



Lenscare for Photoshop manual → v1.3

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# Introduction

The purpose of Lenscare is to provide realistic camera-like out-of-focus and depth-of-field blurs. There are two main features that allow us to accomplish these effects.

**PLEASE NOTE** — There are a few notable differences between the After Effects and the Photoshop version. The most obvious difference is that the version for Photoshop contains a single plugin which incorporates both Depth of Field and Out of Focus. The effect used depends upon whether the plugin is called with or without a selection. The Photoshop version also does not incorporate the background distortion feature and cannot use colored irises.

### Simulation of different lens apertures

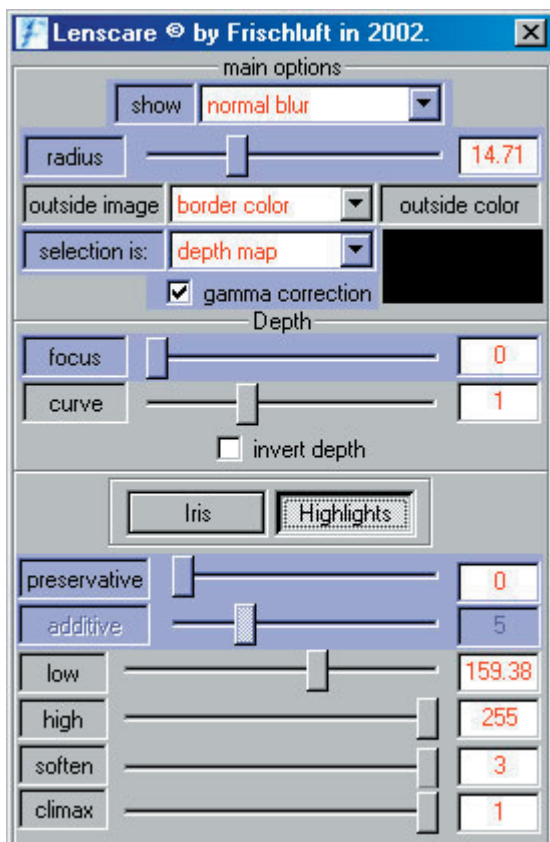
The iris describes the virtual camera's lens aperture. This camera property has an important influence on how the camera's blur will look. The aperture's shape is especially apparent on small bright spots which can be emulated using 'Highlight Selection'. The iris not only describes the lens aperture's shape, but also describes light distribution within the camera's lens. For example, a smudge on the lens can be simulated.

### Highlight selection

Common graphic formats can only represent a limited range of brightness. Thus very bright spots and areas get clipped to this limited range. In order to achieve a correct camera blur the true brightness would be needed. That is because in a blurred image the brightness will be distributed to a larger area. When the brightness has been clipped, there is less intensity to be distributed and the resulting image will be too dark in those areas. This problem is especially apparent with small bright spots. Usually sharp highlights in the form of the iris should appear there. With 'Highlight Selection' it's possible to recreate such spots.

## Overview

Basic parameters in 'Out of Focus' as well as in 'Depth of Field'. Groups of related parameters are from here on referred to as sub topics. There are four sub topics which are discussed in their own sections further below: 'Depth Buffer', 'Iris', 'Highlight Selection' and 'Outside Image'.



Here is an overview of the basic parameters:

- > 'show'
- > 'radius'
- > 'selection is'
- > 'focal point/focus' (Depth of Field only)
- > 'preservative highlight intensity'
- > 'additive highlight intensity' (Out of Focus only)
- > 'gamma correction'

### **'show'**

This is the most important parameter that helps you to adjust all aspects of these plugins by providing appropriate feedback. It deserves a little extra attention. It also lets you choose what the filter's output will be. There are different possible outputs which help you to control the effect.

### **'normal blur'**

The normal blur effect.

### **'iris'**

Shows the simulated lens aperture that is going to be used. The iris or lens aperture is one of the important factors in a camera that determines the look of the camera's blur. The iris' appearance can be adjusted in the 'Iris' sub topic.

