# COLOR CORRECTION HANDBOOK

## PROFESSIONAL TECHNIQUES FOR VIDEO AND CINEMA

ALEXIS VAN HURKMAN

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## Professional Techniques for Video and Cinema

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# DEDICATION

To my wife and companion, Kaylynn.

I merely create the appearance of beauty.
You make the world beautiful
wherever you go…

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Bonus Content for Chapter 9 A-1
Bonus Content for Chapter 10 B-1

SEE LAST PAGE OF THIS EBOOK FOR INSTRUCTIONS ON DOWNLOADING YOUR LESSON FILES.

# INTRODUCTION

This book is intended for developing colorists who aspire to mastering the art and engineering of serious color grading. It incorporates information and techniques that I've found useful during my career as a colorist of narrative and documentary projects. It has also provided me with an excellent excuse to delve deeper into not just *how* to create the adjustments we make in the most efficient way possible, but *why* we make them in the first place, and how they interact with the viewer's visual perceptions so that we can exert more direct and informed control over the process.

Although this book generally assumes that you're a paid professional who's working in client-driven situations, the information is accessible to anyone with an interest in giving their programs a creative polish, from the do-it-yourself (DIY) filmmaker to the creative editor who's looking to enhance her skill set.

It used to be that the ranks of color timers, telecine operators, and colorists for broadcast were a very exclusive and high-priced club. That professional color grading required half-million-dollar suites filled with dedicated hardware meant that there were very few such suites. Learning to operate such systems typically involved an apprenticeship (starting out as a tape operator) where you had the opportunity to learn at the elbow of the senior colorist before eventually graduating to junior colorist, grading dailies and doing night-shift work, and eventually proving your mettle and getting involved with more serious sessions.

This is changing. With the proliferation of high-quality, dedicated color grading systems on desktop hardware, the half-million-dollar investment has dropped precipitously, opening up the field to an ever-increasing number of boutique post houses that can offer truly professional services, not to mention individual filmmakers and production facilities that are daring to go "in-house" with their color grading.

As a result, editors and compositing artists alike are gravitating toward adding color correction to their already wide skill set. This is natural, and one of many reasons I think this book is an important offering to the postproduction community. There are no longer as many opportunities for apprenticeship with a seasoned professional, and the need for talent in this arena is growing as more and more producers that once would never have considered putting their programs through a color correction pass are coming to the realization that if the program isn't graded, it's not finished.

However, even though color correction is becoming increasingly absorbed into the postproduction process, I make a passionate argument for the role of the dedicated colorist working within a specifically configured suite or grading theater. I don't have a problem with color correction being done in a home-office environment, but no matter where you park your gear, it's essential (as I discuss in Chapter 1) to monitor your image in a proper environment on an appropriate display if you want professional results. I liken grading rooms to audio mixing stages: For both audio and video, the best decisions are made by an experienced artist working in a carefully focused environment that allows a fine degree of control over the process.

Although it's arguable that colorists are perhaps the smallest subcommunity in postproduction, a *lot* of applications are currently available that are dedicated to the task of grading. At the time of this writing, some of the more notable of these include DaVinci Resolve, Apple Color, Assimilate Scratch, Iridas SpeedGrade, FilmLight Baselight, Nucoda Film Master, Synthetic Aperture Color Finesse, and Autodesk Lustre.

Each of these applications differ widely in their real-time capabilities and their overall approach to the grading user interface (UI), yet they all share a largely common toolset so that once you learn the basics of three-way color balancing, curves, lift/gamma/gain contrast adjustment, HSL Qualification, and the use of shapes, video scopes, and grade management, you'll have a very good idea of how to go about getting the job done in any one of these applications.

Furthermore, I've deliberately chosen to focus on applications that are compatible with dedicated control surfaces, on the premise that serious-minded practitioners will come to appreciate the comfort and efficiency that these surfaces offer during long grading sessions.

In terms of the specific applications that I mention in this book, it's impossible to do a comprehensive survey of functionality for every single application. Instead, I've tried to include information that's applicable to the most widely used of the color grading applications with which I'm familiar and to call out notable functions within specific applications where appropriate. For obvious reasons, I created most of the examples using one of four applications that I personally have had installed during the development of this book: Apple Color, DaVinci Resolve, Assimilate Scratch, and Iridas SpeedGrade. But I've worked hard to make sure that the majority of the examples apply equally well to other grading applications.

This is not to say that the techniques explored within this book are useful only to operators of dedicated grading applications. As the postproduction software industry has matured, advanced color correction tools have snuck into a wide variety of applications, ranging from ambitious combination editorial/compositing/finishing apps such as SGO Mistika, Autodesk Smoke, and Avid DS, to more focused nonlinear editors (NLEs) including Avid Media Composer, Apple Final Cut Pro, Adobe Premiere Pro, and Sony Vegas Pro. Furthermore, if an NLE's built-in tools don't float your boat, additional third-party color correction plug-ins such as Red Giant's Colorista II and Synthetic Aperture's Color Finesse let you significantly extend your editing software's capabilities.

Last, but certainly not least, compositing applications such as Adobe After Effects and The Foundry's Nuke have color correction capabilities built in, primarily for plate matching and effects work, but there are hardy souls who use these applications for full-bore grading work, and if you're among that group, I salute you for your moxie.

For all of these applications, if you have access to the basic tools I mentioned earlier, then you'll be able to adapt the techniques found here. I've found that it's almost more important to see the idea behind general approaches to solving a particular problem or creating a unique grade than it is to get a specific step-by-step list of instructions. Once you've got an idea of what would be interesting to do, figuring out how to do it in your particular application is simply a detail. For that reason, I've deliberately chosen to put creativity first and to generalize application functionality as much as possible so that the techniques are applicable on the widest possible array of applications.

## COLOR CORRECTION VS. GRADING

At one time (not so very long ago) *color correction* was the description given to color work on video, while *grading* was the term applied to the process of color timing motion picture film.

As the tools for both film and video have merged, times have changed, and now the terms have become suspiciously interchangeable. However, I would argue that color correction refers to a process that is more technical in nature, of making adjustments to correct clear qualitative problems in an image, bringing it to a fairly neutral state, whereas grading refers to a more intensive process of developing an appropriate overall *style* for the image, relative to the narrative and artistic needs of a program.

Practically speaking, you'll find me referring to corrections and grades in different contexts. When describing the process of actually working on a shot, a correction is an individual adjustment, whereas a grade is a collection of multiple adjustments that together create the overall look you're developing for a shot.

Colorist Joe Owens, who was the technical editor for this volume, said it best in a note he sent me, which I paraphrase here: "Correction is a swordfight, while grading is the war." Well said.

## THE SIX TASKS OF THE COLORIST

This section is an updated version of material I wrote, originally, for the documentation of another grading application, but knowing how many people actually *read* user manuals, I felt it was important enough to include here, where it might actually be seen.

In any post-production workflow, grading is typically one of the last steps taken to finish an edited program, although on-set grading, digital dailies correction, and ongoing grading in sync with rolling project re-conforms are increasingly bringing the colorist into the production and postproduction process at earlier and earlier stages.

Regardless, in the end, every program you work on requires some combination of the following steps.

## CORRECTING ERRORS OF COLOR AND EXPOSURE

Images acquired digitally almost never have optimal exposure or color balance to begin with. Just one example of this is that digital cameras deliberately record blacks that aren't quite at 0 percent in order to avoid inadvertent crushing of valuable shadow detail.

Furthermore, accidents happen. For example, someone may have used incorrect white balance settings when shooting an interview in an office lit with fluorescent lights, resulting in footage with a greenish tinge. Unless your client is a big fan of the Wachowski siblings' *The Matrix*, this is probably something you'll need to do something about.

## MAKING KEY ELEMENTS LOOK RIGHT

Every scene has key elements that should be the focus of the viewer. In a narrative or documentary video, this is probably the people in each shot. In a commercial, this is undoubtedly the product being sold (the color of packaging or the glossiness of a vehicle). Whatever these key elements are, your audience will likely have certain expectations of their appearance (referred to in this book as *audience preference*), and it's your job to navigate the difference between the uncorrected shot and the preferred image characteristics that correspond to the key subjects within.

A common example is one of the guiding principles of color correction: All things being equal, the skin tones of people in a scene should look as good as (or better than) those in real life.

## BALANCING SHOTS IN A SCENE TO MATCH

Most programs, narrative or documentary, incorporate footage from a variety of sources, shot in multiple locations over the course of days, weeks, or months of production. Even with skilled lighting and camera crews, differences in color and exposure are inevitable, even in shots being combined within a single scene.

When viewed together in an edited sequence, these inconsistencies of color and contrast cause individual shots to stick out, making the editing appear uneven and throwing the audience out of the scene.

With careful color correction, all the different shots that make up a scene can be balanced to match one another so that they all look as if they're happening at the same time and in the same place, with the same lighting. Although this has traditionally been referred to as scene-to-scene color correction, I refer to it in this book as a process of shot-matching and scene-balancing.

### CREATING STYLE

Color correction isn't just about making every shot in your program match some objective model of color balance and exposure. Color and contrast, like sound, provide another level of dramatic control over your program when subtly mixed and adjusted.

With imaginative grading, you can control whether the image is rich and saturated, or muted and subdued. You can make shots warmer or cooler, extract detail from shadows or crush it, all with a few turns of a dial or trackball. Such alterations change the audience's perception of a scene, setting the mood.

### CREATING DEPTH

As Vittorio Storaro says in his 1992 documentary *Visions of Light,* one of the cinematographer's jobs is to create depth in an essentially two-dimensional medium. With the tools available in modern grading applications, this task also falls to you to implement where improvements to the original image are possible. This has nothing to do with stereoscopic imaging and has everything to do with simple, two-dimensional principles of how color and contrast affect our depth perception in various scenes.

### ADHERING TO QUALITY CONTROL STANDARDS

Programs destined for broadcast usually need to adhere to quality control (QC) guidelines specifying the "legal" limits for the signal—things like minimum black levels, maximum white levels, and minimum and maximum chroma and composite RGB limits. Adherence to these guidelines is important to ensure that your program is accepted for broadcast, since "illegal" values may cause problems when the program is encoded for transmission. QC standards vary, so it's important to check what these guidelines are in advance.

## THE COLORIST'S RELATIONSHIP WITH THE CINEMATOGRAPHER

Many, many people involve themselves in the postproduction process. As a colorist, you'll find yourself working with the producer, director, and cinematographer in different proportions that are unique to every project.

The cinematographer's job during the shoot is to work with the director to plan for and implement the look of the program while it's shot. Choosing specific digital formats or film stocks, camera equipment, and lenses, and determining the quality of lighting are all decisions within the cinematographer's domain of responsibility, as is the ultimate quality of the recorded image. For that reason, the cinematographer has a vested interest in your activities.

It's worth emphasizing that if a good range of color and contrast isn't shot during the production, you won't have the data necessary to do a good job—you can't really add anything that wasn't there to begin with. In this regard, the cinematographer isn't working alone; you should also consider that the art department (set design/dressing, props, wardrobe) exerts direct control over the actual range of colors that appear in each and every shot. Visually, the filmmaking process is a symphony of artists working with paint, fabric, light, and optics to create the image that is ultimately entrusted to your care.

Although the producer and/or director usually have the final say over the creative aspect of your work, the cinematographer should be involved in the color correction process as well. This is usually dependent on the size and budget of the project, as well as the creative relationship of the principals. Typically the higher the budget, the more involved the cinematographer will be.

## DIFFERENT WAYS OF WORKING WITH THE CINEMATOGRAPHER

Another factor in the cinematographer's involvement is the image pipeline that was decided upon in preproduction. Traditionally, a program's overall look was primarily determined *in camera*, through careful choice of film stock, lens filtration, white balance manipulation (in video), and lighting setups.

Although the notion of deliberately exposing the image for later grading is seeping into the field of cinematography, there's still plenty of room, and need, for a traditional adherence to careful photography on the set. When contrast and color is adjusted to taste in the initial exposure, according to the latitude of the recording format, and care is taken to balance each lighting setup for maximum compatibility with the other angles of coverage within the same scene, the need for later color correction isn't simply minimized so much as the potential for creating even more spectacular images is increased.

On the other hand, with digital grading becoming an increasingly affordable and flexible process, some cinematographers are beginning to expose film and digital media in such a way as to sacrifice the immediate projectability of the dailies in favor of preserving maximum image data for the color correction process in post. Methods include slightly (and it should *only* be slightly) overexposing the shadows and underexposing the highlights in order to minimize the loss of detail due to digital clipping and crushing (telecine operators may also do the same thing when transferring film to video for a *safety transfer*). During color correction, the contrast is then easily readjusted to emphasize whichever portion of the image is necessary for the desired look.

When a program's look has been decided in camera, your job is to balance and correct according to the originally intended lighting scheme. If the image was exposed intentionally to maximize image data for later digital manipulation, the creative possibilities are considerably more open-ended and subject to reinterpretation. In either case, the cinematographer's involvement will be invaluable in guiding you through how everything was originally intended to look, freeing you from having to make assumptions (with the inevitable later revisions) and saving you time to focus on the truly important creative issues.

In turn, your job also includes making options available in circumstances where the cinematographer is considering alternatives based on changes during editing, problems with the originally recorded image, or a producer's and director's ambivalence with the originally rendered lighting scheme. You will also find yourself assuming the role of negotiator when conflicts between producers, directors, and cinematographers occur over the look of a particular sequence.

Lastly, issues of quality control must be resolved in programs destined for terrestrial or satellite broadcast, and that is where you need to be mindful of when a requested adjustment needs to be subdued in order to maintain a legal signal. You should always discuss the quality control (QC) standard that a program should adhere to in advance and be prepared to tactfully find alternatives for or overrule adjustments that violate those standards.

## LEARN TO COMMUNICATE

One of the best ways you can improve your rapport with both cinematographers and directors, as well as generally improve your skills as a colorist, is to take the time to learn more about the art and craft of lighting for film and digital media. The more you know about how color and contrast is manipulated on location through all of the tools of the cinematographer's craft, the better you'll be able to analyze and manipulate each clip. Furthermore, the more you know about how a film crew works, the better you'll be able to conduct the detective-work necessary to figuring out why one clip isn't matching another. (Was there a wind blowing the gel in front of the key light? During what time of day was that insert clip shot? Did one of your lighting fixtures become unavailable in the reverse shot?)

Also, cinematography, like every discipline, has its own language. The more familiar you become with terms like low-key, high-key, different lighting setups, film stocks, digital media formats, and color temperatures, the easier it will be to discuss and understand the cinematographer's goals and suggestions.

## SPECIAL THANKS

I want to first extend a very deep, heartfelt thanks to the filmmakers who have graciously allowed me to abuse their work in public within this volume. All of these projects are programs that I've personally graded, and they represent a fair spectrum of what you'll see out in the real world. All were terrific clients to work with, and I sincerely appreciate their contributions to this book:

- Yan Vizinberg (Director), Abigail Honor (Producer), and Chris Cooper (Producer) for excerpts from Persona Films' feature, *Cargo*.
- Jake Cashill (Director), for excerpts from his feature-length thriller, *Oral Fixation*.
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- Kelvin Rush (Director), for excerpts from his Super 16mm short, *Urn*.
- Rob Tsao (Director) for excerpts from his comedic short, *Mum's the Word*.
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I must extend additional thanks for the use of a handful of clips from programs I didn't work on but which provide unique qualities that are valuable to the examples I needed to show:

- Peter Getzels (Producer/Director), Dr. Robert Lawrence Kuhn (Executive Producer), and Robbie Carman (Colorist) for a clip from the documentary series, *Closer to Truth*.
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- Grant Petty, CEO of Blackmagic Design; Peter Chamberlain, Product Manager for DaVinci Resolve, and Rohit Gupta, Director of DaVinci Software

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A big thank you to Joe Owens, colorist (Presto!Digital), defender of the video engineering faith, and generous contributor to numerous online forums on the topic of grading, for reviewing my chapters and providing invaluable feedback. There was a lot of material to review, and I put this book forth in confidence having had a veteran colorist of his talent and unflinching honesty weigh in on its contents.

I also want to personally thank Karyn Johnson (Senior Editor, Peachpit Press), who initially suggested and championed a reimagining of my original *Encyclopedia of Color Correction*, and who gave me all the rope I needed to hang myself with as I essentially created a whole new book.

Last, but very certainly not least, I want to thank Stephen Nathans-Kelly (Editor), who gamely reviewed each increasingly enormous chapter, for treating my prose and technical content with delicacy; this stuff ain't easy to edit. With Karyn, Stephen, and Peachpit Press's support, I've created exactly the book I wanted to, with no compromises. I hope you enjoy it.

## A NOTE ABOUT IMAGE FIDELITY

In all instances, I took great care to present realistic grades within this book, and yet it's often the case that certain adjustments required exaggeration to be noticeable in print. Unfortunately, knowing that a digital edition was going to be made available, I've been in the unfortunate position of having to serve two masters with a single set of images.

I feel that the results serve the purpose of illustrating the topics admirably, although I cannot guarantee what certain images will look like on every possible digital device to come. To those of you who are reading this in the mysterious future of digital books, I hope you like what you see.

## A NOTE ABOUT THE DVD

Throughout this book, you'll see examples of scenes in commercially produced shows that are used to demonstrate various concepts and techniques. The accompanying DVD includes 158 QuickTime clips that you can use as a playground for experimenting with the techniques discussed. These clips are the raw, uncorrected source material for each example, and can be imported into any grading application that's compatible with Apple ProRes media. For more information about the media on the disc, please see the Read Me file on the DVD-ROM.

Also on the disc are two PDFs. One includes details on broadcast safe settings for Avid Media Composer, Final Cut Pro, and Adobe Premiere Pro. The other file includes a discussion about film grain and digital noise. You'll find those at the root level of the DVD.

# CHAPTER 4

# HSL QUALIFICATION AND HUE CURVES

There are many instances where, instead of making a *primary* color correction to an overall image, you instead need to make an adjustment to a specific object or subject within the frame, leaving everything else alone. For example, you may want to make the sky more blue, the grass a bit darker, or tone down an actor's aggressively loud shirt.

