

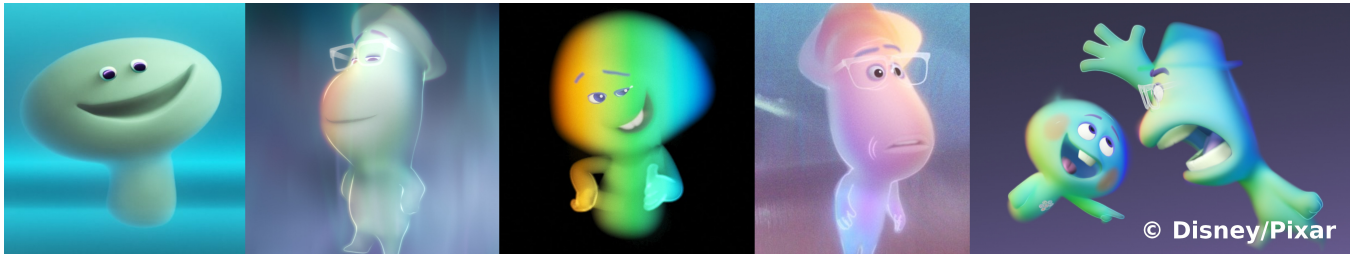
# Finding the Look of Souls

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Various stages of look development on Pixar's *Soul* main characters Soul 22 and Soul Joe ©Disney/Pixar. All rights reserved.

## ABSTRACT

Finding the look of the soul characters for the movie *Soul* was a challenging process. The art direction was based on an ethereal design and turned out to be a moving target during the look development collaboration between the different departments involved. While on a tight schedule, multiple technical approaches were taken in order to find solutions to the difficult design challenges. The final approach features a volumetric shading with a unique line treatment on extreme flexible yet simple and appealing character designs.

### ACM Reference Format:

Jared Fong, Jonas Jarvers, Markus Kranzler, and Ryan Michero. 2020. Finding the Look of Souls. In *Special Interest Group on Computer Graphics and Interactive Techniques Conference Talks (SIGGRAPH '20 Talks)*, August 17, 2020. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3388767.3407342>

## 1 MODEL TESTING

Early designs were indicating extreme deformations with character features changing their correspondences towards each other. A Boolean approach was tested for creating facial features and adding limb geometries. The lack in controlling the crucial details of facial features and the art direction pushing back on those movements led us away from this approach for the face. However, some characters still required turning on and off different limbs and finger styles. Using different geometries for each constellation to ensure a continuous surface turned into an unmanageable complexity. Using volumes allowed us to use separate overlapping geometries and to render them as a continuous surface.

A simplistic, pen stroke like style for the eyes was explored. They were modeled and rigged with simple geometric shapes, allowing the animator to pop into different shapes for creating character emotions similar to a drawing style. A stylistic approach with a white eyeball was tested simultaneously to give the eyes a more complex treatment.

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*SIGGRAPH '20 Talks, August 17, 2020, Virtual Event, USA*

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ACM ISBN 978-1-4503-7971-7/20/08.

<https://doi.org/10.1145/3388767.3407342>

During the modeling process of the soul characters it became obvious that even though the design was simplified, it yet had graphic and iconic characteristics which had to be embraced. In order to hit the appeal of the character, the surface had to precisely follow a smoothed and tapered look with accentuating detail where it was necessary. In order to hit design similarities between the human and the soul version of a character both were always shown side by side and with corresponding animation tests.

Soul Joe's model was based on carefully creating a low resolution mesh with planned landmarks that reduced most deformations to a three point solve, and distinct borders to hold landmark shapes. This level of planning was very useful later for solving complex deformations with relative ease.

## 2 RIGGING APPROACHES

To realize the extreme and graphic designs, Soul Joe had four distinct layers of geometry that were authored at different resolutions to allow for varying levels of detail. The lowest resolution acted as a cage, allowing clean and predictable "flour sack" like deformations. The medium resolution served for sharper shapes and art direction. The highest for collisions and rendering. The fourth geometry was used to drive a spline rig, allowing final silhouette shape changes through its connection with a profile mover and a curve net situated on the the models major landmarks.

Some designs demanded a cheek blush treatment which would follow along with the articulation yet stay circular at the same time. The cheek location was determined by a sliding pivot on a patch and a radial weight field of the posed points was generated from its distance. The weight field was adjustable with various expressions to control the cheek's appearance. Some properties were automated with specific facial expressions allowing the blush to react to a performance and create a natural feel.

