

wacom[®]
Color Master

Natalia Taffarel

Color Theory —
Guide to Color Grading

Understanding & Mastering Curves



Natalia Taffarel

Digital Artist and Workshop Instructor
Argentina



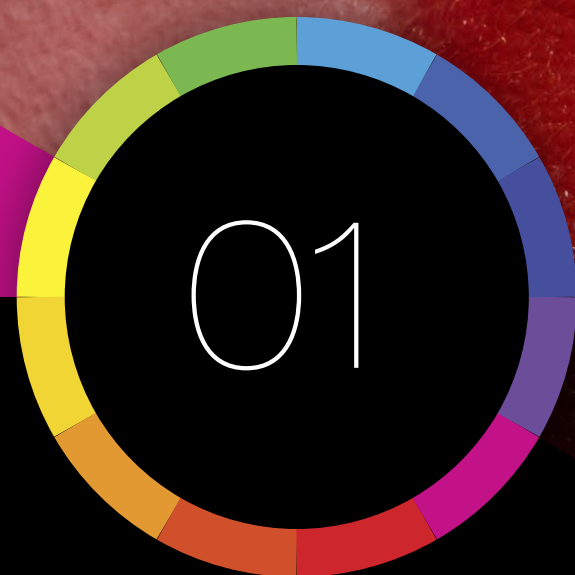
Diving into the world of color is Natalia Taffarel's true passion. Born in 1981 into a family of printers in Argentina, Natalia grew up with a deep understanding of color theory and composition. After studying graphic design and working in the advertising industry, she developed an "obsession" with enhancing images with Photoshop. The high-end fashion retoucher and workshop instructor loves to unleash the hidden beauty in images.

Natalia's color and retouching work embellishes major fashion magazines such as Vogue or Cosmopolitan, and she has taught retouching classes in metropolises around the world, including Dubai, New York and London. Natalia Taffarel runs the digital retouching studio Studiobased (www.studiobased.com), which serves renowned, international clients such as L'Oréal, U2 and Elle magazine.

A certified Adobe expert, Natalia Taffarel finds great satisfaction in making a good image perfect and a perfect image awe-inspiring — and teaching others how to get there. In this eBook, the artist shows you how to understand and work with curves for professional color grading.

All digital work shown in this eBook is carried out with the Wacom pen tablet Intuos Pro, using Adobe© Photoshop.





Color Theory — Guide to Color Grading

Technical

In order to understand Color we need to divide the subject into three spheres: **Technical**, **Artistic** and Communication. But remember: you can't ever completely separate these spheres as they are intrinsically connected.

Let's look at the different color models: **RYB – RGB – CMYK**

RYB: Red, Yellow, Blue

used mostly in painting

We won't be taking RYB into account here since it predates modern color theory. Printing experts (people who care passionately about the gamut of colors that can be obtained by mixing three colors) have determined that cyan, magenta and yellow (in subtractive mixing) make the best set of three colorants to be combined for the widest range of high-chroma colors. I believe that teaching RYB as the (subtractive) primaries should be stopped since it is counterproductive and serves no purpose in photography.

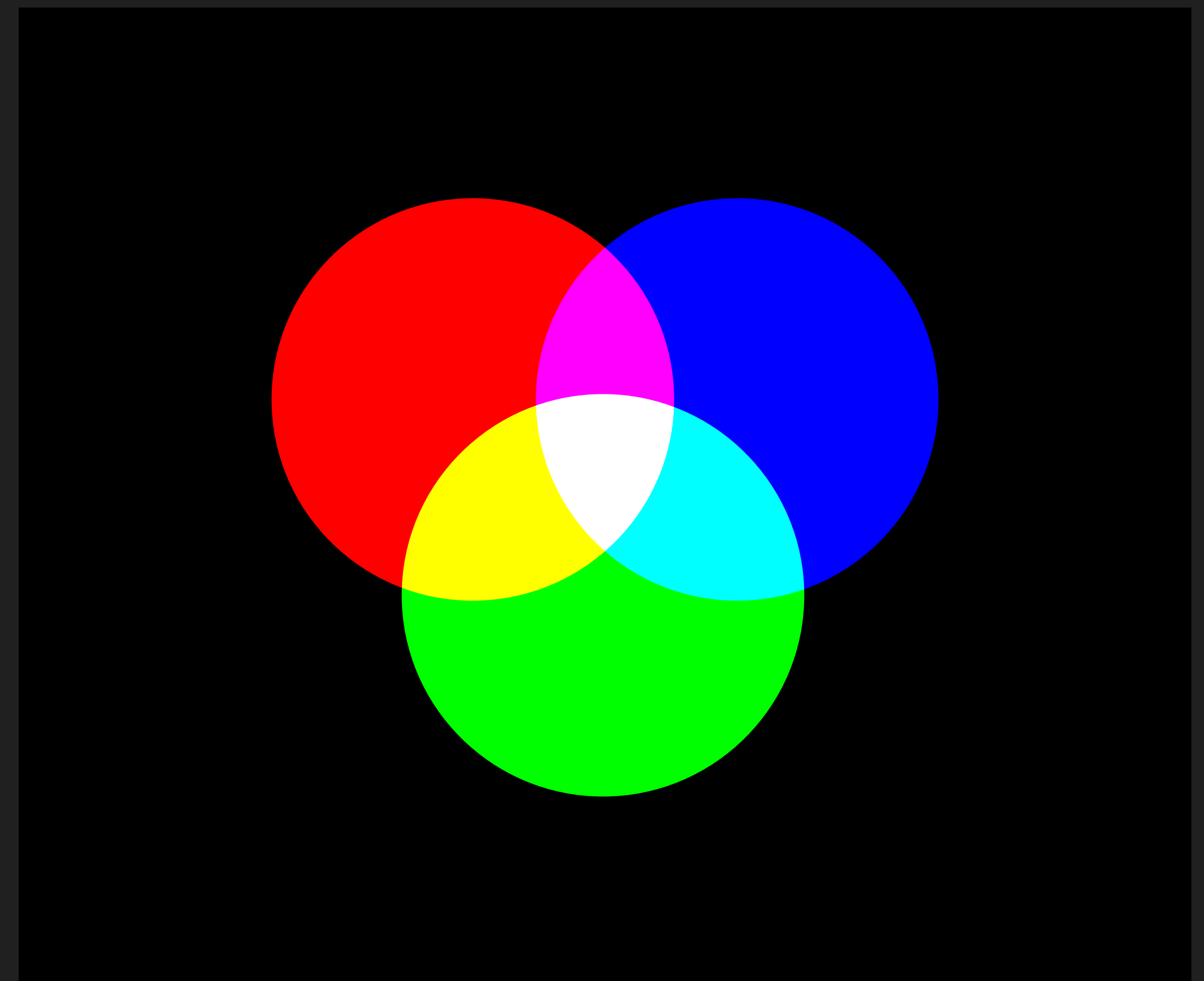
RGB: Red, Green, Blue

Color is light, because one cannot exist without the other. This principle was first established by Isaac Newton (1642-1727) and Thomas Young (1773-1829).

According to this rule, each color is based on the amount of light reflected by an object and measured in wavelengths. A leaf of a tree, for example, reflects only the green, absorbing most of the red and some of the blue, while a tennis ball absorbs the blue, reflecting the green and red (yellow).

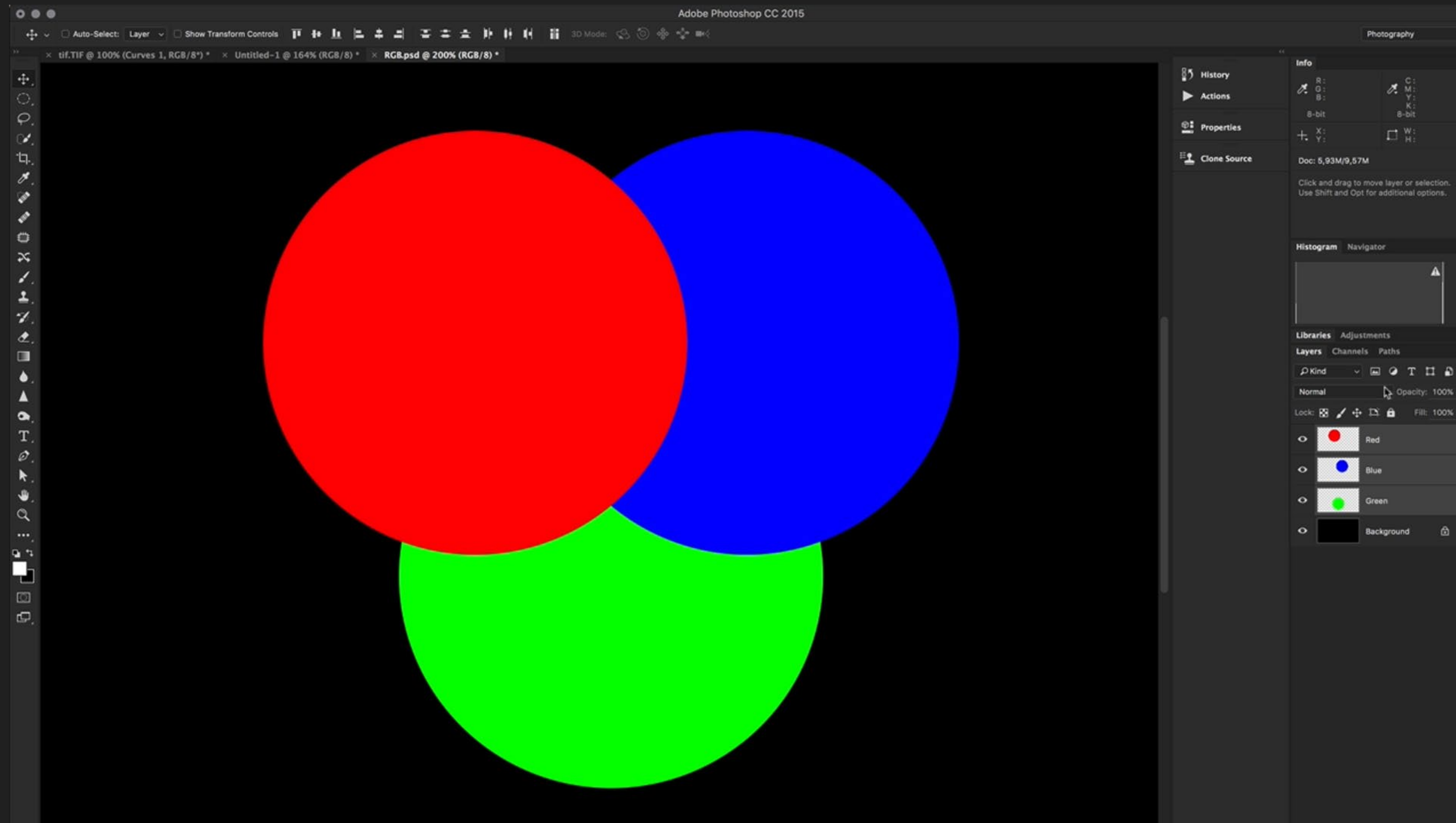
The human eye is sensitive to three colors (red, blue and green as demonstrated by Thomas Young with his flashlights) and perceives them with the photoreceptors located in the retina. Then the brain will interpret what the eye perceives as one distinct color depending on the overlap and proportions of each color according to the additive color synthesis. Monitors work with additive color theory, and Photoshop also understands colors that way.

Remember: **EVERYTHING** in an image is made of only 3 colors: **RED - GREEN - BLUE**



Each circle in this image is painted on an individual, independent layer. The Red has the RGB values set to 255-0-0, the Green has the RGB values set to 0-255-0, and the Blue has the RGB values set to 0-0-255 (Primaries: pure RED, pure GREEN, pure BLUE). Each layer-blending mode is set to screen over a Black background (BG). The interaction between two primaries creates the secondaries Cyan, Magenta, Yellow. The center creates pure white: 255-255-255. The variation of luminosity of each creates all the range of visible colors.

RGB



Relationship of Tones

We also need to take into account the relationship between the tones, which we can see in the RGB color wheel.

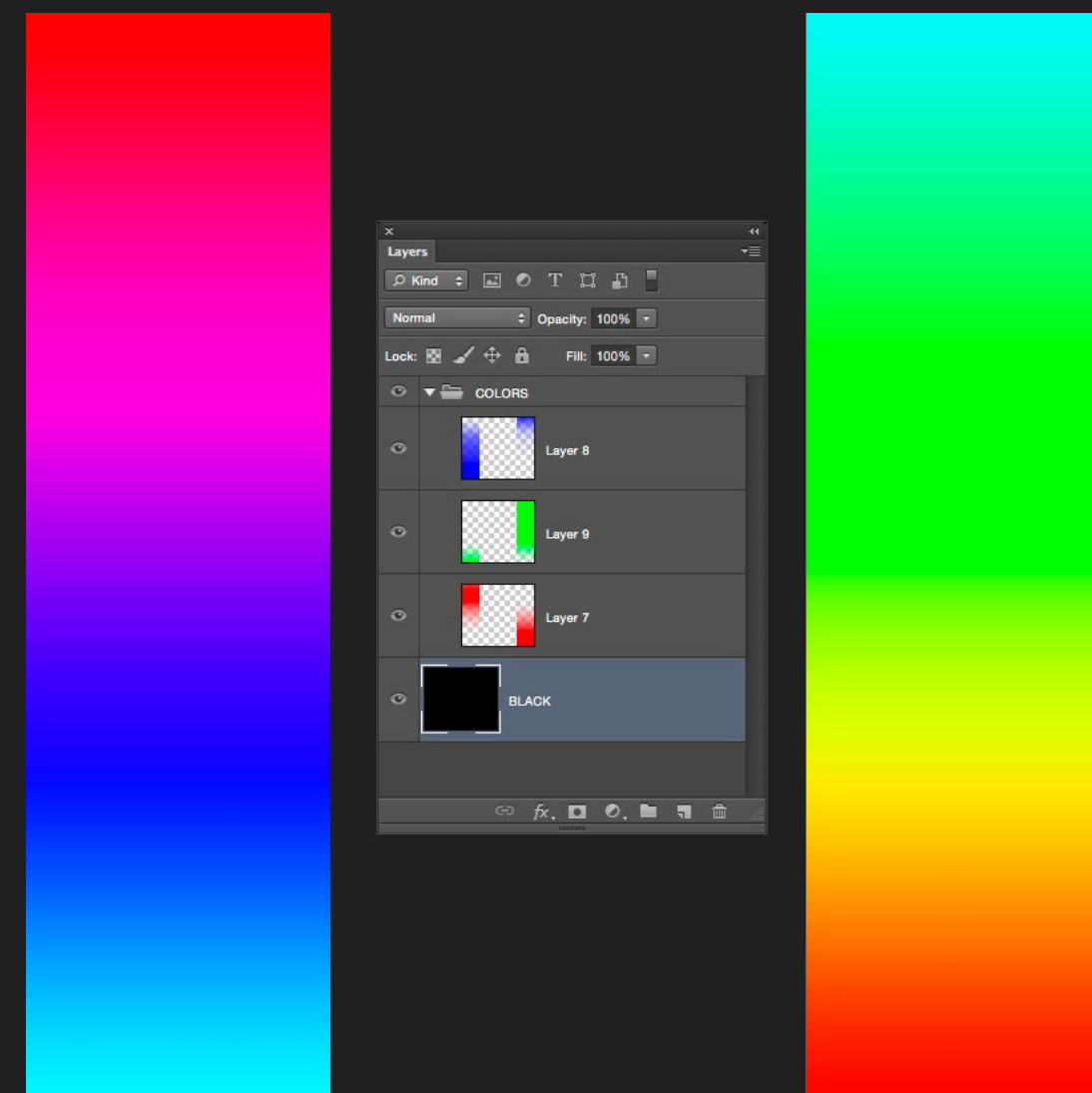
We can see the primaries and also the secondaries as their complementary: RED and cyan – GREEN and magenta – BLUE and yellow.



Every color that we see in a screen is formed with only 3 colors.

These apparent gradients are actually created with gradients of the 3 primaries set to screen-blending mode on black, creating the illusion of the whole range of hues (100% saturation, 100% luminosity).

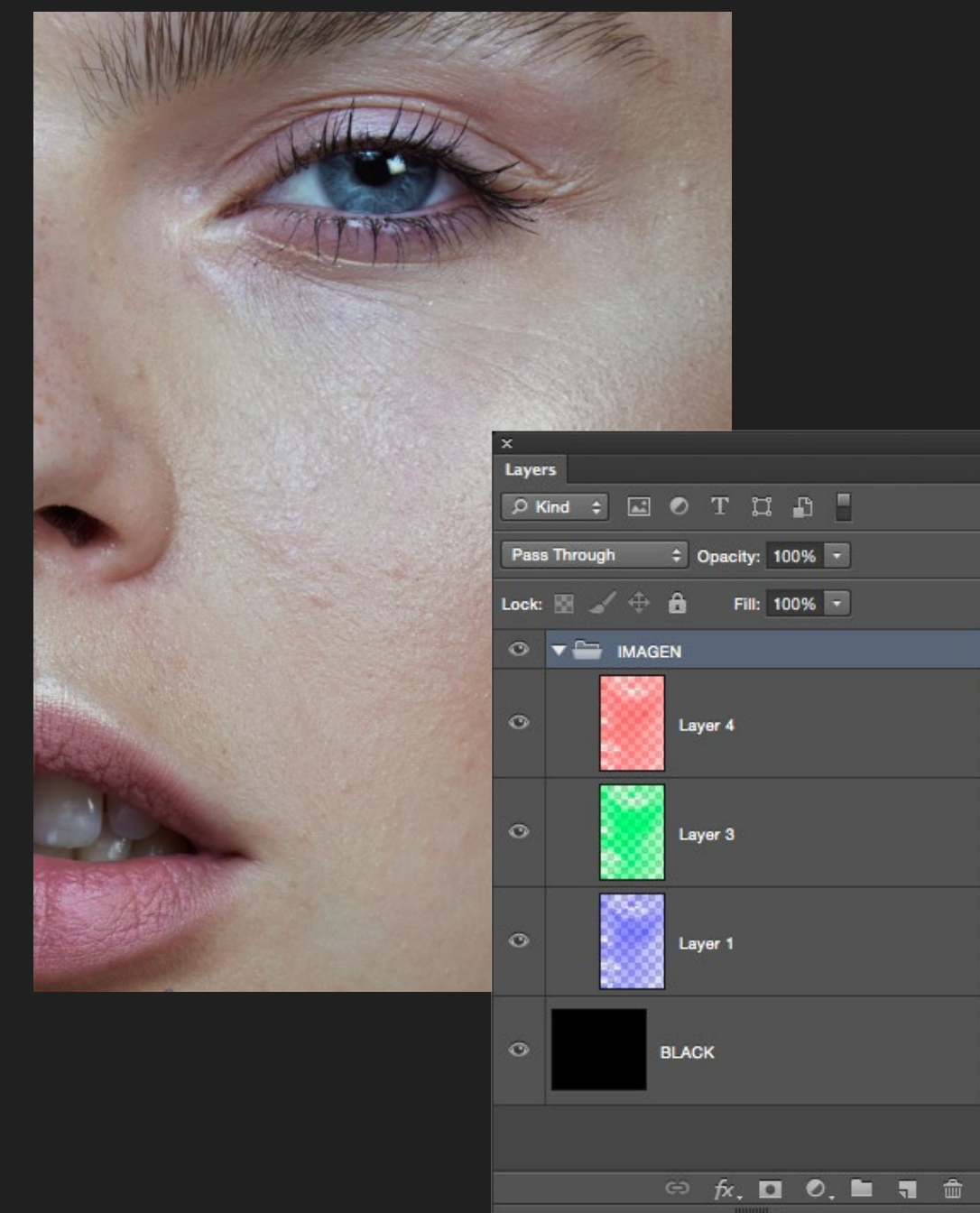
Of course, we need all the ranges of lum/sat to have all the colors, which I will address further on.



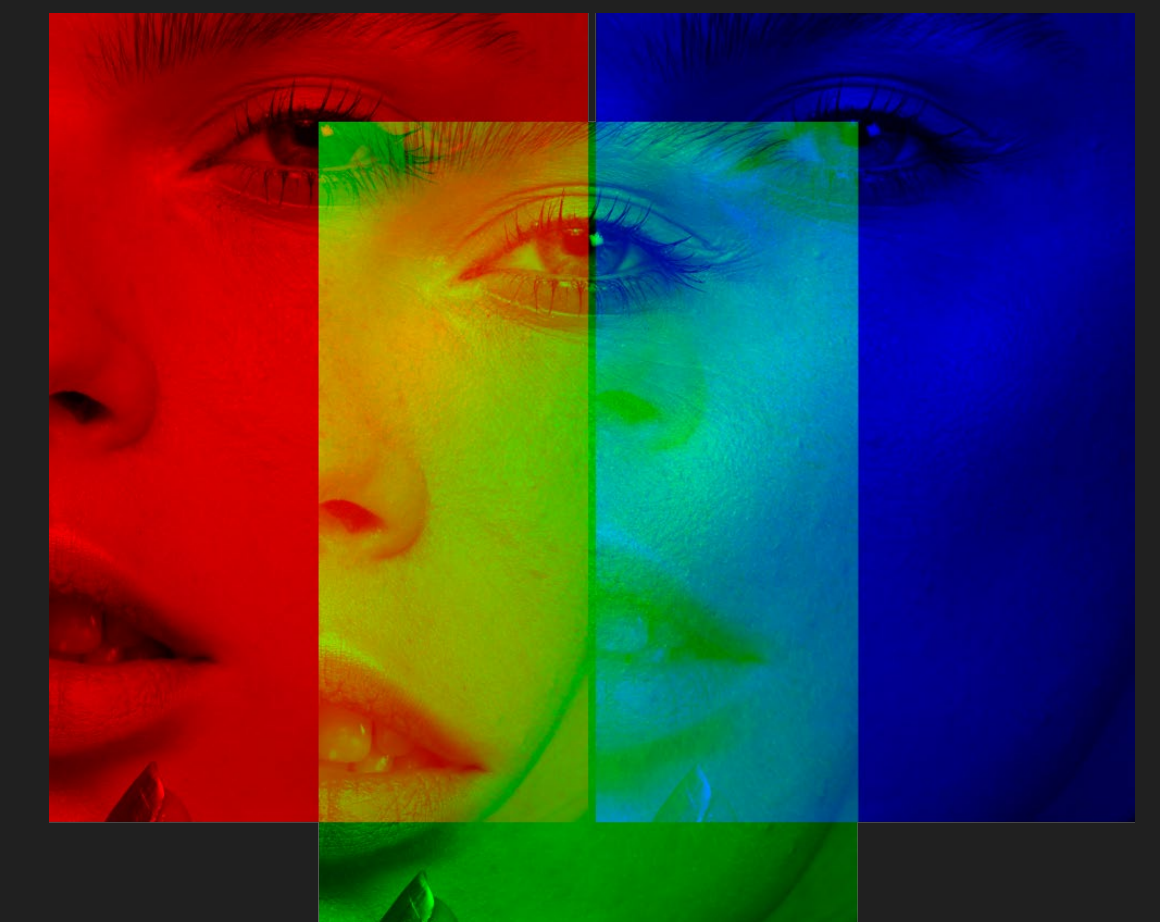
Every single one of the millions of tones we perceive in an image are created by the primary 3.

This image was created filling each independent layer with the primary colors. The Red has the RGB values set to 255-0-0, the Green has the RGB values set to 0-255-0, and the Blue has the RGB values set to 0-0-255 (primaries: pure RED, pure GREEN, pure BLUE).

Each layer-blending mode is set to screen over a Black BG. Then each channel's luminosity was used as a mask of each of the layers to duplicate the appearance of the image without needing to actually have the image.

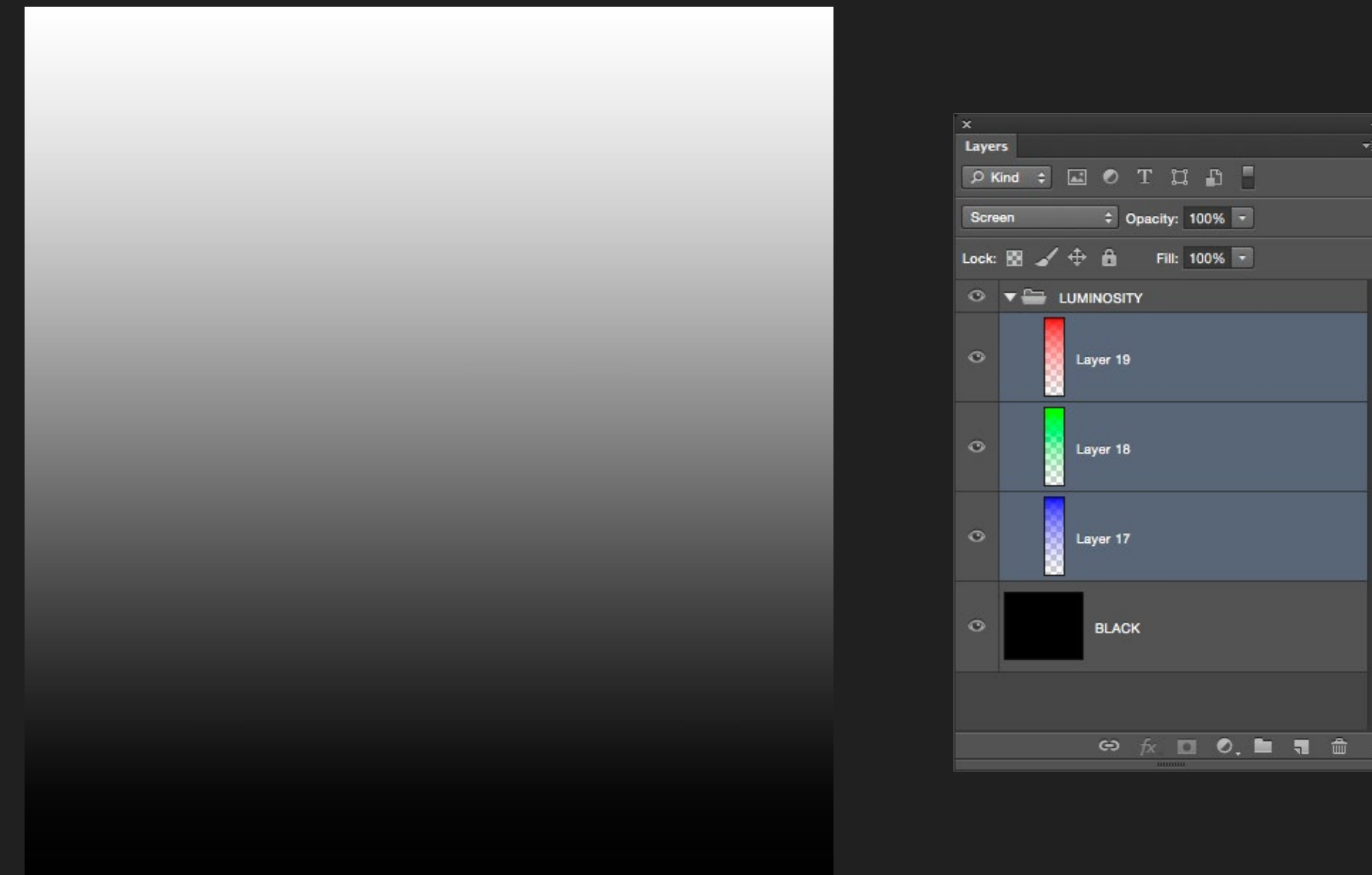


When I separate the 3 layers it looks like this:

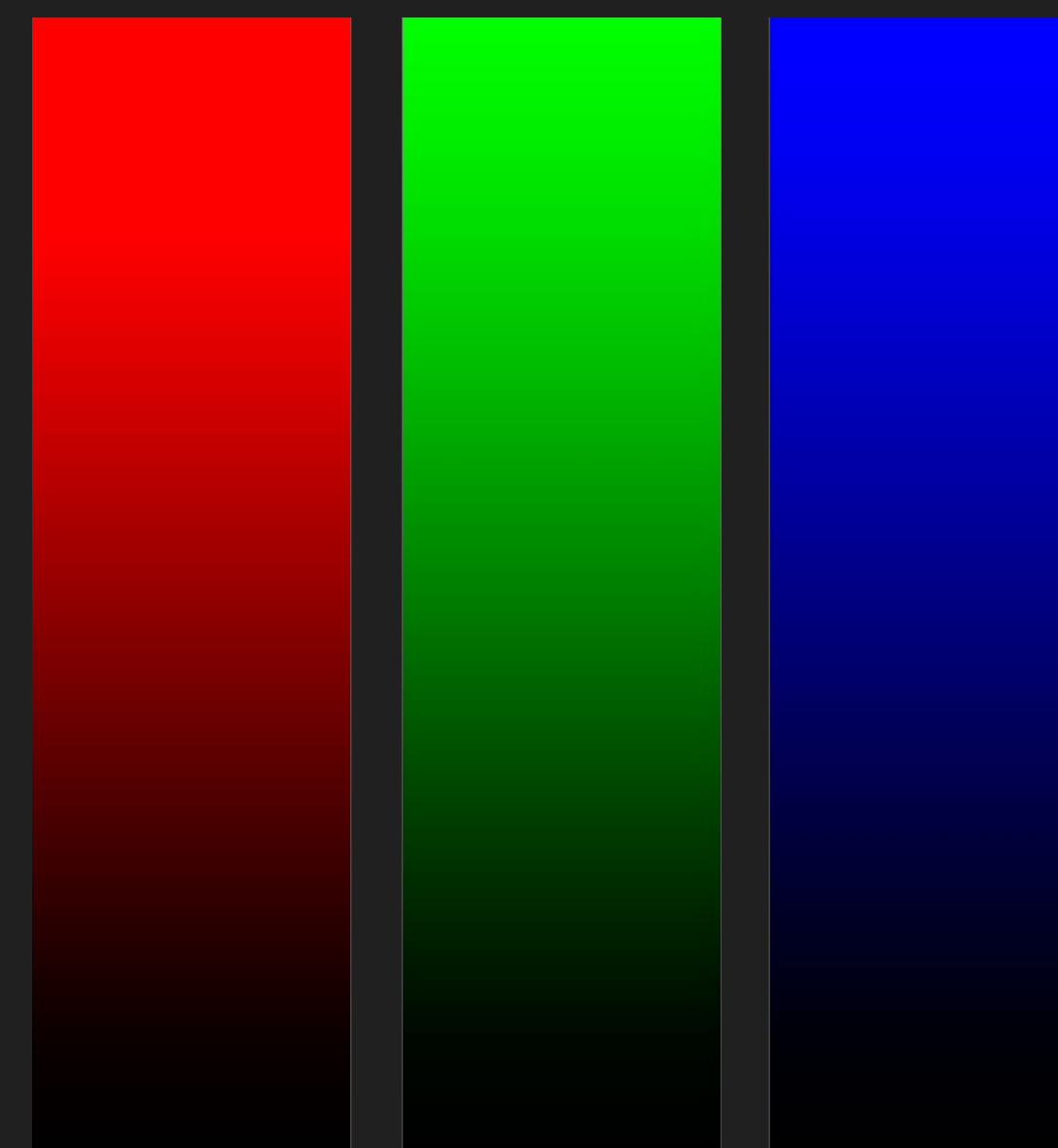


Relationship of Tones

Even what is perceived as luminosity is color!



To create White we need 255-255-255.
To create Black we need 0-0-0.
To create Gray we need 128-128-128.