### **'highlight selection'**

Here you can see which areas are selected to be brighter than the rest of the image. For example, light sources should be selected so that these will be predominant in the resulting blurs. Selections can be adjusted in the 'Highlight Selection' sub topic.

### **'highlight selection only'**

this is the same as 'highlight selection' with the difference that the selected image areas are not shown but only the selection intensities.

Depth of field has two extra outputs:

### **'depth buffer'**

The map that is being used as a depth reference to calculate the effect. This is the most important parameter for the Depth Of Field filter and can be adjusted using the 'Depth Buffer' sub topic.

**'info density'**

Indicates possible defects and thus helps the user identify possible problems areas. All areas marked red potentially contain artifacts. The brightness of the red color indicates the increased likelihood of artifacts. You may ignore the areas of green color.

**'radius'**

Describes the blur radius. For Depth of Field the blur size also depends on the depth buffer and the focal point parameter described below.

**'selection is'**

This parameter is only active if the filter has been called with a selection. It determines how that selection is used. It can either be used as Depth buffer for Depth of Field or as a replacement for the internal generated 'Iris' shape for Out of Focus.

**'focal point/focus' (Depth of Field only)**

This is the depth value where the image will not be blurred and in thus be in focus.

**'preservative highlight intensity'**

Describes how predominant the selected highlight areas will be, compared to the regular image. If only 'preserve highlight intensity' is selected, the selected highlights will never be brighter than they are in the source image.

**'additive highlight intensity' (Out of Focus only)**

Similar to 'preservative highlight intensity' with an important difference. By using this parameter the selected highlights will be made brighter instead of preserving their colors. You'll see little difference if your selected highlight areas are maximum white only, but for darker or colored highlights, enabling this effect makes a real difference.



### 'gamma correction'

If gamma correction is turned on, the image will be transformed to linear space before any calculation takes place. Afterwards it is transformed back again. Usually this option should be turned on because it simulates what happens in a real camera. Blurred colors will look wrong otherwise. Turning this option off makes sense only if you know the image has been transferred to linear color space before or if you want to use the plug for blur gradients rather than simulating a camera.

## Usage

If you use Lenscare for the first time you might want to read this short how-to chapter. It will describe all the basic parameters and how they affect your image.

When using Lenscare the first thing you should decide is whether you want to apply the effect flat, so that the blur amount will be the same for the whole image (Out of Focus). Or if you want the amount to vary (Depth of Field).

### Out of Focus

When applying 'Out of Focus' the first thing you should do is to select the look of your virtual camera's aperture (iris). Change the 'show' parameter to 'iris' and adjust it to your needs. This is done using the 'iris' sub topic. If you don't like the built-in settings you can completely override them by providing a custom form. Read further below in this chapter for more information.

If you feel like the image needs some highlights or a brightness boost you should switch 'show' to 'highlight selection' and select the desired areas as described in the 'Highlight Selection' subtopic. Now you are ready to adjust the basic parameters.

### Depth of Field

When applying 'Depth of Field' the first thing you should do is to select the 'Depth Buffer' you want to use and adjust it. You then need to open the filter with the desired depth image as selection. There is more information about how to do it further below in the chapter.

**IMPORTANT** — Depth Of Field assumes that white pixels in the depth buffer indicate pixels that are closest to the camera and black pixels being the ones most distant (check in depth buffer 'show' option). So if you have a depth map that is rendered the other way around, you should adjust it using the 'invert' option in the 'depth buffer' subtopic. If you don't do so the effect will be calculated with wrong opacity assumptions and will look wrong.

Once you have the depth buffer adjusted you should switch the 'show' parameter to 'iris' output and adjust it to your needs using the 'Iris' sub topic. If you feel that the footage needs highlights or some areas a brightness boost, you should switch 'show' to 'highlight selection' and select the desired areas in the 'Highlight Selection' sub topic.

Now you are ready to adjust the Depth Of Field itself. Before switching 'show' to 'normal blur' it makes sense to decrease resolution for preview because Depth Of Field can be very slow with the 'wrong' settings. Normal plugins usually take 4 times longer to calculate a image with doubled resolution. Due to its complexity, this is not true for Depth Of Field. Doubling the resolution increases Depth Of Field render time roughly by a factor of 8 (yes, eight)!

