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Sky Blue



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1. Introduction

In travel agency brochures, on postcards and even on professional photos blue sky is often too dark and too blue. 'Too blue' means: plain blue instead of cyan-ish blue.

One may suspect that this shift towards dark blue is already introduced by film material or by a digital camera itself.

Figure 1.1 shows a digital photo of a blue sky with clouds in July at noon in Emden (northern Germany). Aperture and exposure were adjusted until the brightest parts of the clouds were just not overexposed.

The original RAW photo was saved as RGB image in AdobeRGB(98) and further processed by Photoshop CS2. After gamut tests the images were finally converted to sRGB.

Figure 1.2 is the result of a very little tonal correction by levels: the brightest parts were shifted accurately to level 255. Now it's possible to measure the CIELab lightness L^* or L in Photoshop's Info Palette. CIELab, or Lab in Photoshop is explained in chapter 2. Top left we have $L=31$ and top right (in the sky) $L=60$. The left part is obviously too dark.

The trees are underexposed, consisting almost only of shadow. Photoshop's tool Shadow / Highlight can be used to make the trees brighter without creating too much posterization. Simultaneously the sky becomes brighter.

Figure 1.3 shows the pleasing result. L reaches from 49 to 68 and the chromaticity values are typically $a=-2...-7$ and $b=-39$ to -29 .

In chapter 5 the CIELab coordinates will be explained. Chapter 2 and 3 show, how the color of the sky can be modified without an accurate selection. These methods are based on *Dan Margulis'* book about Photoshop Lab [2].

Thanks to *Roger Breton*, who had tried to measure sky blue directly by a colorimeter. It turned out to be rather difficult, because one needs not only a blue sky area but also the brightest part of the clouds as a reference for diffuse white with $L=100$.

Thanks to *Norbert Kustos* for providing many photos, here those in chapter 2, 3 and 4. The other photos were taken by the author. All photos were downsampled for this document to 1000 pixel width and resolution 144 ppi (pixels per inch).

For a pixel synchronized and color corrected appearance in Acrobat please use these settings:

```
Edit > Preferences > Page Display
Custom Resolution 72 ppi

Edit > Preferences > Color Management
RGB          sRGB
CMYK         ISO Coated   here not relevant
Grayscale    Dot Gain 20% here not relevant

Zoom         200%          in this document
```

All images are shown pixel synchronized for zoom 200%, because of image resolution 144 ppi and graphics card resolution 72 ppi.

These settings are valid for Acrobat Professional 7. Eventually, not all features are available in the free Acrobat 'Reader'.