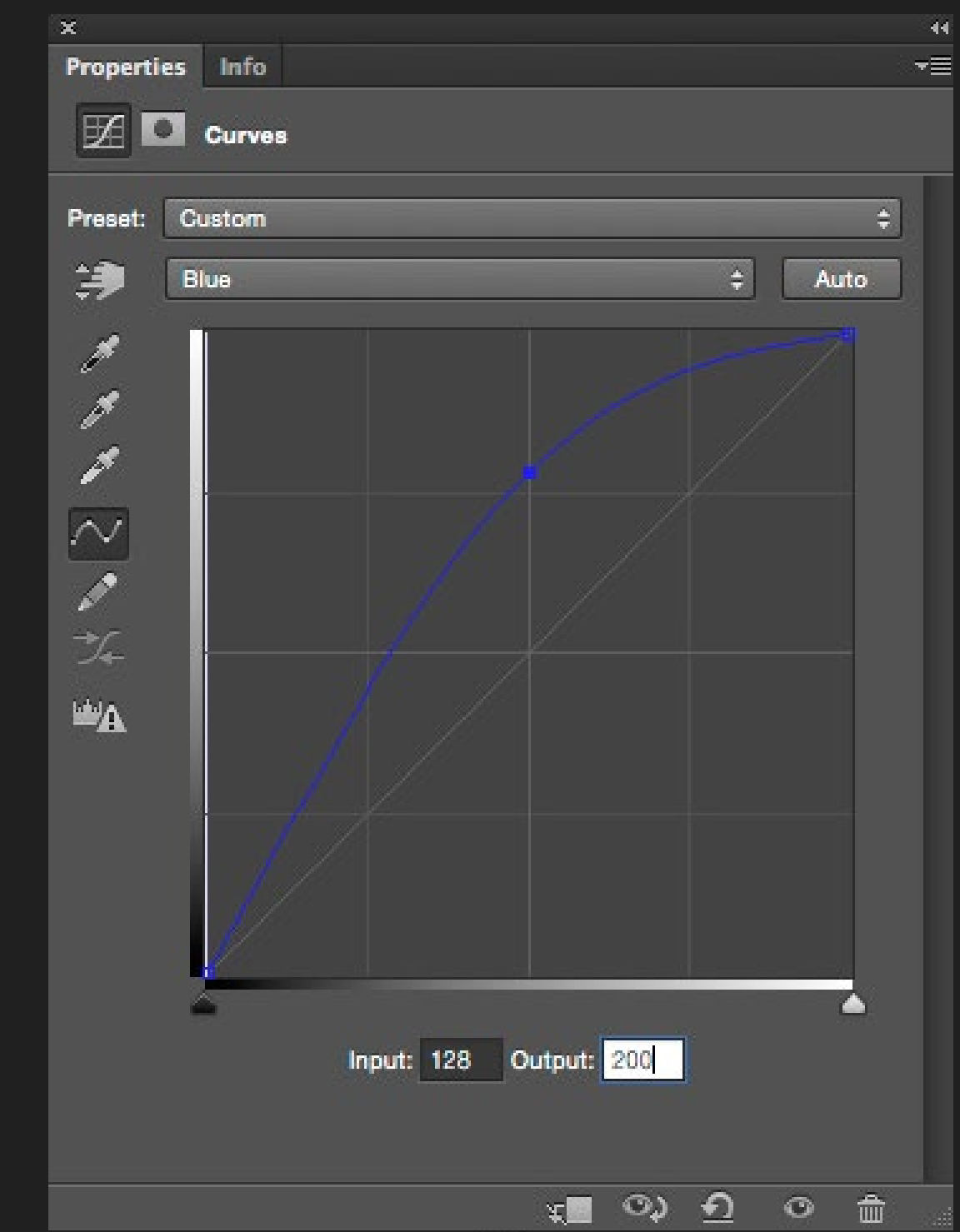
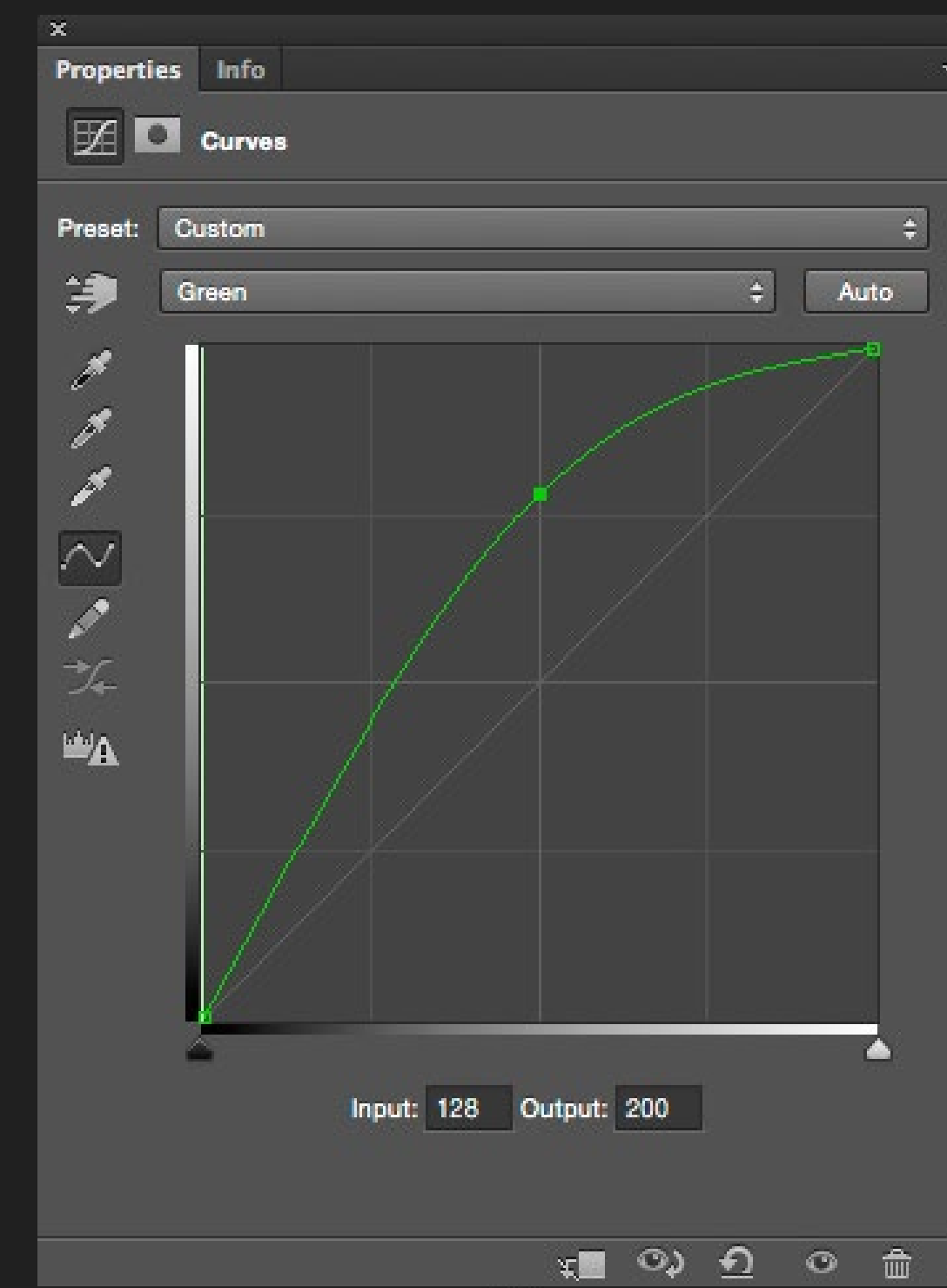
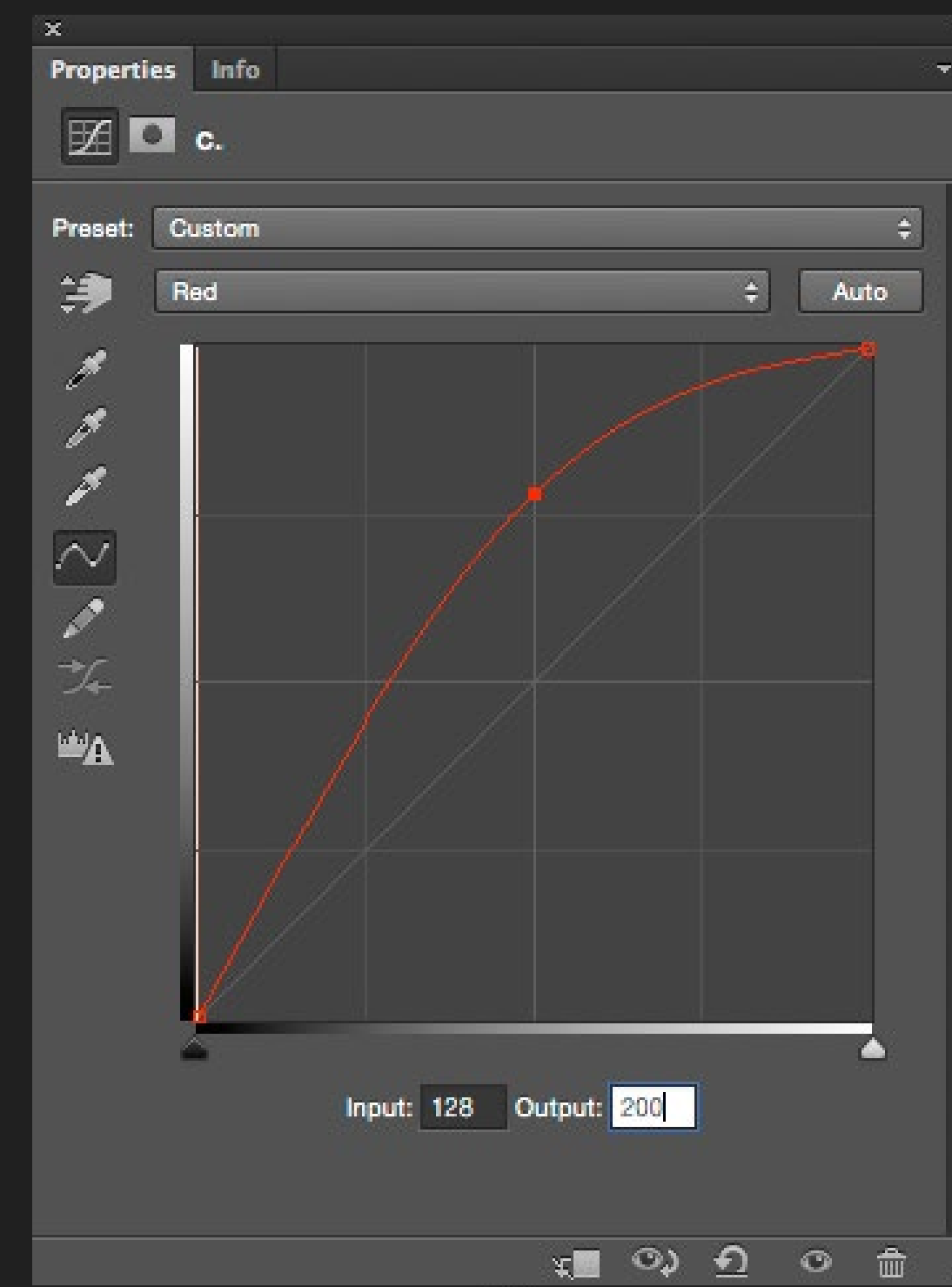
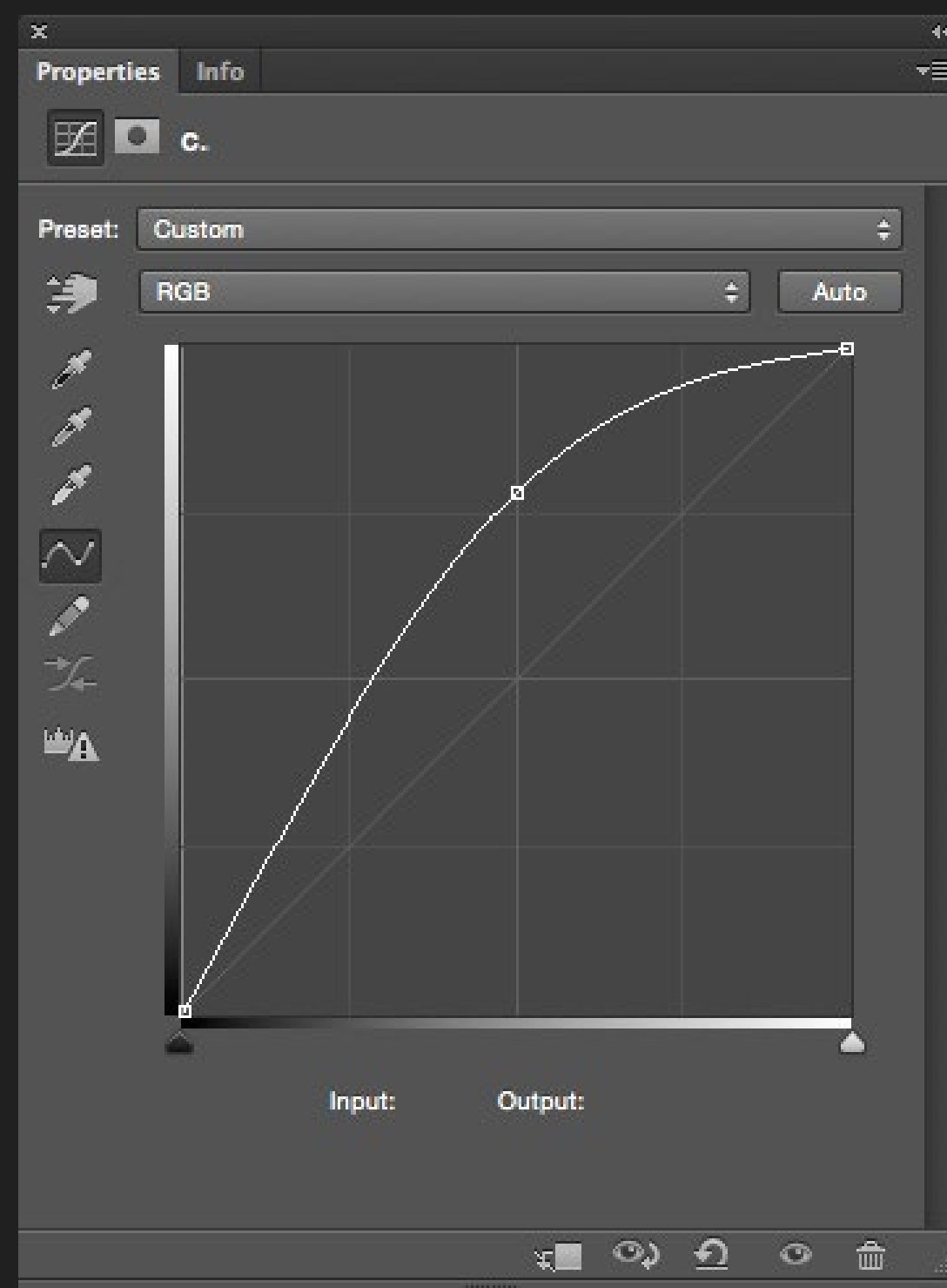
Curves

Curves work with the 3 channels to modify the image, even when you think you're only working with light.

How?

For example, when you pull the curve up to brighten up the image like this:

What you're actually doing is pulling up the 3 individual channels at the same time, like this:

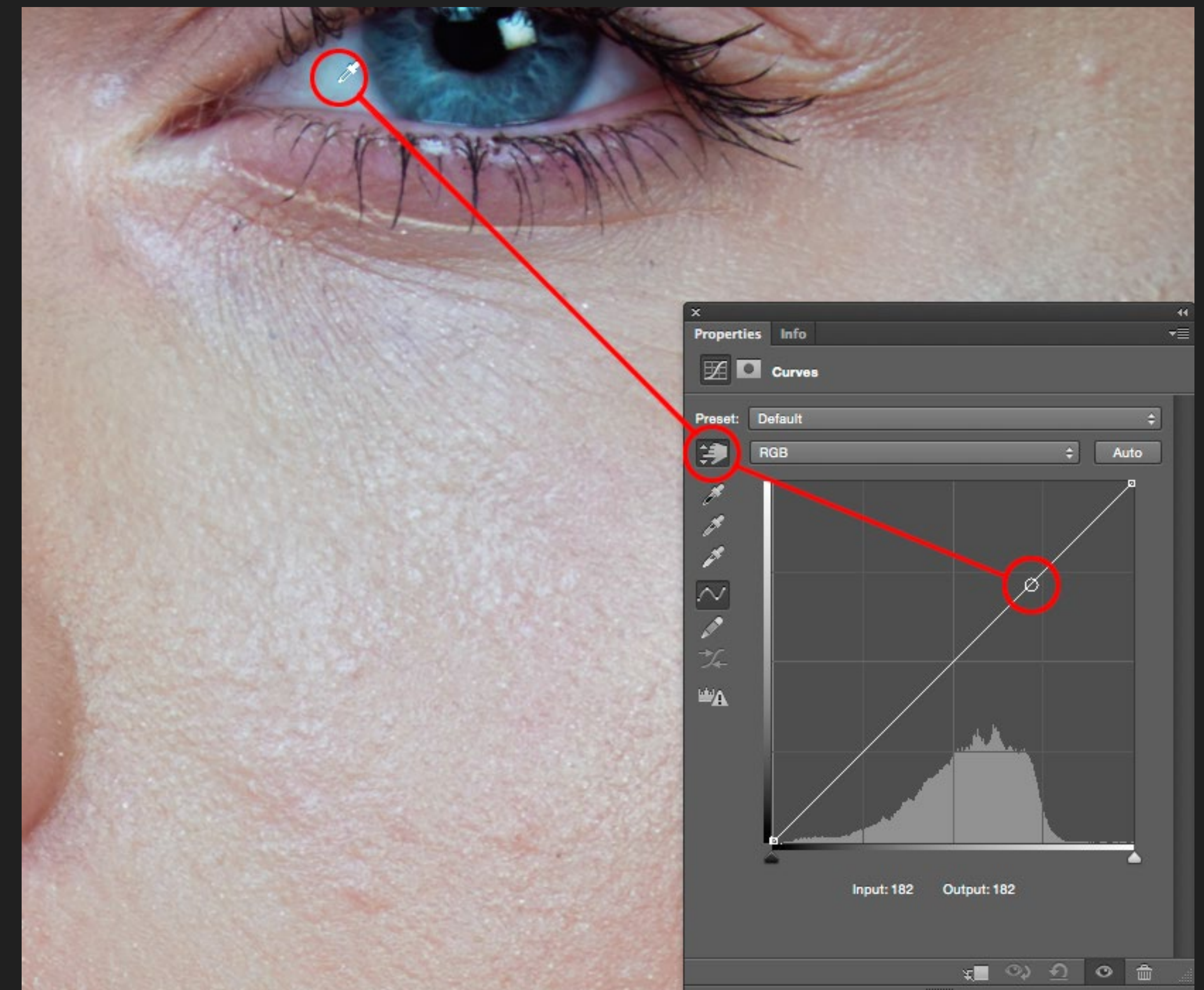
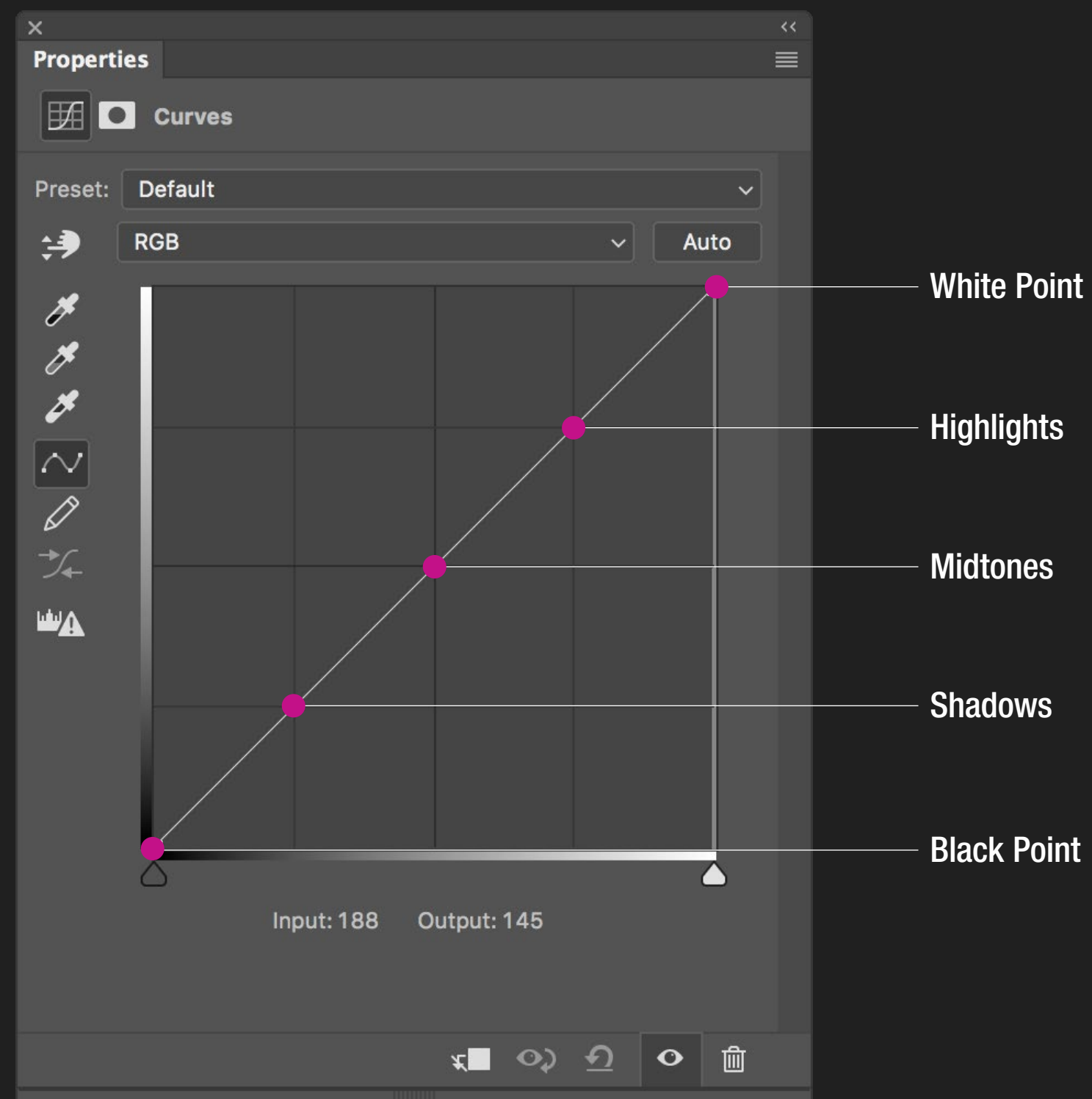


Curves

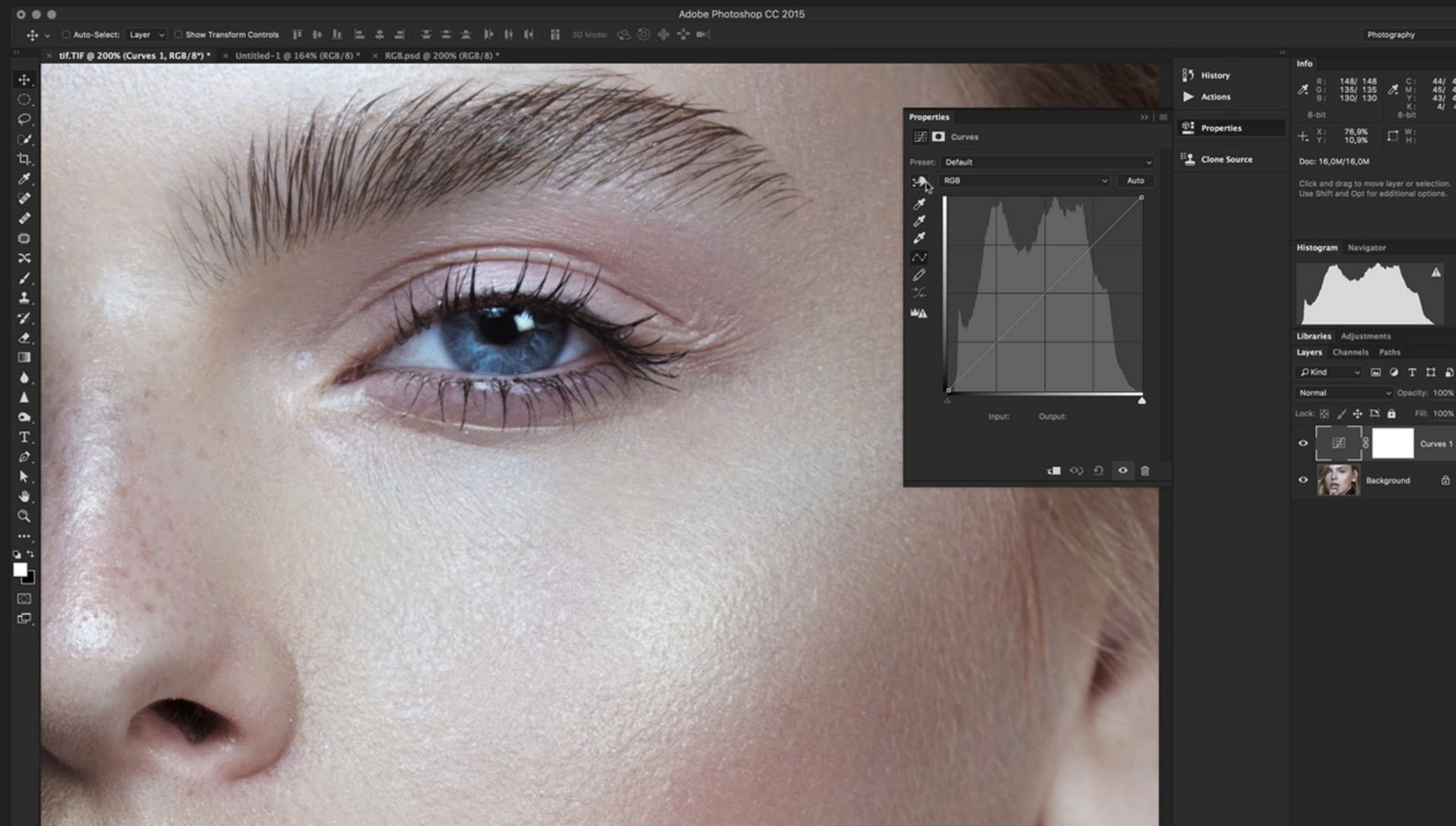
Let's take a closer look at the curves.

A curve can be edited from 16 individual points, the main ones being 5: black point, shadows, midtones, highlights and white point.

You can also use the "On image" tool in the curve to alter a specific range within the image.



Curves

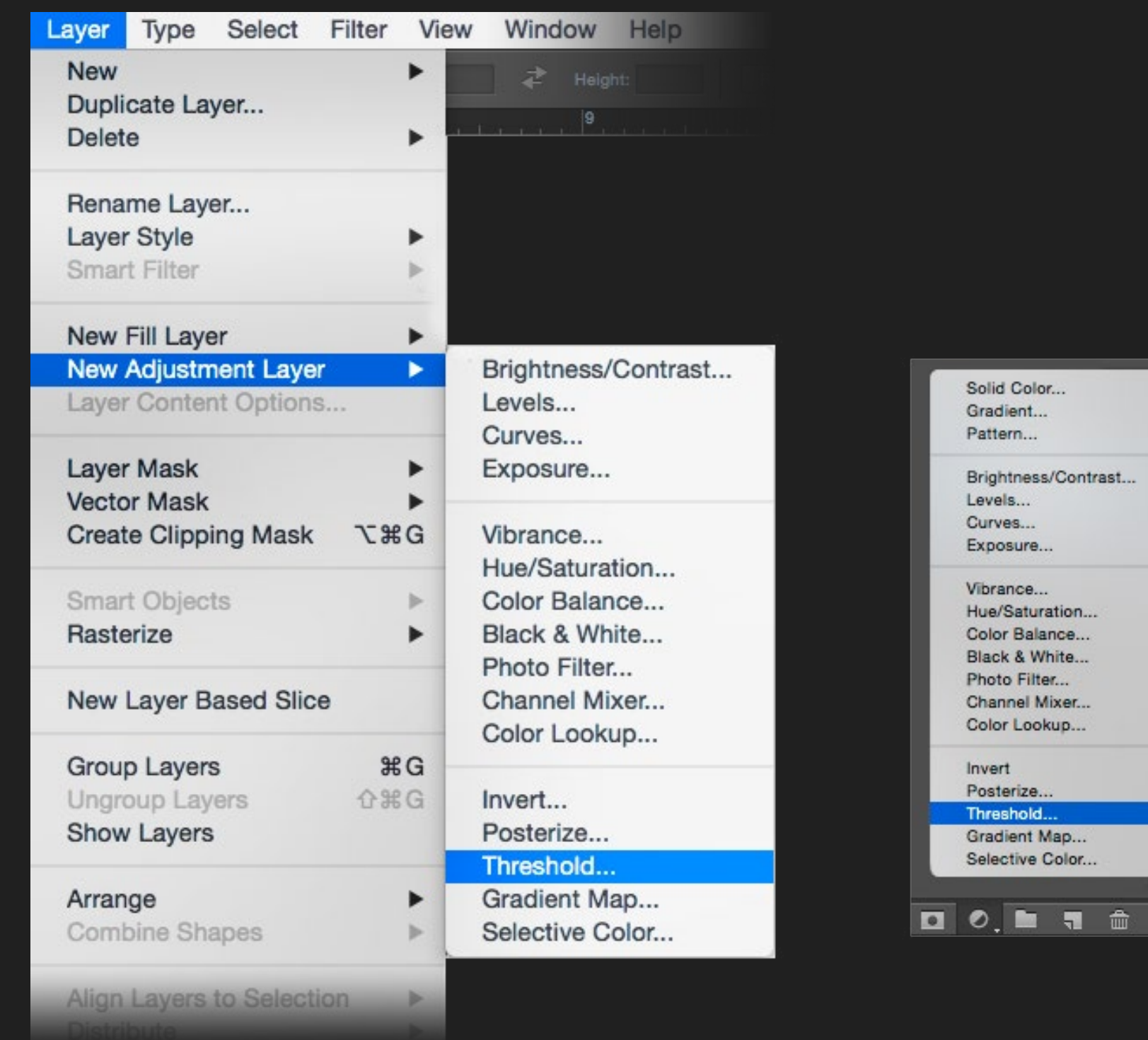
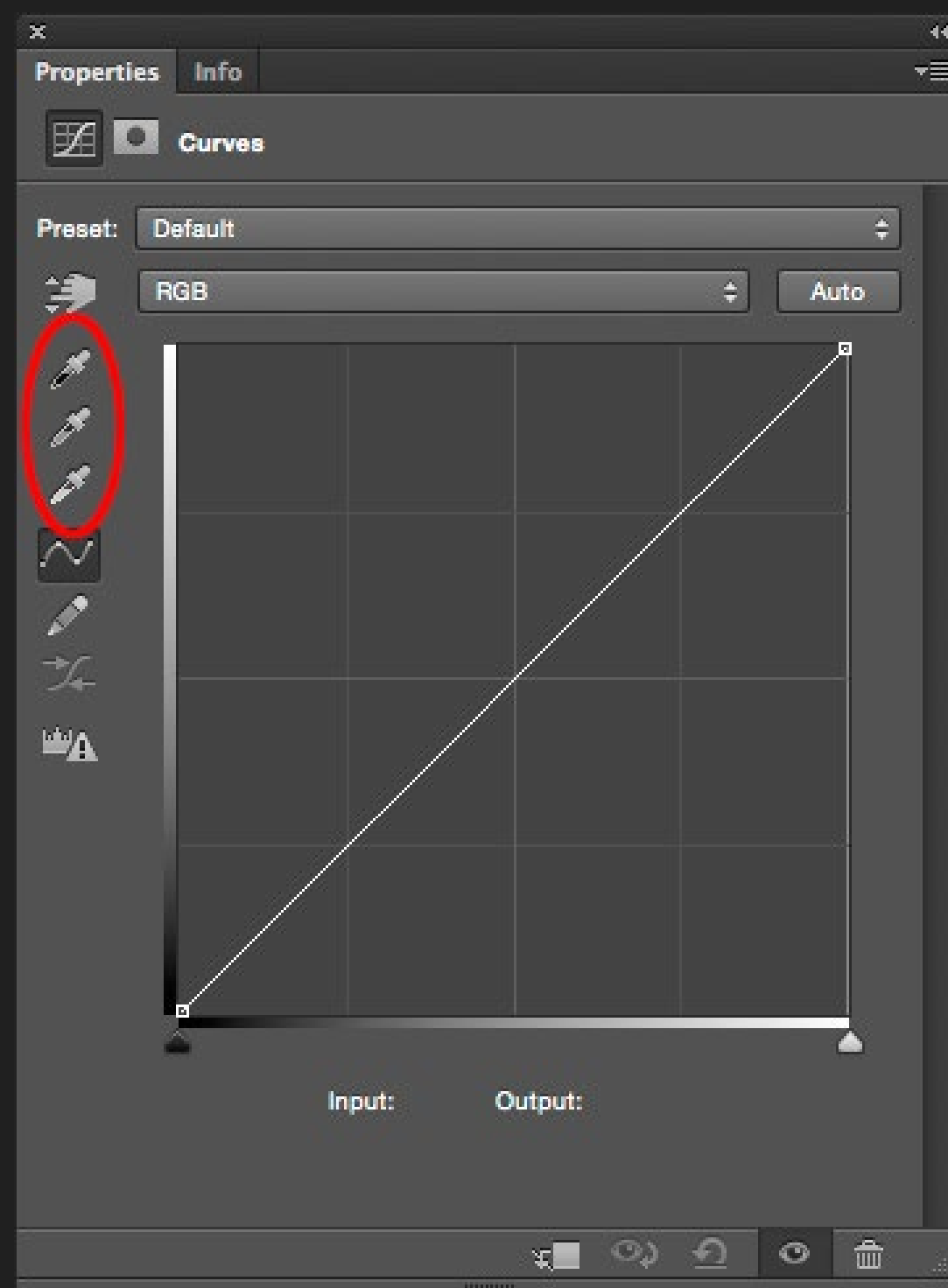


Curves

In the curve we can also find 3 eyedroppers that can be used to select the 3 main points: white point, midtones and black point respectively.

