**Understanding The Basic Curvemeister Curve Interface.**

One of the most basic questions we face as we start to learn about color correction is: "Why 'Do' Curves?"

The standard answer is that Photoshop and other imaging programs try to reduce the effective use of curves and other complex adjustments down to slider bars that allow you accomplish most of the same adjustments but on a more coarse scale. Photoshop gives you from one to three adjusters on the slider and you are left to wrestle with them.  Fine adjustments are just not easy to achieve in the basic tools provided.  One of the most common corrections that bring people to into using curves is the levels tool in Photoshop. People make adjustments in the levels tool and find that no matter how hard they try they are just not satisfied with the results.  With only three adjustment points it is no wonder people are frustrated.  How does 64 adjustment points sound?  Curves allow you to have that level of control over the exposure of the image.

On a photographic correction scale; most people do not come looking for curves as an adjustment tool until they reach a "certain level". That level usually includes basic knowledge of the color spaces and some overview knowledge of what can be done in curves. So, is that level of knowledge enough? Well, so far it has never stopped "Das Curvemeister's" or members of the forum from being able to help people get to know curves.  We want you to understand the curves and the workflows in which they are used. Our goal is to unlock one of the most powerful tools in Photoshop without making it impossible to use the tool.

Curves are a graphic interface; but they go way beyond the basic adjustments in Photoshop.  Photoshop uses adjustment tools that reduce curves down to the coarse slider level and they split the adjustments up across multiple interface tools.  Users have to open the "levels", "hue and saturation", and the "remove color cast" tool to get the results that one correction in a LAB curves window can achieve.   As you will soon see; in just the RGB color space corrections alone; where brightness affects the result across the entire image;  these coarse tools can make a mess of image correction just as well as they can give you a serviceable result.

In Photoshop if you want to adjust the tonal range of the image; you can select presets for brightness, shadow and mid-tone.  The trouble with these is they allow the same level of adjustment as me saying to you..."I will pick the tonal range that you can adjust, you will have to live with it".

I very clearly remember being stuck in the "I want more out of my images but, Photoshop seems so rough here and the Photoshop curves are impossible to understand" shoes. I hated the fact that I could make what I thought were great images but I just seemed to make lousy prints.  I think it is one of the biggest frustrations with Digital Photography...As manufacturers dumb down the exposure and control aspects of cameras; most people are losing the ability to be artistic with camera controls. The mindset is "I'll fix it in Photoshop". There are certainly exceptions but overall, images

are getting worse not better; that is where we get to curves. We are going to make images better.

*A word of caution; as you go further into color correction you may find that you reach the point where curves are not the answer; while this may seem troubling; it really should be telling you that you have a solid understanding of curves and that even with this powerful tool in your tool box you still want more…*

Here is a quote from a recent Student in the Curvemeister 101 class where we teach the basics of curve control.  We end up on some very interesting and complex topics but we try to start out in the slow lane…

*"The CM class needs to let people know that the class is for intermediate level people, not beginners.  A beginner has no chance of understanding CM.....it's too complicated. "*

I am very glad to say that this is not true; not only did we did get this student past his initial frustration;  by the end of the class sessions he was answering questions for other students and applying what he had learned to his own images.  His frustration is very common though; and I want to address it directly because it is so very common and that level of frustration can stop you from progressing in your own study of image correction. More quotes from that student…

*"…It seems to me that it would be better if the first few classes were dedicated to teaching us what tools CM has, how they work, when to use them, and how they interact with each other.  Once this foundation was laid, then you should go on to editing pictures.  You can't edit pictures if you don't know the tools and how they work."*

What a great point to make.  I read those words and I knew I needed to do something about the frustration level for beginning Curvemeister students.

**So, let's begin…At the beginning…Color Spaces**

In digital imaging there are 5 basic color spaces and literally hundreds if not thousands of different color profiles. A color profile defines the color "foot print" within the defined color space.

"What? Tell me that in English please"….
Well, that statement has absolutely no meaning until you know what a color space is.

Color spaces are mathematical models of all of the colors that can be seen, printed, or displayed on a computer, print, or photograph. Color spaces became necessary when images were first printed in color because the printers had to have a set of standards so that their printed images looked consistent and so that they could reproduce the colors accurately as needed. Different color models have been developed over time and some of them have fallen out of use as computers and digital cameras gain popularity; these digital industries are starting to change the way that color is produced and they are challenging the "standards" in color reproduction.
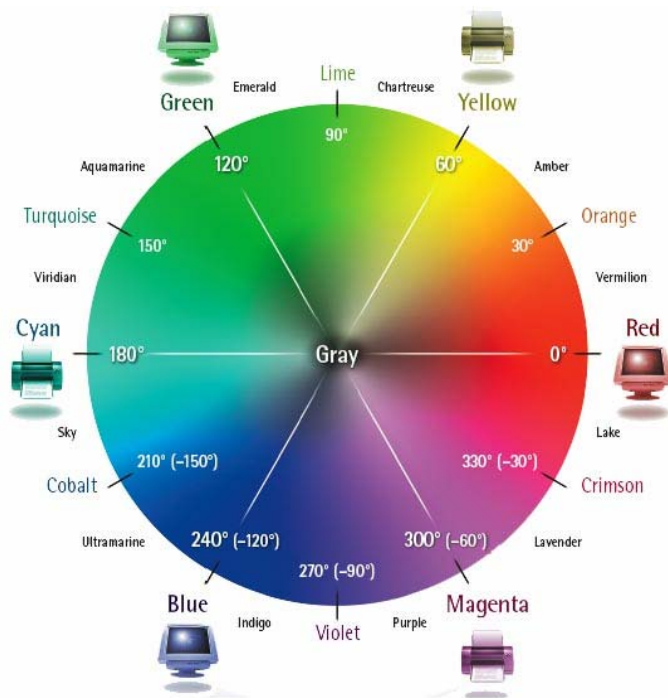


Here is a representation of a color wheel. This is a visual model of color that shows us how colors are related to each other. Notice the colors on opposite sides of the color wheel; these color opposites <complementary colors> are very important to color correction; understanding them and how they relate to each other is one of the very first tasks for you as you go deeper into color correction.
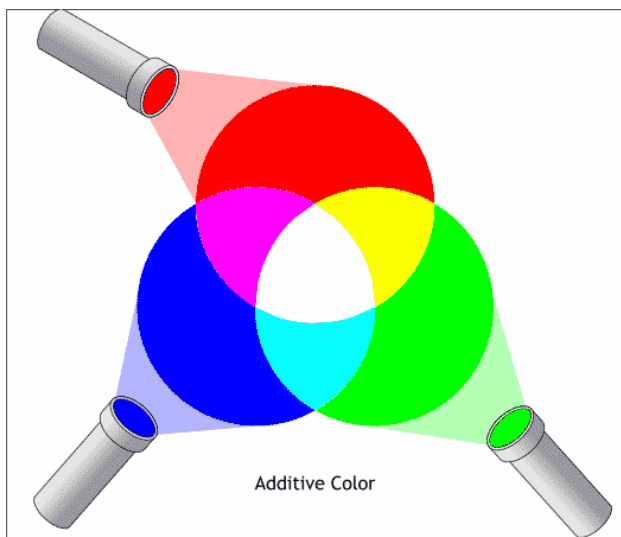


**RGB color space:** Today, RGB is probably the most commonly used color space. TV's, Computer screens, large display signs, and scoreboards all use this color space to show images. Color is produced by adding light together to create white light. Thus, RGB is called an additive color space.
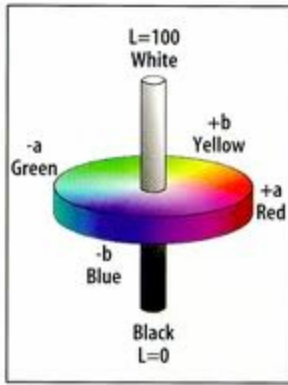
Lab model

**CIEL\*a\*b\* <LAB> color space:**
LAB is a perceptual color space. That means the color is represented as close as possible to how we as humans see color. In LAB the color is separated from the brightness; and in the diagram you see that as the center hub of the wheel with brightness values running from 0 to 100 with Zero being Black.

