

GamutView

By Steve Upton

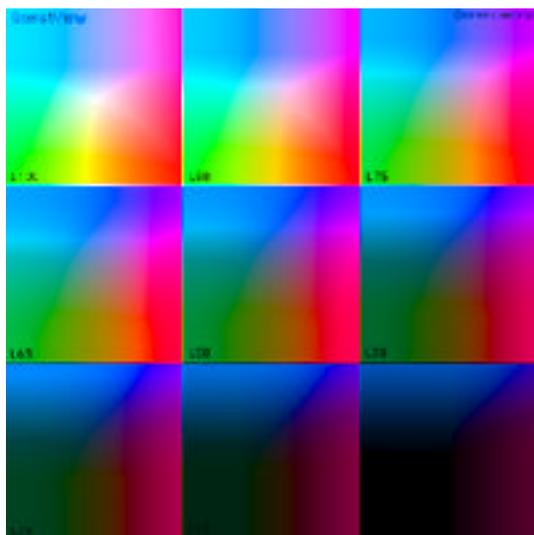


Figure 1

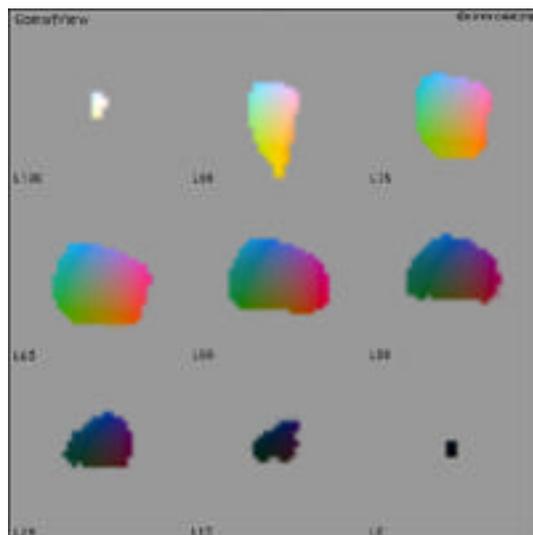


Figure 2

What is GamutView?

GamutView is a method of using Photoshop 5.x and CMYK printer profiles to simulate the gamut of a printer. It can be used to help visualize how a printer's gamut is shaped as well as an overall learning and comparison tool. It's free, (assuming you own Photoshop 5) it's easy, and it's cool (at least for color geeks like me).

What is a gamut?

All devices that produce color have a limit of the total colors they can produce, this is called the device's gamut. It is helpful to understand the size and shape of a printer's gamut in order to determine the overall capabilities of the printer as well as spot-check certain color ranges to determine if they will reproduce properly.

What parts are there and what do I need?

You must have Photoshop 5.0 or newer to do this procedure. Technically that's all you need but I have created images and actions that help make the process of showing a gamut a little easier.

What do I do?

Open the file Gamut View 9L.psd in Photoshop 5. Choose File: Color Setup: CMYK Setup. Select ICC and the printer profile for your printer. If you do not have a profile for your printer or you have an RGB printer and your profile is not displayed in the list, select any CMYK printer for this example and then refer to the questions below for information on how to get your printer's profile visualized.

See figure 1

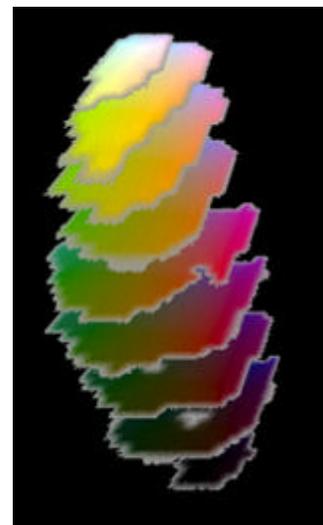
Select View: Gamut Warning.

See figure 2

You should see that much of the image is grayed out and the remaining pieces are strangely shaped. This is your printer's gamut. (or at least a sampling of it)

What am I seeing?

If you take all the “slices” that Photoshop displays in figure 2 and stack them up as they would appear in a three-dimensional color space you would see the image to the right. Unfortunately Photoshop will not allow stacking of the layers as in this image because the gray gamut warning shading is not transparent. In fact, it does not exist in the image at all and if you want to capture the information, you will need to take screen shots. Use shift-command-3 to capture the whole screen or shift-command-4 to get cross hairs and capture a selected area of the screen.



How does it work?