These can be used for automatic color/contrast corrections, because when we select the darkest or lightest point of the image, the curve will automatically make the whites pure White and the blacks pure Black, getting rid of any tint or color contamination.

There's a tool you can use to accurately find the darkest or lightest points of your image: **“Threshold”**



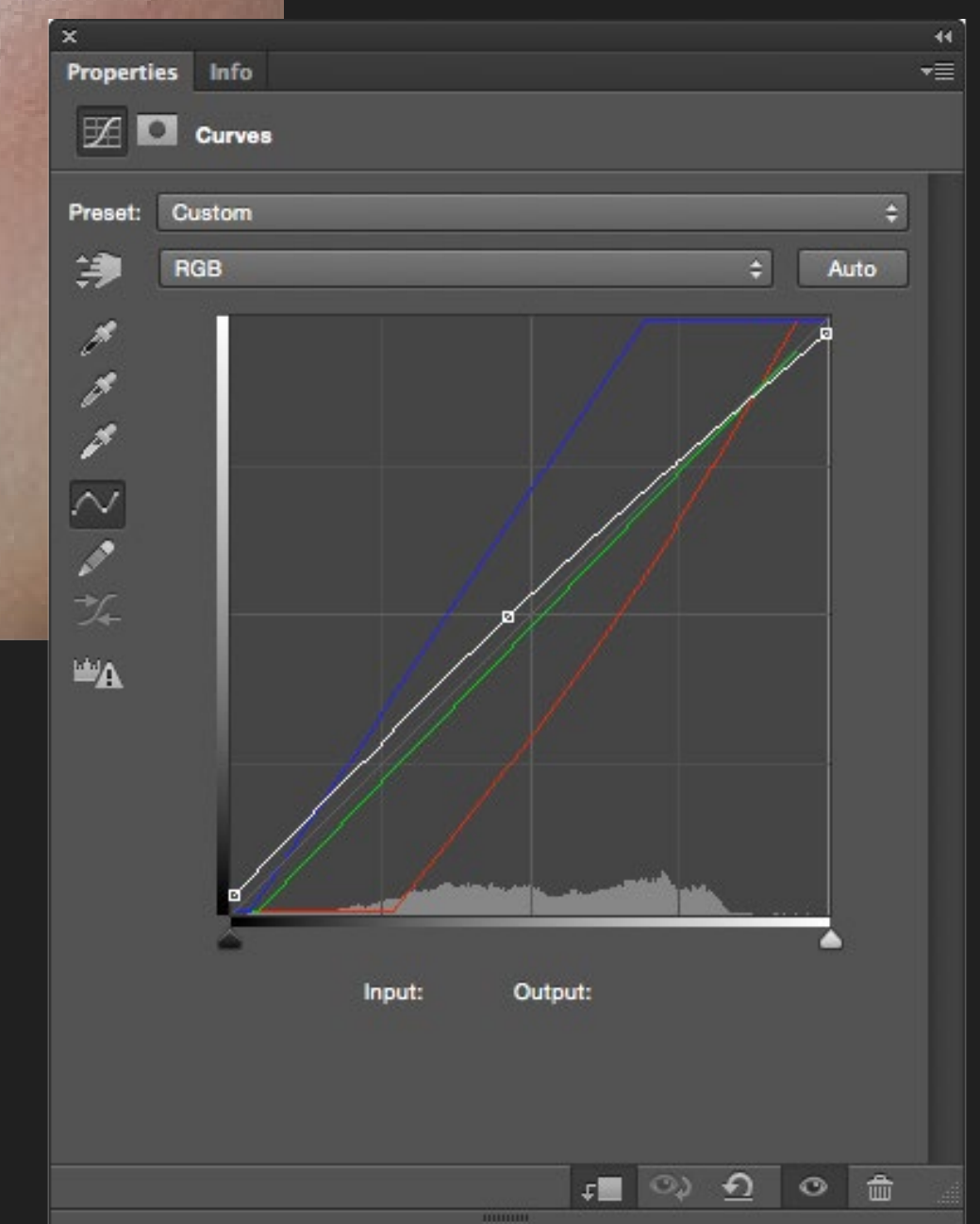
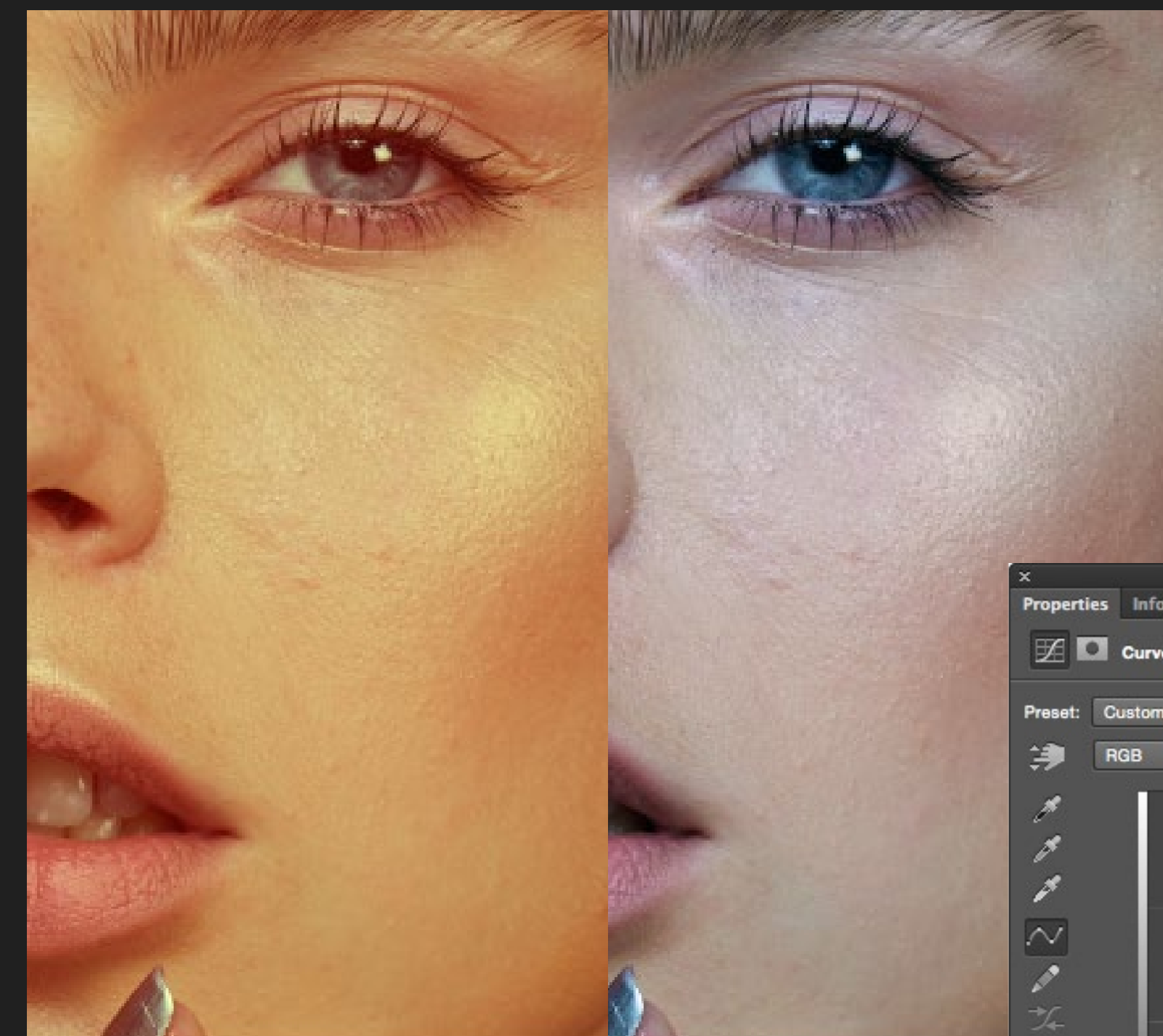
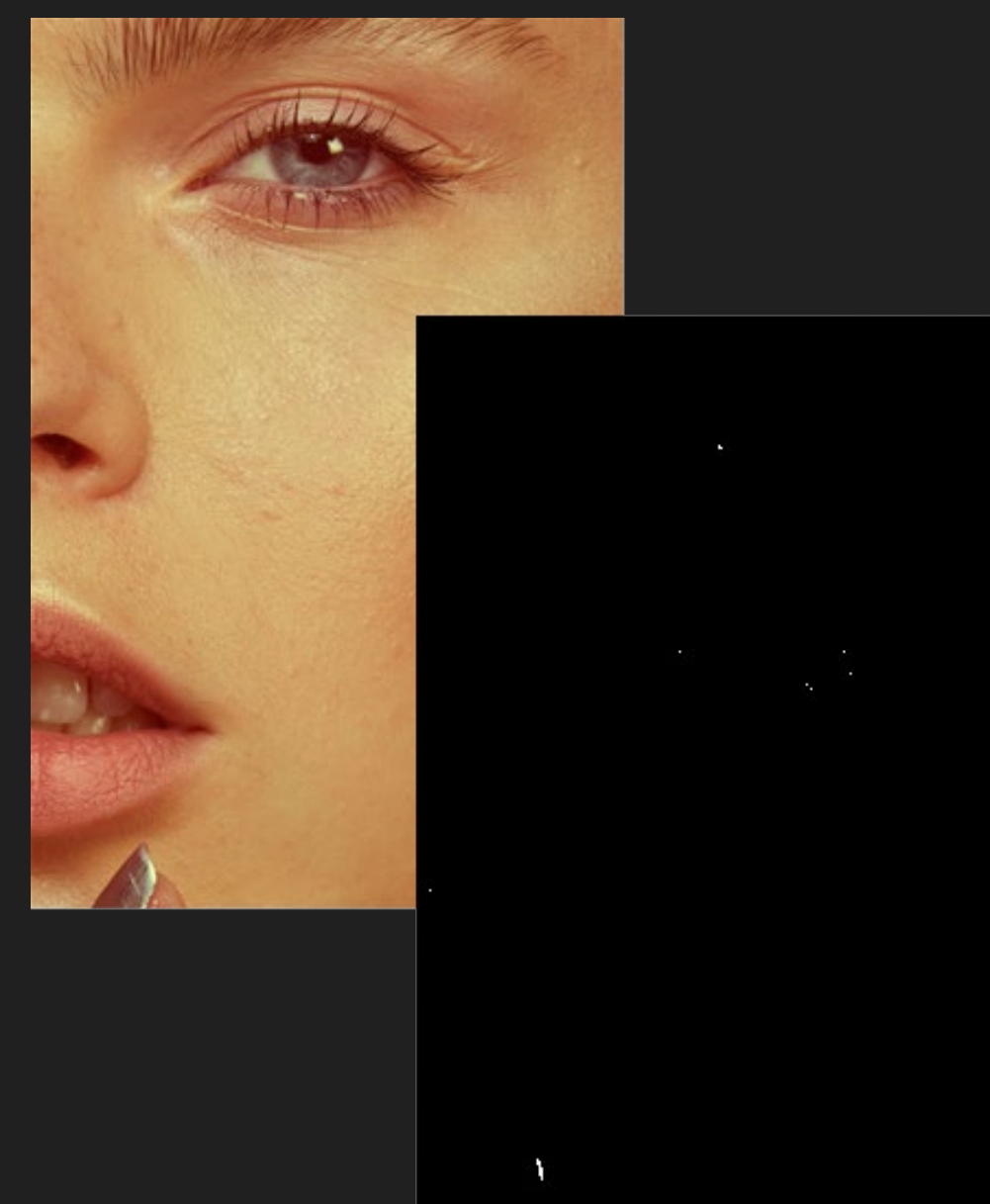
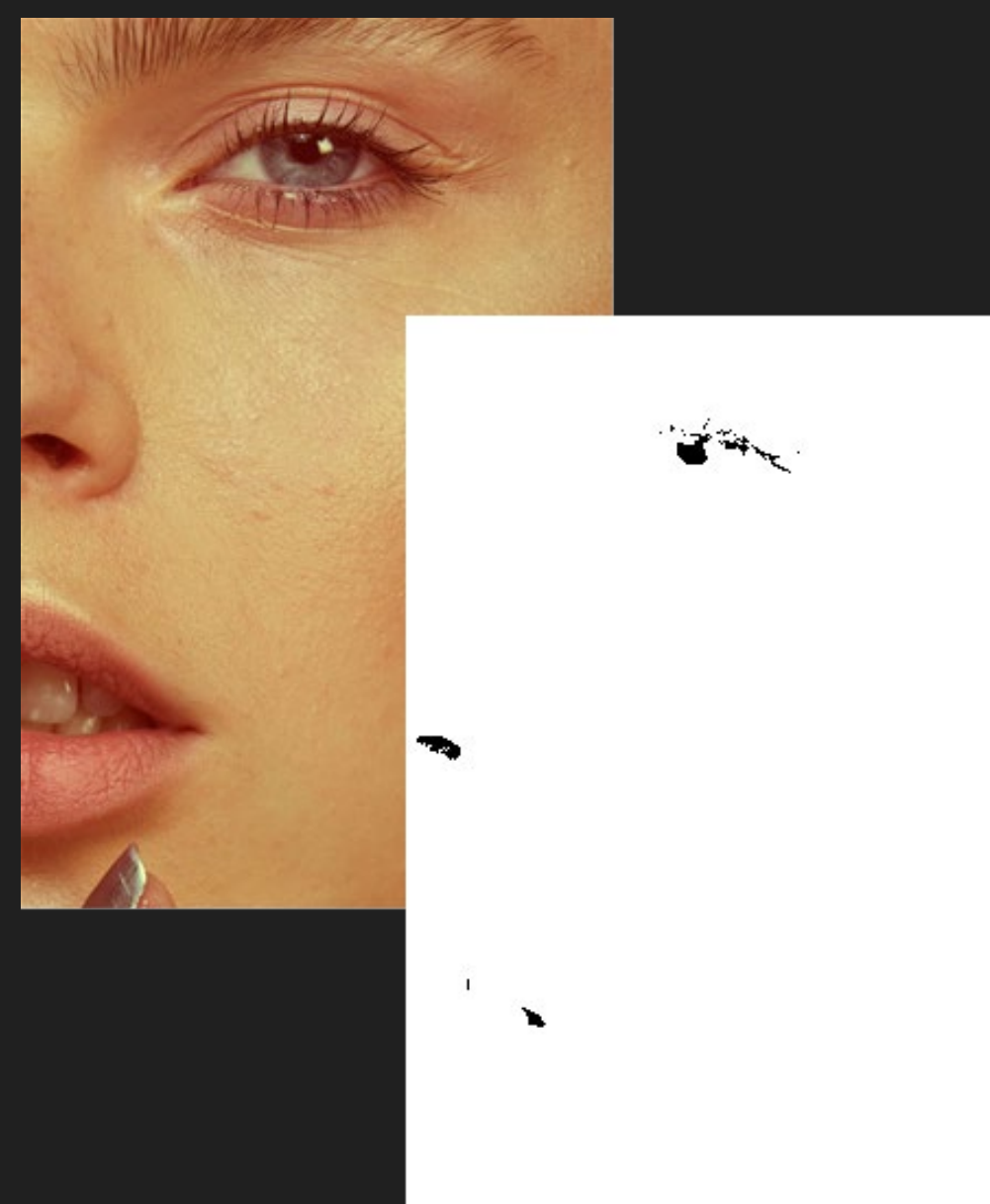
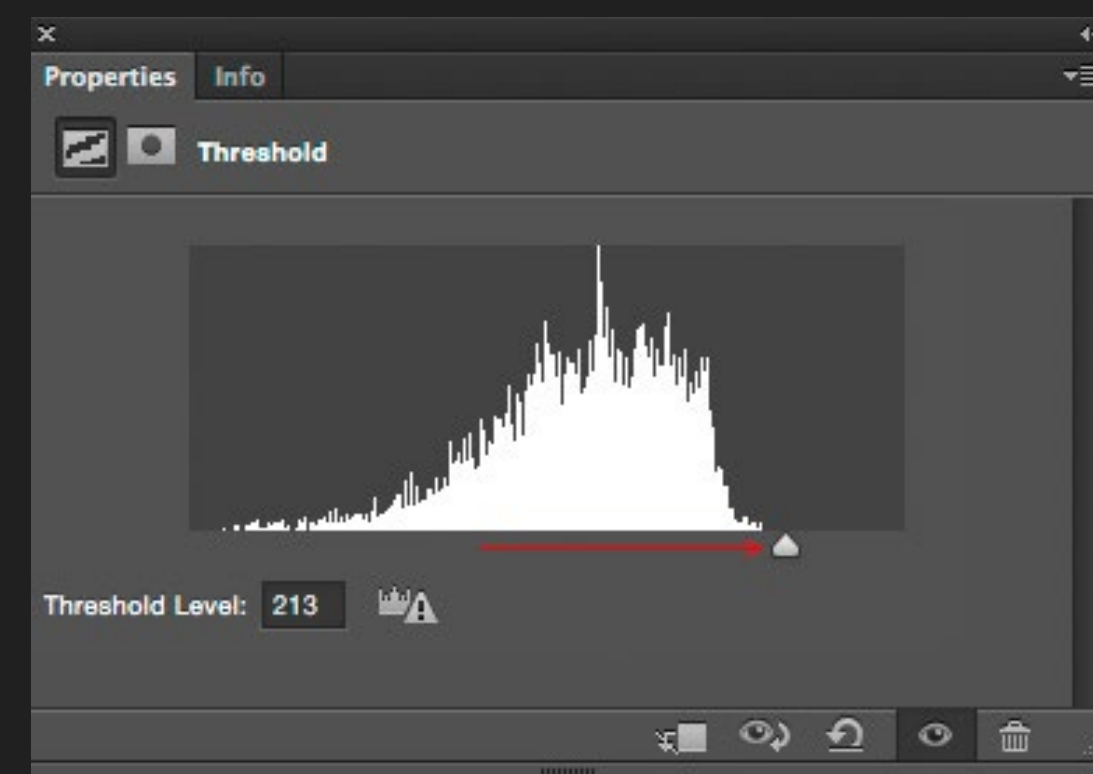
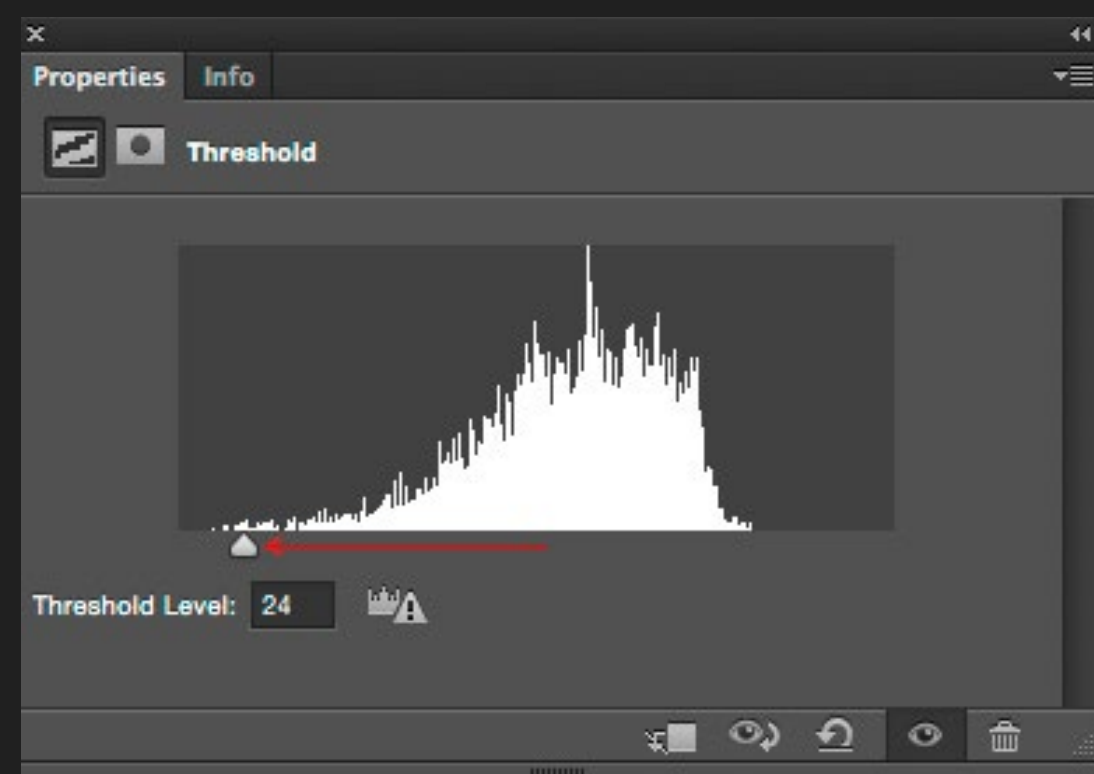
Curves

Pushing the threshold slider to the **left** will make the whole image white, except for the darkest point.

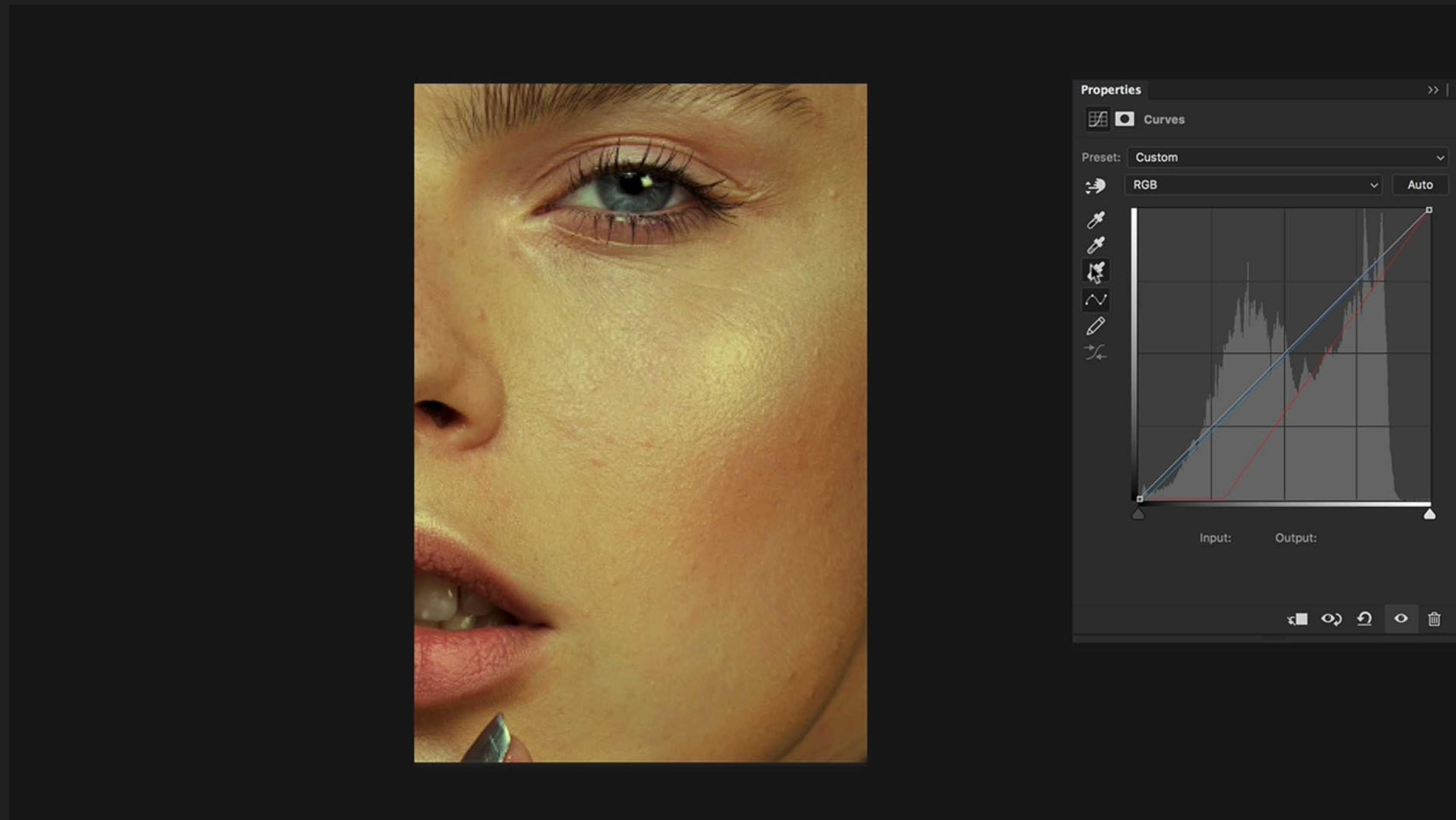
Pushing the threshold slider to the **right** will make the whole image white, except for the lightest point.

We can use this as a reference when using the curves eyedropper to select the white/black points more efficiently.

The curves will automatically make necessary adjustments to the image, correcting the tint.



Removing Color Tint



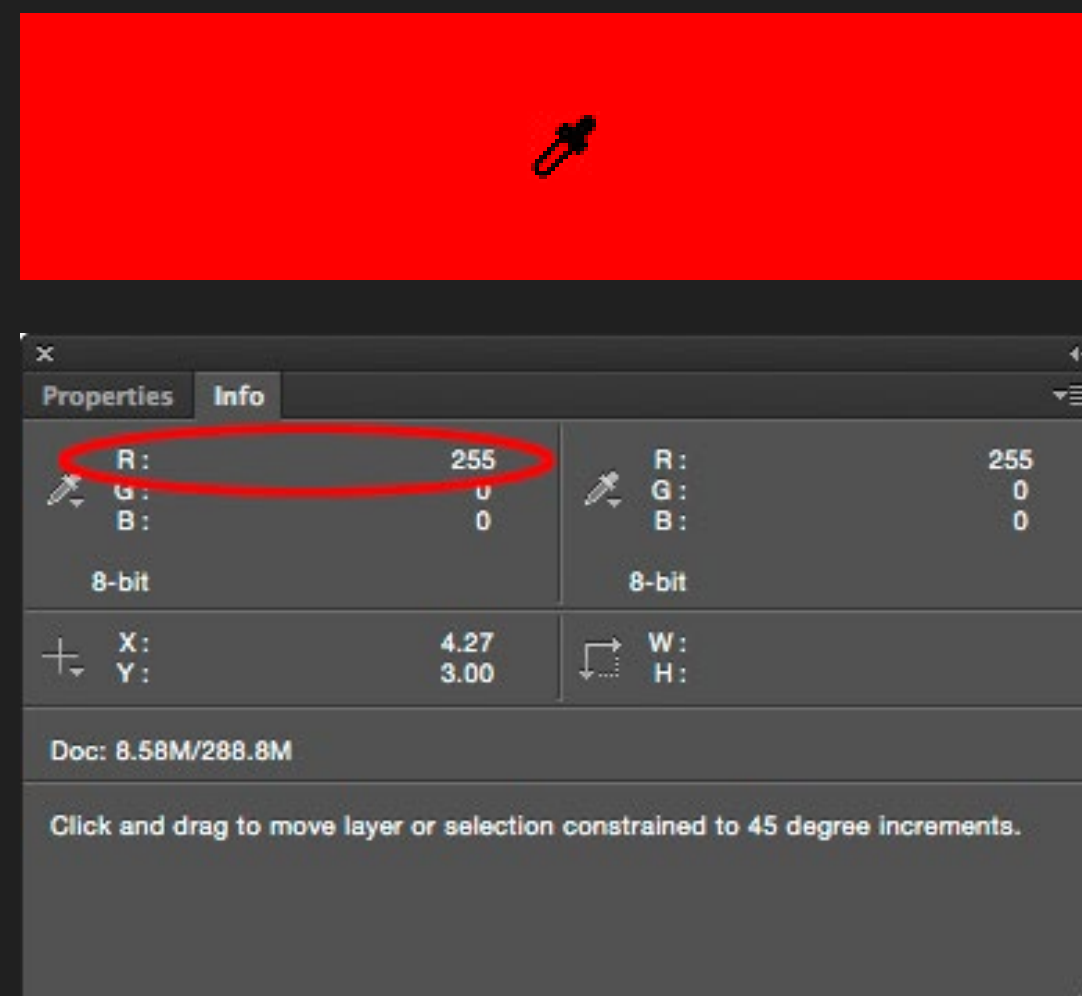
Adjustments: Moving the Curves

But let's understand how to make adjustments ourselves, from simple changes to more advanced color grading.

