

Lambert's emission law and post-processing

by Malcolm McElvaney

The world is governed by many laws of physics yet we aren't required to be aware of them for them to work. Photography captures that mysterious world and its unknowns in the guise of a scene we liked, yet knowing how something works can be helpful. Take the inverse square law of light, for example, any photographer with a studio and lights will need to understand how it works to achieve the best results. At least the inverse square law of light I can comprehend and explain to some extent but other laws are way beyond me like the Lambert emission law.

Drawing out some inspiration ...

I came across this in a rather non-technical way in a drawing instruction video showing a better way to do shading in drawing correcting the use of linear shading verses how light works. He referenced the Lambert emission law as he built up this table below based on the angle of the surface reflecting the light back. When compared to the linear gradient the new scale shifts the idea of where the dark and light areas actually are and the terminator line between them lies.

Lambert Scale	Linear Scale
100% (255) – inclination 0 degrees	100% (255)
99% (252) – inclination 10 degrees	88% (224)
97% (247) – inclination 20 degrees	77% (196)
94% (239) – inclination 30 degrees	66% (168)
89% (227) – inclination 40 degrees	55% (140)
82% (209) – inclination 50 degrees	44% (112)
73% (186) – inclination 60 degrees	33% (84)
62% (158) – inclination 70 degrees	22% (56)
45% (114) – inclination 80 degrees	11% (28)
0% (0) – inclination 90 degrees	0% (0)

I will try to explain this best I can but the video “Mind -Blowing Realistic Shading Tricks” on Proko's channel at <https://www.youtube.com/watch?v=6vapw6n6FyU&t=142s> was my original source of this information. A quick search for this particular law and beyond the advanced math you also get how rendering software simulates light in computer graphics with it. The inclination of the surface toward the light source is what

the degrees are referring to here but in reality light behaves in a much complex way. The falloff of reflected light as the angle increases doesn't match the linear scale as we might assume but follows a different pattern. I think you will find the video I found an interesting watch.

Along with this insight into the perception of light I got a free drawing lesson as well but will share step 5 and step 6 of it.

Step 5 – Keep light halftones subtle

Step 6 – Keep reflected light subtle (in shadows) (darker rest of shadows to help)

In the next section I will be applying the table of values in a none drawing context but I did observe that in step 6 you darken the deeper sections of shadows to keep boundary in the lighter areas more subtle something to note. When I apply a mask and invert it I am in essence doing this by altering darker areas more than the lighter ones. A process most often applied to my overexposed image in my HDR processing but a different way to look at why I do it. Perhaps the reverse is true when the mask is applied as is to alter light areas more than darker ones for a reason as well but I will figure how it relates eventually.

... but I'm a photographer?

The camera doesn't see the world like we do so perception of tonal values might also not be exactly the same either. What I can tell you based on the post processing I've tried so far applying the different points on the curve of the image the results did bring out more detail I had seen. Not the only tool to apply in post but knowing one more possible option to make the image match my "vision" of the scene if applicable helps out. I use Gimp but the curves tool is universal so what I'm about to cover should work for you; also, I prefer to play around with layers, masks, blending modes, and opacity to get my results so my approach might be different but results similar.



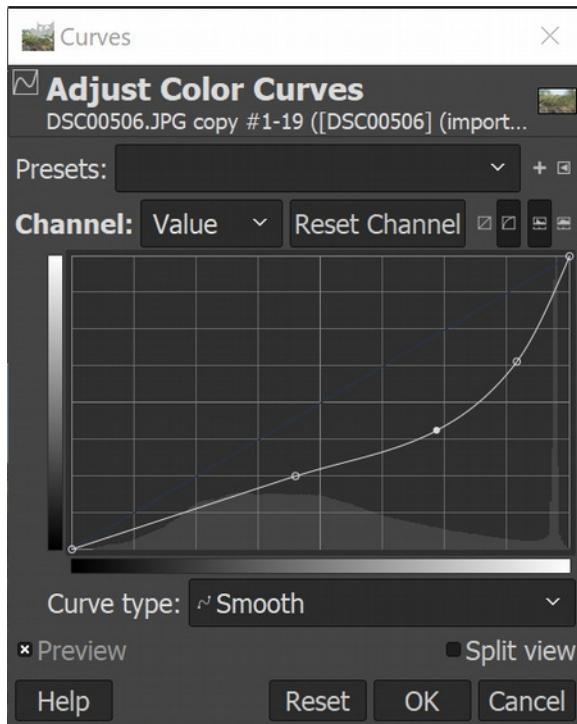
Before curve was applied



After curve was applied

Taken 09-27-2020 at Monahans Sandhills State Park

I use two or three points along the curve to reshape it and alter the distribution of the value range. At (114) the 45% reflection range where the terminator line starts I drop it down to a lower value supported by the image. If the curves of the histogram is below (114, 114) then stopping just above it could result in a point at (114, 86). Ideally I'm not trying to flatten the curve or lose my shadows completely but adjust based on the image. The second point at (227) the 89% reflection range I will also drop down to help smooth out the curve with a third point at (186) dropping down to further smooth the curve if needed.



Hopefully you can see how I used the three points along the curve to reshape it for the sample image. It was my neutral image in the bracketed set and I'm still trying to work this new step into my alchemy of processes but this may be something useful to you as well. So I had points at (114, 63), (186, 103), and (227, 163) based on the image's histogram, an approach of being more flexible and less literal than when I first discovered this concept. The lesson I learned was to stay open minded and try anything that comes to mind since it is reverse-able with quick results.