

# Railgun Shaders

## Introduction

To achieve a non-photorealistic, stylized look, that is also highly customizable and very flexible, we decided to roll out our own lighting model.

We supply the full shader source code alongside the modding tools, including also all of the shader libraries that we use, allowing adventurous modders to create their own shaders reusing part of our code if they desire.

## Our NPR Workflow

### What is NPR?

**NPR** stands for Non Photorealistic Rendering. This is opposed to **PBR** which stands for Physically Based Rendering.

NPR is all sorts of stylized rendering that doesn't want to imitate real life. Such as "anime-style" rendering. Which is, kind of, our goal here.

### Our shaders structure

We currently provide multiple specialized shaders for different use cases. Currently, our maintained shaders are:

- Toon/Base
  - Oriented towards generic materials.
  - Only supports a texture and a normal map
  - It's the fastest shader to render
- Toon/Clothing
  - Specialized for cloth rendering
  - Supports Character Camera Lighting
  - Allows the use of fine detail maps for rendering cloth fibers
  - Supports sheen effect
  - Can be configured to appear like silk or other fancy textiles
  - Supports clothing layers
- Toon/Skin and Toon/Face
  - Specialized for base mesh rendering
  - Supports Character Camera Lighting
  - Built in Sub Surface Scattering
  - Supports colored specular

- Toon/Metal
  - Specialized for metals and shiny/reflective surfaces
  - Supports custom metal coloring
  - Will show reflections from environment when available (requires reflection probes)
  - Will almost always render in HDR range (hence will probably generate bloom)
- Toon/Plastic
  - Specialized for plastic or varnished surfaces (lacqued wood for example)
  - Supports colored specularity
  - Supports colored rim lighting

All of our actively maintained shaders also support light smoothing and balancing parameters. Although they can be fine tuned, we recommend to avoid touching those parameters if possible in order to prevent surfaces to appear badly shaded in specific lighting situations.

## Common features in our materials

Some material parameters will appear across all of our shaders. They work in exactly the same way across all of them

These are found at the top and bottom of every shader from our library.

### Top side: shading adjustments

On the top of surface inputs in our shader there is a set of 3 sliders that control how the lighting should interact with the surface.

- **Light Smoothing:** controls how smooth/sharp the transition between light and shadows is on the surface.
- **Light Min:** sets what the minimum lighting value will be even in full darkness (no light).
- **Mid Point:** offsets how much of the surface is receiving light. If used incorrectly this can cause artifacts to show up on shadows.

### Bottom side: day/night adjustment

This set of options should never be set manually during modding as this is set globally by the time of day controller.

These parameters are currently inoperative as the system is still being developed, but the overall idea is to reuse color theory and change the tinting applied to lights and shadows dynamically based on time of day and environment conditions.

A sunny day will tint with a slight yellow every lit surface and with a thin light blue all shadowed ones. Likewise during dusk lit surfaces will have a bright orange tint applied, while shadowed parts will gain a brownish tint. At night lit surfaces will gain a light blue tint, shadowed ones will instead be tinted by dark blue.

This is also influenced by the current weather, overcast days will have very slight tints, while perfectly clean skies will open up ground for more aggressive tinting.

The exact shades that will be used for tinting are determined by the Day Night ramp. An image that maps time of day over the left/right, and light/shadow over the top/bottom.

The Kelvin temperature slider controls what basically amounts to the "time of day" (it's a bit more complex than that as it's not a 1:1 mapping to the current time of day) while the Day/Night tint strength is the only parameter that should be set per material, indicating how much this material will be influenced by the overall tinting.

