

THE RISE OF SUBSTANCE

Allegorithmic's highly adopted 3D texture software seems to have sprung from absolutely nowhere, but the history of the impressive and user-friendly Substance applications rests in hardcore science

Have you fought the campaign in *Call of Duty: Black Ops III*? Perhaps you've taken aim inside *Rainbow Six Siege*? Or maybe you've become immersed in the universe of *République*? If so, then you've already witnessed the power of the 3D texture-painting software made by software developer Allegorithmic.


Those games are just some of the countless titles from developers, such as Ubisoft, Treyarch and Camouflaj, that have adopted Allegorithmic's Substance tools for 3D material generation and texture painting.

In fact, as the videogames industry continues to push the art in real-time photorealistic characters and environments, nearly all triple-A game makers rely on making use of Substance. But just how did this suite of tools, which is largely made up of node-based texture creator Substance Designer and the parametric 3D texture-painting software Substance Painter, become the global industry standard?

That story begins at the turn of the millennium, when Allegorithmic's founder and CEO Sébastien Deguy was a University of Auvergne computer science PhD candidate. At the time, he was using wavelets and fractal techniques to synthesise natural phenomena like clouds. The result looked great – or so he thought. Deguy's thesis supervisor pointed out that something wasn't quite right – the clouds looked like clouds, but not like real clouds.

That distinction would be critical. Deguy soon figured out that what was missing was a realistic simulation of elements, including wind and gravity in an iterative and 'structurally modifying' process. "I realised that the noise functions that were so important in the creation of rich CGI were not that developed in the most advanced digital content creation tool of the time."

In 2001, Deguy founded Allegorithmic and the company soon developed products, such as Substance Designer, based on the noise function research he had been exploring to enable the



*République by
Camouflaj*

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creation of 3D textures. Built around a node graph with non-destructive capabilities, that product immediately appealed to many artists who were looking for an alternative solution to Photoshop for materials generation.

But Deguy was not done there – Allegorithmic didn't yet have a 3D painting tool. Deguy kept thinking about the clouds dilemma and so, in 2004, he had a trainee write a prototype that "simulated fractures, erosion, dust accumulation, stains and waterdrop movement using a versatile, dedicated particle system."

That prototype was fleshed out a further few years later when Allegorithmic partnered with PopcornFX on a new iteration of the particle system, after Deguy saw what PopcornFX had itself been developing in the area. "I asked them," he recalls, "can your particles stick to a surface if I throw them at it?" That inspired the two companies to collaborate on the particle-based painting feature Deguy had always envisioned.

There was still one more critical step in the process to making what would ultimately become Substance Painter. "One of the talented devs in my team came up with a prototype in his spare time," explains Deguy. "It was a fully GPU-based, multi-channel painting app that was really working well and was super-fast. There was some kind of a planet alignment because such 3D painting functionality was the main, big feature that was missing in the Substance toolset at the time."

It had been more than a decade since Deguy's original research, but when Substance Painter was launched in 2014, Allegorithmic now had an impressive suite of texture painting tools. Despite the lengthy time in development the gaming industry rapidly embraced Substance, for several reasons. Among them were the friendly UI, the highly appealing non-destructive pipeline, that the custom material presets can be shared studio wide for high consistency, and what Deguy suggests are "artist-empowering" tools.



One of the *Rainbow Six Siege* character models in Substance Painter, by Ubisoft character artist Jason Mark

"The tools come with a bunch of new techniques that augment the hands of the artist," he says, "so it is a great feeling to direct the work, rather than having to take care of every little detail and losing the big picture. You can of course paint every pixel by hand if you want because the tools are hybrid. But you can benefit from the tools at your disposal to go faster and concentrate more on your art than on technical details."

If there is one aspect of the Substance applications that has appealed to videogame developers the most, it is perhaps their ability to handle physically-based rendering (PBR) as a default, and handle it fast.

That's exactly what Ubisoft took advantage of in Substance Painter and Designer for first-person shooter, *Rainbow Six Siege*. "Our project demanded realism because it took place in contemporary environments, so we couldn't stylise the game," says Ubisoft senior technical artist Lucas Granito. "We really wanted to create that immersion by getting realistic results."

"We found that traditional software was limiting us in our ability to go full PBR, which means that it was very difficult to get a consistent result between different artists," adds Granito. "Substance allowed us to create the most advanced PBR project to date in Ubisoft's history."

Game developer Treyarch saw benefits in the Substance approach to PBR too, with *Call Of Duty: Black Ops III*. "Being able to create our work in a PBR viewport allowed us to work more quickly and more efficiently," notes Treyarch senior artist Pete Zoppi. "There was far less guess work involved

when authoring our textures because we could clearly see how each texture channel was working on our models. It was efficient and fun to be able to view this information real-time and make artistic decisions on the fly."

