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Color Correction workflow

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Color correction terminology

Traditionally in cinematography, the term 'color timing' has been commonly used to refer to the final color correction to balance the contrast and the color of the shots in each sequence and in the film overall. In video and television 'color correction' or 'color grading' have been the most commonly used terms to refer to the same labor. With the new digital compositing systems that have consolidated the convergence of postproduction tools for cinema and video, both terms are used.

Some authors such as Van Hurkman (2010, pág.ix) prefer the term 'grading' for more creative tasks that involve the definition of an overall visual style, and 'color correction' for more technical questions such as for example, adjusting contrast and color to adapt them to broadcast standards.

Bearing in mind these nuances, we can consider 'color correction' to be the appropriate term and one that encompasses all the colorist's labors in media production.

Color correction workflow

Color correction is a labor usually tackled at the end of the audiovisual production process. However, on occasion it is necessary to involve the colorist in previous stages to make corrections on-set or to work with raw footage, especially in complex filming for visual effects.

Work on the color actually begins during the filming, keeping in mind what will be done in postproduction. Teamwork is the key to achieving the project's artistic objectives.

Material recorded by digital cameras has to be processed and adapted to the different uses that it is going to have: monitoring on-set, postproduction (online editing, visual effects, color correction, etc.), copies for offline editing, dailies, backup copies, etc. For each of these uses, a specific process and color corrections have to be applied.

In commercial productions, carrying out some color corrections before the visual effects is also quite common.

However, it is during the postproduction stage when the colorist's role takes on major importance, applying work processes and his/her talent to achieve the best possible results according to the technical and artistic indications of the film's director and cinematographer.

In the introduction to his book, Van Hurkman (2010, pág.ix) defines the six labors of the colorist.

1. **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." The colorist then adjusts the levels to the standard. Of course, he or she will have to correct any errors in exposure and the white balance made during shooting.
2. **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…" Whatever these key elements are, the colorist will have to dedicate special attention to their appearance so that they meet audience expectations and are shown to their best advantage.
3. **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… 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 are happening at the same time and in the same place, with the same lighting and the same camera."

4. **Creating Style**. Color correction adjustment is also an instrument for dramatic control over your program through creation of an overall visual style. You can enhance brightness with a color that is "rich and saturated or one that is muted and subdued. You can make shots warmer or cooler and extract detail from shadows or crush it…" Such alterations change the audience's perceptions of the scene and make up what we call the look in color correction.

5. **Creating Depth**. Photography and the visual arts have to represent depth through the setting and illumination. Color correction can likewise contribute to this objective, modifying depth perception through manipulation of lighting with gradients, decreasing the saturation of distant elements and emulating the selective blur of photography with shallow depth of field.
6. **Adhering to Quality Control Standards**. Finally, the colorist has to adjust the signal to the corresponding guidelines for the program's type of broadcast. For television, there are minimum and maximum brightness and chroma levels limits. Digital cinema or its internet streaming requires different treatment. The colorist has to adjust the signal according to the different distribution platforms.

Color correction is a painstaking labor that requires first working methodically and meticulously on each shot of the film, and afterwards on the sequences. It is all about ensuring the correction technique and achieving the artistic objectives defined by the director and cinematographer. The workflow is organized into three stages:

1. Primary correction.
2. Secondary correction.
3. Creating a visual style or *look*.

Primary correction is the first stage of the process in which all the shots are balanced in a neutral style and with the contrast and color levels correctly adjusted.

Secondary corrections only affect certain areas of the image. In this phase, we can for example, work on skin tones, highlight the luminosity of the focal point of interest or saturate the color of the sky. For these tasks, we use masks, color selection and motion tracking tools.

Only after we complete the primary and secondary corrections can we take on creation of a visual style that adds a specific look to the cinematography.

Primary contrast adjustment

In the color correction process, the brightness (*luma*) and the chrominance (*chroma*) components are analyzed separately. In this section, we are going to focus on how the brightness adjustments allow us to control the image contrast.

The contrast is the difference between the highest and lowest values of lights and shadows. If there is a large difference between these two values, we have a highly contrasted image, and if on the contrary, there is smaller difference between the maximum level of the lights and the minimum level of shadows, we have a low contrast image.

In the following image, we can see the effect of reducing the contrast in a grayscale. The result is that the white becomes light gray, the black dark gray and all the intermediate grays have been softened.

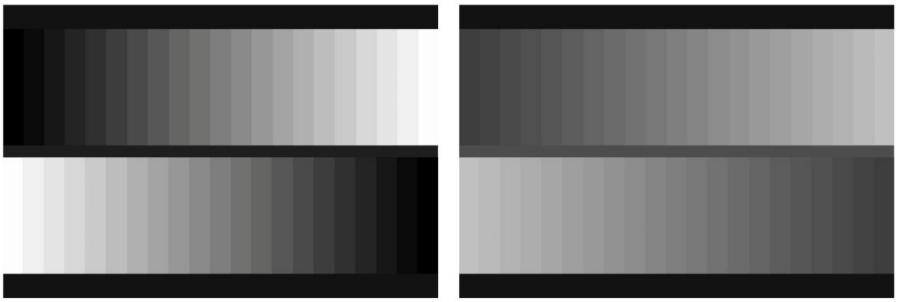

Figure 1. A grayscale on the left with standard contrast levels. The same image on the right has reduced contrast. Source: Prepared by author.

The contrast manipulation is limited by technical standards. Broadcast standards establish precise values for maximum and minimum level of brightness, that is the pure white and the pure black. In color correction, we often have to increase the contrast by adjusting the whites and blacks to standard levels. In this way, we get the light areas as bright as possible and the shadows remain dense. If the original signal has highlights with higher values that those established for whites, it will be necessary to lower them. The shadows with lower black values will have to be adjusted as well.

At other times, the contrast will be manipulated to create a softer image. For example, in some scenes shot at sunset or indoors with soft shadows and low highlights, we might want to lower the contrast to achieve an effect in accordance with the project's artistic objectives.

Figure 2. A reduction of the contrast which makes shadows and highlights softer. Source: Prepared by author.

The redistribution of the grayscale that makes up the luminance signal (Luma) will allow us to lighten or darken the image as a whole, and it is a correction commonly used to make the most important parts of the image easily visible.

To evaluate image contrast with a measuring instrument (video scopes), we need to identify three key elements:

- The level of black, representing the darkest part of the shadows.
- The level of white, representing the brightest part of the highlights.
- The distribution of the midtones, representing the image's overall lightness.

The luminance can be measured in percentages, where 0% is black and 100% pure white. The measurement scales for some color correction systems go up to 110% luminance, creating a range that is called "superwhite", higher than the level allowed.