1. Introduction



Figure 1.1

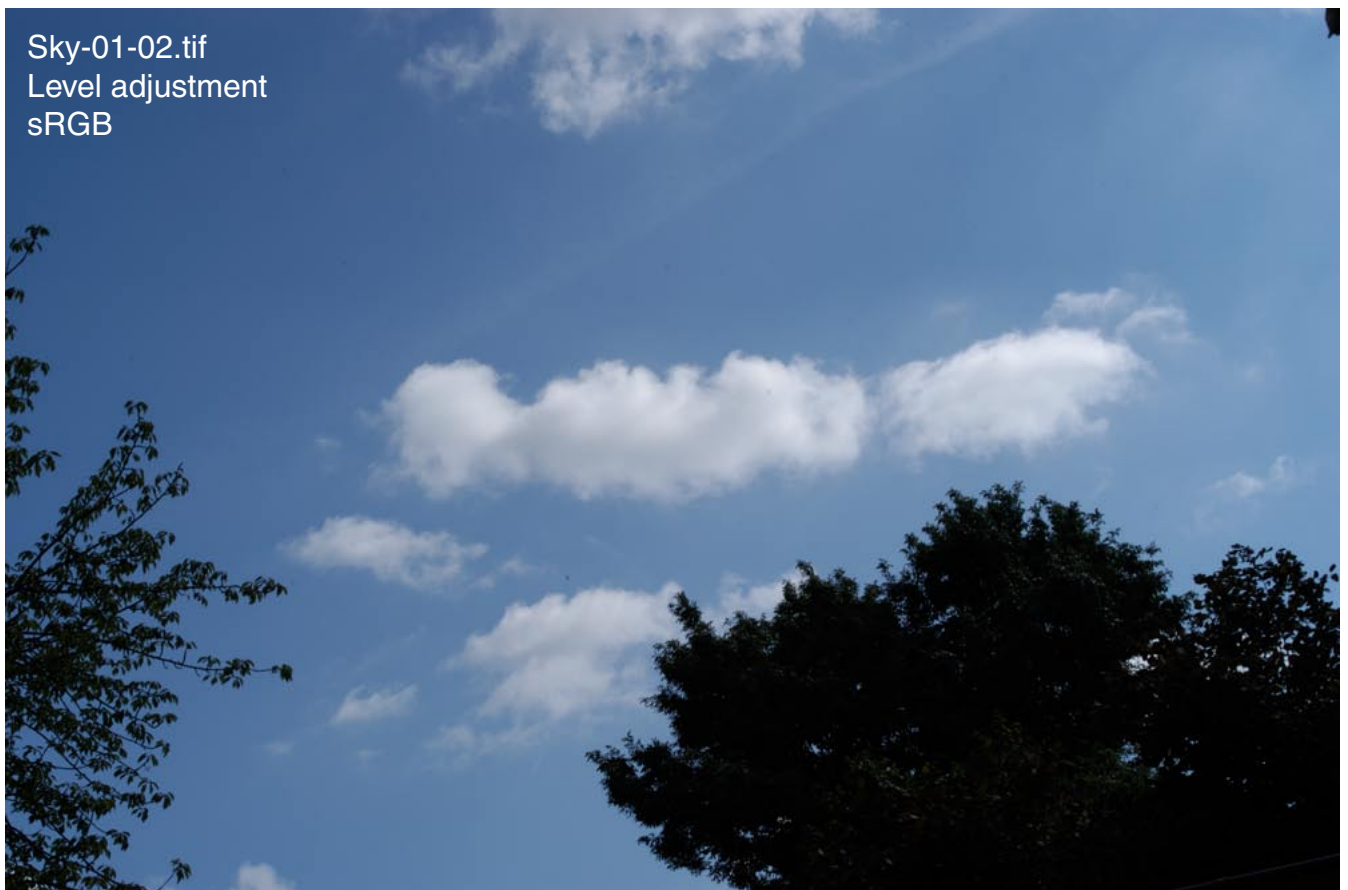


Figure 1.2

1. Introduction



Figure 1.3

2. Examples A / Lighter Sky

The sky in Figure 2.1 is obviously too dark: $L=38$. We are trying now to make the sky brighter without affecting the other parts and mainly without an *accurate* selection.

Indicate color numbers by the Info Palette:

Window > Info > Click triangle top right > Palette Options > First Color Readout RGB > Second Color Readout Lab.

For several tools like Move Tool (top right in the Tool Palette), Path Selection (arrow) or Eyedropper the color values at any mouse position are indicated in the Info Palette.

Choose the Lab color space: Image > Mode > Lab Color

By Polygonal Lasso Tool we make a very coarse selection which contains the whole sky and a part of the adjacent regions, the roofs. The reference points are chosen at the right side and at the top part outside the image. If the end point is near to the start point then a small circle indicates that the contour can be closed.

Then we map the outside contour parts to the image border by a trick:

Select > Inverse > Inverse

The selection is then visible by 'marching ants'. Changes concern only the selected part.

Then we create an adjustment layer for curves:

Layer > New Adjustment Layer > Curves > Confirm default name > Normal

The new layer is indicated in the Layer Palette: Window > Layers

We get immediately the Curves diagram Figure 2.2. There are three options for the channels L, a, or b. We choose L and make the whole selection brighter by moving the curve end point top right to the left until the value for sky blue, as measured by the eyedropper, is near to $L=60$. The result is shown in Figure 2.3. The edges of the roofs are now far too bright, of course.

The top layer contains the new bright selection. The bottom layer is the old image (background layer). An overlay of both layers will be created by conditional blending:

Layer > Layer Style > Blending Options > Normal (default)

Figure 2.4 bottom:

Blend If > Channel b >

Move the upper handles into the blue region until only the sky is copied

Move the lower handles into the blue region for an eventual improvement

There are originally two handles for each slider. For soft transitions each handle can be split:

Alt + Click by Left Mouse + Move

'Blend If' means:

Copy the top layer only if its pixel color (b) is in the indicated range.

Copy the top layer only if the bottom layer pixel color (b) is in the indicated range.

In this example we could leave the lower handles at their end positions left and right.

