
KEYLIGHT
BY THE FOUNDRY

Keylight User Guide

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Rev. November 20, 2008

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INTRODUCTION

Welcome to this User Guide for Keylight.

Keylight has been refined over a number of years to make keying quicker and easier while providing a depth to the tools that will tackle even the most challenging shots. Keylight was first developed by The Computer Film Company to help with difficult keys on feature films. Over the years Keylight has been refined in production on hundreds of films. This pioneering work on digital compositing was honoured with a Technical Academy Award® in 1996.

About this User Guide

Use the Quick Key chapter to see how a simple key is pulled using Keylight. The Basic Keying Chapter goes over the most common parameters you'll need to pull a variety of keys. The Advanced Keying Chapter explains how to tackle more difficult keys.

OFX Plug-ins

These plug-ins have been written and compiled to the OFX plug-in standard. OFX is an open plug-in API for 2D visual effects. For a current list of supported host systems, see www.thefoundry.co.uk.

For technical information on OFX for developers, see openfx.sourceforge.net.

New Features

For information on system requirements, new features, improvements, fixed bugs and known bugs & workarounds, see "Appendix A" on page 63.

Example Images

Example images are provided for use with Keylight. You can download these images from our web site www.thefoundry.co.uk.

Notation

When we refer to blue screens throughout the text we mean, of course, blue or green screens.

Installing Keylight

Keylight is available as a download from our web site www.thefoundry.co.uk. The downloads are in compressed tar format for Linux, executable (exe) format for Windows, and dmg format for Mac OS X.

Keylight on Linux

Follow these instructions if you wish to install Keylight on a Linux machine running Nuke.

1. Download the file from our web site (www.the-foundry.co.uk).
2. Change directory to:
`/usr/OFX/`
3. Copy the download file to this directory and extract the files from the archive using the following command. This will create a Nuke subdirectory.
```
tar xzvf Keylight_2.1v3_Nuke-linux-x86-release-
     32.tgz
```
4. Proceed to "Licensing Keylight" on page 8.

Keylight on Mac OS X

Follow these instructions if you wish to install Keylight on a Mac running Nuke.

1. Download the file from our web site (www.the-foundry.co.uk).
2. Double click on the dmg file.
3. Double click on the pkg file.
4. Follow the on screen instructions.
5. Proceed to "Licensing Keylight" on page 8.

Keylight on Windows

Follow these instructions if you wish to install Keylight on a Windows machine running Nuke.

1. Download the file from our web site (www.the-foundry.co.uk).
2. Double click on the exe file to install it.
3. Follow the on screen instructions.
4. Proceed to "Licensing Keylight" on page 8.

Install Directory

A host-specific directory is searched first for the Keylight plug-in and then the general OFX plug-in directory. For Nuke on Windows this is:

`C:\Program Files\Common Files\OFX\Nuke\`

For Linux:

`/usr/OFX/Nuke/`

For Mac OS X

`/Library/OFX/Nuke/`

Generic Install Directory

After looking in the host-specific directory for a Keylight plug-in, we search in the generic OFX plug-in directory as follows.

For Windows:
`C:\Program Files\Common Files\OFX\Plugins\`

For Linux:
`/usr/OFX/Plugins/`

For Mac OS X
`/Library/OFX/Plugins/`

Moving the Install Directory

You can put the OFX plug-ins anywhere as long as you set the environment variable OFX_PLUGIN_PATH to point to it.

Licensing Keylight

Without a license key, the Keylight plug-ins will fail to run.

The license key is a sequence of numbers and letters, stored in a plain text file, that unlocks Keylight. License keys can be created for a particular computer enabling those plug-ins to run only on that computer. These are called node locked licenses. We also supply floating licenses that will unlock Keylight on any networked computer connected to a machine running the Foundry license server.

Tools to install license keys, manage floating licenses, and diagnose license problems can be downloaded from our web site, www.thefoundry.co.uk/licensing.

Other Foundry Products

The Foundry is a leading developer of plug-in visual effects for film and video post production. Its products include Nuke, Furnace, Tinder, Tinderbox, Keylight, and Ocula and run on a variety of compositing platforms. For the full list of products and supported platforms, see our web site at www.thefoundry.co.uk.

Nuke is an Academy Award® winning compositor. It has been used to create extraordinary images on scores of feature films including *The Dark Knight*, *The Golden Compass*, *Iron Man*, *Transformers*, *King Kong*, and *Pirates of the Caribbean: At World's End.*

Furnace is a collection of film tools. Many of the algorithms utilise motion estimation technology to speed up common compositing tasks. Plug-ins include wire removal, rig removal, steadiness, deflicker, degrain and regrain, retiming, and texture tools.

Tinder and Tinderbox are collections of image processing effects including blurs, distortion effects, background generators, colour tools, wipes, matte tools, painterly effects, lens flares, and much more.

Ocula is a collection of tools that solve common problems with stereoscopic imagery, improve productivity in post production, and ultimately help to deliver a more rewarding 3D-stereo viewing experience.

Visit The Foundry's web site at www.thefoundry.co.uk for further details.

About CFC and Framestore

The Computer Film Company (CFC) pioneered the field of digital film compositing and today operates a state of the art film effects facility in London under the name Framestore. The company has always invested in research, and maintains the kind of edge that has twice been honoured with Technical Achievement Awards from the Academy of Motion Picture Arts and Sciences.

Visit Framestore's web site at www.framestore.com for further details.

Getting Started

Quick Key

Consider this shot from The Saint, pictures courtesy of CFC and Paramount British Pictures Ltd.

Figure 1. Blue Screen.

Figure 1 is the blue screen foreground that should be composited over the background shown in Figure 2.

Figure 2. Background.

Step by Step

1. Start Nuke and read in both images. From the Keyer menu, apply Keylight and attach a viewer.
2. Click the colour swatch next to Screen Colour to activate the eye dropper. In the viewer, Ctrl+Shift+Alt+click (Mac

users Cmd+Shift+Alt+click) and drag a rectangular area over the blue pixels as shown in Figure 3.

