UNDERSTANDING RESOLUTION:

Unraveling the PPI versus DPI Mystery

with Renée Besta

WHY THIS PRESENTATION?

- SLOCC Board members expressed the need for clarification on the confusing topic of resolution and its various applications and meanings (e.g. ppi vs. dpi)
- Some members have trouble properly resizing their images for Competition, the newsletter, or web
- Improper terminology compounds confusion
- Some images received are untagged with no color profile; are improperly sized; have jpeg compression artifacts

WHAT IS RESOLUTION?

- Resolution is a critical concept to understand in digital photography
- Resolution equals color and tonal information and is a factor at every stage of image editing
- ***Image resolution*** describes both pixel (***pic***ture ***el***ement) count and pixel density; these terms are often used interchangeably *but are not the same*
- Different devices use different units and ways to measure resolution from capture to output > digital cameras; monitors; projectors; inkjet printers; scanners, etc.
- Basic types of resolution include overall image resolution in pixel count (megapixels) or dimensions; pixels per inch (ppi) and dpi (dots per inch)

TYPES OF RESOLUTION

- ***Camera Resolution*** = total pixel count measured in megapixels; *fixed number of pixels* based on your camera's sensor; expressed in dimensions such as 4000x6000 pixels (24MP); contains total amount of color and tonal (luminance) information in an image; relates to how large an image can be printed with high quality and detail

- ***Monitor/Projector Resolution*** is measured in pixel dimensions such as 1024x768 (XGA projector) or 2560x1440 (monitor); primary limiting factor is overall number of pixels that can be displayed*, not pixel density of image*

- ***Pixel Density*** *(pixels per inch or ppi)* defines how tightly packed the pixels are in a given area – how close together or spread apart they are – and is very important for printing (larger ppi values produce better prints)

TYPES OF RESOLUTION

- A monitor's resolution is specified by a combination of its native pixel resolution (e.g. 2560x1440 pixels) and its physical size in inches; today's monitors typically range from 85 – 125 ppi (72 ppi is old school), *not dots*

- ***Print Resolution*** is defined by the number of *dots per inch (dpi)* produced by an inkjet printer spraying droplets of ink onto paper; dot density is how closely the drops are placed together in a given area

- ***Myth:*** printing at 2880 dpi uses twice as much ink as at 1440 dpi

- The moment of truth for photographers is when ink meets paper; the more pixels we have in our image, the larger that image can be printed at high quality due to the ability to produce higher pixel density

- A 3000x4500 pixel image at 300 ppi will print nicely at 10x15 inches; the same image at 100 ppi will print at 30x45 inches but with very low quality

MORE ON RESOLUTION

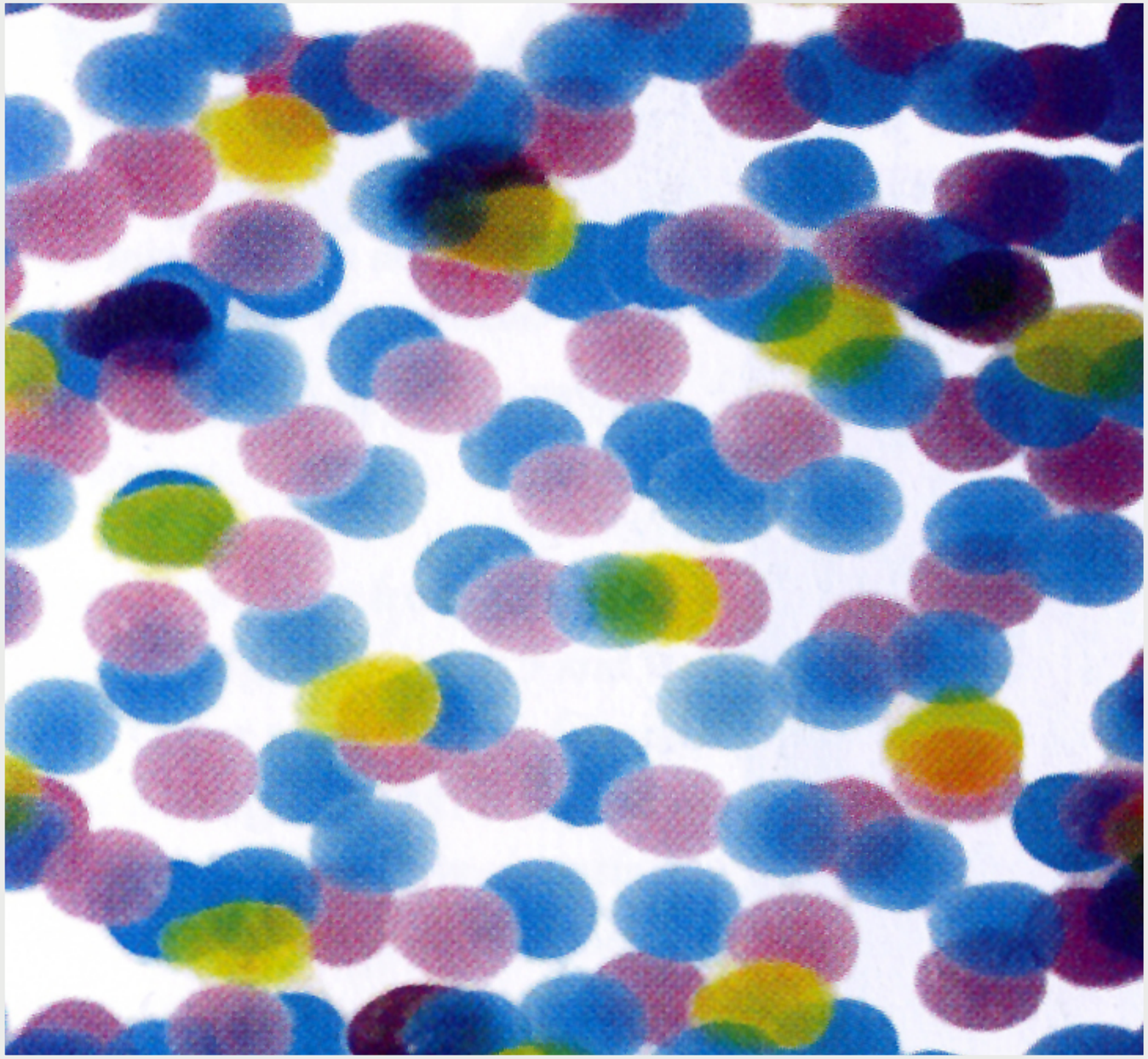
- *Pixel density* or *ppi* matters for *printing,* not for projecting an image on the screen or for the web

