically as well.

And we'll get into that a little more in a second, but notice I've got two maps running through this-- and I accidentally just set that to 1. But you can dynamically scale this to any resolution you want, pretty much up to 8k.

The 8k maps do take a while to compute, but if you want that resolution you can get it. All right. So let's see.

Let's talk about the 3D viewport a little more. There are a few materials in here. So if we click on the material and go to Default, Definitions-- we're working with physically metallic roughness workflow.

So there are three main workflows in texturing. We're going to cover two. We're going to work with metallic roughness, and then we're going to convert them to what I call reflection glossiness, which is what ray trace engines typically use.

Most game engines-- pretty much all game engines-- do support the metallic roughness, so I recommend just starting here. And then it's really easy to convert your materials over to V-Ray or Mental Ray or any of those engines with this.

Now, you can do the specular glossiness workflow. This one acts a lot like a ray trace engine normally does, but there's a few extra steps to convert your materials.

It doesn't really matter where you start because you can always change later. But just note that depending on what maps you are loading here does depend on the shader that you're using here.

So we're sticking with the physically base, and I'm doing tessellation because this will add displacement to the mesh, if we want to do any of that. Just to note, tessellation is not on a

Mac because it's DirectX space. So if you're using Mac OS, that feature is not there.

And you can also load your custom-- if you do write your own shaders, you can load them in as well. So it's very flexible in that regards.

Lights. I typically don't use any lights. I know we've got this HDR. I just turn a lot of the other lights off, but you can have other point lights in here that you can move around and see how the material reflects. You can see that light-- there we go.

So you can do that if you need it. Camera. Pretty straightforward. I do edit, I can start adding depth of field and other special post-production effects.

And I can also say here-- where it says Use Window Resolution, if I want to make sure it's 1920 by 1080, I turn that False. And you can see it will lock me to that, so then when I save a screenshot it'll be at the resolution I'm working with.

Environment. This is where the HDR is. So you can essentially change the exposure. You can rotate it.

I screwed something up there, but that's all right. And then you can disable it. I like actually working with HDR off. I find that sometimes it's too much and I just really want to see the reflection in the lighting on it, so you can do that.

We've got the scene. If we load in a custom SBX, which let's go ahead and maybe do that now, which is really easy.

So I have an SBX here, which is that shader ball scene. I'm going to click and drag that into the viewport. And almost. There we go. No, it did not like that. Oh, that's why. Turn the camera back on.

So now if I come over here to the scene and hit Edit, notice I've got multiple pieces of geometry. So I've got this fabric on here, so I can actually turn that fabric off.

And then there's that shader that we were working on earlier. And now if I come back to the Scene Explorer-- if I go back to Materials, notice I have multiple materials here now and I can click and drag this checkered neutral-- click and drag that in here and do Grid Checkered Neutral and then that will load that.

Then I take the Macbeth chart and I can do this. And then if this brick is exposed, we can just

load that on the Change This Material. Which I may need.

So if that happens-- if all of a sudden it doesn't show-- if you right-click in the node viewport and click-- sorry. View Outputs in 3D. We'll do Change This Material. There we go.

And so now let's change that HDR because that's a little bit much. This is one of my favorites. There we go.

And so that's pretty much the 3D viewport there. Right? Now, the other last cool thing here is if we go to the render, I'm rendering an OpenGL, which mimics the video game engines like Unity and Unreal.

But Iray is in here as well. So if I click and switch over to Iray, I'm going to render on the GPU. If that doesn't happen-- womp womp.

All right. Let's just pick-- let's just start making a new Substance. We'll get to Iray, but Iray is in there. And it will render with the GPU.

And then the other beautiful thing in Substance is that you can actually create MDLs now, and you can export MDL presets and move them into any application that supports MDL.

So again, that notion that Substance is now your one-stop shop for materials is that I can make a material for Unity, let's say, or Stingray-- Substance support is coming to Stingray-- I can take that, I can export to V-Ray, or I can make an MDL, and if I'm working with Iray or V-Ray that will then support MDL, I can move that material the same throughout all the engines.

And then when I go and take my model that I've been doing the high-resolution renderings and I move that into Unity, I can take that same Substance file that I generated the MDL with and I can move it into Unity, and my materials are all looking the same across the board.

So it's pretty much the one ring to rule them all with materials. That's what we can do here.

So when you open up Substance and you get the new scene, we've got some templates. Now, this is sort of just saying, hey, what workflow do you want to work with?

But what this is really doing is it's just going to create the output nodes for you to get going. You can go ahead and name this, so I'm just going to call this AU 2016.

Size mode. I recommend leaving Relative to Parent. What that means is that Substance

natively looks at the host application as what is its base resolution.

For Substance it's 256 by 256. In other applications it might be basis by 12. Ideally, though, what this means is that when you're in something like Unity, you can dynamically scale the resolution at any time.

So at runtime you can say, if you're here be 512 by 512, but when I'm in this scene be 2k by 2k. And so that's a really nice way.

So leaving it Relative to Parent is what I recommend. And then the format I do 16-bit per channel.