These kinds of adjustments are referred to as *secondary* color corrections, since they're generally made after the primary color correction that you made to fix any issues with the overall color or contrast of the shot. Secondary color corrections are an essential part of any colorist's toolkit, and every single professional color correction application provides a variety of ways to accomplish this important task.

This chapter, in particular, covers two of the principle ways of creating such targeted corrections. Most of the chapter is dedicated to how you use *HSL Qualification* to isolate regions of the image for secondary correction. At the end of the chapter, you'll also see how to use *hue curves* (and the slightly different user interface [UI] of *vectors*) to accomplish similarly targeted corrections in a different way entirely.

Many of the techniques in this book rely upon secondary color correction to make adjustments to very specific regions of the picture, but it's a mistake to be too reliant on secondary corrections to deal with simple issues. It's good to get in the habit of checking whether or not you can make the same correction through careful manipulation of your primary color correction controls, instead of wasting time using qualifiers for operations that might be just as effective using the tonally specific Shadows/Lift, Midtones/Gamma, and Highlights/Gain color balance controls.

However, with time you'll start to get the knack of when you can accomplish what's necessary via primary correction, and when it's fastest to throw on a secondary correction to make that special tweak.

### HSL QUALIFIERS VS. SHAPES

Many of you are no doubt asking, "But what about shapes? Who cares about HSL Qualifiers when I can just draw a circle around something and color correct everything inside?"

Call me a contrarian, but I find HSL Qualification to be a more versatile all-around tool than shapes/Power Windows. Like a Swiss Army Knife, the individual color component controls of most HSL Qualifiers can be used in many different ways to isolate regions of the picture based on hue, saturation, and luma, individually or in any combination. Not to mention that a well keyed HSL matte doesn't need to be either tracked or keyframed to account for camera motion or a moving subject.

However, far be it from me to denigrate shapes/Power Windows—I regularly use both. It's important to get the hang of when a shape will be the fastest solution, and when an HSL Qualification will in fact be faster (more often than you might think). I firmly believe that getting the hang of the many uses of HSL Qualification provides the best starting point for understanding what secondary correction is good for.

## HSL QUALIFICATION IN THEORY

Before we launch into how to use these controls, let's first have a look at how HSL Qualification works. Essentially, what you're doing is pulling a *chroma key* to isolate part of the image based on a specific range of color, or a *luma key* to isolate part of the image based only on a specific range of lightness. Those of you who are familiar with compositing software know that keys are usually used to define areas of transparency—for example, making a greenscreen background transparent so that an actor appears to be floating in space.

However, when doing color correction, the key you're pulling creates a matte which is used to limit which part of the image is being affected by the color balance, contrast, or other controls, and which part is not (**Figure 4.1**).

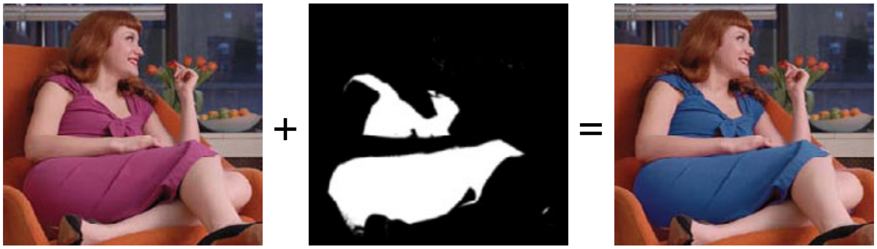


**Figure 4.1** The original image, an HSL Qualification matte, and the resulting secondary color correction. An example of why the costume department sometimes hates colorists (this is a deliberately extreme example, for illustration).

Once you've defined a matte using your qualifier's color sampling controls and refined it using the individual H, S, and L color component controls (along with any blur or edge manipulation parameters), you can then choose whether you want to correct the region of the picture inside the matte (in white) or the region of the picture that's outside of the matte (in black).

Once all this has been set up, it's a simple matter of adjusting the controls to manipulate the image.

## ONSCREEN INTERFACES FOR HSL QUALIFICATION

In most color correction applications, the onscreen interface for HSL Qualification looks pretty much the same, although the programs may differ in how much they rely on the handles of graphical hue, saturation, and luma controls, or whether they rely on sliders and numeric parameters.

Also, your results will vary due to the differences between various applications' under-the-hood image processing, and the different algorithms used for each keyer's implementation (**Figure 4.2**). Still, the fundamental principles of use remain largely the same across many different applications, so if you learn one, you'll know how to use them all.

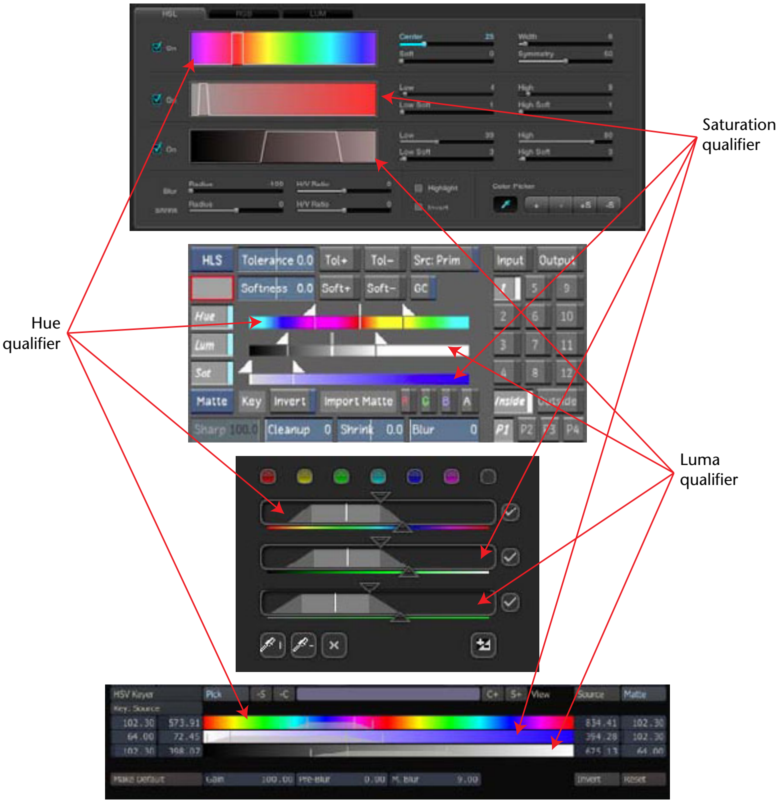
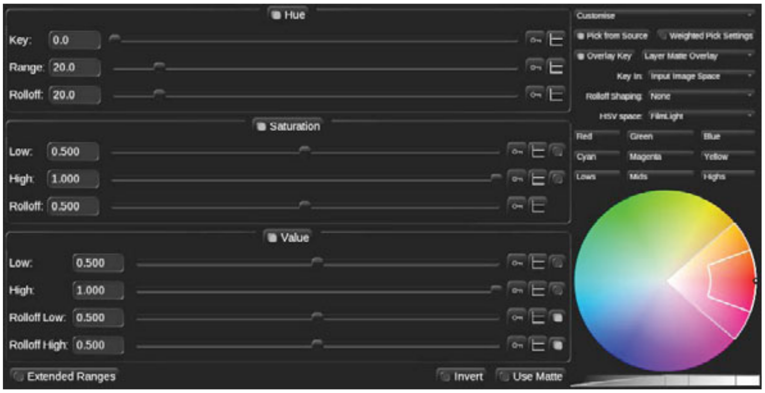

Saturation qualifier
Hue qualifier
Luma qualifier
HLS
Tolerance 0.0
Tol+
Tol–
Src: Prim
Input
Output
Softness 0.0
Soft+
Soft–
GC
Hue
Lum
Sat
Matte
Key
Invert
Import Matte
R
G
B
A
Inside
Outside
Sharp 100.0
Cleanup 0
Shrink 0.0
Blur 0
P1
P2
P3
P4
HSV Keyer
Pick
Source
Matte
Make Default
Gain
Pre-Blur
M. Blur
Insert
Reset

**Figure 4.2** HSL controls compared; from top to bottom: DaVinci Resolve, Autodesk Lustre, Iridas SpeedGrade, Assimilate Scratch.

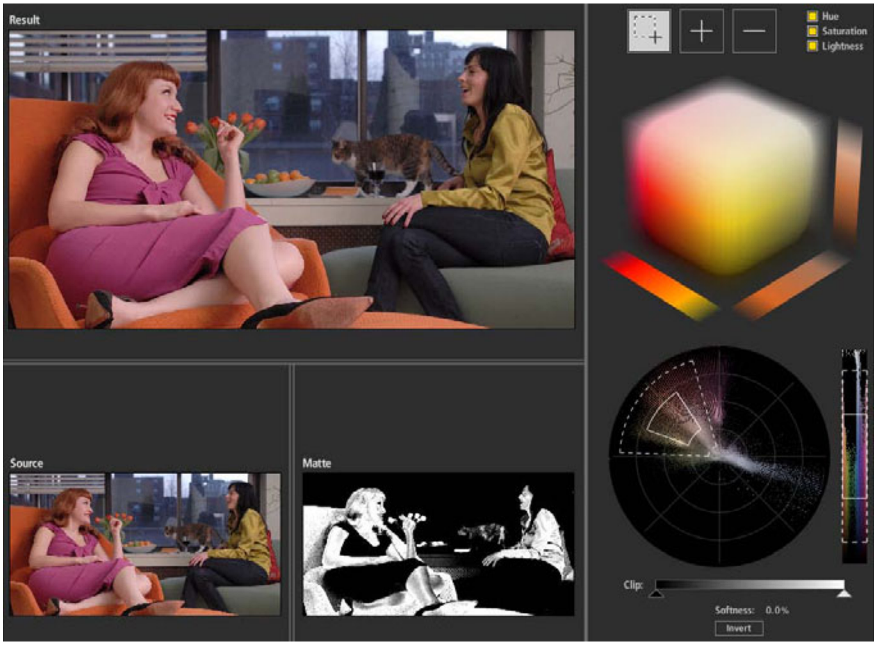
Some brave UI designers have sought to develop this interface using a more graphical UI, a process I applaud when the result provides more obvious functionality in mouse-driven interfaces. For example, the Hue Angle keyer in FilmLight Baselight, while essentially an HSL keyer like those shown in **Figure 4.2**, presents a hue-wheel GUI for simultaneously adjusting hue and saturation in an intuitive way (**Figure 4.3**).


Hue
Saturation
Value
Customise
Pick from Source
Weighted Pick Settings
Overlay Key
Red
Green
Blue
Cyan
Magenta
Yellow
Lows
Mids
Highs
Extended Ranges
Invert
Use Matte

Key: 0.0
Range: 20.0
Rolloff: 20.0
Low: 0.500
High: 1.000
Rolloff: 0.500
Low: 0.500
High: 1.000
Rolloff Low: 0.500
Rolloff High: 0.500
Layer Matte Overlay
Key In: Input Image Space
Rolloff shaping: None
HSV space: FilmLight

**Figure 4.3** FilmLight Baselight's Hue Angle keyer is essentially an HSL keyer, but with an integrated Hue/Saturation control for adjusting and customizing the key.

Another example of an application with a forward-looking approach to keying UI is Magic Bullet Colorista II, a color correction plug-in for nonlinear editors (NLEs) and compositing applications, shown in **Figure 4.4**.


Result
Source
Matte
Hue
Saturation
Lightness
Clip:
Invert

Softness: 0.0%

**Figure 4.4** The graphical interface of the keyer in Colorista II departs from the traditional HSL interface in order to make the process of pulling keys more approachable.

Though a departure from conventional HSL keying UIs, Colorista II retains the individual hue, saturation, and luma controls of the traditional HSL keyer in the form of the cube interface at the upper right-hand side of the UI and luma selection at the lower right, although folks will likely begin their key adjustments using the wedge/vectorscope interface underneath.

Keep in mind that most professional color correction applications map the HSL Qualifier parameters to knobs on a compatible control surface, so the onscreen UI may be incidental to their use. Indeed, many colorists prefer "dialing in" modifications to a keyed matte to tighten it up.

However, if you're working with a system that has a solid onscreen UI, and you find yourself to be a mouse-oriented user, many onscreen UIs present options that aren't available via a control surface. At the end of the day, the best method to use is the one you find fastest.

### SOME APPLICATIONS USE OTHER TYPES OF KEYERS

HSL chroma keying isn't the only game in town when it comes to pulling keys to use as mattes for secondary color corrections. For example, Autodesk Lustre incorporates the Diamond keyer found in other Autodesk compositing applications, and FilmLight Baselight gives the option of using the Dkey 3D Keyer. Furthermore, many applications including DaVinci Resolve, Assimilate Scratch, Autodesk Lustre, and FilmLight Baselight also have an RGB keyer (although that's a more complicated operation).

I focus on HSL keyers since nearly every grading application uses one (including Lustre and Baselight), and because it's flexible to use, and the parameters are easy to understand, easy to manipulate, predictable, and provide a good baseline for understanding how to pull a good key.

## INDIVIDUAL QUALIFIER CONTROLS

This section presents the typical onscreen controls you'll find in most HSL Qualifiers. When used together, each control contributes to a highly selective chroma key, letting you quickly sample a range of colors and refine the resulting key for the best possible effect. When used separately, these controls allow you to perform single-qualifier secondary color correction, isolating portions of an image based on individual characteristics of your image as interpreted using the HSL color model.

## EYEDROPPERS AND COLOR PICKERS

**Figure 4.5** The eyedropper found in Apple Color.

Most HSL keyers have an eyedropper tool (**Figure 4.5**) with which you can click on or drag an image to choose an initial value or range of values to begin creating your key. It's a great way to start out if you're unsure exactly which range of values you need to select (which can be tricky with subtle ranges of color), even if you plan on immediately switching to manual adjustment of the qualifiers after you've found your starting point.

Some applications have just one color sampling tool, with keyboard modifiers enabling you to use the same tool to add to or subtract from the key by scrubbing different pixels of the image. Nucoda Film Master and Colorista II both use bounding-box sampling. Draw a box over the region of picture you want to sample, and the matte is started.

Other applications, such as DaVinci Resolve, have separate onscreen controls for explicitly sampling a primary value, expanding and subtracting from the range of values, and expanding or narrowing the range of softness (tolerance) of the matte (**Figure 4.6**).

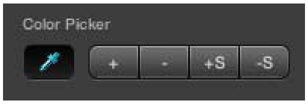


**Figure 4.6** The Color Picker options presented by DaVinci Resolve. From left to right: center color selection, add to matte, subtract from matte, add softness, and remove softness.

However your controls are set up, once you click or drag with your application's eyedropper/color sampling tool, you should see the Hue, Saturation, and Luma qualifiers expand or contract to reflect the color vales of the pixels you're sampling.

Choosing an initial value or range of values with which to begin your key can be a tricky business. The noise, grain, and variation in detail inherent to any image will produce a range of color, even from pixel to pixel. That means that even if you think you've just clicked on a light part of the image, you might have inadvertently clicked on the one dark pixel of noise in that area, giving you a disappointing result. Don't worry, this is bound to happen, just sample other pixels until you find one that gives you the best initial result.

Here are two general tips for choosing a good initial value:

- Choose a color value that's right in between the lightest and darkest values you're trying to key, starting at the middle and working your way outward.
- If the subject you're trying to key has an uneven border with another subject—for example the sky against the horizon—and you're trying to key the sky, choosing a value that's near the border at the horizon is a good way to start building the best part of your key where it's most important.

## VIEWING THE MASK WHILE YOU WORK

Most color correction applications provide you with three different ways of viewing the key you're creating as you work. This is essential to creating high-quality keys. If you only view the final result, is can be difficult to see problem areas like unwanted holes in the matte, excessive noise, or chattering edges. These three modes are as follows:

- A high-contrast grayscale matte-only view (**Figure 4.7**). I find this to be the most useful preview of the matte I'm creating, as it's drop-dead obvious to see the quality of the white areas that represent the keyed area (the *inside* of the correction), and the black areas that represent the unkeyed area (the *outside* of the correction).

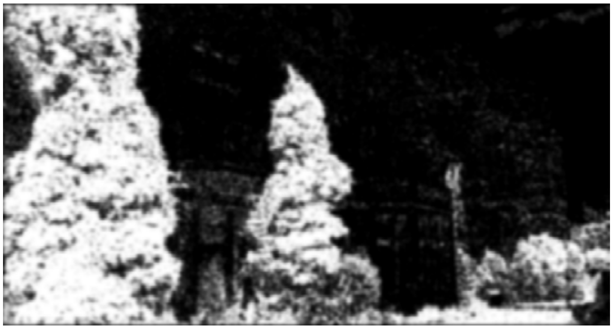


**Figure 4.7** A high-contrast matte, as seen in nearly any color correction application capable of HSL Qualification.

- The keyed area in color against the unkeyed area in grayscale or solid color (**Figure 4.8**). This can be a useful view for seeing how your key is shaping up, while also seeing which parts of the inside or outside of a key correspond to shadows or highlights in the subject you're isolating that you may or may not want to include in your key. The high-contrast mode can make these kinds of judgments difficult if you don't remember the image's details.

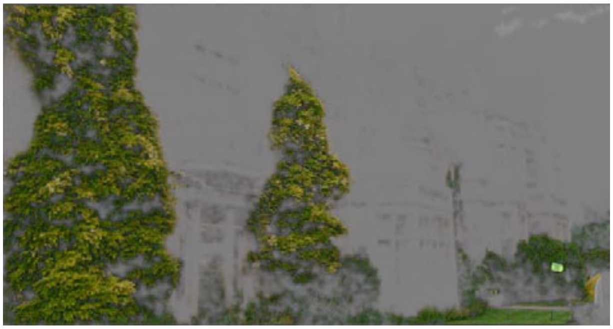


**Figure 4.8** A saturated vs. matte mode, as seen in DaVinci Resolve, that shows you exactly which parts of the image are being included in the key. Other applications show the unkeyed area as simple grayscale, rather than a flat matte.

- The final effect. For some applications this mode is redundant, as the matte and final effect are viewed simultaneously on different onscreen portions of the UI.

