



RGB Color Spaces

# RGB Color Spaces

In this lesson, we're going to cover RGB color spaces, also known as RGB working spaces. This is a critical topic to understand if you want to work effectively in Photoshop. The RGB color space is going to control how saturated colors can become in your image. Understanding the color space will help you understand why colors may not look the same from one document to another.

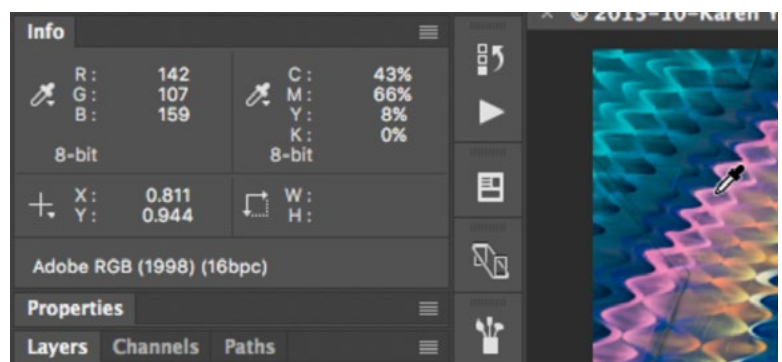
## What's happening behind the scenes

Photoshop's Info panel will show you what's going on behind the scenes in your image. If the Info panel is not already visible in your interface, you can access it by going to the Window menu and choosing Info. The Info panel presents you with different series of numbers. The upper left readout reflects what mode your picture is in.

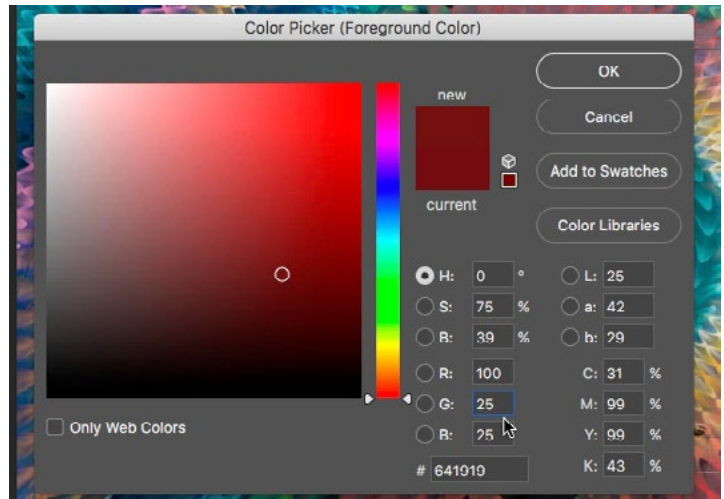
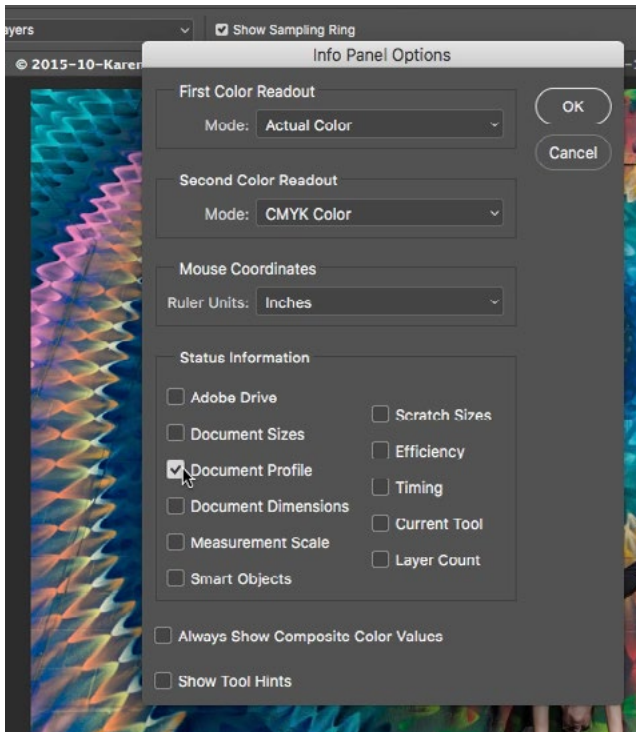
**Color Spaces** Knowing that an image is RGB is truly not enough information to tell you which mode it's in. The image is actually in what we refer to as a color space. A color space is not only the name of the mode, but a way of specifying what colors of red, green and blue you're working with.