Figure 2.5 shows the result. It can be saved as *.psd or *.tif with layers for further corrections. We get rid of the layers by: Layer > Flatten Image

Finally convert to RGB and save as *.tif

Image > Mode > RGB Color

Save As > New name

2. Examples A / Lighter Sky



Figure 2.1

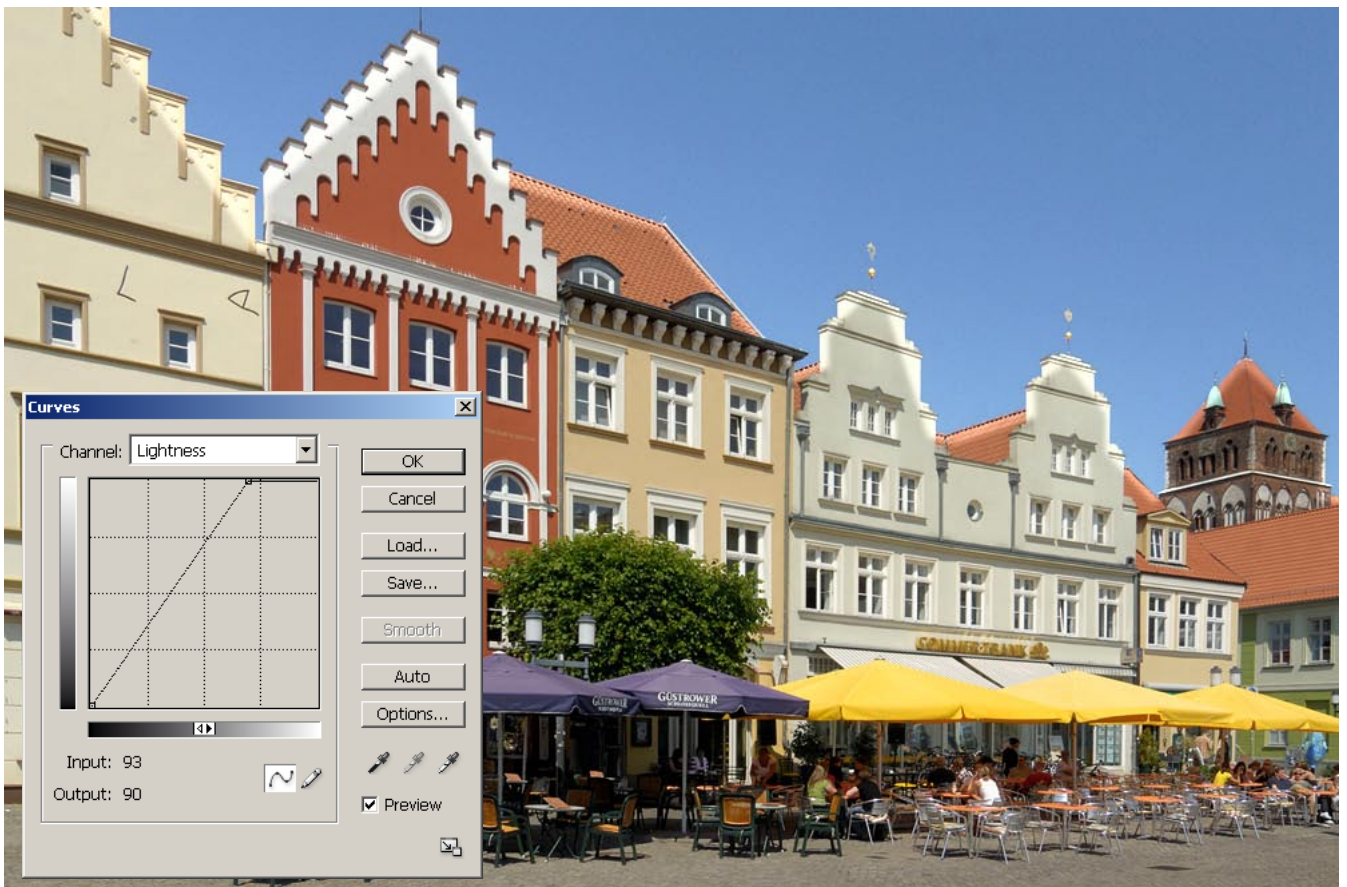


Figure 2.2

Figure 2.3

2. Examples A / Lighter Sky

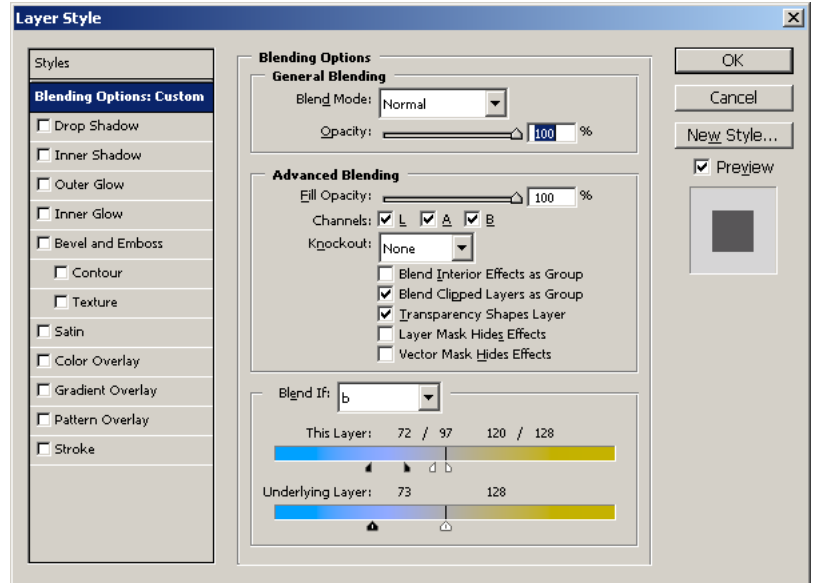


Figure 2.4



Figure 2.5

3. Examples B / Lighter Part of Sky

The workflow is rather similar to Example 1, therefore the description is mostly copied..

The sky in Figure 3.1 is too dark in a small region: $L=48$. We are trying now to make the sky brighter without affecting the other parts and mainly without an *accurate* selection.

Choose the Lab color space: Image > Mode > Lab Color

By Polygonal Lasso Tool we make a very coarse selection which contains the whole sky and a part of the adjacent regions, the hill. The selection is accurate at the horizon. The reference points are chosen at the right side and at the top part outside the image. If the end point is near to the start point then a small circle indicates that the contour can be closed.

Then we map the outside contour parts to the image border by a trick:

Select > Inverse > Inverse

The whole selection is then visible by 'running ants'. Changes concern only the selected part.

Then we create an adjustment layer for curves:

Layer > New Adjustment Layer > Curves > Confirm default name > Normal

We get immediately the Curves diagram Figure 3.2. There are three options for the channels L, a, or b. We choose L. Then we measure the value L for the dark part by eyedropper and distort the L-curve until the average lightness is $L=60$.

The result is shown in Figure 3.3. The edges of the hills are now too bright, of course.

The top layer contains the new bright selection. The bottom layer is the old image (background layer). An overlay of both layers will be created by conditional blending:

Layer > Layer Style > Blending Options > Normal (default)

Figure 3.4 bottom:

Blend If > Channel b >

Move the upper handles into the blue region until only the sky is copied

Move the lower handles into the blue region for an eventual improvement

There are originally two handles for each slider. For soft transitions each handle can be split:

Alt + Click by Left Mouse + Move

'Blend If' means:

Copy the top layer only if its pixel color (b) is in the indicated range.

Copy the top layer only if the bottom layer pixel color (b) is in the indicated range.

In this example we could leave the lower handles at their end positions left and right.

Figure 3.5 shows the result. It can be saved as *.psd or *.tif with layers for further corrections.