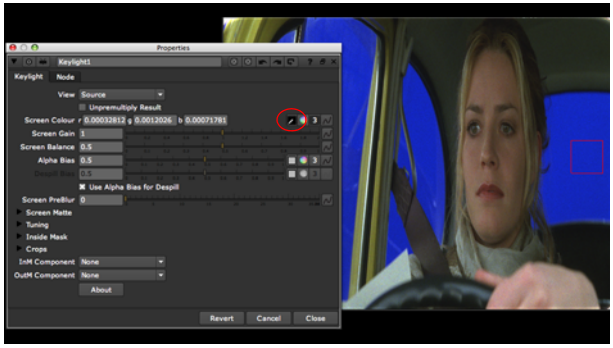

Figure 3. Pick the Screen Colour.

Picking the screen colour also sets the Screen Balance.

3. That's it. In many cases this is all you will need to do to perform a key, since selecting the screen colour creates a screen matte and despills the foreground.
4. Switch output from Final Result to Composite to see the foreground keyed over the background. The final composite is shown in Figure 4.

Figure 4. Final composite.

If you want to have a go of this shot, you can! The images can be downloaded from our web site and this quick key is

also covered in the Tutorial Chapter. See "Tutorial 1: Simple Key" on page 43.

Picking the screen colour may be enough for a lot of keys, but there are many more tools within Nuke that can be used to tackle more complicated shots. These are described in later chapters.

Basic Keying

The following section describes the parameters you need to do basic keying. This will give you enough to tackle most simple keys. A discussion of advanced parameters to fine tune keys and tackle complex keys can be found in the next chapter.

Picking the Screen Colour

The screen colour is probably the most important parameter and you should always pick the screen colour before doing anything else. It should be set to the colour of the green or blue curtain behind the foreground object. Pick the screen colour directly from the image by Ctrl+Shift+Alt dragging (Cmd+Shift+Alt+dragging on a Mac) a rectangle over the blue pixels. The average value of the pixels selected is used.

Tip *If you press Alt when sampling a colour, Nuke always samples the source image regardless of what you're looking at. This means that you can pick the blue screen colour even if you are viewing the matte, status or composite.*

Tip *Picking different shades of blue from the screen colour can give quite different results. It's worth picking from different parts of the screen to get the best result.*

Picking the Screen Colour creates the screen matte used to composite the foreground over the background. It also sets the Screen Balance (if this has not already been set manually) and despills the foreground.

Screen Matte

Setting the screen colour will pull a key, or in other words, create a matte - the Screen Matte. Setting the screen colour

will also despill the foreground, although you can also use the Despill Bias to remove more spill. In some cases this is enough to get a decent key. For more information on Screen Colour see page 22.

Figure 5 shows a well-lit blue screen behind an actor.

Figure 5. Blue Screen.

You should note that repeatedly picking colours does not add to previous selections and key more of the image with each click. To key more of the image, try picking different shades of blue then use the screen strength parameter. See "Keying More" on page 18.

Viewing the Key

After picking the screen colour you have created a matte (the screen matte) and despilled the foreground. The result can be displayed in a number of different ways using the View control. You can output the final composite of the foreground over the background as an rgba, or you can output the premultiplied or unpremultiplied foreground for compositing elsewhere in the tree. The screen matte and the status view are the other two options which are useful in fine tuning the key rather than as an output image in their own right.

The Status is one of the options in the view menu and shows an exaggerated view of the key so that you can make a more informed decision when tuning the key. Figure 7 shows the Status display after the screen colour has been picked from the image shown in Figure 6.

Figure 6. Green Screen.

Figure 7. Status.

Three colours are displayed.

- Black pixels show areas that will be pure background in the final composite.
- White pixels show areas that will be pure foreground.
- Grey pixels will be a blend of foreground and background pixels in the final composite. You need grey pixels around the edge of the foreground to get a good key at the foreground edge. Pixels that are a blend between the foreground and background are shown in just one shade of grey. This is done to highlight potential problems with the key. These grey pixels may represent a foreground/background blend of 50/50 or 99/1. No distinction is made as to this ratio.

You may occasionally see other colours in the Status View and these are covered on page 21 in the Advanced Keying Chapter.

Keying More

To improve the key by firming up the foreground so the background doesn't show through, you should adjust the Clip White parameter. To key more of the foreground so that the background is clearer, you should use the Clip Black parameter. Look at the Screen Matte and the Composite while you're doing this. Don't overdo either of these or the edges between foreground and background will become hard.

ADVANCED KEYING

The following section describes how Keylight works under the hood as well as the parameters you need to fine tune keys and get the most out of Keylight. Basic parameters covered in the previous chapter may also be covered here in more detail.

Under The Hood

Keylight is a 'colour difference keyer', which means that for it to figure out a key, it compares every pixel in the image against a single colour, known here as the **Screen Colour**.

View

The View parameter allows Keylight to render the final composite of the foreground over the background, or the foreground RGBA for compositing further down the tree. Two options, Screen Matte and Status, are for viewing the key rather than an output. The options are:

- **Source** - shows the blue/green screen foreground.
- **Source Alpha** - shows the alpha channel on the foreground input.
- **Screen Matte** - this is the matte created from picking the Screen Colour. It does not include any inside or outside masks.
- **Inside Mask** - shows the inside input. This is used to firm up the foreground matte to stop print through.
- **Outside Mask** - shows the outside input. The outside mask is used as a garbage mask to reveal the background.
- **Combined Matte** - the screen matte, inside mask and outside masks added together.

- **Status** – this renders an exaggerated view of the key so that minor problems are shown clearly. See "Status" on page 20.
- **Intermediate** – use this option on shots that can only be keyed using several different keys on different parts of the image (multipass keying). This renders the original source image with the Screen Matte generated in this Keylight node. In Keylight nodes down the tree, you should set the Source Alpha in the Inside Mask folder to Add To Inside Mask.
- **Final Result** – this creates a premultiplied RGBA foreground that can be composited later. There's an Unpremultiply Result toggle you can use if you wish.
- **Composite** – this renders the foreground composited over the background using all mattes, spill and colour corrections.

Status

Status is one of the options in the view menu and shows an exaggerated view of the key so that you can make a more informed decision when fine tuning the composite. Figure 9 shows the Status after the screen colour has been picked from the image shown in Figure 8 on page 20.

Figure 8. Green Screen.

Figure 9. Status.

Three colours are displayed.

- Black pixels represent pure background in the final composite.
- White pixels are pure foreground.
- Grey pixels are a blend of the foreground and background pixels. The grey is just one colour to highlight any areas that are not pure foreground or background. Grey pixels do not mean the key is poor – the final composite may be fine.