However, if you're viewing the key matte on your output display, you'll need to switch to this viewing mode to go back to making the correction once you've finished refining the key.

**TIP**

**If you're using DaVinci Resolve, the "Mattes display high contrast black and white" checkbox in the Settings tab of the Config page determines how mattes are displayed when you turn on the Highlight button within the qualifier controls. Other applications may have more explicit buttons for choosing among available options.**

Ideally, it's good to create and adjust your key while simultaneously viewing the matte you're creating in your application's canvas or preview window, or even output to your broadcast monitor. Surprisingly, I've found that clients love watching these mattes being made, so monitor output isn't a bad thing.

## THE INDIVIDUAL QUALIFIERS

Once you've sampled an initial range of values to get your key's starting point, the next step in the process is to fine-tune the matte using the qualifier controls. As seen previously, these controls typically follow some common conventions across different applications. In general, each color component has a set of handles and parameters that allow you to adjust one of two sets of values:

- **Range** handles let you enclose a base set of values that contribute to the hardest, whitest part of the key.
- **Tolerance** (or softening) handles let you include an additional set of values that add a gradual falloff around the edge of the key, which appears as a range of gradually diminishing grayscale values surrounding the hardest part of the key. Widening the tolerance yields softer edges and a more inclusive key, and narrowing them yields harder edges and a more restrictive key. If the edges of the key are gentle enough due to the softening that tolerance provides, you may not need to blur the resulting matte.
- **Enable/Disable** checkboxes let you manually decide which qualifiers you want to use for a particular keying operation (**Figure 4.9**).

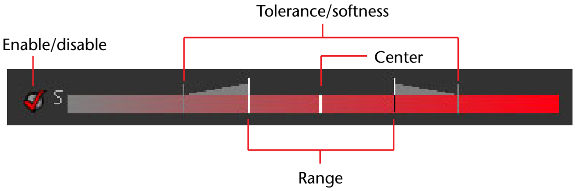


**Figure 4.9** The GUI of a typical qualifier control, as seen in Apple Color. Each set of controls typically corresponds to one or two control panel knobs.

Additionally, there are two general methods used for manipulating controls. The methods used depend primarily on how these controls are mapped to the rotary knobs on a control surface.

- **Centered** controls work using three knobs per color component. The first knob moves the center point of both pairs of range and tolerance handles all together to the left or right, a second knob expands and contracts the range and tolerance relative to the center, and a third knob expands and contracts the tolerance relative to the current position of the range handles.

- **Asymmetrical** controls use four knobs to move the left- and right-hand sets of controls of each qualifier separately. Two knobs for Low and Low Soft adjust the left-hand range and tolerance, while two more for High and High Soft adjust the right-hand range and tolerance separately.

If you're using a GUI rather than a control surface, you might actually be able to manipulate the qualifiers in either of these ways, using keyboard modifiers while dragging the appropriate handles.

## HUE CONTROL

The Hue qualifier lets you select a portion of the color spectrum to isolate a range of color within an image. The spectrum is continuous, wrapping seamlessly from the left of the control to the right of the control (**Figure 4.10**).

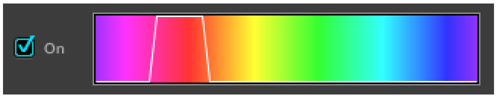


**Figure 4.10** The Hue qualifier graph as seen in DaVinci Resolve.

If you turn on the Hue control without turning on the Saturation control, you'll select all color values within a particular range of hues without regard to intensity or lightness.

## SATURATION CONTROL

The Saturation qualifier lets you select a range of saturation, or color intensity, within the image. The black or colored end of the ramp represents 100 percent saturation; the white or gray portion of the ramp indicates 0 percent saturation (**Figure 4.11**).

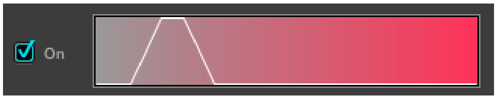


**Figure 4.11** The Saturation qualifier graph as seen in DaVinci Resolve.

If you turn on the Saturation control without turning on the Hue control, you'll select all color values within a particular range of saturation without regard for the actual colors themselves.

## LUMA CONTROL

In a keyer, this qualifier lets you isolate a range of luma, the lightness component of an image (the Y' in Y'CbCr). The black end of the ramp represents 0 percent luma; the white end of the ramp indicates 100 percent luma. In some implementations, there's an additional region of this control that represents the super-white range from 100 to 110 percent (**Figure 4.12**).

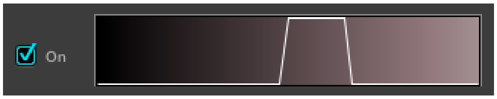


**Figure 4.12** The Luma qualifier graph as seen in DaVinci Resolve.

If you turn on the Luma control without turning on the Hue or Saturation controls, you'll select all areas of an image within a particular range of lightness, without regard to the color, similar to creating a luma key. This frequently yields the greatest amount of edge detail with highly compressed media, and it is a commonly used technique for segmenting an image that we'll see later in this chapter.

### LUMA KEYS MAKE SHARPER MATTES IN COMPRESSED MEDIA

Because the luma component, unlike chroma, is always sampled in its entirety, you'll get better results from luma keys than you will from chroma keys when working with 4:1:1 or 4:2:0 footage (although you'll still see some subtle aliased edges with 4:2:2-encoded video).

## POST-KEY MASK UTILITIES—BLUR AND EDGE MANIPULATION

Once a key has been pulled using the eyedropper/color sampling and qualifier controls, the result is a grayscale image. Most HSL keyers provide additional filtering operations that you can use to manipulate this image to make it more usable in situations where a key was difficult to pull, or when the key has noise, chatter, or other undesirable artifacts that would give the resulting correction away.

Although these operations lend themselves to quick fixes, make sure that you've exhausted the possibilities of the qualifier controls to pull the best possible key, and be careful not to use settings that are too aggressive. If you overdo these types of operations, you may wind up with halos or other problems that might actually be worse than the artifacts you're trying to avoid.

## BLUR/SOFTENING/FEATHERING

Softening simply blurs the keyed matte. This function is useful for eliminating spurious areas of keyed detail that you don't want affecting the final correction, as well as for minimizing the visible effect of animated buzz and noise in the matte (**Figure 4.13**).

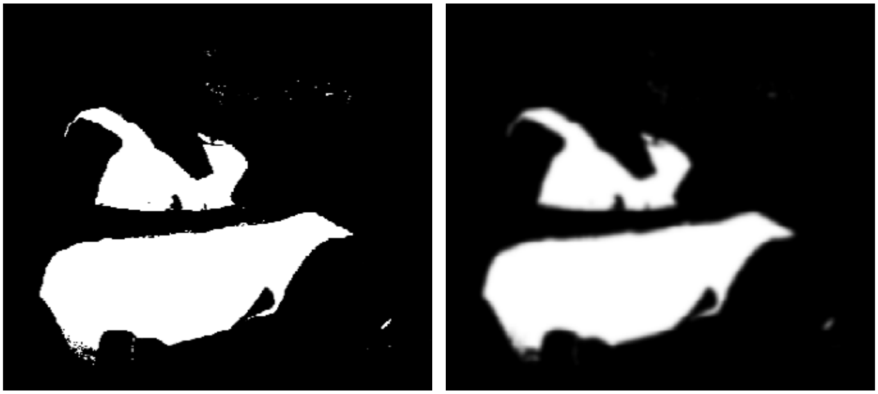


Figure 4.13 A matte, before and after adding blur to soften the edges and minimize marginal portions of the key.

Oversoftening the matte and then creating a correction could result in the same correction being applied to an area surrounding the intended subject, producing an unwanted glow where the correction spills onto the over-feathered area (unless you're intentionally using a secondary to create a glow operation, a process covered in Chapter 10).

## SHRINK

Some applications also have a Shrink parameter (or whatever the corresponding control in your application is named). This is usually an averaging control similar to the matte choke function found in compositing applications (**Figure 4.14**).

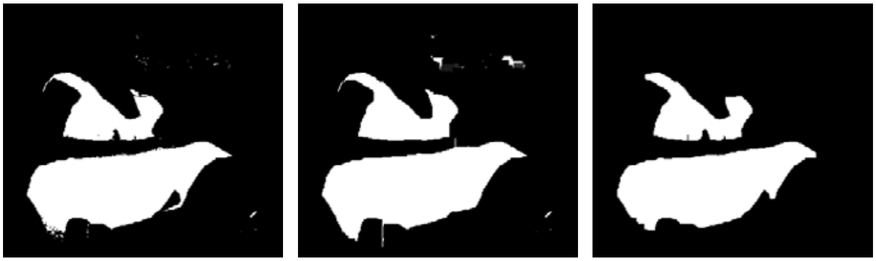


**Figure 4.14** Left, the original mask; center, the matte after using the Shrink parameter to expand it, filling out holes; right, the matte after using the Shrink parameter to contract it, eliminating unwanted marginal areas of the matte. These mattes were created in DaVinci Resolve.

As seen in **Figure 4.14**, this control expands or contracts the edges of the matte:

- Expanding the edges of a matte is useful for filling in small holes appearing in a troublesome matte.
- Contracting the edges of a matte is useful for eliminating spurious pixels and unwanted details in the matte, as well as for shrinking the overall matte.

Using shrink all by itself can sometimes result in blockier edges, which is seldom desirable. In these cases, adding some blur will smooth out the result (**Figure 4.15**).

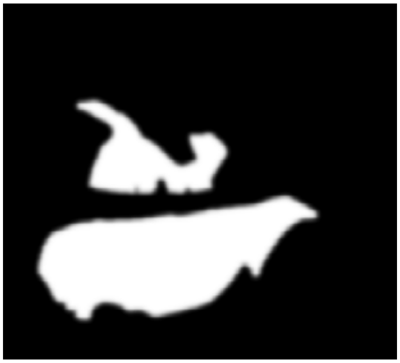


**Figure 4.15** A shrunken matte that's been blurred to address the blocky edges.

## INVERTING THE KEY

Color correction applications deal with whether corrections apply to the white portion (inside) or black portion (outside) of a matte in one of two different ways:

- Applications such as DaVinci Resolve and Assimilate Scratch let you invert the keyed matte, switching which part of the image a correction affects.
- Applications including Autodesk Lustre, FilmLight Baselight, and Apple Color let you explicitly set whether a correction affects the "Inside" or "Outside" portion of the matte.
- DaVinci Resolve's node-based correction interface also lets you create an "outside node" that you can use to grade the opposite portion of a key relative to the original node you created.

Inverting a key is an ideal approach if the subject to be excluded from a color correction operation is uniform enough in color and lightness to be selected with an application's Limit Effect controls, and you want to apply the secondary color correction to everything else.

For example, if we wanted to adjust everything within the frame *except* for the dress, we can still pull our key off of the dress since it's the easiest thing to do (**Figure 4.16**).

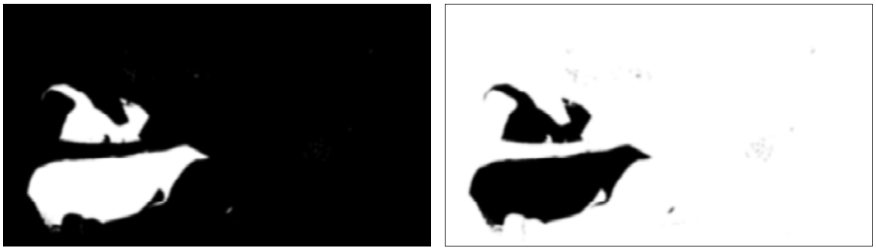


**Figure 4.16** At left, the original key pulled off of the woman's dress. At right, the inverted matte, useful for adjusting everything *except* for the dress.

Then, using whatever control inverts the matte, you can reverse the black and white regions, so now the dress becomes the area that won't be affected by the secondary correction, while the rest of the image is now set up for the correction you want to make.

**NOTE**

**You might notice some light gray areas in the keyed matte that are visible in the inverted version that weren't visible in the original. This is not uncommon, and these marginal values often have little to no effect on the resulting secondary correction. If they're a problem, you can use a shape/Power Window as a garbage matte to exclude these portions of the matte.**

## A BASIC HSL QUALIFICATION WORKFLOW

This section shows you the basic procedure you'll use for doing HSL Qualification using nearly any color correction application. The exact UI may differ, but these general steps remain the same.

### FIRST, DEFINE THE BASIC KEY

There are two ways to begin creating a secondary key.

In the first method, you click the Select Color button, and then click somewhere in the Canvas with the eyedropper to select a primary Hue, Saturation, and Luma value. Depending on the HSB value of the pixel you clicked, Final Cut Pro, for example, turns on (checks), one or more of the qualifiers and sets them to the values found within that pixel. If you click a white pixel, the program may turn on the Luma qualifier only. If you click a red pixel, on the other hand, all three qualifiers are likely to turn on.

The second way to begin a key is simply to start adjusting one of the qualifier controls directly, manually dialing in the ranges of values you want to isolate.

Either method is appropriate, although with practice, you'll find that single-component keys tend to be faster to pull if you know exactly which color component you want to isolate, whereas keys on subjects that naturally combine all components can be tricky. For example, the shadows and highlights of the skin tones on someone's face are always a mix of a variety of hues, luma levels, and saturation, which really requires an eyedropper/image sampling selection to get started.

In the following example, the consensus in the suite is that the red poster that's reflecting in the window behind the woman in the green shirt is too distracting (**Figure 4.17**). We'll take a look at how to quickly isolate the offending object and use the resulting matte to create the necessary correction to address this.

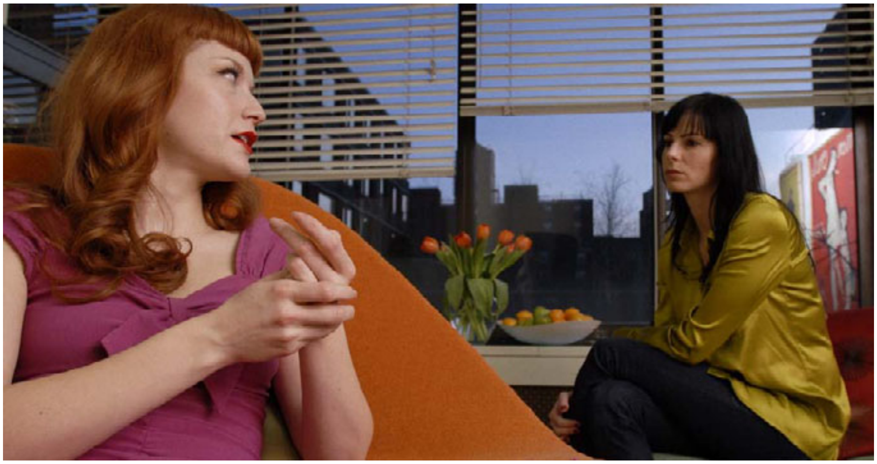


**Figure 4.17** The image with a single primary correction.

HSL Qualification makes isolating the poster really easy.

1 Click your color correction application's eyedropper/Color Picker button to get into the mode for sampling a color from the image, either in your application's canvas/viewer, or on your broadcast display.

2 Using whatever tool appears (an eyedropper cursor, red crosshairs, a bounding box), sample values from the image by doing one of the following:

- Click once to sample the initial value with which to create the key. Then, using a second tool (such as the + button in DaVinci Resolve), click elsewhere to expand the sampled region that contributes to the matte (**Figure 4.18**).
- In other applications, you can simply click and drag to immediately sample a wide range of values with which to create a matte.

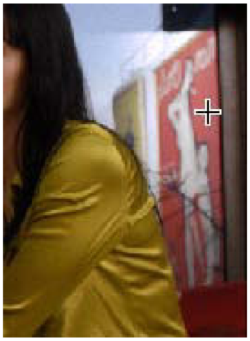


**Figure 4.18** Using crosshairs to sample the color from a subject for isolation.

When you release the mouse button, a few things happen. First, the matte you've just created should become visible. For example, in DaVinci Resolve, the icon of the node containing the new qualifier settings updates to show the new matte.

In other applications, dedicated matte preview areas may display the new matte, or the canvas/viewer may update with a preview display of the matte so you can judge how successful your sample was (**Figure 4.19**).

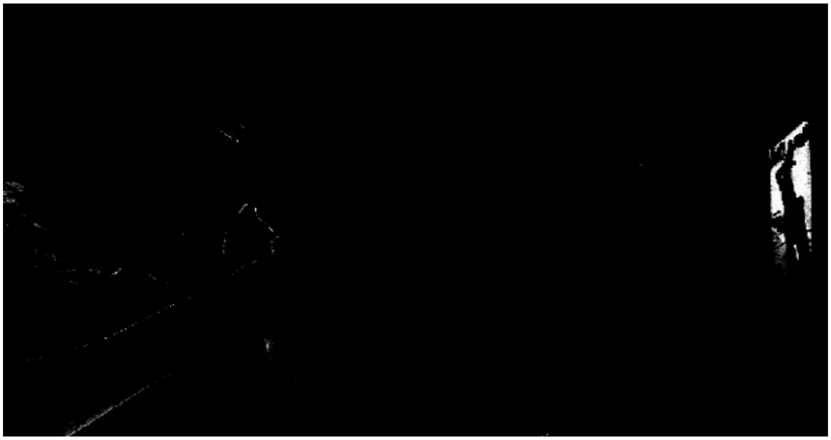
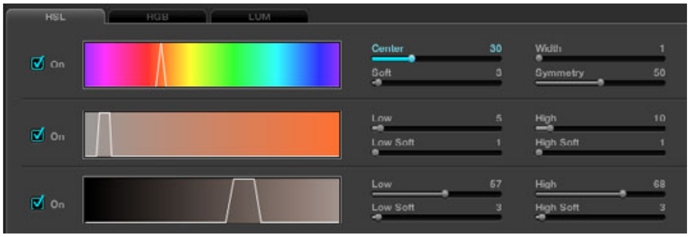


**Figure 4.19** A preview display of the matte.

Finally, the individual qualifier control parameters update to reflect the range of values you've sampled (**Figure 4.20**).



