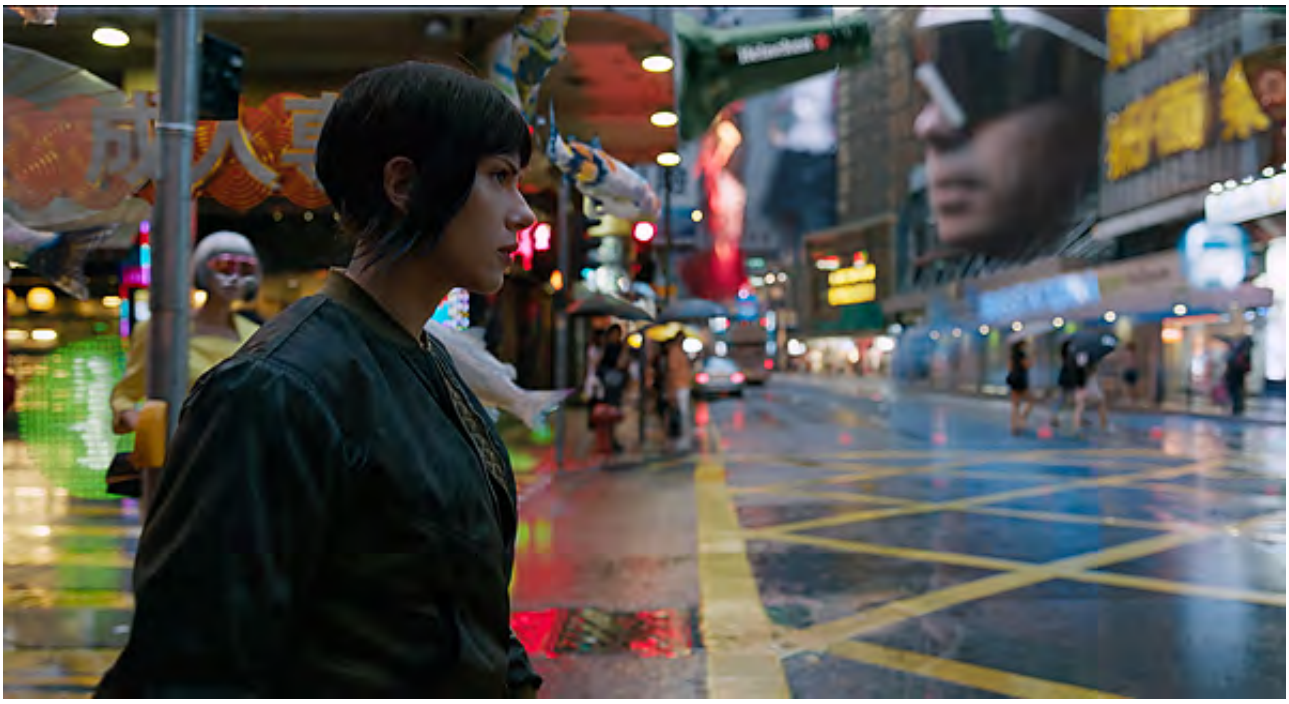
Ghost in the Shell VFX: How MPC brought the anime to live action

The most visually exciting film of 2017 so far *has* to be Ghost in the Shell. Considered to be one of the greatest anime films of all time, the 1995 sci-fi feature of which its based draws on themes of self-identity in a cyberpunk, futuristic NeoTokyo-type setting.

The 2017 remake stars Scarlett Johansson as protagonist Major and with augmented humans and plenty of cybernetics across its characters, any 3D work would be challenging – as human actors would have to be seamlessly integrated with exposed robotic CG parts.

Leading the VFX was MPC, across teams in Montreal, London and Bangalore. MPC VFX supervisors Arundi Asregadoo and Axel Bonami headed up the teams, and worked with Ghost in the Shell production VFX supervisors Guillaume Rocheron and John Dykstra as well as director Rupert Sanders on 1000 shots for the film.

Bonami tells us about how MPC helped to make the global anime phenomenon into a live action treat for the eyes.



3D Artist: 1000 shots is an incredible amount of work. How long did MPC spend working on all the shots for Ghost in the Shell and how many people were involved?

Bonami: We've worked on the show for about 12 months including the shoot stages, but it was about 8 months of post production at MPC with a crew of up to 600 artists.

3D Artist: The environments in the original anime are a huge part of the story, how did you translate this for the live-action film?