You may occasionally see other colours in the Status View. Figure 10 shows black, white, grey and green pixels.

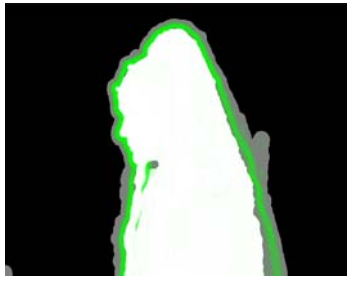

Figure 10. Status showing processing of the alpha channel.

Figure 11. Composite showing Screen Replace Colour.

- Green pixels are a warning. They show you the parts of the alpha that have changed through processing the alpha channel (clipped, softened or eroded). These areas have had the correct amount of spill removed, but the alpha has subsequently changed and the composite may no longer look right. This can be corrected using the Screen Replace Colour to put back colour in these areas. Figure 11 on page 21 is an extreme example to illustrate the point. The Screen Replace Colour has been set to pure red and you can see that this mirrors the green pixels in the Status View.

Similarly, you may see blue pixels in the Status.

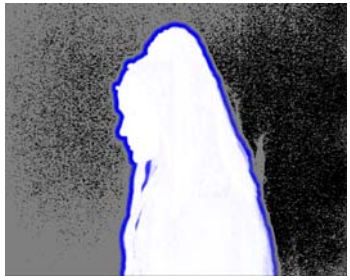

Figure 12. Status showing how the inside matte will affect the foreground.

Figure 13. Composite showing the inside replace colour.

- Blue pixels represent processed pixels in the Inside Mask that affect the despill of the foreground. The Inside Replace Colour will be used to modify these pixels. Another extreme example is shown in Figure 13. The Inside Replace Colour is set to pure yellow and the Inside Replace is Hard Colour.

You may also see dark red pixels in the Status.

- Red pixels indicate areas where an outside mask has been used to reduce the transparency of the image.

Screen Colour

The screen colour represents the colour of the pure blue (or green) screen. The first thing you should do when pulling a key is pick the Screen Colour.

Note *If you press Alt when sampling a colour, Nuke always samples the source image regardless of what you're looking at. This means that you can pick the blue screen colour even if you are viewing the matte, status or composite.*

Picking the Screen Colour creates the screen matte used to

composite the foreground over the background. It also sets the Screen Balance and despills the foreground.

The Screen Colour is a single colour. It has a primary component, blue or green, and that has a saturation. Once the screen colour has been picked, Keylight analyses all the pixels in the image and compares the saturation of the primary component in each of these pixels with the corresponding saturation of the screen colour. Keylight uses this comparison to do two things.

1. It calculates the transparency of that pixel and puts it in the alpha channel.
2. It removes the screen colour from the pixel, a process known as despilling.

Tip *It's worth sampling a selection of screen (blue or green) colours and viewing the result. Picking different colours will give different results.*

Background Pixel

If the saturation of the pixel in the image is as strong, or greater than the screen colour, then it'll be a pixel from the blue screen background, and that pixel will be set to completely transparent and black. See Figure 14.

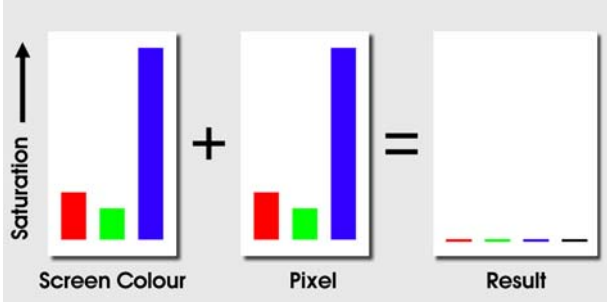

Figure 14. Blue screen pixel set alpha to zero.

Edge Pixel

If the saturation of the pixel is less than the screen colour, then it'll be the edge of the foreground object, and we subtract some of the screen colour from the pixel (de spilling) and set the image to semi-opaque. See Figure 15.

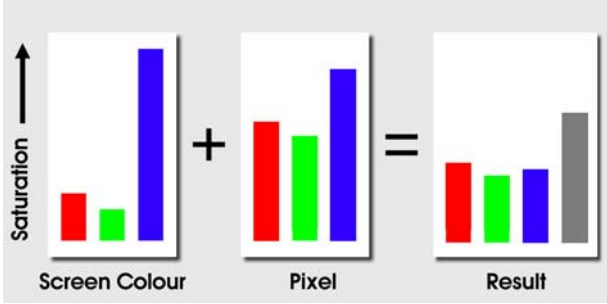

Figure 15. Edge pixel gives partial alpha.

Foreground Pixel

If the primary component in the pixel is not the same as the primary component of the screen colour we have a foreground pixel, and the alpha is set to completely opaque. The pixel colour is not modified. See Figure 16.

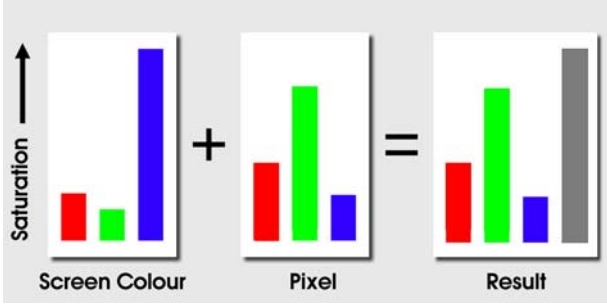

Figure 16. Foreground pixel gives full alpha.

Note *You should note that the Screen Colour is a single colour. You are not picking lots of colours that are keyed out.*

Biasing

What's biasing all about? Biasing in Keylight was originally developed for a shot in the motion picture "Executive Decision". The foreground consisted of reddish browns, but a combination of factors led to the 'green screen' being lit so that its primary component was actually slightly red.

Figure 17. Is this the worst green screen you've ever seen?

So what happens when we pick the screen colour? Well because the screen was 'red', as is the foreground, our pilot ends up being keyed out as shown in Figure 18.

Figure 18. Default key showing the transparency in the foreground as a result of picking the "red" screen colour.

Not a great result, I'm sure you'll agree, and much pressure was applied to the lowly programmers to get around the problem.

A work around to this is to manually colour correct the image so that the background is properly green, pull the key from this corrected image, then 'un-correct' the result of that so that the foreground colours match the original. A corrected image would look something like the one shown in Figure 19. The green screen is now strongly green and distinct from the foreground colours. Notice also the red cast on the pilots mask has been removed and turned into a neutral grey.