Further, in Lab the colors themselves are broken into 2 color channels called A and B. Thus you have L for lightness, A channel for Magenta and Green and the B channel for Yellow and Blue. Notice that the color channels contain color opposites from the color wheel above. When you see the color channels in lab you are seeing a mathematical representation of colors along the axis of the color wheel from Magenta to Green for instance.

Did you notice that the closer to the center of the color wheel you look the more neutral the colors appear? In both the Lab and the color wheel the center is neutral. This is translated in Lab by having the center of the color channels contain neither of the two colors controlled by the channel. **The center of each color channel is the only place in the Lab color space that is neutral.** This is one of the keys to the color space, the understanding that there can only be 1 neutral point in LAB.
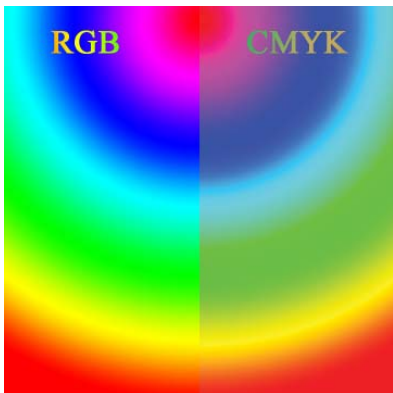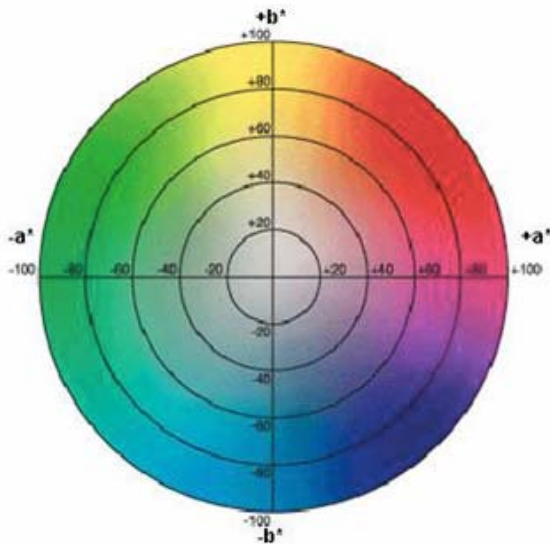




**CMYK: Cyan Magenta Yellow blacK<black> Color Space:** is the commonly called color space of commercial printers. It has been used for decades in the color offset printing process.

CMYK is called a Subtractive Process because it subtracts from the light being reflected off the page by blocking it with colored inks. As more and more ink is added the image gets darker and darker. Cyan, Magenta and Yellow when combined make a flat grayish or even slightly brown color. It is for this reason the black ink is added to the mix to help "complete" the images.

Some very sound reasons for The K in CMYK are:
- The Black is used for printing text. It also helps with density in images.
- If you have 100% ink coverage on the pages they can take too long to dry or the ink can bleed through to other copies when stacked.
- Black reduces the amount of ink required to get the same density results.
- Black ink is cheaper to produce and use.

Many people find it helpful to think of CMYK as a negative RGB color space. The complementary colors from RGB <opposites> are CMY.

**Luminance Plus Chrominance <YPbPr> Color Space:** Is a color space used for television broadcasts and video reproduction primarily in North America. We do not use this color space for still image color correction. It is most commonly used for video compression <MPEG> and image compression processes <JPEG>.

**HSL Also known as HSB:** This color space is generally used by artists and painters since color is more easily thought of in terms of Hue and Saturation rather than in terms of additive and subtractive colors.
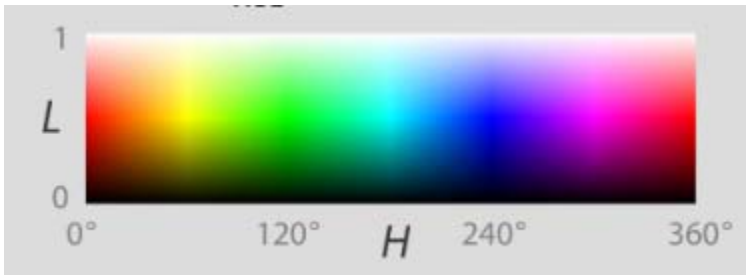


HSL / HSB is derived from the RGB color space using a mathematical mapping that tries to represent the RGB model in a perceptual way so that humans can better understand the color space. HSL/HSB is often used in color pickers and computer graphics programs. In Curvemeister we access HSB for some very interesting adjustments but it is not a very easy color space to correct images in.

**Color Profiles…Mapping the color space for output.**

Having a color space is only one part of the process. Once you have a color space you have to decide how to tell Photoshop or other image processing software how to "see" the color space you want. This is where color profiles come into the picture.

*OK, a few things first…*
*People write books about this stuff so I'm not going to go too deep into the waters here. I believe that you need to know what a color profile is and why it can be important but I have a very limited use for them in general so long as they are working correctly. It is in the knowing when they are part of the color correction problem; that is a big step to solving many common imaging program or hardware output issues.*

**So what exactly is a color profile?**

Color profiles are a set of data that is attached to images, printers, display devices, or even to the color spaces described above. The data in the profile describes the way in which the color space and the assigned output device or color space interact with each other to produce the expected results.

The map created by the profile; *every device that captures or displays color can have its own profile*; is the means for that device to produce colors from the assigned color space. Profile formats are pre-defined; but specific profiles can be calculated in many different ways. There are international standards that are used to format the profile data but the actual data can also be created by end users. This is how you can create your own color profiles for your printer, camera or computer. You can use hardware profile tools to measure the response of your devices to known color sets and map those responses back to the color space you like to work in. You then save the resulted mappings to what is called a profile and then assign the profile to the device.

**Do you need to make profiles?**

Some would say YES! I and others would say that it really comes down to your personal satisfaction. If you are satisfied with the output from your devices as they work together then you have no real need to mess around with profiles. On the other hand if you are constantly fighting for the right hues and tones in your image and you feel that you have no way of knowing what is going to come out of your systems then it might be time to start learning more about profiles.

**"How do you know when to use LAB, CMYK, HSB or RGB?"**

The answer really is a matter of choice. Many times I'll open image and I'll start looking at it in LAB. The reason I choose LAB; is for me currently it is the fastest and easiest workspace to do quick image analysis. When you use Curvemeister you do not have to do a mode conversion you simply open the file in Curvemeister and select the LAB button selector.

LAB is an acronym for CIELAB; as you learned above, it is a perceptual color space. This means it is closer to how we think about color than it is to how we print color. Using LAB requires a conversion back to RGB for print or display when we are done correcting the image.  This is where the Curvemeister program takes care of the color space and converts the LAB values to something really nice in RGB or sRGB.

The Lab color space is most often used for quick colorful solutions to easy imaging problems. I tend to gravitate towards LAB because it is so fast. I can adjust the lightness and the contrast of the image without doing anything to the color; it makes it very attractive choice to begin the correction with. In my experience the vast majority of problems with images have more to do with exposure than with color; therefore opening in LAB for me is a natural choice.

The choice of color space also depends on the goals you have for the image, if the image is going to be published or used in a book or even printed on your local printer; you are going to make most of your color corrections in RGB. The reason for this is that RGB is a much more accurate space when it comes to accurate color adjustments.  You will come to know this from experience, intuition, and correcting a lot of images.  The RGB color space is also what most printer and processors are using to produce prints today.