Whenever you see the same image or video presented differently across multiple screens, it means that there is no effective color management. Color management tries to make the colors look consistent across various different screens.

When you look at the Info panel while hovering your cursor over your image, the numbers in the upper left will tell you what levels of red, green and blue are required to make the color that is under your cursor (providing you're working in RGB), but it's not enough information to truly



**The Info panel shows what's going on behind the scenes in your image.**



**Left:** You can tell the Info panel to provide a readout of the current color profile by going to the side menu on the panel, choosing Panel Options and then turning on the Document Profile check box. **Above:** The RGB color numbers can also be found within the Color Picker

describe the color. You also need to know what color space you're working in. You can specify that the Info panel show you the current color space by clicking on the little side menu in the upper right corner of the panel, choosing Panel Options from the dropdown menu and then turning on the Document Profile check box. This will give you a readout of your current color space at the bottom of the Info panel.

You will also find the number values that make up a color within the Color Picker, which you can easily access by clicking on the foreground color swatch at the bottom of the Tool Bar.

## Consistent colors across screens

A screen uses red, green and blue light to display the colors you see and each screen uses a different set of those three colors. The color chart (on the next page) shown represents the most vivid colors your eyes are capable of seeing. The set

of black dots represent the red, green and blue hues used on an older Apple display. The set of black dots with the white outline represent the red, green and blue hues used on the new iMacs or iPhones. The set of white dots represent the red, green and blue hues used on an NEC display. As you can see, each of the screens are using red, green and blue, but they're using different versions of those colors in order to present the image. This causes subtle (and sometimes not so subtle) differences from screen to screen.

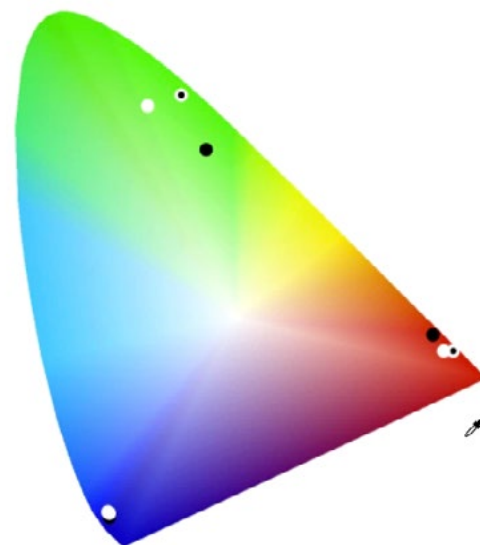
In order to display our colors accurately, we'll create our images not based on the monitor they'll be displayed on, but by using a consistent standard. Then, the color management system that we use will figure out how to transpose that standard for all the different displays.

## Working space choices

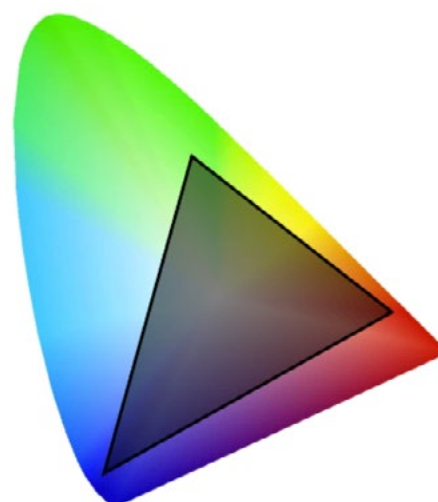
Let's take a look at the standard choices we have when choosing an RGB working space.

