How G7™ Makes Inkjet Color Management Better

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About G7

- G7 is a known good print condition based upon gray balance that takes the substrate white point into consideration.
- Gray is the one color we can say is right or wrong simply by looking at it.
- Grays appear correct if they match the viewing environment's white point (e.g. paper).
- http://idealliance.org/g7
Known Good Print Condition
What is Color Management?

Controlled conversion between the color representations of:

- Digital cameras
- Monitors
- Offset presses
- Wide format inkjet printers

The goal is to obtain a common visual appearance across the different devices and medias that are output.
Color Management Visually
What is an ICC profile?

A look-up table that represents the color input or output of a given device.

The design is specified by the International Color Consortium (ICC).

We connect the devices in a Profile Connection Space (PCS).

- Occurs in L*a*b*
Kinds of ICC Profiles
Kinds of Profiles

Canned Profiles

- Consider the source.
- Match your printer, media and ink?
- Ink restrictions for your environment?
- For color critical work, it leaves a lot to be desired.
- But it’s cost effective and quick.
Kinds of Profiles

Custom Profiles

- You are the source (or you hired a color management expert).
- Perfect match for your printer, media and ink.
- Ink restrictions tweaked for your environment – maximized gamut.
- Perfect for color critical work.
- But it’s not free and takes time.
Kinds of ICC Profiles

- Canned
- Custom
Why Bother?

Color is about evoking a feeling from you - the potential consumer - of a product or service.

Sometimes those feelings are good and sometimes those feelings are bad. At other times, the feelings are neutral.
The Touchy, Feeling Side of Color

Designers could care less if we hit the right L*a*b* values within the specified Delta E tolerance range.

What designers care about is walking up to the product on the store shelf and feeling the way they intended us to feel.
The Touchy, Feeling Side of Color

Designers care about what we do.

They just don’t want to know how we do it.

Our deliverable to them is the right color every time, all the time.
The Starbucks Quiz

Imagine walking through the door of a Starbucks – any Starbucks in any city. To enter, you have to open the door with the circular sign that signifies a Starbucks. You open the door and you see the familiar tables and chairs and the rack of Starbucks coffee and mugs for sale leading to the counter. Maybe this particular Starbucks is grand enough to have a fire burning in a fireplace in the middle of the store. There’s a buzz in the air of people meeting and talking about important things. You can smell the fresh-roasted coffee and sweet caramel mocha lattes being made to order.
The Starbucks Quiz

Are you there? Can you hear it, smell it, feel it?

Good. Now I have two questions for you:

What color is that circular sign on the door you walked through?

What symbol or image is in the middle of that sign?
The Starbucks Quiz
Color Perception

Color results from an interaction between, *light*, *object* and the *observer*. It is light that has been modified by an object in such a manner that the observer (human visual system) perceives the modified light as a distinct color.
How Many Colors Are There?

The average human eye can see millions of colors!

An RGB monitor can typically reproduce around 16.8 million colors.

A typical CMYK printing device can reproduce thousands of different colors depending on calibration and dot structure or halftone used.
Defining Color-Additive Color Model

RGB - When two additive primaries overlap, a subtractive primary is produced.

Where all three are combined, white light is produced.
CMYK Color Space - Subtractive

Subtractive color system:

- Equal portions of cyan, magenta and yellow subtract color from the viewer’s eye to produce black. Additional black ink or toner is used to create a more true black tone.

CMYK colors are used by:

- Wide format printers, copiers and full-color printing presses
Additive vs. Subtractive Models

Primary Colors of Light

Additive Mixing

Subtractive Mixing
Gamut

Gamut refers to the range of color that a device can capture (camera or scanner), or reproduce (monitor, proofing system, or printing process). Every device will have its own unique gamut.

2D and 3D Gamut Map: Outside shape is AdobeRGB (1998) – shape in middle is GRACol2013 CRPC6
Gamut Conversion

Color workflows work from larger gamut input devices to a smaller gamut output device

RGB? – CMYK?

Rendering intents translate the differences
Perceptual rendering intent

Compresses all colors (detail) into the destination space while trying to preserve color appearance and color relationships. It does this by adjusting all of the colors – even those that were in gamut. This causes more colors to shift than any other rendering intent.
Relative Colorimetric Rendering Intent

1 to 1 matching of in-gamut colors. Out of gamut colors are clipped to nearest reproducible hue. Relative colorimetric causes the white in the source space to be re-mapped to the white point of the destination space.