CMYK on the other hand is used by commercial printers and offset press printing. It is pretty rare that we would use CMYK to send a picture out to say Kodak or SnapFish.  In Curvemeister we will use CMYK on occasion since it is also a very subtle color correction space and it can solve problems that RGB is to coarse to work on. For instance a cyan cast; a true cyan cast, is most easily corrected in CMYK since cyan is one of the color channels.  In RGB you have to mess around with both the red and green channels to fully correct the cyan cast.

HSB is more of a specialized color space. We use it in Curvemeister to tackle specific problems for instance if I have a portrait of a person and their eyes; only their eyes, appear to be to cyan or blue, I can select with a mask; just their eyes, and reduce the saturation to make them appear much more white without effecting the color of the iris. I am just going to work on the whites of the eyes. We show you HSB in Curvemeister to make you aware of the possibilities and to give you another tool for you to use in your color correction it is by no means a primary color space and most of Curvemeister users would only go in to HSB to solve specific problems. On the other hand if we don't show you that it's there how would you ever know it you could even access it?

**Color Channels:  Where the curves live.**

Every pixel in an image has a set of values assigned to it to define the exact color and tonality of the pixel in the color space you are using.  Let's take them on 1 at a time and define what the values represent and how knowing that can help you correct images.

RGB is probably the most common color space we use and the one most people understand because they have already worked in RGB in some form or other.

RGB color is defined by three color values; a red value, a green value, and a blue value. In R,G,B (#,#,#) The numbers are on a range from 0 to 255 where 0 is no color or black, and 255 is all color or white. A specific color has a unique value for each. If you want to make pure red; the RGB value is (255,0,0) you have all of the red possible but no other color because the other two values are zero. That single pixel would be as red as RGB can produce.
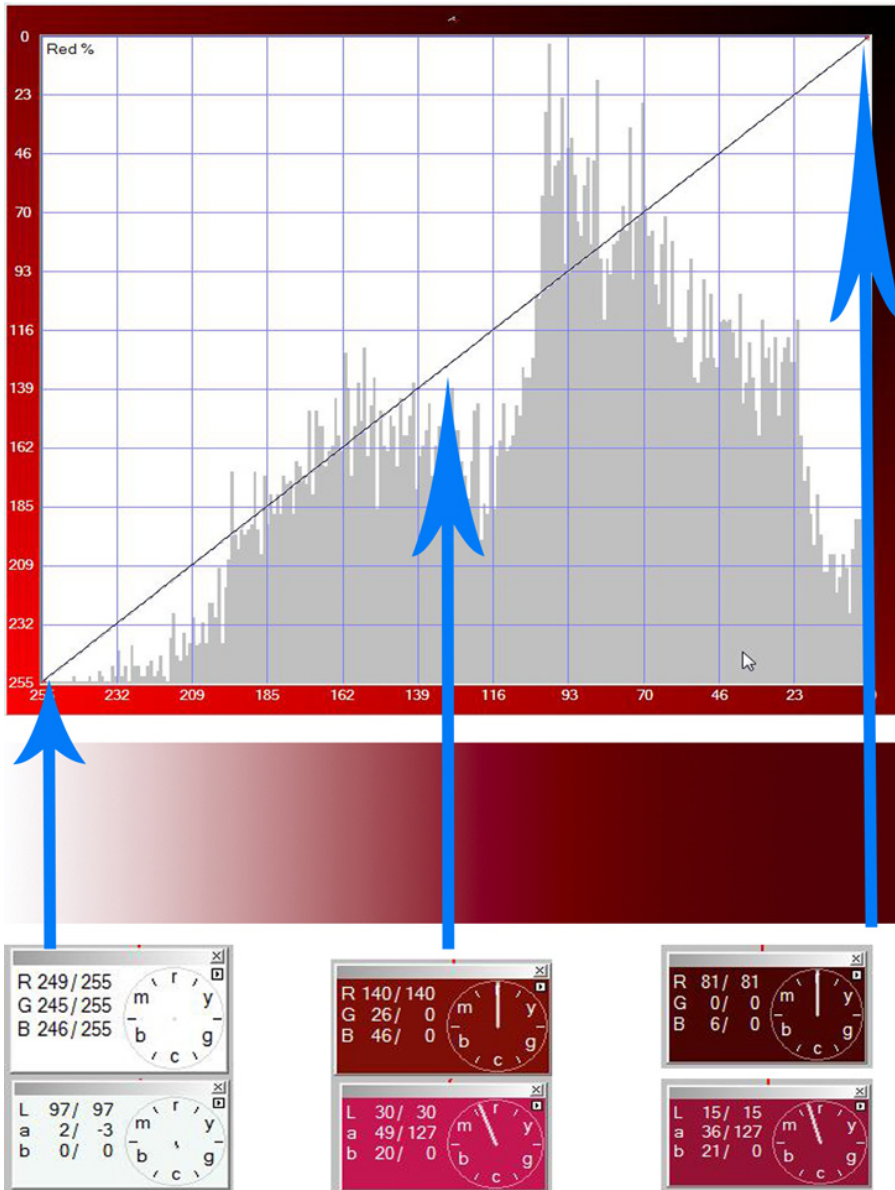


In this image the top half of the frame is a curve channel from RGB as it is displayed <RED> by Curvemeister.

This Is the color gradient for the Red channel in RGB from all red "255" to no red "0" every possible value of red as displayed by RGB is shown.

These Hue Clocks are another tool from Curvemeister. They show the exact values for the pixels under the sample point. At the ends of the arrows

An Image shown *only* by this color channel on the other hand is a black and white image. This is because the picture information is incomplete. There is only one channel's worth of data so the red values are displayed as shades of gray. The image below is an

example of a single color channel from within an image.  As you look at the image remember…
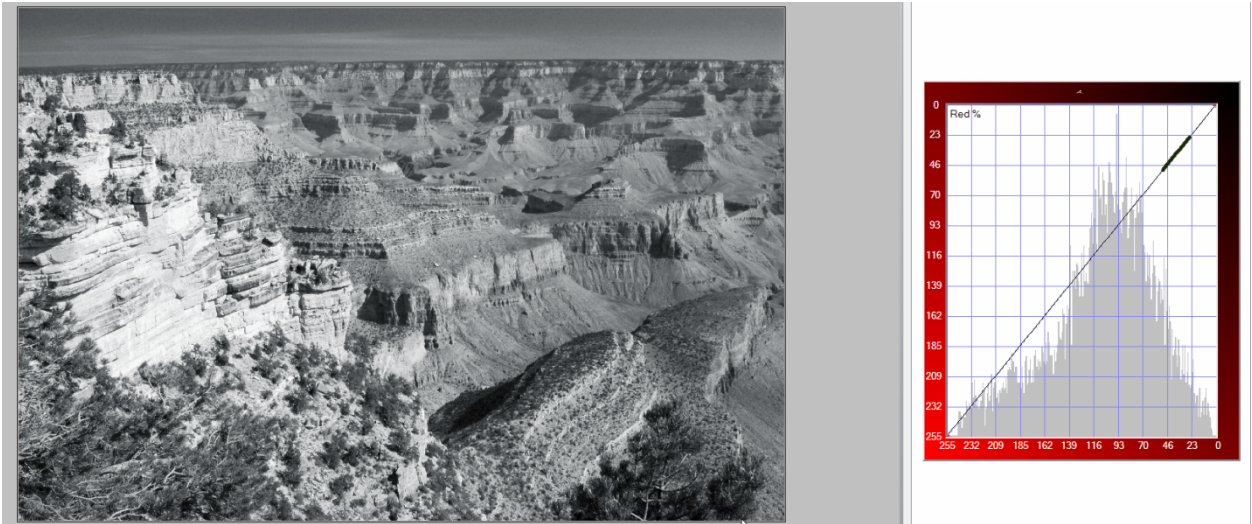