Figure 19. Colour corrected image that would give a better key.

This is effectively how the Keylight developers got around the problem. They introduced the concept of a 'bias' colour, which is a colour cast that is removed from the source image and screen colour, then a key is pull from this modified image, then the colour cast is put back. In essence, this automates the 'work around' described above, however, it is done in a way that does not slow Keylight down at all.

For our Executive Decision shot, an appropriate colour is the red cast on the pilot's mask in the source footage. Setting our bias to this now gives us the far better result as shown in Figure 20.

Figure 20. Final Key, with the Bias Colour Set to the Value of the Pilot's Mask.

The Bias Colours in everyday use

It also turns out that the bias colour is actually useful for situations without strong casts, typically where there is some colour spill around the edge of keys. By setting the biases to the main colour that occurs near the edge of the foreground (typically flesh tones or hair tones), you allow Keylight to better discriminate between foreground and background.

Picking a Bias Colour

To pick a bias colour, click the colour swatch next to Alpha Bias to activate an eye dropper and Ctrl+Shift+Alt+drag (Mac users Cmd+Shift+Alt+drag) a box over the image foreground. The average colour under the box will be used for the bias you have chosen.

Note *If you press Alt when sampling a colour, Nuke always samples the source image regardless of what you're looking at. For instance, you may be looking at the blue screen keyed over the background but you will be picking colours from the Source image.*

Why are there two Bias Colours?

Remember that Keylight does two things, calculates a transparency and removes the screen colour from the foreground. By default one bias colour, the 'Alpha Bias', is used for both operations. This works fine in most situations, for example, the Executive Decision shot above.

However, sometimes you can pick a bias that gives a great alpha, but performs a poor despill, and another bias that gives a great despill, but a poor alpha. Consider the blue screen from the TV series Merlin, courtesy of CFC Framestore shown below in Figure 21.

We pick the strong blue of the background without choosing an alpha bias, and end up with the lovely alpha shown in Figure 22, but the despill resulting from this key is poor as shown in Figure 23 on page 30.

Figure 21. Merlin blue screen.

Figure 22. Nice Alpha.

We can pick an alpha bias to get a better despill, but this destroys our nice alpha. The way around this is to turn off the 'Use Alpha Bias for Despill', which gives you a separate bias factor to use solely for despill calculations. If you then pick the 'Despill Bias' to be something from Miranda Richardson's hair or skin tone, you will keep the nice alpha,

and get a good despill as well (Figure 24).

Figure 23. Poor despill.

Figure 24. Final Key, Using Separate Despill and Alpha Biases.

Clip Black and White

The clip levels are adjusted using two parameters – Clip Black and Clip White. Any alpha value at or below Clip Black will be set to zero and any alpha value at or above Clip White will be set to 1. Figure 25 shows the original alpha of an image and Figure 26 on page 30 shows the result of clipping it.

Figure 25. Clip Black = 0

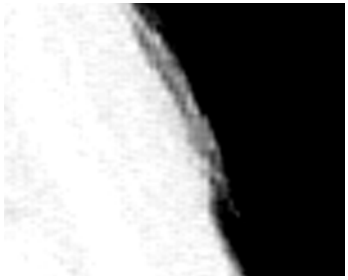

Figure 26. Clip Black = 0.5

Notice how the grey areas in the black background have been reduced and that the grey edges have hardened up considerably. When compositing, the Clip Black control can be used to improve the background image if parts of the

foreground are showing through. The Clip White control, on the other hand, can be used to firm up the centre of the matte, making it less transparent to the background.

Note *If you choose to use Clip Black and Clip White, you need to be really careful that you don't destroy the edges on your foreground. It is possible to use Clip Rollback to compensate for this.*

Screen Gain

The screen gain controls how much of the screen colour is removed to make the screen matte. Increasing this value will key more. Figure 27 shows the Status after picking the Screen Colour.

Figure 27. Status after picking the Screen Colour.

Figure 28. Status showing the increase in Screen Gain.

You can clearly see that parts of the background are grey where they should be black. When composited, you may see faint pixels from the foreground where you should be seeing pure background. Increasing the screen gain will fix this, as shown in Figure 28, but increasing it too much will destroy your good work. Like many keying parameters it's a balance – not too much, not too little. Increasing the screen gain too much will lead to the background showing through the foreground and edge detail will be destroyed. Figure 30 on

page 32 shows this quite well.

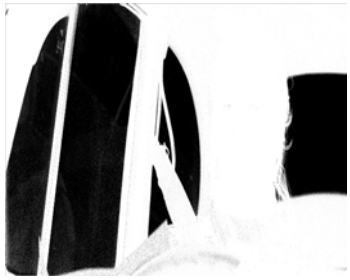

Figure 29. Screen Gain = 1.05 giving a good Screen Matte.

Figure 30. Screen Gain = 1.50 giving background show through and over eroded edges.

Note the steering wheel is black when it should be white. If you look at the composite you will see the background showing through here. Also, some of the fine hair detail on the actor, visible in Figure 29, has been eroded in Figure 30.

Screen Balance

The Screen Balance is set automatically after picking the Screen Colour.

Saturation is measured by comparing the intensity of the primary component against a weighted average of the two other components. This is where the **Screen Balance** control comes in. A balance of 1 means that the saturation will be measured against the smallest of the other two components in the screen colour.

A balance of 0 means that the saturation will be measured against the larger of the other two components. A balance of 0.5 will measure the saturation from the average of the other two components.

The appropriate balance point for each image sequence you key will be different depending on the colours in that image. Generally speaking, blue screens tend to work best with a balance of around 0.95 and green screens with a balance of around 0.5. These values are selected automatically the first time you pick the screen colour. If the key is not working too well with these settings, try setting the balance to about 0.05, 0.5 and 0.95 and see what works best.

PreBlur

Some shots can be improved by softening the foreground image that is used to generate the key. The original image is then used in the composite and colour corrections. The **Screen PreBlur** parameter is used to do this. DV footage or grainy shots may benefit from subtle use of this control.

Tuning

Keylight creates the screen matte after the screen colour has been picked. You can make fine adjustments to this matte using the **Gain** controls. Increasing the gain controls makes the screen matte more transparent by increasing the amount of screen colour showing through the matte. This tends to tint the edges the opposite of the screen colour (for blue screens, edges become yellow). Decreasing the gain makes the main matte more opaque by reducing the amount of screen colour showing through the matte.