Some measuring instruments use other scales to measure luminance. In the U.S., the *Institute of Radio Engineers (IRE)* established the IRE unit for the NTSC color television system. A 100 IRE level corresponds to white and a 0 IRE level to black. The analogic European PAL system uses a minivolt scale that goes from 0 to 700 mV.

Some professional color correction tools use the digital encoding scale. For an image that uses 8 bits for the luminance signal (256 shades of gray), the maximum level would be 255 and a minimum would be 0. For images encoded with 10 bits (1024 levels of gray), the scale will go from 0 value to 1023.

Measurement instruments to evaluate contrast

Digital compositing and color correction systems have instruments that enable us to evaluate image contrast: the video scopes. The ones most used are the histogram and the waveform monitor.

The luma histogram is an instrument that measures an image's brightness. It represents the brightness of all the frame's pixels in a statistical graph. The shadows are in the left area, the highlights on the right, and the midtones in the center. It is a very commonly used tool in photography.

In the following figure, we can observe the histogram for two images and identify the graphic areas that represent the different elements making up the image.

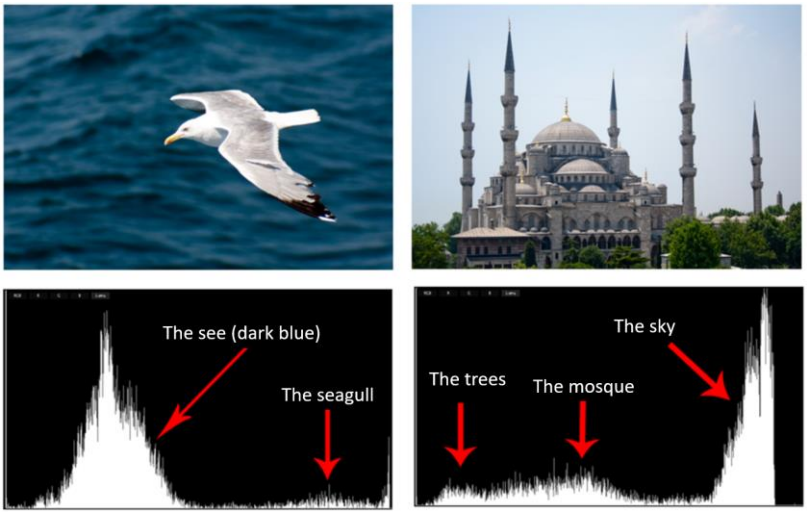

Figure 3. With the histogram we can identify the highlights, midtones and shadows. Source: Videoedición (Cutanda, 2010)[1].

The seagull's white feathers are made up of light pixels and as such are located in the right of the graph.

The sea is dark, with a quite homogeneous hue, and takes up a large part of the frame. We can observe how a peak has formed in the graph in the dark midtones, since there are many pixels with that brightness level.

The same thing happens with the sky in the image of the mosque. It takes up a lot of the frame's surface and the brightness is very homogeneous. It is easy to identify it in the histogram graph because it forms a column in the right area that corresponds to the whites and the highlights.

The far ends of the graph indicate the pure white and pure black pixels. When a large amount accumulates in this area, they form a column that shows that the image is clipped. That is, there is no detail or texture in the whites or blacks. We usually say "the highlights are blown-out" or "the shadows are crushed".

The following figure shows the same image with two different brightness and contrast adjustment, along with their respective histograms. We can see the difference between the one

[1] http://www.videoedicion.org/documentacion/article/introduccion-a-la-correccion-de-color-o-etalonaje

with details in its highlights and shadows and the one with clipped whites (the sky and the water) and clipped blacks (the tree trunk and the shadows in the tree in the background).

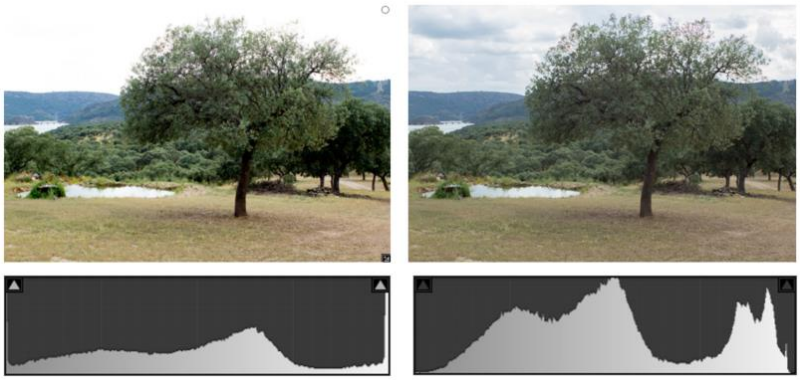

Figure 4. We can observe in the histogram when the blacks and whites are clipped because a column is formed at the far left and the far right of the graph. Source: Prepared by author.

Another instrument that graphically represents an image contrast is the waveform monitor (WFM). In the graph generated by the waveform monitor, each pixel is located in a horizontal position corresponding to the image, and the vertical axis indicates the luminance level. The level of black is at the bottom of the graph and the highlights are represented in the upper area.

In the following image, the figure of the child can easily be identified in the left area. Likewise, we can see that the reflection on the wall is totally white: a straight line is formed at value 1023. This is the clipped area.

In the other image, we can see the waveform for the skin tones of the little boy's face. An HSL mask was used to isolate the skin tones (explained in the section on secondary correction).

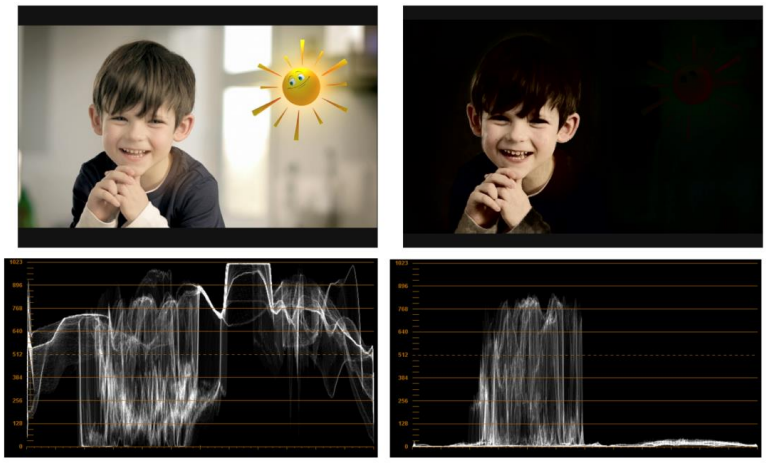

Figure 5. The waveform monitor enables identification of the luminance level in each area of the image. Source: Prepared by author.