And then pretty much we click OK. And we're using, again, the metallic roughness workflow. So we click OK, and we're going to get a base scene that looks a lot like this.

And let's just do Environment. That looks super bright. And I'm just going to do a rounded cube to start with.

And so a nice way to get going with Substance is something called the base material, which I showed earlier. So if I come down here to Base Material, this loads a really, really nice preset material that's physically based, so you can switch from metal roughness to specular gloss.

And it's got some nice presets, so if you want to work with a dielectric it'll switch things over to make sure that you're still staying in the mode of working with dielectrics. And if you want a metal, you can do that.

So if I want gold, I can do that. And there's a really nice hotkey shortcut here because if you notice, these are all the outputs for this node, and these are all the output nodes we were given.

So we've got a base color, a normal roughness, and the metallic. If I hit 3 on the keyboard, notice this node collapsed to this little green node that says metal.

And if I click and drag this over, it automatically connects those nodes for me. And then they show up here in the view port.

And then with the base material, I can change the roughness value. So we can go really, really matte or super shiny. I'm going to pick another HDR. This one's bothering me.

Let's do this and that. OK. We can add-- they have modes for adding grunge. Oh. That's because there's no roughness. There we go.

So I can dynamically add a little grunge to this and make it a little more dirty if you want. And that's really the base node.

Now, what I like to do, and I picked this technique up from a few other masters of Substance-- again, going back to that handout-- what we can do here is we're going to set this to a dielectric because that's what we're going to make. We're going to make stone.

And everyone know the difference between dielectrics and metals? OK. So pretty much, if it's not a metal like gold, aluminum, and anything like that, it's a dielectric.

So there are certain reflectance properties that have to go with those versus metals. I've outlined all of that in the handout, and it's a lot to take in, but really there are the two metal types. There is a third one-- it's called gemstones-- we're not even getting to get into that.

But keep in mind, dielectrics absorb a lot of light and only reflect the color. Metals will pretty much absorb everything and just reflect one ray, and that becomes the color of the metal.

Again, I cover all of that. And then there's some really, really good documentation on the algorithmics website for a lot of that information as well.

But what we're going to do here is we're going to go ahead and we can we can plug in additional maps to this base color. So I'm going to just expose a height, and now notice we have a plug-in for there.

And with Substance, it's best to work in greyscale all the way up until the end. And just like doing illustrations or photography, or any other kind of art, if your values of your material look well, they're going to read really, really well when you add color.

The other thing, too, is that color in Substance takes a little longer to compute, so you want to save that in a change until the very end. You don't want to introduce too much color early on because of just the calculation time that goes through all of that.

So let's go ahead and get started. So I'm going to start with some noise, and let me back up. This is the reference I used for this material.

And so when looking at breaking down a material, you want to break it into big shapes and

then go into finer and finer detail. And so that's what we're going to do here.

We're going to look at creating a lot of this wavy noise that you see back in here, and there we're going to start adding more of this splotchy look effect, and more and more noise on top of each other.

So let me just get my little recipe because, like a cooking show, we need to have this premade. So we're going to start with some wood fibers.

So we just go ahead and drag this in. If I double-click on this, we can see what that looks like. Now, notice we're working at 256 by 256. I'm going to change that by double-clicking in the grid here, coming up to the Output Size, and if I type in 3 by 3 that's going to give us a 2k map.

Working in 2k is pretty good, and then you can always change this to 4k or 1k afterwards. But 2k gives you enough resolution to really get into this.

Another node we're going to start with next is that I'm going to go into a Transform to 2D. And think of this as Transform in Photoshop, so I can scale, I can skew, I can rotate-- I can do anything like that.

What we're going to do is we're going to rotate this 90 degrees because our noise is going horizontal and not vertical in this here. Be careful with this node, though, because you can easily introduce tiling and seams.

And so if that's the case, there are other nodes to take care of that. But you can see I can come in here, I can skew this, and you can see how the tiling starts to get introduced into that.

So be very, very careful. You can introduce seams with this node, but there are other nodes to clean that up that we actually will probably cover in a little bit.

Now, one of my nodes that I use all the time is something called a directional wart. So we're going to take this, and what this allows us to do is it allows us to plug in another kind of noise, which I'm going to do Clouds 3. All right.

Now, if I plug this in here, we can start to sort of rotate and introduce some distortion into the noise. And then if I take this-- and don't ever be too afraid with sliders. Notice I can go up to 20 with this. I can actually type in 500, and you can start to get some really, really crazy effects. So you see, this is one way to start making the strains in wood. If you want to create any crazy

marble look. I mean, this is one way.

The Distort mode is-- the directional warp is the way to do that. But we're going to leave this at something like 16 to introduce this wavy pattern there.

Another one of my favorites that I like to use is we're going to throw in a histogram scan. And so notice this node looks black at first, but as you move the position over it starts to reintroduce white into the mix.

And this is really nice when you can take certain nodes and you can start to introduce some really, really creative noise bits and whatnot. So things start to look a lot less procedural.