We get rid of the layers by: Layer > Flatten Image

Finally convert to RGB and save as *.tif

Image > Mode > RGB Color

Save As > New name

3. Examples B / Lighter Part of Sky



Figure 3.1

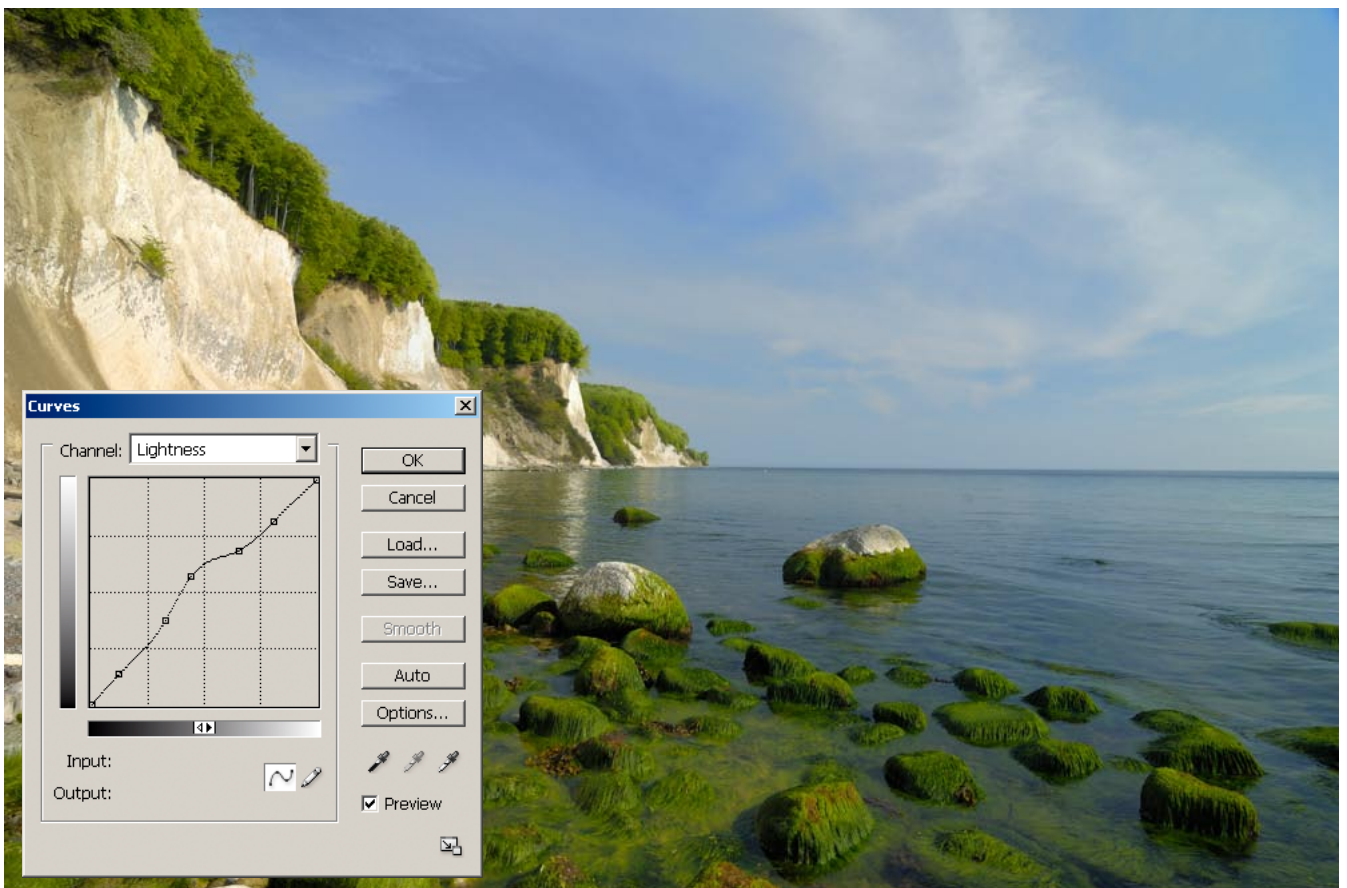


Figure 3.2

Figure 3.3

3. Examples B / Lighter Part of Sky

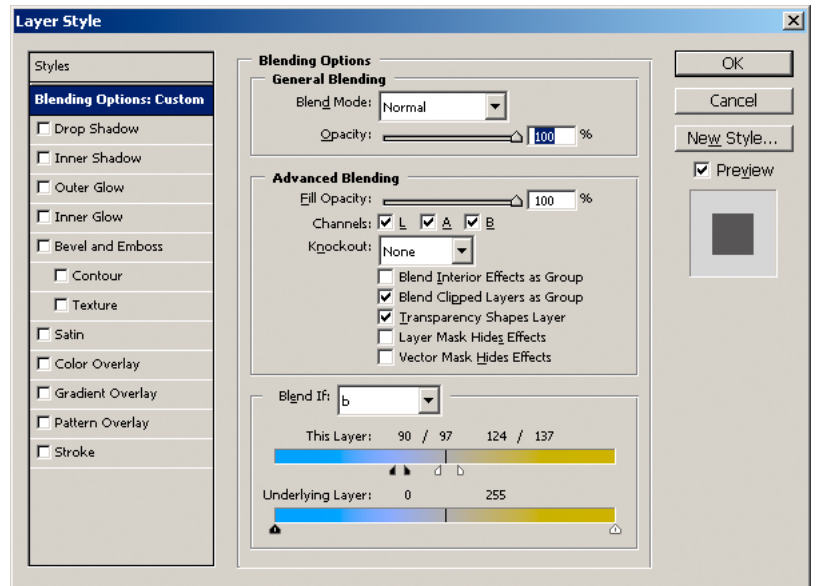


Figure 3.4



Figure 3.5

4. Examples C / Uncorrected images

This chapter shows a couple of uncorrected images, as delivered by the photographer Norbert Kustos. Only in Figure 4.4 a forgotten level correction was applied, shifting the brightest parts to white.

These sky blues are considered as agreeable by the author of this doc, with the exception of Figure 4.3 which is perhaps too blue.

Typical values for the skies:

Figure 4.1 L=62...76 a=-3...-6 b=-10..-25

Figure 4.2 L=59...67 a=-3...-6, b=-12...-26

Figure 4.3 L=58...67 a=-5...-8 b=-43...-46

Figure 4.4 L=61...80 a=-9...-14 b=-19...-32

For a comparison:

Title image L=59...67 a=-4...-10 b=-38..-45

Lab-values can be measured by loading the respective page in Photoshop. Mode sRGB, Resolution 72 ppi or 144 ppi.