### **Selections as depth buffer or iris shape**

If you want to use a custom iris shape or a depth buffer you will have to open the filter with an active selection in Photoshop. Use the parameter labeled 'selection is' to determine what the selection will be used for.

If you have the custom iris or the depth buffer which you'd like to use as an image, you will have turn it into a selection before opening the plugin. In Photoshop you can do that this way:

Load in the image that is to be blurred and the one containing the depth buffer (iris). Now copy one of the color channels from the depth (iris) image to the other one. Load that channel as selection using the 'Load Selection ...' dialog from the 'Select' menu in Photoshop. Before applying the effect delete the new channel or make sure that only the original channels of the image that is to be blurred are active.

## Depth Buffer

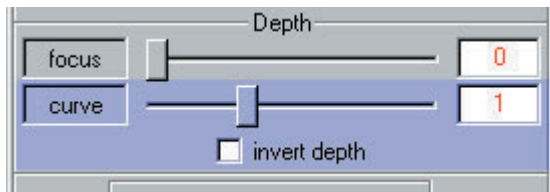
**PLEASE NOTE** — This applies to the Depth Of Field effect only. To calculate the effect, a depth buffer is needed. It describes the distance to the virtual camera for each pixel. It can either be painted by hand for photos and drawings or if the image has been rendered the raytracer can be used to render out a nice exact depth map.

**IMPORTANT** — There are anti-aliasing issues that you should be aware of. Please read the discussion about it in the Tips’N’Tricks section.

The depth buffer needs to be delivered to the plugin using the selection. The selection that is active when the filter is called can be used in two ways. When you want to do a depth of field effect, insure that the ‘selection is’ parameter is set to ‘depth map’. Otherwise, an out of focus effect will be calculated with the selection as replacement iris.

**IMPORTANT** — Depth Of Field assumes that white pixels in the depth buffer indicate pixels closest to the camera and black pixels the ones being most distant. If you have a depth image that is rendered out the other way around you should adjust it. Use the ‘invert’ option in this subtopic. If you don’t invert it, the effect will be calculated with wrong opacity assumptions and will look wrong! Typical glow effects around depth borders will appear.

**PLEASE NOTE** — Depth Of Field can have a maximum of 256 different blur levels. Even if you work with 16 bit images, there will be a maximum of 256 different blur levels. Initially, this may sound like a serious quality restriction, but we have never experienced artifacts that would be related to this constraint. Compared to the apparent problems with 8 bit color channels, an 8 bit blur resolution is much less troublesome due to the nature of a blur.



Here are the parameters of the depth buffer sub topic:

> 'invert depth'

> 'curve'

#### 'invert depth'

Simply inverts the depth buffer. White parts will become black and vice versa. This is important if you want to apply a depth buffer where black points indicate front parts. Depth Of Field assumes white points to indicate front pixels.

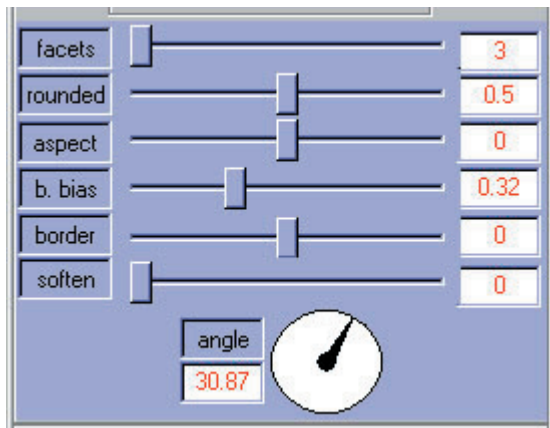
#### 'curve'

Can be used to adjust the brightness curve of the depth buffer and thus the blur distribution within the image. If you need more sophisticated adjustments you should apply external filters like 'Curves' to the depth map.