Photoshop 5 has a mechanism where you can mark the colors in your image that are outside the capabilities of your printer. This is called the Gamut Warning. Photoshop uses the settings you have selected in your File: Color Settings: CMYK Setup dialog to determine the color capabilities of your printer (or press or whatever) and then changes all the pixels that fall outside of your printer's gamut to gray pixels. On a normal image, you will often see specks of gray appear in certain areas of the image.

In the case of GamutView, I have simply created a file in Lab color-space that displays all the colors visible to the human eye (at least approximately). When you select Gamut Warning, Photoshop grays out all the "unprintable" colors and what is left over is an image showing only the colors which can be printed on your printer: your printer's gamut.

An important thing to note is that a printer's gamut is a three dimensional thing (at least we often look at it that way). As Photoshop is not a 3-D program we are limited to showing "slices" through the 3-D gamut. If you imagine the 3-D color space of your printer as a watermelon standing on its end, the a and b axis of lab space both go horizontally and the L or lightness axis is vertical with 0 (black) at the bottom and 100 (white) at the top. Now if a horizontal slice is taken at some point in the space, say L=50, then you would see the limit of colors your printer can produce at that lightness. As you slice the color space in different places, you will find the size and shape of the printer's gamut change dramatically.

To help illustrate the entire gamut in a simple way, I placed nine "slices" on one screen, each at different lightness settings. They are at L=0, 13, 25, 38, 50, 63, 75, 88, and 100.

What if I want more detail?

I have also included a file that only shows one gamut "slice" called [GamutView 1L.psd](#). Open it and setup Photoshop as described above to view your gamut in greater detail.

To vary the lightness value and move the "slice" up or down in the gamut, select Window: Show Channels and click on the word "Lightness" so it's the only one selected and the only one with the "eye" icon beside it. Then click on the background color patch and select an L value between 0 and 100. Click OK and select Edit: Fill, choose "background color" and OK. Then go back to the Channels palette and select "Lab" so the whole image is displayed again. If you turned it off, select View: Gamut

Warning again to see your new gamut "slice". (on a Mac command-delete will flood-fill with the background color and shift-command-Y will turn the gamut warning on and off)

I have also created an action set which can be imported into the action palette so you can use the F1 through F11 Keys to quickly vary the L value from 0 to 100 without all the work.

Why is the gamut so misshapen at different lightnesses?

It's the nature of the (human) beast. I know it's a glib answer but it's true. While we would like to believe that our color perception could be visualized as a nice round sphere, it just isn't so. When you map human color perception into a 3-D space, you find it's a strangely shaped blob. The yellows extend way out into saturation at high Lightness values but virtually disappear at low ones (there is no such thing as a saturated dark yellow). Blues, on the other hand, become quite saturated at low L values but not at high ones (there are plenty of non-saturated light blues but few saturated ones). The resulting shape has been referred to me as "the penguin" by David Piccus of Color Solutions (ITEC now, makers of ColorBlind products) and it's a pretty fair visual with a yellow beak and blue tail. The fact that your printer's gamut pretty much follows this shape is not surprising. Within their limitations, printers are designed to produce color that matches, as closely as possible, the human color perception system.

Why are printer gamuts so different?

Printers use different inks, media and printing technologies. Each one of these can drastically change the amount of color a device can produce. On an Epson 3000 inkjet for instance, changing from normal 70lb paper to Epson's Photo Quality Glossy paper increased the printer's gamut by at least 2x! Use GamutView to compare printers you may want to buy or use at your service provider.

What do I use it for?

Visualization – Use the info tool to move around the different gamut slices and determine the limits of Lab and RGB colors that your printer will produce.

Printer comparison – With the Gamut Warning on, select File: Color Settings: CMYK Setup... and move the dialog away from the GamutView image. Ensure that "preview" is checked and then try selecting different profiles. Photoshop will take a few seconds to recalculate the new gamut but it is a great way to directly compare gamuts. Only one

CMYK setup for the entire application is allowed at one time so you will need to take screen shots as described above if you want side-by-side comparisons.

Rendering comparison – Select File: Color Settings: CMYK Setup... as above and change the rendering intent and black point compensation settings. This can have a dramatic effect on the size of the printer's gamut.

What other things can I see?

Try the following suggestions with the gamut warning off.

Try CMYK Preview and see what the Lab color space would look like printed from your printer. It's interesting to see how poorly the colors are rendered on some printers.