Thanks to *Mike Russell* [3] for his post:

Here are some Lab numbers collected by Jim Hamilton. These values are provided to curvemeister customers as a reference for a blue sky.

The values are from photographs, taken at different times of year, in Scotland.

The values of the first one are extremely close to your suggested value. Cyan-blue is generally acceptable, whereas Magenta-blue looks unnatural. The sky should also decrease in saturation toward the horizon.

| | | |
|---------------|-----------------|------------------------|
| Glencoe Sky | Lab(68,-2,-45) | pin hue and saturation |
| Inverness Sky | Lab(81,-11,-29) | pin hue and saturation |
| Brodie Sky | Lab(75,-7,-38) | pin hue and saturation |

4. Examples C / Uncorrected images



Figure 4.1



Figure 4.2

4. Examples C / Uncorrected images



Figure 4.3



Figure 4.4

5. CIELab

The CIELab color space is based on CIE(1931) colorimetry [1]. In Photoshop it's called simply Lab, and the CIELab coordinates L^* , a^* and b^* are called L, a and b.

Lab is a very powerful color space for editing, as described by Dan Margulis [2].

One doesn't need to know the mathematical details [1].

The sRGB cone (Standard RGB) is mapped to a strange object in Lab, here shown for six different views for the *same* object. Black is at $L=0$, $a=0$, $b=0$. White is at $L=100$, $a=0$, $b=0$.

Any $L=0 \dots 100$ with $a=0$, $b=0$ is neutral (gray). The axis (a) points from cyan-ish green to red-ish magenta, or (simplified) from green to red. The axis (b) points (simplified) from blue to yellow.

See also next page. Numbers for (a) and (b) are in Photoshop in the range -128 to +127.

