From Comic Book to Movie Screen: Achieving symbiosis between Rigging and Creature Effects for *Venom*

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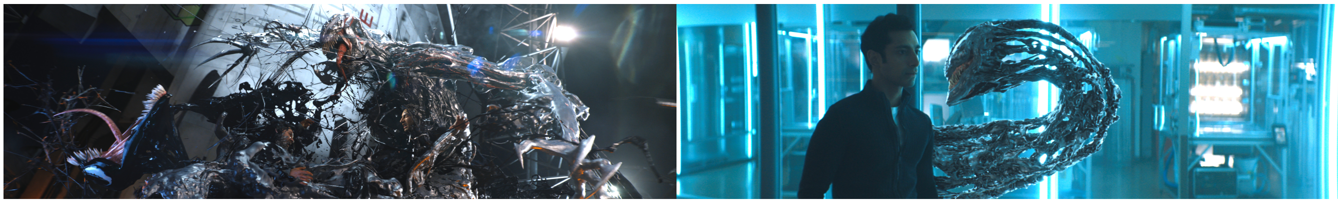

Figure 1: Venom and Riot (left); Wraith (right). ©2018 Sony Pictures. All right reserved.

ABSTRACT

The primary challenge at the heart of Visual Effects lies in the ability to translate the director's creative brief into compelling visuals using a combination of art and technology. In the case of *Venom* a key requirement was to keep the character design as faithful to the comic books as possible. This talk describes the challenges tackled by the Rigging, Effects, and R&D departments at DNEG in order to bring this classic antihero to life in a photorealistic manner.

CCS CONCEPTS

• **Computing methodologies** → **Computer graphics**; **Animation**.

KEYWORDS

Aesthetic, Style, Comic, Rigging, Modular, Kinematics, Deformation

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1 INTRODUCTION

In the original comics, *Venom*, *She-Venom* and *Riot* are alien shape-shifting symbionts who lend their hosts superhuman powers and an iconic high-contrast look. Bringing this striking graphical style to the movie required us to tackle several challenges, all critical to the movie's visual identity:

- while visually distinct, the three symbiotic characters shared strong design similarities, leading us towards **exploring the re-usability of their procedural rig components**;
- *Venom* needed to be recognisable in dark, stylised shots, highlighting the need to **maintain a distinctive silhouette**;
- *Venom*'s ability to form tendrils required the development of a powerful custom **tentacle solver and rigging module**;
- finally, the goo-like substance that makes up *Venom*'s body puts the character in a unique spot between traditional rigging and FX work; as such achieving the desired look required close **co-operation between our rigging and FX departments**.

2 RIG RE-USABILITY

The design of many fantastical movie characters is often based on human anatomy, with additional aspects borrowed from different parts of the animal kingdom. This allows riggers to reuse similar rig structure and components across multiple character types, allowing the creation of rig "templates" that can be extended to accommodate additional needs and requirements.

Such templates, or *rig descriptions*, form the basis of Pinocchio, our in-house procedural build framework. They are comprised of a series of data-driven build tasks, which assemble a set of pre-defined components into a complete rig.

As Pinocchio has been used to deliver dozens of shows over the years, we have built a library of generic templates (e.g., Generic Man, Generic Woman, Horse, Bird). The 'Generic Man' template provided the Venom rigging team with a solid foundation – applying this template out of the box and scaling it accordingly led to a first rig that could already be used for rough animation and layout.

Starting from this template, we implemented the features necessary to turn the Generic Man into Venom; in particular – swapping any mesh references to the Venom geometry; adding a sophisticated tongue setup to give animators enhanced control over Venom's expressive tongue; and specifying tentacle and facial connection points to assist with rig connections. The resulting rig was then tweaked further to produce the She-Venom and Riot rigs.

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Modifications are tracked and version-controlled in our publishing system, allowing us to perform quality-control checks and roll back setups if needed.

3 CROSS DEPARTMENTAL WORK

3.1 Animation and Creature FX

One of the defining features of both Venom and Riot is their silhouette, which is closely linked to their muscle definition and design.