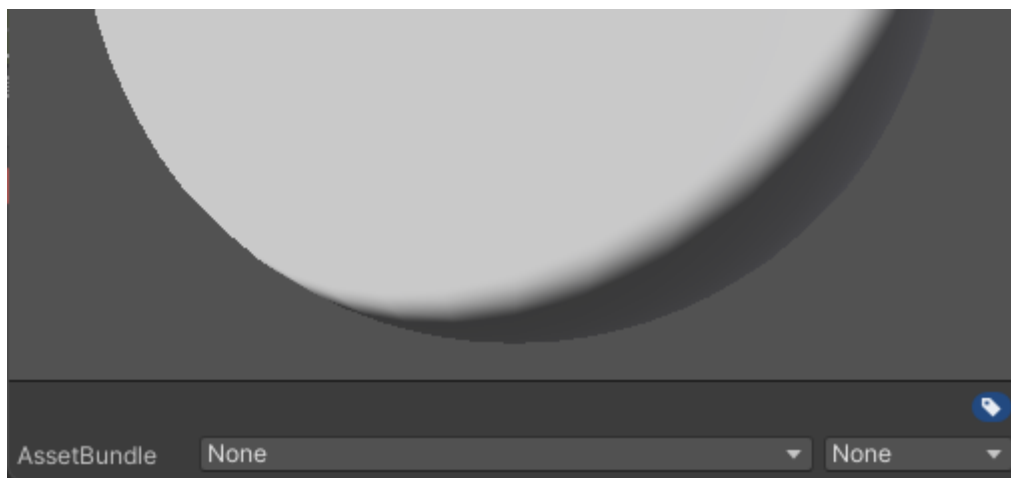
Shift amount also has a saying in how intense the color frequency shift will be but this is more of a global setting.

## **The Materials**

### **Base Material**

From the unity editor, our base material appears like this:





The first block, *Surface Options*, allows the user to customize some general settings about how the material should be treated at render time.

Option	Values	Description
Surface Type		Selects how this material should be treated.
	Opaque	Renders only solid/fully transparent (i.e. with "holes") surfaces.
	Transparent	Allows for semi-transparent surfaces (glass, see-through fabric etc...)
Blending Mode		<i>(available only if surface type is <u>transparent</u>)</i> Selects how the transparent surface is going to blend with itself and the background.
	Alpha	Uses the surface alpha as mix blending amount.
	Pre-Multiply	Multiplies the surface color by it's own alpha value then blends it with the underlying color.
	Additive	Adds it's own color (multiplied by it's own alpha) to the underlying color.
	Multiply	Multiplies it's own color by it's own alpha, then by the underlying color.
Preserve Specular Lighting	True/False	Does nothing due to our own custom lighting.
Render Face		Selects which face side are considered for rendering.
	Front	<i>(default)</i> Uses the side that is considered as exterior.
	Back	Uses the opposite side, the one considered interior. Useful if your model appears invisible from the correct side.
	Both	Evaluates both sides for rendering. This is the preferred way to handle clothing.
Depth Test		Selects how to determine if a pixel will be drawn or not depending on the depth. In most cases, <code>LEqual</code> is fine.

Option	Values	Description
Alpha Clipping	True/False	Enables the use of an alpha map to cut holes on an object. This works both in Opaque and Transparent. (it is recommended to use it only in opaque to avoid depth sorting errors)
Threshold	0f-1f	Selects the cutoff point at which the alpha will be considered transparent and not opaque.

The second block, *Surface Inputs*, allows the user to configure the appearance of the actual material.

Option	Values	Description
Main Color	Color	Color used to tint the Base Color.
Base Color (RGB)	Texture2D	Color texture applied to the object.
Normal Map	Texture2D	Tangent space Normal map to use on the object.
Normal Strenght	0f-1f	Intensity of the normal map texture over the surface.

Advanced options documentation can be retrieved from unity docs themselves.