"The Reaper in *Black Ops III* is a great example of where Substance Designer saved us an immense amount of time," says Zoppi. "The Reaper had close to 30 materials, many of which needed similar texture and material treatment. We were able to make one graph in Substance Designer for his metallic armour and once we nailed down the look, we were able to propagate that graph to all of the other metallic parts seamlessly and quickly."

"It allowed us," continues Zoppi, "to spend the time upfront on one part of the body and finesse that texture until we were completely happy with it. With that one part approved we applied the same graph to all of the other similar pieces, and we ended up with an [almost] fully textured character in a fraction of the time it would have previously taken."

Another studio that has wholeheartedly adopted Substance is Camouflaj, the maker of episodic stealth game *République*. Originally developed for

iOS and Android devices, *République* was expanded to PC, OS X and PlayStation 4 in 2016. But those expansions required much higher quality shaders than had been realised for the mobile versions of the game to be produced – they needed to be done

quickly inside Unity 5, and this is where Substance came in.

"In less than four months, one of which was the team learning the software and best practices," outlines Camouflaj art director Stephen Hauer, "we were able to process and update over 2,000 unique materials resulting in over 10K worth of unique texture data. Substance provided us the quality and fidelity to be able to hit our aggressive deadlines with time to spare. On top of that, having the ability to create hundreds, if not thousands, of material variations from a single substance file saved hundreds of [working] hours. That's performance and authoring speed you cannot ignore as a game developer."

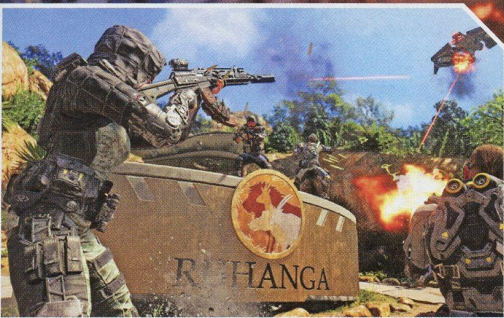
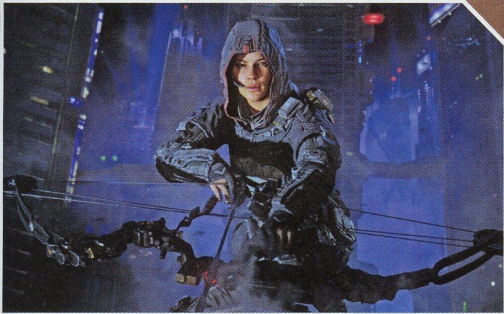
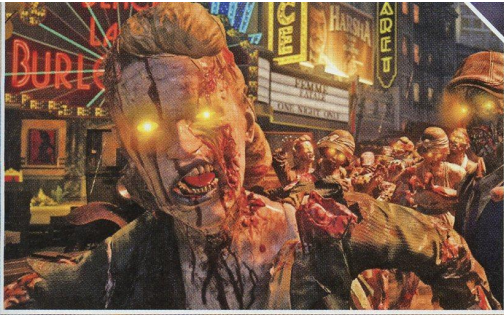
A fast adoption rate in the videogames industry can lead to a nightmare when it comes to training and support, however this isn't true in this instance. Substance's meteoric rise amongst game developers has, according to many Allegorithmic users, been accompanied by strong



PRO TIP

"To create a painted metal surface, start with a metal material as your base and add a paint material on top, then use the layer mask to remove paint in key areas"

Lucas Granito, senior technical artist, Ubisoft



Substance Designer enabled Treyarch senior artist Pete Zoppi to be more efficient with his time

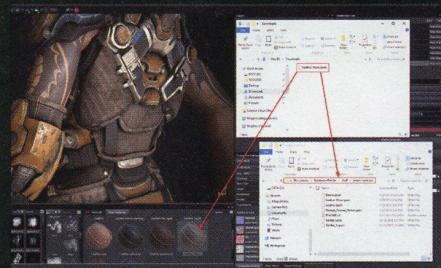
TEXTURE WITH SMART MATERIALS

Allegorithmic community manager Wes McDermott reveals how to get flexible materials with Smart Materials

A Smart Material is a preset of layers constructed from the layer stack in Substance Painter. The layers within a Smart Material are fully editable. Any baked maps that are used in a Smart Material will automatically be updated when the material is applied to a different texture set. This makes Smart Materials very flexible and versatile for use across texture sets and projects.



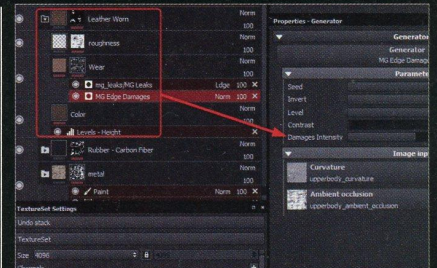
01 Get Smart Materials Substance Painter ships with several Smart Materials in the Shelf under the Smart Materials tab. You can also download free Smart Materials from Substance Share (share.allegorithmic.com) for use in your projects.