☑ On
Center 30
Soft 3
Width 1
Symmetry 50

☑ On
Low 5
Low Soft 1
High 10
High Soft 1

☑ On
Low 57
Low Soft 3
High 68
High Soft 3

**Figure 4.20** The updated individual qualifier control parameters in DaVinci Resolve.

3 To prepare for the next stage, switch your color correction application to display the matte, if is hasn't already done so automatically.

## WHICH IS SAMPLED, THE ORIGINAL OR THE ADJUSTED IMAGE?

It's important to know what state of the image the HSL Qualifiers are sampling. Many grading applications give you a choice of sampling the original uncorrected media, or sampling the media after it's been adjusted with one or more corrections. There are advantages to either option, which are covered in greater detail later in this chapter.

## REFINE THE KEY

With any key you pull, you'll rarely get it perfect with the very first drag of the eyedropper. In the best cases, there may be a bit of fringe around the edges that you don't want, as in the current example. In less ideal circumstances, you'll be attempting to isolate a difficult range of color (isolating swimsuit skin tones when the actors are surrounded by beige sand can be challenging), or working with video that has limited chroma information, making clean edges difficult.

1. You can sample another part of the image to add it to the matte. For example:
   - In DaVinci Resolve you simply click the + button next to the eyedropper and then click to sample another range in the viewer.
   - In Apple Color, you click the eyedropper again and then Shift-drag to expand the selection.

   Trying this with our image lets us solidify the poster matte while at the same time adding other parts of the image that we don't necessarily want to include (**Figure 4.21**).

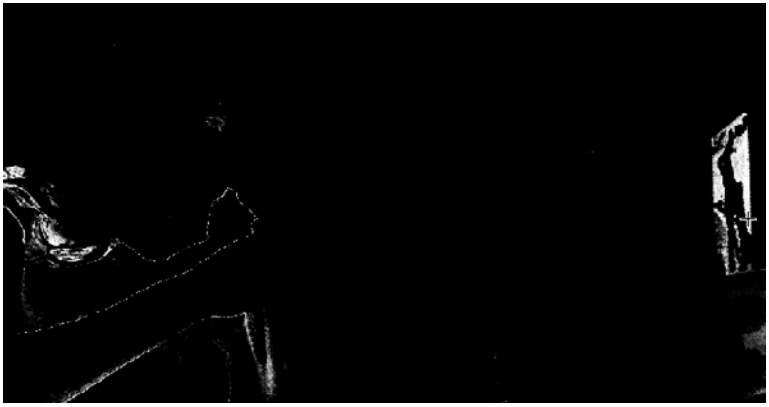


**Figure 4.21** The matte after adding to the selection. More of the poster is included, but some of the woman's dress at the far left is included as well, which we don't want.

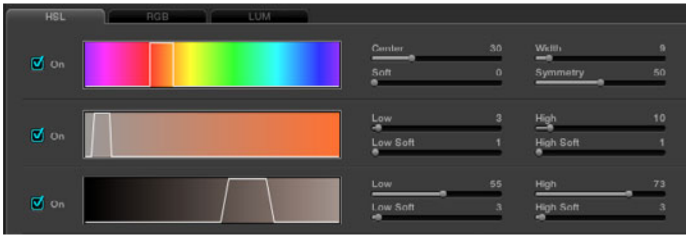
   At this point, we're probably going to have to turn to the individual qualifier controls to make more specific adjustments to most successfully fine-tune the matte.

2. If your application's qualifiers work using the "center adjustment" model, a good tip for figuring out if manipulations to any of the qualifiers will do you any good before you start manipulating them, is to wiggle the center of each qualifier to the left and right while watching the matte. If the matte changes dramatically, then chances are that manipulating that qualifier will do you some real good. If the matte changes only slightly, then your initial sample probably got the range about right, and you can move on.

3 Once you've identified which qualifiers you need to adjust, carefully widen and/or re-center their inner range handles/parameter to highlight as much of the subject you're trying to isolate with white (or color, if you're viewing the matte in color/desaturate mode), while excluding as much of everything else as you can with black.

Adjusting the qualifiers one by one is a good policy, and I usually start with Hue, since that almost always does me the most good. For this example, I made the following adjustments:

- **Hue**: I increased the width of the isolated range of hue.
- **Saturation**: I increased the range of isolated saturation, shifting it asymmetrically to include less saturated values.
- **Luma**: No adjustment to luma was necessary to improve the key (**Figure 4.22**).



Center 30
Width 9
Soft 0
Symmetry 50

Low 3
High 10
Low Soft 1
High Soft 1

Low 55
High 73
Low Soft 3
High Soft 3

**Figure 4.22** Adjustments to the individual qualifiers in DaVinci Resolve to solidify the matte.

This had the effect on the key shown in **Figure 4.23**.

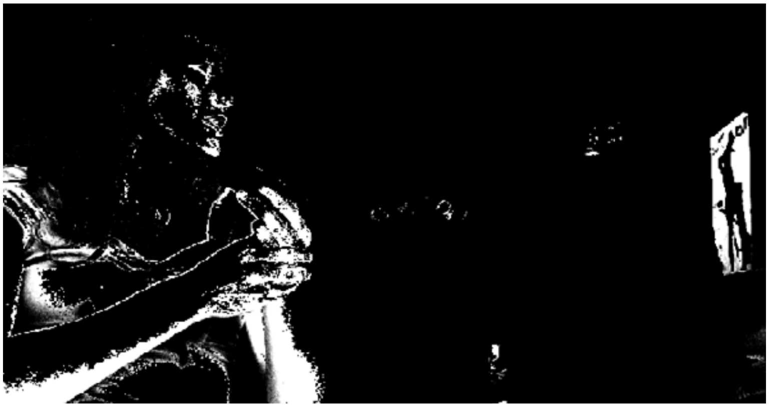


**Figure 4.23** The key after adjustments to the individual HSL qualifiers.

At this point, several edge details of the woman at the left are being included in the matte. Fortunately, the unwanted details are far away from the poster we're trying to isolate, so we'll ignore all that for now to see what we can get away with.

## MANIPULATE THE KEY USING BLUR

Once the general key has been defined and you feel that you've made it as good as you can using the individual qualifiers, it's time to refine the matte using some filtered post-processing in the form of blur and edge processing.

The key created by any HSL keyer is simply a grayscale image, and these parameters apply a filter-style effect to this image to help you make difficult keys more usable by minimizing rough edges, eliminating small holes in the matte (if necessary), managing noise and grain, and subduing edge chatter.

At the very least, every grading application has a blur parameter with which you can feather the matte, which can be a huge help in cases where fringe in the matte is hard to eliminate. It also comes in handy with highly compressed media that may exhibit blocky edges in the matte.

For this example, adding a small amount of blur helps to take the edge off of the matte itself (**Figure 4.24**).

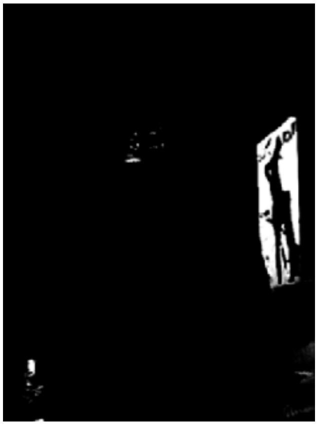


**Figure 4.24** The Blur parameter softens the matte just a little bit, to minimize aliasing.

Don't overdo matte blurring or you'll end up with either a halo around the area you're keying once you start to make your correction, or you'll unwittingly shrink the key so that original color will remain at the edge of the keyed subject after the correction.

### ALWAYS WATCH YOUR KEY PLAY

Whenever you use the HSL Qualifiers, make sure you watch the shot play while you're looking at the matte in order to make sure it doesn't buzz or chatter visibly at the edges or in "thin" areas of the matte. If there is buzz or chatter, manipulate the matte until it becomes unnoticeable in the final effect.

## USE A SHAPE/POWER WINDOW TO CROP UNWANTED FEATURES FROM THE MATTE

Often, unwanted portions of an image get included in a key you're trying to pull because the chroma or luma values are simply too close to the colors you're trying to isolate, with one of two results:

- You have good isolation but a crummy matte.
- You've got a great matte but it's too loose, keying other parts of the frame that you don't want to include.

You can fiddle with the qualifiers all you want, but you just can't pull a completely clean key. In these situations, the best thing to do is to turn on whatever shape/Power Window control is available in your grading application, and use it as a *garbage matte* (to use compositing terminology) to exclude the areas of the image you don't want to be included in the key.

Applications do this differently, but the general idea is that whenever you use both HSL Qualification *and* a mask/shape/vignette/Power Window within a single secondary/scaffold/strip/grade, the two will be combined so that the only keyed areas that are preserved are those appearing within the shape.

1. Turn on the type of shape that will best isolate the portion of the key you want to preserve (for more details on using shapes/Power Windows, see Chapter 5).
2. Make sure you feather the edge of the shape so there are no harsh edges should you need to crop the key really closely.
3. Reposition the shape to isolate the desired portion of the HSL key (**Figure 4.25**).

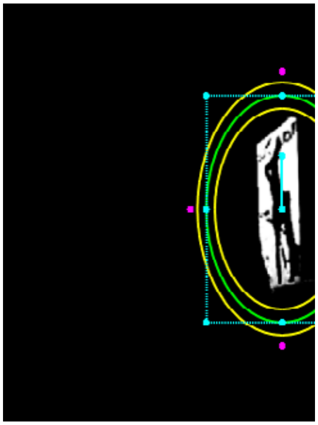


**Figure 4.25** Cropping out unwanted portions of the key using a shape/Power Window.

The resulting shape-limited matte is now suitable for making our correction. At this point, all we need to watch out for is whether or not it's necessary to animate or motion track the shape so that it follows the subject if it or the camera is moving (both of which are covered in Chapter 6).

So, if shapes are so handy, why not just use a shape all by itself? Because, as you can see in **Figure 4.25**, shapes aren't nearly as specific and discriminating as a good key. In this example, the key conforms well to the red portion of the poster, while leaving the figures within alone.

If we were to try using a custom shape/Power Curve, it would require a lot of drawing, and we'd risk needing to rotoscope the resulting shape to match a moving camera.

It's much more detailed and faster to key the poster, even though we're including other parts of the image by accident, and then limit the key using this simple oval shape/Power Window, tracking it to generally follow the subject if there's motion.

## MAKE YOUR CORRECTION

Now that we've refined the matte to our satisfaction, we're ready to make an adjustment. The spectacular example would be to change the red poster to another vivid color, but the whole point is to make the poster less noticeable, so we'll do the opposite of what we usually do, reducing contrast and fading the color to make it as much of an indistinguishable part of the background as we can. Here are the steps you need to take:

1. Turn off the matte preview so that you can see the actual image.
2. Eliminate the objectionable red by desaturating it until it's a muted, pale color, and then rebalance the Midtones/Gamma color to be bluish rather than reddish.
3. Lastly, reduce contrast by raising the Shadows/Lift contrast control, while lowering both the Midtones/Gamma and Highlights/Gain controls, doing your best to make the poster as unnoticeable as possible (**Figure 4.26**).

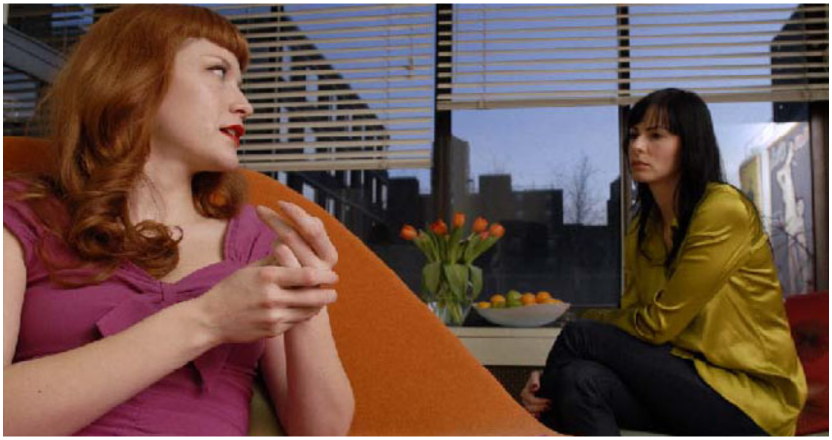


**Figure 4.26** The final effect, the poster in the reflection is muted, no longer drawing attention to itself.

And the correction is complete.

This is but one of the myriad uses of the HSL Qualifiers. In the next section, we'll take a look at what to do when you've got a hard-to-key shot, for which an HSL Qualification is your best bet.

# TIPS FOR USING AND OPTIMIZING HSL QUALIFICATIONS

The quality of your secondary correction is going to be dictated by the quality of the key you can pull. As with ordinary keying, it can be tricky to pull the matte you need in every clip, especially if the clip isn't that great to begin with. This section discusses ways you can maximize the quality of your secondary corrections to keep noisiness and rough edges from standing in the way of a successful adjustment.

## WHAT IS THE PERFECT KEY?

If you've spent any amount of time pulling blue and green screen keys to create mattes for compositing, you know how time-consuming and imperfect a process chroma keying can be. Fortunately, one of the nice things about color correction is that it's not usually necessary to pull pixel-perfect keys in order to create a reasonably convincing and invisible secondary correction, although how true this is depends on how extreme a correction you're making.

- If you're making a subtle adjustment to a clip's saturation, you'll be able to get away with a pretty sketchy matte.
- If you're making a naturalistic adjustment to the highlights of the image when holes in a keyed matte correspond to shadows that are falling on the subject you're isolating, you probably don't want to include such shadowed areas in the correction, so there's no need to make further adjustments to the matte.
- If you're making relatively extreme corrections to color and especially to contrast, you'll want to pull a considerably tighter, denser key to avoid visible artifacts. At the end of the day, chroma keying for color correction is all about what you can get away with.

No matter how loose or tight a matte you're creating, the most important thing you need to watch out for is buzz and chatter in the key, both of which can be minimized by judicious use of blur and shrink filtering operations. Sometimes, it may be faster and just as good to create a decent key and just soften the edges to make sure the matte isn't too animated, while other times you'll need to work the qualifiers to improve the overall key. However, you want to make sure you don't soften the edge of the matte too much, or you'll end up with a halo around the correction.

In all cases, the best thing you can do to check any secondary key is to play it all the way through to make sure it's not buzzing and that the color isn't bleeding later on in the clip. These sorts of problems aren't immediately visible while you're working on a clip with playback paused, and they're the very issues that ruin a perfectly good secondary.

## USE HIGH-QUALITY DIGITAL MEDIA

There are abundant reasons for color correcting and otherwise finishing a program using the highest quality source media possible. Aside from image quality considerations, secondary keying is one of the biggest beneficiaries of higher-quality media.

The best way to improve the quality of secondary color correction operations is to use the highest-quality video you can; ideally, uncompressed or minimally compressed media with the highest chroma subsampling ratio possible. High-quality video formats such as Avid's DNxHD 220x, 220, and 145, as well as Apple ProRes 422 and ProRes 422 (HQ) encode video with 4:2:2 chroma subsampling. As a result, you'll get relatively clean keys and smooth edge detail in secondary keys when working with shots in these formats.

Other mastering codecs such as Apple ProRes 4444, as well as uncompressed image sequence formats such as DPX, allow for fully 4:4:4 RGB data streams with minimal to no compression. These media types will yield exceptionally good keys since they have a maximum amount of data with which to feed a chroma keyer's digital algorithms.

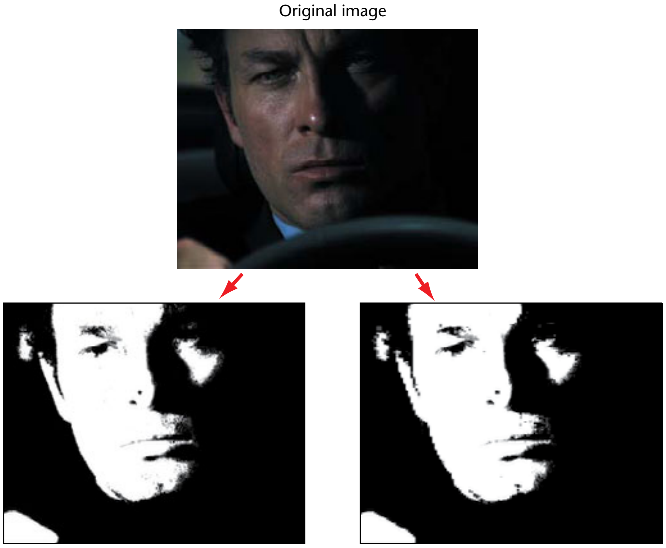
## HSL QUALIFICATION WHEN YOU'RE FORCED TO USE HIGHLY COMPRESSED FOOTAGE

Because you're pulling a chroma key, highly compressed footage poses the same challenges for secondary color correction that it poses when you are keying to create visual effects. This is especially true when you are keying off of footage with limited color sampling.

Keys off of video formats using 4:1:1 and 4:2:0 chroma subsampling (including the DV-25, HDV, and H.264-based formats) will suffer from blockier edges and more compression artifacts exposed in the key (such as macro-blocking) than keying from 4:2:2 or, even more preferably, from 4:4:4 formats. You can see the difference in **Figure 4.27**.

If you're working with highly compressed source media, you'll find yourself frequently relying upon the Edge Thin and Softening sliders to smooth off the edges of your key.

Another technique that works well when you are doing secondary color correction on highly compressed media is to create single-qualifier secondary keys using only the Luma controls. Because all video formats preserve the full quality of the Luma component of a color signal (Luma is the *4* in *4:1:1* and *4:2:0*), you'll find that this renders mattes with the best edge detail.



Secondary matte pulled for skin tone with 4:2:2 color sampling

Secondary matte pulled for skin tone with 4:1:1 color sampling

**Figure 4.27** As you can see in this illustration, the key pulled from the 4:2:2 source media is much smoother at the edges than the key pulled from the 4:1:1 down-converted version of the same clip. The right matte's aliasing and blockiness makes it harder to make seamless corrections.