- Don't confuse *image output resolution in ppi* (pixel density) with *print resolution in dpi;* they're not directly correlated because you will always need far greater dpi than ppi (4-8x) for a high quality print (e.g. 1440 or 2880 dpi)

- Most printing methods (inkjet or offset) simulate a halftone value of a pixel *using a pattern of minute dots* consisting of ink droplets on paper; this is different than continuous tone printing via a Lightjet or dye-sub device

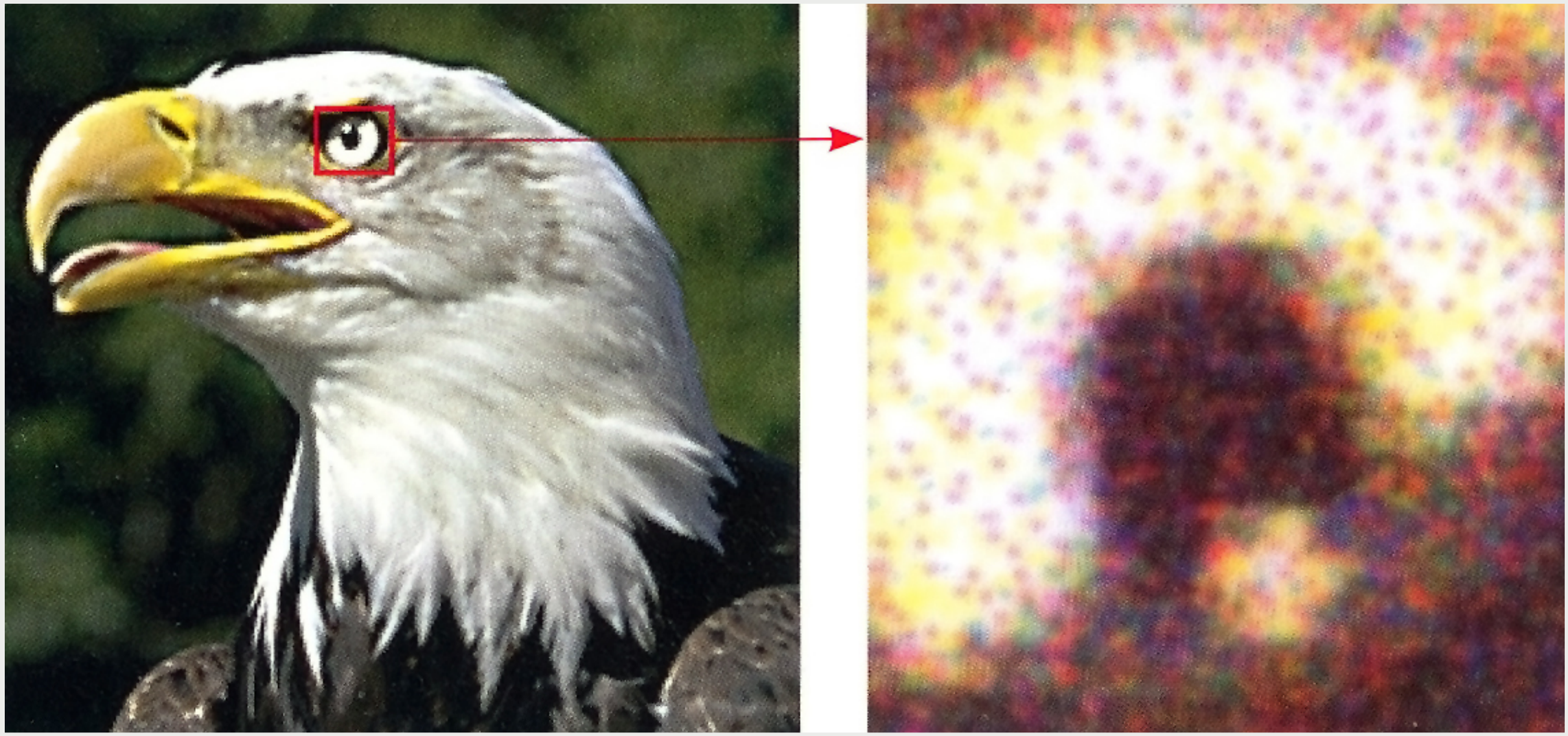
- This dot placement technique is known as *dithering,* a secret sauce