Standard luminance levels for television broadcast

The technical guidelines for television broadcast establish white and black levels for a video signal. These levels are not the same as those for digital cinema or for internet. As such, the colorist has to modify the luminance level and contrast of the master according to what it will be used for.

- Legal range (VIDEO) are the standard levels for television.
- Extended range (DATA) are the levels for digital cinema.

With 8 bits encoding, there are 256 values available corresponding to a grayscale. In the legal range, the maximum value allowed that is used for pure white is 235. Pure black is at value 16. When there are 10 bits for encoding the signal, the total range of values available is 1024. In this case, the values for the legal signal are between 940, which is used for white, and 64 for black.

Digital Cinema have its own standard and uses the extended range. Whites are located at 255 for 8 bits encoding, and at 1023 with 10 bits. In both cases, blacks are at 0.

For video in the internet, these types of standards do not exist. Computer screens use the extended range. Accordingly, when a master is prepared for internet streaming, extended levels should be used.

The following table summarizes the values used in the legal range and the extended range for 8 bits encoding as well as for 10 bits.

	Legal range (VIDEO) Broadcast	Extended range (DATA) Digital cinema
8 bits encoding	16-235	0-255
10 bits encoding	64-940	0-1023

Table 1. Levels established for pure whites and blacks in the legal and the extended range. Source: Prepared by author.

Tools for adjusting brightness and contrast

All of the color correction systems provide tools for contrast manipulation that act on the brightness (luma). The names of the commands can vary for the different tools, but the functionality is basically the same. These tools allow joint or individual control of the contrast for shadows, midtones and highlights.

1. **The shadows** control enables the level of blacks to be raised or lowered and affects the darkest part of the image. These controls can also be called 'Setup', 'Lift' (when measured in percentages) or 'Pedestal' (when the IRE scale is used). Shadows corresponds to the left side of the histogram and the bottom of the waveform monitor. Some applications also have a control called 'Master Offset' or 'Exposure'. In this case, when the level of black is lowered or raised, it affects the overall luma signal, not only the shadows.
2. **The midtones** controls are usually called 'Gamma' and permit lightening and darkening the image but leaving the white and black level fixed in place.
3. The level of the whites and **the highlights** are controlled with the 'Gain' or 'Picture' to selectively work on the image's brightest areas.

Manipulating these three parameters allows us to redistribute the image's brightness and contrast levels.

The recommended workflow is first to adjust the level of shadows at the base of the waveform monitor or at the extreme left of the histogram. Black should be pure, but we must be careful to avoid clipping, that is, losing detail in the shadows.

Secondly, highlights should be raised up to the maximum level allowed, likewise avoiding clipping. This means bringing the brightest points to the top part of the waveform monitor or the far-right side of the histogram.

Lastly, we deal with the midtones according to a subjective criterion. Brightness should be adjusted mainly at the focal point of interest to make the key elements of the image look right. If there is some element in the scene that is too conspicuous, its brightness intensity will be reduced in the secondary correction process. During the primary correction, the image must be correctly balanced and neutral.

There are two types of tools for manipulating contrast: levels and curves. In all the systems, we can find these two options somewhere on the user's interface. The resulting effect will be the same. Each operator chooses the tool he/she feels more comfortable with. For example, photographers are used to working with curves and histograms, because Photoshop has had these features for many years.

The level controls for brightness can be located under the color wheels. The following image shows this panel in DaVinci Resolve. The horizontal dial settings under the color wheels allow us to raise or lower the levels of 'Lift', 'Gamma' and 'Gain' which correspond with shadows,

midtones and highlights. The 'Offset' control lets us raise or lower the complete level of the signal without varying the contrast. A specific 'contrast control' can be found at the bottom of the panel.

In order to use these levels, it is essential to observe the effect generated in a waveform monitor and in a correctly calibrated video monitor.

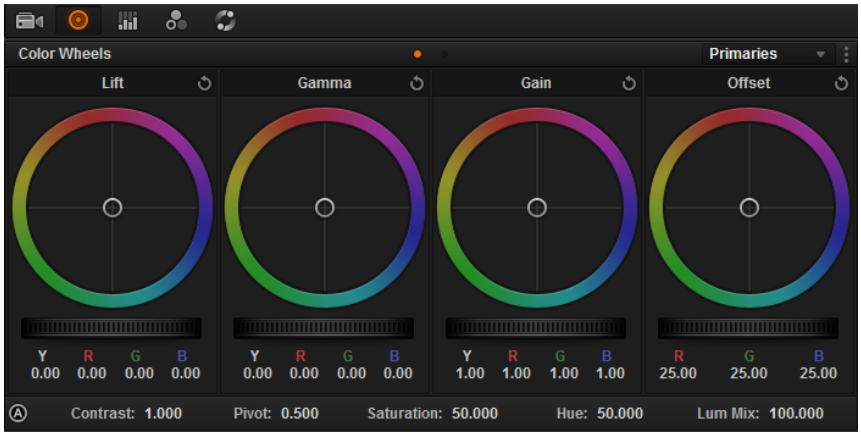

Figure 6. Primary correction panel in DaVinci Resolve.

Another common way to adjust brightness and contrast is with sliders at the bottom of a histogram. In this kind of "interactive histograms" we find controls for adjusting shadows, midtones and highlights. This tool enables us to have a very precise graphic vision of the loss of detail in the highlights and the shadows.

In the following figure, we can see an example of this in Adobe After Effects with an image of a model on a runway. The level of whites and blacks has been shifted leading to clipping, which means a loss of information in the shadows and highlights. We can see in the histogram that this loss of detail is not very important, and the result is a more contrasted image.

By moving the central slider towards the left, the image has been lightened and above all the model's face illuminated, which is the image's focal point of interest. The retouched image is more attractive because it is brighter and the focal point of interest has been enhanced.