## Iris

The iris describes the virtual camera's lens aperture. This camera property has an important influence on how the camera's blur will appear. Lenscare offers the possibility to model or even replace this iris (in Out of Focus only).



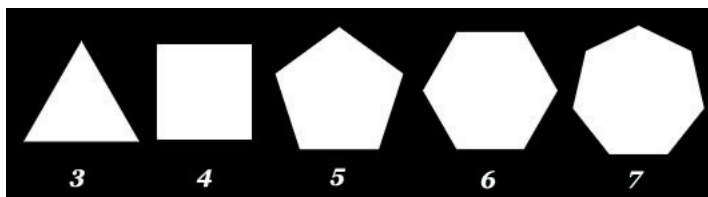


Here is a description of the 'Iris' subtopic parameters:

- > 'facets'
- > 'angle'
- > 'rounded facets'
- > 'aspect'
- > 'relative border brightness' and 'border thickness'
- > 'smooth' (Out of Focus only)

#### 'facets'

Determines the number of facets or blades of the lens aperture.

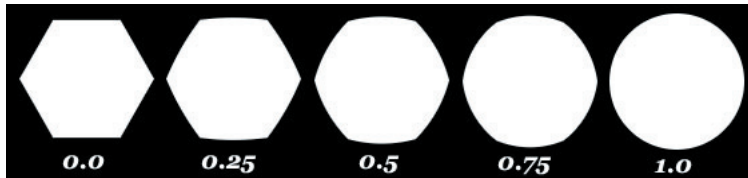


#### 'angle'

Rotates the iris around its center.

### 'rounded facets'

Rounds off the facets. 1.0 will result in a disc where 0.0 will result in a pure polygonal like form and 1.0 in a sphere-like shape.

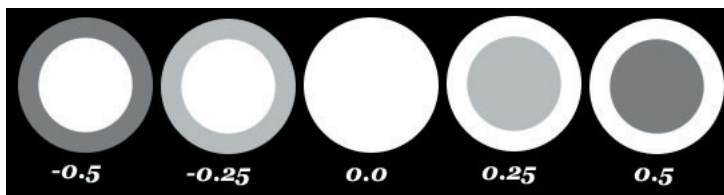


### 'aspect'

Changes the x-y proportions of the iris. Some high quality cameras have oval lens apertures. This parameter can be used to emulate those camera types.

### 'relative border brightness' and 'border thickness'

These two parameters let you add a border around the iris which is different in intensity from the inner iris. A similar brightness distribution is often found in real cameras.

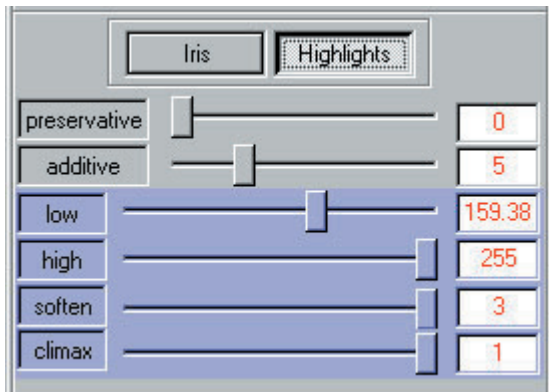


### 'smooth' (Out of Focus only)

Applies a blur to the iris.

## Highlight Selection

Lenscare offers the ability to compensate for the problem of missing brightness information. Using this sub-topic, areas can be selected and given a boost. Based on the footage you can select brightness ranges.



The following is a description of the available parameters:

- > 'low/high'
- > 'soften'
- > 'climax'

#### 'low/high'

Mark the lower and upper brightness threshold. Everything in between will be visible.

#### 'soften'

Darkens the selection relative to the climax position.