- This is a method to simulate many colors utilizing a few primary colors; viewed from a distance, they're perceived as continuous tones – an optical illusion from afar; necessary due to binary system of digital devices



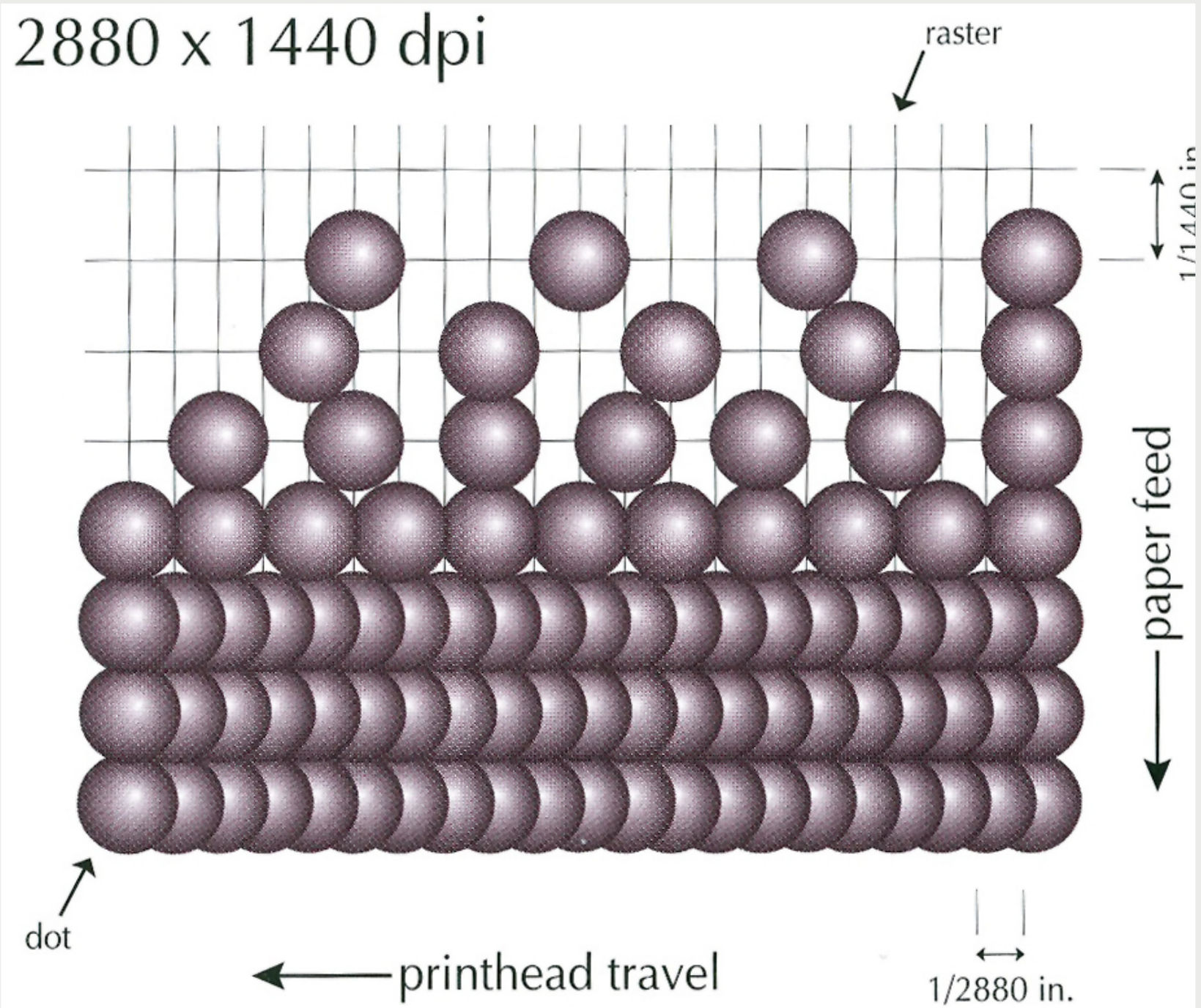
DOTS PRODUCED BY EPSON 3.5 PICOLITER DROPLETS WITH SOME OVERLAPPING TO PRODUCE SECONDARY COLORS