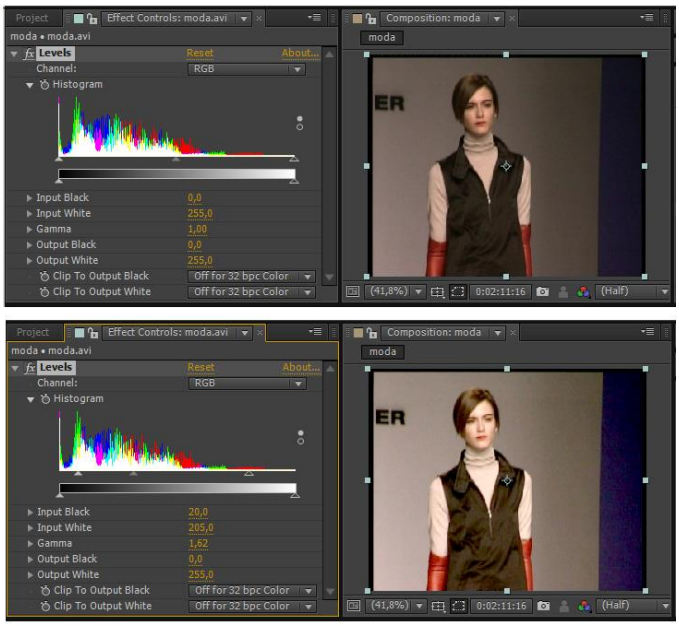

Figure 7. Luminance level controls in an interactive histogram in the Adobe After Effect. Source: Prepared by author.

Some editing systems have a specific tool for adjusting brightness and contrast with two simple sliders. In the following figure we can see the menu of this effect in Adobe After Effects.

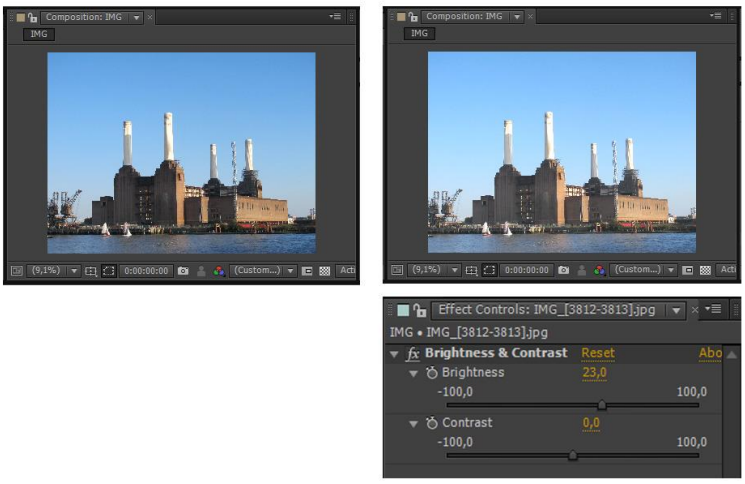

Figure 8. Brightness and contrast in Adobe After Effects. Source: Prepared by author.

While only two sliders are not enough in certain contexts, they do allow us to increase or decrease the contrast and push the brightness up or down. In this example, the brightness has been increased 23 points. The result is that the shadows get washed-out and the midtones and highlights have been increased. The image has become brighter with a loss of chromatic

saturation. From an artistic point of view, it could be described as a softer and more luminous image.

We will now look at how curves work. The curves tool is a graph that represents the input signal on a horizontal axis (x) and the output signal on the vertical axis (y), that is, the retouched image. The value 0 on either of the axes represents the blacks and the value 1, the whites. When it is a straight line laid out diagonally going from bottom to top, it is not creating any effect since the (x) value is equal to the (y) value.

Figure 9. Luma curve without any adjustment. Source: Prepared by author with BMD pictures.

This diagonal line can be bent by adding a point at the center and then moving the line upward to the left or downward to the right, creating a concave or convex curve. By dragging the center point up to the left, we raise the midtones and as such lighten the overall image. If we lower the center point to the right, we are darkening it.

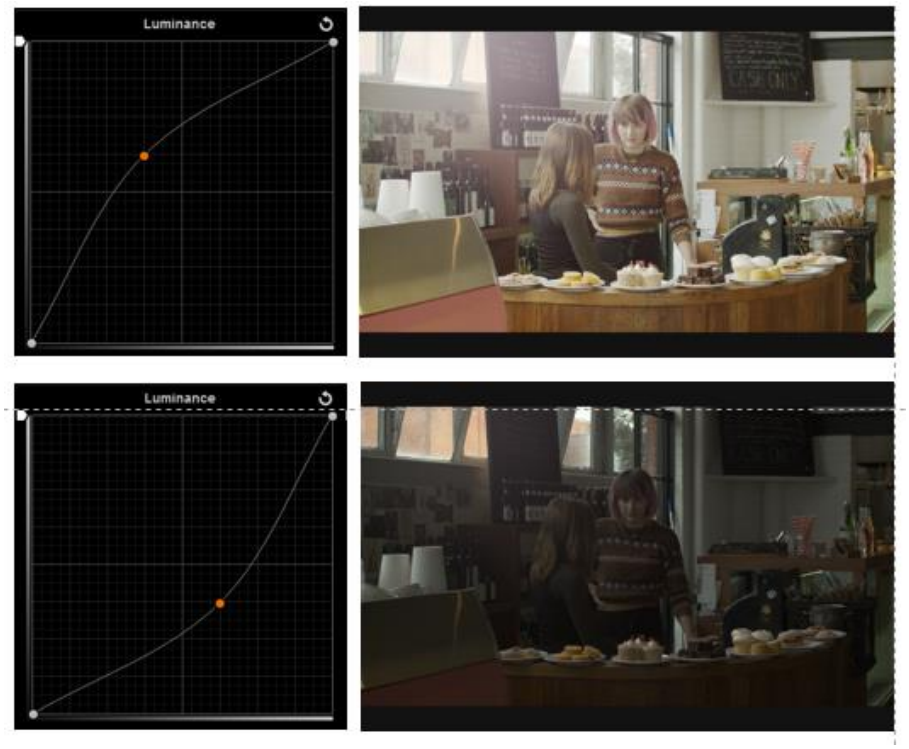

Figure 10. By sliding the center of the curve, the midtones can be increased or decreased, resulting in the general lightening or darkening of an image. The blacks and whites stay at the same level. Source: Prepared by author with BMD pictures.

Another very common way to use the luma curve is by making the brightest areas of the image lighter and deepening the darkest areas. In this case, the curve adopts the characteristic "S" shape. The result is a more contrasted image that is more striking and vivid. This action also has the effect of enhancing the color saturation.

Figure 11. The "S" curve generates a more contrasted image and enhances the color saturation. Source: Prepared by author with BMD pictures.

Primary color adjustment

Primary color adjustments affect the overall image. Many times, an incorrect white balance made during shooting can result in an orange or blue color cast that has to be corrected. In other cases, we will modify the color balance to adjust it to the project's artistic requirements. For example, warm lights (orange tones) might be considered more appropriate for sequences that are more emotionally intense. Exteriors are more often represented with a colder light (blue tones) than are interior scenes.