Bonami:The director Rupert Sanders had an exact idea of the look of the future world he wanted to create for the movie. It had a lot of references from our current modern day world, but with additional ideas including that it has been growing over itself. It is futuristic but also feels old and decayed, with new monolithe buildings next to older concrete ones. Over the top we generated the sologram advertisements. Sologrames are

giant,three-dimensional billboards which are embedded around the city, some of which are low quality and glitch, others are more high end. Rupert had his own interpretation of how the sologrames should look, using the original material from the manga but adding his own take on it. We used a lot of plates, whether aerial or on ground level, and augmented them with CG buildings, matte painting and sologrames and holograms.

3D Artist: How were the holograms of the city achieved?

Bonami:The sologrames (solid holograms) are a combination of footage of real people combined with graphic advertisement designs.

To create these photoreal volumetric displays, the movie's motion photogrammetry camera system provider, Digital Air, designed a new custom-made rig of 80 2k cameras, running at 24fps, to capture volumetric footage of actors. We then used photogrammetry to process the 400 frame clips, and there are around 60-70 assets processed this way. The photogrammetry generates a mesh with textures baked in for every single frame. We then run the voxelisation process that we created using Houdini that converts these meshes into a 3D voxel grid which keeps the info of the texture. We can then control the density, the size and the behaviour of the voxels. We set up a internal naming convention that so we could define

what type of voxel quality is related to which location of sologrames. Some sologrames and holograms were high tech, others were glitchy. We combined some of these sologrames with graphic designs logo and pieces of advertisement and placed them into shots.

3D Artist: How did you turn New Zealand and Hong Kong into the futuristic NeoTokyo?

Bonami:There's a gun fight scene at a street intersection that was shot on the streets on Wellington, and become part of NeoTokyo. There was street dressing and set design added to the location, and we topped that up with our CG assets and matte paintings to take care of the distant and vertical extensions. We replaced street signage with holographic versions. Then we have the "Ghost Cams", which are one-minute long flyovers of the futuristic city, which are establishing shots used to introduce the different parts of the city to support the storytelling. These were based on real Hong Kong locations, but then entirely computer generated with added futuristic assets, buildings, elevated highways, street dressing, sologrames, holograms, CG crowds and cars to create a new city.

Before plates and after of Skinny Man in Ghost in the Shell.

3D Artist: Where did the environment designs for NeoTokyo come from?

Bonami: There was a lengthy concept art process for the city. We had a lot of city concept art from the production designer Jan Roelf, Ash Thorp and our concept art department in MPC LA led by Ravi Bansal. Concepting was an ongoing process as the city was continually growing. The city landscape included a lot of retro and futuristic buildings, as well as hundreds of graphic designs and sologrames that needed to be incorporated. The latter took months to build to populate the city.

How much influence did the original film have on your VFX work?

Bonami:It was part of our visual research and references, but most important was to deliver Rupert's interpretation and vision of it, and to bring something new to Ghost in the Shell. It was important to get the mood, but not to copy it.

3D Artist: Were there any complexities you ran into staying loyal to the original Ghost in the Shell whilst putting MPC's own VFX spin on the new film? Can you give us any examples?

Bonami: I believe that the most complex part was the pre-production work and design that the film makers and the Production Supervisor Guillaume Rocheron put into visualising the world. When MPC got involved the material was already visually strong enough for us to have a very good idea of how this world should look. We then focused into making all of the designs and art make sense and look photoreal, so that it would integrate seamlessly into the newly created world. There are couple of scenes which are very true to the anime, but still end up with their own distinct interpretation when presented as photoreal VFX. The manga's background is more abstract and contemplative, the feature film is more grounded, I think.

3D Artist: The transition of The Major's skin suit turns visible from invisible so seamlessly whilst there's a bunch of splash effects happening all around her – then going straight into an action sequence. Were these shots complex to work on? How was this entire sequence achieved?

Bonami: Each sequences in Ghost in the shell had its own level of complexity and we wanted to bring something new to everyone of them. That required MPC's team to think out of the box and to come with new

ways and ideas to build the visuals. The thermoptic suit and its invisibility features were one of these challenges.

Major's thermoptic suit was originally designed and built by Weta Workshop and was meant to be a practical effect in the movie, MPC were supposed to build a CG version of it for some of the sequence's incredible stunts and the invisibility effect. However due to the extreme body motions in the fight scenes, the practical suit would end up with unwanted folds and creases so in the end for our scenes we decided to replace the full practical suit and create a CG suit. This gave the director the opportunity to refine the suit's design, add a slight grid pattern and also the irridescence. With this full CG approach, we now had full control to add the voxel based invisibility effect.

