Comart Color Management

The 5-C approach to managing color.

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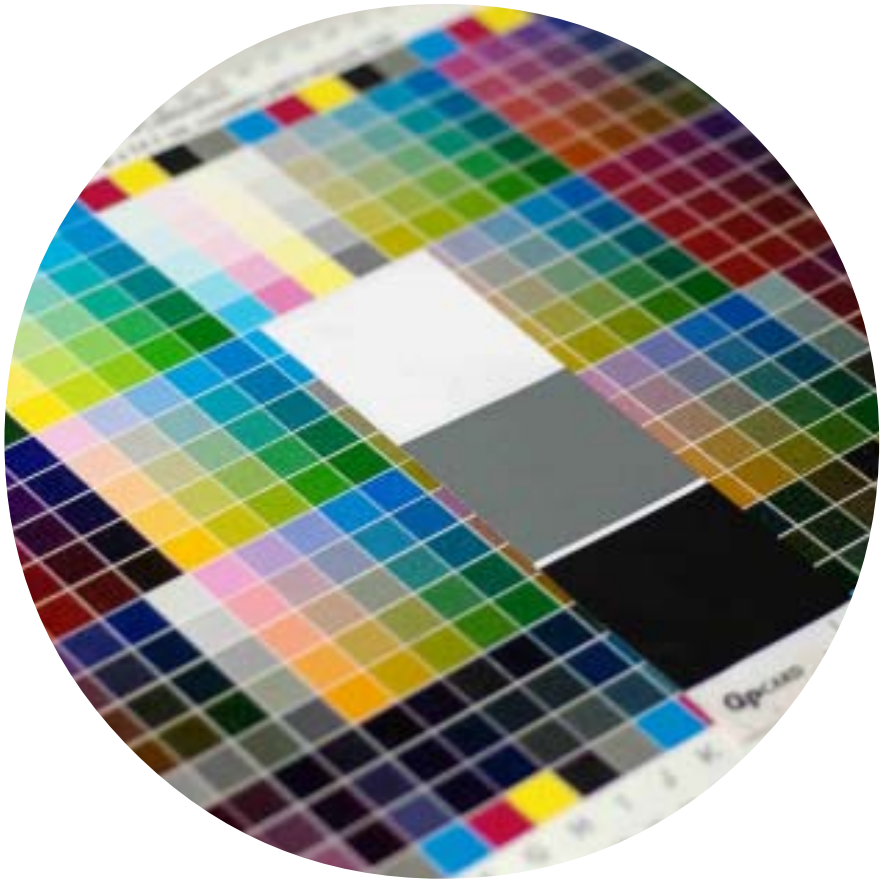

Comart
Integrated Premedia and Print

Understanding colour management

In graphic arts processes, one of the biggest challenges has been to reproduce colour the way the eye sees it, on a series of devices that have progressively diminishing colour capabilities.

Colour management is the means to achieve this consistency of reproduction of colour content in text, line art, graphics and pictorial images on different media – paper, board, flex and on viewing devices such as computer monitors. Achieving consistency of colour is however, tough given the variations in standards followed by media, device and equipment vendors. It takes a deep understanding of a wide gamut of issues at different stages of the graphics production processes – from creative to print. But more significantly, it takes expert techniques and adoption of standards to get the right colour consistently.

Today, this witchcraft of the yester years has been transformed into a pure science by the **International Colour Consortium** (ICC) (www.color.org) and the **Commission International De L'Eclairage** (CIE) (www.cie.co.at/cie/).

The purpose of the ICC is to promote the use and adoption of open, vendor-neutral, cross-platform colour management systems. The ICC specification has recently been approved as an International Standard by the ISO (International Standards Organization).

The purpose of the CIE, the International Commission on Illumination, is to promote international cooperation and exchange of information on all matters relating to the science and art of lighting. The CIE is also recognized by ISO as an international standardization body.

The **ICC Colour Management workflow** consists of a collection of utilities and resources whose goal is to automate colour conversions between different media and devices, and at the same time to reproduce the desired colour appearance of an original in a way that is consistently pleasing and acceptable. Colour Management Systems make use of ICC device profiles. These profiles provide the data necessary to transform the colour of an image from the colour characteristics of one device to those of another.

Comart has two full time professionals, having a doctorate and a master's degree in colour science, to manage the colour workflow at Comart. Award winning Gretag Macbeth software and hardware is used to manage colour reproduction across all devices and systems on our shopfloor.

