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EXPERT TECHNICAL **GUIDE**

TEXTILE PRINTING

GUIDE 3: MEASURING COLOURS ON TEXTILES

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MEASURING COLOUR ON DIGITALLY PRINTED TEXTILES

Colour management has been applied to printing, including textile printing, from the very beginning. But modern colour management came about when spectrophotometers came down in price and became affordable for both printers, prepress operators and even savvy designers.

Many printers and print buyers use visual evaluation to judge if the colours match a certain reference, or to general expectations. And this is not a bad thing, since the human eye is very good at comparing even very small colour differences, even on textiles. The problem is that this assumes a good light source at the place of evaluation, and the perfect colour vision of all parties involved. One of the most common mistakes when evaluating printed materials is to do the evaluation in an uncontrolled lighting situation, be that indoors in an office, outdoors or by a window.

The perceived colour of a printed fabric depends very much on what light source is used, and the brightness of this light. At too low light intensity (darkness) no colours appear, while we will get blinded by light that is too strong. And colour perception is subjective: only about 10% of the population have a superior colour discrimination capacity. Men dominate when it comes to being colour blind, but there are women as well with severe limitations to their colour vision. The point here is that before you make critical assessment of colours, you should test your colour discrimination capacity. The best and most comprehensive test is the FM100 test, but there are more simple tests which will reveal limitations in colour vision.

You should evaluate printed colours in a viewing booth ideally conforming to ISO 3664 (Graphic technology and photography -- Viewing conditions) which tells you how to make sure you have the correct viewing conditions. The light source should have the correct whitepoint, and a good spectral distribution.

USE THE CORRECT TYPE OF SPECTROPHOTOMETER

Once we have assured ourselves that we have a correctly set up viewing booth, with the correct type of light, and know that we can trust our capacity to assess small colour differences in a correct way, we can start to measure colour before and during print. For this we need a good spectrophotometer. Spectrophotometers measure the actual spectra produced by the reflected light bouncing off of the printed fabric. You can also use a spectrophotometer to measure the light from a monitor, and so use it to calibrate your proofing monitor.

When measuring printed fabric it's important to use a suitable spectrophotometer with a large aperture. Shown here is the Barbieri Spectro LFP, popular within large format digital print production.

The spectral data can be expresses as spectral data or converted into a device independent colour space, depending on the needs of the colour management software. The file format used for spectral data is CxF, recently published as ISO 17972 (Graphic technology — Colour data exchange format (CxF/X). Spot colours especially are often expressed using CxF, since this file format uses rich metadata to describe both the printing conditions and the setup of the spectrophotometer when the measurements were made.

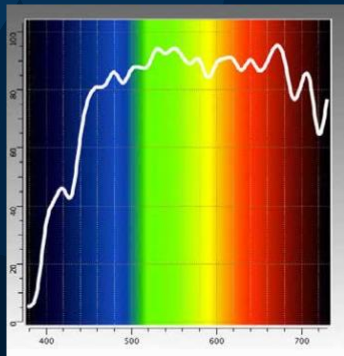
One challenge with taking measurements on printed fabrics is that the surface is uneven and the resolution relatively low. To counter this technically we need to make sure that the aperture is quite big in the spectrophotometer, and also that the measured samples are large enough to give a stable and representative value.

WHAT TO DO WITH THE MEASUREMENTS?

It's all well and good to have a decent spectrophotometer, but to make full use of this equipment you will need good software. The first use of a spectrophotometer is to check the colour of a specific sample. There are several printed colour guides for spot colours, but the Pantone system is perhaps the most commonly used. Be aware that the sample may be old or worn, so a better option is to measure the sample. Take note of the CIE Lab values and then try to match those values as close as possible. This might not be possible when only using the process colours CMYK, which only can reproduce about 60% of the spot colours. When printing using analogue processes you are used to loading a specific spot colour in the press, but this is not always possible when using digital presses. You might be able to load a few very popular spot colours as a special ink in the digital press, but you are not likely to be able to order all the 1000+ colours in the Pantone colour library.

Of late using an extended colour gamut made up of CMYK and additional inks such as Orange, Green and Violet is increasingly popular in some digital printing systems. Using an extended gamut ink set, you should be able to reach about 90% of the spot colours in the Pantone library, but this depends a great deal on what fabric you are printing and on the ink set.

To express the perceived colour difference a couple of formulas have been developed over the years. The oldest is from 1976, and if nothing else a colour difference, expressed as Delta E (written ΔE), is calculated using the formula from 1976. Of late the year 2000 formula is becoming more and more widely used. However it must be stated if the colour difference measured, or tolerances defined, have been done using the year 2000 formula. The tricky thing is that while it's generally said that humans can detect a colour difference smaller than ΔE 1, this is only true according to the old formula from 1976. The year 2000 formula typically gives you values for colour difference that are about half compared that of the formula from 1976. But checking that you reproduce colours within the specified tolerance for colour deviation is one important use of a spectrophotometer.



When evaluating prints and proofs it's important to use the correct light. An ISO-compliant viewing booth typically uses a specific standard daylight called D50. This means that the spectral distribution for the artificial light is even, and the white point is at 5000 Kelvin, or K. (The Kelvin scale is used to measure the colour temperature of visible light).

The other important use of the spectrophotometer is to calibrate a printing device, and after that to characterise it, meaning building an ICC profile. The ICC profile describes the colour gamut the printer can produce, and is used both for colour conversion from RGB and to simulate the printed result. If you activate this ICC profile in the software used for design and the creation of artwork, you can simulate the printed colours in what is often called a softproof, an image presented on a high end and carefully calibrated monitor.

Moving from conventional and mainly analogue printing technologies to digital printing on fabrics is a timely move. The technology is developing fast and opens up a huge array of opportunities. But it's also a move into a fully digital world, where the colour management is expected to be computer controlled, and the resulting colours properly validated. There isn't any specific ISO standard for digital print in general, and definitely not for digital printing on fabrics, but there are well defined standards for viewing (including softproofing), measurements, file formats and hardcopy digital proofing.

There are still limitations to digital printing on fabrics, especially in terms of the ink sets that can be used, but on the other hand those limitations will change over time. All in all the opportunities outweigh the limitations, so if you master the art of colour management in this area, you stand a good chance to fully meet, and possibly exceed, your clients' expectations.