

# Color Management and Print

Daniel J Gregory

photography  
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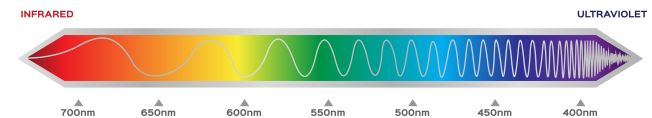


The print is always  
correct

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Thinking about color?

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# Humans and color

Terrible at color

Humans distinguish about 10 million colors

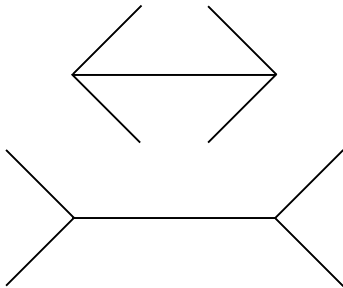
Eyes have rods and cones

Cones see color as response to wavelengths SML (RGB). Cone is stimulated to create color perception

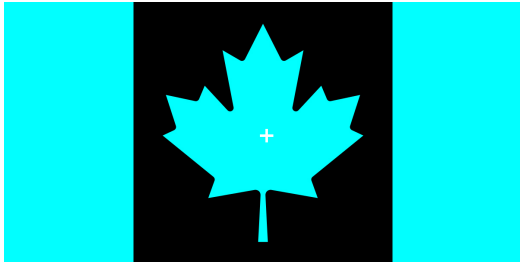
Color is subjective often based on culture, archetypes, or context

Humans understand of color is based on contrast to surrounding

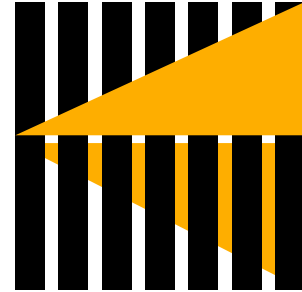
# Human eye and perception



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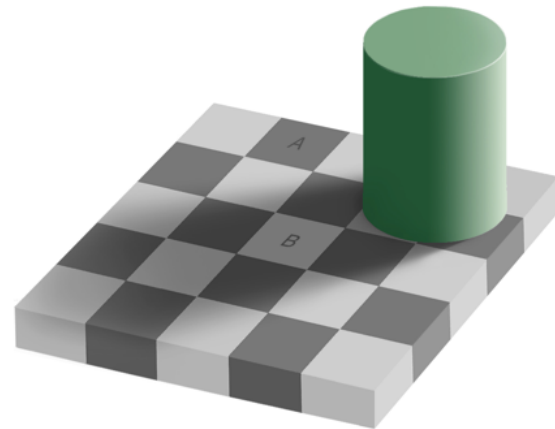
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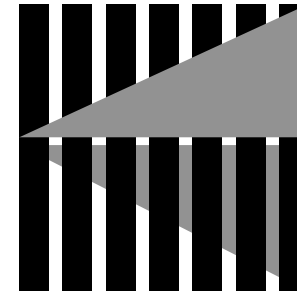
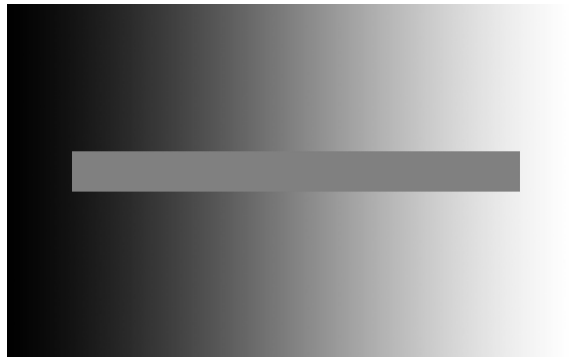
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## What is color management?