Courtesy of Epson America, Inc.



CLOSE-UP OF HALFTONE DOT PATTERNS PRODUCED BY INKJET PRINTERS

Source: Fine Art Printing for Photographers by Uwe Steinmueller and Juergen Gulbins



MULTI-PASS DROPLET OFFSETTING OR 'WEAVING' IS A FACTOR IN AN INKJET PRINTER'S RESOLUTION; NOTE THE HIGHER RESOLUTION IS IN THE HORIZONTAL OR PRINTHEAD TRAVEL DIRECTION

Source: Mastering Digital Printing by Harald Johnson

CHECKLIST FOR RESIZING IMAGES

- If resizing for the web or screen projection, determine the longest pixel dimension needed and let the short side fall proportionally based on the image's aspect ratio (usually 1.5:1) such as 1800x1200 pixels; *note that ppi resolution is irrelevant when resizing pixel dimensions*

- The SLOCC website has a page that explains how to resize images as jpegs for projection using Photoshops's Image > Image Size dialog box; however, there are multiple steps involved before and after that leave room for error

- For example, the image first needs to be duplicated, flattened, downgraded to 8-bit mode if in 16-bit mode, the color space converted to sRGB from Adobe or ProPhoto RGB and so on

- *A simpler way:* use Photoshop's Image Processor script (File > Scripts > Image Processor) or Lightroom's Export function to make things easy and get the job done with fewer steps and less confusion

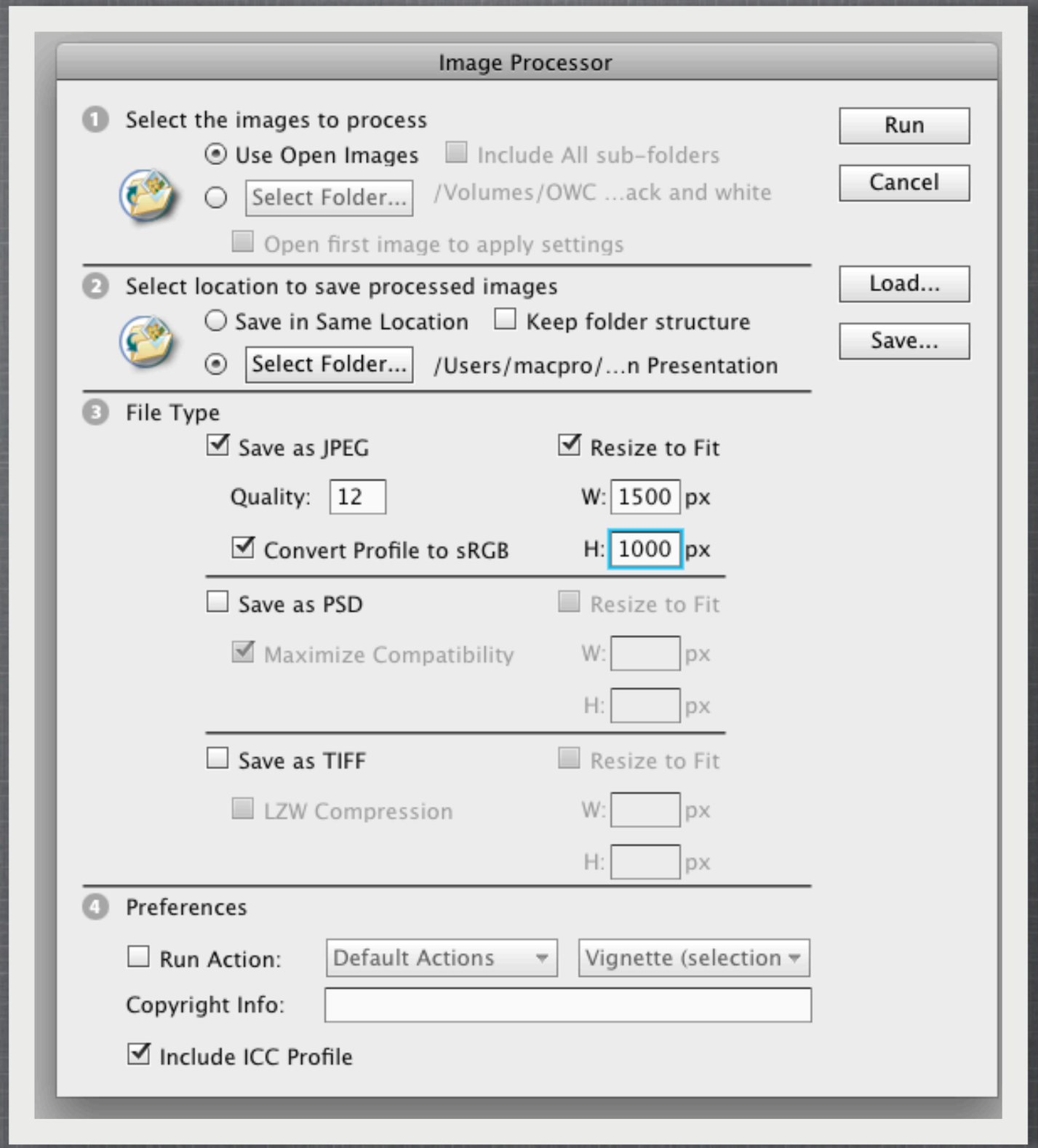
- Photoshop's File > Save for Web and Devices script is another option