Because that's one thing you can easily do is your material can look very procedural, so you want to start doing things that break up that predictable randomness and you want to introduce a little more chaos. We're going to go ahead and just leave this about there.

And then there's a contrast bit here, too. It's also a good way to make some crazy masks if you need to.

And now we're going to use the one node that you will use religiously all the time, and that is the blend node. This is how you're going to start connecting things together.

Think of it like Photoshop. This is going to be your base layer, this middle node. This is what you're adding on top of it, and then your opacity is the mask that's going to cut out the rest of that.

And you have your typical blending nodes-- add, subtract, multiply, add, sub, and so forth. They're all found here. And then here's an opacity slider.

So we're going to introduce some additional noise now. So I'm going to take something called Moisture Noise, which is a fun node.

And we can see this here in this view port. You can do all kinds of crazy things with this guy. He's really good to introduce some really just sporadic splats and spots.

And we're going to go Transform 2D again. And this time I'm going to do the width out by 500 because I want to get this crazy-looking. And in fact, I actually might do something like that. I want some stretch in there.

And I'm just going to reset this node to default. That might be a little too much. Oops. Let's do 300. All right.

Now, notice we've got scenes. Like I was saying early, this node will introduce seams if you start to do something along these lines.

So we're going to use something called Make It Tile Photo Greyscale. Some of these nodes do have color versions, so I'll do that again real quick.

So notice we have Make It File Taupe. This is going to be the color one. You can tell if a node is color. And to note, too, if you do connect a greyscale node to a color note, it's going to add this gradient map node automatically.

But greyscale node-- their dots are gray. Color nodes are yellow. Nodes that accept both, like this one, will have the half-and-half.

So you can plug either the greyscale or the color in. But once you plug one color in, the other node is going to convert to that, so keep that in mind.

This is why working in greyscale all the way up to the end and then doing a color pass with these nodes is ideal, because you can just keep everything consistent.

So this node has some controls to help with the tiling and some of the distortion here. Again, this is where I just recommend coming and playing with some of this stuff. It's the best way.

And then once we do that, I'm going to go ahead and connect this down here. So I double-click this blend node, and now notice if I decrease the opacity I can start mixing and matching the two together.

So what I'm really looking to do is I'm just looking to add some of this value variation and striation into this. I don't need it to be too much.

And don't be afraid to use a really, really small values with any of these. You just want to add that little touch of something and that's it. It's really easy to get heavy handed, much like using filters in Photoshop and adding lens flares to things.

If you think you've done too much, you probably have and should probably kick it back a little bit. OK. So we're going to use another blend node.

I think I'm making good time. And we'll do another one of my favorites. Fractal sum base.

And this one gives us a really nice fine-grained noise. And you can smooth it out, you can increase-- you can really increase the intensity of that.

Change the values. You can change the min levels and the max levels, and you can really create some really cool-looking noise with this. This one's really flexible.

And so we're just going to leave this at 1. We're going to crank that up a little bit. Put this at 6. And again, I'm still kind of looking at those big, big value variations. I'm not adding too much detail at the moment.

One thing I do want to do, before I do that, is I do want to add another directional warp. As I said, I do this a lot. And I'm actually going to warp the node on itself, and that's going to give me some really cool-looking-- again, those splots. Those random little bits that we're looking-- if I start to zoom in, I don't know how that looks on there, though.

But there's these little blotches and things, and that's kind of what I'm going for right now. We can kind of see that happening there.

And again, we just plug that in. I'm going to lower the opacity a little bit. And we're going to keep going.

All right. So we're getting close to this. So I'm going to move this guy off. I like to work left to right. That's me. You can work any which way, shape, or form. These are just sort of the techniques I picked up. I can put this all the way up here and then drag it down.

And I've seen some graphs that get ridiculous, so don't be afraid to add nodes and do certain things. We're going to do another blender node now. I think you guys are starting to see a pattern here, a little bit?

I'm going to take another Clouds. These are some of my favorite noises. These are good ones for doing things. And we're going to go ahead and just do another histogram scan.

Again, I do this a lot because what I'm looking to do-- I don't want all of this. I just want a little bit of it. So we'll pick up some of that.

Maybe add a little contrast, bring this in, and then really lower this down. Something like that.

I'm going to jump ahead a little bit. So let's go ahead and look at creating these darker areas, these little striations, the cuts in the stone that degrade in a little bit.

So I'm going to go ahead and use Wood Fibers 1 and not 2 this time. And I can't give you a really good rhyme or reason why I'm picking some of these nodes.

Again, it's going back to that practice and just learning what all of these are, and looking at tutorials and following along, and just getting your head wrapped around that. That's kind of where the learning curve.

Once you start to really learn how these nodes act with each other, and the kind of noises they produce, it just gets a little more fluid for you. Let's see. Histogram. Transform.

And I'm going to grab a Black and White Spots. B&W. There we go. So we're going to do this. We're going to do a histogram scan. I'm going to just do just a little bit now. I don't want much.