## Clothing Material

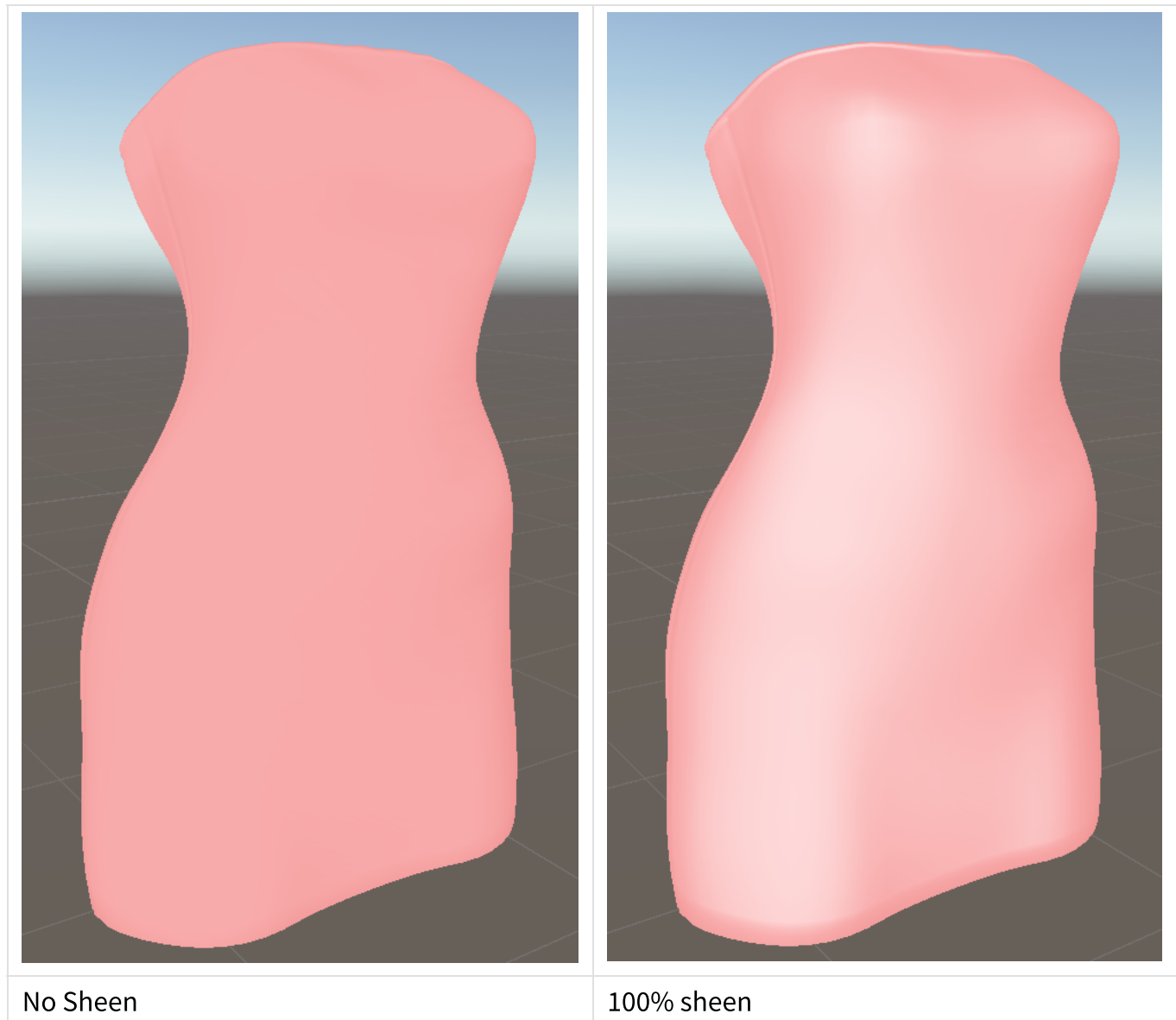
All of the base material options are available, plus:

Option	Values	Description
Enable Camera Light	True/False	Whether this clothing material should be using fake camera lighting (should be enabled for wearable cloth, disabled for props or non worn cloth, for example, curtains)
Camera Light Color	Color	Color tint for the camera fake light
Camera Light Smoothing	0f-1f	Works identical to <a href="#">Top side shading adjustments</a>
Camera Light Mid Point	0f-1f	Works identical to <a href="#">Top side shading adjustments</a>
Cloth Fiber Map	Texture2D	A texture that can be tiled containing cloth fiber details
Cloth fiber Normal Map	Texture2D	Matching normal map for the Cloth Fiber Map, <i>usually the tiling parameters should match across these two textures</i>
Fiber Strenght	0f-1f	Basically a normal map strenght but just for the Cloth Fiber Normal Map

Option	Values	Description
Sheen	0f-1f	Controls Visibility of the Sheen effect
Sheen Power	1-1000	Power factor for the sheen
Sheen Color	Color	Tinting applied to the Sheen effect