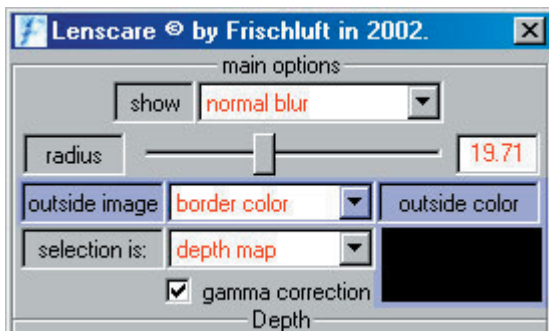
#### 'climax'

Refers to soften parameters and only takes effect if 'lightness soften' is not zero. This marks the relative position in between start and end which is not influenced by soften.

To fully understand climax, soften and the low/high parameters the best way is to load in a black to white gradient and play around with these parameters. This will allow you to quickly get a feel for each control.

## Outside Image

This sub-topic describes what is assumed outside the image.



The following is a description of the parameters:

- > 'horizontal/vertical assume' | 'outside image'
- > 'outside color'

#### 'horizontal/vertical assume' | 'outside image'

These parameters determine what is assumed outside the current image and changing it will only result in changes at the borders. Note that in Photoshop there is only one parameter for combined horizontal and vertical behavior. Here are the possible values:

#### 'border color'

the image's border colors are assumed to continue on the outside

#### 'mirrored image'

a mirrored image is assumed on the outside

#### 'repeated image'

a repeated (tiled) image is assumed on the outside

#### 'color'

the color specified below will be assumed outside

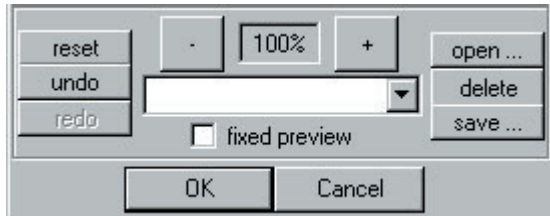
#### 'outside color'

If 'color' is chosen in horizontal or vertical assume, this color is assumed outside.

## Interface

The plugin has a few controls that do not alter the effect. Among them are controls to load and save settings.

Settings are stored in external setting files where only one is active at a time. All operations on settings take place on that active file. These controls are located at the bottom of the control window:



Here is the overview of those controls:

- > '+'
- > '-'
- > 'reset'
- > 'undo'
- > 'redo'
- > 'open'
- > 'delete'
- > 'save'
- > 'fixed preview'

'+'  
enlarge preview image

'-'  
decrease preview image size

'reset'  
resets all parameters to their default values

'undo':  
undo the last operation



**'redo'**

redo the last undone operation

**'open'**

Opens a file dialog that lets you choose a settings file. You can either choose an existing settings file or create a new one by typing in a new file name. The available settings from that file will be listed in the dropdownbox and can be selected from there.

**'delete'**

Deletes the setting from the settings file whose name is currently shown in the dropdownbox.

**'save'**

Opens a dialog asking for a new settings name and saves the new setting in the current settings file.

**'fixed preview'**

When turned on the image's resolution will not be decreased in order to show a lower quality realtime preview. The image will then be displayed after it has been calculated completely.

## Tips'N'Tricks

1. Depth of Field speed considerations
2. Out of Focus speed considerations
3. To anti-alias or not to anti-alias
4. Depth of Field quality considerations
5. Depth of Field looks wrong
6. Depth of Field has strange artifacts on depth borders

### 1. Depth of Field speed considerations

As a rule of thumb the time needed to calculate a frame depends on the average blur radius and image size. Another slowing factor is the shape the Iris. If 'relative border brightness' in the Iris sub topic is not zero, the render time will increase. When 'Highlights Selection' is enabled, speed will also drop somewhat. There is no 'low quality' speed gain because results for low and high quality are absolutely equal. Normal plugins usually take 4 times longer to calculate a image with doubled resolution. Due to its complexity, this is not true for Depth Of Field. Doubling the resolution increases Depth Of Field render time roughly by a factor of 8! It makes sense to decrease resolution in preview mode.