The brighter the tones the more red the image, the darker the tones the less red



All of the red values in an image are represented as numbers on the curve line. In this image I have the curve box tilted to show the line as horizontal. <#2>

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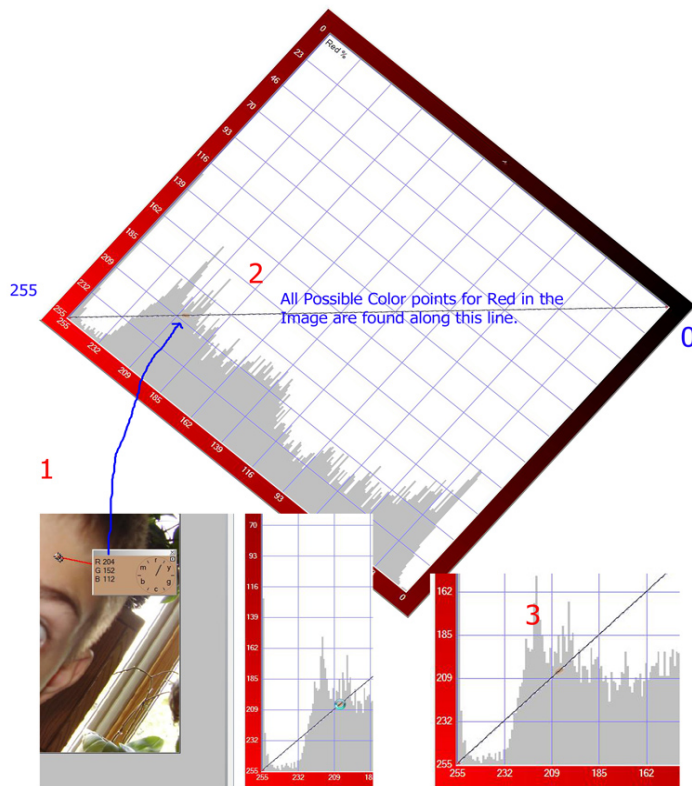
If you select a point from an Image <#1> and read the R value < in this case 204 > you can see where the 204 value falls on the curve line by following the arrow.  Every pixel in the image with a red value of 204 is controlled by this point.

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Curvemeister shows you that color using a color "worm" marker on the curve line <#3>

Let's look at a curve window in detail so that we can learn some of the terms and landmarks you will need as you go further into using Curvemeister.

Below you see a curve grid; as you look at the outside edge you see that the frame has a light side and a dark side.  The light side corresponds to the lighter parts of the image.  If you want to adjust the highlights you need to work in the lower right of the grid as shown.  The same information is used for the shadow side of the grid.  Shadows are found in the upper left.

The grid shown is from the L channel of LAB.  This is a lightness only grid that shows markings on the left and bottom edge for the zone system.  Zone 0 is black and zone 10 is white.  In LAB lightness can be described as a scale from 0 to 100.  This zone system view simply breaks the curve line into 11 equal parts based on brightness.

The Curve line actually runs diagonally from the lower left to the upper right.  Points along the line correspond to pixels in the image.  The Gray shaded area in the background is a coarse calculation of the pixel histogram from the source image.  In general the histogram is not very useful in curves adjustments.  It tells you how many not how much.
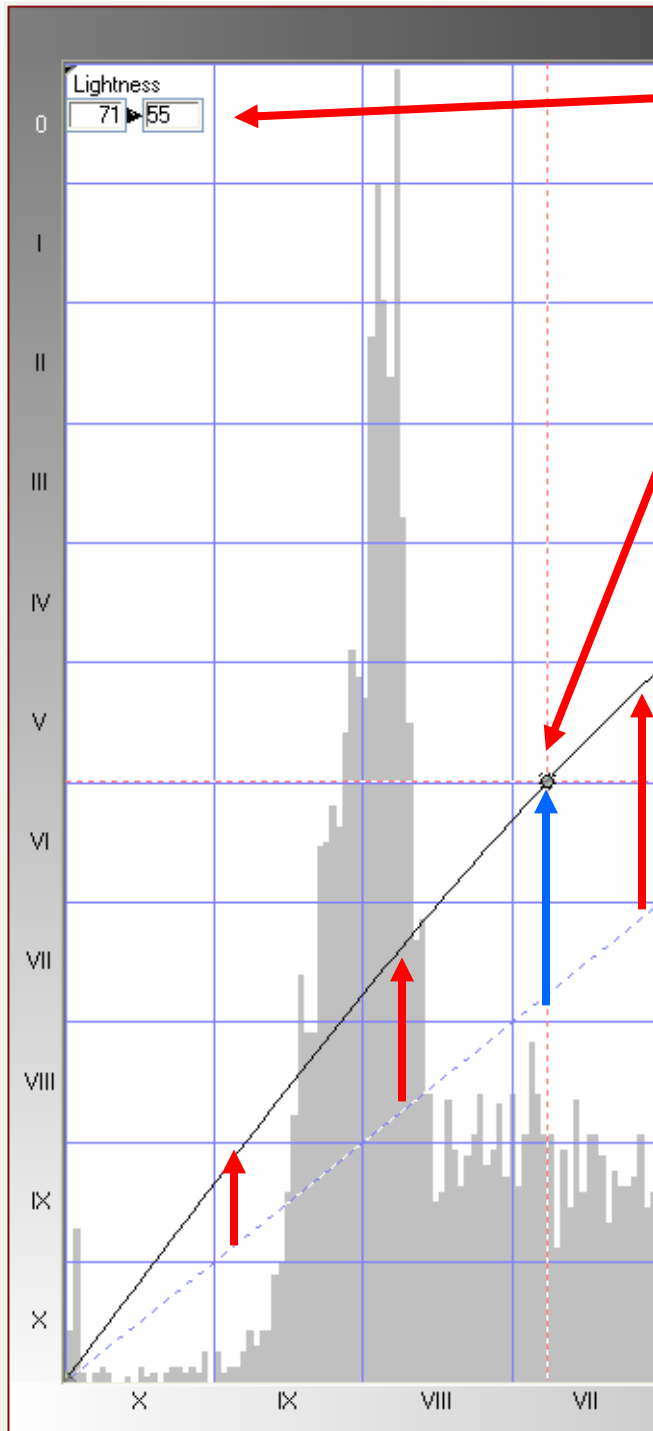