The matte can be adjusted independently in the shadows, midtones and highlights giving more control than the clipping levels.

The level of the midtones can be adjusted too. For example, if you are working on a dark shot you may want to set the

midtone level to a dark grey to make the gain controls differentiate between tones that would otherwise all be considered shadows.

Screen Processing

Once you have picked the screen colour and got the screen matte, you may wish to process this matte using the parameters in the **Screen Matte** group. The matte can be adjusted using clipping levels; it can be eroded or grown, despotted and softened.

Two Stage Keying

Consider this example. Having applied Keylight and picked the screen colour you have good edges to your matte but the background is showing through the foreground. You could fix this by tweaking the Clip White, but in doing so it ruins your edges. One way round this is a two stage key (another way is using Clip Rollback). In the first key, you process the screen matte using the clipping levels to give a harsh black and white matte, then soften and erode it. Switch View to Intermediate Result to output the orginal green screen with the eroded matte as an RGBA. Then use this as the input to another Keylight node. In this second node, pick the screen colour to give good edges but with transparent forground. Don't process this matte, instead use the input alpha channel to fix the transparent foreground. Just set Source Alpha in the Inside Mask folder to Add To Inside Mask.

Clip Rollback

Pulling a screen matte (Figure 31) will typically produce lots of transparency (grey) in the matte at the edges. This is good since this is what you need to key hair well. You may also get transparency in the foreground as shown in Figure 32. This

is bad as your subject will appear slightly see-through, and this should be corrected.

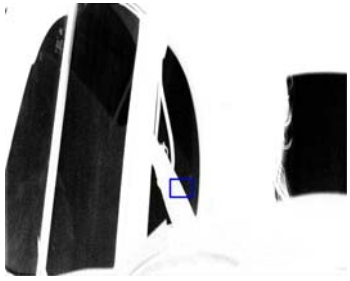

Figure 31. Screen matte highlighting the close up view as shown in Figure 32.

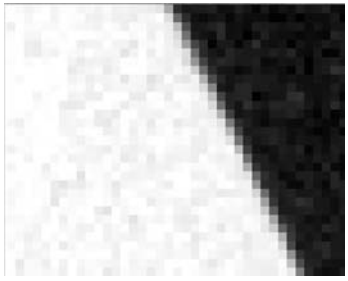

Figure 32. Close up screen matte showing unwanted (grey) transparency in the (white) foreground.

You can do this by connecting a matte into the third (InM) input, or you can use the **Clip White** parameter to turn these grey pixels white. This cleans up the foreground (Figure 33) but it will also destroy the edge detail you want to keep. This is where **Clip Rollback** comes in. This is used to put back the edges to restore the detail that was lost. A rather exaggerated clip rollback is shown in Figure 34 to illustrate the point.

Figure 33. Clip White has been used to remove the unwanted grey pixels in the white matte.

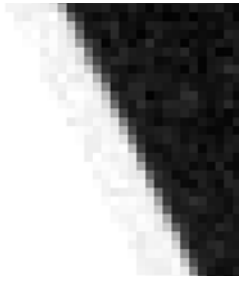

Figure 34. Clip Rollback has been used to restore the unwanted erosion of the edge.

Dilate

This control should not normally be used as eroding the edges can produce a very poor key. However, the **Screen Dilate** parameter allows you to grow (if greater than zero) or shrink (if less than zero) the alpha in the Screen Matte. These controls are sub-pixel accurate.

Figure 35. Screen Matte.

Figure 36. Eroded Matte.

Softness

Occasionally, it is useful to be able to blur the matte. Use **Screen Softness** for this. The most common example would be to pull a very harsh matte that you would use as an inside matte further down the tree. For this, you'd soften and erode the screen matte. (See "Two Stage Keying" on page 34.)

Despot

This controls how much to simplify the matte. It coagulates similar regions so that, for example, black specks in the white matte can be absorbed by the surrounding white areas. Increasing the Screen Despot Black will remove isolated spots of black in the white matte. Increasing Screen Despot

White will remove isolated spots of white in the background up to that size.

Figure 37. Eroded matte.

Figure 38. Despot.

Mattes

There are 4 mattes in Keylight.

1. Screen Matte
2. Inside Mask
3. Outside Mask
4. Alpha (Composite Alpha)

The **Screen Matte** is generated by the Keylight algorithm after the screen colour has been picked. It can be processed (clipped, eroded, etc) by the screen matte processing tools.

The **Inside Mask** is the hold out matte. It is used to confirm areas that are definately foreground. If your subject has blue eyes and is being shot in front of a blue screen, this mask can be used to put back the eyes. This mask is taken from the InM input to Keylight. The embedded alpha channel of the foreground input can be added to this mask using the Source Alpha parameter in the Inside Mask folder.

The **Outside Mask** is the garbage mask and is used to

remove unwanted objects (lighting rigs, etc) from the foreground. The mask is taken from the OutM input to Keylight. The luminance or the alpha of this input is set using the **OutM Component** parameter.

The matte used to blend the foreground and background in the final composite is the alpha displayed in the alpha channel of the composite. This matte is the combination of the screen matte, inside and outside mattes.

Inside & Outside Masks

If you can't adequately improve the screen matte using the clip levels, you can create a matte in Nuke round the pixels you definitely want to be foreground or background and use this as a mask input. The inside mask makes the foreground less transparent and the outside mask is used to clean up the background that might have bits of the foreground showing through. It is sometimes referred to as the hold out mask.

The outside mask (garbage mask) is often used to clean up screens that are not a constant colour or have lighting rigs in shot (Figure 39) by forcing the alpha transparent.

Figure 39. Green screen with lighting rig visible.

The inside mask can be used to keep elements in the foreground that you don't want to lose (an actor's blue eyes in front of a blue screen). These masks should normally be softened externally to blend into the screen matte.

Figure 40 on page 39 shows the bezier spline drawn around the lighting rig on the left side of the screen.

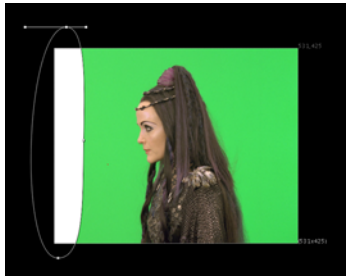

Figure 40. Bezier drawn round the lighting rig.