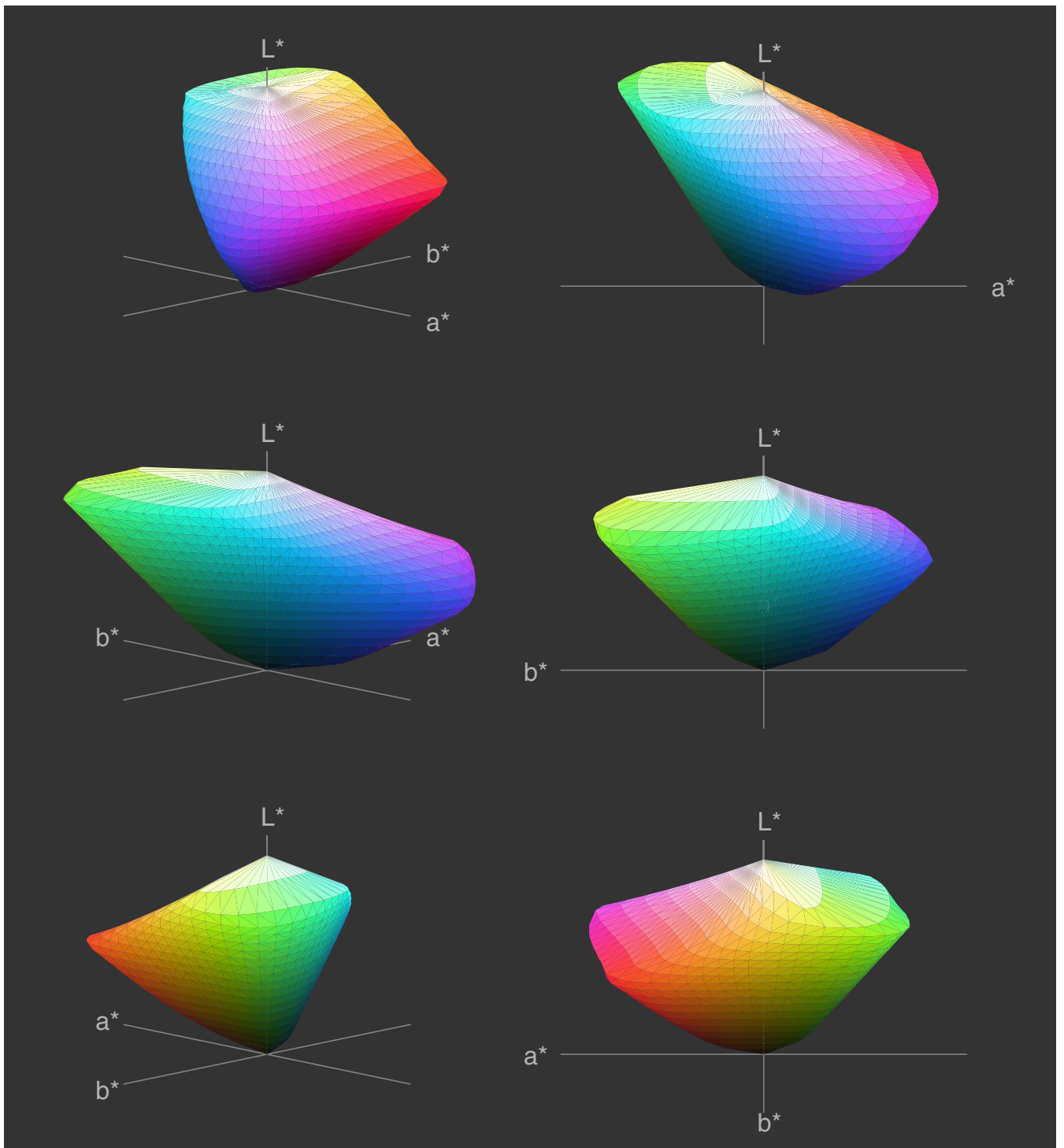


Figure 5.1

5. CIELab

This diagram shows a horizontal slice of the Lab volume for sRGB at L=50. The gray area shows the range -100 to +100 for (a) and (b). The colored area shows the maximal projected area of the whole volume. The black contour contains the valid colors for L=50.

We can see that '(a) from green to red' and '(b) from blue to yellow' are simplified descriptions. Furtheron, darker yellows don't exist - these colors are browns.