CHECKLIST FOR RESIZING IMAGES

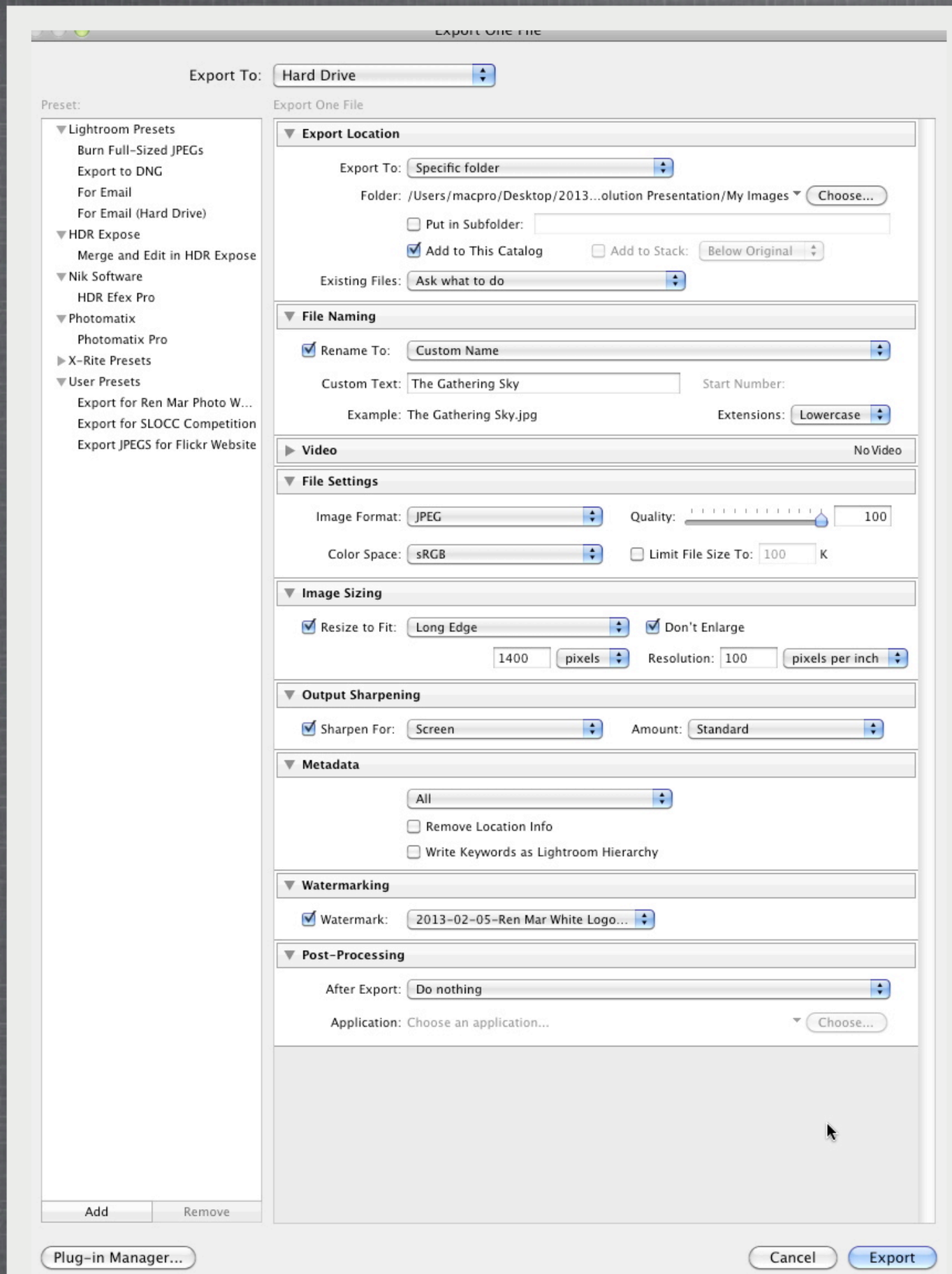
- Regardless of the method used, save your image as a high or maximum quality jpeg for the web or projection to avoid compression artifacts; avoid low or medium quality jpegs as they may look bad on screen