The chromatic component of an image is controlled during shooting with the color temperature of the lights illuminating the scene and with the camera's white balance setting. In fact, the light's chromatic component also conveys the time of day and where the action is taking place. For example, the light at sunset has a warmer color than it does at noon. Simply from the color of the light, the audience can identify if it is morning, afternoon or nightfall or if the character is indoors or outdoors. Likewise, a dramatic color association can be established with the plot to differentiate for example if the ongoing mood is serene or if the film's character needs to be on edge.

Color measurement instruments

Chrominance is the part of the video signal that contains the color information for each pixel and can be manipulated independently of the luminance. The color tools work on two characteristic components: hue and saturation.

The hue is one of the color properties determined by a wavelength or a range of wavelengths of the light. Usually it is represented by a circular graph, the color wheel, where each hue is identified by an angle between 0 and 360º.

Figure 12. Color wheel.

The saturation or the purity of the color is the measurement of the hue's intensity. A very saturated hue has a rich and intense color (pure colors) and a less saturated one is washed out and grayish (pastel colors). If we remove all of the saturation from an image, it would be black and white. Saturation is represented in the color wheel as the distance to the center of the wheel. The colors located at the wheel's edge have 100% saturation and, at the center, the saturation is 0%.

We can evaluate the color balance of an image by observing the image in a calibrated monitor and with measuring instruments. The most common tools to evaluate color in video postproduction are the 'vectorscope', the 'RGB parade' and the 'RGB histogram'.

The vectorscope graphically represents the hue and the saturation of pixels that make up an image. The graph has a circular shape and follows the scheme of the color wheel whose center contains the completely desaturated pixels, and as we go toward the perimeter, we find the more saturated colors.

The angle indicates the hue and the proximity to the perimeter (radius) indicates the saturation.

The following figure shows some pink flowers and green leaves with a blue sky background. The vectorscope verifies that the level of saturation for the pink is higher than that of the blue and the green. In the retouched image, the contrast is increased and the color saturation has been raised in an exaggerated way so that the difference can be clearly observed in the vectorscope.

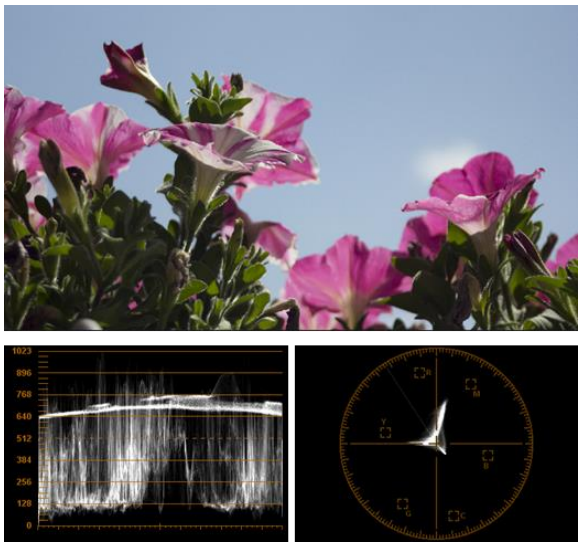

Figure 13. The vectorscope enables us to evaluate the saturation level of the image's colors. Source: Prepared by author.

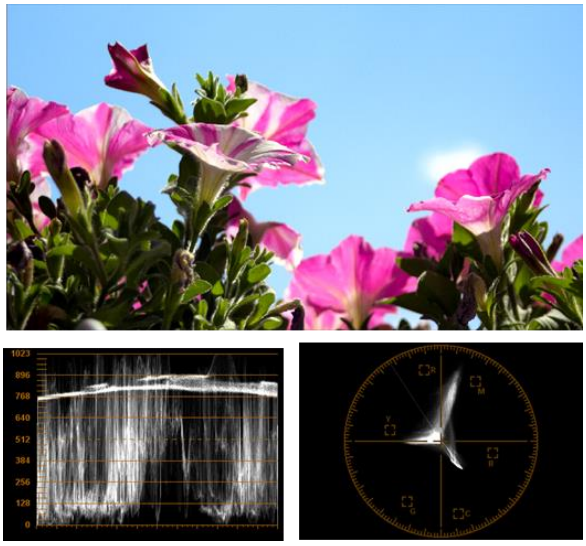

Figure 14. We can see in the vectorscope and the waveform monitor that the image's contrast and color saturation have been raised. Source: Prepared by author.

Another instrument to evaluate the color of an image is the RGB parade. This instrument shows the waveform of each of the three RGB color components alongside one another. The comparison of the three waveforms lets us identify the dominant color cast in the shadows, the midtones, and the highlights.

When the red waveform is more abundant in the highlights and midtones, we know that the image has a dominant reddish warmth.

For shots with balanced whites and blacks, the waveforms are perfectly aligned at the top and at the bottom. They have the same quantity of each RGB component and the result is black and white.

In the following images, we can see three versions of a close-up of a character. The corrections were made with the DaVinci Resolve program. In the first image, we can see that the white balance in the shot is incorrect. There is a strong warmth dominance. In the RGB parade, we see how the waveforms of the color components are not aligned. In the following version, the color has been balanced to a neutral position. Now the three components are aligned and we can see that the wall in the background is completely gray, without any chromatic dominance or color cast. In the third version, by means of the secondary correction, the luminosity and the skin tone of the character's face have been corrected to create a specific visual style.

Figure 15. Image with a strong warm color cast. In the RGB parade, we can see that the waveforms of the color components are not aligned. Source: Prepared by author.

Figure 16. Correction of color balance up to a neutral point. Source: Prepared by author.

Figure 17. Color correction on the same image creating a visual style through secondary corrections. Source: Prepared by author.

The process with the 'RGB histogram' is the same as with the 'RGB Parade', except that the graph shows the statistical representation of the pixels' luminosity for each color component.

Tools for adjusting color balance

A basic concept in color balance adjustment is the capacity for chromatic cancellation of complementary colors. Complementary colors are two colors that sit at extreme opposites on the color wheel. For color correction, this is a crucial phenomenon, since by mixing a color with

its complement, they neutralize each other. In this way if we wish to lessen a dominant orange, we enhance the blue tonality, which is its complementary color. If we wish to moderate a greenish color cast, we would have to add more magenta.

Just as in the brightness and contrast adjustment, to work on the color we can divide the image into shadows, midtones, and highlights. For example, we can boost the blue component for the shadows and leave the midtones and highlights warmer. This technique enhances the photogenic quality of actors and their skin tones, making them visually more attractive.

Specialized color correction equipment has a specific keyboard, a color control panel, with three trackballs that enable us to work on three color wheels: one to adjust the color balance of shadows, another for the midtones, and a third one for the highlights.