- Grid Flip Tool
- Curve Line
- Histogram
- Curve Grid Frame
- Number Scale
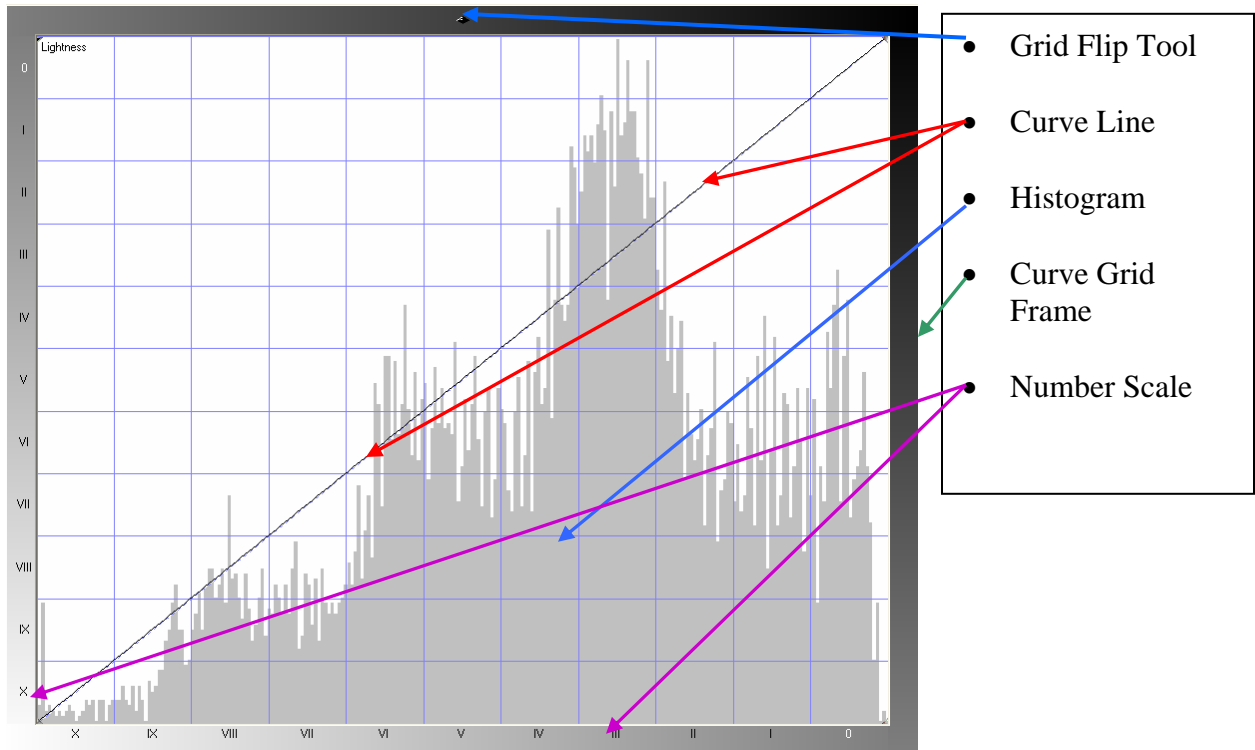
All curve grids in Curvemeister use a similar layout.  This is the basic view of the curves window.

**Next let's add an adjustment point to the curve and see how it changes some of the information you see.**



- Input and Output Values for the selected point. Currently they show that the point has not moved since they are the same.

- Highlight lines that show the current selected point on the grid at the intersection point of the lines.

- Selected Point where the adjustment will occur. Currently it is located at "71"
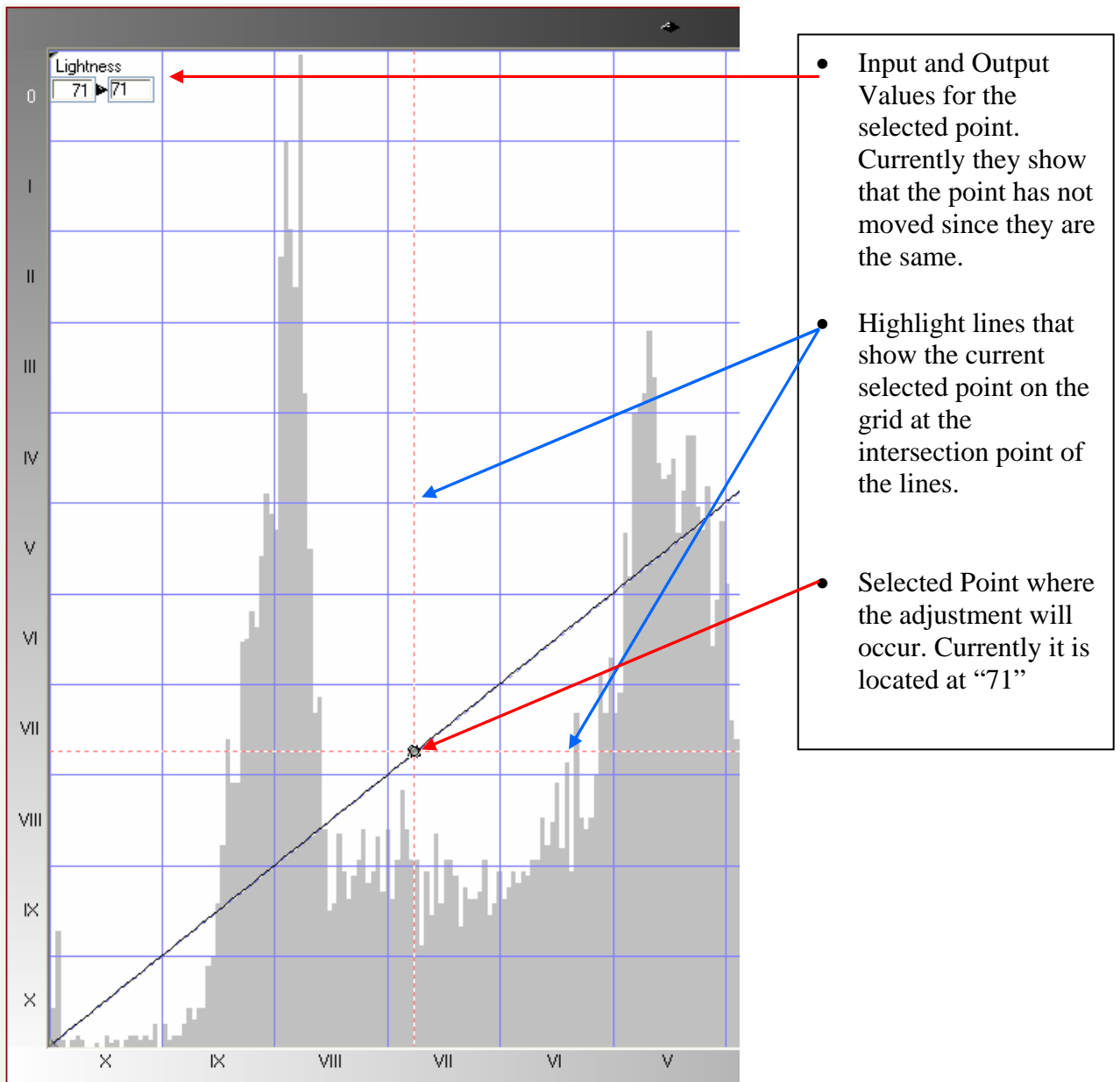
**Now let's move the point by clicking on it and dragging it upward with the mouse.**



Lightness
71 ▶ 55

- Input and Output Values have changed. I moved the original 71 point upward until the new value was 55.

- The curve line has moved with the point and we have created a "curve".

- Notice that all points on the line have moved with the selected points. Every point on the curve line is affected by the change to 1 single point.

- The closer you are to one of the corners the less the change affects the image.

Visually here is the result of that simple move.
Before:
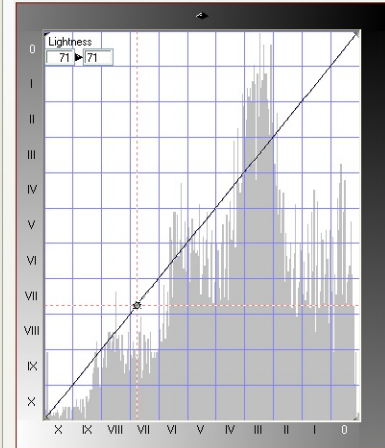


After:
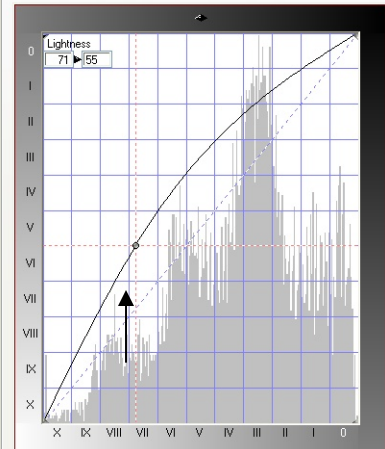


Notice the green shaded area; this is the area of the image that has a value of 71 when it was selected.  It stays the same shape and size despite being moved to 55 < upward > This is because all of the pixels with a value of 71 on the "before" were moved together.