Unified approach to dealing with color where an absolute color reference is used for each step and device in the process

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Respond to our perception of what a color is and make sure that perception stays consistent from device to device

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# Environment Setup

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Color of the room

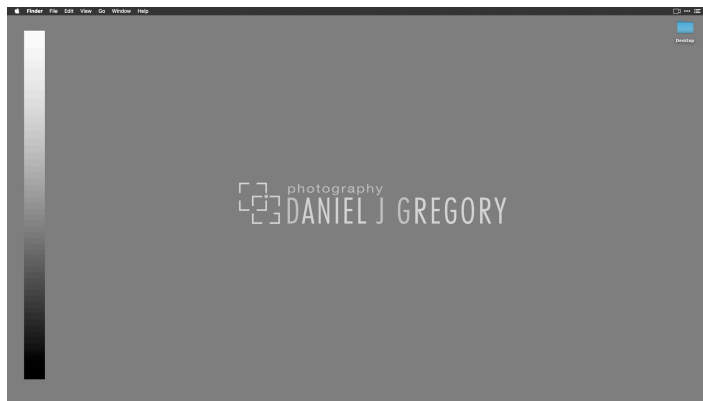
Color of clothes

Brightness and temperature of  
ambient light

Background of your monitor and  
working space

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ICC profile

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Define gamut  
(Volume of color)

White and black point

Color look up table

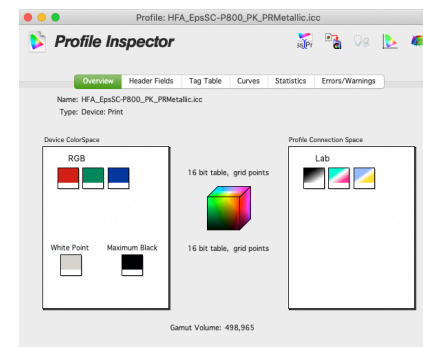
L\*a\*b\* and CIE XYZ are ways to define colors based on human vision, but larger than human vision

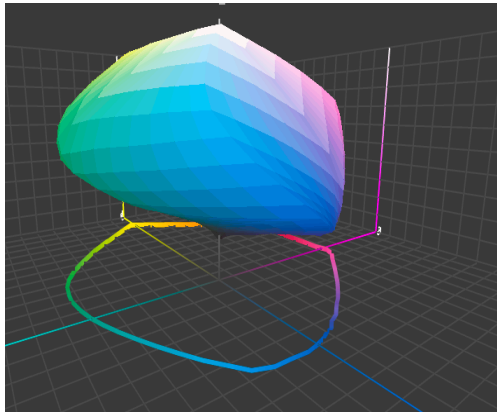
One of these models is used to translate color from one space or profile to another

Colors can be explained mathematically that can't be seen or distinguished which impacts how we edit and covert colors

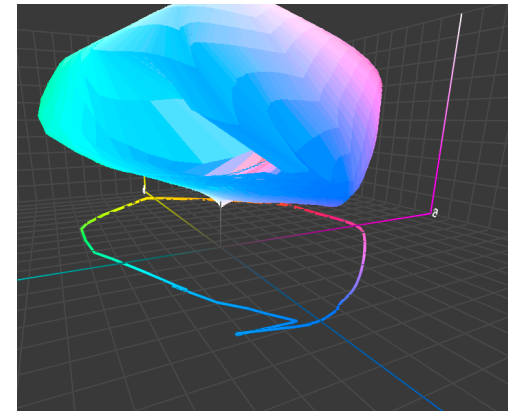
Profiles are all about getting known values so that color management

**CAN**  
work correctly

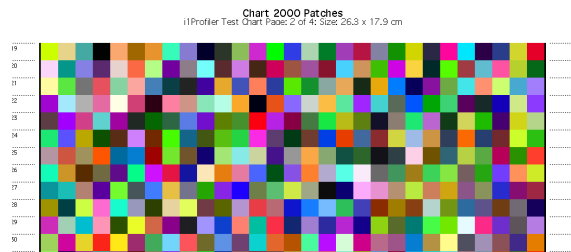




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# Color Spaces

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RGB color is based on transmission of light, print (cmyk) is reflection of light

RGB produces high saturation at high luminosity values

Colors that exist outside of smaller color space (sRGB or Adobe RGB 1998) when rendered in smaller space are clipped and gradations become single tonal spaces

RGB devices need a profile, color space and are device dependent

RAW files do not have a color space or profile at time of capture this is assigned by the opening application

Since Photoshop® 5, Adobe created RGB working spaces that are **independent** for the device for editing and storage of images

## Rendering Intents

Relative—respect hue and lightness and clip to nearest available color

Perceptual—all colors can be remapped to maintain relationship. Can desaturate in gamut image if used

Saturation—preserve the saturation of color at the expense of hue and lightness

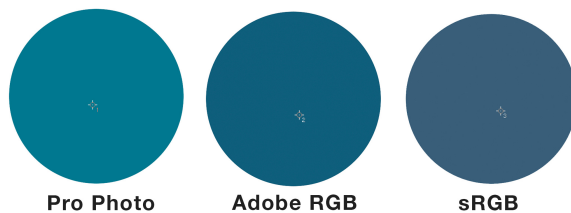
Absolute Colormetric—colors out of gamut are clipped or deleted no black point compensation

Perceptual works well with highly saturated colors and responds well to the blues and cool reds

Relative works well for majority of prints because color are shifted relative to printer/ink and white/black points

Check both in the soft proofing or printing process and watch for banding or unwanted color shift.

