The Filigree Effect in *Shrek Forever After*: Making Art Dynamic from Sketch to 3D

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1 Introduction

The visual divide between simulated and natural phenomenon is one that shrinks every year, however solving the novel problem of capturing an aesthetic renews with each new idea. The Filigree Effect, developed for DreamWorks Animation's feature film *Shrek Forever After*, is used whenever a character transports to an alternate reality, and involves a flash of light after which the character sucks back towards a point where filigree emerge as if drawn in space. In this effect we present a method of capturing the stylistic appeal of hand drawn artwork with the advantage of dynamic simulation for stereoscopic viewing.

2 Approach

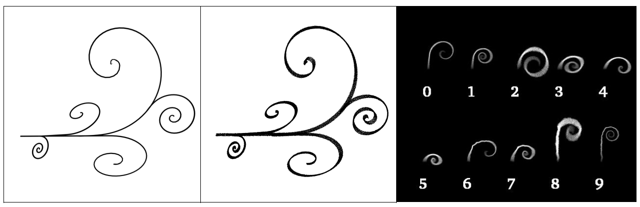

Figure 1: Ordinary curve (left). Filigree curve (center). Filigree curves in library (right)

Our solution for the filigree are split into two sections: the layout of the curves, and the simulation of the curves. The layout of the effect utilizes a tool that creates a filigree curve from an ordinary spline complete with controls for pen angle and nib thickness. This same tool also allows the user to save the curve to a library (Fig. 1). To expedite the placement of curves on a character, we bake the limbs and spine into proxy curves by tracking and connecting specific joints on the character rig. Then, new filigree curves are grown off each proxy curve using an algorithm that attempts to keep each filigree facing the camera (Fig. 2).

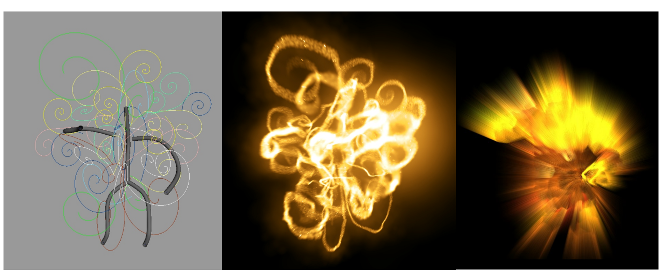

Figure 2: Layout of curves on character (left), and the resulting render (center). and ray render (right)

In addition to the line quality and curvature settings, each filigree curve in the library has an associated simulation setting and cache that is saved on disk. This data is used when we simulate the filigree in static and dynamic environments. In a static simulation, the transformation and animation keys of each curve is recorded in a particle file and exported. Then, at render time each particle pulls in the proper simulation data from disk and instances it using the stored transformation and animation data. This method has the advantage of eliminating the simulation of each swirl, and instead relies on the cached performance of each filigree curve.

A different approach is used for the Filigree Effect in a dynamic environment. In order to react to external forces or objects, the filigree curves must be simulated. Processing the whole set of filigree curves at once results in prohibitively long iteration cycles, so we instead develop a tool to link a pre-positioned filigree curve to its simulation settings instantly. Effectively, this pulls in the particle performance that was previously saved on disk and allows the artist to either preview each filigree curve interactively under the new external forces, or even make changes to the simulation.

3 Stereoscopic challenges

The stereoscopic nature of our films forces us to be a lot more resourceful with how we create our effects. The Filigree Effect utilizes a morphing character and rays of light - two problems easily solved in the composite, but much more difficult to pull off in 3D.

To morph the characters using a true volumetric representation is too costly to compute and simulate, especially over multiple characters. To create a more efficient representation, camera depth maps are used to place particles in world space to recreate the character using a more sparse dataset. Then the beauty pass is used to shade each particle. This allows the artist to work quickly with an optimized set of data that still renders the character faithfully in 3D (Fig. 3).

Figure 3: Particle based character render with morphing and light rays

Another stereoscopic challenge we solve with the *Filigree Effect* is the efficient rendering of rays of light. Using a light as a source, rays are cast out through a particle set outwards. Along each ray, we sample a point and place a new particle with an opacity and radius falloff. This effectively creates a fast, art directable shaft of light that works both in 2D and stereoscopically (Fig. 3).

Figure 4: A final frame showing various stages of the effect

4 Conclusion

Taking filigree from sketch to screen is a multifaceted problem, from creating an art directable effect, to realizing a translation from 2D to a 3D environment. However, by rethinking old problems and developing creative techniques, the Filigree Effect can be propagated across multiple characters and still be art directed to the single, smallest swirl.