## CHROMA SMOOTHING 4:1:1 OR 4:2:0 MEDIA

If you're correcting source material recorded with 4:1:1 or 4:2:0 chroma subsampling, you're left with as much color information as was captured, which is to say not much. Although this isn't necessarily such a severe liability with simple primary corrections, blocky secondary keys can occur, depending on how important the chroma channel is to the key.

Even 4:2:2 encoded media displays some aliasing along the edges of keys. One way to smooth this out, and potentially to quiet some of the jitter inside of a noisy key, is to apply some sort of chroma smoothing operation via a plug-in (such as the Color Smoothing—4:1:1 Color Smoothing—4:2:2 filters in Final Cut Pro, or Graeme Nattress' G Chroma Smooth plug-ins for Apple Color) to your clips prior to keying operations. In Apple Color, however, this forces you to do your secondary isolation within the Color FX room, with nodes applied after the chroma smooth node.

These filters selectively blur the Cr and Cb channels of video clips in order to smooth the rough edges left by the blocks of missing color information from the original compression process, and in fact, if your color correction application allows selective filtering operations to specific color channels in the Y'CbCr color space, you can do this yourself without the benefit of additional plug-ins. Slightly blurring the chroma component of a video signal slightly can in many cases improve the edges and lower the noise of a keyed matte.

## CONTROL THE IMAGE PROCESSING PIPELINE

Another way you can optimize the keying process is by making adjustments to the image prior to keying it. Now, this is only possible if your application lets you control the image-processing pipeline that feeds the HSL Qualifier's keyer. Most do, some don't:

- In DaVinci Resolve, you can connect the input of the correction node containing the HSL Qualifier to the output of any node coming before it, choosing either the original state of the image, or any other correction node, sampling the state of the image as of that point in the grade.
- In Assimilate Scratch, you have the option to key from the Source (the original media), the Primary, Recursive (the Primary and all scaffolds up to the one you're working on), or Texture Fill or Matte (for special effects).
- In FilmLight Baselight, a Reference strip appears along with the InsideOutside and HueAngle layer strips that are created when you add a keyer. The Reference strip controls whether you use the original or graded image as the basis for the key.
- In Autodesk Lustre, a Source Primary button determines whether to use the source, or the primary correction, as the basis for the key.
- In Apple Color, the keyer always samples the original, uncorrected media.
- If you're color correcting using your NLE, the filter interfaces of Apple Final Cut Pro, Adobe Premiere Pro, and Avid Media Composer are stack-based UIs, where the order of the filters determines the order of processing. When you insert a color correction filter at the bottom of a list of other filters, the keyer samples the output of all filters applied earlier in the stack.

When sampling values for a key, there are various reasons to choose either the original state of the media, or a graded version of the shot.

In some instances, your grade may be so extreme (a low-saturation bleach-bypass effect, for example) that inserting an HSL Qualification at that point would result in a terrible key. This is a case where you'd want to sample the original image in order to get the best result.

On the other hand, if you're grading media that is inherently low contrast and low saturation (for example, a flat best light safety film transfer, or media using a raw format such as RED), you'll probably get far better results by pulling a key from a color corrected version of the image.

The following sections describe ways in which controlling the image-processing pipeline will improve your keys.

## BOOST IMAGE OR COLOR CONTRAST

A key method that often helps improve keys is to boost the saturation and/or increase the contrast of the overall image, pulling a key off of the result. By increasing color contrast and luma contrast, you increase the distance between discrete values in the image, which can make it easier to manipulate the qualifier controls to isolate more specific slices of color. You can think of a saturation/contrast boost as widening the difference between the colors of the subject you're trying to isolate and the areas you're trying to exclude.

In **Figure 4.28**, the man's pale blue shirt in the uncorrected shot at left is difficult to distinguish from the cool highlights overall, mainly because the initial contrast of the shot is so low. However, boosting contrast and raising saturation makes the shirt a much easier target for HSL Qualification.

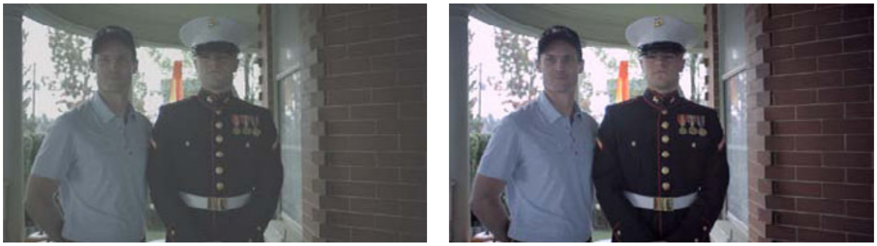


**Figure 4.28** The uncorrected image at left will be difficult to key, owing to its low contrast and saturation. At right, the same image has had the contrast boosted, preparing it for keying.

Often, you'll be boosting contrast and saturation as part of your primary grade anyway. However, if your goal is ultimately a desaturated look, you'll need to boost contrast and saturation with one correction, add a secondary in another correction to create the isolated adjustment you need, and then reduce the contrast of the overall image using a third correction to get the overall look you require (**Figure 4.29**).

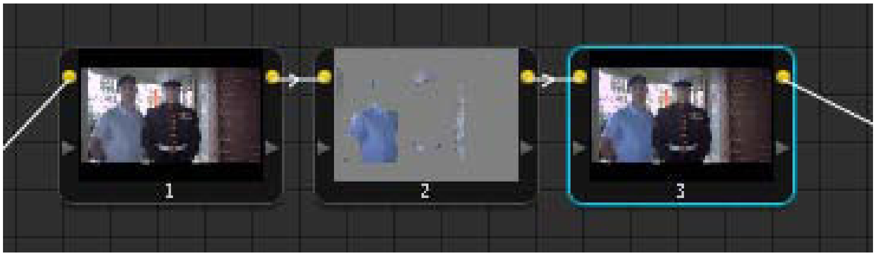


**Figure 4.29** A three-correction sequence.

In **Figure 4.29** we can see this process in action. The image is made ready for keying with node 1, the HSL Qualification to adjust the man's shirt happens in node 2, and a final correction in node 3 reduces overall saturation to create the final desired effect.

## MAKING A SECONDARY ADJUSTMENT BEFORE A PRIMARY

Another strategy is to make a secondary HSL Qualifier adjustment *before* making your primary correction. This is especially useful in instances where the primary correction you want will clip highlights or crush shadows to the point of impeding a high-quality key, preventing you from making an adjustment to retrieve necessary detail.

In **Figure 4.30**, we can see that slight underexposure coupled with a white, reflective driveway, means that we can't simply boost the midtones to the level we want without clipping the driveway.

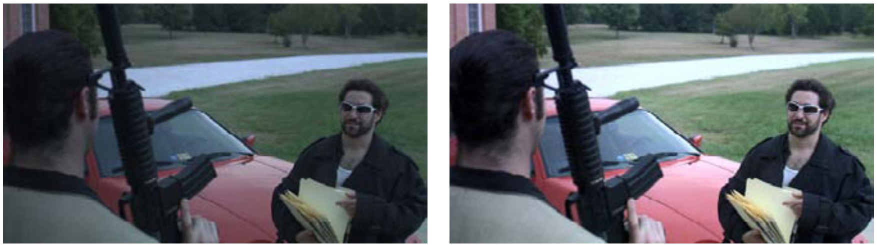


**Figure 4.30** Adjusting contrast for a proper exposure results in the white driveway getting clipped, as seen in the image on the right.

To work around this, you can make a secondary adjustment as your *first* correction, which lets you key and manipulate the image using all of the detail found at the original signal levels. Then, in a second correction, you would use a primary adjustment to clip the highlights or crush the shadows as desired for the look you want (**Figure 4.31**).

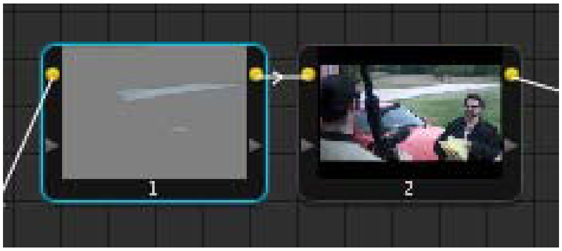


**Figure 4.31** Node 1 pulls a key on the road, allowing you to selectively control its contrast before the adjustment made by node 2, which raises contrast overall.

When you work this way, you can lower the exposure of the road in proportion to the amount you'll be raising exposure in the second corrections. In other words, if you know you'll be jacking up the highlights of an overall image and losing detail as a result, then isolate the detail you'll be losing, and *lower it before it gets raised in the second correction*, so the final result is properly exposed all the way through (**Figure 4.32**).

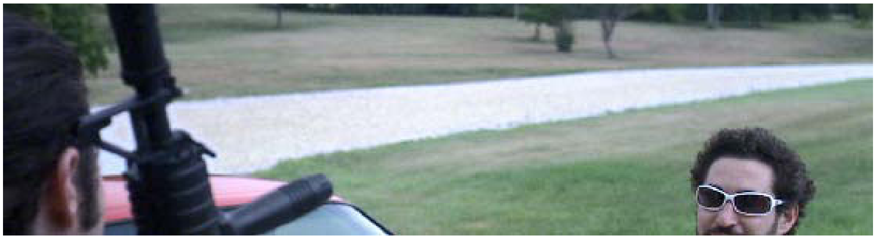


**Figure 4.32** The end result. By preemptively lowering the lightness of the road, you preserve detail even though you're still boosting the contrast of the entire shot.

This technique works equally well with saturation enhancements, enabling you to lower saturated elements before they get clipped later on.

## PREEMPTIVELY BLUR THE IMAGE YOU'RE KEYING

In some cases, excessive noise or movement in an image makes it challenging to pull a smooth key, even if you're using a post-key blur. One thing you can try in such situations is to blur the image before you pull a key. There are several ways you can do this.

- Assimilate Scratch has a convenient Pre-Blur parameter that lets you blur the image before you pull a key. This doesn't affect the image visually; it simply softens a branch of image processing that's being fed to the keyer.
- In DaVinci Resolve, you can do the same thing by creating a node tree where a correction that blurs the image is connected to a second correction set up to pull the key. To avoid actually blurring the corrected image, you then insert that key into the mask input of another correction that takes the original state of the image as its image input (**Figure 4.33**).

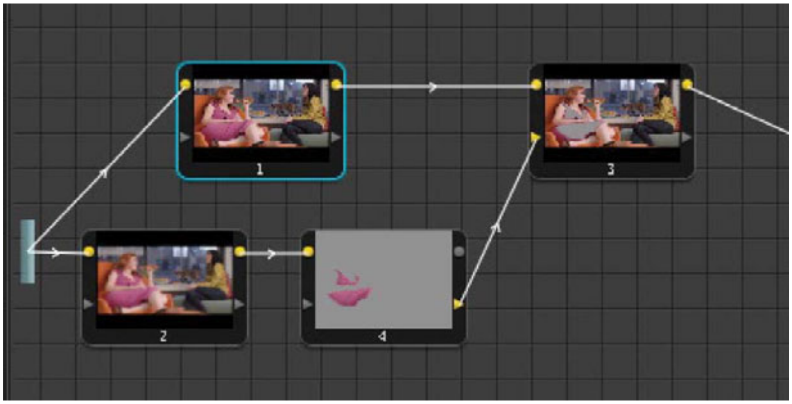


**Figure 4.33** Blurring an image in order to improve a key, without blurring the final image in DaVinci Resolve. Node 2 blurs the image, and node 4 pulls a key from the result. Node 1 is the initial primary correction for the shot, while node 3 is a secondary correction that uses the matte that's fed to it from node 4 (via the mask input at the bottom left).

- In Apple Color, you can do the same thing in the Color FX room. Use an Alpha Blend node to apply a correction to the area isolated via the HSL Key node attached to its third input. Attaching a blur node to the HSL Key node's input blurs the image used to create the matte, while leaving the images combined by the first two inputs of the Alpha Blend node alone (**Figure 4.34**).

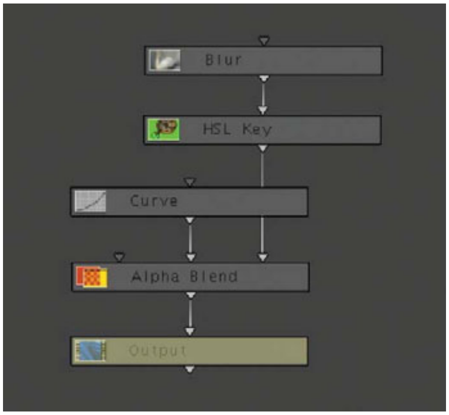


**Figure 4.34** Blurring the image that feeds the HSL Key node in Apple Color. Since the matte is only connected to the mask input of the Alpha Blend node, the image remains unblurred.

## UNUSUAL QUALIFIER COMBINATIONS

One thing that's easy to overlook when you're trying to pull a tricky key is that you might be able to solve your isolation problem using an unusual combination of qualifier controls. I directed a movie that took place in the desert (and, being me, graded it as well), and I was endlessly vexed at how closely some of the character's costumes came to the hues of the earth that surrounded them.

However, I began to realize that I could pull a much more isolated key by limiting the qualifiers to one of the following combinations:

- **Hue & Saturation:** I've had shots that were so equiluminant (the luma throughout the image was within a very narrow range) that it was tough to isolate the feature that I needed because the luma key kept polluting my matte in unwanted areas. Then I realized that those features were more saturated than the rest of the image. Keys pulled using only Hue + Saturation aren't necessarily going to be either pretty or smooth (especially with highly compressed media), but this combination can sometimes work in a pinch.
- **Luma & Saturation:** The combination of luma and saturation can be a good way to isolate skies when there are other, less saturated blues in the image (water, costume).

# DIFFERENT WAYS OF USING HSL QUALIFIERS

Image segmentation describes the process of divvying up an image into individually adjustable segments for purposes of performing highly specific color corrections (**Figure 4.35**). The more you work, the more you'll spot easily segmented regions of the frame, and the faster you'll be able to deploy the most suitable secondary tools for the job at hand.

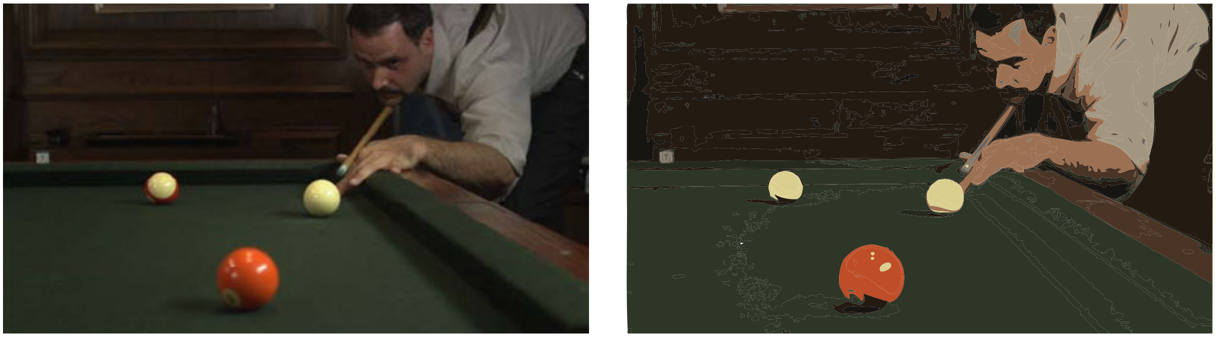


**Figure 4.35** At left, the original image. At right, the image has been artificially color-quantized to show how the image is naturally segmented for purposes of creating isolated corrections using HSL Qualification.

Segmented adjustments using secondary corrections is a key strategy, both for addressing specific problems and for stylizing an image. Although you can do a solid grade using only a single primary, it puts the burden upon the cinematographer to have anticipated and created the careful pools of light and dark, color and colorlessness, using a combination of lighting instruments, flags, and art department trickery, and working with the costume department to control the visuals' impact on the viewer.

This kind of control over the practical photography is not always feasible on lower-budget features with limited schedules, or documentary productions where you don't have a whole lot of control over where you shoot, when you get the shot, and what people are wearing. As a result, the colorist's job grows.

The following sections illustrate different ways of using the very same tool, HSL Qualification, to achieve very different creative goals.

## ISOLATING AND ADJUSTING SPECIFIC ELEMENTS

This is the most basic use of HSL Qualification. In particular, I find the most common application of HSL Qualification in my work is to address problems with saturation.

As we saw earlier in this chapter, a common operation is dealing with subjects that are too distractingly saturated. For example, the image in **Figure 4.36** has had a primary correction to increase contrast and boost saturation. The result, unfortunately, is that the balloons in the background have become excessively bright. Using a qualifier, it's easy to isolate the balloons and make them more subdued.

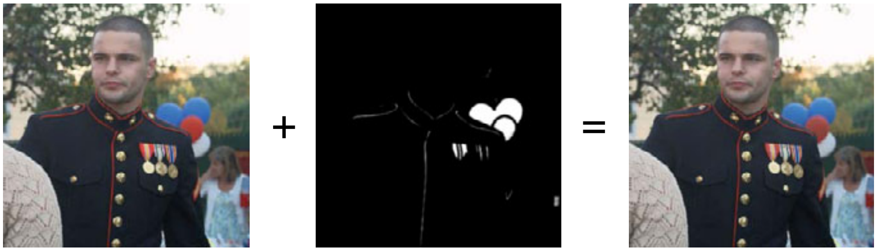


**Figure 4.36** The balloons and ribbons at left are distractingly saturated. Isolating them with a key lets us slightly reduce saturation so they don't draw our eyes away from the actor.

Another technique for dealing with the opposite issue, a lack of saturation, is to enhance the color contrast of an image by using "contrast of extension" (covered in Chapter 3) to create the illusion of higher saturation by using HSL Qualification to boost the saturation of specific subjects in the frame, rather than boosting the saturation of the entire image.

For example, **Figure 4.37** has plenty of saturation but not a lot of color contrast. An easy fix for this is to isolate the woman's sweater in the image, and then increase the saturation. The resulting splash of color gives life to an otherwise blah image.

