Fluorescent whitening agents make your paper appear brighter and whiter, but the treatment can wreak havoc in your color management system.

The trouble with FWAs

A number of factors can affect our ability to perceive a match between a print and a display, some of them we have no control over. One is the fluorescent whitening agents (FWAs) used in several papers often used in photo printers. Also called optical brighteners, these paper dyes absorb invisible ultraviolet light and reemit it as a visible light in the blue area of the spectrum.

Paper manufacturers use this tricky optical illusion to make paper appear brighter and whiter than it actually is. Laundry detergent makers use the same technique to give your whites the appearance of being *really* white. You might have seen the effect under a black light; the FWAs produce a bright bluish fluorescence we don't see under other illuminants. The black light fluorescent tube has a single phosphor that produces a bluish light, 370 to 400 nanometers in the color spectrum. The visible light spectrum from violet (400nm) to red (700nm) is pictured in **Figure 1**.

What's the problem with FWAs? First, when you measure the paper with a spectrophotometer so you can build an ICC profile, the instrument often detects the

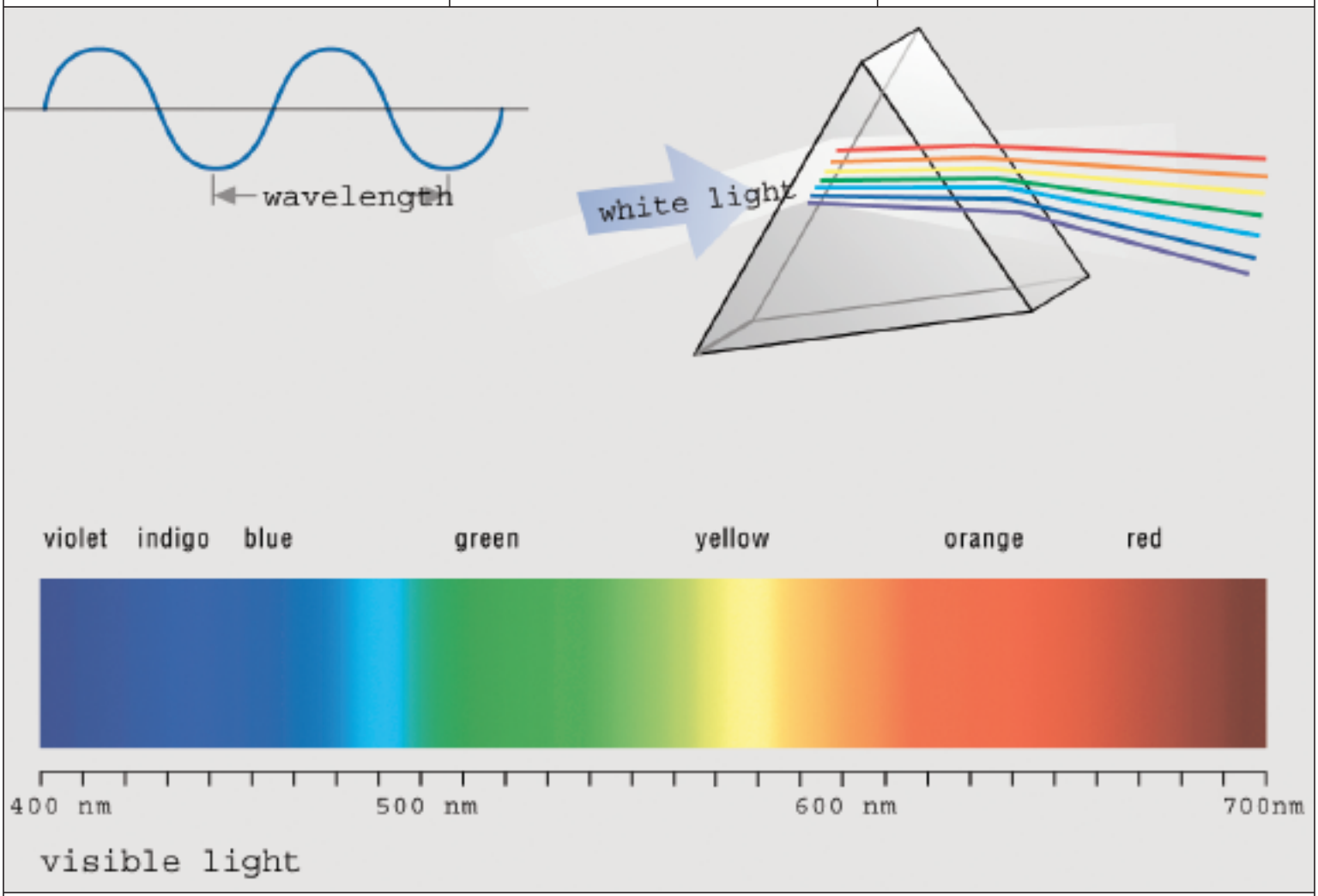

Figure 1: The visible light spectrum covers an approximate range of 400nm to 700nm. It's the wavelengths below 400nm that are problematic—we can't see them, but the spectrophotometer often can.

part of the electromagnetic spectrum that we can't see without that aid of a black light. The spectrophotometer reads the paper as blue, though we see it as white. The resulting ICC profile can produce a nasty colorcast, or what appears to our eyes as a cast. Placing a UV-blocking filter over the spectrophotometer is a partial solution, but can be an ineffective fix. UV-blocking filters can block all but the visible light spectrum, but you get the best color matches when the print-viewing conditions have the same amount of UV as the light source in the spectrophotometer that's used to build the paper profile. Filtering UV is like correcting one error by introducing another. These filters don't account for any specific light source, either in the spectrophotometer or the illuminant under which the print is viewed.

