

## Integrity of Scientific Imagery:

### Photoshop v.4 versus v.5

Michael Shaffer, University of Oregon

Having installed Photoshop 5 after using version 4 for some time, I think that all scientists who believe that the integrity of their imagery is important, understand what Photoshop 5 brings with it: the issue of "color space" or "color profiles". Whereas users could rely on the integrity of their image being retained with Photoshop 4, this changes with version 5, and in some cases rather severely. For example, an image bitmap which might represent elemental spatial distribution data should be considered to have a gamma of unity. Photoshop 4 would represent this data for editing via the display monitor's gamma compensation only. That is, the integrity of the pixel values would remain and visual compensation happens between data and display. Photoshop 5, on the other hand, will modify pixel values in accordance with either a desired "working" color space or an anticipated "target" color space.

A good example of this would be if version 4 is used to create a linear gradient of grays. Examining the histogram shows a flat distribution of pixel values, 0 to 255. Now, if the gradient is saved and loaded into version 5's default working space (caveats below) and the histogram is examined, a very different set of pixel values is found. If this file is now saved, the original data is lost. The degree of change is for the most part moving from "simple data" (gamma=1) to a color space gamma (gamma could be anything). The changes also reflect color gamuts associated with either the display or the target, but what is most noticeable is a compensation for gamma, for

which the default is 2.2.

Adobe has addressed this problem in the sense that the earliest distributions of version 5 installed "color profiling" behind your back without asking you to understand it. An available patch (version 5.02) and current distributions now provide warnings, and choices for defining the desired default color space or turning it "off". Still, there are many virtues of color space if it is understood. My message here shouldn't be considered as a suggestion that every scientist should avoid Photoshop 5, just be aware of this issue.

My suggestions would be to:

- (1) Always keep the original image files intact.
- (2) Keep the installation of Photoshop version 4.
- (3) If version 4 isn't available, install only the latest distribution of version 5.02, or install the patch (5 to 5.02) as soon as possible.
- (4) Turn off "color space" conversion when opening files, and use "profiling" only when a particular target color gamut and gamma is desired.
- (5) Do not rely on the manual for an understanding of color space and profiles. Adobe provides much more information at their web site:  
<http://www.adobe.com/supportservice/custsupport/TECHGUIDE/PSHOP/main.html>.

Also, investigate with the aid of 3rd party texts, such as *Real World Photoshop 5* (Addison-Wesley, 1999) by Bruce Fraser and David Blatner, and *Essentials of Digital Photography* by Akira Kasal, Russell Sparkman, and Elizabeth Hurley (New Riders Publishing, 1997). ■

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