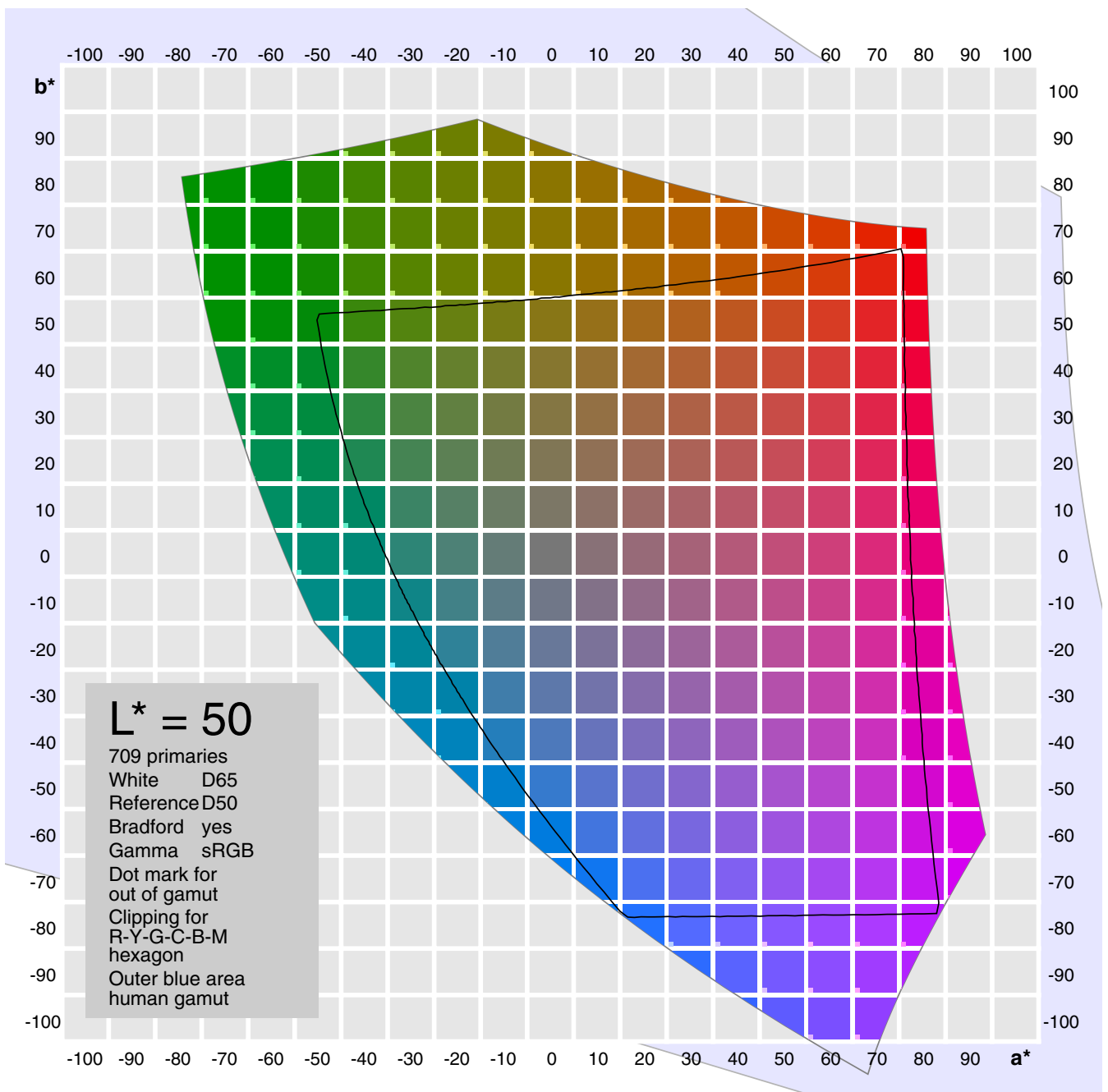


Figure 5.2

5. CIELab

Curves (more accurate: gradation curves) define the relation between the old input (horizontal) and the new output (vertical). They are initialized by a straight line bottom left to top right.

In RGB mode we have either RGB (luminance) or single channels R, G, B. In Lab we have the channels L, a and b.

The origin for the L-curve is bottom left for black. The origin for the (a) and (b) curves is in the middle: $a=b=0$ for grays. The axes are going from green to red and from blue to yellow.

In Margulis' book the axes are swapped, as traditionally done for CMYK. This is indicated by the black-white gradient: then white is left, black is right.

A few examples for modified curves (white lines):

Figure 5.3
Absolutely increasing lightness.

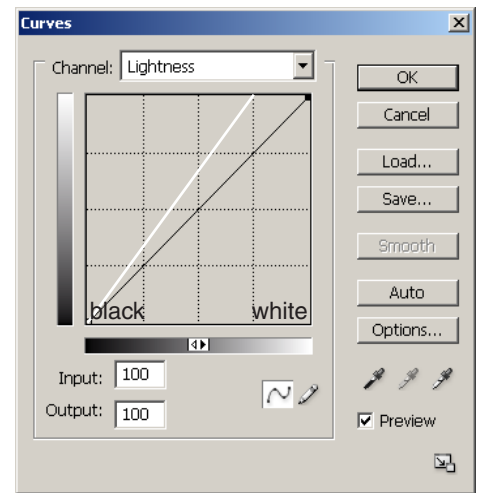


Figure 5.4
Less vivid green. The same red.

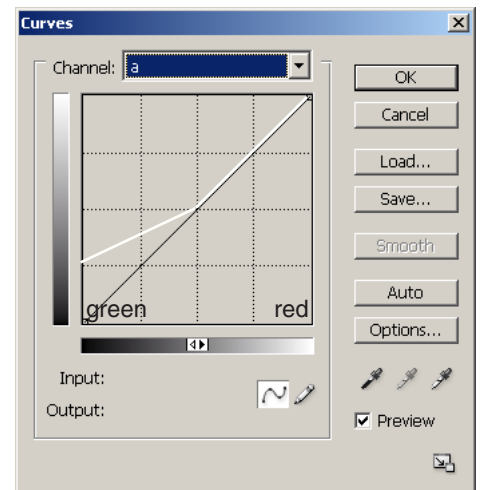
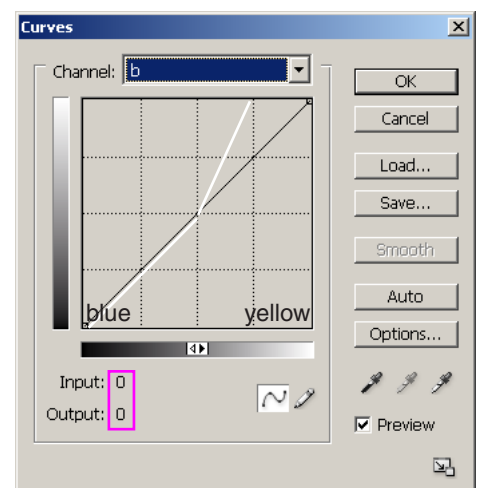


Figure 5.5
More vivid yellow. The same blue.



Assign numerical values to any mouse point, here 0,0

6. References

- [1] Gernot Hoffmann
CIELab Color Space
<http://www.fho-emden.de/~hoffmann/cielab03022003.pdf>

- [2] Dan Margulis
Photoshop LAB Color:
The Canyon Conundrum and Other Adventures in the Most Powerful Colorspace
Peachpit Press, 2005

- [3] <http://www.curvemeister.com/>

This document

<http://www.fho-emden.de/~hoffmann/skyblue14072008.pdf>

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