The following image shows the Tangent Element control panel which works with any color correction system. The three center trackballs are programmed to work on the color wheels and the outer rings on the luminance. The buttons above them serve to reset the adjustments or to quickly compare shots that have to be balanced.

Figure 18. Tangent color correction control panel.

If we do not have the control panel, we can do it perfectly with the mouse on the user's interface. To work on the color wheels with a mouse or digital pen, we drag the center point of each one towards the angle that corresponds to the correction we are working on.

Some simpler software only has two sliders that operate just like the color wheels, but with a fixed angle: one allows us to increase oranges versus blues and the other to work on the green and its complement, magenta.

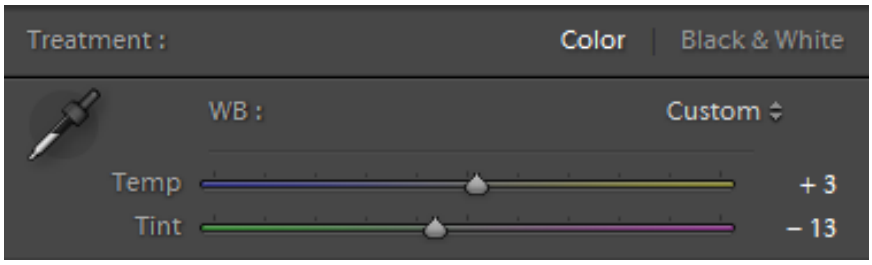

Figure 19. Color balance adjustment in Adobe Lightroom

These color balance corrections affect the three RGB channels in a different measure. We can see that in the 'RGB parade', when for example, the color wheel of the midtones is moved towards the blue, the waveforms of each color component are simultaneously modified: the midtones in the blue channel will be raised at the same time as greens and reds are lowered in that area. However, when we manipulate luma, the three RGB channels move in a synchronized and parallel fashion.

Another equivalent instrument that can be used is 'RGB curves'. The color curves allow each of the RGB channels to be independently manipulated. When we operate by one channel, it does not affect the other two. Its functioning is identical to the luminance curve: it enables us to work on the shadows, midtones and highlights. In this case, however, we have a curve for each of the color components. Using the curves, we can increase a color in the highlights without affecting the overall balance of the shadows, for example.

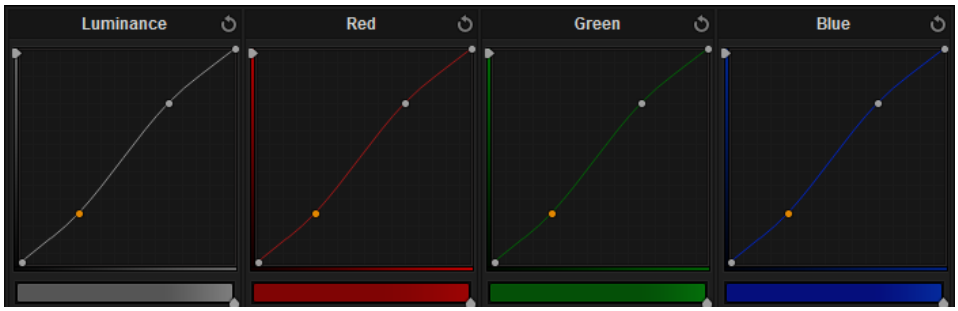

Figure 20. DaVinci Resolve RGB Curves.

We can see how the curves work with the same example used for the RGB Parade. This time, the RGB curves from the software 'Aperture's Color Finesse' were used, which is a very interesting plug-in integrated in many editing programs. The four curves at the bottom of the image correspond to luminance, red, green and blue. The RGB histograms were used to evaluate

the procedure. In the first image, we can see the close-up of our subject shot with an incorrect white balance.

First, we have boosted the contrast with a slight "S" luma curve. To adjust the color balance, since there is an overall orangeish color cast, we have increased the blues, the complementary color of orange. We have done this a bit more in the highlights than in the shadows. It has been also necessary to lower the red, especially in the highlights and midtones areas. The result is a balanced neutral image. We can verify this in the RGB histograms.

Figure 21. Image with a warm color cast. We can see in the RGB histogram that colors are unbalanced. Source: Prepared by author.

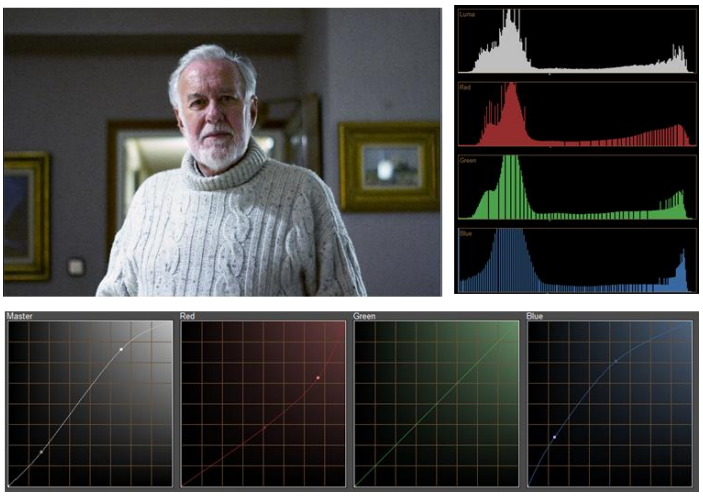

Figure 22. Color balance adjustment with RGB curves in 'Aperture Color Finesse' plug-in. We can see in the histograms that the image is now chromatically balanced. Source: Prepared by author.

In DaVinci Resolve, the RBG curves are anchored by default. That is, when we manipulate the luminance curve, the three RGB curves are also modified synchronously. Many colorists prefer to make the first primary adjustment with curves instead of using the color wheels panel. They make the first brightness adjustment on the luminance curve. Then, after de-anchoring the RGB curves, they make finer adjustments in the color.

Secondary correction

In secondary correction, we work on only a part of the image. The area on which we want to apply the correction is selected, and the rest of the image will not be affected. The selection is represented by an alpha channel which marks out the area to be worked on.

Secondary correction is used, for example, to boost the blue in the sky, or to enhance the contrast in the clouds. Likewise, it can be used to balance skin tones or to reduce the saturation of an overly showy element in the scene.

In this section, we will review the different techniques used for secondary correction.

HSL selections

HSL (Hue, Saturation, and lightness) is a color model, a system that allows us to represent and describe colors using discreet values of hue, saturation and lightness. Through these values, we can make selections of a range of colors that let us isolate an area of the image to make secondary corrections. The tools to make the HSL selections use the same principles as the Luma keyer or the Chroma keyer.