The invisibility effect was a challenge. Invisibility had been done many times in movies before, but we wanted to introduce here the invisibility suit in a visible manner if that makes sense. We had to come up with a new way of thinking the invisibility. In collaboration with Guillaume and John, we worked on a technical physical principle of its effect. As we were developing voxel grids for the sologrames with our FX lead Timucin Ozger, we used similar language for the invisibilty. The voxelisation allow us to generate a sort of three-dimensional voxel grid of small cube pixels, that could be activated by proximity, and we could control its size, life span and introduce digital artefacts around the subject. It was as if Major generates a field around her of three-dimensional pixels that have different optical responses such as reflectivity, refractivity, self occusion and opacity. We generated maps for the different panels of the suit so we can then play around with the different stages of panel glitching. The invisibility effect was a combination of reflective, refractive, opaque, fully transparent and colour compression artefacts, using velocity maps to combine it all together.

3D Artist: The characters are visually a real mix between human-looking androids like The Major, with shots showing her android parts, and full-on robotic geishas. How did the character work on these differ?

Bonami: With such strong production design from the filmmakers, we knew from the start that our job would be to seamlessly and realistically blend the characters into this world. The approach to all of the characters was very similar. It was a mix of CG and live action although some shots would be full CG rendered characters and others would be live action

performances with CG integration. I think thats what makes the geishas so impressive on screen. The first section of that sequence is mainly practical costumes with additional digital blinks and touch ups added. The viewer gets used to this very real and present BG character and when the face open and the hacking starts it's a surprise. When her joints break, she extends her limbs and crawls back and up the wall like a spider, the effect is really believable, even though we switch to MPC's fully computer generated character to do that. The illusion and switch from practical to digital is seamless, and therefore works really well. We replaced the face mechanism, and the hacking cables with CG versions. A similar method was used for Major and Kuze. Kuze had real legs, a full CG upper body, with live action face features tracked back onto CG to keep the finessing of the actor's facial performance and the skin on his left arm switches between full CG to live action.

3D Artist: Can you tell us about how the shots showing the android parts of The Major were achieved?

Bonami: There are a couple of sequences were you see major exposed parts, but they all have the same common approach. We generated a RotoAnim of the actress's performance, using a digi-double we built to make sure we could line up all the body features to the practical ones. We match the exact same lighting and render the computer generated version of it, with the inner parts, but also with the skin layer. For the most exposed sequence of the second full body repair, we just kept the head and added a full cg body. For the face off with Kuze, we implement the CG exposed face into the real performance, when her face panel is removed, we tracked back the CG face to all of the subtle movement of Scarlett's performance using OpticalFlow, animation matching eye mvt to the real eye for the CG part of her revealed face. Kuze's hand was digitally removed and replaced with a CG version, so we had full control on interactions, but it was all based on the actor's actual performance.

3D Artist: Did any of the character work involve working digitally with the animatronics that Weta Workshop created? Can you run through the process of this work if so?

Bonami: We did indeed, and I believe that blend is what makes it so successful. Almost all of the character work that we did had some kind of practical reference. The shelling sequence for instance was mostly shot practically, but we switch to full CG to add more movement, adjust the framing and scattering through the different parts of the skeleton to add realism. There are quite a few parts of the scene where it's a practical skeleton with some digital enhancements, then it switches to full CG seamlessly. Hopefully you cant tell which one is practical and which is full CG. As mentioned above similar techniques were used on Kuze, the Geishas and Major's CG thermoptic suit. The big challenge of creating a computer generated character is to make it believable. We were very lucky to have such great designs, practical material references and actors' performance. It's what makes it all work together.

Before plates and after of the Major in Ghost in the Shell.

3D Artist: What other character work did MPC create for in Ghost in the Shell?

Bonami: Our character builds work included, Major in various forms: tactical, thermoptic suit, invisble suit, skeleton…, Kuze, Geisha, Spider tank. And some secondary character work on Security Droids, Dahlin Opening face, Black Figures, Barman robotic arms, Butchers arm, Diamond face Jaw, Secretary hands.

3D Artist: What was your favourite shot that MPC worked on for Ghost in the Shell?

Bonami: I can't really say as I have so many in mind! Our work was so diverse, I have my favourite shot for every sequence but if I had to pick only one… the opening ghost cam shot.