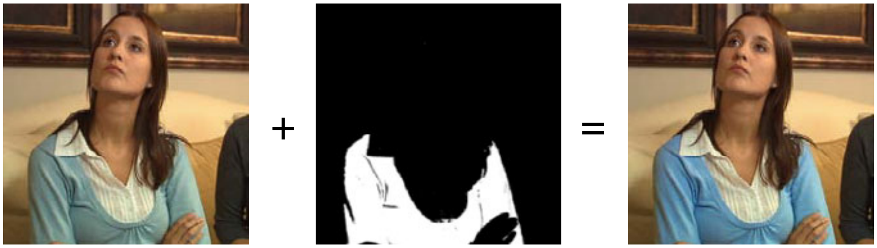


**Figure 4.37** Isolating the woman's lackluster sweater lets us pump it up with a bit more color, bringing welcome color contrast into an otherwise monochromatic scene.

Using this strategy, you get to have your cake and eat it too: You can even desaturate an image, yet by selectively boosting the color of one or two objects, make it appear as if it's even more colorful.

**NOTE**

**Secondary keys in low-saturation shots tend to be tricky when you're trying to isolate small areas of specific color. As a result, this is one of the more time-intensive operations discussed here, and it's possibly not suitable if your client is in a hurry.**

## CORRECTING TWO EXCLUSIVE AREAS

We've already seen how you can invert a key to leave one element alone when you want to correct everything else. Another segmentation strategy involves using an HSL Qualifier to key an easy-to-isolate region, and then apply separate corrections to the inside and outside of the matte (**Figure 4.38**).

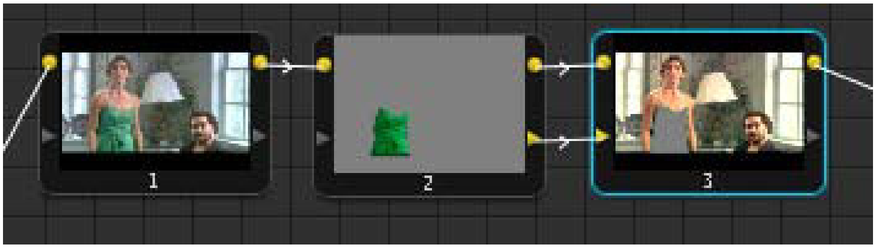
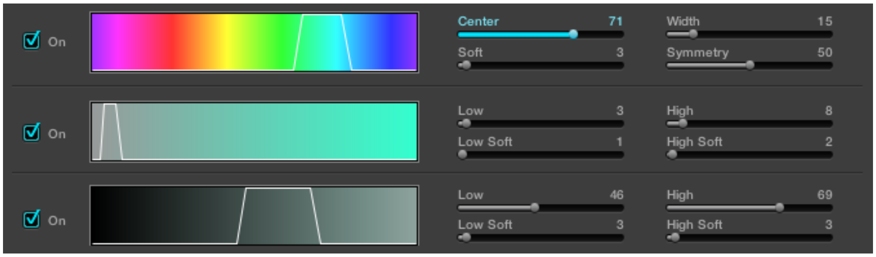


**Figure 4.38** A basic correction is applied with node 1, and nodes 2 and 3 apply separate corrections to the inside and outside of a keyed subject, respectively.

This is an especially useful strategy when you're trying to protect or uniquely grade a specific subject. For example, the woman's green dress in **Figure 4.39** is a deliberately specific shade that the client wants graded in a particular way, even though the environment is supposed to be graded very differently (in this case a very warm yellow).

Using HSL Qualification, it's an easy thing to key the dress to isolate it from the rest of the picture.



☑ On
Center 71
Width 15
Soft 3
Symmetry 50

☑ On
Low 3
High 8
Low Soft 1
High Soft 2

☑ On
Low 46
High 69
Low Soft 3
High Soft 3

**Figure 4.39** The green dress needs to be keyed to isolate it from the rest of the image in order to produce the grade the client wants.

Then, you can apply a correction to the inside (white) of the resulting matte, grade the dress however you need it to appear (in this case darker and more saturated), and apply a second grade to the outside (black) of the matte, grading the environment separately to blow out the highlights and add a burning warmth (**Figure 4.40**).

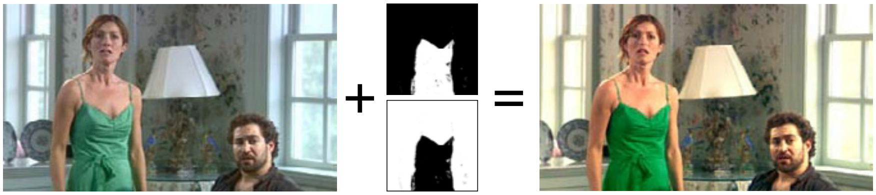


**Figure 4.40** Grading a scene with two exclusive corrections, one applied to the inside of the keyed dress to boost its greens and darken the color, and another applied to the outside of the dress to blow out the environment.

How you approach grading the inside and outside of a matte depends on your grading application:

- In DaVinci Resolve, create an "outside node" from the correction node with the dress qualification.
- In Apple Color, choose Inside from the Control pop-up menu to switch that secondary to adjust the inside of the mask.
- If you're using Autodesk Lustre, click the Inside button.
- In Assimilate Scratch, duplicate the scaffold that has your initial qualification, and invert the mask in this new scaffold.
- In FilmLight Baselight, select the layer with the qualification, and choose an appropriate grade type from the Inside column of the Inside/Outside table.

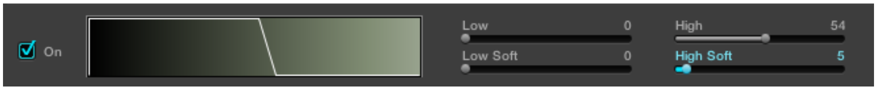
Many NLE filter-based secondary corrections handle this functionality by duplicating the filter doing the keying and inverting the filter to correct the outside region of the matte.

For a detailed example of using this technique to segment skin tone adjustments and environmental adjustments, see Chapter 7.

## GRADING LIGHT AND DARK REGIONS OF AN IMAGE SEPARATELY

In many instances, you may be dealing with an image that has areas of overexposure combined with areas of underexposure, such as when an underlit subject is standing next to a window, or sitting in a car in front of a window. Backlit windows are notorious for being difficult to expose, and unless the crew was able to apply sheets of neutral density over the windows, or bounce some fill light onto the subject in the scene to balance the exterior light with the interior, they're often deliberately overexposed.

If, in a situation such as this, the extremely bright region of the picture (the window) isn't overexposed to the point of losing all visible detail and the interior subject isn't too horribly underexposed, you should be able to use HSL Qualification to solve the problem. In particular, you can use the Luma qualifier all by itself to isolate either the highlights or the shadows—whichever portion of the image is more cohesive (**Figure 4.41**).



☑ On

Low 0

Low Soft 0

High 54

High Soft 5

**Figure 4.41** Luma-only key as created in DaVinci Resolve.

Then, you can use the resulting matte to grade the under- and overexposed areas of the image to bring them closer in line with one another (**Figure 4.42**).

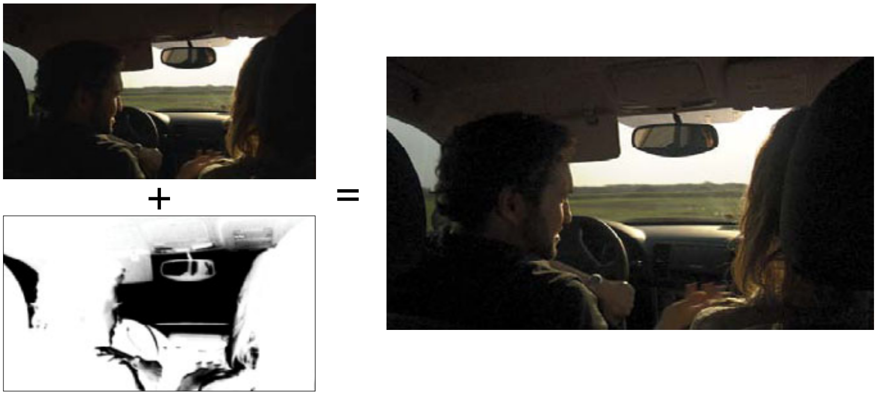


**Figure 4.42** Keying the darkest parts of the car exterior makes it possible to lighten the deeper shadows, adding detail to the man's face and the dashboard of the car.

Aside from window shots, this technique is effective for any clip where you have to deal with two areas that are exposed very differently. However, be careful of how much the softened edge of the matte overlaps from the shadows into the highlights of the image; too much overlap can result in haloing that will look artificial.

## CONTROLLING SHADOW CONTRAST

One of the hardest things to deal with is the adjustment of shadow ratios. For example, it's easy to generally lighten or darken a subject overall, although the result may appear a bit washed out. Unfortunately, if you're matching a shot from late in the day into a scene that was photographed at noon, or if you're asked to change the apparent time of day of a scene, you're likely going to have a shadow ratio mismatch that you'll want to attempt to fix.

However, it's not that easy to alter the ratio of shadow to light that falls on someone's face. In the uncorrected image on the left in **Figure 4.43**, there's a distinct shadow on the woman's face, with a highlight on the other side, that indicates higher-key, dramatic, afternoon lighting.

One strategy would be to use a luma curve to lighten the midtone shadows, while keeping the deepest shadows to maintain a good sense of image detail. However, you might not be able to make a specific enough adjustment using just curves.

The other possibility is to use the previous technique, trying to carefully create a secondary key using the Luma qualifier to isolate the midtone shadows on the face that you want to lighten. Coupled with an adjustment to cool off the highlights, this does the trick, and we now have a lighter, less high-key shot, as seen on the right in **Figure 4.43**.

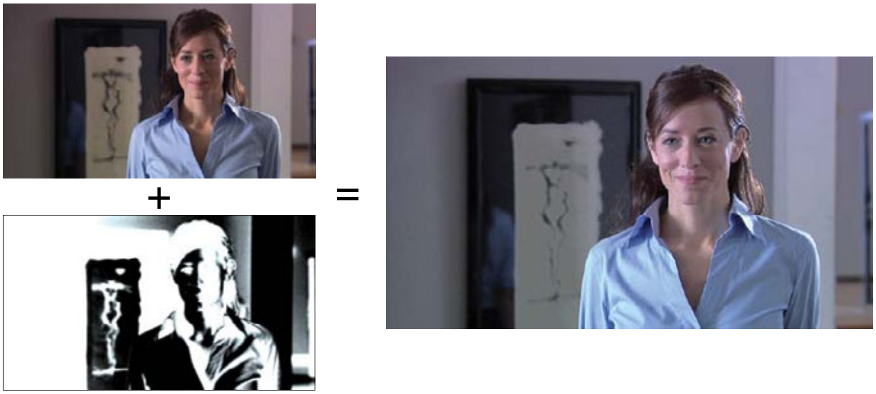


**Figure 4.43** Keying the shadow regions of the image makes it possible to lighten them, gently, in an effort to reduce the shadow ratio for a more noonday look.

When attempting to lighten the shadows on a subject's face, you need to pay particular attention to the transition between the unadjusted highlights and the adjusted shadows. If this middle-point starts to reveal itself as a solarized border, you'll want to adjust the tolerance and/or feathering that you're applying to the Luma qualifier to try and minimize it. If that doesn't solve the problem, you may need to back off of your correction a little bit.

When you create this sort of correction, make sure you don't overdo the shadow lightening or you'll *solarize* the image (create lighter areas where they should be darker, and vice versa, for an early-'80s music video look). The other possible consequence is that, if the feathering and brightening isn't done just right, the image could start looking like bad HDR (high dynamic range) photography.

## ISOLATING A SUBJECT WITH DESATURATION

A commonly asked-about technique is that of isolating a color subject within an artificially created black-and-white environment, as used in the movie *Pleasantville*. From the techniques we've covered so far, this should now be a easy nut to crack, especially if the subject you're trying to isolate possesses a unique range of hue, saturation, or luma.

Basically, key on the subject you want to keep in full color, invert the matte, and then desaturate everything else (**Figure 4.44**).

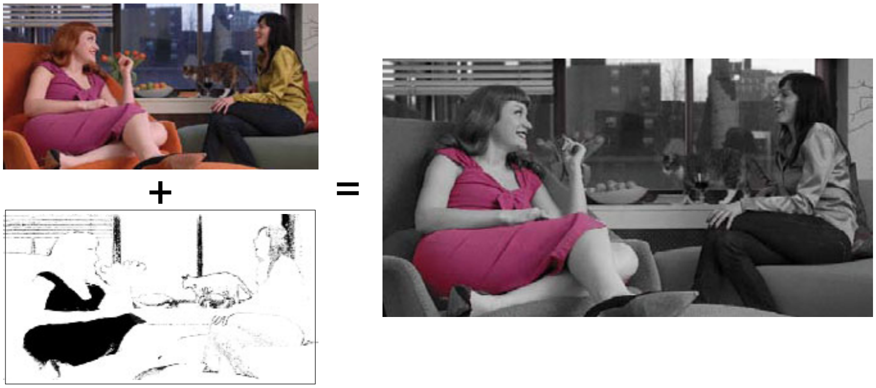


**Figure 4.44** Keying the woman's pink dress, inverting the key, and desaturating everything else.

## DOING A BETTER JOB BY COMBINING MATTES

The previous example in **Figure 4.44** is fine if we're happy with the one dress being in color and everything else being in black-and-white. However, things are rarely that simple. For example, what if we wanted both women to be in color? Fortunately, some applications let us combine mattes from different keys.

**Figure 4.45** shows how, in DaVinci Resolve, we can use four separate corrections to isolate the pink dress, the red hair, both women's skin tones, *and* the other woman's green shirt, and then combine them using a Key Mixer node.

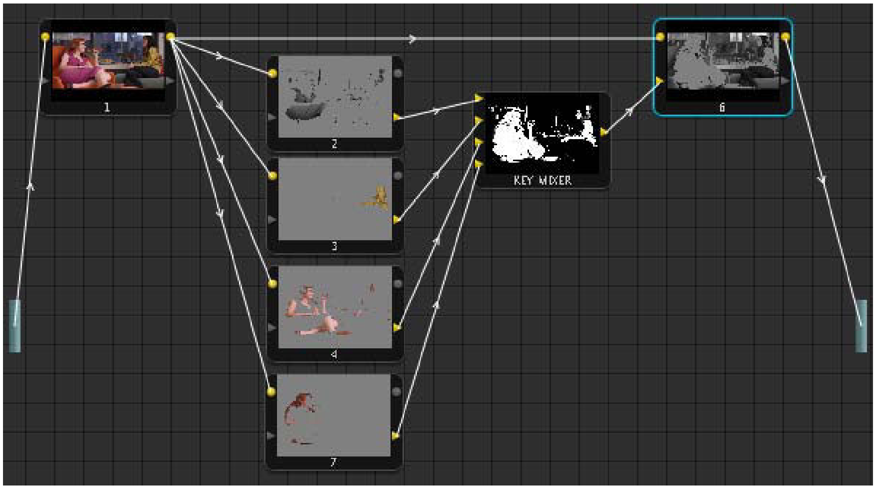


**Figure 4.45** Using multiple nodes in DaVinci Resolve to combine four separate HSL keys to use as one. Each individual key can be optimized to isolate one subject well.

The resulting combination matte can be fed into the mask input of a correction (node 6), inverted, and used to desaturate everything we didn't key, all at once (**Figure 4.46**).

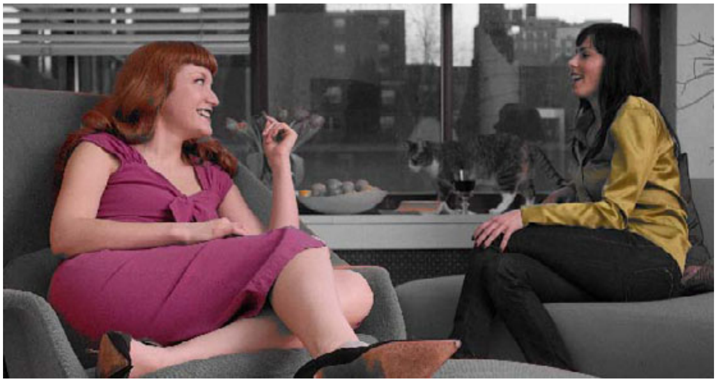


**Figure 4.46** Desaturating everything outside of the combination key shown in Figure 4.44. I left the imperfections to illustrate just how difficult an operation this is, and the importance of spotting these issues. I count 14. (You'll find a complete list at the end of the chapter.)

**TIP**

**If you're combining mattes in DaVinci Resolve using the Key Mixer node, a pair of parameters in the Key tab of the Color page, Gain and Offset, let you adjust the contrast of each incoming matte; click the connection between the incoming node you want to adjust and then click the Key Mixer to choose which matte you adjust.**

Now, the example in **Figure 4.46** could obviously be further improved with some more aggressive keying combined with shape/Power Window garbage mattes, but hey, I have a book to finish.

The same technique can be used in the Color FX room of Apple Color by combining multiple mattes created with HSL Key nodes and Shape nodes using the Lighten and Darken nodes. This is worth spending a bit of time on, as the Apple Color node interface makes it explicit how you can combine mattes using *blending modes* (sometimes called *transfer* or *composite modes*) to create different shaped mattes. These blending modes exist in other grading, compositing, and editing applications, and you should be able to adapt these techniques to your own application if they're supported.

**Figure 4.47** shows how you can combine two mattes using a *lighten* blending mode, with the result being that the white interiors of both mattes are merged together to become a single matte. This happens because the lighten blending mode compares both images and preserves the lightest pixels within each.

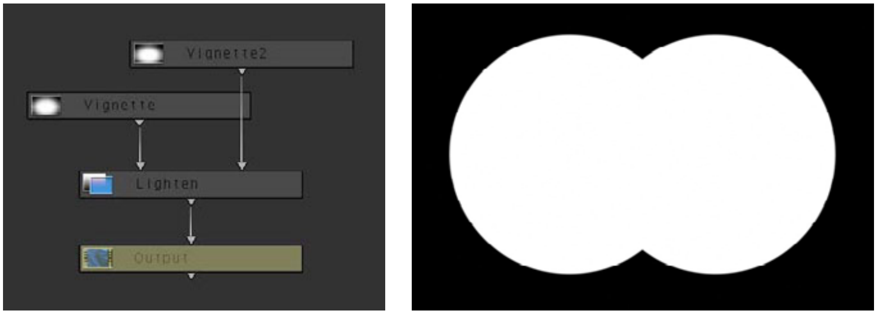


**Figure 4.47** Combining shapes using a lighten blending mode to combine two matters in the Color FX room of Apple Color.