Comart's reputation and industry leading expertise in managing colour is guided by a set of methodologies that we call **"The 5-C Policy"**. This whitepaper outlines the 5-C approach we follow.

Comart's 5-C approach

1) Calibration

The setting up of an imaging device (Monitor, Printer, Proofer, Scanner, Camera, etc) so that it gives repeatable data from day to day is the process of Calibration. Calibration of a device is an essential first step before any imaging process is carried out.

At Comart, display devices are calibrated on a weekly basis. Displays are calibrated to ICC standards of simulating a D50 light source with a luminance of 100 Cd/m2.

The Printers and Proofers are calibrated on a daily basis to achieve optimum colour reproduction. This involves the setting of the individual colour densities, dot gain curves, and total ink limits to achieve a visually linear reproduction of each primary colour of the printer, while maximizing its colour gamut without loosing shadow detail.

Professional Digital Cameras and Scanners, used at Comart, come with their own methods of calibration given by each manufacturer. These devices are quite stable and need to be calibrated once a month. Please note that the usual desktop scanners and digital cameras do not come with any calibration and hence are not reliable for reproduction of colour.

2) Characterization

Characterization is the process by which a relationship is defined between the colours of a device and the colours seen by a Standard Human Observer as defined by the CIE. The Standard Human Observer defined by the CIE colour space is taken as the device independent colour space. The process of the characterization results in an ICC profile defining this relationship.

The making of a profile involves obtaining two set of values. One, the actual colour value in the CIE colour space obtained by measuring the set of colours reproduced by a device using a spectrophotometer. Second, the set of values as input to the device to produce that colour. The colour profiling software then uses these two set of values, along

with other user definable controlling parameters, to create an ICC profile for the device.

Characterization is a more time intensive step than calibration. Hence, it is important to first calibrate a device before characterizing it. When and if, a device drifts, a simple re-calibration of the device is sufficient to keep the ICC profile valid.

3) Colour transformation

Since all ICC profiles describe the relationship of the device colours to a common device independent colour space, in theory, it should be possible to transform the colours reproduced by one device to that reproduced by another device with maximum efficacy.

However, the different devices that graphic artists use to view their images differ widely in their gamut to reproduce colour. Display and input devices are mainly RGB devices while printers are CMYK devices complicating this issue further. Hence, to get the maximum efficacy when transforming colours from one device to another, the CIE has put down four different rendering intents (absolute colorimetric, relative colorimetric, perceptual and saturation). It is beyond the scope of this white paper to go into the details of these rendering intents, but will suffice here to state, that the colorimetric rendering intents are more accurate and used when proofing a smaller gamut colour space on a target device with a larger colour space. The other two rendering intents are used for converting from a larger colour gamut to a device that has a smaller colour gamut, sacrificing colour accuracy for maintaining the relationship between adjacent colours so that colour gradients are not flattened out as would happen with the colorimetric rendering intents.

4) Certification

This is to verify the colour managed workflow is well with in the tolerance specified by different display and printing standards. Comart Proof verification using ORIS Certified Proof is the next step in quality control process. It gives a colorimetric quantification of variation in a printing process. This ensures a certified Proof giving the clients confidence in every print they receive.

5) Colour Editing Standards and Viewing Standards

Most image files are edited in the RGB colour space. Without any standards, each artist would be editing the image in his own display colour space and such a file when transferred to a different display device would look different. To overcome this problem, certain standard RGB colour spaces have been defined for editing image files.

Image files that are meant to be ultimately viewed on a display device, such as for the web are edited in the sRGB colour space which is meant for viewing on CRT monitors calibrated to the CIE standards. The sRGB colour space was originally defined for HDTV (High Definition Television).
Image files that are meant to be ultimately viewed in print are edited in the adobeRGB colour space which is a wider colour space than sRGB and better suited for converting to the necessary device specific CMYK colour space for printing onto a specific device.

A cruel trick that our eyes play on us is the change in a colour due to changing lighting conditions. Two colours that may look alike under one lighting condition may not look alike under another lighting condition. This is called metamerism and the pair of colours exhibiting this effect is called a metameric pair. In order to avoid the effects of metamerism the CIE and ISO committees have specified a standard light source with a colour temperature of 5000 Kelvin (D50) for viewing prints. Hence, all prints in Comart are viewed under a special viewing booth meeting these standards ■

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