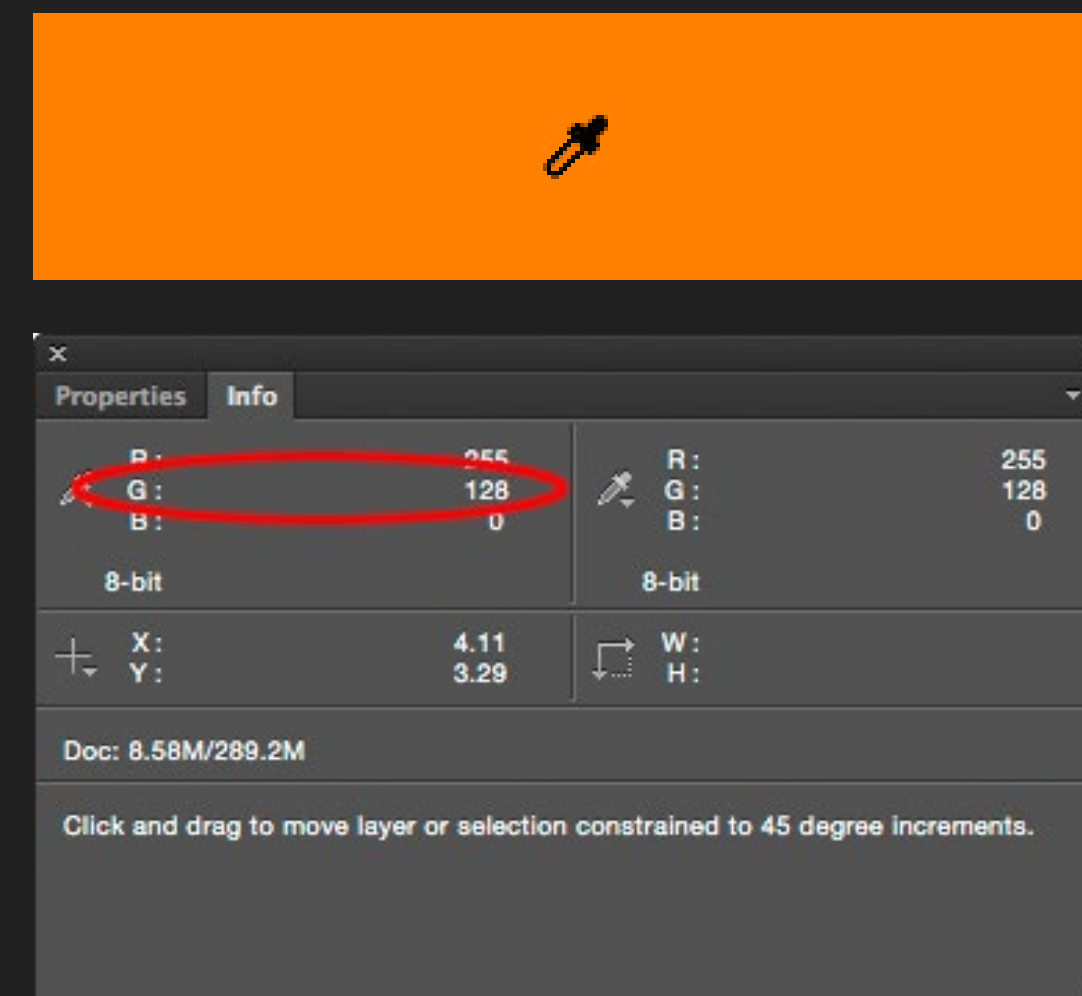
Let's say you have red and you want the red to be orange.



First, let's learn what red is.

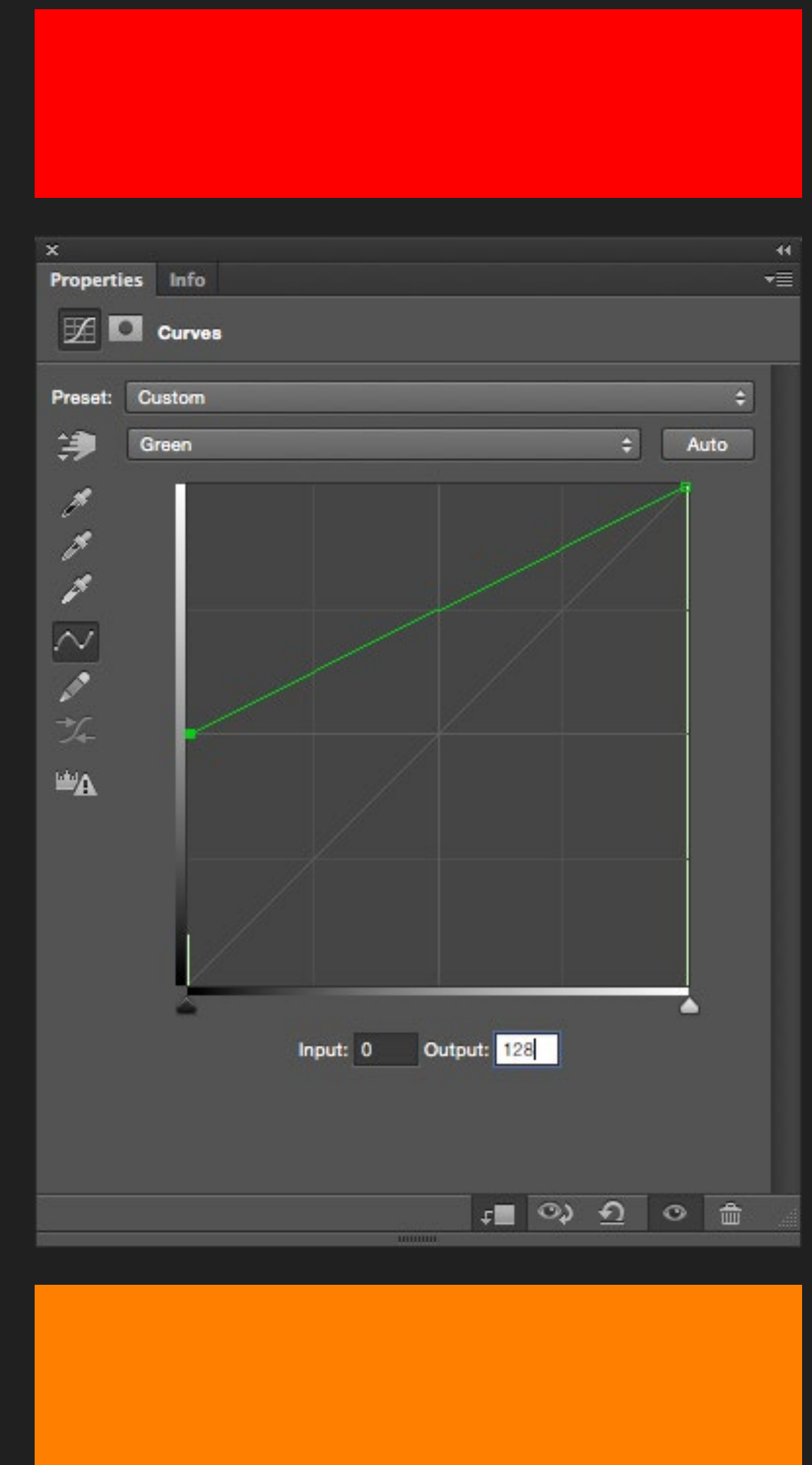


And what orange is.

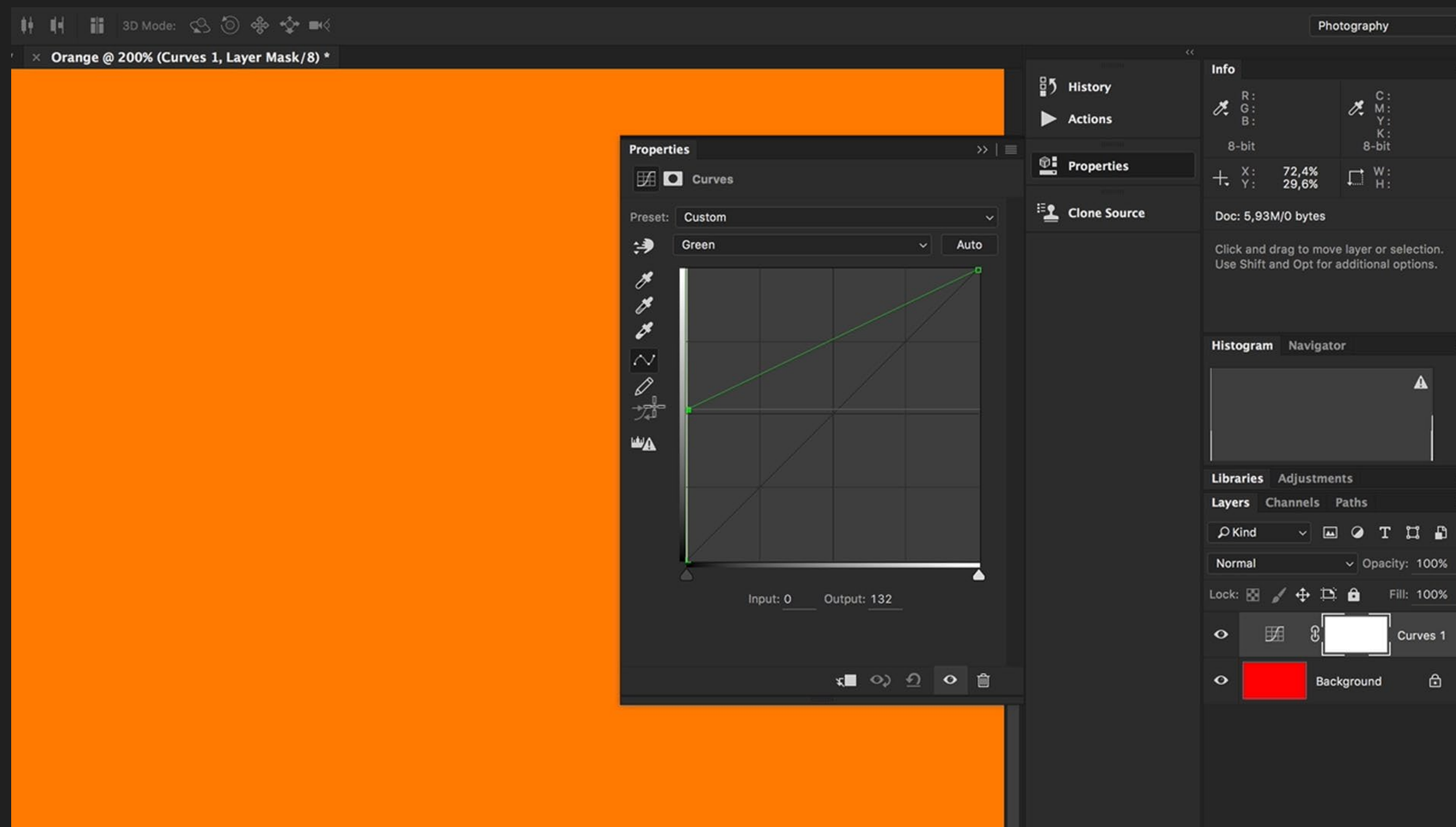


So the difference between this red and that orange is 128 points of green. Take the curve, pull up the green from the input 0, take it to input 128, and you'll get orange.

Input and output are how curves work.



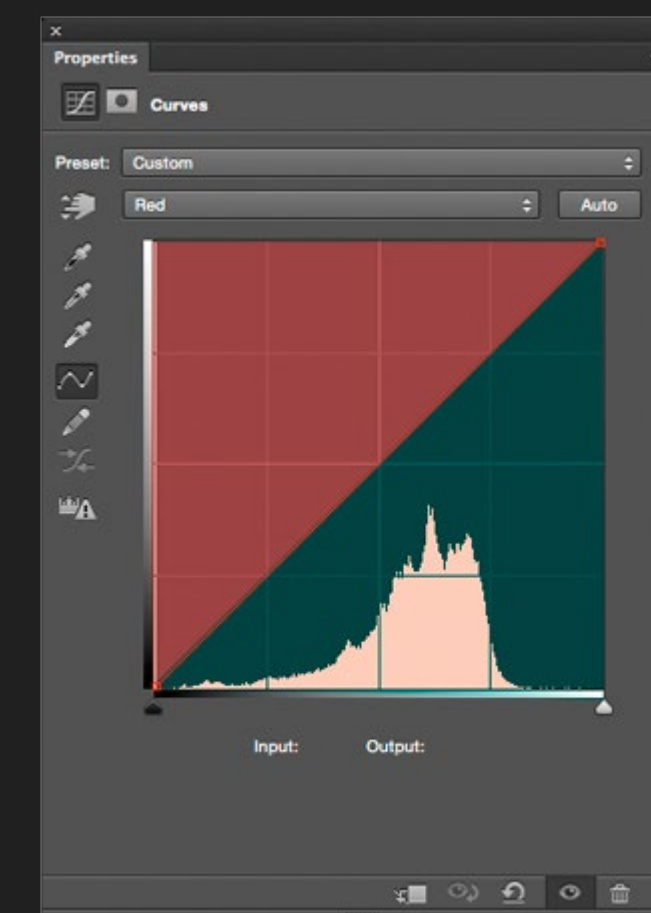
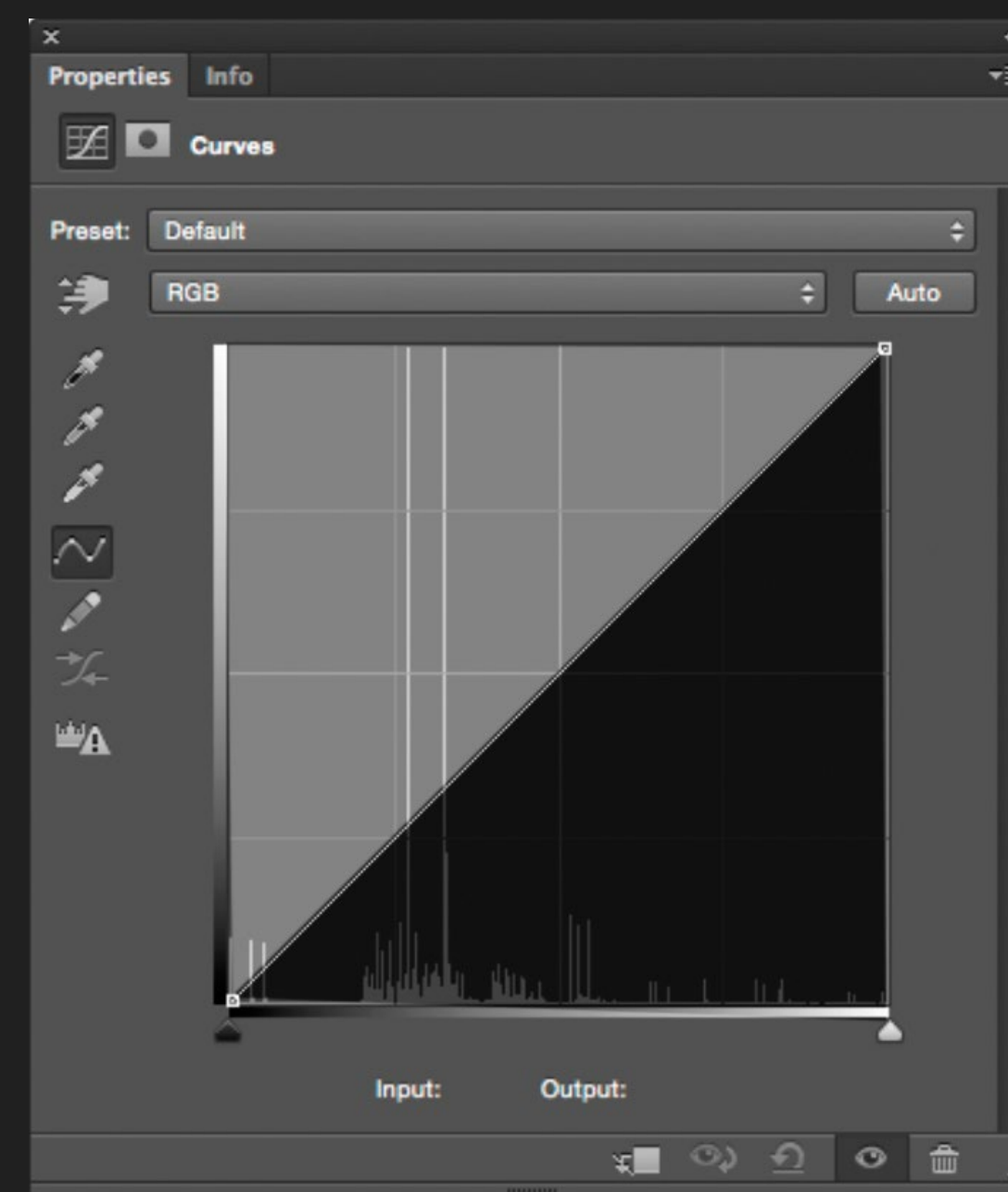
Adjustments: Moving the Curves



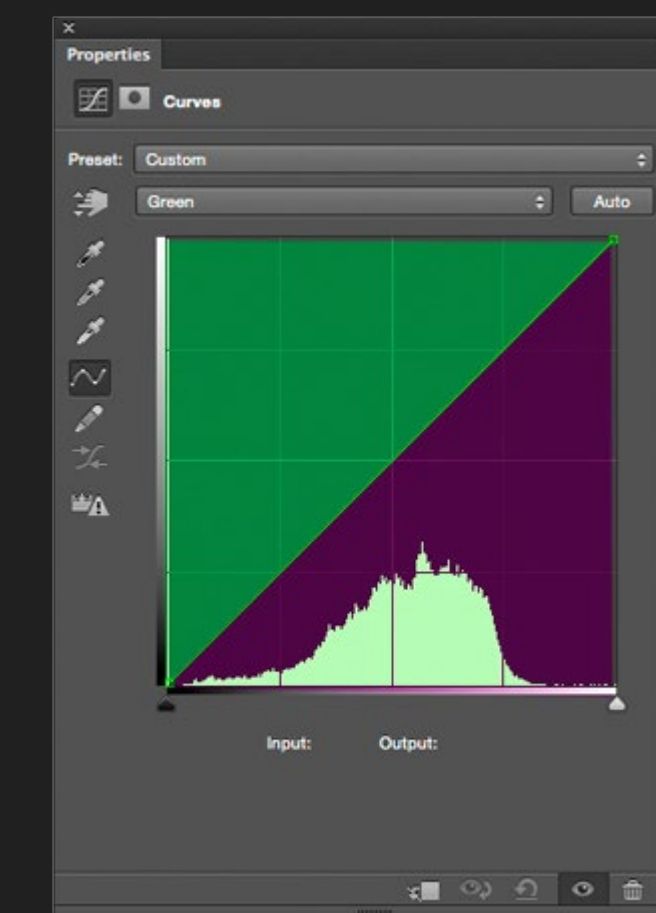
Adjustments: Moving the Curves

Let's look at this in more detail.

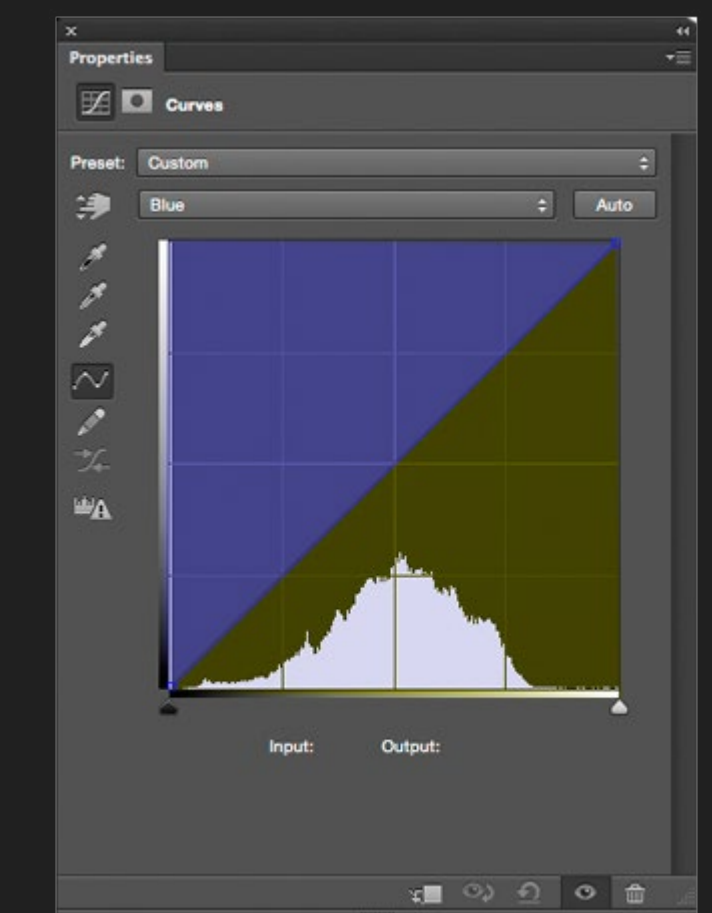
Initially, the tonal range of an image is represented with a straight diagonal line over a graphic. When working in RGB the top right represents lights while the bottom right represents shadows. The horizontal axis represents the input values (the current values in the image) and the vertical axis represents the output, that is, the values after you adjust them.



Red

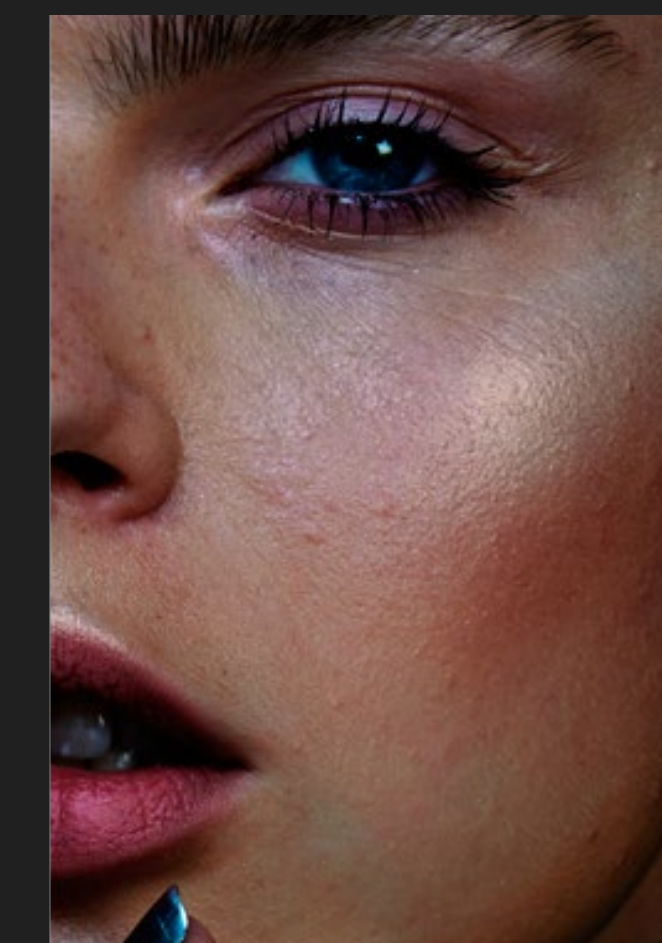
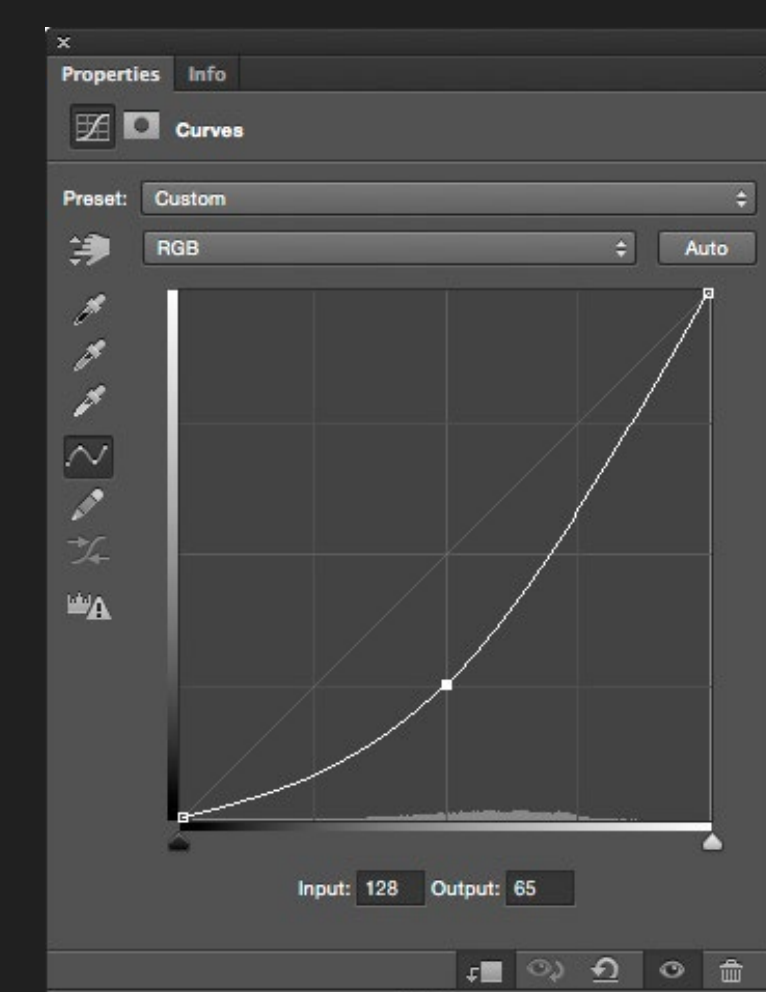
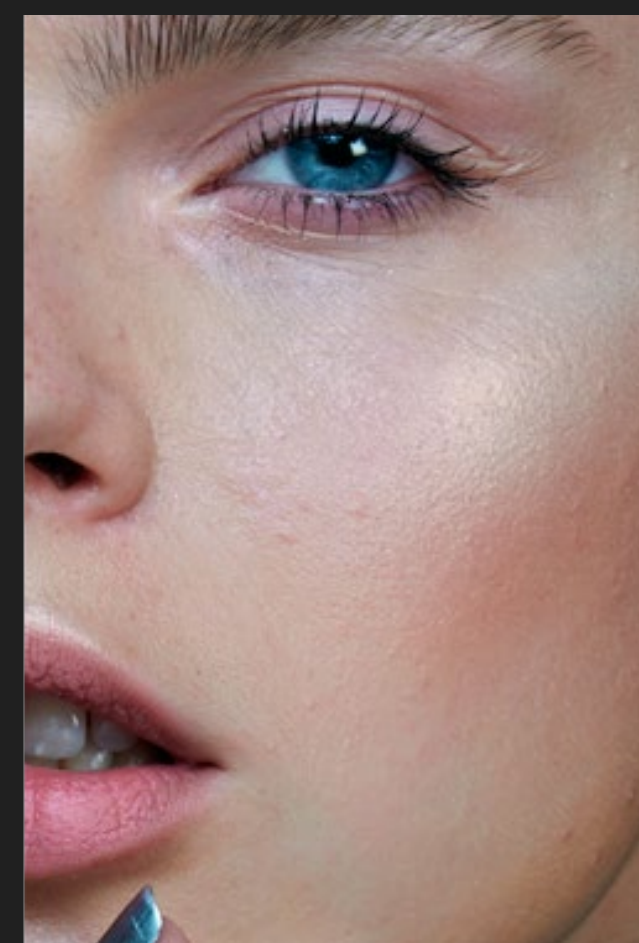
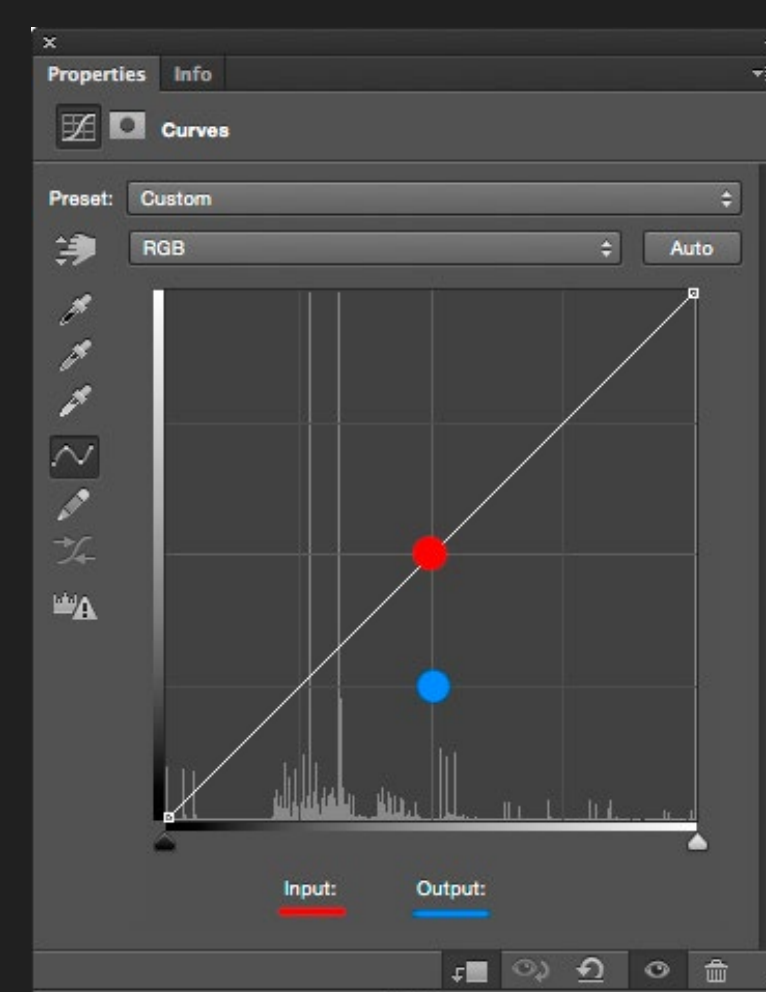


Green



Blue

The same happens with the color curves. Here's a visual representation of what happens when you move the curves:



Adjustments: Moving the Curves

And you can even see how it affects an image.

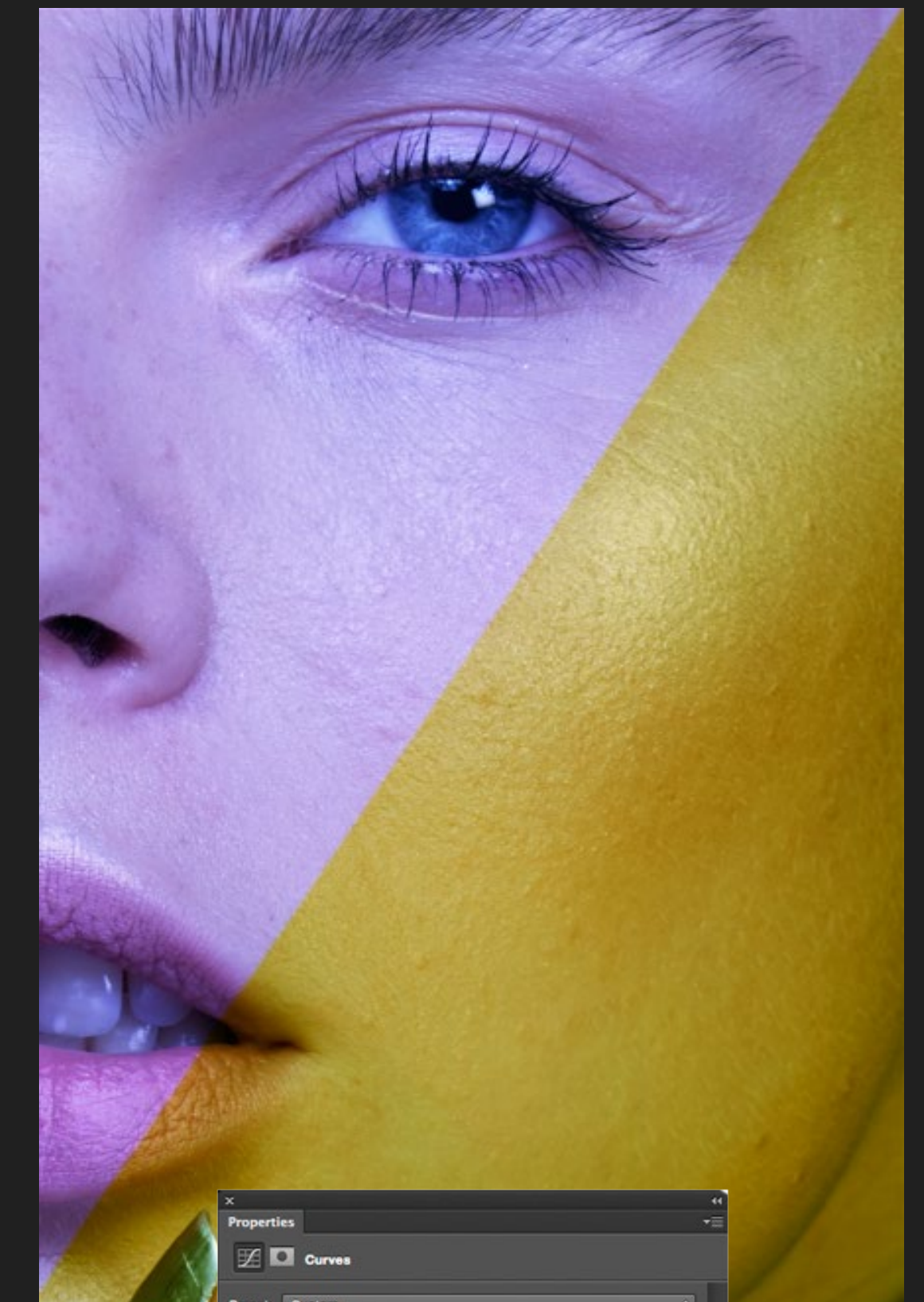
In each of these examples the color curves were pulled up from input 128 (midtones) for the top left triangle and pulled down from input 128 for the bottom right part.