Let's look at another move we can make from the starting point we have selected.
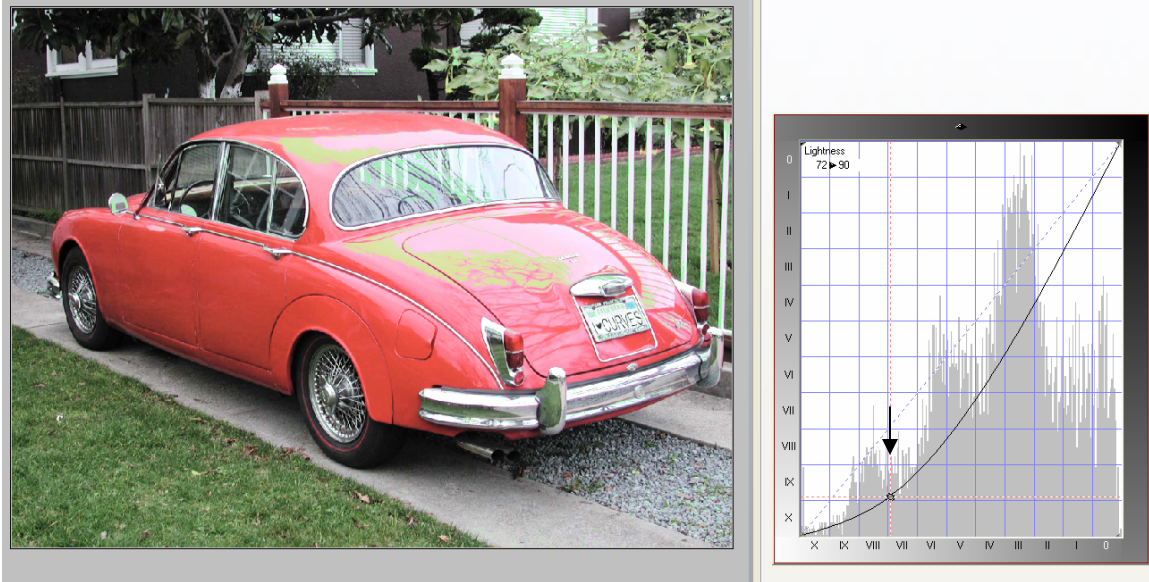


This time I moved the point to 90. Notice that all of the image has become brighter.  We have changed all of the pixels with this simple move but again all of the pixels with a starting value of 71 have stayed in the same place.

We now know that North and South type of moves <up and down if you like>  will change the brightness in the pixels.  What about East or West?

West ward we go…Let's look:
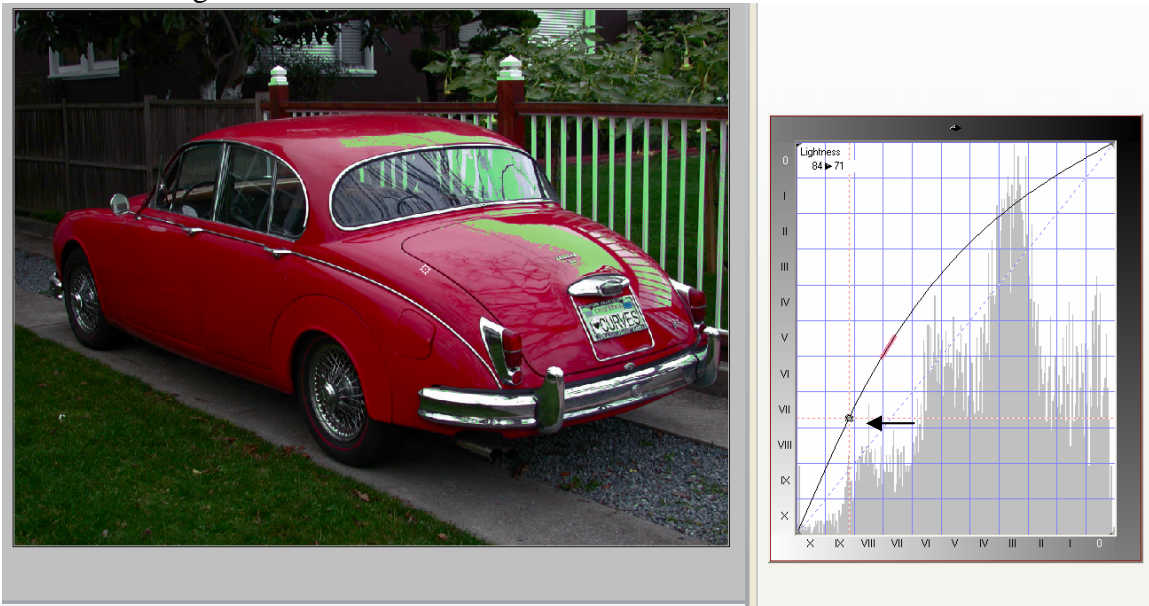


This time the curve moved the same as the first example; but an interesting thing has happened to the green highlight area.   It has shifted to a different spot in the image.  If

you look at the grid square above the pink mark shows where the 71 value is located on the curve line.  The input number has changed you are no longer adjusting 71 we are now adjusting 84 and moving it to 71 the overall adjustment is the same as far as the image is concerned but the location of the pixels and some of the contrast has moved and changed as well as expanded.  I am affecting more of the image with my adjustment.

Here is a move to the East….
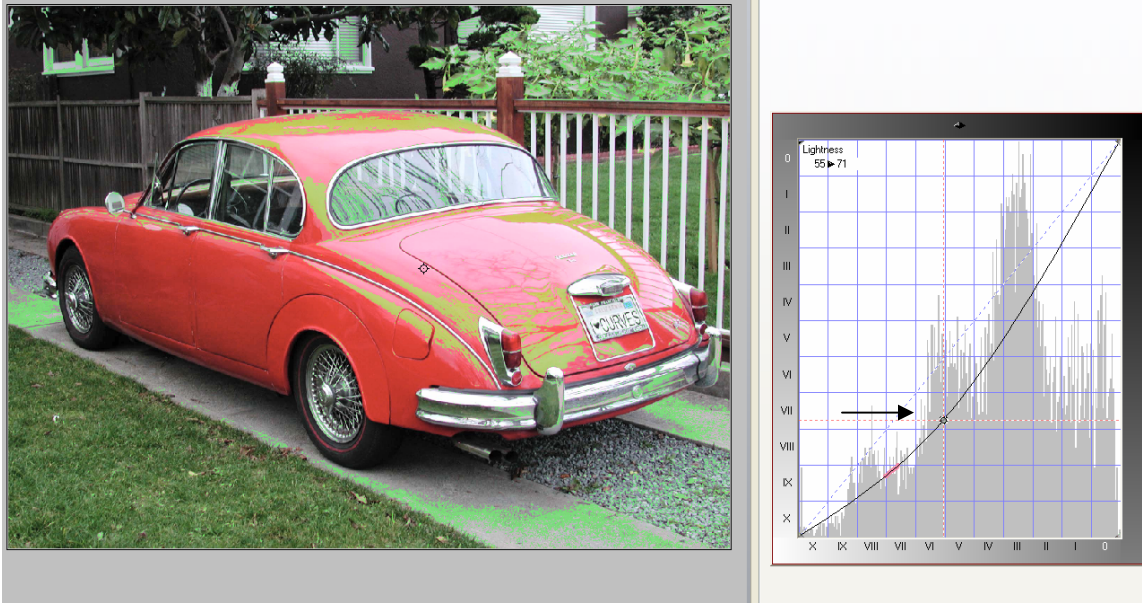


Notice again that the area has moved but this time it has expanded into the lighter areas of the image.  Because the brightness has changed you have moved value 55 up to 71which is a different point in the image.  You need to be aware of these kinds of changes as you go forward into working with curves.  They can have a profound affect on the contrast of your images.