The smallest working space, meaning the space that uses the most restricted range of colors, is the sRGB space. Looking at the sRGB diagram, the three points of the triangle represent the red, green and blue colors used in this color space. Everything inside this triangle represents the different colors you can create.

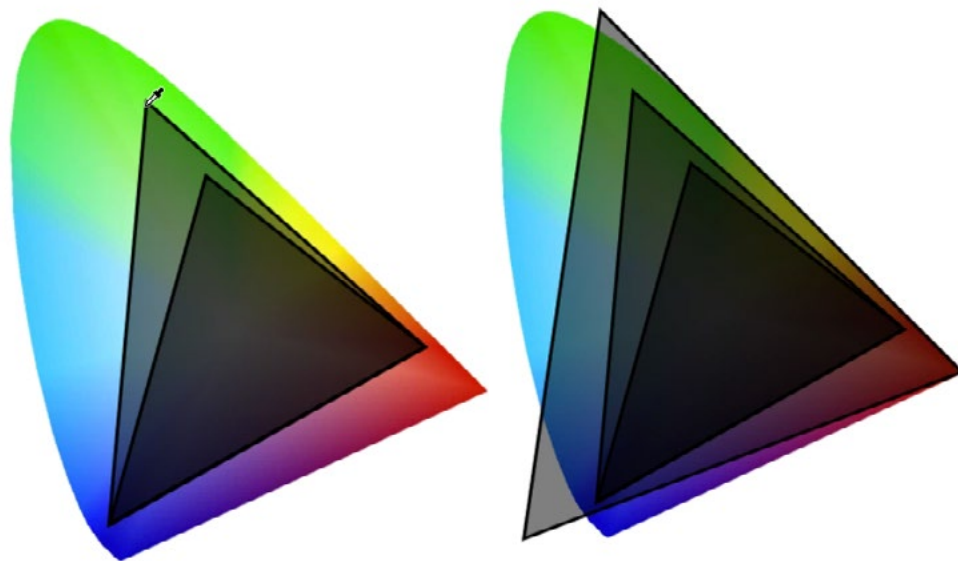
The Adobe RGB color space is a bit larger than the sRGB space, and you can see from the diagram that it includes a wider variety of green hues.



**This chart represents the most vivid colors our eyes are capable of seeing. The dots represent the capabilities of different displays.**



**The three points on this RGB triangle represent the most vivid reds, greens and blues created by the sRGB color space.**



**Far Left:** The outer triangle represents the most vivid reds, greens and blues that can be created by the Adobe RGB color space.

**Directly Left:** These triangles represent the range of colors you can create in a document, depending on which color space you're working in. The triangles represent the sRGB, Adobe RGB and ProPhoto RGB color spaces.

type in the highest value possible for Green within the color picker, you can see that the resulting hue would be different in the Adobe RGB space than it would be in the sRGB space.

ProPhoto RGB is the widest color space. The red, green and blue points each extend much farther than they do for the other color spaces. The shape of color under the triangles represents the range of colors you can see with your eyes. You'll notice that the ProPhoto RGB spaces extends beyond the shape of color and that's because it can create colors that your eyes will never be able to perceive.

## Color spaces and screens

Different screens will display different ranges of color, and it's important to know how many colors your screen can work with. The older Thunderbolt display can incorporate a certain amount of colors. The P3 display can show more, and the NEC display can show even more yet. Note that a high quality monitor will tell you what percentage of the Adobe RGB color space it can display. The higher this percentage is, the better the display. If the monitor does not tell you what the percentage is, it's likely not a high quality display.