- Be certain your image is tagged with a color profile in the correct working space – sRGB for the web or projection, and ProPhoto RGB (preferable) or Adobe RGB (1998) for print

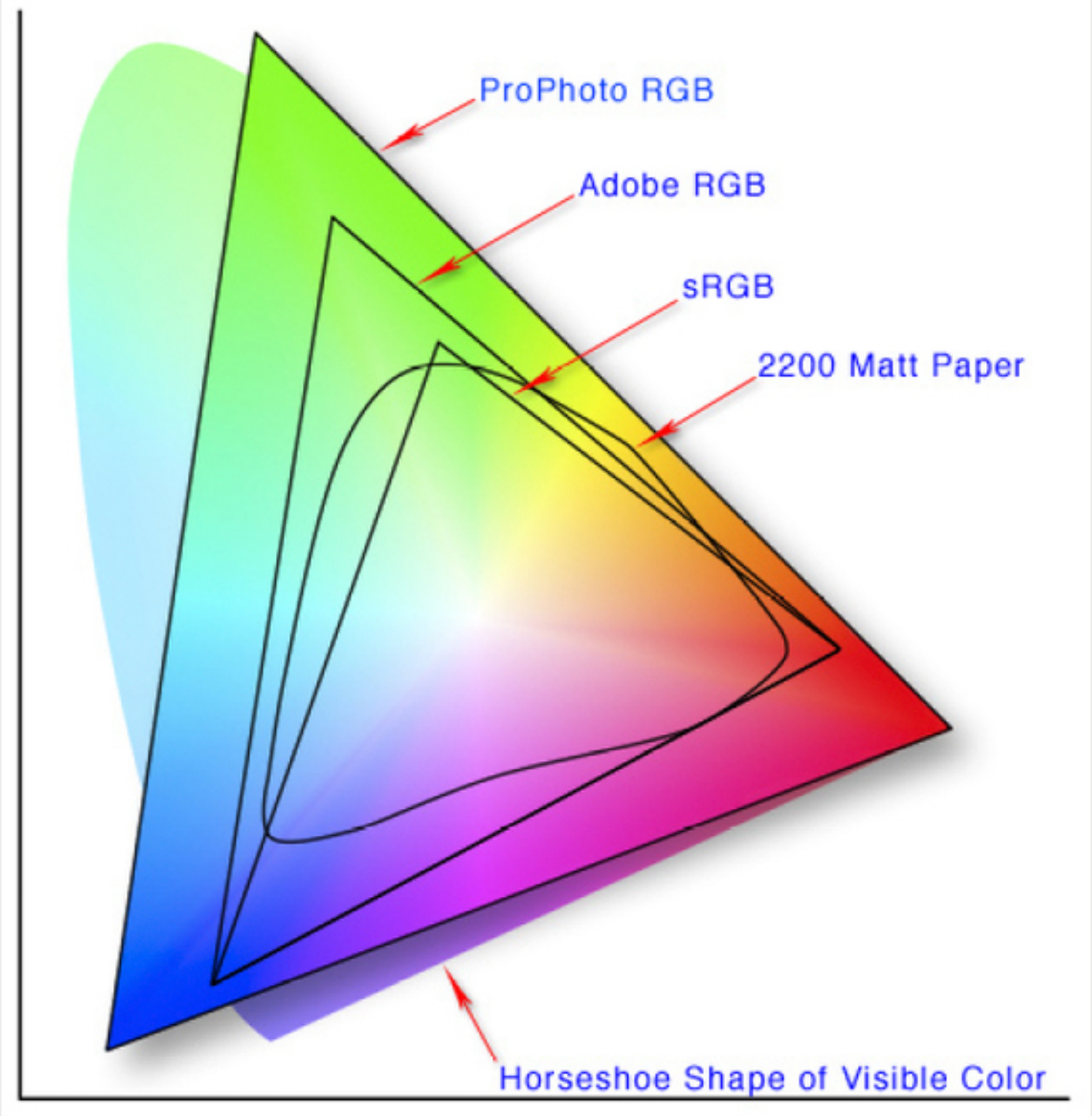
- Sharpen the image for screen display or your printer's paper type (textured matte or glossy for example) appropriately; third-party software such as Nik Sharpener does a great job and offers more options