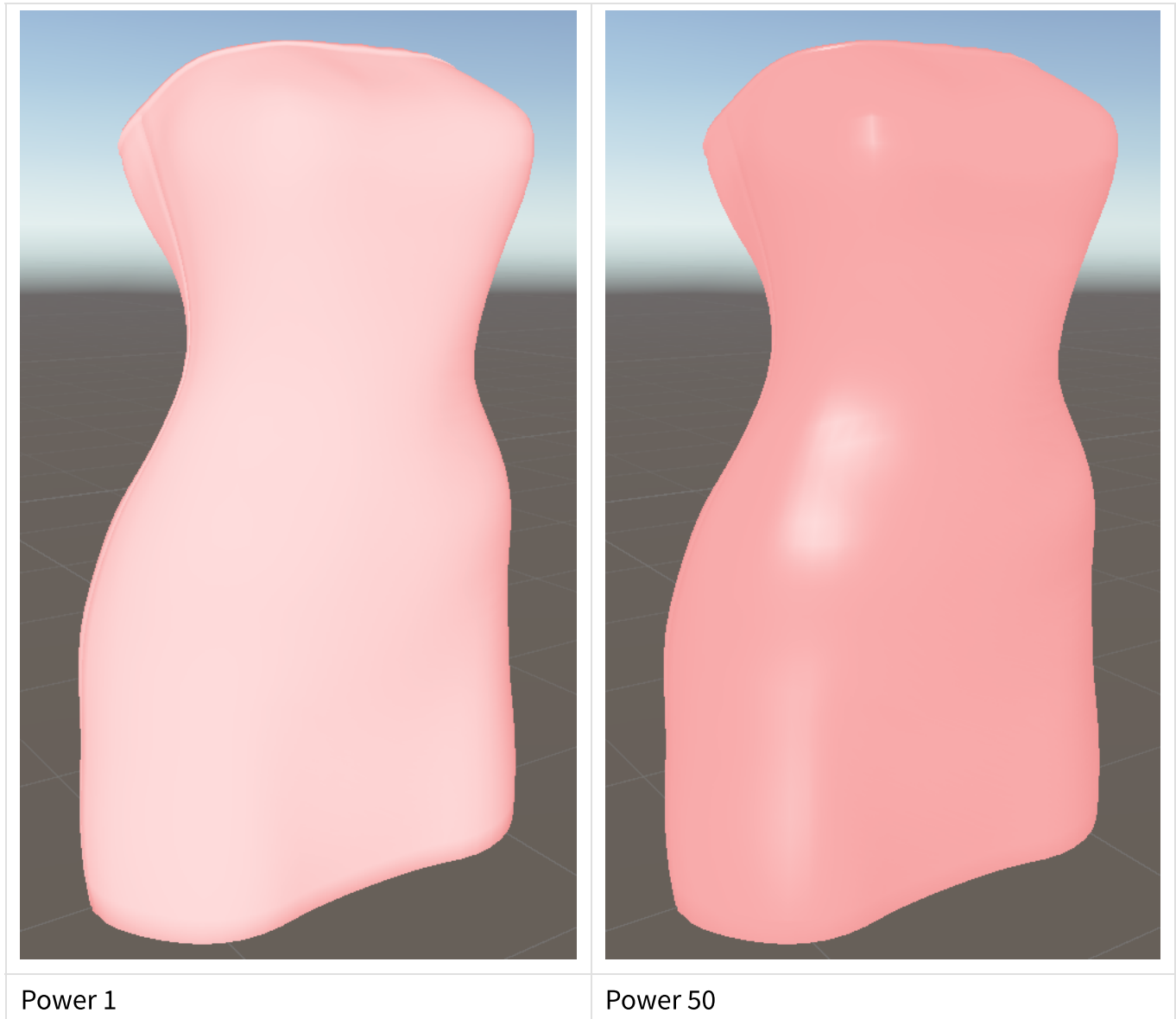
## Sheen Effect

Sheen simulates the light dispersion on a cloth surface who has free thin fibers all around.