Minor moves can have a profound effect on an image as we have seen.  Many times when you are correcting images you need to be subtle; instead of using the mouse to drag the points around the curve grid you can also use the arrow keys on your keyboard to move the selected points with more care and a lighter touch.
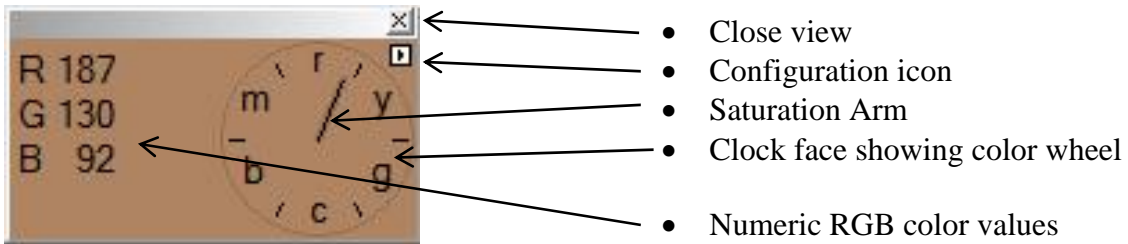
Curvemeister allows you to use the keypad once a point is selected on a curve to move that point up down left or right in very small increments.  To do this all you have to do is highlight a single point, you'll know it is selected when the point has a dark circle around it and the red crosshairs on the graph center on the point.  Each press of the keyboard moves the curve point one increment in whatever direction you are trying to move, this is especially useful when correcting skin tones or making subtle changes to a neutral point within your image.

**A hue clock?  What will I ever do with that?**

One of the most powerful features in the Curvemeister tool is what are called a Hue Clocks. Hue Clocks are sample points that you set on the image that show you graphically what the color values are under your sample point.  In Photoshop you can set sample points but they only tell you the exact numeric values under the sample and you are on your own to figure out what that means.  In Curvemeister we have added to that basic functionality and expanded the use of the sample points.

*Note: the hue clock shows the average color value under your sample point; therefore if your sample size is 10 x 10 pixels, you are actually sampling over 100 pixels.  It is very difficult to get accurate color reading using a hue clock set to 10 pixels.  It is usually recommended that for color samples you should set the hue clock sample size to be three pixels.*

Below is a picture of a hue clock:



- Close view
- Configuration icon
- Saturation Arm
- Clock face showing color wheel

- Numeric RGB color values

In this small space you are given a great deal of information about the pixels you have selected.  You can see the actual color values (the numbers), the relative amount of saturation (The length of the saturation arm), the average of the pixel values under the selection point (the color background), also the saturation arm points to the hue value in degrees.

To place a hue clock on your image you need only hold down the "Alt" key and click on the image.  Curvemeister places a sample point on the image but not the curve and opens the hue clock.

Hue clocks are linked to the image in Curvemeister by a red line and are displayed as shown:
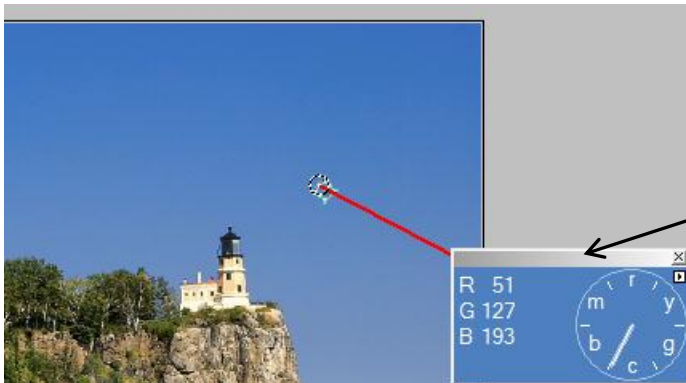


To move the Hue Clock out of your vision you need only click and drag the top gray bar.

Changes to the configuration of the hue clocks can be made by either clicking on the individual hue clocks "config" icon or by making changes to the Curvemeister configuration settings using the Configuration menu or the Wrench icon of the interface itself.



Under the wrench icon you will find a 3 tabbed dialog box with multiple settings.
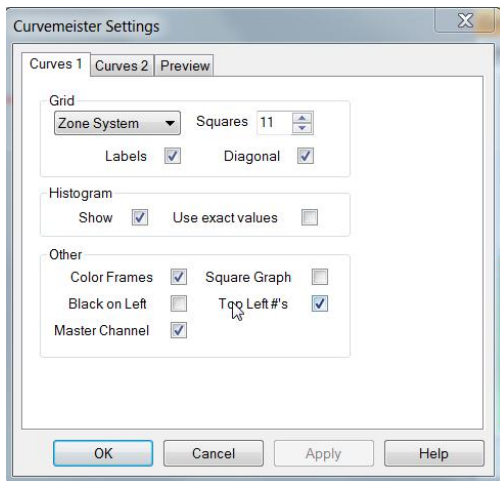


Settings on this tab help you define the work space you see in Curvemeister. Note the settings in the "other" section of this tab. These are applied to every color space in Curvemeister.
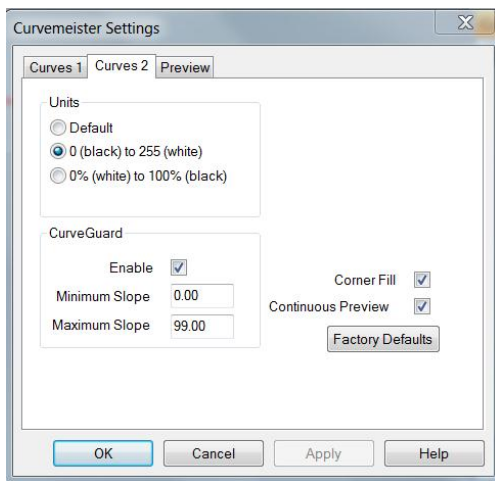


Settings on this tab control how Curvemeister displays it's basic units and how it behaves while in use.

This tab contains multiple useful settings that you should take the time to understand.
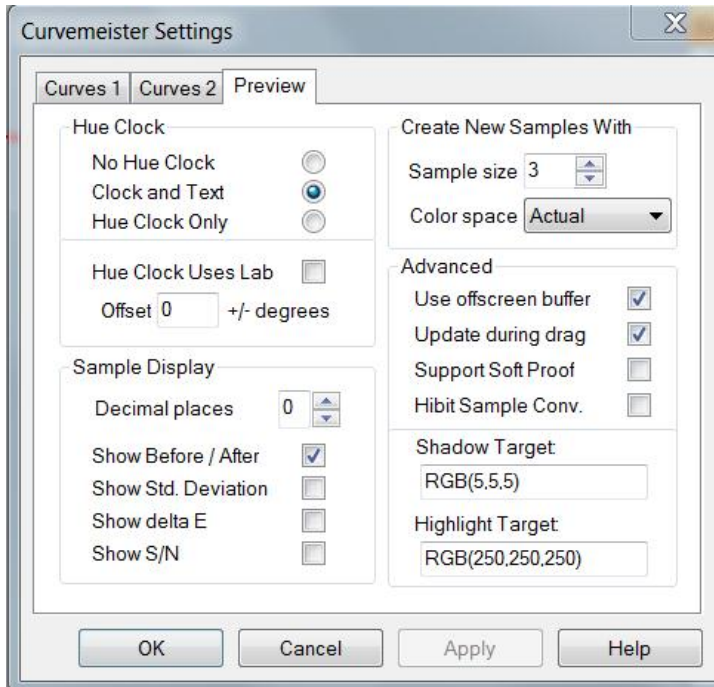


- **Sample size:** this setting determines the relative size in square pixels that your hue clocks are going to use.
- **Hue Clock Settings:** This is where you add additional information to the basic hue clock. Note the with text setting. This adds the numeric color values to the hue clock.
- **Show before and after:** This setting displays the original pixel values and the new pixel values in the same hue clock after you make a change to a curve.
- **Shadow and highlight targets:**
  These are settings that limit the output of the curves process. These settings help you to avoid losing detail in the shadows and highlights.

