

The background of the cover is a low-angle shot of a weathered wooden building. On the upper part of the facade, there are two pairs of crossed swords mounted on circular metal plates. Below these, there are three circular objects: two with a yellow and black radiation symbol and one plain silver metal plate. In the lower part of the facade, four human skulls are mounted on wooden poles. The text 'SE Screen-Space' is written in a white, stylized, italicized font across the middle of the image. Below it, ' Shadows' is written in a similar font, with 'v1.0' in a smaller font to its right. To the right of ' Shadows', the text 'For Unity' is written in a smaller, italicized font.

# SE Screen-Space Shadows v1.0 *For Unity*

User Guide v1.0

Copyright © Sonic Ether 2016

# 1. Introduction

## 1.1 Summary

SE Screen-Space Shadows provides screen-space raytraced shadows for directional lights for sharp, detailed contact shadows. It can capture details in shadows that would otherwise be missed using traditional shadow maps alone.

This effect works by tracing in screen-space using the depth buffer information, similar to SSAO or screen-space reflections. Like these other effects, anything that is not directly visible in the main view will not contribute to screen-space shadows. However, because this effect is meant to be used in combination with traditional shadow maps to improve close-proximity contact shadows, this limitation is generally not apparent.

## 1.2 Compatibility

This effect requires DX11 or OpenGL 3.0 or newer. It is not compatible with OpenGL ES and won't work for WebGL or mobile platforms. It is compatible with Unity 5.0 and up.

## 2. Usage Guide

This section will help you setup SE Screen-Space Shadows and provide tips for implementation so you can make the most of this effect.

### 2.1 Adding SE Screen-Space Shadows to Your Scene

#### Step 1: Add the SE Screen Space Shadows Script to your Main Camera

1. Select your **main camera** in the **Hierarchy**, and from the **inspector**, click the **Add Component** button.
2. In the drop-down menu, select **Image Effects > Sonic Ether > SE Screen-Space Shadows**. Alternatively, you can type **SE Screen Space Shadows** and hit **Enter**.
3. The order of SE Screen Space Shadows in relation to other image effects does not matter.

#### Step 2: Assign the Sun Property to your Main Directional Light

1. Drag and drop your **key directional light** from the **Hierarchy** to the **Sun property**.

# 3. Parameter Info

This section will help you understand the adjustable parameters of SE Screen-Space Shadows.

**Sun:** The directional light that you want to have screen-space shadows applied to. *You must have this property assigned!*

**Blend Strength:** The overall opacity/contribution of screen-space shadows after they're calculated.

**Accumulation:** How much each individual trace step accumulates and contributes to the shadow result. Lower values result in a softer look and can also help preserve translucency in objects like grass and foliage. Lower values can also help hide artifacts. Higher values result in a harder shadow.

**Length Fade:** How much traced shadows fade out as they near the maximum trace length. Lower values reduce the strength of the fade. Higher values increase the strength of the fade and help to make the transition from screen-space shadows to traditional shadows more subtle.

**Range:** How far to trace for screen-space shadows in world units. *If this value is too low in relation to the Samples property, you will see incorrect self-shadowing artifacts. Adjust with care!*

**Z Thickness:** How thick objects in the depth buffer are assumed to be during shadow tracing.

**Samples:** How many trace steps to take while tracing for shadows. Higher values result in higher quality shadows and increased rendering cost. *If this value is too high in relation to the Range property, you will see incorrect self-shadowing artifacts. Adjust with care!*

**Near Sample Quality:** Affects the quality of nearby screen-space shadows. Higher values allow for more samples per-pixel for areas near the camera in exchange for increased rendering cost.