Because you can see now I can start to pick out these little nice areas of noise. Maybe something like that. And I'm going to do the same thing to this guy. There.

And then I'm going to add a Transform 2D and I'm going to rotate this guy 90 degrees because I don't know what just happened to him. Here we go. Bring that back.

Because again, the noise is running horizontal, so we're going to do the same thing to him. And then we're going to blend these two together.

So one on top. One on bottom. We'll do linear dodge add. There we go.

And then if we want to, if that might be too much we can make maybe-- grab a Perlin noise zoom. And I can plug this in to the mask.

And with the zoom, the zoom Perlin noise is nice because I can make it really, really big this way. And I can change the disorder a little bit.

And what that'll do is it'll now come in and tone down certain areas and things like that and make a little variation, if you want to. That's a good way to start blocking out and just adding more. Again, more of that randomness and less procedural look because you can then start cutting out certain parts. OK.

And again, now we're going to use a directional warp because these are probably a little too

straight. If you notice, there's some nice waviness and sporadic behavior in some of that.

So we'll come in here. We'll plug in a Clouds 3. But what I'm going to do this time is I will go ahead and crank this up a little bit.

Let's do 50. Change the angle of that. Maybe put that over here.

We're getting some nice waves, but maybe that might be too much. So if you can, on these you can do a Transform 2D and I'm actually going to scale this guy up a little bit.

And that way we get maybe a little more, maybe too much. Let's just bring that down. You can create some nice distortion in the waves that way and just play with it a little more.

OK. I don't need that. OK. So we can add a Levels node onto this. And Levels just works like it sounds in Photoshop.

I can bring that over and crush the whites a little bit, and crush my blacks if I need to. Another good way to make masks. Or if you want to invert this, you can click and drag those two down there.

There is an invert node as well, but we're going to-- let's see. OK. I'll just put that back. And so we're going to leave that noise there for a second because this is going to come into the chain in a little bit.

Right now let's take a look at making some tiles. So tiles are always fun. There's a lot-- I could probably do a whole class on just this node.

We're going to do the tile generator. We'll do black and white. And this little guy gives you a nice start.

You can go in here and you can start creating all kinds of different patterns. In fact, you can even input a pattern if you want to. So coming down to Pattern Type, it's set to brick. I'm actually I set this to square, but if we took a shape node and I made this like a bell, I could plug that in here.

And if I'm change the input to pattern, notice the bell comes in. So you can really start getting creative with a lot of different shapes.

I believe I linked to a really good ornate tile-making tutorial, so if you want to make those crazy

shapes in different tiles there's a gentleman who just put that out that was pretty good. Not too expensive on Gumroad.

But we're going to go ahead and just stick with squares. And one thing we're going to do that's pretty cool is I can come down here-- and I always lose it.

Lumens variation. So I want to come in here and I'm just going to crank this guy up. And now notice, each square gets a different level of variance.

And I'm doing this, and your first intention might be to maybe come in here and turn down the scale a little bit so you can start getting the grout lines, or the separation. We're actually going to introduce that differently, and I'll show you-- and it'll make a little more sense in a second why we're going to do it this way.

But if I come in here and I take an edge detect, what that will do is it's actually going to detect all that contrasting edges and then create a line around it. Now, this also gives us a nice little rounded corner if you want that as well.

Some objects do have that, but you can come in here and really shrink that down. Again, don't be afraid to do small values if you really need to. But this is also where resolution starts playing a bit, so like when I was saying working at 2k because if you don't work at 2k and you work at maybe smaller, the edge detect is going to look a little different.

Now what we're going to do, though, real quick is we're going to drag this up here briefly. And to show you where I was going with why this node is because you want to use as few nodes as possible, but you can also-- remember, you can reuse nodes over and over and over and over again. That's the beauty of node-based editing.

So we're going to do a directional work, and this is a cool little trick that I found on the algorithmic forums, which I recommend reading. We can plug this greyscale in up here. And then if I crank this up to something like 500 and I do this, now notice the noise is no longer going across the same.

And this is going to be really important because if I do something like this, or we take a blood node and I plug this edge detect in on top here, and we do multiply, notice the noise seamlessly runs across the tiles. And that's not how this works. Every tile is individual, right?

So if I go ahead and delete that, this is what gives us that ability. So now if I go ahead and take

a blend node here-- we can illustrate that a little better. If I do multiply-- now we've got that separation. Each tile is now randomly different. We're still using the same base noise across it, though, so you get that, again, variation and less procedural look.

And then we're going to do the same thing with these little flakes up here. We're going to go ahead and grab another directional node, or directional warp. Sorry.

I'm going to take, again, that same tile thing that we're driving earlier. All right. So if you just did what I did and accidentally plugged these noodles into the wrong slots, if you select both and hit x, it will invert it for you.

So there is that. Another good little trick, too, since we're here and I'm talking about hotkeys, if there's a node getting in the way and you want to clean up your graph a little bit, if you hit D it'll dock it to the next node. So it's just another quick way if you-- a level might not be something that you really need in the way, so you can hide it if you want.