These tools have an “eyedropper” to make an initial selection of the color we want to use to define an area of an image. We can repeat this operation to add or take away hues until we get the most precise selection possible.

In the following figure, we can see a shot of a bowl of oranges with an out of focus dining area in the background. The color orange has been selected to make the mask (alpha channel). In the graph menu, we can observe the values of the hue (Hue), saturation (Sat) and lightness (Lum) that have been delimited.

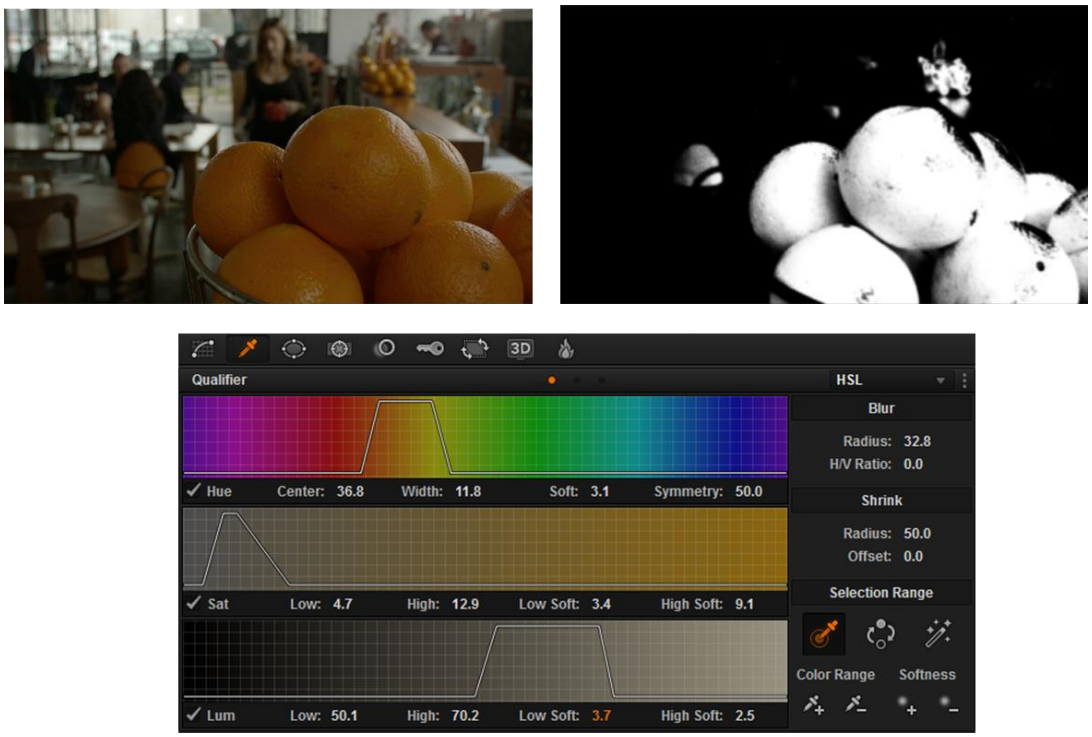

Figure 23. HSL selection in the DaVinci Resolove. Source: Prepared by author with BMD pictures.

Using the interactive graphics and menus of the 'HSL Qualifier' tool, the selection can be fine-tuned: setting the values of hue, saturation and luminance; the tolerance levels; defining the features of the contours with feather controls, softness or mask blur; etc. As in all image integration and touch-up processes, we have to carefully fine tune the masks' creation parameters to get satisfactory results.

In many cases, the HSL selection has to be combined with other shape masks or with a garbage matte, drawn and rotoscoped by hand, to limit the area to be worked on.

In the image of the fruit bowl, for example, we can see a girl in the background wearing an orange skirt and another one coming forward who is holding a cup that is orange too. If what we are trying to do is select exclusively the oranges and their reflection in the counter, we will have to eliminate the girls in the selection.

To do this, geometrical shape masks can be used to limit the area the HSL Qualifier is going to work on. In the next image, we can see how a small circular mask and a deformed rectangle have achieved this objective.

Figure 24. With two geometric masks, the area to be worked on by the HSL Qualifier has been marked. Source: Prepared by author with BMD pictures.

The color correction tools can now be used and it will only affect the oranges. In the following image, we see some tests made with this selection. In the first one, the oranges' chromatic hue has been modified to a lemon yellow, and in the other, I have worked on the background using an inverse mask, to leave it completely desaturated in black and white.

Figure 25. Two technical tests done with the hue of the oranges and on the background color saturation. Source: Prepared by author with BMD pictures.

In the following image, we can see a color correction procedure that targets a natural look. The levels of brightness and color balance of the oranges and the background have been adjusted independently.

Figure 26. Through a secondary correction, the brightness and saturation of the oranges in the bowls have been enhanced. Source: Prepared by author BMD pictures.

Shape masks for secondary correction

Another very common tool for making selective corrections in an area of the image is the shape mask. Shapes that are circular, oval, rectangular or hand drawn with a spline can be used as a mask to mark out the area of the image in which we wish to apply the correction.

They can be used for example, to raise the luminosity of a face, or the focal point of attention, whatever it may be. They can also be employed to select the sky in a long shot in order to increase the color saturation of that area without affecting the rest of the shot. A vignette effect can also be created with a shape mask for slightly darkening the edges of the image.

Different terms are used to refer to the shape masks tools in the different color correction applications. According to each software program, they are called, for example, shape mask, power windows or spot correction.

Some compositing applications do not have specific shape mask tools for color correction. However, the same result can be achieved with the standard masks in an editing or compositing system. In such cases, we will have to duplicate the layer in which we want to make the secondary correction, place a shape mask between the two of them and then the color correction can be selectively applied in one of the layers.

The shape mask tools lets us select the pattern shape, change its positions, change the size and rotation and adjust the softness of the edges. As we saw earlier, shape masks can also be added or taken away and combined with HSL selections.

In the following, we can see the shape masks control window in DaVinci Resolve and an image of a cup of coffee selected with a circular shape.