**Trace Bias:** Similar to shadow map bias, this can help reduce incorrect self-shadowing artifacts, but can reduce detail in shadows. Keep this value as low as possible. *If you're experiencing self-shadowing artifacts, you may also want to consider decreasing Samples or increasing Range, as certain combinations of these two values can cause these artifacts.*

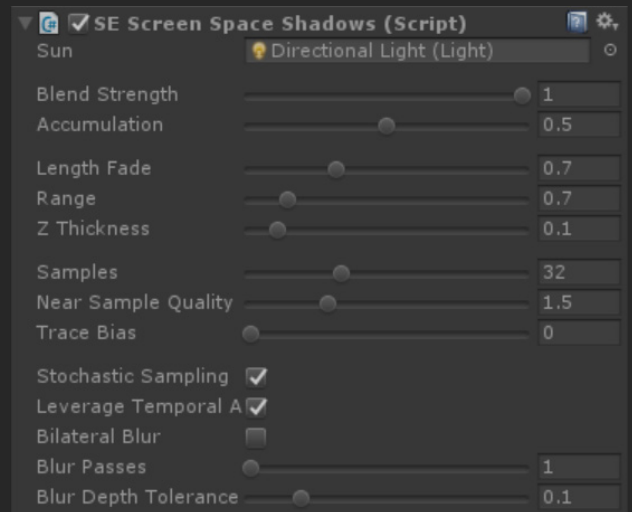
**Stochastic Sampling:** Enables per-pixel random tracing offset in order to trade banding artifacts for noise. This noise can be reduced either by using **Bilateral Blur**, or by enabling **Leverage Temporal AA** and using a Temporal Anti-Aliasing effect.

**Leverage Temporal AA:** Requires **Stochastic Sampling**. This causes the per-pixel random offset caused by **Stochastic Sampling** to vary for each frame. When used with Temporal Anti-Aliasing, this can greatly improve shadow smoothness and reduce noise.

**Bilateral Blur:** Applies an edge-aware blur to the screen-space shadows result.

**Blur Passes:** The number of bilateral blur passes to perform. Two passes can give a softer result than one.

**Blur Depth Tolerance:** The depth difference tolerance for bilateral blur. Higher values mean the **Bilateral Blur** is less strict on what is considered an edge based on depth values. Lower values can catch more edges in complex surfaces. If this value is set too low, the bilateral blur may falsely detect edges on steep surfaces and negatively affect the blur result.



# 4. Effectively Utilizing SE Screen-Space Shadows

This section includes things that you should know in order to make the most of SE Screen-Space shadows!

## 4.1 Noise, Bilateral Blur, and Temporal Anti-Aliasing

It is highly recommended to use Temporal Anti-Aliasing (TAA) with this effect for multiple reasons. Firstly, since this effect uses screen-space information, any aliasing present in the source image will be visible in the screen-space shadows. Secondly, TAA can be leveraged in order to reduce banding and noise if Stochastic Sampling and Leverage Temporal AA are both enabled. This effectively means that fewer samples need to be traced per-pixel for a good result.

If you'd rather not use TAA, you can use Bilateral Blur to reduce artifacts. However, TAA is recommended because blur can arguably defeat the purpose of sharp contact shadows in some situations.

## 4.2 Translucency

A downside of this effect is that it can reduce apparent translucency from your key directional light on objects like foliage. This is an inherent limitation of screen-space tracing. Reducing the Accumulation property and increasing Trace Bias can help alleviate this downside.

## 4.3 Range, Samples, and Tracing Artifacts

As mentioned in Section 3, the parameters Range and Samples should be adjusted with care. When Samples are too high in relation to Range, incorrect self-shadowing artifacts can occur.

## 4.4 Shadow Bias and Range

Using screen-space shadows can help fill in the gaps caused by a high Bias value on your key directional light. It is recommended to adjust the Bias on your directional light in tandem with the Range property in SE Screen-Space Shadows. You may even want to increase Bias higher than you normally would to ensure that contact shadows are nice and sharp.

# 5. *Support*

If you need help with SE Screen-Space Shadows or would like to report an issue, you can find a link to the Unity Forums thread on [this page](#), or you can use the [contact form](#) on my website.

If you are reporting an issue, please provide a detailed description of the problem you are experiencing, as well as system information (graphics card, operating system, Unity version, etc.).