All right. So now, the reason why we did it this way is we had to have-- we needed to create this guy to offset because if we add these guys in later and we're going to be making some color masks, it's important to offset this noise here and this noise here first because now, when we add them together and we start doing some other masking later, it'll all relatively stay the same.

And the beautiful thing is, too, now, if you have other tile patterns you want to create, you can actually create a switch node-- and I'm not going to go into this today, but there's documentation online-- you can create circle tiles. You can create star tiles. You can do whatever kind of patterns you want.

You can create a switch node, expose that parameter, and then at runtime in a game engine you can slide a slider and the substance will update that pattern. And you're going to see everything updating down the chain, which is some of the real power of where this application comes into play.

All right. So now we're going to add these two guys together. So we're going to take another blend node.

I'm going to choose that guy here, and I'm going to do Subtract because I want this noise to be black, and you'll see why in a little while, but that's just one of my preferences.

And now you can see how that's going, but that noise looks maybe a little too big for what we're doing. So we can come back here. Whoa. Calm down. Stop it.

Do a Transform 2D. And then I can just sit here and shrink this a little bit. And that's looking pretty good.

And what we need to do is to come back to this directional node and change the-- I forgot to do that. And now we've got random spots going across.

All right. So I'll show you another one of my favorite nodes, and we're going to come back down here to the edge detect. This one is called slope blur.

And what we can introduce with slope-- oops. That's not what I wanted. If you need to go backwards like I just did, with that for some other reason-- if you need to take a node and reconnect it back or-- hold Shift and then grab the little circle, and you'll be able to reconnect.

Trust me, you're going to want to do that because for the longest time I was struggling with that. I'm like, I've seen people do this and I can't-- and then one day I found it and I went, all right. That's better.

So the slope blur. What we're going to do is we're going to actually introduce some chipping away at this tile now. So let's just say it's not perfect, right? Nothing is extremely perfect.

So let's go ahead and grab a Clouds. Let's do Clouds 1. Plug that guy in. And at first it's not going to look great. You can up the samples a little bit and then bring this intensity down.

And again, notice how that starts to look like Chip Away. But you're going to probably use really, really finite values with this.

And now notice we just got that little bit of variation. I mean, if you really want to chip this away, though, like some people-- you're really trying to create that really broken tile-- you can.

And then we'll set this to minimum. So you can see it's no longer affecting inside the grout because then the stone looks like it's coming in and that's not how this works.

You can do min and now notice the variation goes just inside of the mask. And that will be important.

Then I'm going to go ahead and we're going to create a level's node here. Because what I'm

going to want to do is I want to go ahead and just set this aside, And I want to make another mask so we can work specifically with the grout, and then we can also have a mask to work specifically with the tile.

And then this is going to be a blend. I'm going to add another blend node. I think I'm running behind now, so I'm going try and speed up a little bit.

Everyone seeing the pattern here, though? We're introducing detail, using blend nodes, distorting it-- it's rinse and repeat for that. I mean, it's pretty straightforward once you get the groove going.

I'm just going to do a [INAUDIBLE] white spots. And so what I'm going to do here is I'm just going to introduce some noise variation into the grout for later.

So we can have some normal detail, we can have some glossiness detail here, or we can do some coloring with it. And once that's been done, I'm going to make one more mask.

I'm going to come back up here to this directional warp, and now that we've set aside and we've randomized that noise a little bit, I'm going create a level's node.

This is, again, going to be a mask, so I'm just going to clamp down on that. We're going to use this for coloring. And so you can go ahead and set these nodes aside and reuse them in a little bit.

So now that we're pretty much ready to go, I'm going to bring this guy back over. I'm going to reconnect him. And now we can start to see in here-- come on.

Sorry. I was on the light again. You can come in here and we can start to see the detail we did.

Now, that's way too shiny right now. So I'm going to come in here and I'm just going to turn the roughness down. We'll leave it.

But now from this base node, we can actually control the normal intensity. So if I come down to Normal and I click 5, we can really crank that up.

But that's not what we want. This stone is relatively smooth, and it's pretty much just these little darker areas that come in.

So we're not going to use the normal map coming from the base material. We're actually going

to go ahead and create our own normal map.

So I'm going to drag this guy down here. And how we're going to start that is we're going to turn-- I've got to think about this for second.

So you can take a normal node and this essentially takes a greyscale input and then converts it to a normal map. So we're going to go ahead and do that for our grout lines, and we can see now we've got normal there.

If the transparency here bothers you for some reason, you can come in here and take a levels node, go to the alpha channel, and kill that. And then you've got a normal map that you're not used to seeing.

And then what we're going to do is I'm going to take-- actually, that's it. And then I'm going to take another normal map from the spots because this is where that's going to be coming down.

So I'm going to drag that mask that we created earlier. And then I'm going to take a normal combined like that.

And much like the blend node, you can start mixing and matching two normal maps. So there and there. And then you plug that into your normal map, and there we go.

Now, we actually need to invert these, so I grabbed the wrong mask. So let's just do this. Like that. There we go.