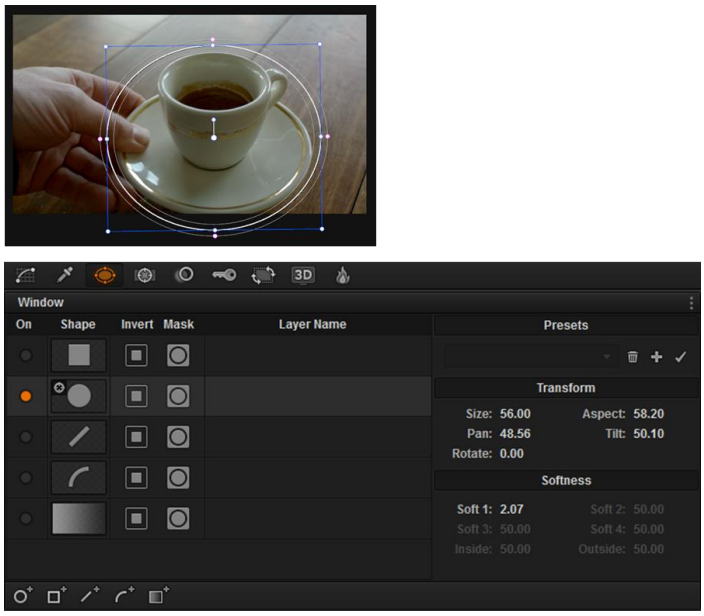

Figure 27. Control panel for geometric masks in DaVinci Resolve. Source: Prepared by author BMD pictures.

In shots with camera movement or internal movement of the characters, frequently, we have to program an animation of the shape mask to follow the action. To do this, the keyframes animation techniques or motion tracking can be used.

The following figure shows the DaVinci Resolve panel to program the motion tracking of an object selected with a shape mask. We can see in the sequence how the system has created animation to track the cup of coffee while it is in motion in the frame.

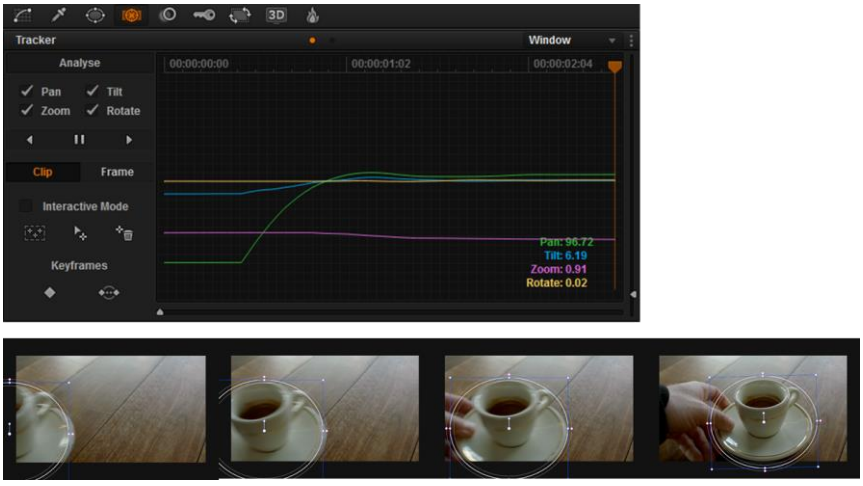

Figure 28. DaVinci Resolve control panel for motion tracking. Source: Prepared by author with BMD pictures.

Management of looks

While color correction has a technical component, it also has a strong artistic component. The personality of a film's cinematography to a greater or lesser degree culminates with the work of the colorist.

In commercials or music videos, very characteristic styles for color treatment have been developed moving away from the natural look that is usual in cinema and television. There are also well known examples in the history of cinema where color corrections have taken center stage. To cite just a few, we can point to the combined use of color and black and white in "Schindler's List" (Spielberg, 1993) and "Sin City" (Miller, Rodríguez, Tarantino, 2005); the striking use of green in "The Matrix" (Wachowski, 1999); or the importance of color as a narrative element, including for the film's characters, in "Traffic" (Soderbergh, 2000).

In this sense, we can distinguish between two types of color correction: the natural look and creation of stylized looks to achieve a special effect.

In a natural look, the colorist seeks to enhance the cinematographer's strategies, brightening or softening the scene's lights and shadows. This correction is imperceptible to the audience. Its aim is not to call attention to the color manipulation, but simply to reinforce the artistic intentions of the cinematography, without it been noticed. As such, the colorist needs to know and dominate the language and the techniques of the cinematographer. There are two fundamental labors:

- Shot-matching. This is the basic process of color correction by which the small differences in light and color between the different shots that make up the sequence are matched up. It is also necessary to match up shots taken with different cameras.
- Enhancing. Through secondary corrections (masks, HSL selections, etc.) cinematography effects can be enhanced or imitated. For example, optic filters can be imitated, flags hung to reduce the impact of light on certain areas of the image, contrasts softened or heightened, etc.

On the contrary, in stylized color correction, the colorist's work is conspicuous; it can be clearly seen and recognized. It incorporates elements that are not in the image originally shot. The color correction is not seeking to be invisible, but instead wants to be noticed. Keeping this in

mind before shooting is important because it will affect the work of both the cinematographer and the production designer.

All the color correction systems offer a broad menu for management of 'looks', that is, the color correction presets, which with a simple click, can be applied to the raw material. The looks can be created and saved in one's own grade presets or a catalogue of predesigned styles can be used.

The management of grade presets is a fundamental part of color correction workflow. Within each project, adjustments applied to a frame will have to be replicated for the others from the same sequence or reel in order to create visual continuity. Each colorist will have his or her own resources on file that they can use throughout the film or in different projects, with different clients. These grading presets of looks make up the colorist's trademark style.

Different terms are used for grade memories: looks, styles, stills, memories, versions, power grades or presets. Each color correction system has its own functioning although they are basically all the same. They are used to save different versions of color correction for the same shot, to compare one shot with others from the same sequence, or to export a style from one project to another. A window from the Adobe Speedgrade look management menu can be seen in the figure below.

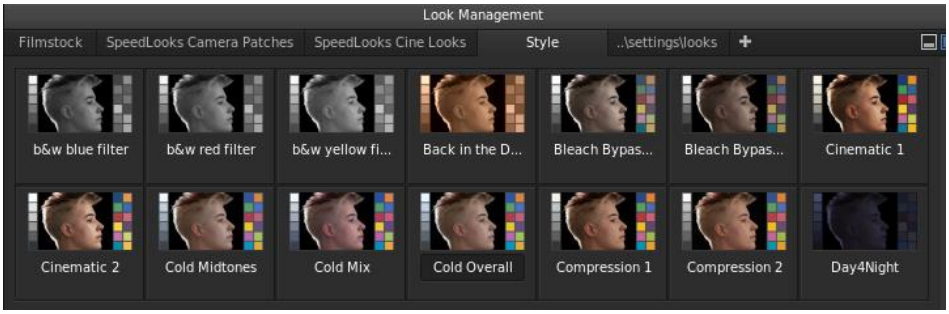

Figure 29. Abobe Speedgrade look manager (discontinued in 2017)

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