### 2. Out of Focus speed considerations

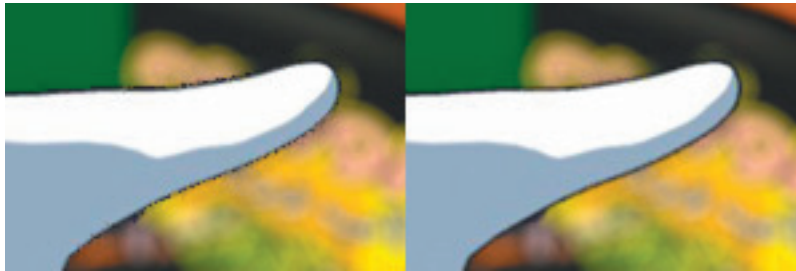
Speed is mostly (!) independent of the blur's radius. A 'colored Iris' in the Iris sub topic will increase render time as well as an enabled 'Highlight Selection'. Another factor that increases render time is enabling refraction by selecting 'blend layer'. The algorithm's implementation makes speed virtually uniform over wide ranges of image sizes and takes sudden jumps on certain image size levels. These levels are all powers of two, e.g. there is a great difference between a image sized 950x950 and 1050x1050. [ $2^{10} = 1024$ ]. We hope to be able to reduce this rendering differential in future upgrades. There is no 'low quality' speed gain because results for low and high quality are absolutely equal.

### 3. To anti-alias or not to anti-alias, quality considerations

Anti-aliasing is a topic that needs special discussion for 'Depth of Field'. The restriction is that the depth buffer cannot be anti-aliased. If the depth buffer were anti-aliased, any gray values in between the black and white areas would indicate wrong depth values and would thus result in artifacts. Conversely, when there is no anti-aliasing on the depth buffer but there is anti-aliasing on the image, then those two images don't match exactly, which results in more or less visible artifacts. One way to deal with the second problem is to render in doubled resolution, apply Depth Of Field and then resize back to normal resolution. In order to reduce the rendering time for the raytracing, it is possible to decrease anti-aliasing on the image by the same factor the resolution has been increased. For example, if 16 times oversampling is enabled with a doubled resolution only 4 times oversampling is needed.

If you already rendered out your image in normal resolution it is acceptable to increase image size in After Effects and render out only the depth map in doubled resolution. Then use that z-buffer to apply Depth Of Field on the bigger resized image.

Here is a comparison of an image rendered in single vs. doubled resolution.



#### 4. Depth of Field quality considerations

The best way to improve quality for Depth of Field is to read the 'To anti-alias or not to anti-alias' topic above. Apart from this, there are inherent problems with any depth of field post-processing solution. A serious problem is missing information: information that is occluded in the 2D image and would be needed in order to generate a completely correct Depth Of Field effect. In order to help the user identify those areas, Depth of Field provides a 'Show' mode where those areas can be identified. This mode is named 'info density' in 'Show' and using it can simplify the identification of possible problems. Red areas indicate missing information. The brighter the red color is, the more likely problems are to occur. Areas of green color can be ignored. If artifacts are too apparent you might want to render in layers and apply multiple blurs.

#### 5. Depth of Field looks wrong

Try setting 'invert' in the 'Depth Buffer' sub topic. When looking at the depth buffer, you need to make sure that pixels closer to the camera need to be lighter than more distant ones. Otherwise the plugin will perform opacity calculations with wrong assumptions.

#### 6. Depth of Field has strange artifacts on depth borders

Check the used depth map. It may not be antialiased. If the depth buffer was antialiased, any gray values in between the black and white areas would indicate wrong depth values and would thus result in artifacts. Try rendering out your depth buffer again with no anti-aliasing.

## Examples

Enclosed with this manual there are some example images for you to start toying around with. Please note that these images are copyrighted. We thank all the authors by heart for their help.

The Maserati 3200 GT was modelled and is copyrighted by Elvis Blazencic a.k.a Lewis.

— [www.lewis.tomsoft.hr](http://www.lewis.tomsoft.hr)

The comic image was drawn and is copyrighted by Ila Solomon.

— [www.ilasolomon.com](http://www.ilasolomon.com)

The picture of Harrod's illuminated at night was taken and is copyrighted by R.T. Hasbrouck, Pleasanton, CA.

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