02 Add the material to enable access To gain access to the Smart Materials across all of your projects, you can add the SPSM file to the user shelf directory. All that's left then is to physically add them into the project, which we will go over in the following step.



03 Use the chosen Smart Materials Now you can start using Smart Materials; all you have to do is simply go over to the Shelf>Smart Materials tab, and then drag and drop the chosen materials into the layer stack for the currently active texture set.



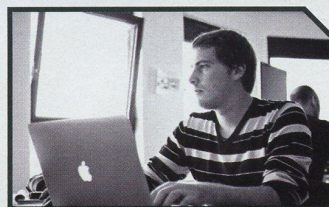
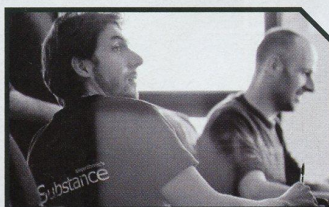
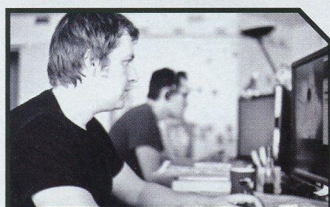
04 Customise the material The layers and content that comprise the material are fully editable. You can easily make changes to any of the parameters, and that includes changing colours, using blending modes or adjusting the values set by the mask generator.



05 Export for engine You can export textures using presets for popular renderers and game engines such as Arnold, V-Ray, Unreal Engine 4 and Unity 5. You can also convert maps and configure custom exports to pack maps for specific implementations.



With offices spanning three continents, Allegorithmic's team is constantly growing



support from the company itself. "When we started using Substance Painter," comments Ubisoft's Granito, "it was an early version, but Allegorithmic was such a great partner and helped us along the way. We were able to fully integrate it into our pipeline in time for full production."

Zoppi had a similar experience: "On many occasions, Allegorithmic visited our studio to inform us of new tools and developments with the software. We have open lines of communication with them for feature requests, as well as bug reporting and overall feedback to help make the software better. Even in the short amount of time that their software has been available we've seen immense progress in feature set and overall quality."

With such an accelerated uptake from games studios, is there anything left for Allegorithmic to conquer? Definitely, answers Sébastien Deguy, who says the company is pushing development in the areas of industrial design, arch-vis, VR and feature films.

"Film studios have been so vocal about their interest in seeing Substance Painter integrate a few features to make it perfectly suited to their needs, [and] we are currently implementing them."

While Deguy is somewhat coy about what we might expect in future Substance releases, he admits that "what still needs to be cracked is

mostly on the [user experience] side, and we have things in the works."

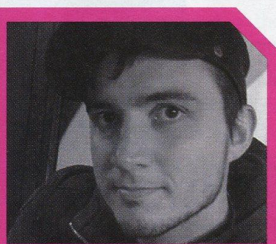
The CEO also says upcoming iterations of Substance Painter will look to make all actions editable, even more than the already comprehensive non-destructive aspects of the software. Another item on Deguy's wishlist is the desire to remove the need for UVs - "if not completely, at least making the process less painful," he says.

Allegorithmic is certainly ramping up with big plans in mind. There are already nearly 60 employees spread between three French locations, the US, Japan, South Korea and China. And in an ever-changing industry, Allegorithmic has adapted its products to suit - last year it introduced Substance Live, a rent-to-own licensing system for its main suite of products.

The company is constantly hiring new members to join the team and is also looking to broaden the scope of Substance in the digital content industry. There's now even an

Allegorithmic Research division which, says Deguy, is all about "having a bunch of crazy scientists work on crazy stuff, 90 per cent of which will never be in any of our products, but 10 per cent of which might change our little world."

Given Allegorithmic's progress so far, that certainly looks possible.



PRO TIP

"The validation materials in Substance for verifying if content is authored physically correct is a time saver, especially when on-boarding new talent"

Stephen Hauer, art director, Camouflaj

FIVE WAYS SUBSTANCE APPS CAN IMPROVE YOUR WORKFLOW

There's so much, well, substance to Substance. Find out how these must-know features can help you make the most of texture painting

01 Have no fear Every action and stroke in Substance Designer and Painter is non-destructive, so you can try things out and not lose any work.

02 Stay focused Built-in texture bakers let you remain in one program without having to move images or other data back and forth between a variety of applications.

03 See results fast Preview your asset in a PBR (physically-based rendering) viewport with all textures applied to fine-tune Albedo, Normal, Specular and Gloss maps.

04 Less sculpting, more painting Take advantage of height maps in Substance Designer to reduce the need for ZBrush sculpts.

05 Try something new Go beyond the usual painting tools by using a Substance Painter particle brush to mimic the effects of natural elements like wind and rain.