Next, we can see in **Figure 4.48** how the *darken* transfer mode can be used to preserve the white interior only where two mattes overlap. This is, in fact, the very method that's used to use HSL keys in combination with shapes/Power Windows to limit the keyed matte to within the area of the shape (we'll see this combination later on in Chapter 5). The opposite of the lighten blending mode, the darken mode compares two images and preserves the darkest pixels from each.

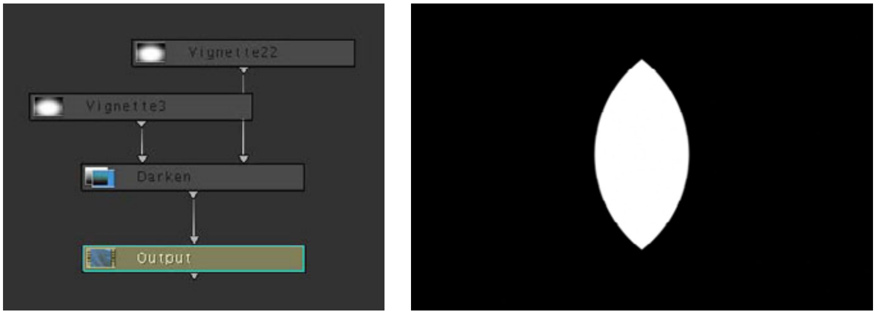


**Figure 4.48** Combining shapes using the darken transfer mode.

Finally, **Figure 4.49** shows how you can use the darken blending mode in a different way, using one matte to carve out the overlapping part of another matte. In the node tree, you can see that Vignette2 has been inverted. Since the darken blend mode compares two images and preserves the darkest pixels in each one, this means that the now black portions of the inverted Vignette2 node cut into the Vignette node.

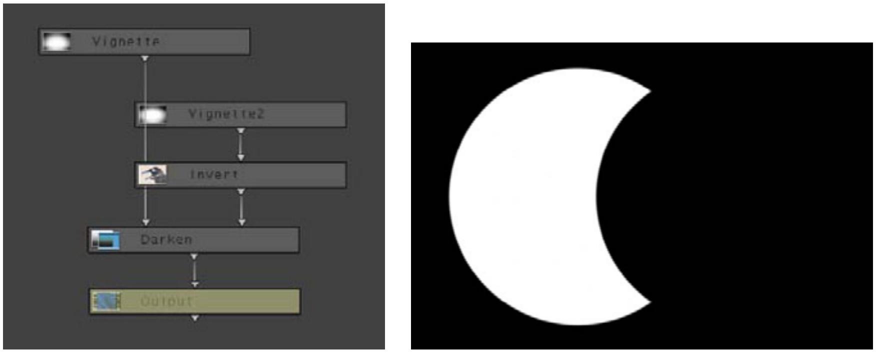


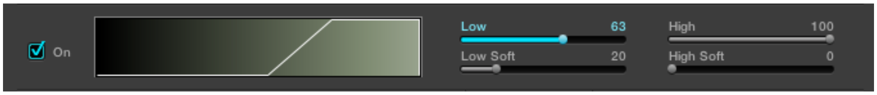
**Figure 4.49** Using the darken blending mode with Vignette2 inverted.

If you're having a tough time isolating every part of the subject you need to adjust, you might try using combinations of mattes instead.

## ALTERING SATURATION WITHIN A SPECIFIC TONAL RANGE

Although some applications have specific controls for highlights and shadow saturation that let you adjust specific zones at the extremes of image tonality, if you lack these controls, there is a simple way to customize a tonal region for adjustment of saturation.

All you have to do to use a Luma qualifier all by itself is to select a range of image lightness within which you will decrease or increase saturation (**Figure 4.50**).



☑ On

Low 63

Low Soft 20

High 100

High Soft 0

**Figure 4.50** Using the L (luma) qualifier in DaVinci Resolve to isolate a range of image tonality within which you can adjust saturation.

Once you've defined the area of the image to adjust, it's a simple thing to lower or raise saturation to achieve the necessary result. In **Figure 4.51**, you can see that a much larger area of the highlights have been isolated for saturation adjustment than is typically possible using some applications' highlight saturation controls.

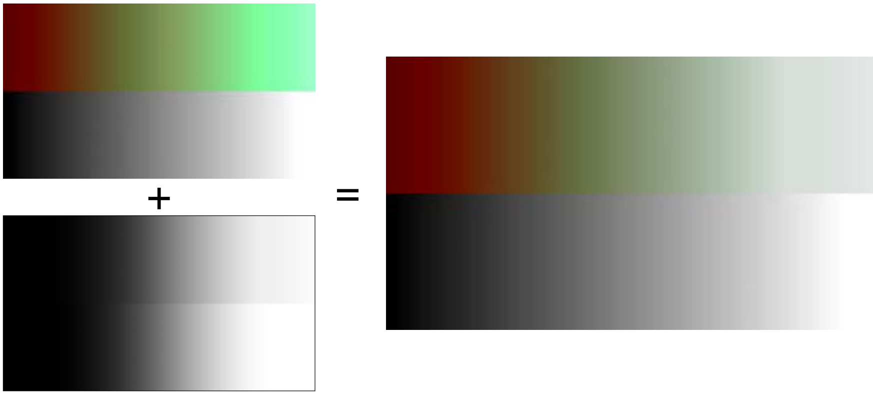


**Figure 4.51** A custom tonal region of the image can be selected using the Luma qualifier for tailored saturation control, in this case desaturating a broad range of highlights.

Furthermore, you can make separate saturation adjustments to the inside and outside of the matte you've defined. This can be a good way of boosting midtone saturation without needing to subsequently lower saturation in the highlights and shadows for purposes of video legalization.

This is also a good technique for isolating a limited range of highlights or shadows with an extremely soft falloff for subtle adjustments.

## DESATURATING AN IMAGE AND SELECTIVELY RESATURATING IT USING HSL QUALIFICATION

This next technique is one that Chicago colorist Bob Sliga showed me. It's a bit more specialized, but it comes in handy for both creative looks and the occasional utilitarian adjustment. This technique is only possible on grading applications that let you pull keys off of the original source media, rather than the graded state of the image.

The trick is to desaturate an image completely and then pull a key based on the original colors in the source media, as shown in **Figure 4.52**.

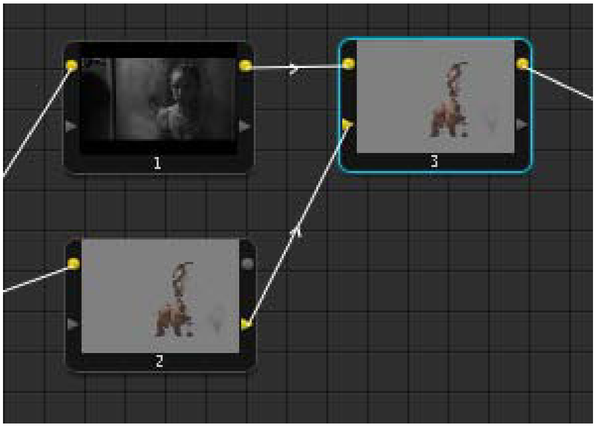


**Figure 4.52** Pulling a key based on the original colors in the source media.

Using that key, you can add artificial color back into the scene to "colorize" a subject you want to give a special look to (**Figure 4.53**). A node tree for creating this effect in DaVinci Resolve can be seen in Figure 4.52.

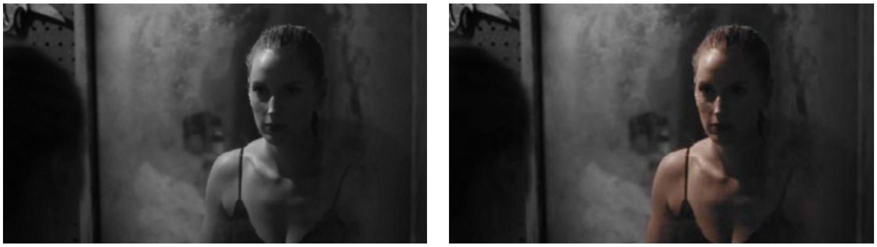


**Figure 4.53** At left, the desaturated image with boosted contrast. At right, the portion of the image that was colorized using the key pulled from the original color in the source.

This technique is great for giving an otherworldly look to people in special situations. However, I've also used it for shot blowups that have excessive chroma noise in a brightly colored portion of the image. Desaturating the offending subject (an apron in the example I'm thinking of) eliminated the most objectionable noise pattern, and I could then make it red again by keying and colorizing. The final result was a vast improvement, and the effect was nearly indistinguishable.

# HUE CURVE ADJUSTMENTS

Hue curves are powerful, fast-to-use controls that let you make gentle or sharp alterations to the color components of an image by placing control points along sections of the spectrum. Unlike RGB curves, which plot individual color channels vs. image tonality, hue curves plot individual color components relative to user-defined ranges of hue (**Figure 4.54**).

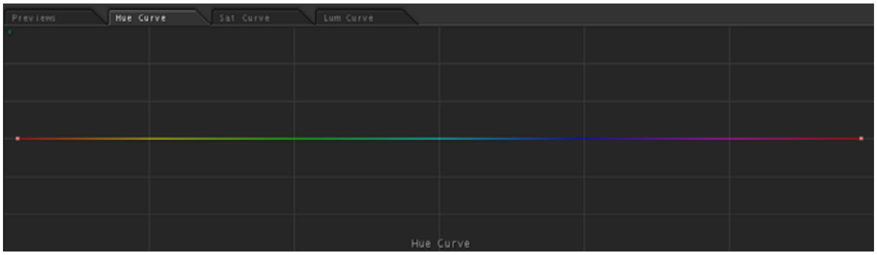


**Figure 4.54** The hue curves UI as seen in Apple Color.

Their power lies in their ability to quickly make alterations to specific subjects in an image based on their hue alone, and the mathematics of curve operations make most adjustments really smooth and seamless, with none of the edge artifacts you can get when you're using HSL Qualifiers to pull a key. This is especially good when you're making huge targeted changes to image saturation (something I do quite a lot).

**NOTE**

**Even though you can make very specific adjustments by careful placement of control points to lock off certain parts of the curve while adjusting others, you may also find that HSL Qualifiers are able to isolate elements more tightly. With practice, you'll develop habits regarding when to use either type of control.**

Most grading applications have, at minimum, three hue curves:

- *Hue vs. Hue*
- *Hue vs. Saturation*
- *Hue vs. Luma*

Some applications also have Saturation vs. Luma (providing curve-based control over saturation in targeted areas of image tonality that's quite powerful); however, the minimum hue curve controls correspond to the three essential color components of the video signal.

## HUE CURVE CONTROLS COMPARED

Hue curves are available in many applications, including Apple Color, Assimilate Scratch, FilmLight Baselight, and Quantel Pablo (Quantel was the originator of these curves, and Quantel applications from Paintbox through Pablo have referred to this as the *Fettle* interface). **Figure 4.55** shows a comparison of Hue curves as represented in different color grading applications.

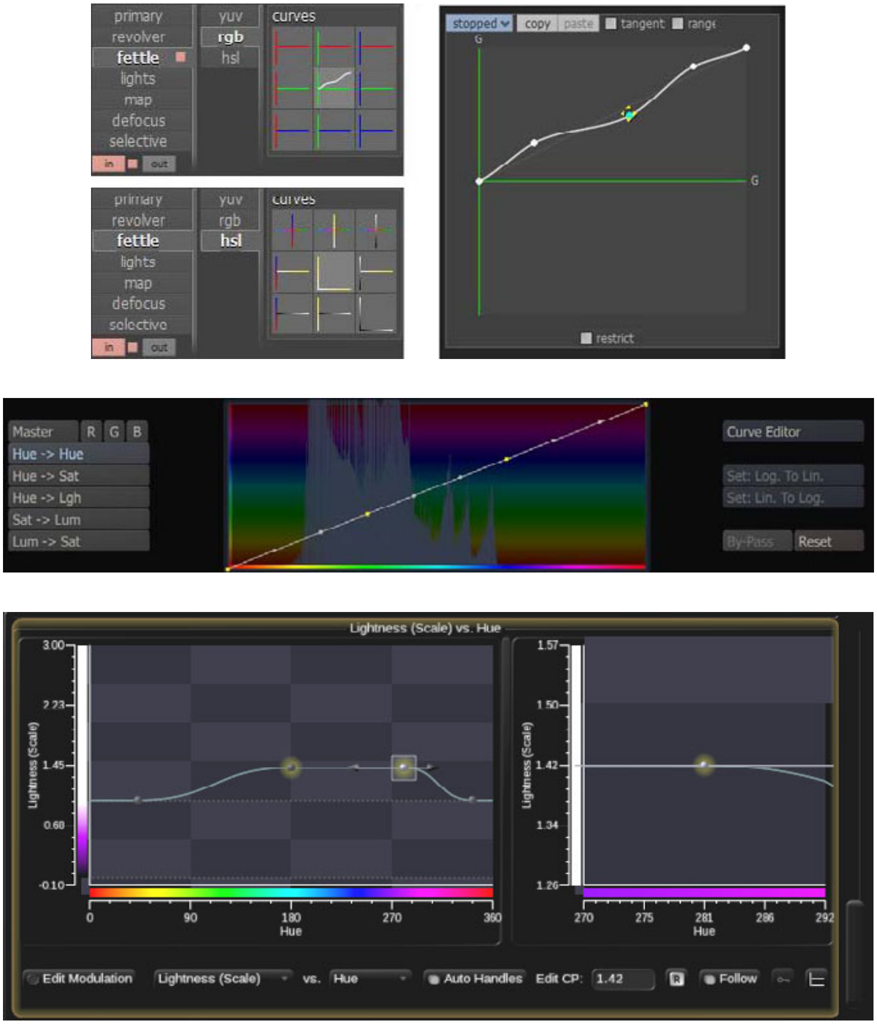

primary
revolver
fettle
lights
map
defocus
selective
in
out
yuv
rgb
hsl
curves
stopped
copy
paste
tangent
range
G
restrict
Master
R
G
B
Hue -> Hue
Hue -> Sat
Hue -> Lgh
Sat -> Lum
Lum -> Sat
Curve Editor
Set: Log. To Lin.
Set: Lin. To Log.
By-Pass
Reset
Lightness (Scale) vs. Hue
Lightness (Scale)
3.00
2.23
1.45
0.68
-0.10
0
90
180
270
360
Hue
1.57
1.50
1.42
1.34
1.26
270
275
281
286
292
Edit Modulation
Lightness (Scale)
vs.
Hue
Auto Handles
Edit CP:
1.42
Follow

**Figure 4.55** Images of hue curves in UIs compared, top to bottom: Excerpts from Quantel's Fettle UI, Assimilate Scratch, and FilmLight Baselight.

While we're on the subject, one of the standout features of Colorista II is a pair of circular HSL controls, which essentially perform the same function (**Figure 4.56**).

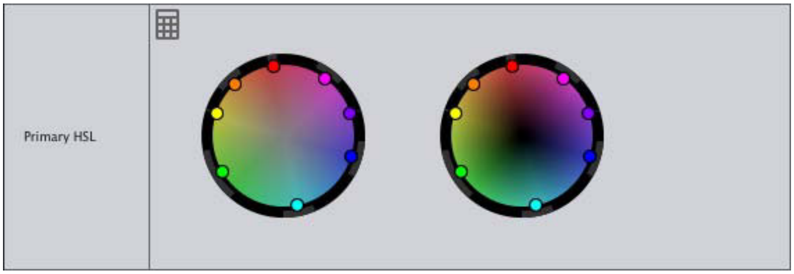


**Figure 4.56** Circular HSL controls in Magic Bullet Colorista II.

These unique takes on the hue curve interface have efficiencies built into their UIs:

- The left control combines the functionality of the Hue vs. Hue and Hue vs. Saturation controls; changing the *angle* of a particular hue handle shifts hue, and changing its *distance from the center* adjusts saturation (similar, in fact, to the familiar use of color balance controls).
- The right-hand control lets you alter Hue vs. Luma.

The only drawback of this system is that the number of hue handles is fixed, whereas curves let you add as many control points as you like. However, practically speaking, you can do just about anything with the Colorista interface that you can do with curves, except for perhaps a handful of extremely tight multi-hued adjustments.

Let's take a look at each of the three basic hue curve functions using a helpful hue-wheel test pattern to examine their effects.

## USING HUE VS. HUE CURVES

*Hue vs. Hue* lets you isolate a range of hues that you want to literally change into other hues. The effect is similar to the hue parameter that most grading applications have, which rotates the hue of the entire image around a 360-degree axis (which causes a familiar "rainbow shift" if you animate it). However, using a curve interface, you limit hue shifts to specific portions of the spectrum.

In the following example, the blue portion of the spectrum is loosely isolated and raised on the curve (**Figure 4.57**).

The result is that the hue of the blue wedge of the color wheel is altered, in this case changed to green. Because the curve has a smooth falloff, you can see hue transitions from the altered green into the other original colors on the wheel. Although obvious on the test pattern, this isn't always obvious in a real-world image, but it shows that subtle hue shifts are usually more successful than huge ones.

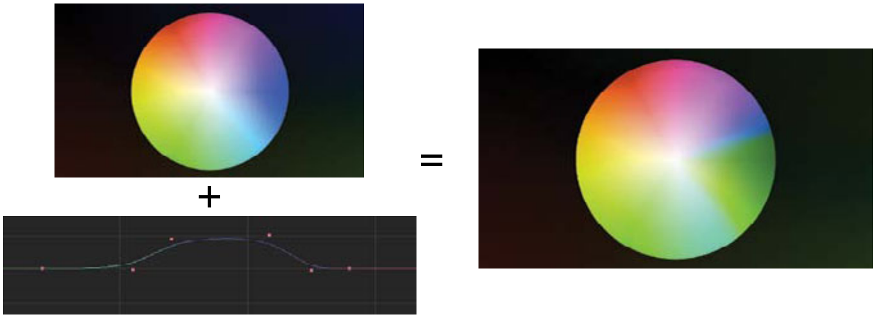


**Figure 4.57** The blue portion of the hue spectrum isolated and raised on the curve.

I use this control for making subtle adjustments to skin tone (taking advantage of the narrow range of hues that skin occupies), foliage, and skies (all techniques you'll see in subsequent chapters).