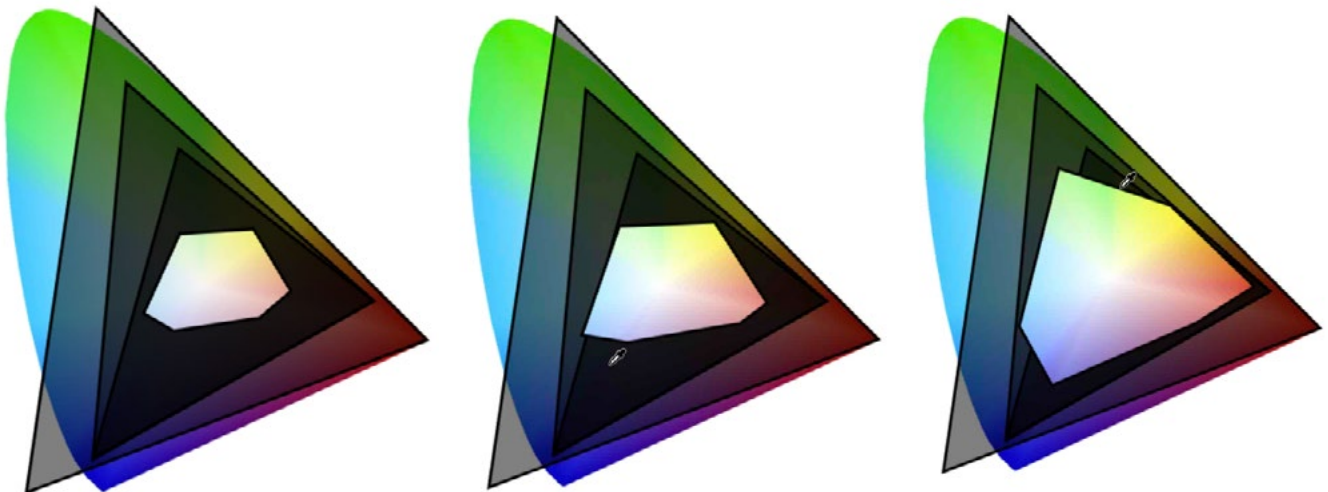
## Color spaces and printers

Often times, the end result of your work on an image is the print. Each printer has a certain range of colors that it's capable of reproducing, and it's nice when we can have all of those colors incorporated in our documents. Ideally, you want the color space of your document to be close to the same size as the color space for your printer.

**Printing on a printing press** When working with a printing press, the goal is to be economical with ink. Because of that, you usually don't have as wide a range of colors.

**News Print** Looking at the range of colors you can use with news print, it's clear that the color space doesn't matter because every color space is capable of creating the small range of colors a news press would use. The shape that represents news print fits inside all of the color space triangles.

**Sheet-fed printing press** When printing on a sheet-fed printing press with uncoated paper, the range of colors we can print is a little larger, and the shape that represents those colors extends beyond the sRGB triangle slightly. This means that it can print some colors that the sRGB space is not capable of creating. For this reason, we'd probably use the Adobe RGB space because it is big enough to contain the range of colors this type of printer can produce.



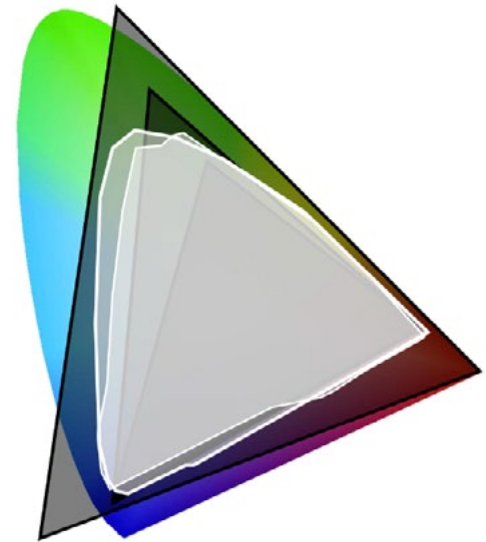
The light shapes represent the colors that can be displayed on three different types of printers. From left: News print, a sheet-fed printing press and a sheet-fed printing press with coated paper.



When printing on a sheet-fed printing press with coated paper, the quality is higher and, looking at the graphic in the video, you can see that the shape extends way beyond the bounds of the sRGB space. In order to best represent the vivid colors, we'd need to use Adobe RGB mode instead of sRGB.