For allowing the soft shading treatment to be supported by distinctive line elements, polygon strips and cylinders were used as facial accent lines. They were rigged with curves, sliding on a patch and warped to the character's geometry. Various rigging controls allowed full adjustments of these lines and some were automated to appear with specific expressions. A silhouette prim was developed to exactly mimic the representation of the shaded silhouette lines for the animation team. It would consume an adjustable, viewable

weight map which allowed specifying regions for the silhouette lines and controlling their length, presence and falloffs.

### 3 SHADING AND ART DIRECTION

**Figure 1: Volumetric look development with line work for Soul 22 and Soul Joe.** ©Disney/Pixar. All rights reserved.

The soul world has soft forms that are semi-opaque and feel ethereal, therefore we decided to use volumes generated in Houdini. Early tests showed by removing the surface and relying on volumes, with a low density we would achieve a very ethereal look, but lose virtually all definition of the forms. High densities would preserve the detail, but would look too much like a surface with a lot of subsurface scattering (we called it "marzipan look"). In order to accomplish both, the softness with the definition, we came up with a lot of approaches inspired by 2D techniques.

To solve the visual distraction of semi-opaque volumes in front of each other, we only kept the front most volume details and removed everything that would have been concealed if we were still using surfaces. We developed Houdini networks which would compute lines for silhouettes, contours and self intersection depending on the camera view. To give these lines a pen stroke quality we are tapering the ends of each line, which was challenging, because it exaggerates temporal discontinuity. The facial lines were also processed in Houdini with the same treatment to integrate them into the look. For the small details we transferred the normals of the surface into the volume and faked diffuse and specular lobes in a custom shading node (called Iridescence Driver). This shading node also reads shading signals which we exported as volume fields to allow us to address individual volume regions.

The color was achieved through a lookup in a color spline based on the normals and combined with the fake shading lobes output as the volume's albedo. Even though souls look like a manifestation of chromatic light, we didn't want too much visual complexity for crowds. Most of the color is limited to yellow to cyan range, with the deeper reds and blues pushed to the very edge of the characters. We also added a colorful halo around the silhouette of their heads. This accentuates the ethereal prism-like look of the character, while increasing the color complexity around their faces.

Giving Joe's hat a similar look as the character combined both as one silhouette and included it in his personality. His glasses on the other hand were lifeless, hence colorless and more transparent, but also treated with a sharp outline for readability. This treatment was later used on many other soul characters.

### 4 ILLUMINATION AND COLOR

The goal for the Lighting and Shading teams was to develop a visual language for how the volumetric characters appear in different

environments and lighting scenarios. The idea was that they would not illuminate the environment but actually respond to incoming light to allow us to take advantage of using light and shadows to shape the characters and give depth and richness to the final images. We also didn't want the characters to appear to have a local color, but a color as a result of light interacting with the soul's material, similar to the dispersion of light through water droplets. Initial look tests used dense, white homogenous volumes with heavily backscatter-biased phase settings and projecting colored lights on to the volume. This created appealing coloration and had intuitive lighting controls, but looked very obviously like a projection. Additionally, we found that even with thinning out the volume and adjusting scatter coefficients so that light penetrated further into the medium, physically correct extinction and shadowing did not help us preserve the vibrancy of our light colors. Some more successful early tests entailed using a rainbow color ramp based on distance from light combined with increasing intensity based on distance as well, to combat the attenuation of the light through the volume. While this preserved color well and gave the impression of light changing as it scattered through a volume, the ramp seemed too disconnected from an animated character.

Testing shifted towards more forward scattering anisotropic volume material settings so that we could scatter light through the characters from behind. This produced a more ethereal visual quality of light scattering through a thin volume, and successfully emphasized the outer contours of the characters. However, it was not well suited for the shaping needed to read facial expressions for animated characters. We eventually settled on a balanced material response – essentially isotropic for lighting predictability but with some anisotropic back-lighting response as well. Even though the color was achieved through the Iridescence Driver, we wanted to give the impression of light creating the color. We drove the directionality of the color spline with a coordinate system attached to a light. Additionally, to counteract the natural darkening from shadows, without eliminating the shaping we added a new shadow tinting mode to our volume shader. This allowed us to pipe a varying color (in practice, the output of the Iridescence Driver, darkened and saturated) into the internal self shadowing of the volume, giving the complexity of shadowing while preserving the brightness and saturation of our colors.

**Figure 2: Soul Joe and Soul 22 in their final soul form.** ©Disney/Pixar. All rights reserved.