And I'm going to create an additional levels node right here for an inverted mask of the little cutouts. So let me just invert that. There is an invert node, too, if you want to use that. I just got in the habit of doing it with the levels. It's really no different.

I'm going to plug that in there. There we go. And those lines go in. And so now we've got our normal map, so the stone is pretty flat.

And I've got additional grunge in here, which I don't want, so I need to come back and take that out. Which gives us a little more of a smooth surface.

But you can add it in a little bit. I actually kind of like that now. And then we can maybe make this stone a little shinier. Right? I mean, that's the power.

So now if I want to change anything down here-- for instance, if we pick a new noise-- oh, let's do crystal for the hell of it. If I take that and I plug this guy in here, notice how everything is changing, and then this is going to spit out something relatively new, though it's not plugging into our normal map.

So let's grab this blend map, and you can see if I undo that what the difference is. And you can create switch nodes, and you can do all things. You can give options to people. You can expose all of that.

The possibilities start to become endless when you start looking at this, and some of the materials I have seen other people made blow my mind. You would think they were photographs scanned and all that.

It's really fun. This application-- I've spent a good long few hours at night and not realized it. And it's like, oh, it's 2 AM? All right. Well, let's keep going.

All right. So I'm running a little behind, so I'm going to touch on color briefly and then I'm going to do the cooking show thing where it's pre-baked and we start looking at the render engines and things like that.

So one of the beautiful things that I love is this gradient map node. This guy is really cool.

So I'm going to hit 1 on my keyboard to bring this back out. And I'm going to take the height map that we are generating, as it's greyscale, I'm going to plug it into this guy here.

And this node is where it gets really, really cool because, looking at the values of this height map-- let's just go back here for a second-- these are now going to correlate. Where this is black, that's white, that's 128 gray, and so forth, that's what's going to correlate to this gradient ramp right here.

So if I come in here and I take what's black and I make it red, anything else that's got that value is going to become red. OK?

And I'm actually going to throw a bit of a levels node on here because I notice this is a little washed out. So let me just go ahead and grab that node there. Hit levels.

So if you grab a noodle, highlight it, and then type in the node you want, it'll connect it for you so you don't have to keep manually doing it. It's really smart and intelligent that way.

And I'm just going to go and hit auto levels, and that should do it. All right. And so what I can do then is, if I start introducing another color, I can clamp that a little bit. And then if I want to make this blue, for instance, right?

You can see how this node starts to become really crazy. This is how you start to make wood, in that variation of the colors of wood. Some people put millions and millions-- and the other really cool tool I like in the gradient node-- and I'm going to move this guy over real quick.

No. To the side. Thank you. I'm going to go ahead and pull up our little sample.

See this pick gradient tool right here? I'm going to click this and-- oh no. I forget, it doesn't like 4k screens. It has an issue with that.

What I can do-- and I'll go ahead and just do an example here-- if I click and drag over these colors like this, it's going to create a gradient from the colors I've selected, which is really powerful.

Yeah. You can go to town with this. It's a good way to start. Sometimes it will give you a little too much, and you'll want to come in here and start picking out the colors you don't want, or if you want to change anything, but this is really cool.

Let's just go ahead and take a look at-- I'm going to do-- so we'll go ahead and take a look at this. This is some wood tiling I made.

Again, like I was talking about, how many people hate making these wood tiles? It drives me up the wall, but now I can do that.

Now, notice even with a reflection, I've got different levels of glossiness across the board. And again, going back to that one node where it's like, OK, this is that black and white version and it's driving all of that as one node.

If I change this-- if I give it more tiles or less tiles-- all of that's going to update. Where was I going? Oh, I was going with a gradient.

OK. So let's go ahead and look at the color here. So I've got the levels, and here's my gradient map for this. So if I View Gradient Editor-- and this is now driving the greyscale version of this.

The other cool thing, too, is notice I'm having to double-click to select a node like this. If you want to make an adjustment and view another node at the same time-- for instance, let's say--

I can single-click and then I can start making adjustments.

This isn't really the greatest example. Well, let's see if I come in here-- OK. So if I double-click this node here and I single-click this level node, realize the first node I double-clicked that I'm wanting to see the preview on is visible and I can come in here and I can change the levels node, and I can see how it's affecting the other node that I want to see how it previews on.

So just note, if you want to double-click on a node to edit and preview, it's double-click. If you single-click a node, you're still technically previewing the other node you were previously on.

And that's how that's done. And so here is a really cool thing, and I was going to show this on the stone, but let's just go ahead since this is done.

So we got that. And one thing I love to do to start introducing variations of color, now-- and this is a really cool trick I picked up at Substance Days-- you start with this gradient node, and then we can add a hue saturation mode on top.

You can blend the two together and then use a mask to control how that color is. So if I double-click this node and would click here, and if I just start really changing this-- so you can see how you can start introducing crazy variations of color.

Now, no one wants to do that, but you can start to add just that slight variation. Again, it's breaking up that procedural effect.