Now, let's relate the Hue Clock to specific points on a curve…
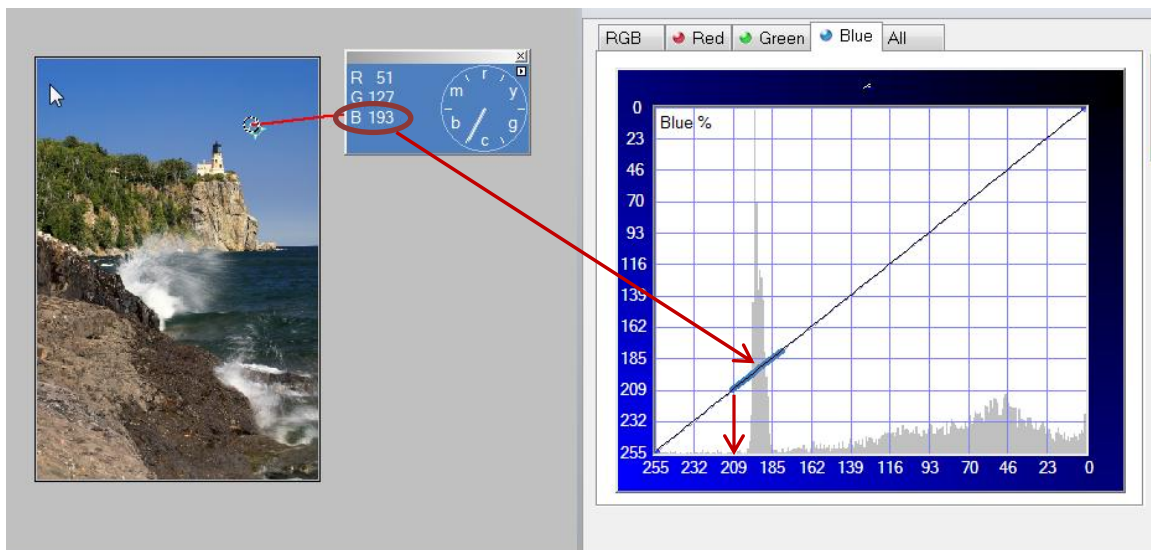
In the image on the last page you see a hue clock set on the sky. This hue clock displays the numeric RGB values. Remember that the RGB values are from 0 to 255 so the numbers shown make perfect sense for a sky. The values are R=51 G=127 and B=193. In relative terms the sky is more blue than green and much more green than red.

The image also shows the Blue channel curve grid and the red arrow points to the "color worm" on the curve line. This color worm is showing the upper and lower pixel values from under the 3X3 sample I have selected. So from the 9 pixels the highest value is just about 209 and the lowest value is about 175. You can find this by following the end points of the curve down to the bottom where the number labels are located.

Now using some of that information let's make an adjustment….
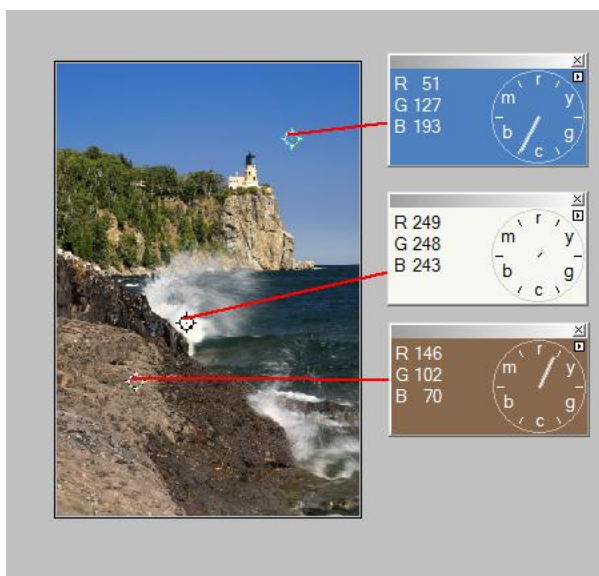


We start by setting a few more hue clocks so you can see how the adjustment of one curve can affect the color of the entire image..
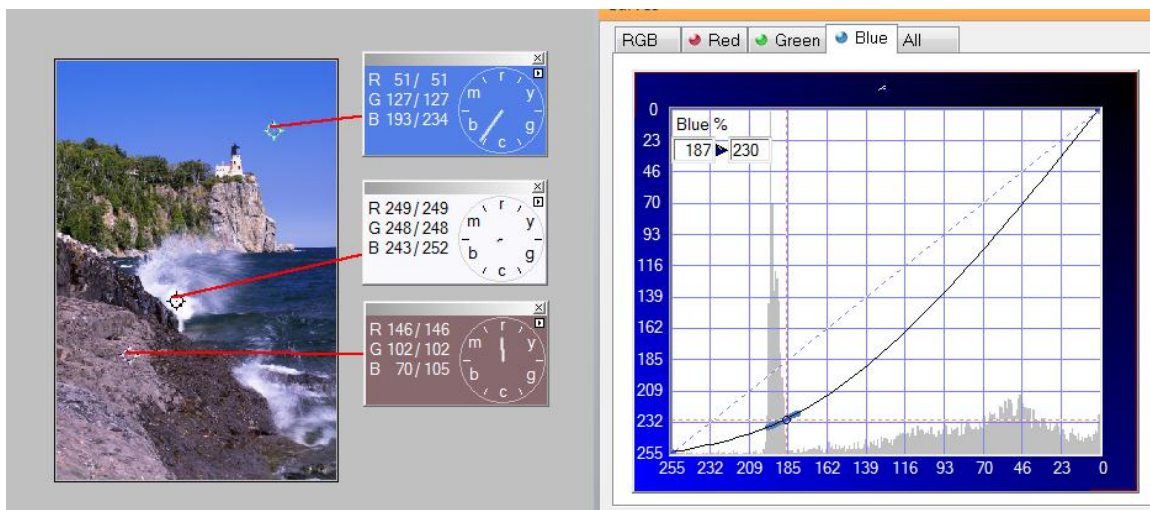
So what happened here??
Look only at the Blue values in the three hue clocks.  The Sky value went from 193 up to 234. A brighter blue but still acceptable.  The white splash saw only a slight change and still remains nearly neutral but the yellow is almost gone from the lighthouse itself.

The rocks in the foreground have the biggest change.  The addition of the blue <increasing the blue value adds blue to the image> changed the rocks from a nice rich Red/Brown to a Magenta / Red color.  The addition of the blue makes the rocks look almost purple in comparison.  Notice how the Blue channel value went from 70 to 105; also notice that the values of the other two channels did not change in the slightest.

Hue Clocks allow us to see these changes in a very visual way and they help us later on as we work on shadows and highlights as well as finding neutral values in an image.


There will be so much more to try and learn but this is a good start…Please feel free to ask questions.  We are all here to learn and explore….


Greg