Connect the mask to the OutM input of Keylight and switch the parameter Outside Component to Alpha. The outside mask forces that part of the image to be in the background thus keying out the rig.

Source Alpha

This parameter determines what to do with any embedded alpha in the original source image. You will need this if you are doing multiple keys on different parts of the image with the View output set to Intermediate Result.

- **Ignore** – this will not add any embedded alpha to the screen matte.
- **Add To Inside Mask** – the embedded alpha is added to the inside mask. You should select this when multipass leying with Output set to Intermediate.

- **Normal** - the embedded alpha is used to composite the image.

Colour Replacement

Remember that Nuke does two things - it removes the screen colour to despill the image and generates an alpha (Screen Matte) to composite the foreground over the background layer.

If you then process the Screen Matte, for example, by eroding the alpha or changing the clip levels, Keylight will be removing the wrong amount of screen colour from the pixels whose transparency have now changed. The **Screen Replace** instructs Keylight how to deal with such pixels. The Status will display which pixels use a replace method. Those pixels who use a replace method because the alpha processing tools modified the transparency will be green, whilst those pixels whose transparency was modified by the inside matte will be blue. See the Status View on page 21.

There are four options to the replace method, these are:

1. **None -** the despilled image is left untouched if the alpha is modified.
2. **Source -** the image will have a corresponding amount of the original pixel (screen colour and all) reintroduced/ removed if the alpha is changed.
3. **Hard Colour -** the despilled image has a corresponding amount of the **Screen Replace Colour** added for any increase in alpha.
4. **Soft Colour -** the despilled image has a corresponding amount of the **Screen Replace Colour** added for any increase in alpha, however, it attempts to modulate the luminance of the resulting pixel so that it matches the

original pixel. This will give a more subtle result than the Hard Colour option.

Inside Mask

If the changes to the screen matte are due to an inside mask, the **Inside Replace** and **Inside Replace Colour** parameters can be used to modify the colour in these areas just like the Screen Replace parameters described above.

Edges

Built-in crop tools are included to quickly remove parts of the foreground at the edges of the image. It can also be useful in tidying up a matte at the edges where luminance changes in the blue screen are proving difficult to key out.

With **X Method** and **Y Method** set to Colour and **Edge Colour** set to pure blue (for a blue screen), set the **Left** to crop out the lefthand side of the image revealing the background. Figure 41 and Figure 42 show the changes to the Combined Matte with cropping.

Figure 41. Left = 0.

Figure 42. Left = 0.35.

InM Component

The component (luminance or alpha channel) of the inside mask input that is used in the calculations.

OutM Component

The component (luminance or alpha channel) of the outside mask. This mask is used as a garbage mask to reveal the background through the foreground as shown in Figure 44.

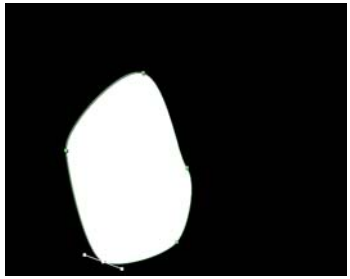

Figure 43. Outside Mask.

Figure 44. Revealing the background.

TUTORIAL

Introduction

We have included several tutorials with example images that you can use to practice Keylight.

- Tutorial 1: Simple Key
- Tutorial 2: Fine Tuning a Key
- Tutorial 3: Extreme Blue Spill
- Tutorial 4: A Red Green Screen
- Tutorial 5: Inside & Outside Masks

Example Images

The tutorial images referred to in this chapter can be downloaded from our web site www.thefoundry.co.uk.

Tutorial 1: Simple Key

Using the blue screen clip from The Saint, you will composite the actor over the background.

Download File

Saint.tar.gz

The clips you will need for this task are called SaintFG.tif and SaintBG.tif, pictures courtesy of CFC and Paramount British

Pictures Ltd for the film The Saint.

Figure 45. Blue Screen - SaintFG.tif

Figure 45 is the blue screen foreground that should be composited over the background shown in Figure 46.

Figure 46. Background - SaintBG.tif

Step by Step

1. Read in SaintFG.tif and SaintBG.tif.
2. Connect the images, Keylight and viewer in the node tree. Specifically, wire the blue screen foreground picture into the Source input of Keylight and the background image into the Bg input of Keylight. Apply a viewer to the output of the Keylight node.
3. Click on the Keylight node in the tree and pick blue pixels from image shown in the viewer. A good place to pick is the blue from the back windscreen as this has no

reflections. Picking this blue will key the back windscreen perfectly leaving reflections in the side window.

4. That's it. In many cases this is all you will need to do to perform a key, since selecting the screen colour creates a matte and despills the foreground. Switch output from Final Result to Composite to see the foreground keyed over the background. The final composite is shown in Figure 47.

Figure 47. Final composite.

There are a couple of extra steps that can be taken to fine tune this key and these are discussed in "Tutorial 2: Fine Tuning a Key" on page 46.

Tutorial 2: Fine Tuning a Key

Using the images from the film The Saint, you will learn how to fine tune the key pulled in Tutorial 1. You will learn how to:

- Use Status to highlight any problems.
- Use the Screen Gain to improve the background.
- Use an Inside Matte to improve the Screen Matte.
- Use the Despill Bias to remove more blue spill.

Download File Saint.tar.gz

Step by Step

1. Read in SaintFG.tif and SaintBG.tif.
2. Pick the Screen Colour from the back window of the car.
3. Before we do anything else, we need to look at the quality of the key so far. On first inspection, the composite looks pretty good, but it's hard to judge. You should also look at the Screen Matte to see how good the key is in the foreground and background areas. To see any potential problems more clearly, switch View to Status as shown in Figure 48.

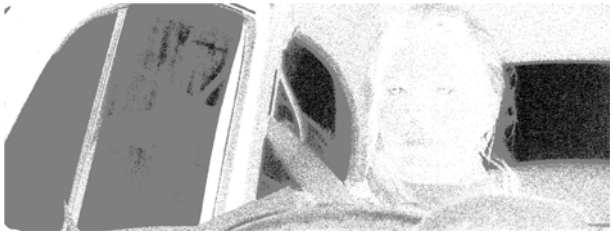

Figure 48. Status showing grey pixels in the background.