Red



Green



Blue

Adjustments: Moving the Curves

Using curves you can also change the saturation, not only the hue/luminosity of colors. But let's go back to my red square. I turned it orange, but it's too saturated for, let's say, skin tones.

This part is kind of logical: if you want white you need the 3 tones in their pure state 255-255-255, so if you want gray you need 128-128-128. You had orange 255-128-0.

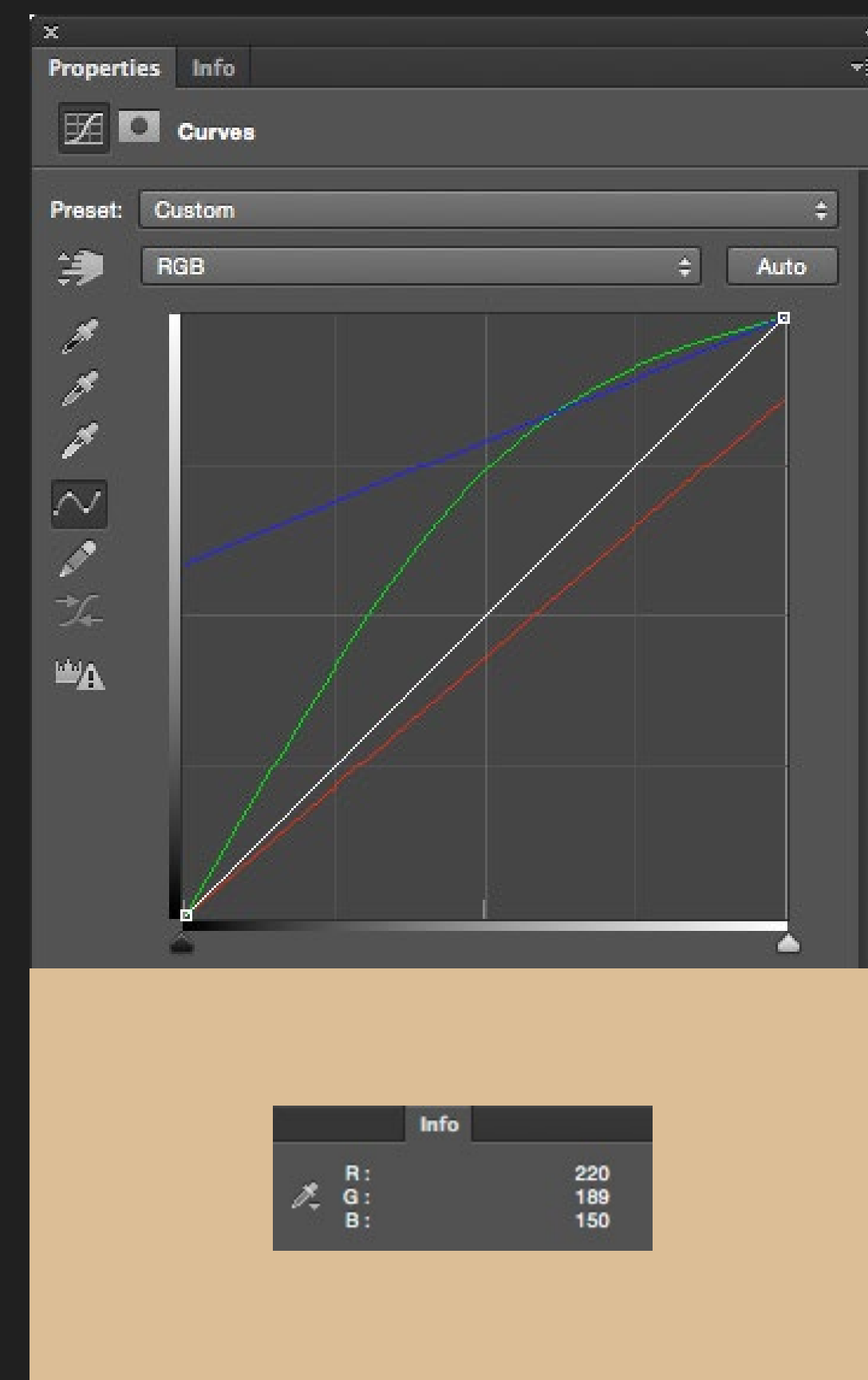
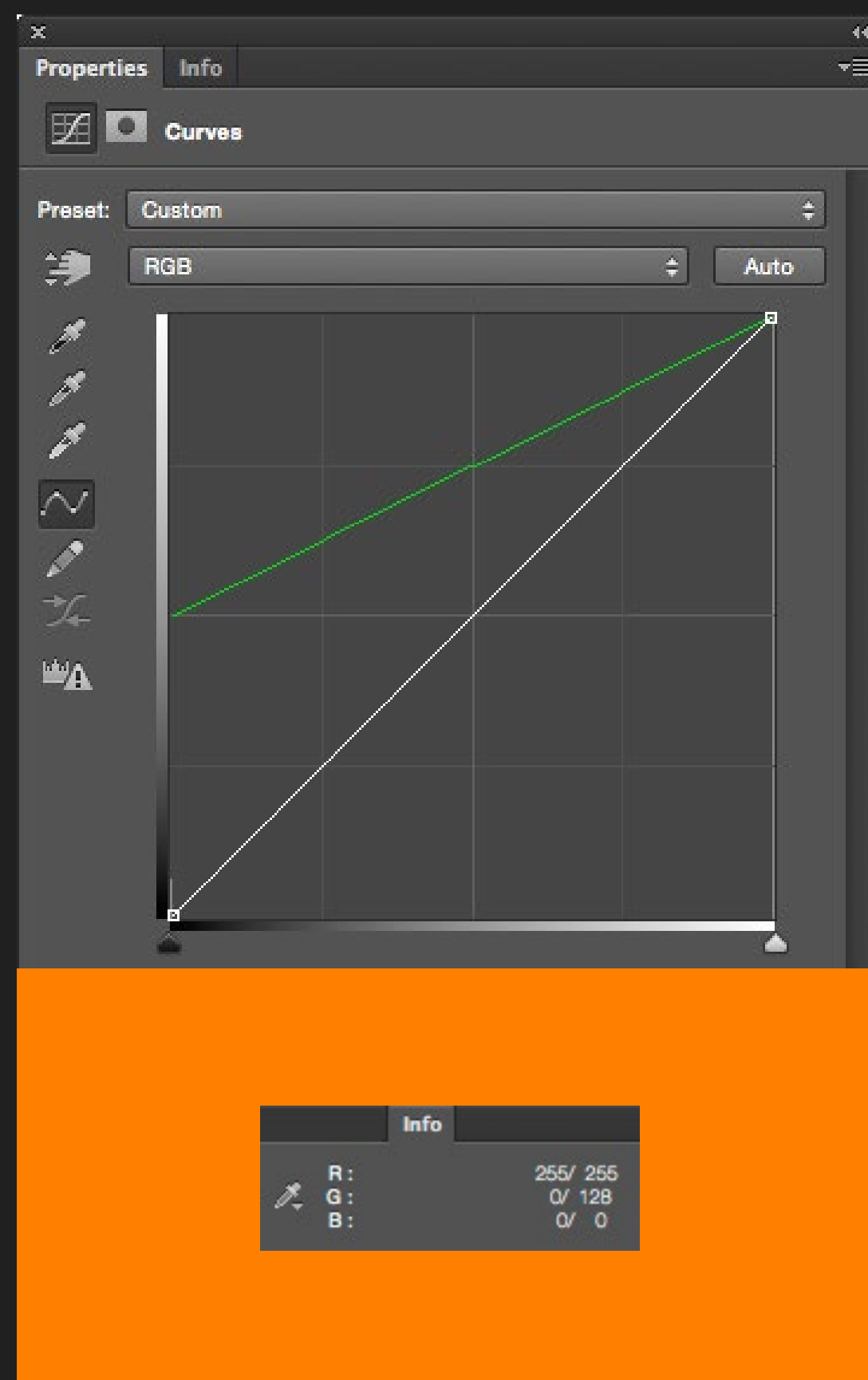
You need this orange to be brighter (closer to white) for more even values while keeping the proportions in a way that it's still "orange". Something more like 220-190-150 (approximately, this is not exact, but I'm sure it will work). The RED is starting at 255, so we need to go to the input white point (255) and pull it down to 220. The GREEN was at 128, so we go to the input 128 (midtones) and move them up to 190. The BLUE was at 0, so we need to go to the input 0 (black point) and pull it up to 150.

The result:

See? Told you it would work.

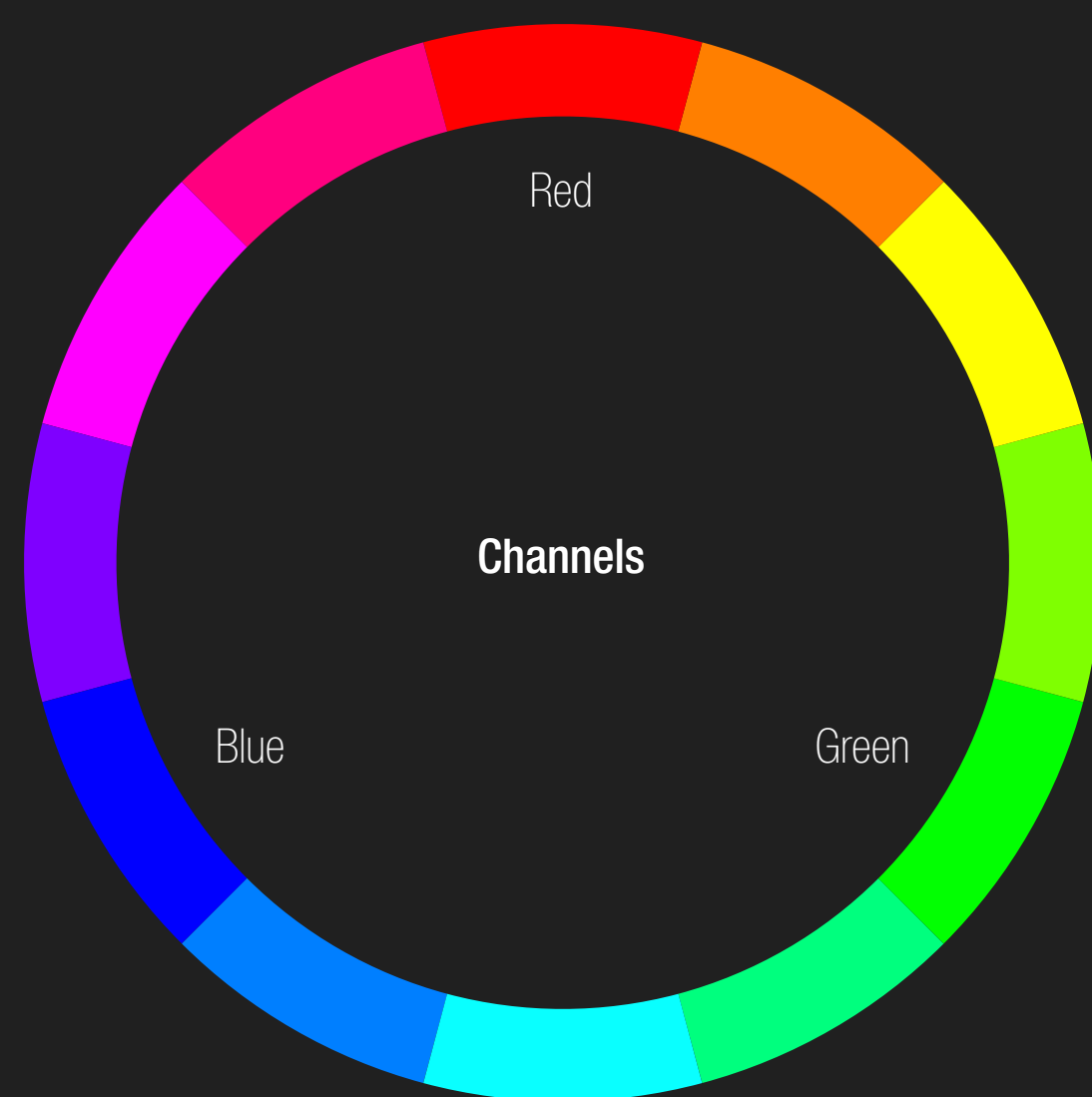
So do you need to use these numbers or know these numbers by heart to understand curves?

No, not really. Knowing the numbers is gonna make it exact and mathematical, but you can also do it by eye and use the color wheel as a base.



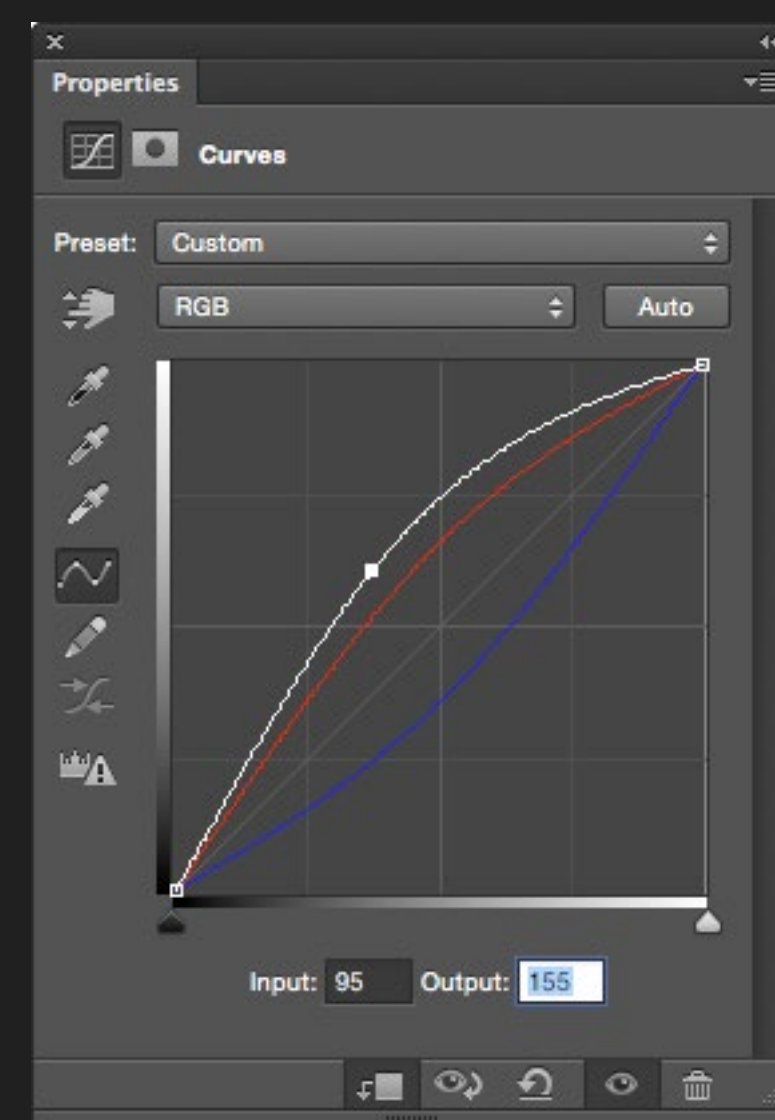
Color Wheel

We only have 3 channels (RED, GREEN, BLUE), therefore if I want YELLOW, there's no yellow curve to move and I will need to remove blue if I want yellow. Skin color is yellow and red. So If I want to turn something gray into something with skin tones I need to pull down the blue and add some red. It will probably be pretty dark, so I add some light using the RGB.



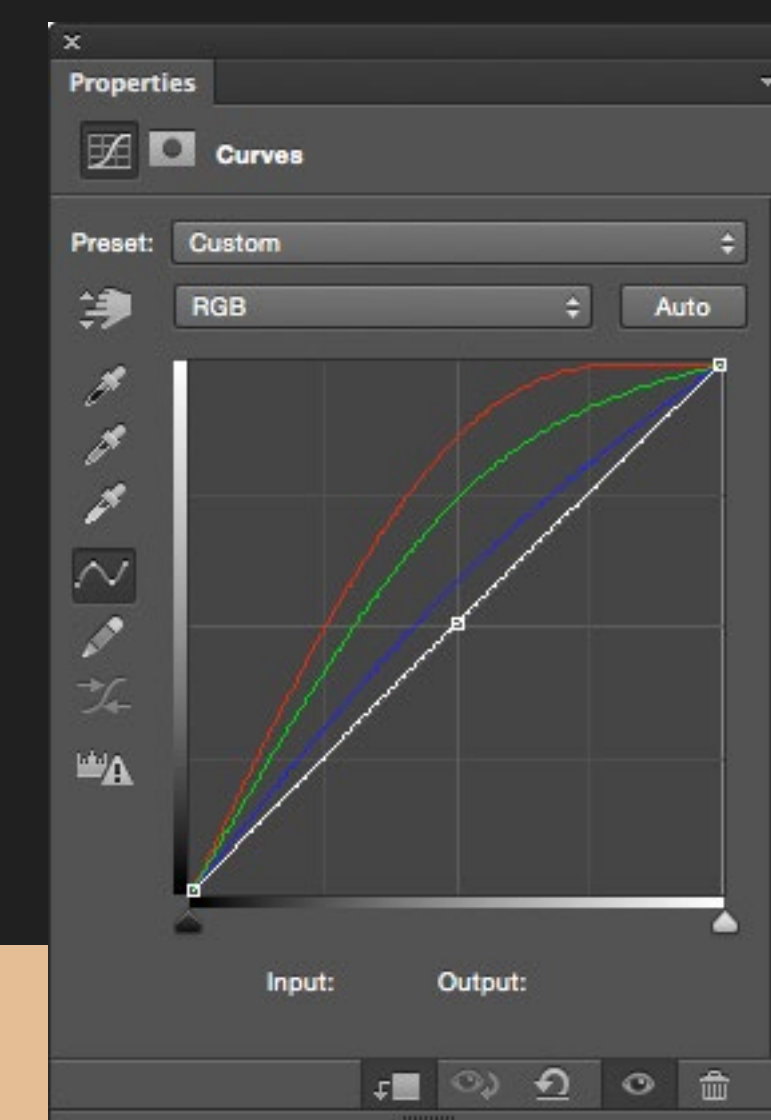
Always start from the input of 128 because that's gray.

You can see this as you go without knowing any of the numbers. You do need to know your color wheel though.



But . . . didn't we just use another curve to do the skin tones with the even values and all that?

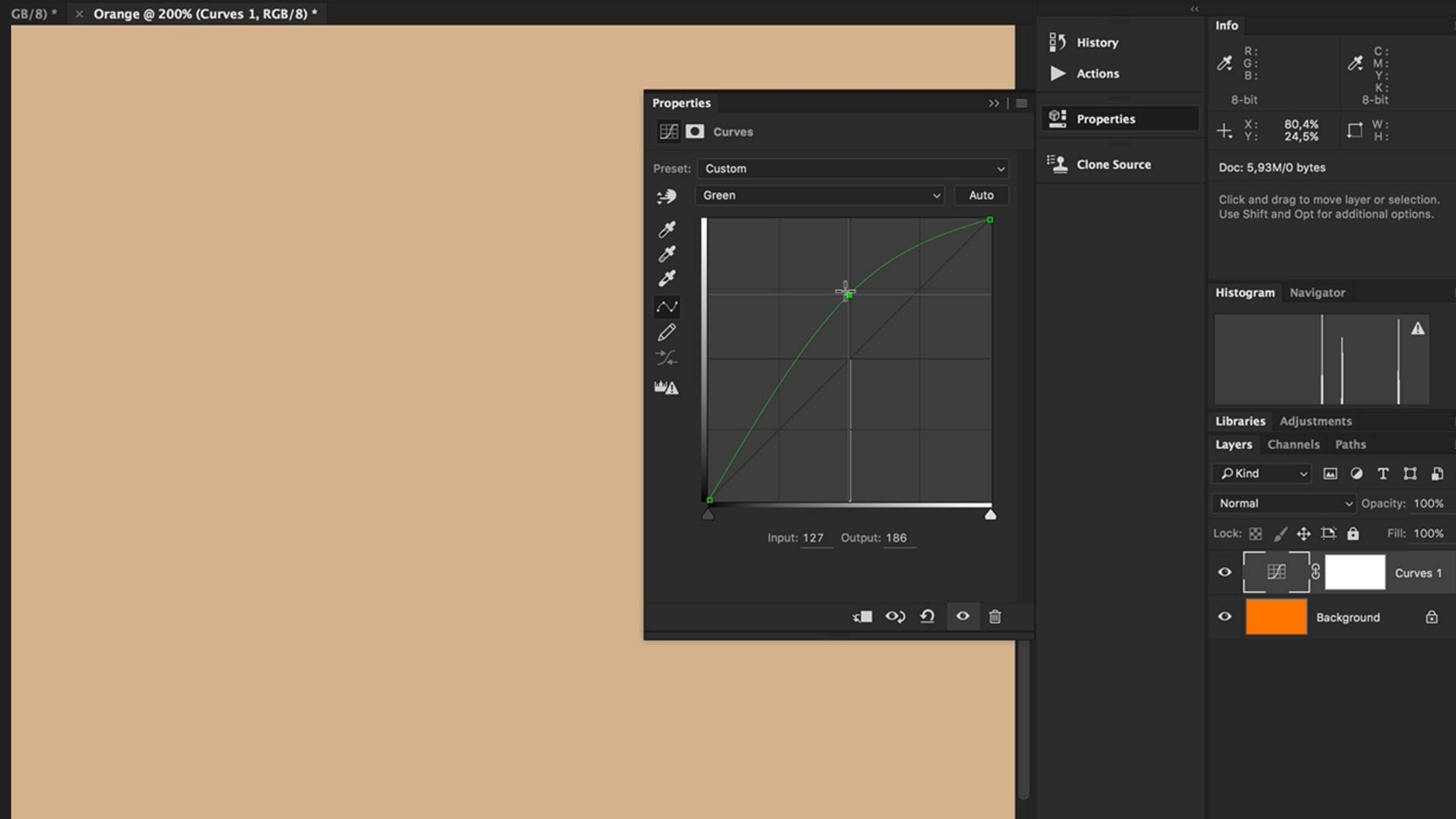
Yup! And that's the beauty of curves: it also works! Different curve, same result...



This last one has a mathematical base because it was thought out from color numbers, while the previous one is pure color knowledge: "well... if I want to do skin color then I need red, yellow and light".

Both ways work as long as the theory behind the thought process is correct.

Skin Tones



Colors

Let's change more colors and forget the numbers a bit. Let's go from black to skin tone. Evidently we start from the input of 0 now because we are trying to change black. Also consider that I'm starting from black — a complete lack of color — 0-0-0. So my previous idea of turning the blue down doesn't help me much here. I need to pull the green up.

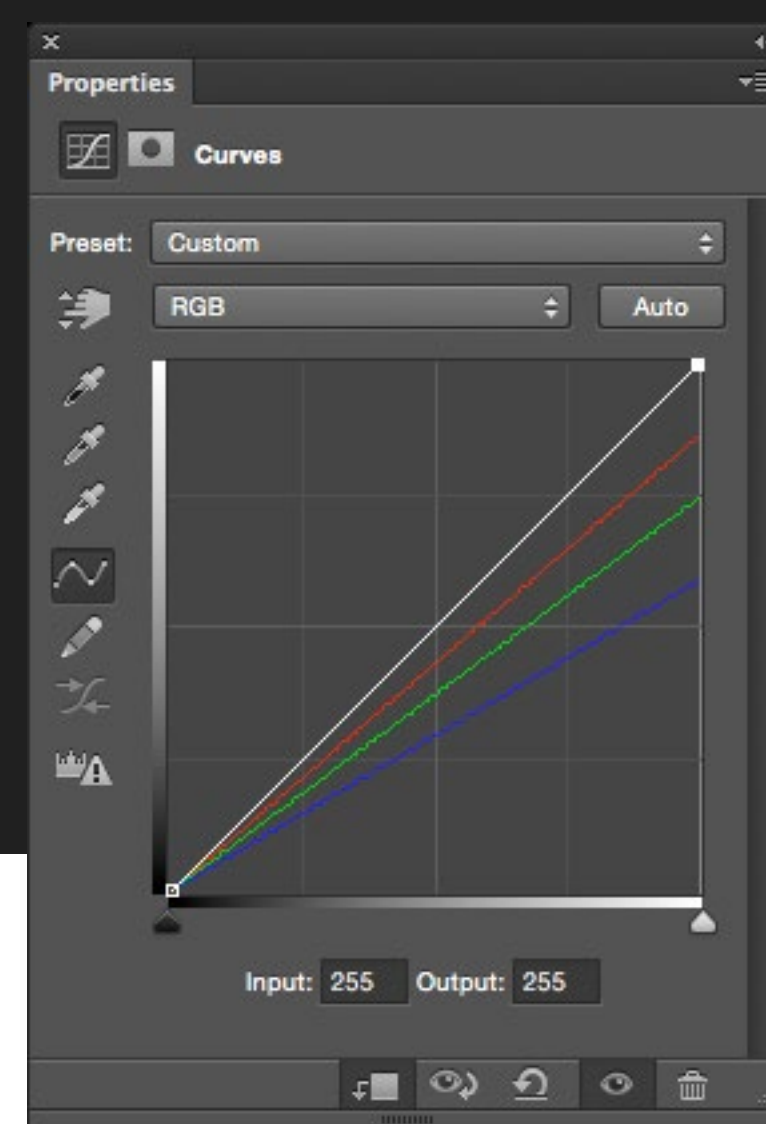
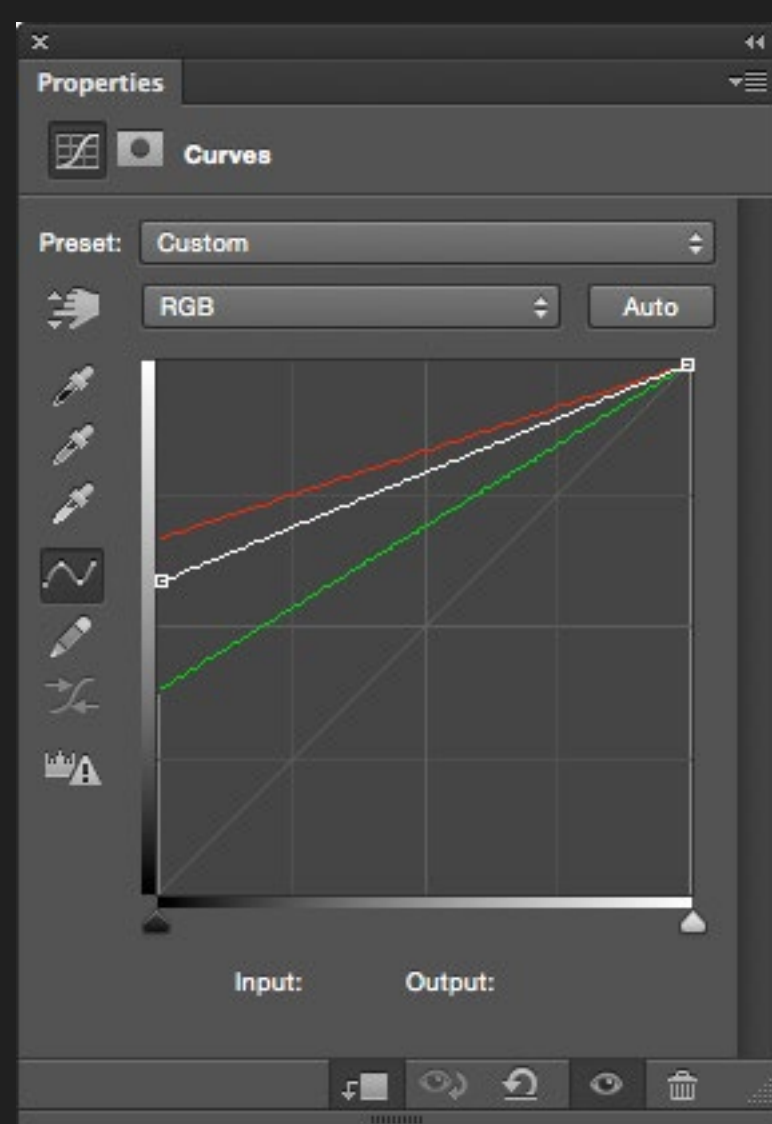
When changing whites, again, I need to change the input from where I'm starting. I can't alter the midtones or black point since that wouldn't change the image at all. Now I need to start from the white point, 255-255-255. I can't add light because it's already the brightest it can be so I need to reduce the tones while keeping the proportion.

Well... Now you know how to change whites and blacks and midtones.

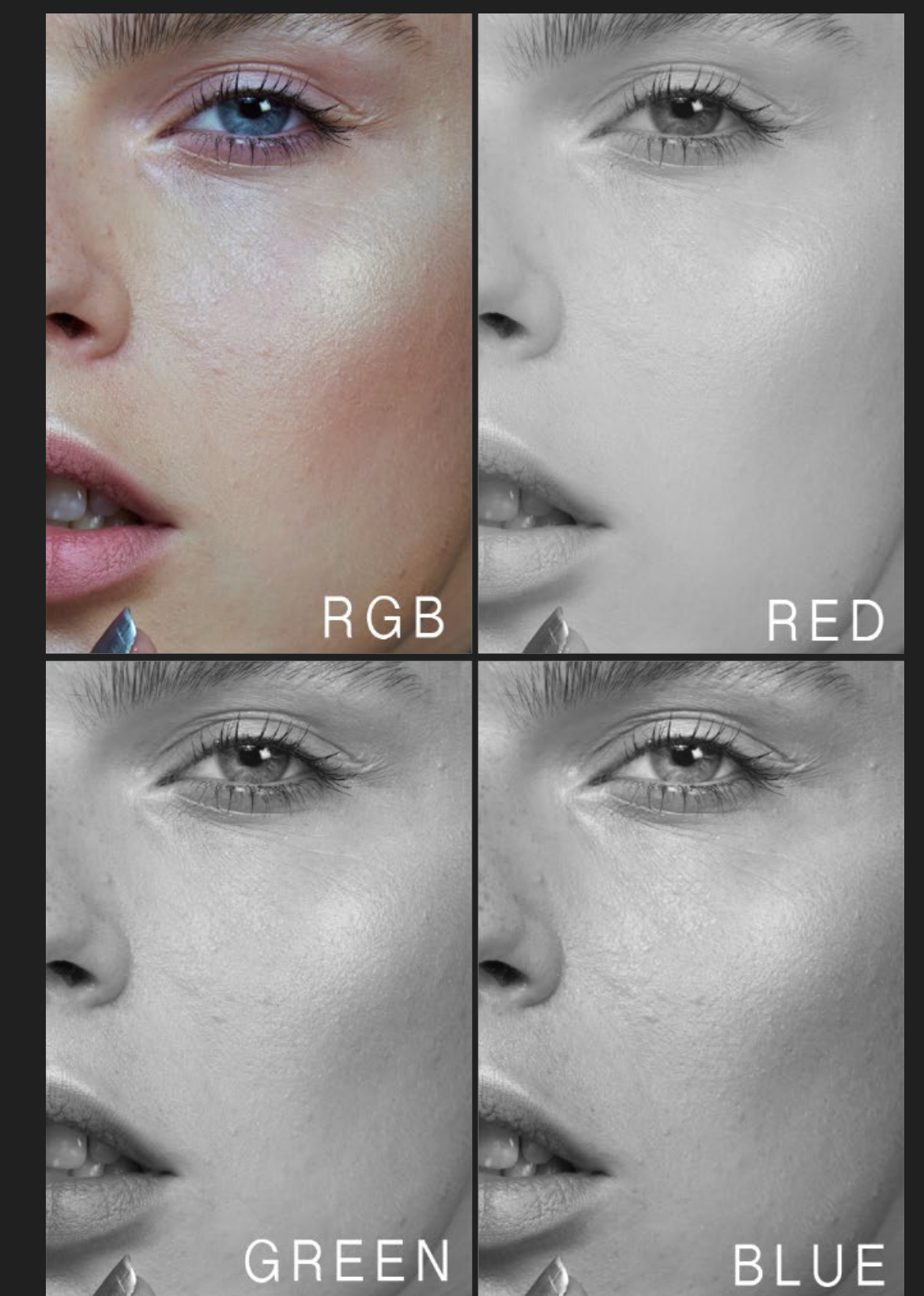
Now that we know what happens to white, gray and black, let's move on to colors.