## USING HUE VS. SATURATION CURVES

*Hue vs. Saturation* is the hue curve I use most frequently. It lets you isolate a range of hues within which to raise or lower saturation. Again, isolating the blue of the spectrum—in this case, lowering the curve—lets us desaturate that particular portion of the color wheel. Again, because this is a curve, the falloff is gentle, although a sharper curve results in a sharper transition from the desaturated to fully saturated areas of the image (**Figure 4.58**).

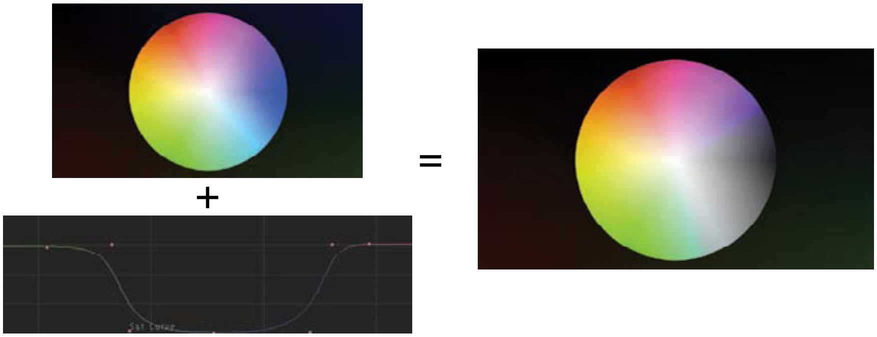


**Figure 4.58** Lowering the curve to desaturate a portion of the color wheel.

This is a powerful tool for stylistic adjustment (reducing the saturation of everything except the blue of the sky, for instance), addressing quality control violations (reducing the intensity of reds that are peaking too much), or shot matching (eliminating a subtle yellow cast that's otherwise hard to isolate).

## USING HUE VS. LUMA CURVES

Hue vs. Luma lets you isolate a range of hues within which to lighten or darken corresponding features. Isolating the blue portion of the spectrum and lowering this control darkens the blue wedge of the test pattern (**Figure 4.59**).

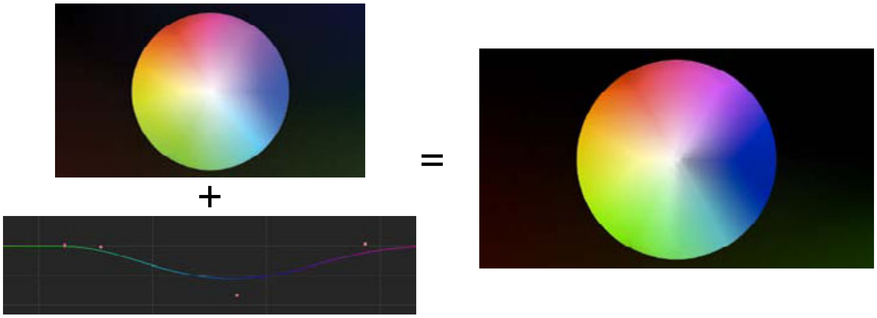


**Figure 4.59** Isolating the blue portion of the spectrum.

This is a potentially powerful tool but also a really tricky one, the results of which depend highly on the quality of your application's image processing. Although it's possible to make smooth adjustments using nearly any type of application that uses Hue vs. Hue and Hue vs. Saturation curves, the Hue vs. Luma curve is at a disadvantage because it manipulates the most data-rich component of the signal (luma) relative to the most *data-poor* component (chroma). As a result, it can exhibit unpleasant artifacts such as macroblocking and edge aliasing.

These artifacts appear almost immediately (**Figure 4.60**), no matter how small a correction you're making, if you're working on media with 4:2:0 chroma subsampling (such as HDV or H.264-based formats). 4:2:2 chroma subsampled media has a bit more resiliency, allowing small adjustments before unpleasant artifacts appear; although, past a certain point, even 4:2:2 media will suffer.

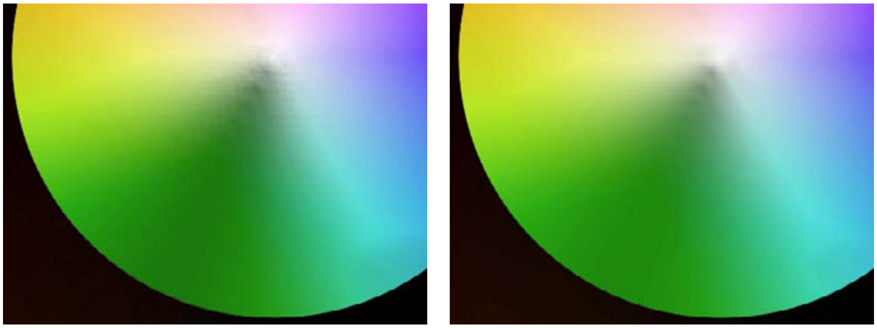


**Figure 4.60** At left, our test pattern downsampled to the 4:2:0 Apple Intermediate Codec, showing harsh artifacts from use of the Hue vs. Luma curve. At right, the same image at its original ProRes 4444 encoding; an identical correction exhibits smoother transitions.

However, as you can see in **Figure 4.60**, this control comes into its own when you use 4:4:4 chroma-sampled media. With the full range of luma and chroma available to you, you'll be able to use the Hue vs. Luma curve to the best possible advantage.

## CONTROLLING HUE CURVE ADJUSTMENTS

Some hue curve interfaces place a series of pre-defined control points on the curve, giving you a rapid starting point, while others present you with a blank slate.

The most important thing to know about controlling hue curve adjustments is that you should "lock off" parts of the curve you don't want to adjust using additional control points. For example, in the following curve, you might want to make a series of adjustments to alter the orange hues of the image, without affecting the neighboring yellows or reds.

Placing control points at the neutral center position at the border of the areas you don't want to affect limits the falloff of your adjustments, preventing your correction from spilling over into hues that you don't want to affect.

**TIP**

**I often save preset corrections with different combinations of curve control points for common operations that I know I often perform. That way, I save myself several mouse-clicks that I otherwise would spend adding control points to a curve before I make my adjustments.**

## USING HUE CURVES TO FIX MIXED LIGHTING

So now that we've seen the theory of how hue curves work, let's see some practical examples. One of the biggest bugaboos of many scenes is mixed-lighting scenarios, where you've got light of two different color temperatures competing with one another. You might be able to overcome the problem with a creative use of color-balance adjustments, but more often the solution won't be that simple.

I've found that, especially for subtle mixed color shots, the Hue vs. Hue curve can make a quick fix that works really well. In the following shot, a subtle greenish/yellow cast from a practical fluorescent fixture that the production couldn't eliminate is polluting the cool blue sky-lighting of the scene (the spill can be seen within the red circle of the original image in **Figure 4.61**).

The problem is too subtle for HSL Qualification (which is a mixed lighting solution I often use for window exteriors that are a lot more blue than the rest of an interior scene), and trying to fix this with color balance will only make the midtones more magenta than we want.

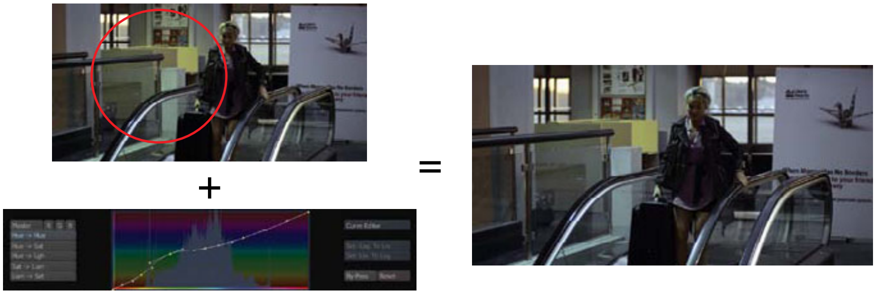


**Figure 4.61** A Hue vs. Hue curve adjustment (shown in Assimilate Scratch) used to shift the green/yellow fluorescent spill toward the cool blue sunlight of the rest of the scene.

Another strategy could have been to desaturate the offending greens, but that would have leeched color from the scene; this way, the offending greenishness has been converted to a pleasing sunlight-emulating bluishness. The result is smooth, seamless, and quick.

## USING HUE CURVES TO SELECTIVELY ALTER SATURATION

Here's a practical example of using the Hue vs. Saturation curve to make a stylistic alteration to a real-world image. In **Figure 4.62**, the original shot as graded has a saturated green pool table with an orange ball. The client wants to bring more attention to the ball, and one way of doing this in a creative way is to both raise the saturation of the narrow portion of oranges that correspond to the ball, and lower the saturation of the green table to make it a subtler, darker shade.

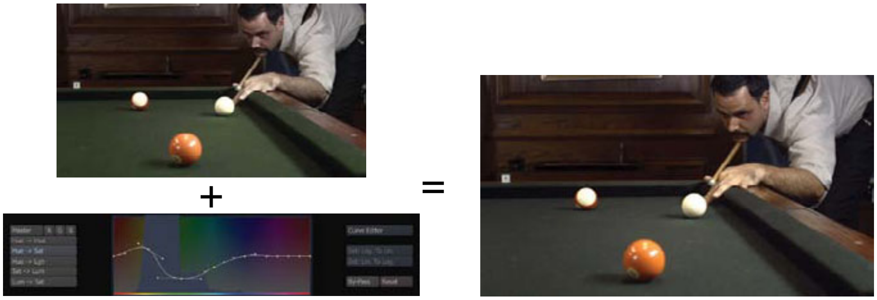


**Figure 4.62** A multi-point Hue vs. Saturation curve adjustment (shown in Assimilate Scratch), deemphasizing the green in the table, and heightening the warmth of the orange ball and man's skin tone.

This serves to lend greater weight to the wood tones throughout the image, which are also picking up a bit more saturation because of the increased orange, which is additionally giving the man's skin tone a bit more warmth. More to the point, the orange ball really sticks out after this adjustment.

The Hue vs. Saturation curve is also great for quickly lowering the saturation of elements that are too distracting, such as an overly colorful blue shirt, a vividly painted red car, or an insanely reflective magenta life-jacket (all situations I've fought with).

Overall, it's a useful tool for enhancing color contrast, bringing out colorful elements that can't quite compete with the rest of the scene. For example, if the green grass of a summertime shot isn't grabbing you, you can pump it up using the Hue vs. Sat curve to give it a more vibrancy.

### USING HUE CURVES TO LIGHTLY EMPHASIZE CERTAIN COLORS

Another way you can achieve uniquely saturated looks is by using Hue vs. Saturation curves to consistently lower or boost the saturation of specific hues throughout an entire scene, creating a look based on the relative strength of certain colors.

This level of control has long been exercised by cinematographers through careful selection of film stocks. A frequently made generalization has been that Kodak color negative stocks yield excellent warm tones, with vivid reds and oranges, and Fujifilm color negative stocks are slightly cooler, with great sensitivity to greens and blues. These are generalizations—specific stocks vary—but they're useful nonetheless because many of the directors and cinematographers you'll be working with may have this as a frame of reference.

You may be thinking that with all this talk of warm and cool tones, why not just use the color balance control to warm or cool the images? Emphasizing more or less saturation in different parts of the spectrum is not the same thing as a color cast, because selective saturation adjustments won't have any effect on the neutral tones in your images. This is a wholly different technique for your bag of tricks.

# OTHER TYPES OF HSL ADJUSTMENTS

There are other tools available in different grading applications for making similar types of targeted adjustments based on specific ranges of hue. Although the techniques found throughout this book focus on the use of Hue curves where appropriate, it's useful to know that the following styles of correction may be substituted should you feel there is an advantage to doing so.

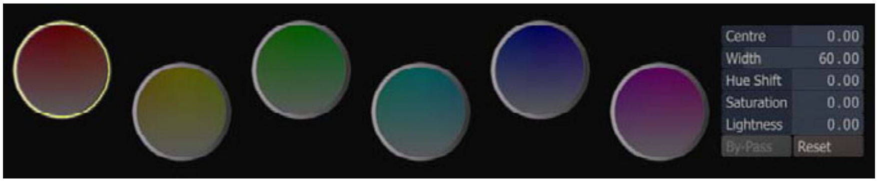
## VECTOR/KILOVECTOR ADJUSTMENTS

Before HSL Qualification and hue curves, there were vectors, a means of isolating a wedge of color as represented by its distribution on a vectorscope for isolated adjustment. In 1982, VTA Technologies (the predecessor to DaVinci) introduced The Wiz, a telecine controller and color corrector built upon an Apple II computer, which featured 10-vector secondary correction. Later in 1989, the renamed DaVinci Systems introduced the more accurate sub-degree Kilovector system to the Renaissance grading system.

Vector-style secondary correction is still in use and is now available in many different grading applications. Assimilate Scratch has a Vector interface, providing six customizable color ranges that you can use to shift the hue, saturation, and lightness of isolated ranges of color. Other applications with Vector-style adjustments include FilmLight Baselight and Quantel Pablo.

In the Assimilate Scratch interface, the Centre parameter specifies the angle of hue that's being isolated for adjustment, while the Width parameter specifies how much of a range of values to the left and right of the center hue to include within the adjustment (**Figure 4.63**).

**Figure 4.63** The Vector UI in Assimilate Scratch.



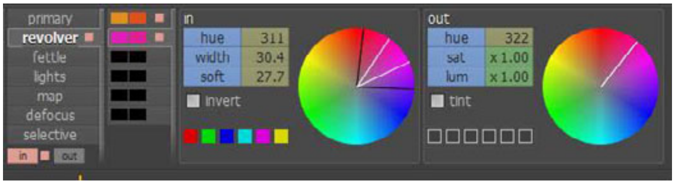
Centre 0.00
Width 60.00
Hue Shift 0.00
Saturation 0.00
Lightness 0.00

The six color pots of the UI show the default colors that can be immediately adjusted, namely the primary and secondary colors of the RGB color space. Clicking a pot selects that range of hues for adjustment, and adjustment of the Hue Shift, Saturation, and Lightness parameters allows them to be modified.

Other interesting implementations of vector controls include the following:

- Baselight has a *Six Vector* grade, using a UI similar to that of the Hue Angle keyer, that lets you choose one of six customizable hue ranges to adjust using either knobs on the control surface or sliders within the onscreen UI.
- Quantel's Pablo, iQ, and eQ systems have an interface called *Revolver* (**Figure 4.64**), which provides six customizable controls for altering color ranges. However, the adjustments are made using "color warping" algorithms that allow for a different quality of adjustment.

**Figure 4.64** The Revolver UI in Quantel Pablo, iQ, and eQ.



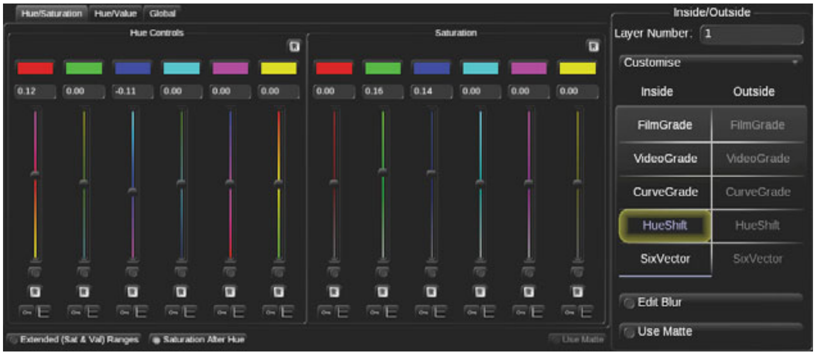
in
hue 311
width 30.4
soft 27.7

out
hue 322
sat x 1.00
lum x 1.00

## GRADING WITH HUE SHIFT IN FILMLIGHT BASELIGHT

FilmLight Baselight has another style of hue adjustment called the *Hue Shift* grade. Applying this adjustment opens a UI consisting of vertical sliders that correspond to each of the primary and secondary hues of the RGB color space.

To make an alteration to the image, simply manipulate the slider that corresponds to the hue you want to adjust. Two sets of sliders let you individually adjust the hue and saturation of each color range (**Figure 4.65**).


Hue/Saturation
Hue/Value
Global
Hue Controls
0.12
0.00
-0.11
0.00
0.00
0.00
Saturation
0.00
0.16
0.14
0.00
0.00
0.00
Extended (Sat & Val) Ranges
Saturation After Hue
Use Matte
Inside/Outside
Customise
Inside
Outside
FilmGrade
FilmGrade
VideoGrade
VideoGrade
CurveGrade
CurveGrade
HueShift
HueShift
SixVector
SixVector
Edit Blur
Use Matte

Layer Number: 1

**Figure 4.65** The Hue Shift UI in FilmLight Baselight.

### THE PROBLEMS IN FIGURE 4.46

Let's see how good you were at spotting the issues in my first, rough pass at the saturated/desaturated grade in Figure 4.46.

1. There are holes in the pink dress woman's hair.
2. The pink dress woman's lipstick is desaturated.
3. The pink dress woman's elbow is desaturated.
4. The top edge of the pink dress woman's chair is still orange.
5. The arm rest by the pink dress woman's knee is still orange.
6. The edge of shadow along the pink dress woman's bottom is desaturated.
7. The shadow where the pink dress woman's legs are crossed is desaturated.
8. The pink dress woman's shoe bottom transition could be softer.
9. A flower is still saturated.
10. Some fruit is still saturated.
11. The book is saturated.
12. The cat's bottom is saturated.
13. The pillow behind the green shirt woman is saturated.
14. The green shirt woman's lips are a bit too desaturated.

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