Here, we can see that the windscreens are a mixture of black and grey pixels. The black pixels tell us that pure background will be seen here in the final composite. The grey pixels tell us that there will be a mix of foreground

and background pixels. Now remember that the status view is an exagerrated version of the key to help us quickly see where there may be problems. You should always look at the Screen Matte and the Composite. But for now, let's try and clean up the background showing through the windows, while leaving some reflections in the side window. In other words, we need mostly black pixels with a few grey ones.

4. Figure 49 on page 47 shows the Status view that we're aiming for. The background has been cleaned up and we still have some reflections in the side window. To get this you should increase the Screen Gain to 1.05.

Figure 49. Improved screen matte with Screen Gain.

Observant readers will note that the background can also be cleaned up by increasing the Clip Black value. You should try this as well as the Screen Gain. There are subtle differences. In this particular example, the Screen Gain method give lovely reflections but tints them green. The Clip Black method gives (I think) worse reflections but doesn't tint them.

5. There is a fair amount of print through in the foreground under the seat belt and stearing wheel. You can see this as the grey pixels in Figure 49. This can be removed with an inside matte (sometimes called a hold matte). Use another Keylight node to pull a screen matte then greatly

soften and erode the edges as shown in Figure 50. This is then fed back into the downstream Keylight node as the inside matte input.

Figure 50. Diagonal split screen showing the unprocessed screen matte and clipped/eroded matte used as an inside matte.

6. The status view showing the improved foreground with the inside matte is shown in Figure 51.

Figure 51. Status with inside matte.

It's worth comparing Figure 49 on page 47 and Figure 51.

7. Finally, if you look closely at the composite you will see a tiny amout of blue spill on the woman's hand and in her hair. This was from reflected light from the blue screen. Pick skin tones for the Alpha Bias to remove this blue spill

and in the Inside Mask folder set Inside Replace to Soft Colour and pick skin tones.

Figure 52. Final Composite

Tutorial 3: Extreme Blue Spill

This is a really interesting clip from Merlin. The results with Keylight are certainly not perfect, indeed it is unlikely that you will ever end up with a truly realistic looking shot. However, there are some interesting things to observe. You will learn how to:

- Reduce the blue spill Despill Bias.

Download File

MerlinBlue.tar.gz

Step by Step

1. Import the MerlinBlueFG.tif (Figure 53) and Merlin-BlueBG.tif clips and apply Keylight.

Figure 53. A tricky blue screen.

2. Pick the purest blue you can see for the Screen Colour.

Figure 54. Serious blue spill.

3. Now let's try and get rid of that blue spill. Normally, you would pick skin tones for the Alpha Bias and while this does remove much of the blue spill it also makes the foreground very transparent.

Figure 55. Alpha Bias.

4. Undo this change, switch off Use Alpha Bias for Despill and click the colour swatch next to Despill Bias to activate an eye dropper. Now, pick skin tones from the image. This will remove spill but better preserve the alpha.

Figure 56. Despill Bias.

5. You will notice that Miranda Richardson's face still has a number of highlights that we should fix. The best way to

do this is by drawing a bezier round the face (Figure 57) and using it as an inside mask.

Figure 57. Bezier as inside mask.

6. Compare the Screen Matte and Combined Matte to see the effect of this mask. Now, view the Composite as shown in Figure 58.

Figure 58. Result.

You'll see that her face is fully opaque. To remove the blue/purple pixels from around her eyes, set the Inside Replace to Soft Colour, rather than Source and set the colour to a dark brown. Try also Hard Colour.

Tutorial 4: A Red Green Screen

Using the images from the film Executive Decision, you will learn how to pull a key from a poor green screen using the Despill Bias control. You will learn how to:

- Pick the Screen Colour.
- Pick the Alpha Bias.
- Produce a final composite.

Download File ExecutiveDecision.tar.gz

Step by Step

1. Import ExecFG.tif (Figure 59) and ExecBG.tif. Apply Keylight.

Figure 59. Poor Green Screen.

The foreground image is actually a green screen shot, although it doesn't look it. If you analyse the pixels it's slightly more red than green. To key this, we'll have to fool Keylight.

2. Pick the Screen Colour. You should go for the slightly darker green patch to the left of the pilot. Although feel free to experiment picking different parts of the green

screen. The initial selection gives the composite shown in Figure 60.

Figure 60. Default key.

3. To fix this, we need to tell Keylight to scale down the red component to make the green the most dominant so that it keys correctly. To do this, pick the browns from the rubber mask for the Alpha Bias. Click the colour swatch next to Alpha Bias and sample the mask. The result is shown in Figure 61.

Figure 61. Decrease the Despill and Alpha Bias.

4. If you look closely, the background and foreground needs cleaning up. Figure 62 shows the Status View.

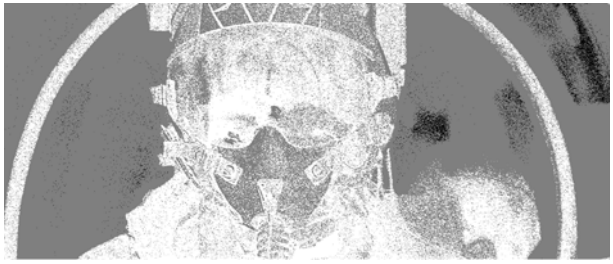

Figure 62. Status View.

We will use the Screen Matte processing tools to make the cockpit windows black and the pilot white.

5. Increase Clip Black to 0.2 to remove some of the foreground showing through the background. Decrease Clip White to 0.7 to improve the opacity of the foreground. Increase Softness to 1, Despot Black to 2 and Despot White to 2.

Figure 63. Composite.

6. As a final tweak, try increasing the PreBlur.

Tutorial 5: Inside & Outside Masks

Using the 16 bit blue screen test card image you will learn how to:

- Use Inside and Outside mattes.
- Use the Replace Method to put back keyed out colours.
- Process the Screen Matte.

Download File

TestCard.tar.gz

Step by Step

1. Read in TestCard.cin (Figure 64) and ColourGrid.cin and apply Keylight.

Figure 64. Test Card.

2. Pick the blue from the image. Keylight will create a matte and despill the foreground as shown in Figure 65.

Figure 65. Basic Key.

3. To remove the garbage around the subject, we will use an outside mask. Draw a bezier spline around the person and test cards. Please refer to Nuke's user guide. An example spline is shown as the yellow line in Figure 66.