At least one paper profiling software product, GretagMacbeth (X-Rite) ProfileMaker Pro with Eye-One Match, automatically looks for evidence of optical brighteners and attempts to compensate in building the subsequent ICC profiles. It works quite well in most cases, so I haven't used spectrophotometers with UV-blocking filters for a few years. But even this approach isn't perfect in every case.

A general amount of UV compensation is calculated, and most affordable spectrophotometers can't measure light in the UV wavelength below about 380nm. In addition, the software needs to compensate for the UV correction based on the intended viewing illuminant, and most products are designed on the assumption that prints will be viewed under D50. Thankfully, ProfileMaker Pro allows the user to measure the viewing illuminant or to select a set of presets when building a profile rather than always defaulting to D50. If you're viewing a print near your calibrated display under one illuminant, but will display the final print under a different illuminant, this could be a problem. The question of whether or not to use UV filters or intelligent software is still in debate among color geeks.

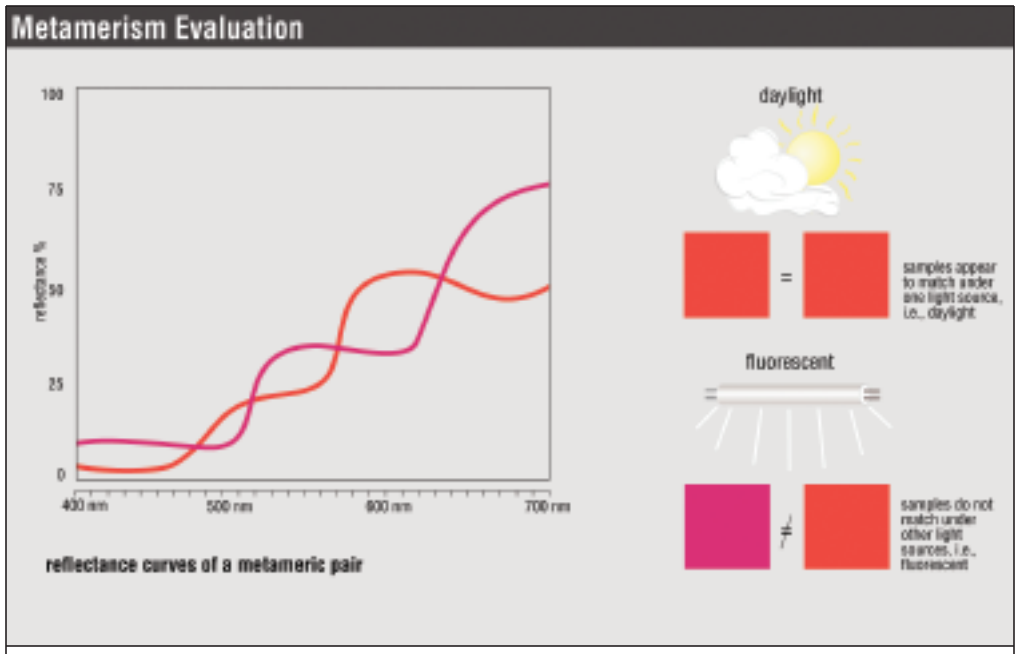

Figure 2: In a metameric pair, two different spectral colors produce a color match under one illuminant but not another. This is a metameric match or mismatch, depending on the illuminant. This effect is different than the color casts introduced by FWAs.

The white appearance of FWA-treated papers—paper makers use varying amounts of FWAs to achieve a "clean" white appearance—may radically change based on the spectrum of light, making it even harder to produce consistency between what we see on the display and what we see on our prints. You might view a print under a fluorescent daylight-balanced light box and find that it looks quite different when viewed outside or under tungsten light. Color management can't fix this.

Don't confuse mismatching colors due to differing illumination with the problem of metamerism, although metamerism can manifest as a similar illusion. Metamerism is a phenomenon that occurs when two color samples of different spectral properties appear to match under one illuminant but appear dissimilar under another illuminant (***Figure 2***).

FWA-treated papers tend to lose their fluorescence as the paper ages, which could present a major problem in archiving prints. Over time, the appearance of the paper, and thus all the colors in the print, could become more yellow.

The easiest and best solution to FWAs is to avoid papers that have them. Before I commit to using a paper, I check for the presence of FWAs with a portable battery-operated black light. If I see any indication of fluorescing in the paper under this illuminant, I move to the next sample. ■