And you can see, this one is super reds. If I come down here and we take a look at this node, it's subtle, but it's there.

Maybe if I invert these a little bit you can see it better. No. But it's there. The wood I was looking at had these really nice red hues that flew throughout.

So with that being said, let's say you're done with this material. How do I get it out?

Also to note real quick is that you're not limited to these output nodes. You can create a new output node.

So if you hit space and come down to output, right here under Usage it says Add Item, and then you can name this anything you want.

So for instance, if you wanted a height map for some displacement, that doesn't come by

default with the template, but all you would need to do is pick Height from here. Call this Height.

And now if I plugged in the height map down from here and then I went to Materials, Default, Edit, this is where you can find the displacement. So I can update the tessellation factor of the mesh. And then here's the scale.

And I probably need to, say, right-click output nodes to view how that displacement is working. And you can kind of see it if I crank this up a little more. And maybe really do it.

That's too much, but you guys get the idea. That's how you can add the displacement I was talking about earlier.

And if you want to tile, too, you can find that. So that was, again, Materials, Default, Edit. And then I can tile the texture on here and see how that works.

So let's say we want to go ahead and now move this out to another engine. And So let's say we're going to go to Unity.

If you right-click on this package over here and do export.sbsar, that's how we do this. We're going to go ahead and we're going to make a new little file, and I'm just going to put it on my desktop at the moment.

I'm going to call it that. I'm going to hit Save. If you've exposed any additional parameters-- maybe you had, again, different tile patterns you wanted to do, if you wanted to add wetness, you name it-- those would be listed here, and you'll check which ones you want to go with the package file and you click OK.

And that pretty much just spits out a brand new little file right there. Now, inside of Unity it's super easy to bring it in. All you have to do is click and drag it in like that.

So for Unreal-- if you're using Unreal-- you have to make sure you download the free Substance plugin from the Unreal assets store. That's the only other additional step. Otherwise, you click and drag it in Unreal and it works the same way.

I have been told-- I haven't used it with Stingray yet, but I've been told it's the exact same workflow. So I just picked Unity to do this in.

And now we've got our little Substance material right there. You see the little red flame. If I

drop that down, we've got our outputs that came with it and then we actually have the shader itself.

So don't click and drag the actual Substance file into the viewport. It's not going to do anything. You have to click and drag the material like so. Like that.

And then if I double-click this and I come over to the Inspector, I can do the tiling offset to, let's say, like 3. Right? And then now that's my wood floor in Unity. That's how easy that was.

And then you can come down here, and I can override. So by default it's at 512. If I want that at 2k by 2k, I'm compressed because I'm not making a game.

Don't fail me now. And now our texture is at 2k by 2k. So that's unity. Pretty straightforward. I'm not going to spend too much more time on that.

But let's go ahead and take a look at some of the heavy hitters. So let's look at V-Ray at first. Right?

So to get out, V-Ray doesn't support roughness or metallic. Again, this is what I was going back-- so we're working in the metallic roughness workflow.

That's not unique to games anymore, and I'll get to that, but we're now looking at-- oh, I am running out of time. We're looking at ray trace engines, so we need to move to reflection and roughness.

So the guys at Algorithmic have made a little tool. So if I want to make a new graph by clicking on the package, going to New Substance Graph, I'm going to click Empty, and I'm going to leave it, again, relative to the parent. 16-Bit. Click OK.

This is where we need to reset the resolution of this graph to zero because when we bring it into the next graph, it will automatically come in at 2k and then when we try to resize this graph we'll double up on the original node. So it'll become 4k feeding it into-- it gets messy, so just make sure when you start moving graphs around that you zero them out a little bit.

So I'm going to click and drag this graph into here. There we go. I'm going to type in Convert. And there is this base color metallic roughness convert node here.

And we're going to switch this from Target from PBR to fuse specular gloss, which means if you're working in spec gloss and you want to convert to metallic roughness, you can use this

node. Or if you notice, we have V-Ray, Corona, Redshift, and Arnold here.

For the most part, we're going to use V-Ray. If you're going to use Corona, use the Corona 1. If you're going to use Redshift, don't use Redshift. Redshift changed their material to metallic roughness now, so their shader in Redshift supports the metallic roughness workflow. So when we go to art in a second, we're not going to do this little convert node. We can actually just export the outputs here into bitmaps and then plug them right into Art and Redshift and anything that supports metallic roughness.

So we've got that, and I'm going to hit 3 on the keyboard to move to Material mode. I'm just going to go ahead and click and drag that into here, which gets him ready.

I'm going to switch this to V-Ray. You can use the V-Ray preset for Mental Ray and Iray as well. And honestly, in most other rendering engines the V-Ray preset will probably work just fine.

Because at the end of the day, there's only three properties that you really need to pay attention to. Fuse, Reflection, and Glossiness. And all materials have some form of channel for that.

And once we have that, I'm going to right-click on this guy and this is where it gets a little easy. I'm going to do Create, and I'm going to do output nodes.

And it's going to ask me, do you want to create hidden connectors? And just say no. And it generates the diffuse map. No longer base color. So now diffuse.