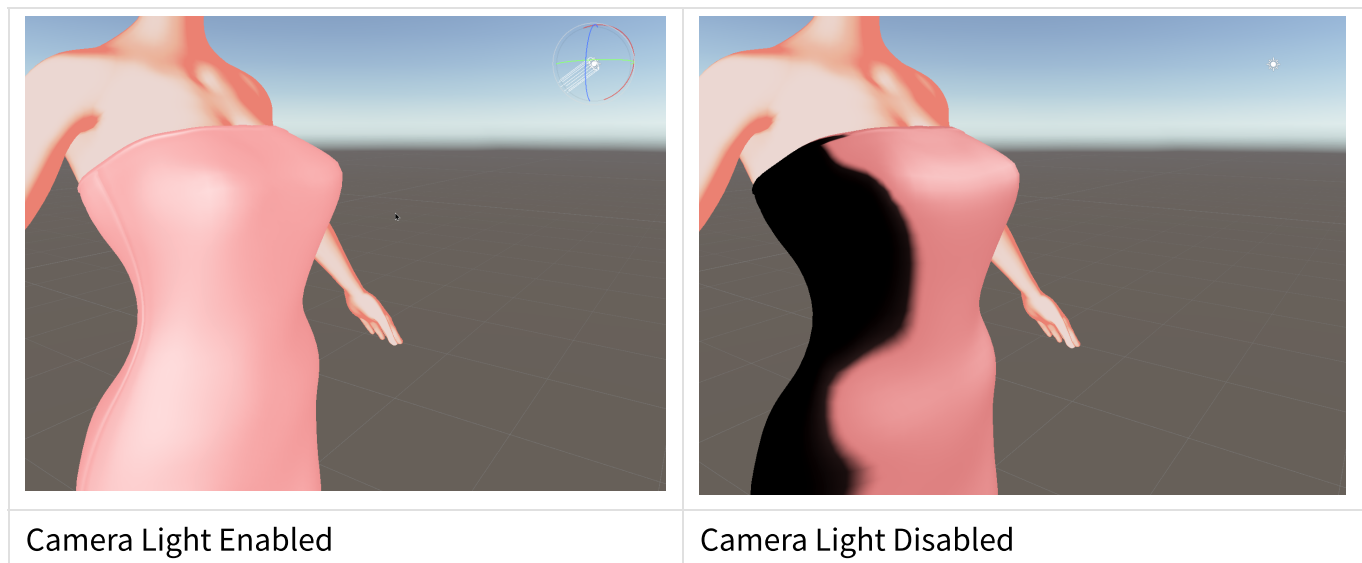
Sheen power heavily influences how much the dispersion effect will be visible. The higher the value the less it will be visible if the surface is not perfectly aligned with the viewpoint. This works in a way very similar to specularity.





### Camera Light

Camera light uses a common technique for stylized games where despite the environment being lit by normal light sources, for characters and their clothing an additional key light is casted from the cameras direction and added to the light and shading calculation in order to avoid dark contrast when unwanted. Because this is meant just for characters, this checkbox should not be enabled for scenery related materials.



## Skin Material

Option	Values	Description
SSS Shadow Color	Color	The color of the simulated subsurface scattering shadow part.
SSS Transition Color	Color	The color of the simulated subsurface scattering middle part.
Specular Power	1f-1000f	How narrow the specular reflections are (higher = smaller and narrower).
Specular Amount	0f-2f	How strong the specular reflections are (higher = stronger).
Specular Color	Color	The color of the specular reflections.

## Face Material

Option	Values	Description
Face Shadow Texture	Texture	An SDF texture representing how the face should be shaded. This can be created using the SDF tool given in the modding tools.
Face Shadow Smoothing	0f-0.25f	How smooth the transition between light and shadow is.

## Metal Material

Option	Values	Description
Metallic Color	Color	(UNUSED) The color of the metallic reflection.

Option	Values	Description
Metallic Strength	0f-1f	The strength of the metallic reflection.
Metallic Reflection	0f-1f	How much of the environment is reflected on the object as metallic reflections (requires reflection probes).
Metallic Roughness	0f-1f	How rough the metal should be (higher = more diffuse reflections).

## Plastic Material

Option	Values	Description
Rim Light Color	Color	The color of the rim light.
Rim Light Amount	0f-1f	The strength of the rim light.
Rim Light Power	0f-30f	How narrow the rim light is (higher = smaller and narrower towards the border of the object).