PHOTOSHOP'S IMAGE PROCESSOR SCRIPT DIALOG BOX

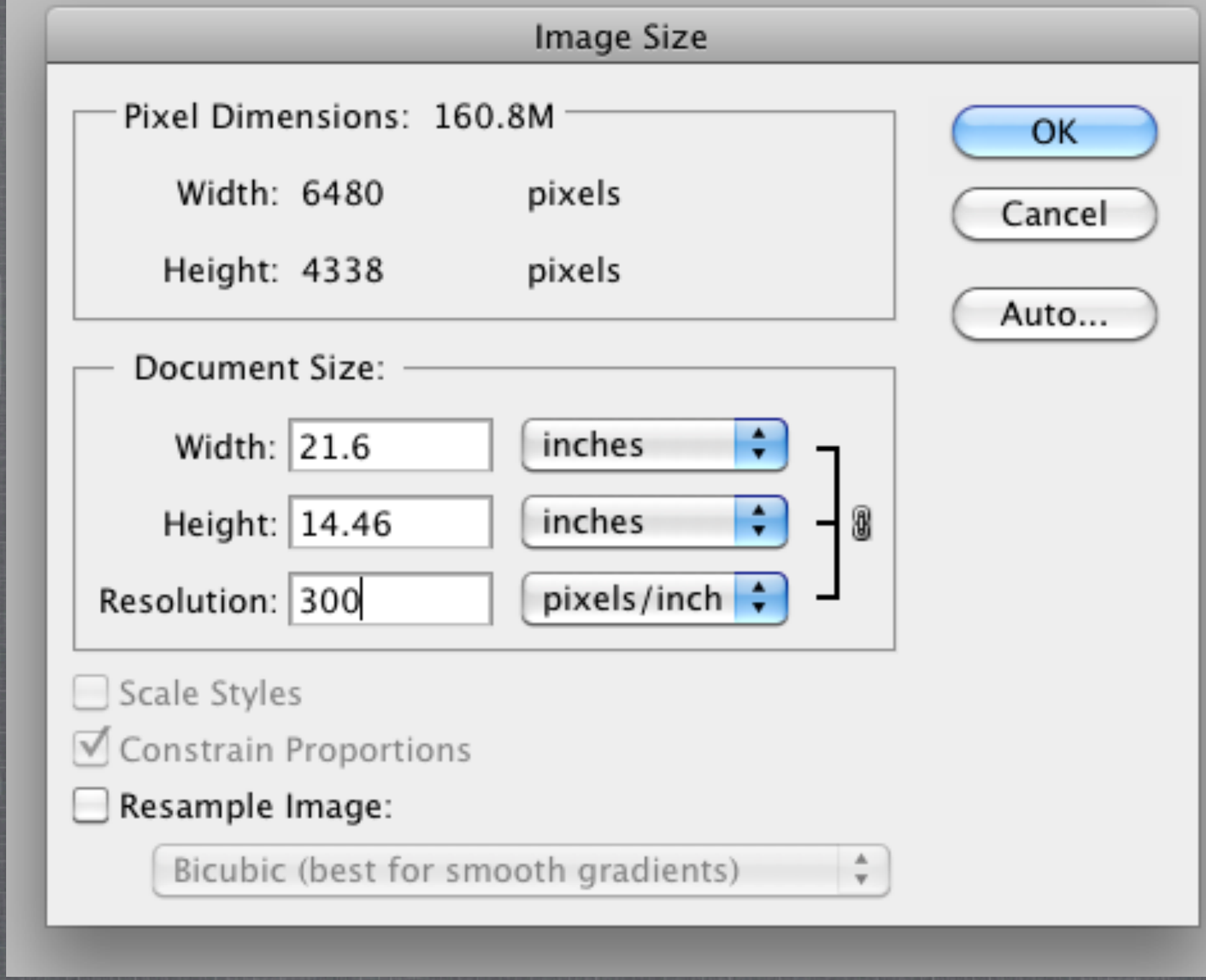


LIGHTROOM'S COMPREHENSIVE EXPORT DIALOG BOX

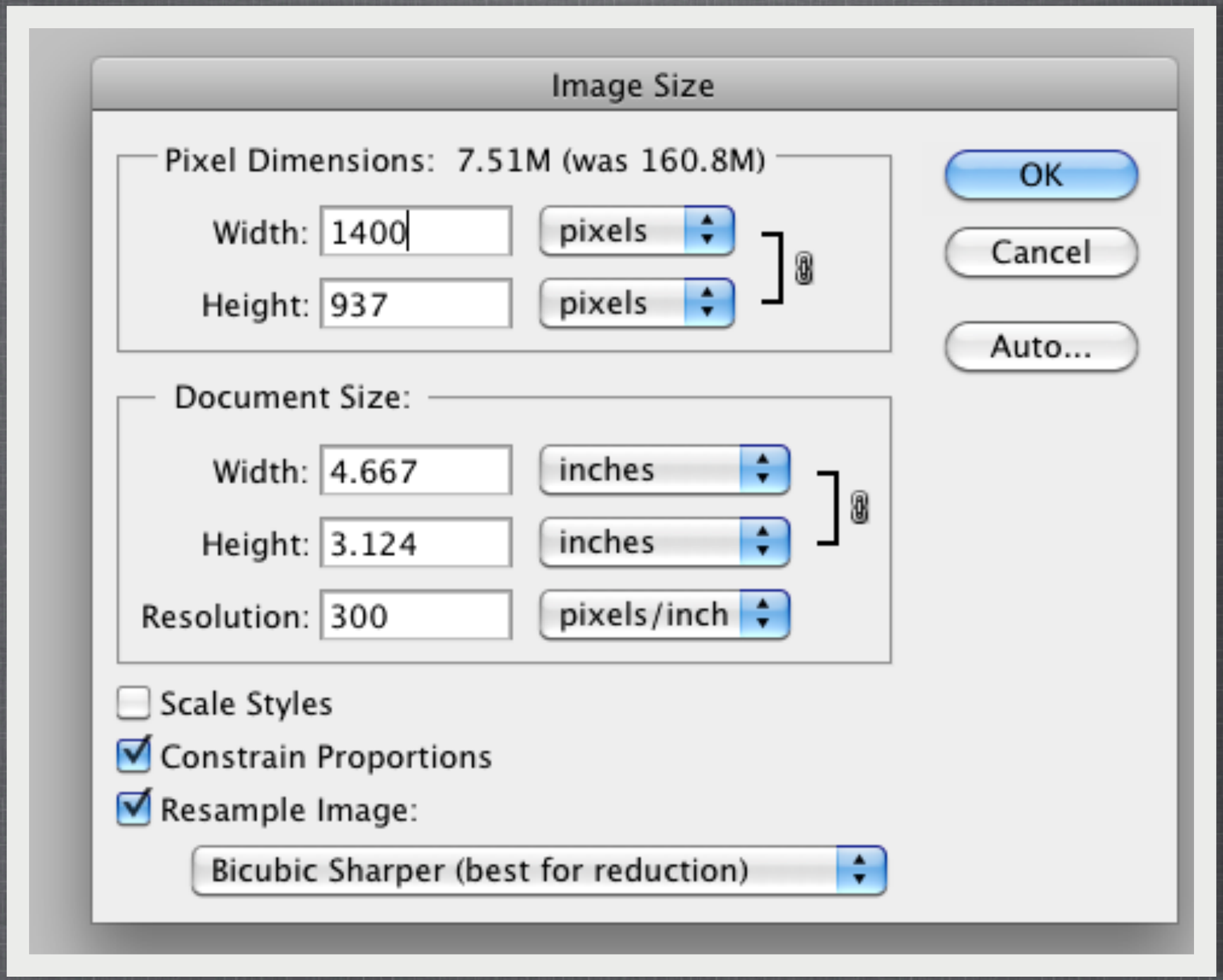


COLOR SPACES FOR DIGITAL IMAGING

Source: A Color Managed Raw Workflow - From Camera to Final Print by Jeff Schewe



Photoshop's Image > Image Size Dialog Box:
Native Pixel Dimensions of Original Image



PHOTOSHOP'S IMAGE SIZE DIALOG BOX:
EXAMPLE OF RESIZING FOR COMPETITION
NOTE: RESOLUTION IN PPI IS IRRELEVANT HERE