An image is regularly made up of neutral tones.

It's also common that images have mostly even channels, usually within the midtone range.



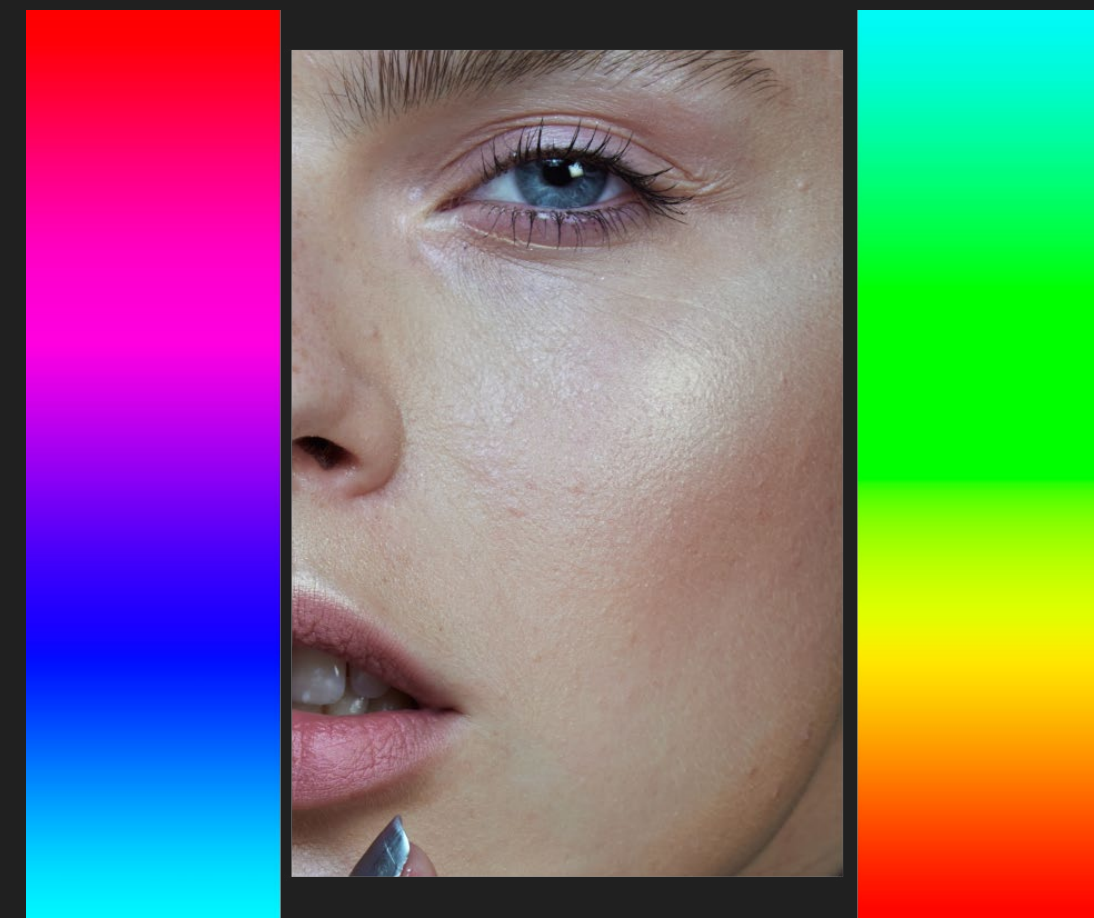
In this visual everything that is not gray (lights and shadows) is black and everything that is midtone has been filled with 50% gray. A good way to select midtones is to use "Color range" in the "Select" menu: it has an option to select only midtones.



Colors

This means the image will change (be affected) when making movements on curves from the midpoint (128 input value).

However, this isn't always so, sometimes we have parts that are too dark, too light or too saturated, and we need to understand how the color curves work in these cases as well.



These colors were purposely chosen to have 100% sat/lum so they would create uneven channels.

Let's see how the channels look in these mostly pure tones.

MOSTLY BLACK AND WHITE – with little midtone.



Red

Green

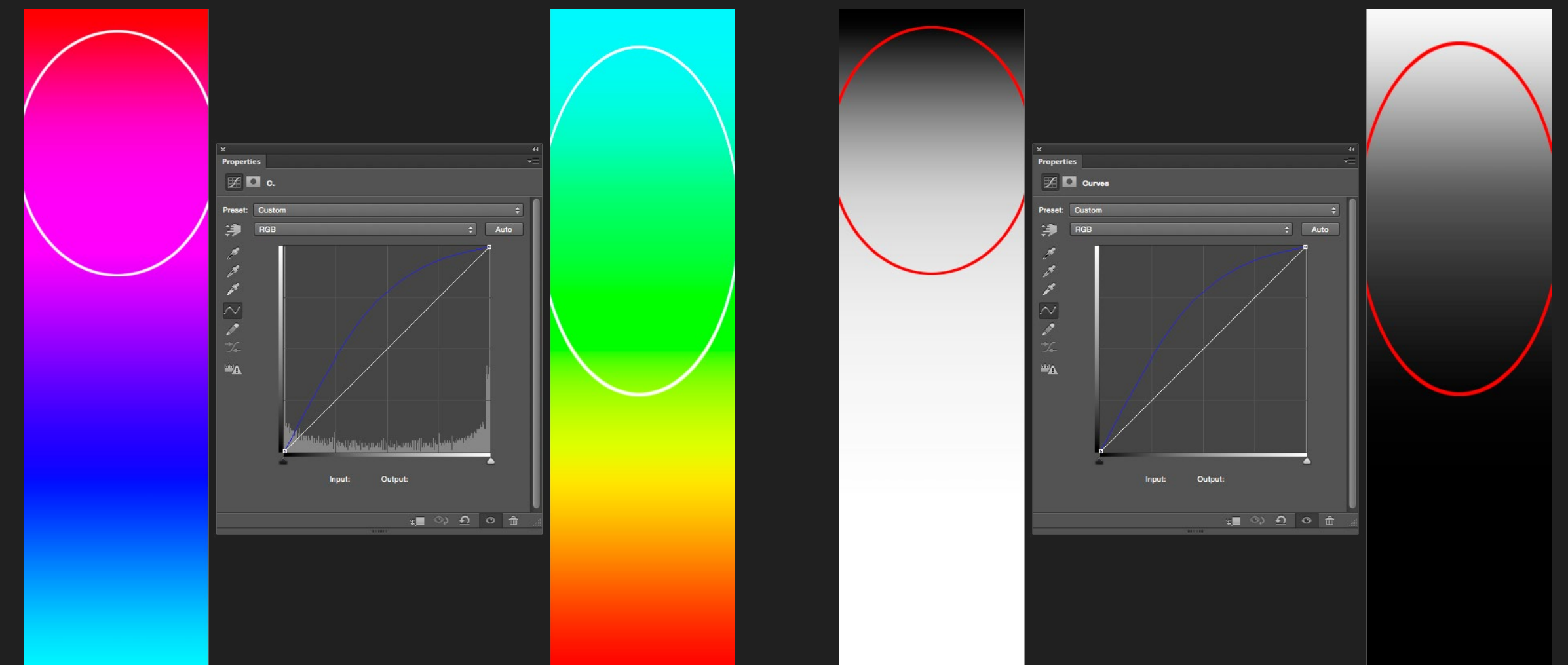
Blue

Colors

It is important to understand that since each color is mostly white or black, it will not be affected by a movement of a curve from the middle tone. By being mostly pure colors, each of them will have a 255 value in one or two of the 3 colors and a 0 in the other one, so the channels generally will be almost black/white with little midtone range.

Looking at channels will help us know from where in the curve you need to make the moves. This is only necessary at first, because after a while you will get used to “perceiving color in channels” and you no longer have to look at them to know what they look like.

To understand this visually: if I apply a blue curve from the midtones it will only affect areas of the image containing gray in the blue channel.

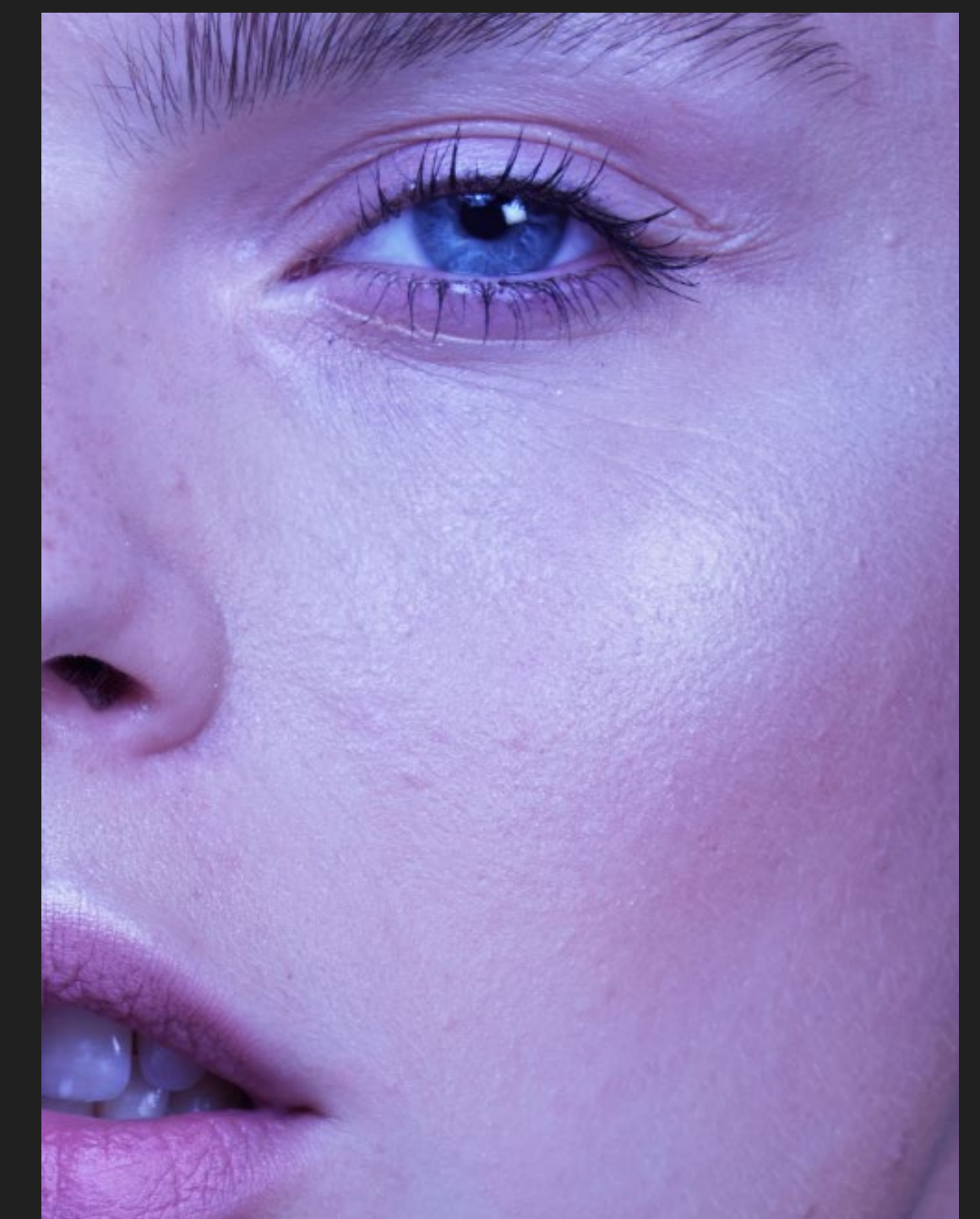
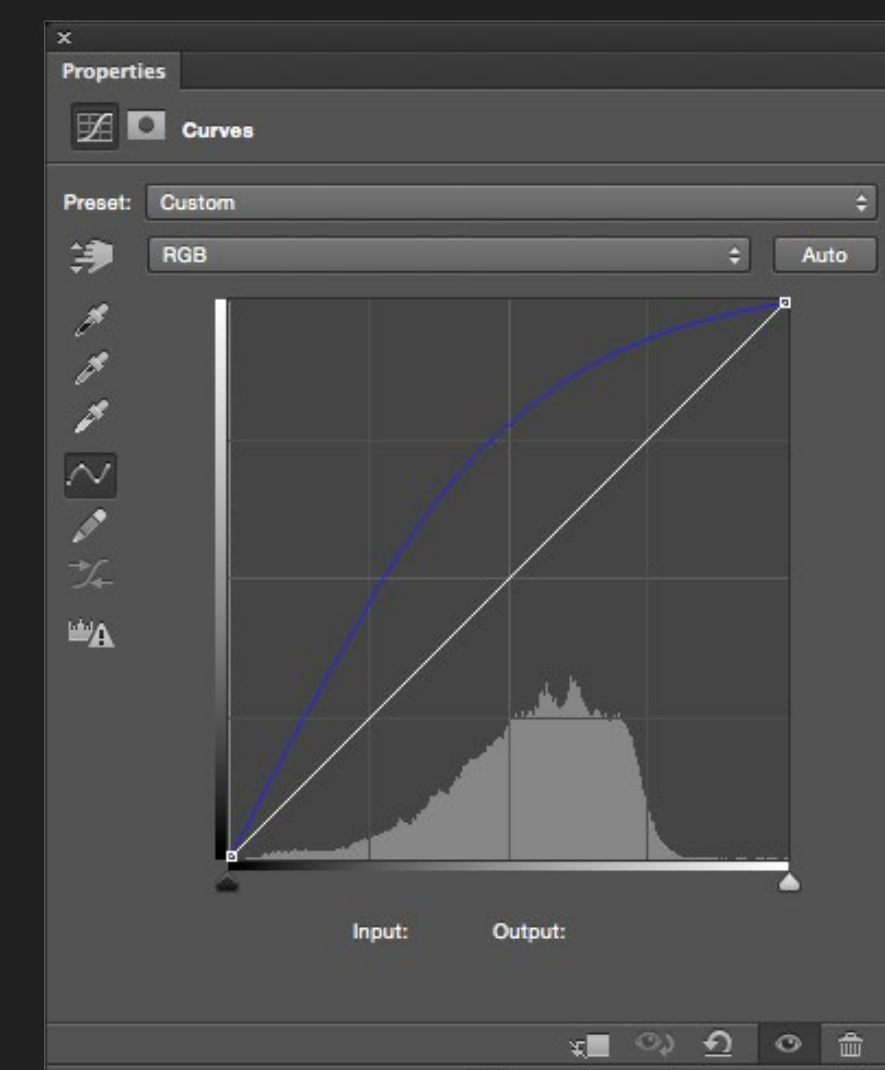


When a channel is WHITE and you move the curve from the midtones nothing happens.

When a channel is BLACK and you move the curve from the midtones nothing happens.

When a channel is GRAY, it means most of the image is mostly within the range of midtones, so if you move the curve from the midtones it affects MOST OF THE IMAGE.

So when I alter the curve, the effect of that curve will affect most of the image as well because the channel is mostly gray.



Brightness

Another thing to take into account is this: when we change the colors in an image from the ends (white or black input), we will be changing the apparent brightness of the image and its depth.

We have to keep this in mind when making changes: not only will the image be bluer, it will also be brighter. If we make the changes from the black or white point, the image will gain or lose contrast as well.

Practice with an Image

Let's see how we can use what we have learnt to actually work on an image. This model seems to have a lot of redness around the eyes.



But it's not really red, it's more like pink.

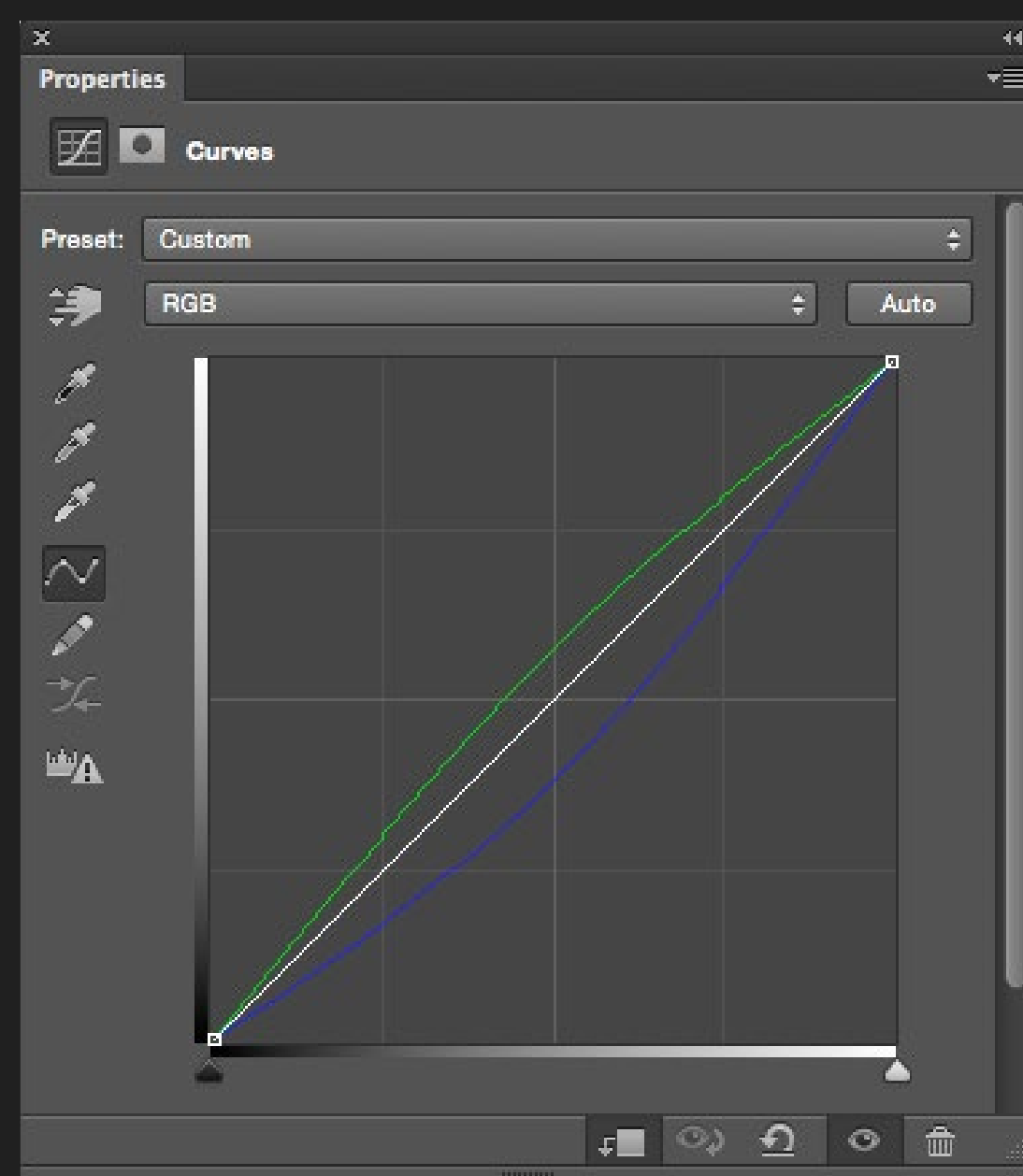


And I want that pink to be orange.



Practice with an Image

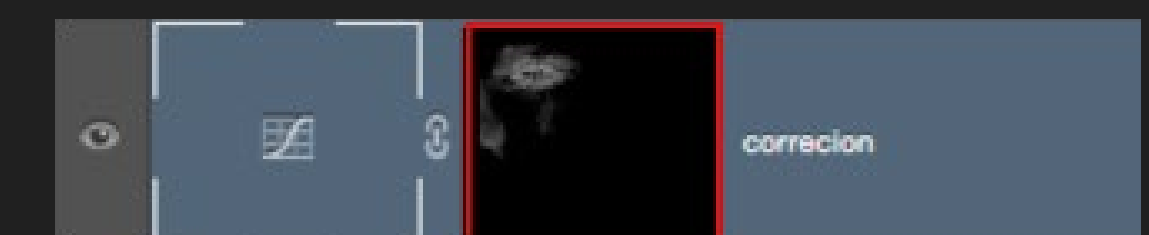
So starting from the midtones (remember: our image had mostly gray tones in the channels), I can take some blue out and add a bit of green, then use a mask to constrain the correction and with this curve neutralize the redness without losing saturation and keeping the area with the original tonal variations.



When you use saturation or paint on an empty layer or any other correction that implies one flat color, you will lose naturalness.

With curves, it's a lot better.

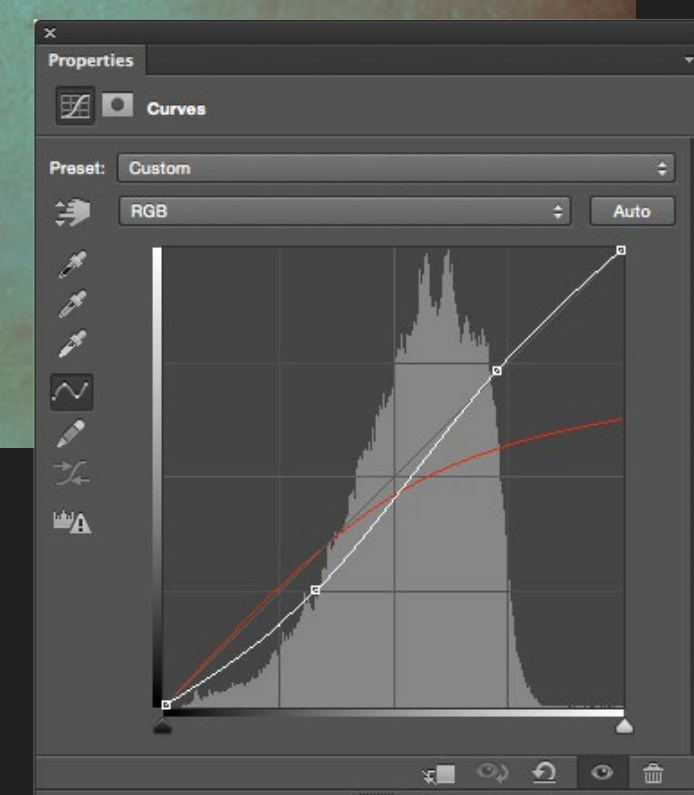
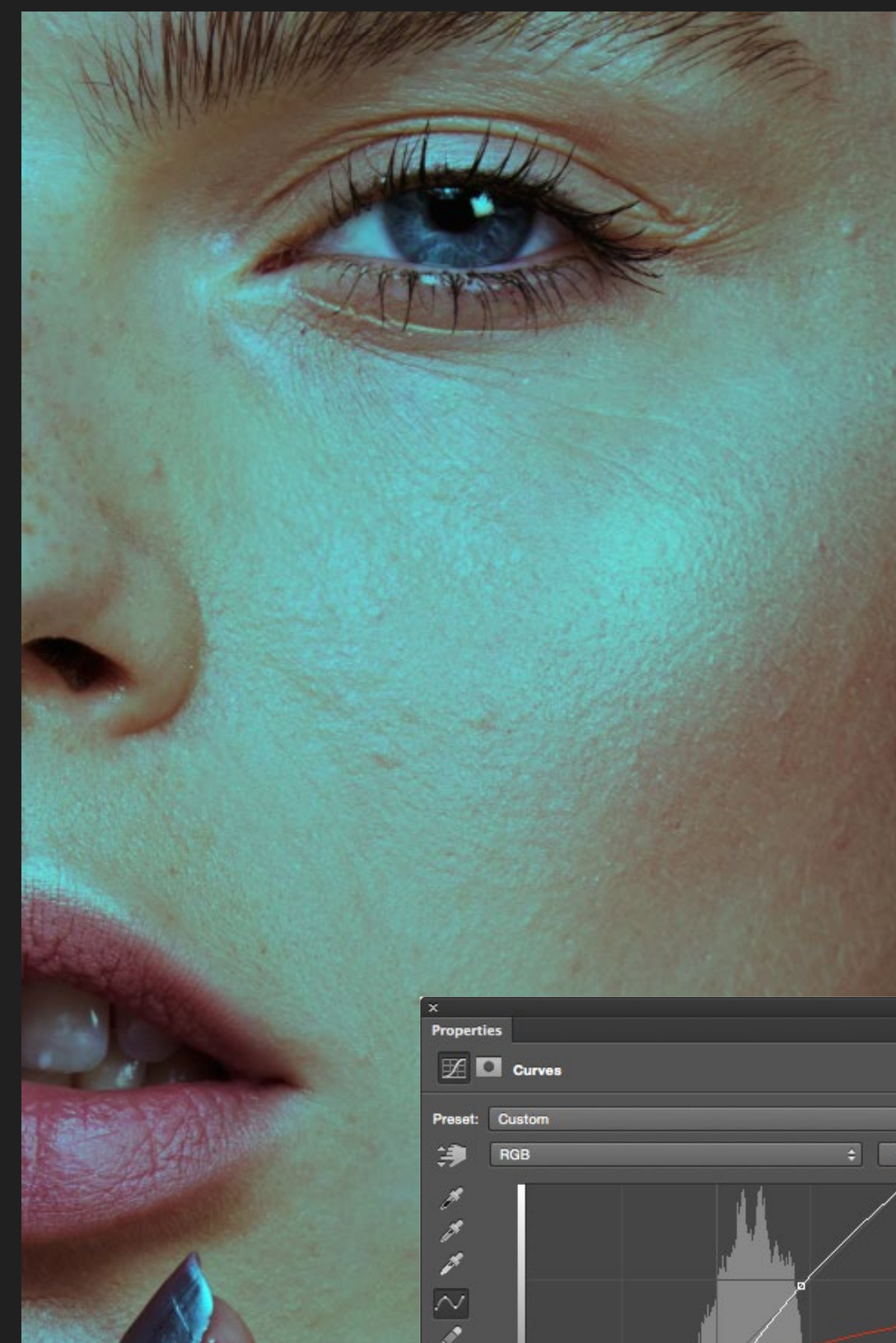
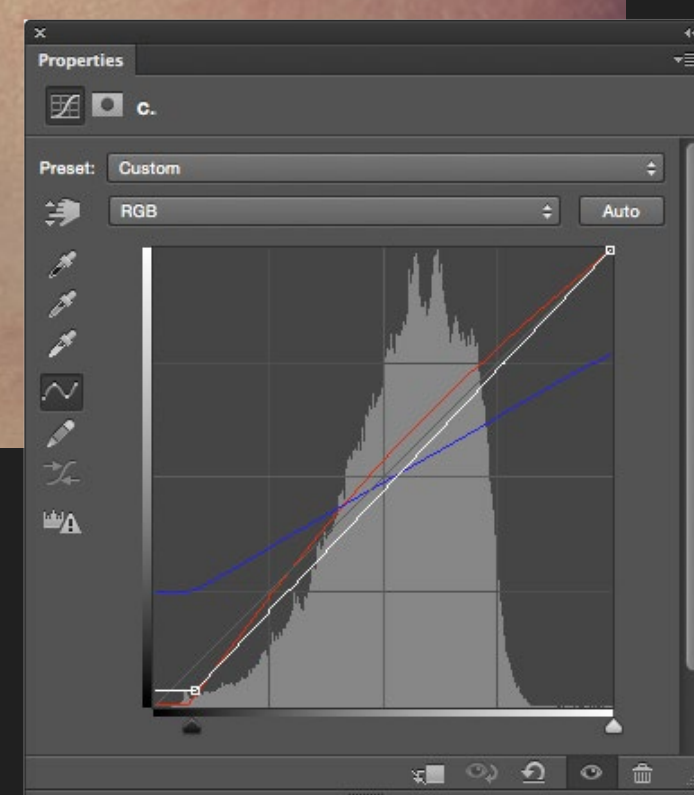
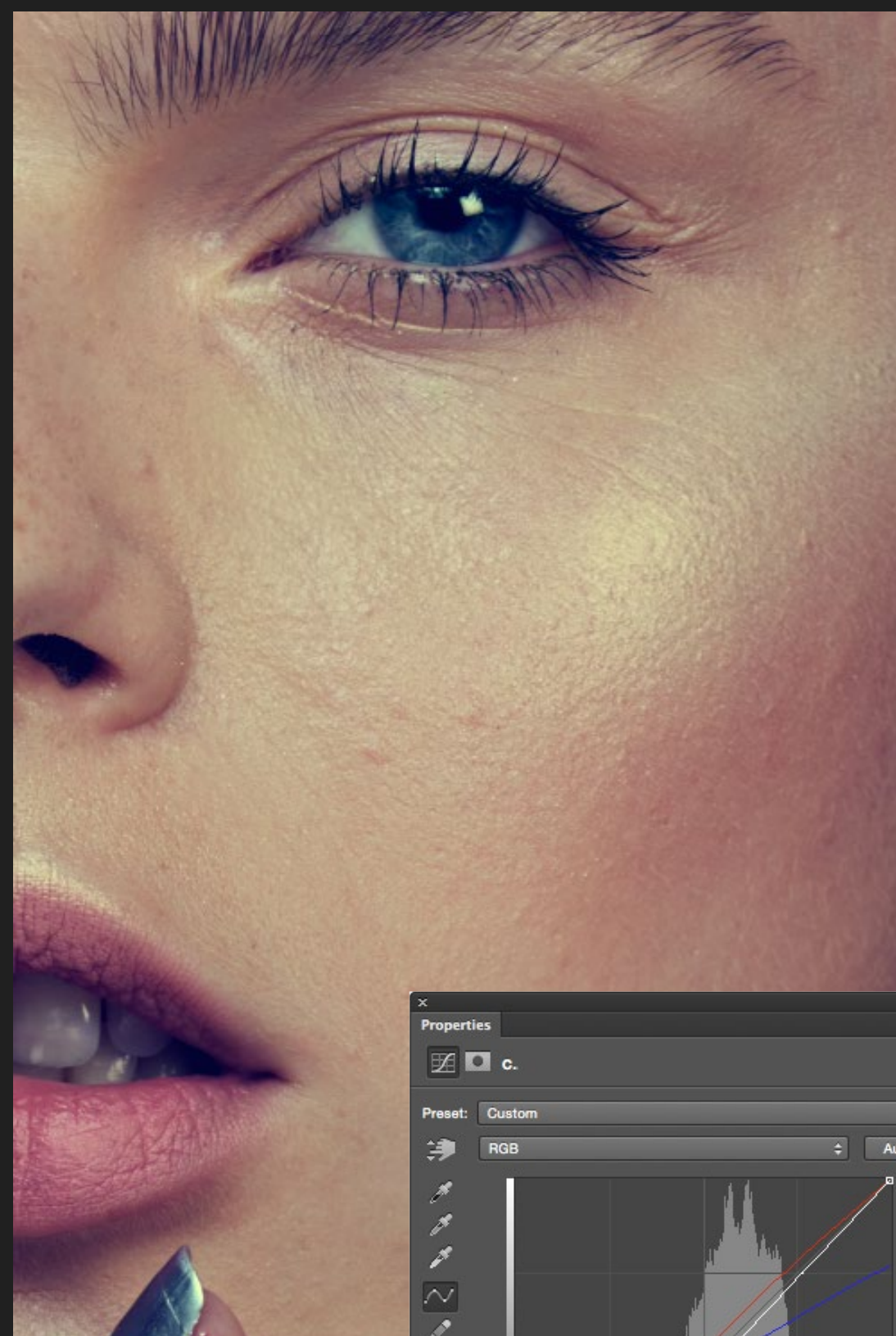
Like this you can do all sorts of corrections, always taking into account the RGB wheel for the relation between colors.