## Assign vs Convert



All colors are R56, G95, B122





\$100 USD

\$100 CAD



## Monitor Calibration

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Getting a monitor calibrated is 90% of the color battle. The printer only prints the colors sent to it.

Bad monitor = Bad print

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Hardware calibration color accuracy comes from making changes to a monitor's hardware electronics. The monitor must have a built-in look-up table (LUT) to store the adjustments within the monitor itself.

Software calibration improves color accuracy by changing the video graphic card or operating system. The adjustments are loaded when you start your computer.

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Brightness  
White Point  
Even display edge to edge  
Gamma  
Contrast

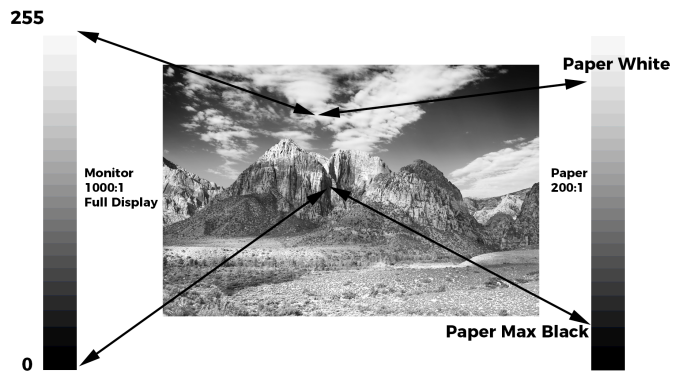
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Turn off auto-brightness adjustment  
Use D65 for your white point  
Gamma of 2.2  
Monitor on for 30 minutes  
Update profile about every two weeks  
or before printing final prints

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Dark prints are result to bright monitor  
Recommend starting at 100  
luminance level reduce to 80 if still  
issue

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## Application

Photoshop, Lightroom, Illustrator,  
InDesign

Printing

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Paper

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# Cost

- Color
- Thickness
- D-max
- Contrast
- Surface
- Texture
- Archival
- Brightness
- Gamut
- Size

Gamut is combination  
of printer, ink & paper

Manufacturer generic profile  
Custom profile specific to your printer

A General Guide for Printing on Hahnemühle FineArt Papers

#### Installing Profiles

Please refer to your printer manual or our website for a detailed instruction how to install profiles for your printer.

#### Canon iPF Pro-1000 – Matte Black (MK)

A General Guide for Printing on Hahnemühle FineArt Papers

#### Installing Profiles

Please refer to your printer manual or our website for a detailed instruction how to install profiles for your printer.

Note: Your graphic application needs to be restarted if it was open when profiles were installed. New profiles will be detected automatically during the start of the application.

#### Settings

Print drivers will vary from printer to printer and from Macintosh to PC but the general setup will be the same. Be sure to select the proper profile for the printer, paper and ink combination you are using. In our profile names you will find the proper combination to use.

#### Print with Preview / General Settings:

1) Source Space: Document

2) Profile: regarding to your paper and ink combination

3.4) Rendering Intent, Black Point Compensation:  
Needs to be chosen regarding to the image you're using. Eventually you need to test. No recommendation possible.

#### Print Driver / Media Settings:

5) Media: High Density Fine Art Paper

6) Quality: highest

7) Mode: Colormangement Off

3) If it was open when profiles were installed. New he start of the application.

acintosh to PC but the general setup will be the r, paper and ink combination you are using. In o use.

#### Print Driver / Media Settings:

5) Media: Velvet FineArt Paper

6) Quality: 4 (1440 dpi)

7) Mode: Colormangement Off

Optical Brighteners boost white appearance of paper by absorbing UV light and reflecting blue

Regarding color management, the higher the OBA in the paper, the more difficult to control the print and reduces longevity of print.