We've got the reflection, which is pretty much always going to be pure light, unless you're making a metal and then this is the color of the metal. We have our glossiness map, and we have the index of refraction map.

So I'm not really going to use the IOR map because it's one material and I like setting the IOR in the shader itself, but if you're mixing and matching metals and dielectrics together in the same substance texture, you are going to need this because that's going to tell the shader what's metal and what's not, and how reflective one surface is against the other. So this is an important map, but we're not going to deal with it today.

Again, we're just looking at Diffuse, Reflection, and Glossiness, the three properties that every single material needs. So notice everything is at 256, including our little base material we

brought in.

I'm going to upgrade this to a 2k map. And then we're going to export. We're going to click this little gear. We're going to do Export Outputs.

And here you can pick any format you want. I'm just going to go with jpeg for the moment. And we're going to dump these.

Let's do just on the desktop. It's fine. I'm going to hit Save All. And if we look at the desktop, there they are.

Now, we called them New Graph. You can name them and add other variations, but on the case of time, I'm going to open up Material Editor here in V-Ray.

So we're going to do Diffuse, General Bitmap. We're going to pick that map there.

I'm not going to load in the reflection map because it was just a solid color, so to save on memory I'm just going to leave that white like I have here already. But in the glossiness, we'll go ahead and load that bitmap in.

Now here's the key part. In Max-- and I'm getting ahead of myself-- in Max, you have to make sure that your gamma and LUT is set up like this. It should be by default in 2017.

Reason being is that diffuse maps are in SRGB. Their gamma has to be converted, and I cover this in the handout a little more in-depth.

But maps like the reflection glossiness, normal maps, things like that, they have to come in linearly. And this is for every single rendering engine. This is not just V-Ray.

And so in Max, we'll have to tell that as we load in the map by clicking on our map and not picking automatic, but by clicking override and making sure this says 1. If you don't do this, especially with normal maps, it's not going to render properly regardless of anything you're doing, whether it be with Substance or not. This is just required for the rendering engine to work properly.

And again, that's every rendering engine, whether it be Unity or Unreal-- now, Unity does it all behind the scenes for you. Unreal, you actually do have to specify with the bitmaps what's SRGB and what's not.

And for the normal map, we're going to find Bump. Where did Bump go? Ah, it's up here. For a normal map, for V-Ray at least, we have to load in the V-Ray normal and then we can load in the bitmap.

And I have no normal map. Oh, that's right. OK. So again, we have to make a new output node because with the Converter it doesn't convert normal maps because it doesn't need to.

So I'm going to click that. I'm going to change this to a normal like so. Let's call this normal. Does anyone have any questions? I'm going to start taking questions so we have some-- go for it.

AUDIENCE: Going back a long ways to things like [INAUDIBLE] and more recently, things like [INAUDIBLE] maps that do a lot of procedural map creation and distortion you've shown, they look beautiful in still images, but they introduce huge amounts of [INAUDIBLE].

PRESENTER: Fairly well. I haven't really done too many animations recently. I do a lot of still renderings. But since you say, let's just go ahead and--

[VIDEO PLAYBACK]

[MUSIC PLAYING]

PRESENTER: I'm going to scrub though this a little bit, but if anyone has played any of these games, all of this used Substance.

If it's looking good here, I can only imagine it looks fairly well [INAUDIBLE]. And if anyone is going to play-- what is it, Watchdogs 2? That's the new one that just came out. That's all Substance. Or a good chunk of it is Substance. So you guys kind of get the idea the power behind it.

So again, cooking show-wise--

[END PLAYBACK]

PRESENTER: --I've already pre-rendered a lot of things. So let's just jump into that. So this is what it looks like rendered with Art.

Now, again, I mentioned Art. Art and Redshift both use the metallic roughness workflow, so you can completely skip the converting I did just here.

So in that regards, you can take your node that you were working in-- you've got the roughness map, the metallic map, and all of that already. So you just come up to the gear here and do Export, and you can export all those. And they plug right into their slots as is.

With Art real quick, and I'll show you-- I do have that open. By default, when you make a new physical material, these little two invert nodes might be on like that. That turns it into a specular gloss workflow.

So if you're going to go ahead and use metallic roughness, just make sure that those aren't gray or they aren't blue. And then you can plug the metallic roughness workflow into that render engine.

And so this is Art. This is Corona. This is FStorm. This is Iray. Mental ray. Redshift. V-Ray.

That's pretty much all those. So I'm out of time. I've got to get ready for the next guy. Any last questions? I'll try to answer while I'm packing.

AUDIENCE: [INAUDIBLE]

PRESENTER: Yep. Changes to GDX. Yes. Real quick, I guess I can show that. If anyone's-- make sure you're using the latest version of V-Ray. You'll need the latest version of all these plug-ins to open my files.

But if we come to the shader right here, under BRDF, make sure you switch it from [? blin ?] to the microfacet [? GGRGGX. ?] Thank you. That's what I've got.

[APPLAUSE]