**Printing on an inkjet printer** This is the type of printer you would have at home and the kind that is used when you order photographs to be printed from a photo lab. Because these printers aren't producing the mass quantities that a printing press is producing, they can use higher quality ink and use a wider range of colors. In the video, we show the diagrams for a few different inkjet printers. Most of them can print a range of colors that extends far beyond the triangle representing sRGB. This means that the sRGB color space will limit you rather dramatically in terms of colors you can use in your images. Many of these printers can produce a color space that even extends beyond the bounds of the Adobe RGB color space. For this reason, it could be best to use the ProPhoto color space to ensure that we can create all of the colors that our printer is capable of producing.

This is where things can start to get tricky. In using the ProPhoto RGB color space, we can create all of the colors our printer is capable of producing, but we are limited in what our screen can display. This means that some printers can reproduce colors that the screen can NOT reproduce.



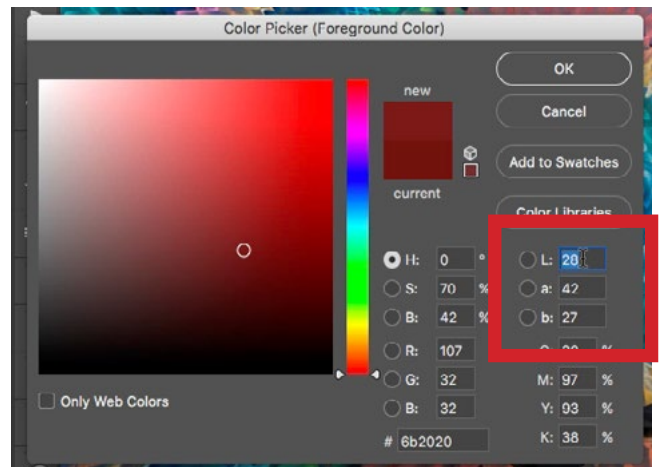
**The white shapes represent the colors that two different inkjet printers are capable of producing. You can see that the color ranges extend beyond both the sRGB space (the smallest triangle) and the Adobe RGB space (the medium triangle).**

## ProPhoto in 16 bit

Whenever I work in ProPhoto RGB, I always make sure that my image is in 16 bit mode. When working on a photo in 8-bit mode, the numbers that define colors range from 0 to 255. With 16-bit, we have thousands and thousands of color shades to describe our colors. The wider the color space we use, the more it becomes necessary to work in 16-bit mode. If we don't, the image can end up with a bit of posterization, which creates an unappealing banding effect.

## RGB numbers in Photoshop

**The Color Picker** Inside the Color Picker, we can enter in exact values for red, green and blue in order to create a specific color. It's important to understand, however, that those same values will create a different result when you type them into a document that uses a different color space. If you would like to create a color that is consistent across color spaces, use the LAB values within the color picker. LAB does not have a working space attached to it. The numbers there are enough to describe the colors as a whole and therefore you can use those numbers to perfectly match colors between documents.

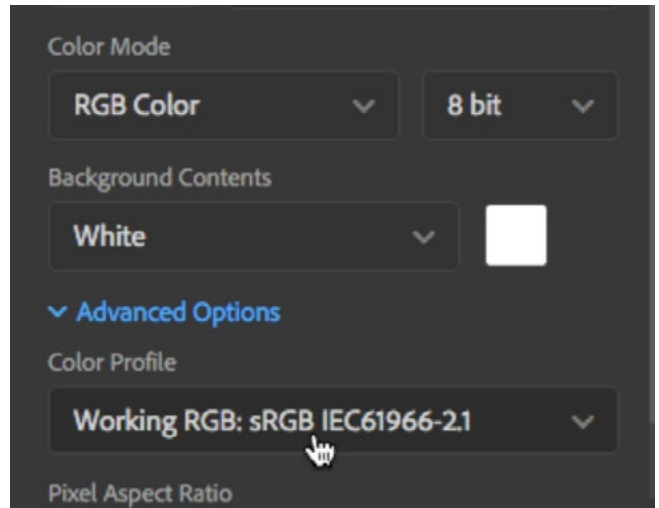


**If you want to perfectly match a color from one document to another, use the LAB values, located within the Color Picker.**