All colors maintain relative position to the white point.
Color Management Pyramid

- Profile
- T.A.C.
- Linearization
- Primary Ink Restrictions
- RIP Settings
- Calibrating Media to Printer
- Ambient / Environmental Conditions
Color Management Pyramid

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Stabilize the System
Stabilize The System

- Ambient / Environmental Conditions.
  - Temperature
  - Humidity
  - Static Electricity
  - Electrical Power Issues
  - Dust/Dirt, Etc.
Environment - Problems
Environment - Better

Stabilize The System

Calibrating Media to Printer
- Head Height
- Nozzles
- Uni/Bi Directional Alignment
- Media Feed Adjustment
- Heat/Cure Settings
Stabilize The System

RIP Settings
- Dot Pattern
- Resolution
- Pass Count
- Print Speed
- Overprint/2\textsuperscript{nd} Strike
- Variable Dot Settings
- Light Ink Transitions
Profiles and Rendering Intent

Input Profiles
  a/k/a Source Profile
  Defines the target color space(s)

Honor Embedded Profiles?
  Trust the file provider or not.

Rendering intent(s)
  Changes overall color rendition
Color Management Visually
Remember Rendering Intents?
Color Management Pyramid

Profile
T.A.C.
Linearization
Primary Ink Restrictions
RIP Settings
Calibrating Media to Printer
Ambient / Environmental Conditions

Profile Creation
G7 happens here
Inkjet is Different.

At some point on the uncalibrated tone ramps, each primary color stops being the color we expect it to be (ISO 12647-2) in conventional printing and becomes some other color.
How We Solve This Difference

Properly setting primary (or single channel) ink restrictions is the single most important aspect of creating inkjet profiles.

This is particularly challenging with solvent, dye sublimation and UV.
What an ISO Compliant Ink Looks Like

Reaches the target delta-E ellipses via a fairly linear and predictable path.

This graph is the end result of a properly ink restricted and profiled aqueous printer that passed G7 Color Space certification.
Where We Run into Problems…

Notice cyan coming up short.
And a hooked magenta.
Then, see what happens to red as a result of a hooked magenta.
AND this is after proper ink restrictions and profiling.
One more look: side-by-side
Sounds Like it Might be Hopeless

At this point you might be asking yourself, why bother?

Sounds like it can’t work or that it’s very difficult.

But it’s not and it does work.
Color Management Pyramid

- Ambient / Environmental Conditions
- Calibrating Media to Printer
- RIP Settings
- Primary Ink Restrictions
- Linearization
- T.A.C.
- Profile

Profile Creation
G7 happens here
Print, Measure, Calculate
RIP Linearization
RIP Linearization/G7 Calibration
Why Does it Work?

Because G7 is a process-based solution to achieve near neutral or gray balance of CMYK devices.

G7 is not a shiny thing or a quick fix for all your color problems.
Known Good Print Condition
Color Management Pyramid

- Profile
- T.A.C.
- Linearization
- Primary Ink Restrictions
- RIP Settings
- Calibrating Media to Printer
- Ambient / Environmental Conditions

Profile Creation
G7 happens here
Total Area Coverage (T.A.C.)
Set The T.A.C.

A: Do gradient patches maintain different color?
B: Are small characters clear?
C: Are patch boundaries clear?
Color Management Pyramid

Profile
- T.A.C.
- Linearization
- Primary Ink Restrictions
- RIP Settings
- Calibrating Media to Printer
- Ambient / Environmental Conditions

Profile Creation
G7 happens here
Print and Measure ICC Target
ICC Profile Creation Options

1. Maximum total area coverage.
2. Maximum Black only coverage.
3. Black ink starting point.
4. Black ink curve (GCR)
1 Facility
UV, Aqueous, & Solvent Paper, PVC, Banner, and Vinyl
Certified G7 Master Printer for Color Space and Gray Scale
Understand The Color Targets

What is the target?
- CRPC?

Have a plan to get to the select color target(s)
- The right software and instruments

Verify the process
- If it’s not repeatable, color management will be difficult or even impossible
Accuracy vs Precision

- Precise, but not Accurate
- Accurate, and Precise
- Accurate, but not Precise
Hitting Industry Specifications: Accurate and Precise
A Picture is Worth 1000 Words
Caution: Spot Colors

CMYK verification does not ensure that spot colors will match. That is why most RIPs include spot color replacement and matching tools. Verify spots separately.
G7 Delivered
Dye sub
Mental
And ceramic
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