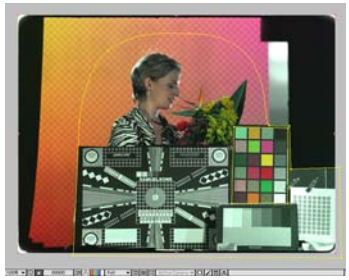

Figure 66. Outside mask.

Connect this mask to the OutM input of the Keylight node.

4. Set the OutM Component to Inverted Alpha or you'll be removing the person rather than the unwanted pixels at the screen edges.

Figure 67.

5. You will have noticed in Figure 67 the "dirt" around the subject's head.

Figure 68.

Clearly, we have to improve the key. You can also see the the faults in the matte if you view the Status as shown in Figure 68.

6. Increase the Screen Gain to 1.1. This cleans up some of the background as shown in Figure 69.

Figure 69. Increase Clip Black.

7. Sections 7 to 10 will cover the changes to the Screen Matte that will improve the key. Decrease the Clip White

from 1 to 0.7. This will improve the foreground as shown in Figure 70.

Figure 70. Clip White.

However, you will notice in the composite that the edges have become a little hard. We can fix this using the Clip Rollback and softness in the Screen Matte group.

8. Increase the Clip Rollback to 3 and the softness to 1. It's also worth trying to improve the key around the spikey flowers with a sub-pixel erode of the edge. Change Screen Dilate to -0.5.

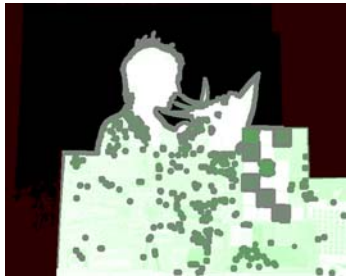

Figure 71.

9. To remove the foreground spots, increase Despot Black to 1. The result is shown in Figure 72.

Figure 72. Despot Black.

10. The composite is shown in Figure 73. You will see that the colours of the colour swatches have been altered by the Keylight algorithm. This can be fixed with an inside matte.

Figure 73. Composite.

11. Draw a bezier spline around just the colour swatches. Set the Inside Replace Method to Source to pull back the original colours..

Figure 74. Inside matte and Replace Method Source.

12. That's it.

APPENDIX A

Release Notes

This appendix describes the requirements, new features, improvements over previous versions, fixed bugs and known bugs and workarounds in Keylight.

Keylight 2.1v3

This is a maintenance release of Keylight on Nuke.

Requirements

- Nuke 5.1v1 or later.
- Foundry FLEXlm Tools (FFT) (4.0v8 or later) for floating license support.

Release Date

November 2008

New Features

There are no new features.

Improvements

There are no improvements to existing features.

Fixed Bugs

Fixed instability in plug-ins caused by OS incompatibility with FLEXlm 10.8 licensing module. Upgraded FLEXlm to 10.8.6 for improved Mac OS X 10.5 (Leopard) compatibility, and to 10.8.7 for improved 64-bit Linux compatability.

Known Bugs and Workarounds in Keylight

There are no known bugs.

Known Problems in Nuke 5.1

There are no known problems running Keylight in Nuke 5.1.

Keylight 2.1v2

This is a maintenance release of Keylight on Nuke.

Requirements

- Nuke 5.1v1 or later.
- Foundry FLEXlm Tools (FFT) (4.0v8 or later) for floating license support.

Release Date

September 2008

New Features

There are no new features.

Improvements

There are no improvements to existing features.

Fixed Bugs

BUG ID 6248 - Keylight failed to support tiled processing correctly when Screen PreBlur, Clip Rollback, or Screen Softness were used. This bug has now been fixed.

Known Bugs and Workarounds in Keylight

There are no known bugs.

Known Problems in Nuke 5.1

There are no known problems running Keylight in Nuke 5.1.

Keylight 2.1v1

This is a new release of Keylight to support 64bit Nuke.

Requirements

- Nuke 5.1v1 or later.
- Foundry FLEXlm Tools (FFT) (4.0v8 or later) for floating license support.

Release Date

September 2008

New Features

Support for Nuke 64bit.

Improvements

There are no improvements to existing features.

Fixed Bugs

There are no fixed bugs.

Known Bugs and Workarounds in Keylight

There are no known bugs.

Known Problems in Nuke 5.1

There are no known problems running Keylight in Nuke 5.1.

Keylight 2.0v3

This is a maintenance release of Keylight on Nuke.

Requirements

- Nuke 4.8v1 or later.
- Foundry FLEXlm Tools (FFT) (4.0v1 or later) for floating license support.

Release Date

April 2008

New Features

There are no new features.

Improvements

Keylight 2.0v3 for Nuke is installed to the host-specific place (for example on Mac OS X) /Library/OFX/Nuke/ rather than the general /Library/OFX/plugins/ folder of previous releases. Although Keylight for Nuke is an OFX plug-in and should work in other hosts (like Fusion), this change ensures that this version, that has been tested for Nuke, is loaded before any others.

Fixed Bugs

Various fixes to ensure compatibility with Nuke 4.8 and Nuke 5.0.

Known Bugs and Workarounds in Keylight

There are no known bugs.

Known Problems in Nuke

Keylight 2.0v3 running on Nuke 5.0v1 will take an interactive license (keylight_ofx_i) when rendering from the command line. In Nuke 5.0v2 this has been fixed so that a keylight_ofx_r license is taken.

Keylight 2.0v2

This is a maintenance release of Keylight on Nuke.

Requirements

- Nuke 4.7v4 or later.
- Foundry FLEXlm Tools (FFT) (4.0v1 or later) for floating license support.

Release Date

December 2007

New Features
There are no new features.

Improvements

1. The Keylight icon has been updated.
2. Some missing parameter descriptions in the Advanced Keying section now included.

Fixed Bugs
There are no fixed bugs.

Known Bugs and Workarounds in Keylight
There are no known bugs.

Keylight 2.0v1

This is the first release of Keylight on Nuke.

Requirements

- Nuke 4.7v3 or later
- Windows XP, RHEL 4, Mac OS X.
- Foundry FLEXlm Tools

Release Date
2 October 2007

New Features
This is the first release of Keylight on Nuke.

Improvements
This is the first release of Keylight on Nuke.

Fixed Bugs

This is the first release of Keylight on Nuke.

Known Bugs and Workarounds in Keylight

There are no known bugs.

Appendix B

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