**The New Document dialog** We are also presented with color profile settings when creating a new document. In the New Document dialog, there is a Color Mode menu where we can choose between RGB, CMYK, etc. and if we click on Advanced Options, we will get a Color Profile menu where we can specify



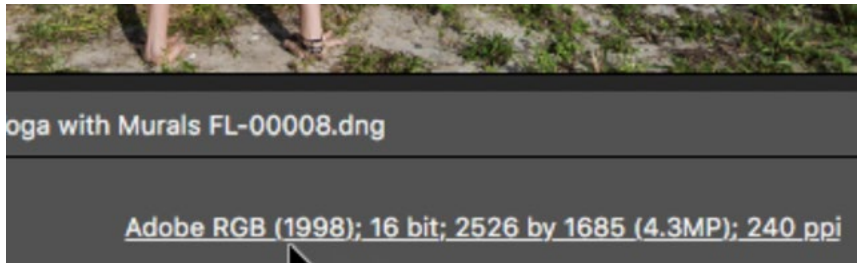
which Color Profile to use (sRGB, Adobe RGB, etc.). Each of the color modes will have a default working space, and we can specify what the default working color space should be within the Color Settings dialog, which is located within the Edit menu. This dialog looks complicated, but we only need to pay attention to the Working Spaces settings in the upper left. This is where we tell Photoshop what the default settings should be when creating new documents.



The Color Profile setting within the New Document dialog.

## Adobe Camera Raw (ACR)

ACR thinks about the range of colors that your camera captures. That range is not yet defined by a color space, but when it moves out of ACR and into Photoshop, it needs to have a color space attached to it. You can specify which color space to use



This text can be found at the bottom of an ACR window. Clicking on it will allow you to specify what color space should be used when the image is opened in Photoshop.

by clicking on the line of text at the bottom, center part of the ACR interface. This text displays the color space that will be used. Change it by clicking on the text to get the Workflow Options dialog and then use the Color Space settings to specify which one should be used.

**Lightroom** When we export an image from Lightroom, we need to specify what color space the image should have. In Lightroom's Export dialog, we'll find settings for both color space and whether the image should be in 8 or 16 bit. We'll

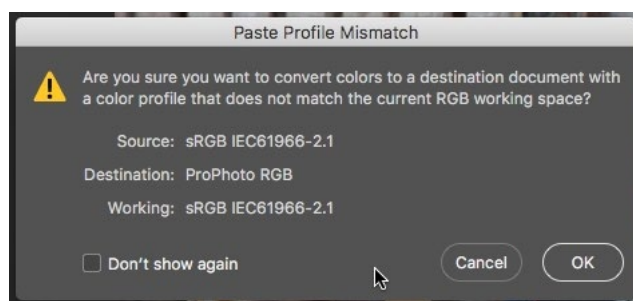
also find the color space settings in Lightroom's Preferences, under External Editing. This is where we specify what color space should be used when we move an image from Lightroom into Photoshop (or another program).

**The Info panel** We mentioned earlier that a document's color space will be represented in the top left number set within the Info panel. It's important to remember that a color is defined not only by the RGB values but also by the color space used.

## Working with color spaces between documents

When looking at the same image in two different documents that contain two different color spaces, you will likely only notice a difference when you have really vivid colors in the image.

To copy an image layer from one document to another, use the keyboard shortcut Command+A (Ctrl+A on Win) to select everything. Then go to the Edit menu and choose copy. Move to the document in which you'd like to place the image, go back to the Edit menu and choose Paste. If the destination document has a different color space from the document you copied the image from, a warning dialog may appear. The warning will tell you that the color space between the two documents is different and it will ask if you'd like to convert the colors to the color space in the destination document. You can simply click ok to continue pasting the image into the destination document.