Printer pipeline resolution

Most Epson prints default to 360, but newer 9570 is 300

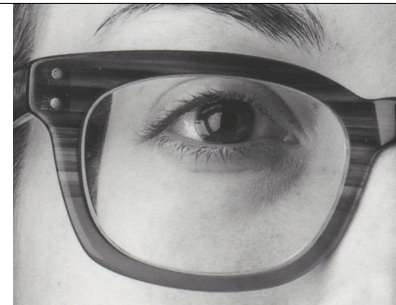
Canon printers default to 300

File will be resampled by printer pipeline to required printer resolution

Bicubic sharpening enlarges better  
than it reduces

If resolution is 300/360 or less resample  
to 360

If resolution is greater than 300/360  
upsample to 600/720



Sent to Printer at 360ppi  
Native to Epson

Sent to Printer at 240ppi  
Resample by print  
Driver



Print options that drive  
quality

Image Resolution

# Who should resize

Test your own setup

Lightroom and Photoshop do a better controlled job of resizing and sharpening is applied at the resolution level.

Printer pipeline resizes again after the sharpening is applied

Algorithms for resizing are more advanced in Photoshop, Lightroom, Topaz Gigapixel etc.

# Sharpening

Output sharpening is for offsetting the softness caused by ink and paper

Based on resolution, size of image, media type and viewing distance

Ideally we would sharpen light contours and dark contours differently to maximize impact but minimize artifacts

Workflow order matters (sharpen after resizing)

Lightroom sharpening

Third-party tools like Sharpener Pro, or PKSharpener from PhotoKit (now free, but no support)

PS combination of smart sharpen, unsharp mask, layer styles, blending modes and edge/contour masking



With output sharpening properly set

No output sharpening

Lightroom handles all adjustments for printing without impacting source pixels

Photoshop you duplicate the image, resize, sharpen and then print

If printing on an Epson printer only check the Fine Details check box if you are printing at 720. That checkbox tells the driver to upsample to 720. If you are working on a file at a resolution that requires 360, you don't want to have an unnecessary resampling.

Same goes for a Canon at 300 versus 600 in the driver. In many drivers they call the 600 Highest.

## Workflow expectations and common issues

Soft Proofing  
Gamut Warnings

First and foremost

**Good ICC profile for your paper and  
printer combination**

Image colors and tones vary based on  
paper. Select the right paper for the  
right print.

Use the Epson or Canon printer plugin  
if available for your printer

What about printer manages color?

## Working with black and white

Use printer manages color

Use monochrome option in Canon or  
Advanced Black and White for Epson

Use the Epson or Canon printer plugin  
if available for your printer

Media Controls for ink levels and  
density

## RIP driver

Accuracy of color (particularly spot colors)

Allows more control over layout and paper use

Use variety of print queues for managing ink/printer optimization

Calibration options are often greater (linearization, adjustments to ink volumes etc)

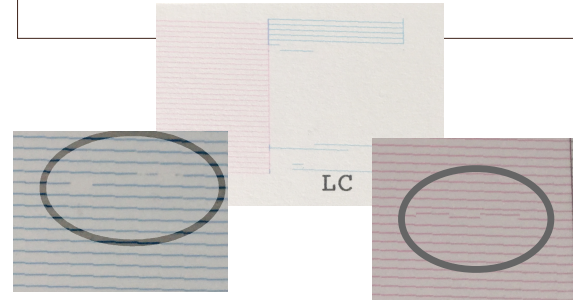
## Printer maintenance

What printer should I buy?

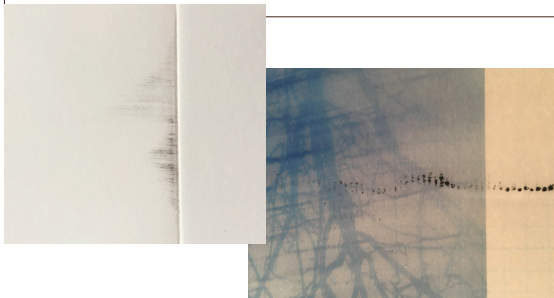
My friend says blah blah blah blah about X so I should buy that.

## Troubleshooting the print

## Clogged nozzles



## Platen and head height issues



## Over inking



## Output and viewing conditions

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Consistency of light

Balance of daylight and viewing light

Recommend solux bulbs for viewing

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