The mask was created to exaggerate the pink with a saturation adjustment in conjunction with a black and white adjustment to enhance the difference further and then using channels to extract it.

Creative Changes

With curves you can also do creative changes. Very popular examples are the split tones, since the human brain is very keen on complementaries.



But most of the times, we have a reference in mind. Sometimes it is a clear one, such as another image. I've decided to use a non-traditional reference that came up in my retouching group.



The way to match references is to learn to see. Understand what to look for in references. If the thought process is organized then it should be easy and fast (after years of doing it, of course).

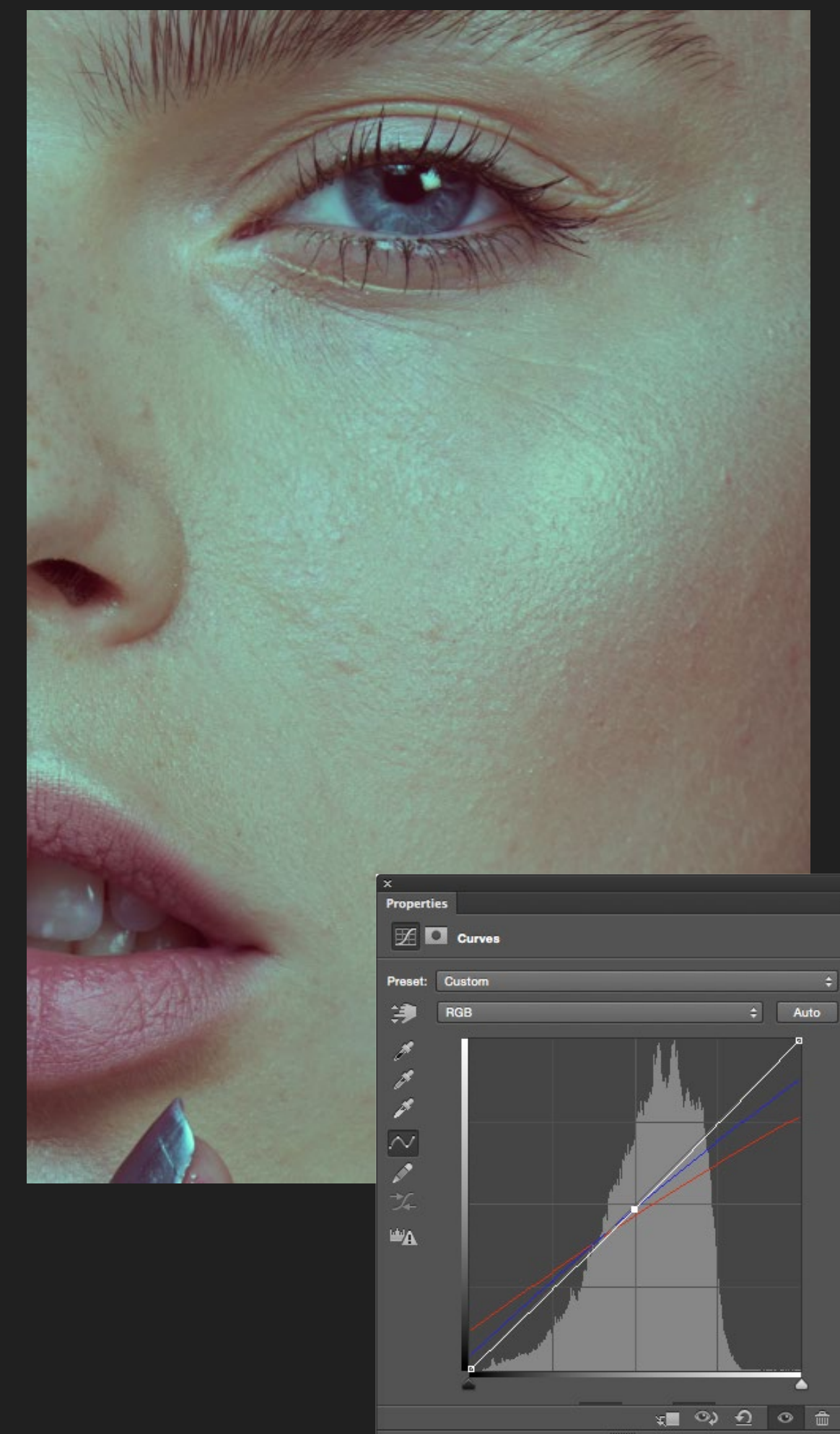
Creative Changes

The main issue is to know where to look and what to look for. My brain is already fully programmed to think in “curves”, therefore my mind immediately asks a few questions:

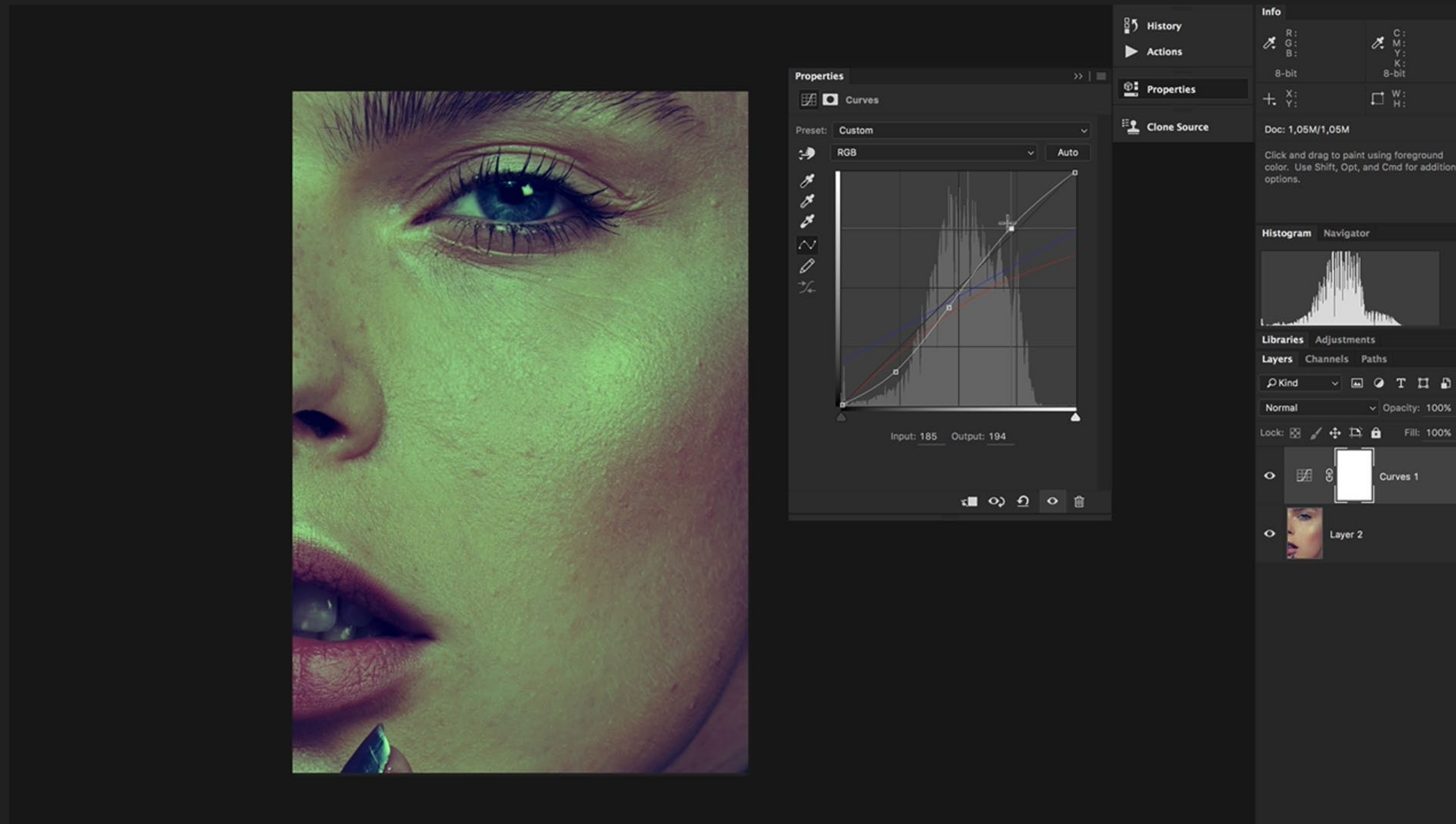


1. How wide is **the range** between the highlights, lights, midtones, shadows and black point? How much contrast does the image have? In the case of this reference, the contrast is quite low, with the exception of a few highlights.
2. **The highlights:** do they have a tint? Which one? Are they pure white or grayish? The lights are definitely not white (with the exception of those few highlights) and have a green tint for sure.
3. Do **the blacks** have a tint? Which one? Are they pure black? Blacks are not even close to being pure black and usually have a lot of red.
4. What happens in **the midtones**? Having little contrast and complementary colors in highlights and shadows in this reference generates a neutralized appearance of midtones.
5. What about **saturation**? Is there a lot? A little? Where? In this case there is not much saturation in general while both LIGHTS and BLACKS are very saturated.

As you can see in the result, everything you can do in Photoshop you can do with curves because it controls the primary (additive) colors.



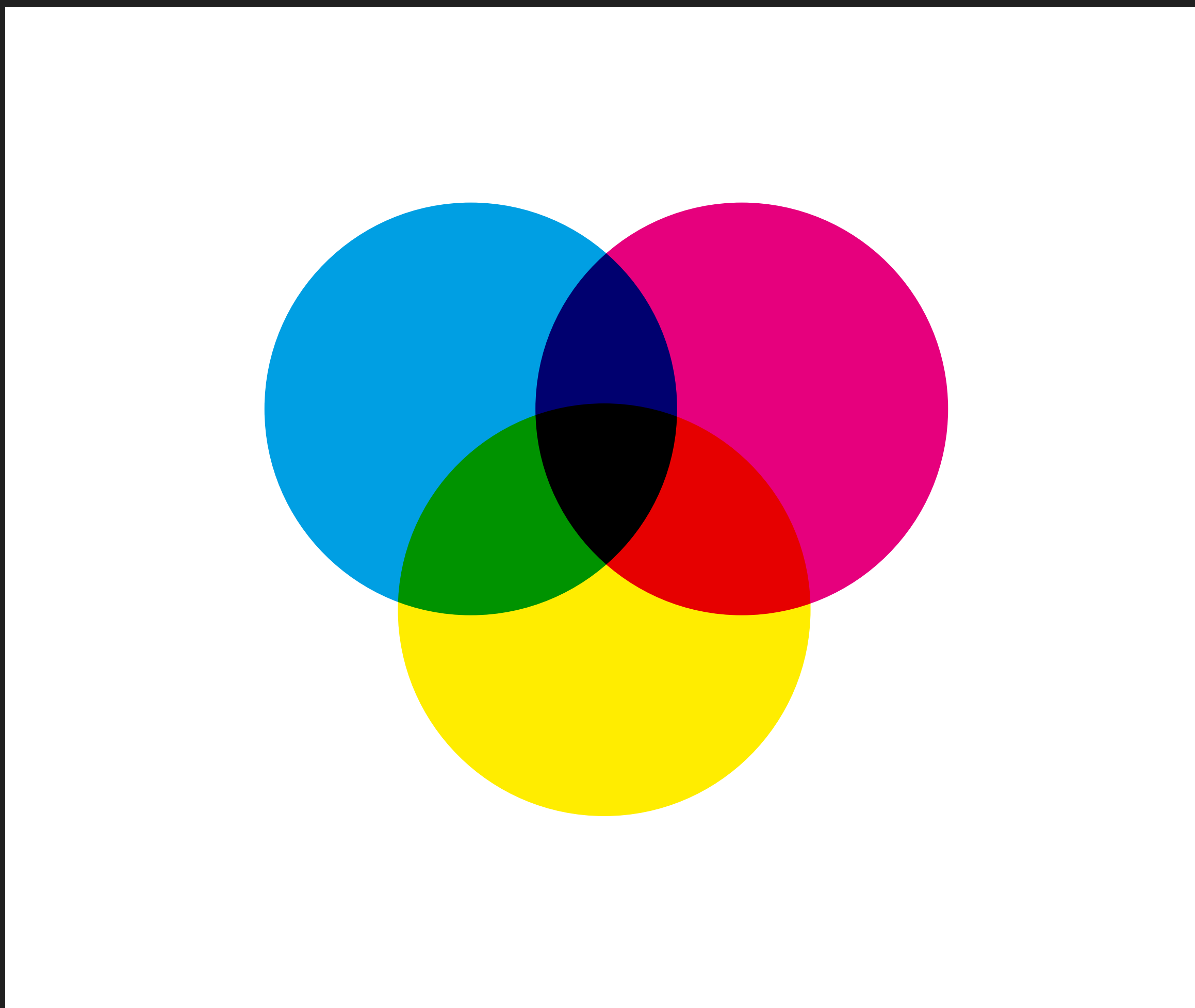
Creative Changes



CMYK

Cyan, Magenta, Yellow and Key (or black)

This model works by masking colors out of a lighter, usually white, background (paper). The ink reduces the light that would otherwise be reflected using subtractive color synthesis. Inks “subtract” the perceived brightness from white.



Generating the CMYK color wheel

I won't get into printing specifics in this article as is focused more on understanding color for color grading. The CMYK wheel is not the wheel we will use for the artistic part of the color theory.



Each circle is painted individually on a separate layer with the document in CMYK mode. The Cyan circle has the CMYK values set to 100-0-0-0, Magenta has the CMYK values set to 0-100-0-0, and Yellow has the CMYK values set to 0-0-100-0 (primary: Cyan, Magenta and Yellow). Each one has the layer-blending mode set to multiply on a white background. The interaction between two primaries created the Blue, Green and Red. Varying the brightness of each color creates full range of visible colors.



Color Theory — Guide to Color Grading

Artistic

“Goethe’s theory is one main basis of our understanding of color vision today.”

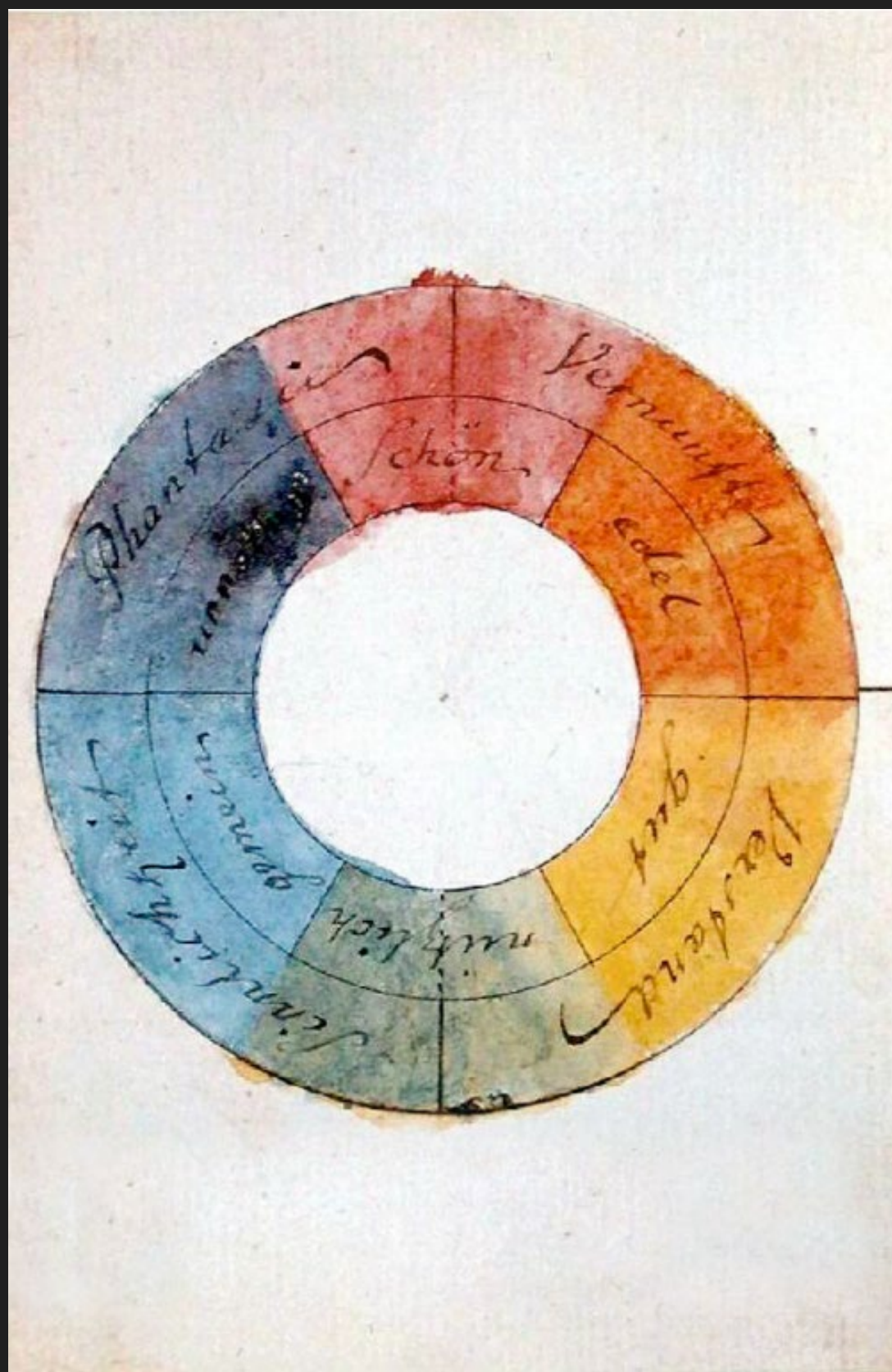


Illustration from the color theory of the German poet, painter and scientist Johann Wolfgang von Goethe, 1809.

Goethe reformulated how we understand color. Newton only contemplated color as physical problem, involving light striking objects and entering our eyes. Goethe introduced perception, that is, the way our brain processes information. Two colors interact with one another and change our perception (simultaneous contrast). What we see of an object depends on the object, the lighting and our perception.

Goethe's theory is one main basis of our understanding of color vision today.

We ♥ Goethe

So this is the wheel we will use to create harmonious color palettes.

Memorize it well!



Hue, Saturation and Luminosity

What we use in any type of visual art when creating palettes or applying color to an image are color harmonies.

To understand color harmonies, the first thing to do is distinguish the three characteristics of color:

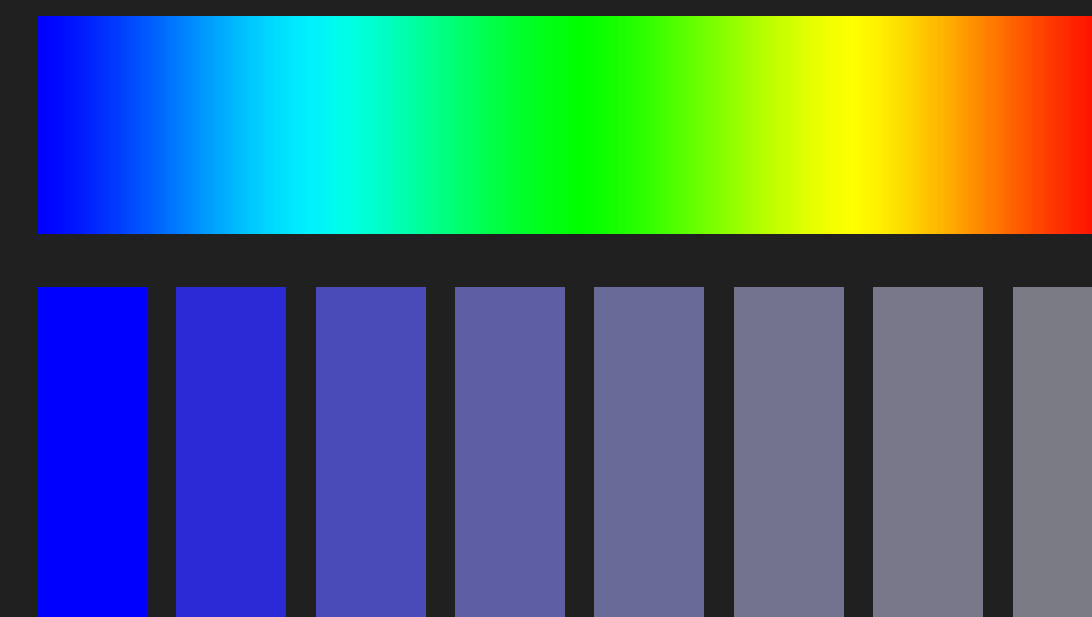
Hue

What is popularly known as color. Optimally, the eye can distinguish about two hundred different hues. Hues are: yellow, red, green, blue, violet, orange, etc.



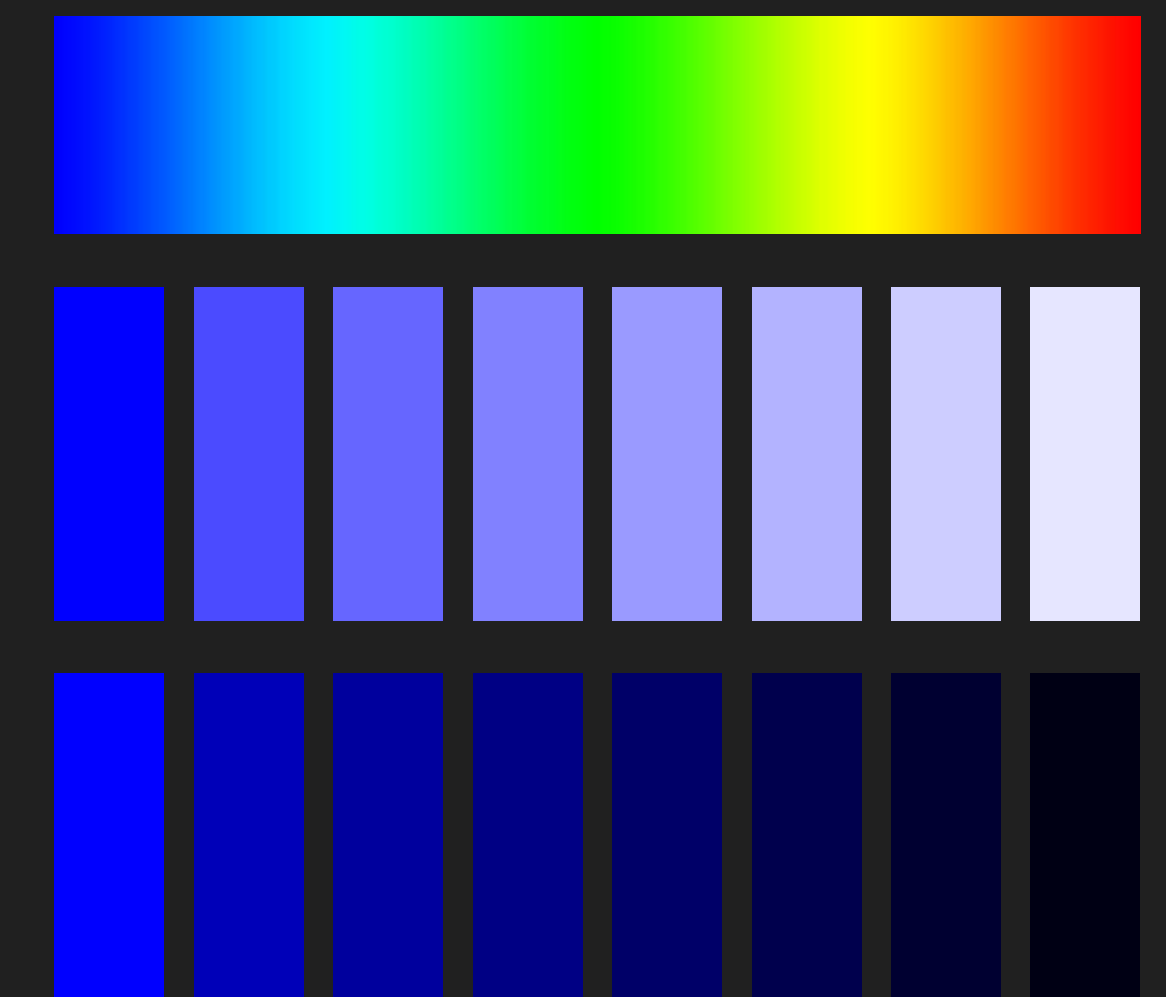
Saturation

The purity of color. The less the saturation, the closer we get to neutral gray.



Luminosity

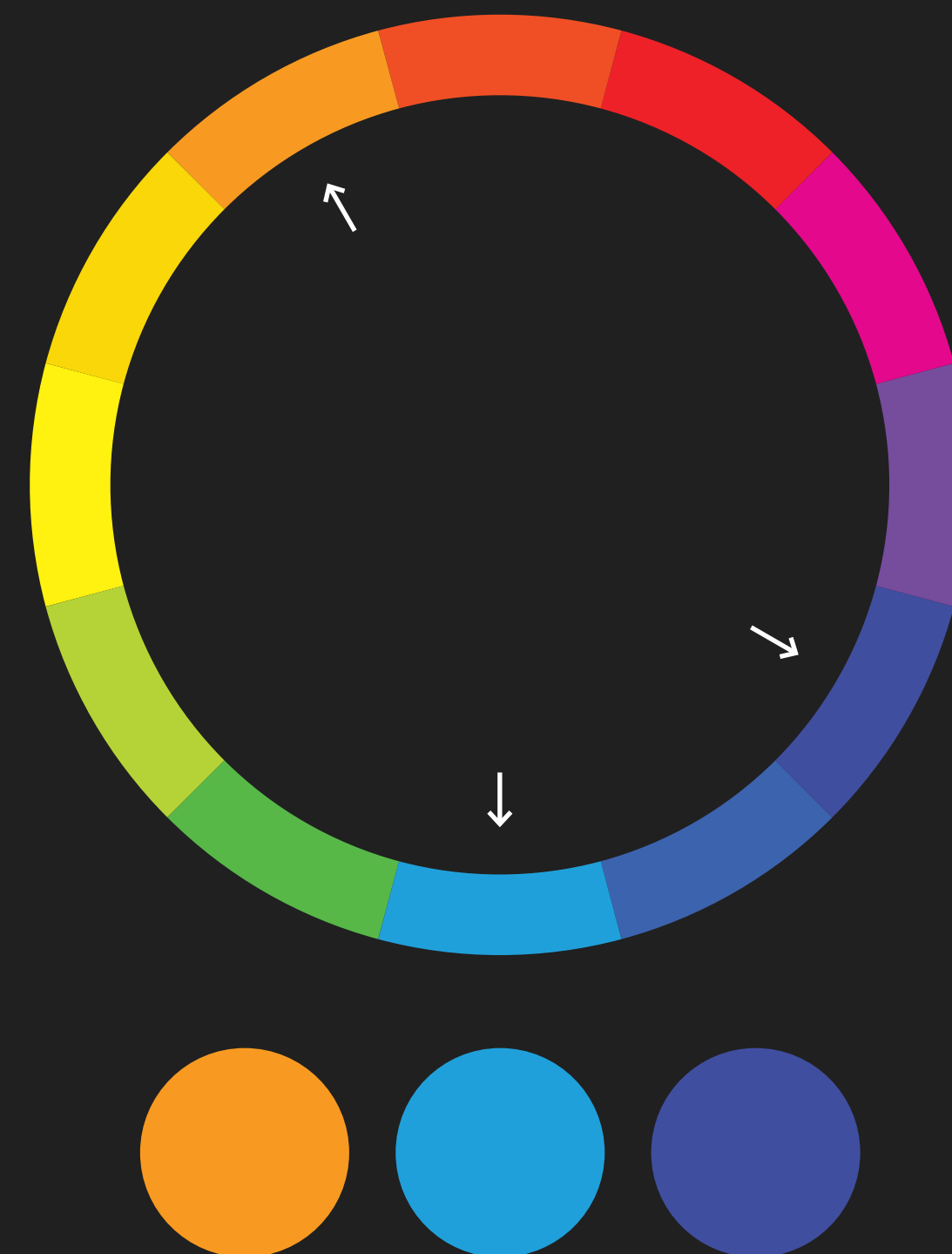
The amount of light/the brightness of one color. It corresponds to the gray scale.



Hue, Saturation and Luminosity

It is important to distinguish and understand color characteristics because harmonies are exclusively determined by the HUE regardless of saturation and luminosity. The proportion of each hue (to create a balanced, harmonious palette), however, will depend exclusively on saturation and luminosity, regardless of hue.

For example, from a split complementary in a given harmony, we can generate different variants/ palettes.



These color combinations, despite being visually different, are the same harmony.



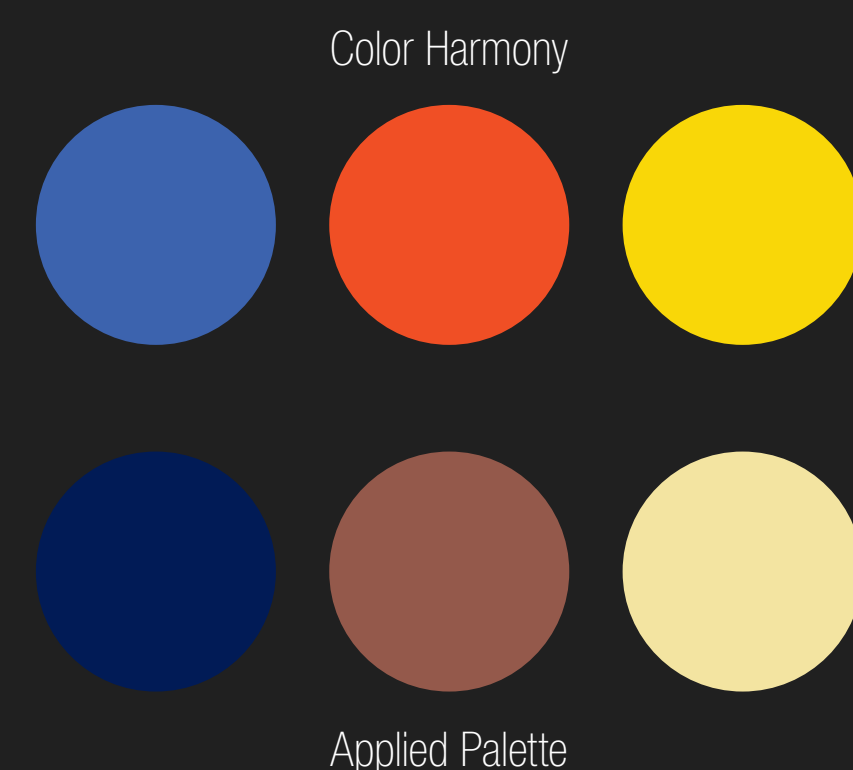
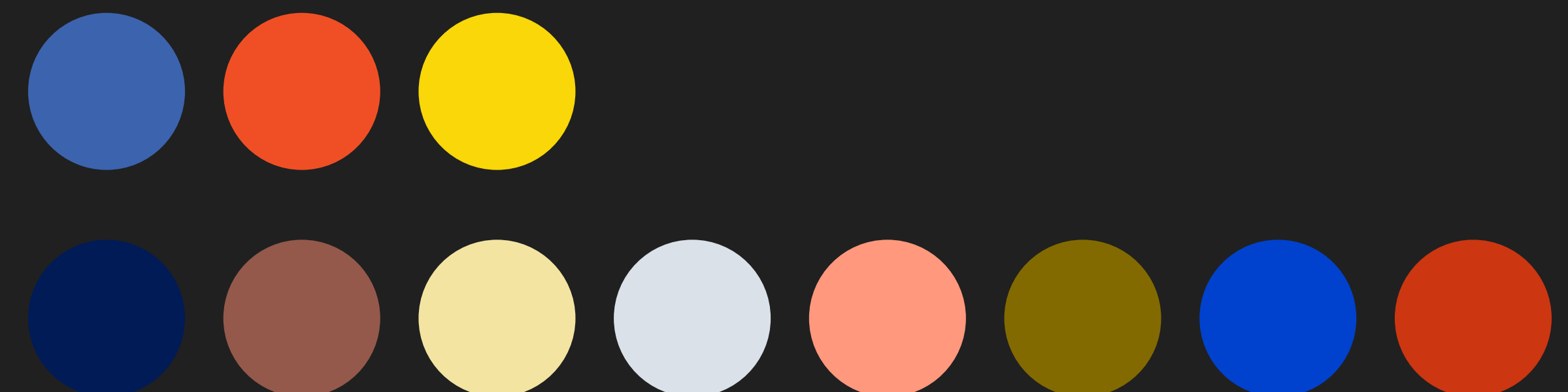
Options 1 and 2 were generated by changing the saturation and brightness of colors arbitrarily.