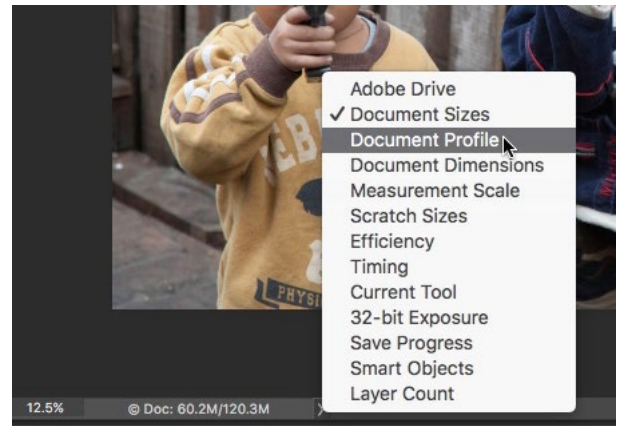


**If you try to paste an image into a document with a different color space, this warning dialog will appear.**

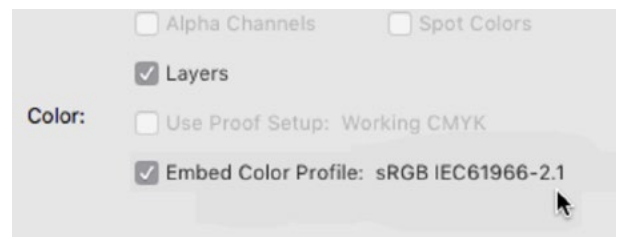
## Where to find the document's color space

We already mentioned that you can set up the Info panel to display what color space the document is using. You can also display this information in the bottom left corner of the image window by clicking on the little arrow to the right of the text and choosing “Document Profile” from the popup menu.

Additionally, when saving an image using the Save As command, you will see an “Embed Color Profile” check box at the bottom of the Save As dialog. It's extremely important that you always have that turned on when saving your images. If this setting is NOT turned on, the colors in the image will not look the same when you send the file to someone else. In order to accurately describe the colors in your picture, Photoshop needs to know what versions of red green and blue are being used.



**We clicked on the arrow to the right of the text at the bottom of the document window and are choosing “Document Profile.”**



**When saving an image, always make sure the “Embed Color Profile” check box is turned on.**

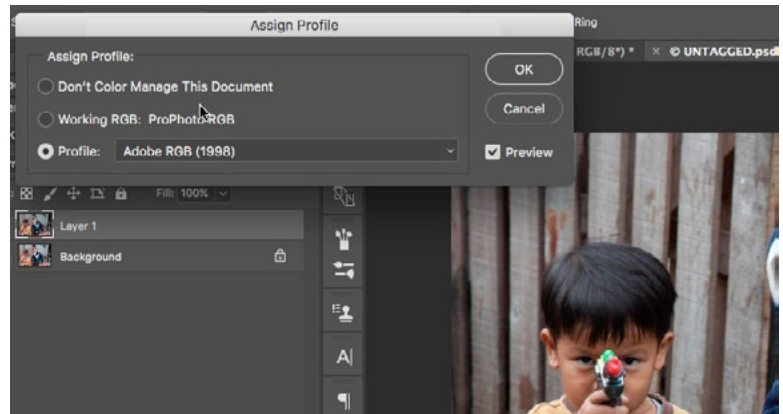
## What to do with an untagged image

If you ever receive an image from someone that is untagged (lacking a color space), you can try and figure out which color space the image was created with and is supposed to use. In order to do this, switch between the different RGB working spaces and see which one makes the image look the most natural. To do this, go to the Edit menu and choose Assign Profile. This command will not change the information that's in the picture and it won't change the RGB numbers. It WILL change the colors of red, green and blue that those numbers refer to. In the

Assign Profile dialog, turn on the Profile box and switch between the different RGB workspaces. When you find the one that looks most natural, click OK.

You can tell Photoshop to warn you any time you open an untagged image by going to the Edit menu and choosing Color Settings. In the Color Settings dialog, turn on the “Missing Profiles: Ask When Opening” check box.

With this setting on, Photoshop will give you a warning dialog any time you open an image that does not have a profile assigned to it. When you see this warning, you’ll know that the first thing you should do to your image is use the Assign Profile command to specify a color profile.



**The Assign Profile command is being used on an image that was untagged (lacking a color profile).**