Use the flood fill tool (paint bucket) with a tolerance of 20 or so and fill different regions. You get an interesting shape and the size and orientation of the filled area changes. Worthy of some discussion.

Are other gamut visualization tools available?

You bet. Some of the best tools are built into profile building software by ITEC (ColorBlind), Heidelberg (Linocolor Print Open), and Color Synergy.

There is however a great free tool called Rotator. It cannot use profiles directly but can use the 3-D Lab data that created them. With Rotator you can plot all the hundreds of sample points from your print target in 3-D and you can then "grab" and rotate the color space and view it from any angle. It is a VERY useful tool. Go to www.chromix.com and follow the links to Color Management: Tools for more information. (we have some sample files online if you don't have data yourself and if you get profiles built by us, we'll be happy to send you the raw data to play with)

Can I create my own images to use in the same way?

I created and included the images to save time and have standard images to refer to in this documentation but creating your own is easy. Creating a full-color Lab image in Photoshop is surprisingly fast and I owe thanks to Michael Riedel of the Seattle Art Institute for showing it to me.

- Create a new Lab file of whatever dimensions you desire.
- Select Window: Show Channels and click on the "a" channel so it's the only one selected and the only one with the "eye" icon beside it.
- Choose the "Gradient" tool from the palette and draw a white to black gradient horizontally across your image from edge to edge. (use the shift key to constrain the gradient to be perfectly horizontal)
- In the Channels Palette click on the "b" channel so it's the only one selected and the only one with the "eye" icon beside it.
- Choose the "Gradient" tool from the palette and draw a white to black gradient vertically across your image.
- In the Channels Palette click on the "Lab" channel.

That's it! Now you can apply the Gamut Warning and see the results for yourself. See the above instructions for information on how to vary the Lightness channel.

Can I use Gamut Warning for other purposes?

When choosing colors in the Photoshop color picker you may see a small caution triangle appear. This is Photoshop checking your color against the current profile and warning you that it will not print correctly on your printer.

What if my printer is an RGB printer and I have an RGB profile for it?

The folks at Adobe made some major changes in Photoshop 5 and really thrust us all into the world of color management faster than perhaps any other application upgrade before. A few things got left out along the way however (they need a reason for you to get the next version ;-)) and RGB devices as first class output devices was one of them. The Gamut Warning function is limited only to a CMYK device. That said, a few ingenious people found a way to tweak an RGB profile and fool Photoshop into thinking it's a CMYK profile. It's a little cumbersome but it does work. To get the full directions on how to perform the conversion, get it from Andrew Rodney's website at <http://www.digitaldog.net/files/PS%20actions.sea.hqx>

What if I don't have a profile for my printer?

You will need to have a profile made for your printer. Luckily this is not a difficult or expensive task. We supply custom printer profiles and you can have one produced remotely by downloading the profiling kit from our website. See www.chromix.com for more details.

Where can I get additional profiles for testing and comparing?

At CHROMiX we have created an online database of device and process profiles for you to search and download for free. This service, called Profile Central, is free and over time, more and more service provider's profiles will be made available for you to find and download. Try downloading profiles for presses and other printers and testing their gamut using GamutView. Profile Central is at www.profilecentral.com

Can I do this on Macintosh and Windows?

Yup - Adobe has written Photoshop to operate identically on both platforms. I have only tested this out on Macintosh but it should work fine on Windows as well.

Who is CHROMiX?

I thought you'd never ask. In fact, if you have read this far you deserve a reward! CHROMiX is a firm based in Seattle, Washington that concentrates on color management, media asset management, and workflow management. We are the producers of Profile Central (at www.profilecentral.com) which is a clearinghouse for ICC profiles and information regarding color savvy service providers. We provide onsite and remote color management and profiling services as well as sell a select group of color management products including those from ITEC (Colorblind), Praxisoft, Heidelberg CPS, X-Rite, GretagMacbeth, Pantone, and others. Please feel free to phone or email with any questions you may have.

As with all this color management stuff, the more people experiment and discover new techniques and visualization methods the better. In this spirit I have spent some time documenting this remarkable technique in an attempt to further people's understanding of the technology and principles behind color management. I truly hope you have found it useful and perhaps have learned something new.

If you find new techniques, disagree with anything I've said in this document (or anywhere else for that matter), or have anything else to add, please do not hesitate to contact me at 206-985-6837 or upton@chromix.com or bring it up as a point of discussion on Apple's ColorSync mailing list. I'm always interested in learning more.

Regards and happy gamut hunting

Steve Upton (President and color geek)

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