The hue is the only factor that determines the color harmony.

Hue, Saturation and Luminosity

We need to learn to see color harmonies in applied palettes. Abstracting them is a great exercise.

And as long as you don't change the hue you can use as many variants (sat/lum) of the main hues in the harmony within the same image.



Let's see the different color harmonies and the proportions when using the full saturation.

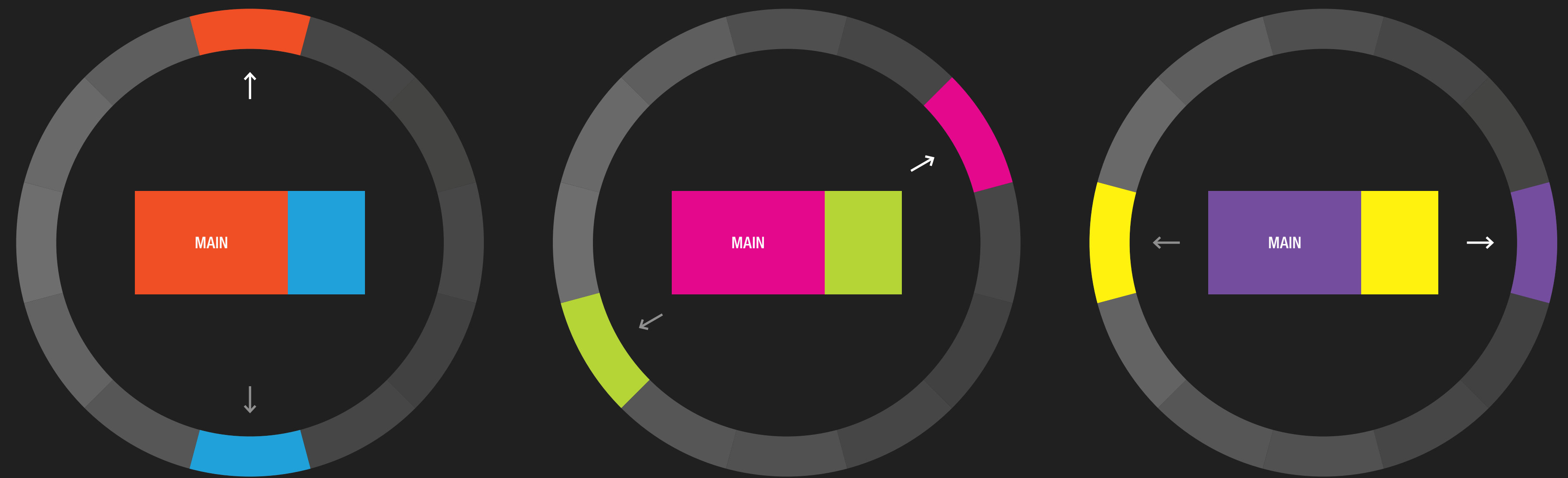
The proportion of each hue will vary according to other factors, but harmonies usually have a main color on which the harmony is based. That color in most cases will be the one covering most of the image (proportionally) and will be complemented with other tones. This main tone might shift as the harmonies are independent of specific hues.

So it's more about color relationships: as long as you keep the proportions you can spin the main tone and alter the others respectively.

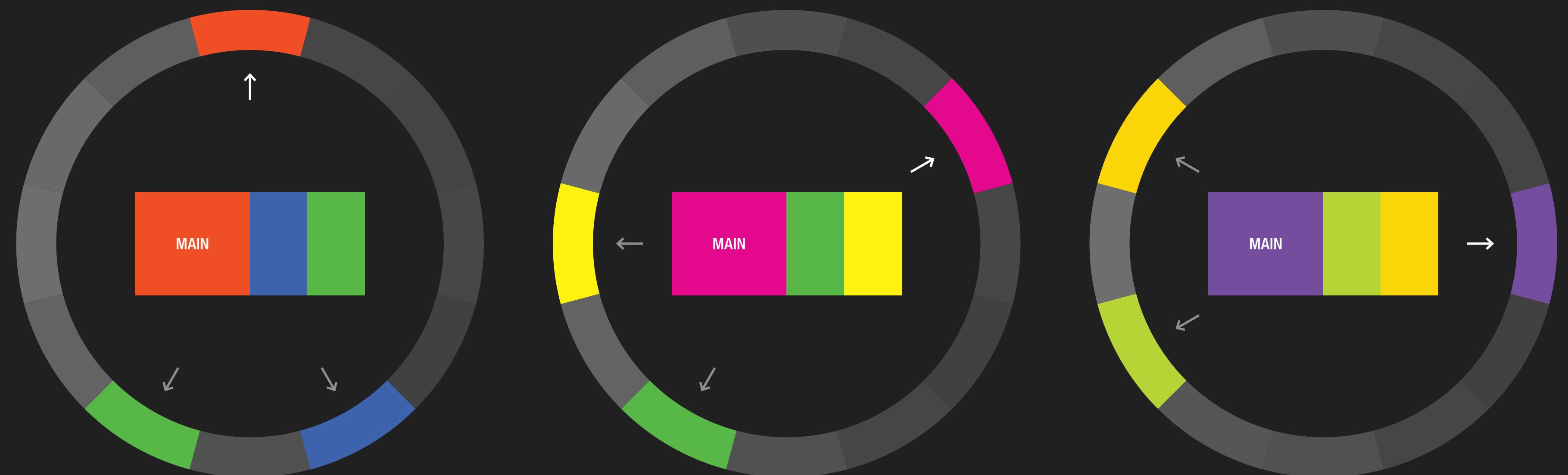
Hue, Saturation and Luminosity

Complementary

Two colors opposite each other on the wheel.

**Split Complementary**

A variation of the previous harmony: splitting a complementary hue into two hues while keeping the proportion.



Hue, Saturation and Luminosity

Triad

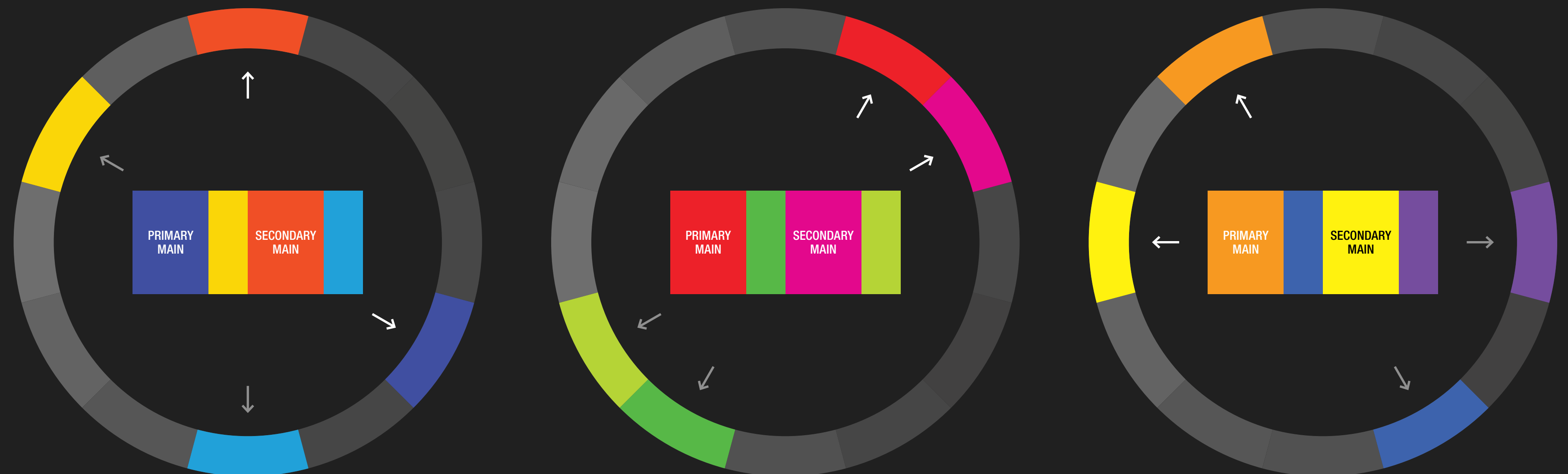
In the case of a triad there's no main tone. They all share equal importance and should be distributed based on that fact.

Also, the triad spins exactly at 60-degree angles.



Tetrad or Double Complementary

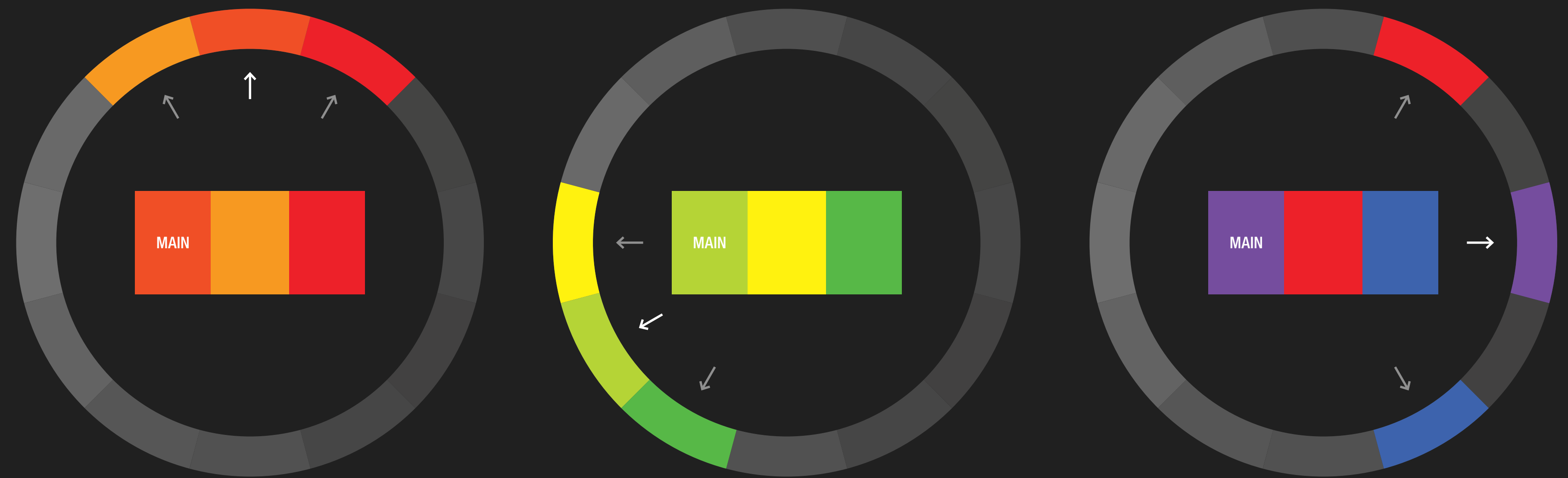
Two sets of complementaries, each set with its main tone and complementary tone. One will have more importance in the image and will be complemented by the second pair.



Hue, Saturation and Luminosity

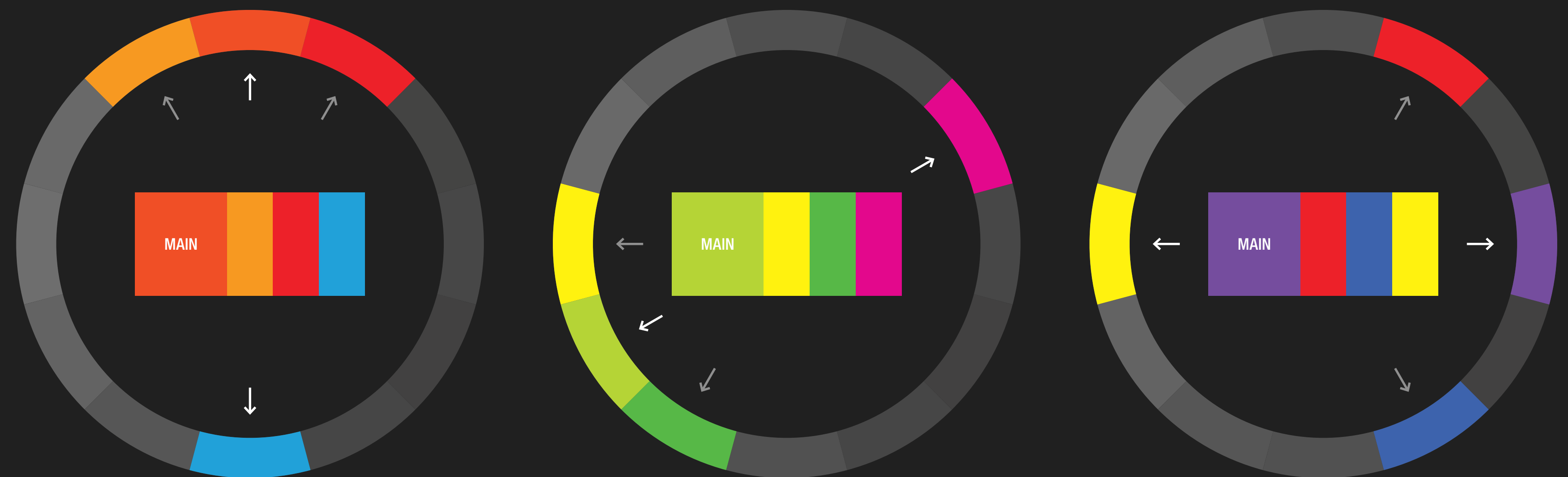
Analog

3 colors that are next to each other on the color wheel. Proportionally they are balanced by one main tone.



Accented Analog

My personal favorite, the same as before but accented by the main tone complement.



Hue, Saturation and Luminosity

Balance based in Composition

Once you have determined the color harmony, you need to balance its hues based on the composition of your image.

There are three factors that determine the weight of the elements in composition:

Size, Saturation, Luminosity

In a large area, you need to desaturate or brighten colors to obtain the same optical weight as a much smaller area, more saturated and darker.

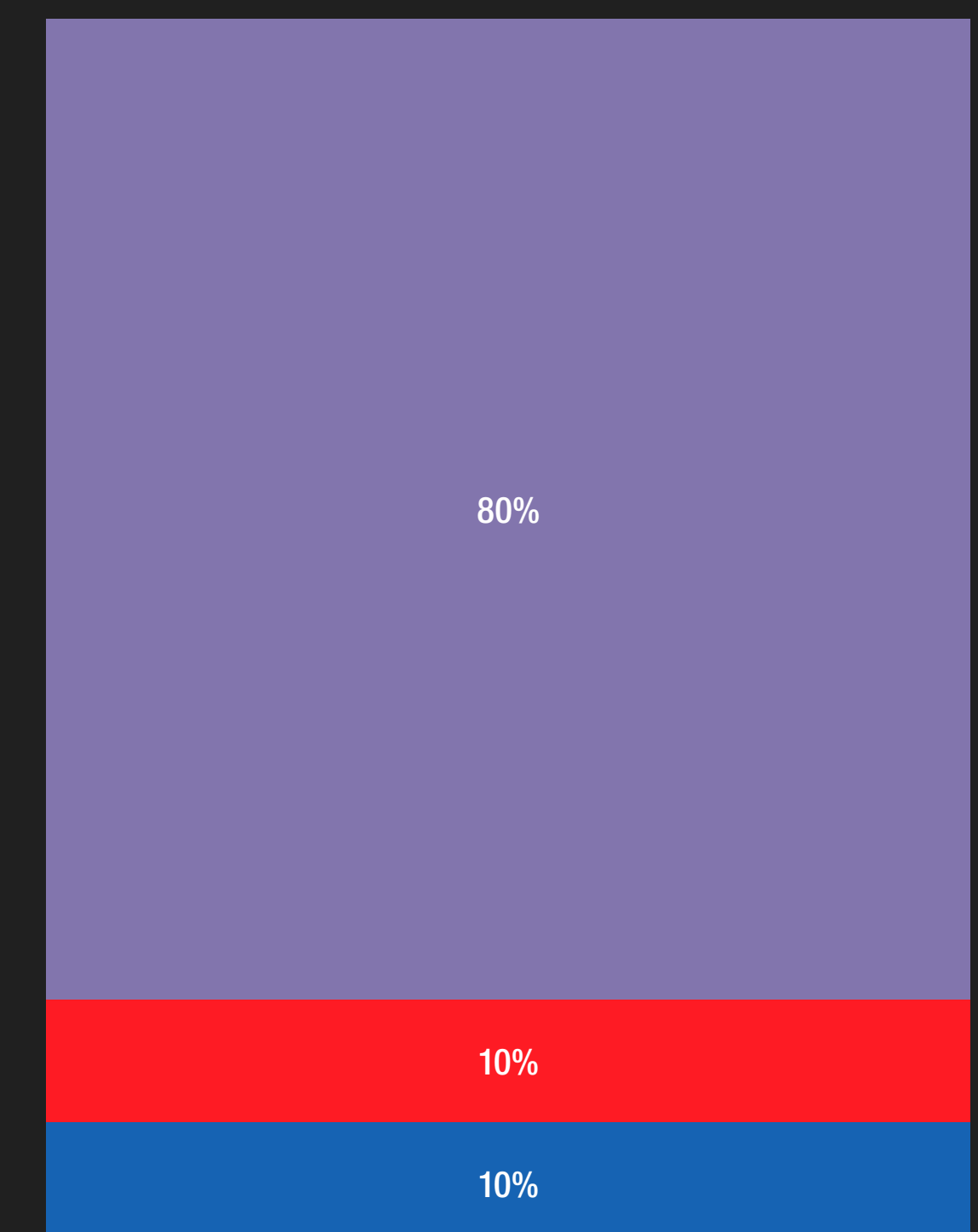
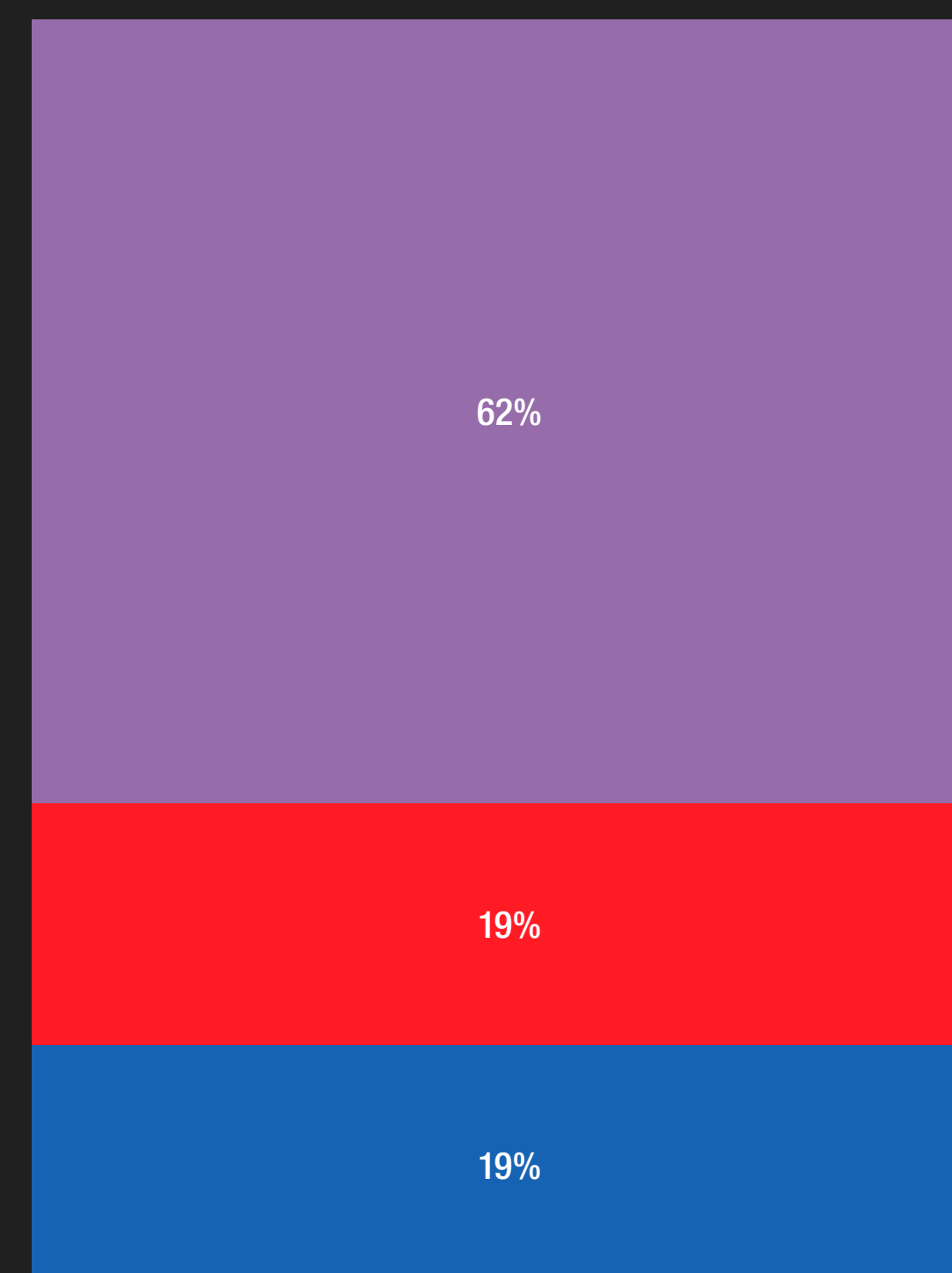
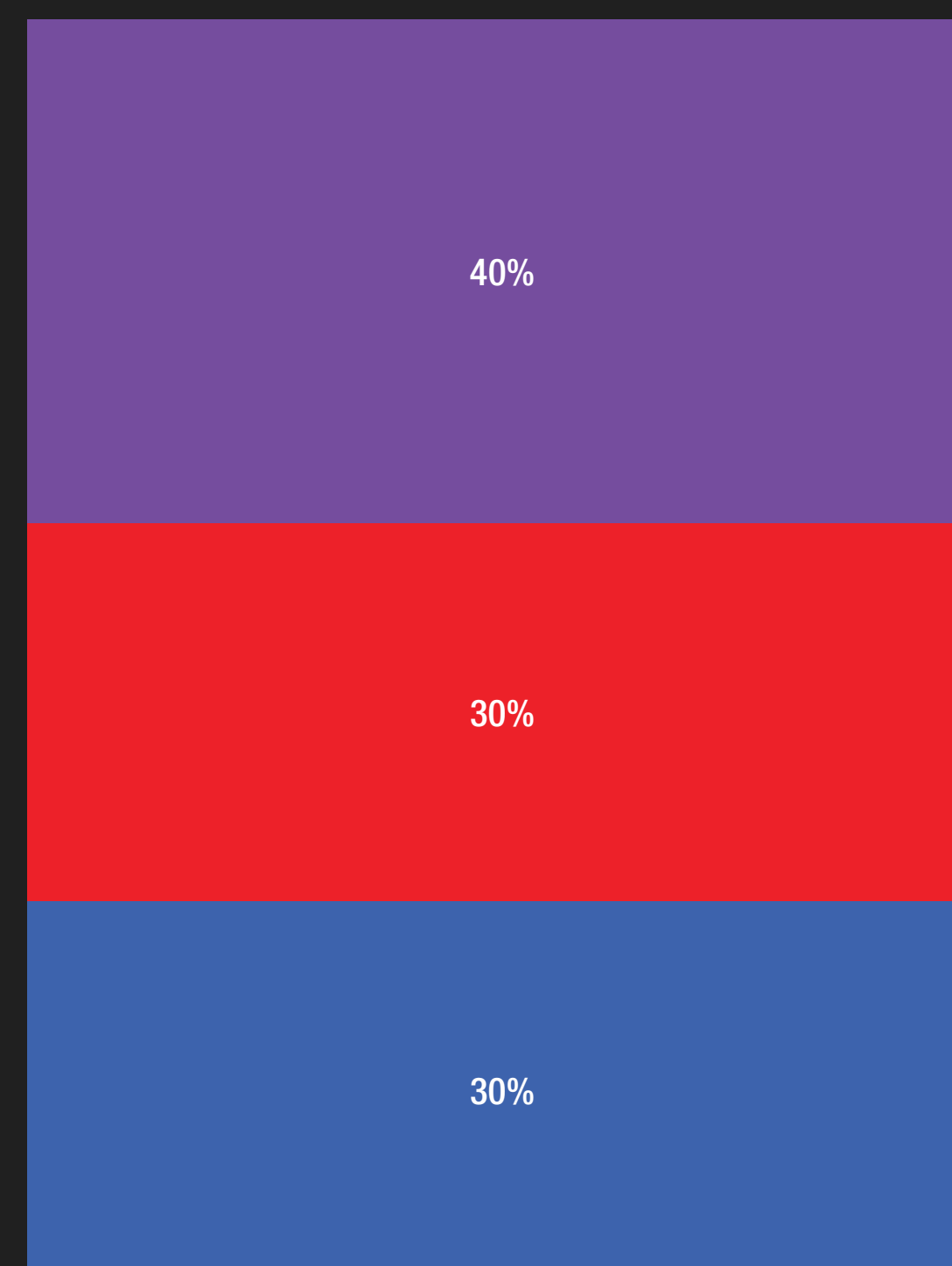
Visually, it would be something like this:

Using the analog example, I have 40% of the main tone with 30 and 30 % of the other tones complementing the analog harmony.

If I, let's say, use the main tone in the BG and highlights in a beauty image that is in SIZE more than 40% of the image (the image had a big theoretical background), I need to compensate for the extra size, reducing the saturation and increasing the luminosity to control the weight and to balance the harmony every time I use that hue in a bigger portion of the image.

You need to take into account the perceived weight of the elements as well. Not only size, saturation and luminosity will alter the weight but also position, order and relative position (like superposition).

I recommend a really good read on composition basics in the book "Point and line to plane" by Kandinsky.





Color Theory — Guide to Color Grading Communication

Color semiotics or semiology of color

It's a known and studied fact that colors can convey certain information that will make their viewers feel a certain way. For example: a RED signal will make viewers think of a warning or a risk and may even cause anxiety.

People pay more attention to color than you think. It can play a powerful impact on decision-making, way beyond simple taste, preference and aversion.

This form of encoded information that color gives us can be used by consumer product brands, and it is often used in advertising to generate brand recognition or even rebranding.

An example I use in workshops: whisky.

You don't normally drink whisky at the beach when it's hot — unless, of course, you're an alcoholic. But let's assume you're not, which means you'll much rather drink whisky by the fire when it's cold.

So if you want to sell whisky you need colors that convey this kind of warmth: warm colors such as red or orange, but also colors that evoke home, manliness, roughness, such as (wood) brown. Whisky is not a cheap drink, so you might also consider colors that convey "expensive/rich" such as black, gold, silver.

Now go and look for whisky ads and you'll see how concept and intention is everything when deciding on tones.

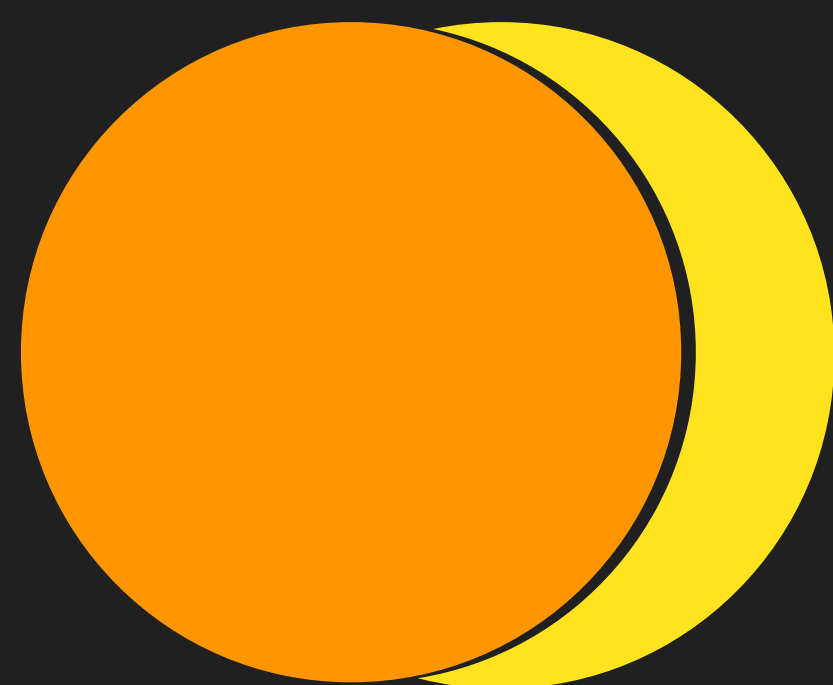
The color in an image should be worked out in the beginning (before you even start shooting), because it is the main thing and will define how everything else looks and also where you should be placing the attention.

Remember: the tones depend on the concept and intention.

If you're working with a commercial image and want to display a product of mass consumption, you won't use an edgy, contrasty black and white with grain. If the concept is modern, slick, chic and manly, you won't use pastel pink/purple and yellow tones.

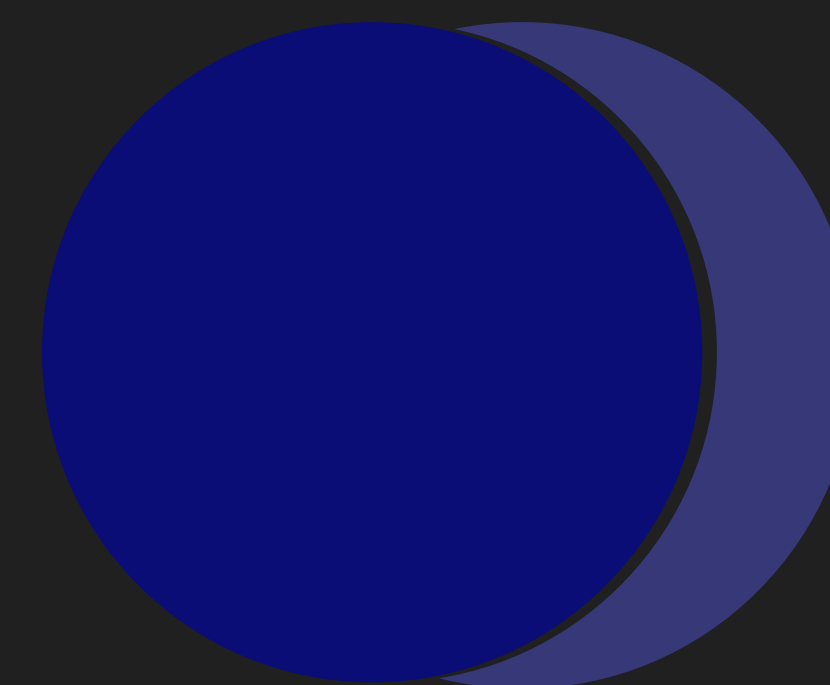
Another great example is an online financial brand that used to target young and fun, working, freelance entrepreneurs.

Their logo used to look like this:



After the brand got all that market, they decided to change/widen their objective to companies as well as the fathers and mothers of those young, fun, freelance entrepreneurs who are used to trusting "serious" companies. So the old logo didn't work anymore and they needed a rebrand, something that would make people trust them even if they were just perceived as an online company who dealt with "virtual" money.

Now their logo looks like this:



Same typography, same name. They do the same things and sell the same service. Yet, now my parents trust them. Want to guess why?

So remember when composing the tones in an image to take into account how they interact with the viewer.

Color is a means of communication like any other, and it speaks very loudly.



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