Muscle and skin systems are often complex and relatively slow to evaluate; as a result they are not usually included in the rigs used by animators, who need interactive frame rates. Instead, animators must rely on simpler rigs which can achieve real-time speeds but only produce approximate deformation. The finer muscle and skin detail is then added in a subsequent step referred to as Creature FX (CFX). Since this can be a computationally-intensive process, it is usually evaluated off-line on the render farm.

For Venom, however, the importance of preserving the characters' silhouettes meant that a higher degree of visual accuracy was required at animation time. To achieve this, we implemented a system derived from Pose-Space Deformation [Lewis et al. 2000] – we 'baked' a number of example deformation poses from the CFX rig to static caches using a range-of-motion animation, while recording the relevant control parameters for each pose. This provided us with a simple linear system closely approximating the complex rig deformation, while maintaining an acceptable framerate.

As such, Venom challenged the traditional perception of the creature pipeline as a sequential one, highlighting a clear need for the output of the CFX step to feed back into the animation stage.

3.2 Sending to Effects

For the Venom and Riot "merge-fight" scene, it became clear that we could not represent their complex look entirely within Autodesk Maya – our usual tool of choice for rigging and animation. The two rigs, while keeping their distinct silhouettes, needed to merge together and move in ways that broke the rules of volume preservation. We ended up calling these rigs the "stretchy rigs", which represented a broad idea of what the characters were doing.

The "merge fight" was a combination of all the CFX technology produced on the show. First, procedural geometry was generated on top of the simple animation rig meshes, with additional veins grown onto the characters. These meshes were then used to drive velocity fields which produced particles for Fluid Implicit Particle (FLIP) simulations. The simulated particles were converted to a volumetric representation and combined into a single mesh which was then used for rendering. We also used a solver to produce contact strands based on the proximity to a surface and the speed at which the geometry was moving. "Magnetic fluids" were added to move between the creatures, and a custom grain solver was used to preserve the shape of the impact splashes.

4 SOLVING TENDRILS AND WRAITHS

4.1 A faster, more powerful tentacle solver

During the prototyping of the Wraith rig, we quickly encountered performance issues with our Maya-native tentacle module – its time complexity scales linearly with the number of instances and controls, with Maya evaluation overhead accountable for a significant portion of its evaluation time.

To address this, we leveraged the work of Nieto et al. [2018], which enabled us to quickly prototype, test, and finalise a powerful and fast tentacle solver despite production being on a tight schedule.

4.2 Automatic Twist and Pre-roll Problems

The free-form nature of the articulation of a tentacle requires simplified animation controls, allowing animators to focus only on positional information, while computing the rotation and twist of the underlying rig automatically.

Traditionally, our animation rigs are purely kinematic, immediately and deterministically responding to the animator's input. With their state fully defined by the current state of the controls, they have no knowledge of surrounding frames and information contained in them. In the case of a tentacle that can potentially rotate by more than 180° during an animation, a kinematic solution is not unique, and often leads to "flips" between frames as it moves from one solution to another.

Our approach, which included a dynamic solver with an explicit state, prefers a solution consistent with the previous frame rather than one derived kinematically from the current state of the controls.

Unfortunately, this led to complications later on in production. For CFX simulation initialisation, the animation needs to be extended using "pre-roll". However, the additional frames caused the twist to behave differently compared to the performance already signed off by the director. Our solution was based on blending the additional frames with the first frame from the approved animation, keeping the part of the animation included in a shot intact.

5 CONCLUSION

The creature work on Venom is representative of a growing need to blur the lines between rigging, simulation and effects. The close relationship between the teams that specialise in these areas was pivotal to our ability to deliver the director's vision for this movie.

In the future, we would like to further explore this approach by incorporating technologies traditionally associated with simulation and effect directly within our animation rigs. For DNEG, using the tentacle solver of Nieto et al. [2018] for Venom was the first step in this direction, and we expect it to become a new standard for our character and creature setups.

ACKNOWLEDGMENTS

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