How to *prepare* and *save* image files

for Digital Media Communicatons

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Graphic Media Publications

Preparing: The Digital Image • Bit Depth—Tone and Color • Image Resolution • Pixels vs. Lines Per Inch • Determining File Size • Compression
Saving: JPEG— Joint Photographic Experts Group • PNG— Portable Network Graphics • TIFF —Tagged Image File Format • RAW File Format • GIF— Graphic Interchange Format • PDF—Portable Document Format

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Digital Technology

This saguaro cactus image was captured while hiking the Saguaro National Park near Tucson, Arizona. It appeared to be a real find, but it was discovered later that this same image is in a publication sold at the visitors center. Nevertheless, it will be used to discuss the basics of this topic.

Figure 1: An image captured with a digital camera.

The Digital Image

Creating images, in any manner, is possible when the basics of digital imaging are understood. Digital images, of any kind, are made up of pixels *(Figure 1)*. The word pixel is short for the words picture and element separated by an x and is one dot of digital data in a web, video or still image. It is an individual unit that cannot be divided. In a color image, it occupies an exact location and has a distinct *color* value *(Figure 2)*.

The pixels in a grayscale (black and white) image also occupy an exact location and have a distinct tone value *(Figure 3)*. Pixels are the core units of digital imaging regardless of the imaging system. All visual systems work with square pixels. Pixels on computer screens and in high-definition video signals are also square.

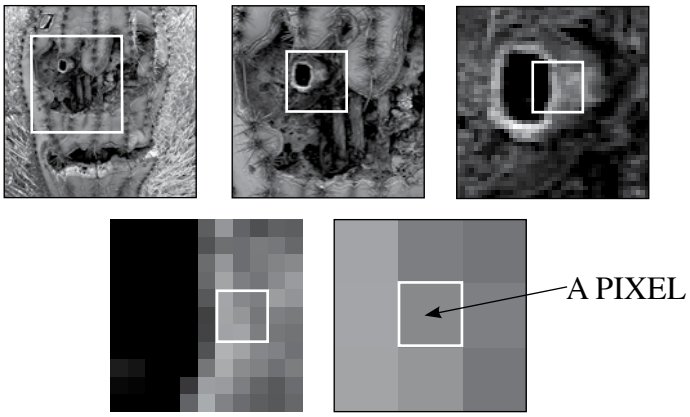

Figure 3: Pixels are the core units of digital imaging.

Digital pixels exist on a grid referred to as a bitmap. This grid is why digital images are known as bitmap images. When you work with a digital image you are not moving pixels, you are modifying the value of pixels. Bitmap images are also called raster images. Video enthusiasts use the term raster because video images are made up of rows or raster lines of horizontal pixels which are displayed line by line.

Bit Depth—Tone and Color

Pixels have value. The number of potential tones or color values is called bit depth. A 1-bit image contains only two values—black-and-white, line art for example *(Figure 4)*. The other two most common bit or color depths are 8-bit— 256 values *(Figure 5)*, and 24-bit (8-bits per each R, G, & B channel— 16.7 million color choices *(Figure 1)*. All digital black-and-white

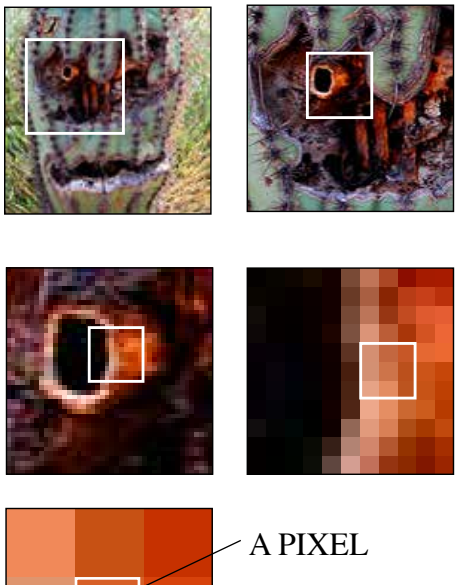

Figure 2: A pixel is one dot of digital data.

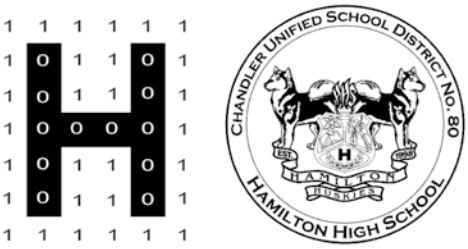

Figure 4: As shown in these 1-bit images, each pixel is assigned a tonal value. In this example, 0 is for black and 1 for white.

Figure 5: A black-and-white image consisting of more than one tone. A black-and-white picture is typically made up of 256 levels of tone—solid black, white and 254 levels of gray—a grayscale image.

continuous tone pictures are 8-bit images. Also, all digital full-color images are 24-bit. Bit depth is the major contributor to file size. For example, the size of an 8 x 10-inch bitmap photo at 300 ppi is 879 kilobytes. An 8-bit grayscale photo at 300 ppi is 13.7 megabytes. An 8-bit/channel color photo at 300 ppi is 20.6 megabytes. A 16-bit/channel color photo at 300 ppi is 41.2 megabytes. It is clear that high-resolution color files can occupy a large block of space on a storage device.

Bit Depth: The measure of the amount of different possible colors in an image.

Most concerns about bit depth are the difference between 8-bit per channel and 16-bit per color channel images. In the Photoshop application, 32-bit is also listed (Image > Mode—*Figure 6*). The use of 32-bit for image adjustment and retouching is not practical or necessary at this point since 16-bit allows you to work with over one trillion colors.

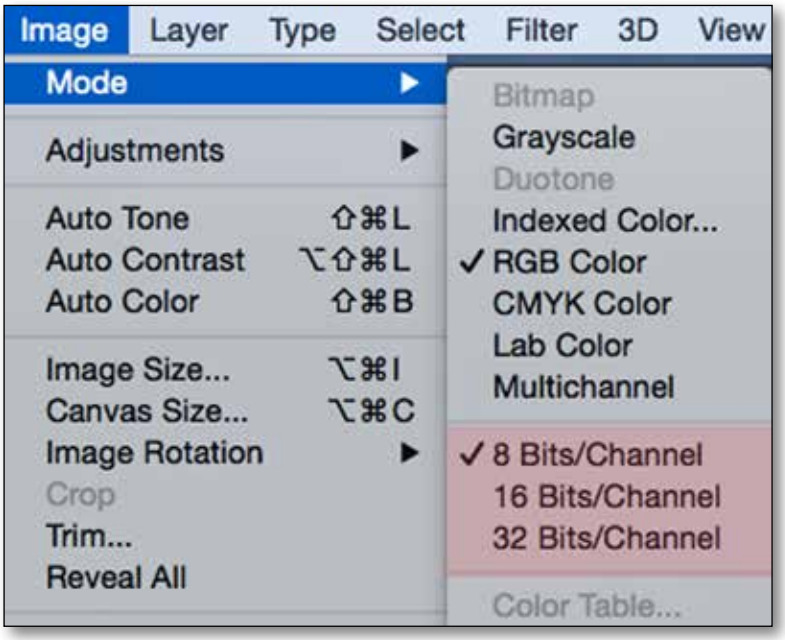

Figure 6: Photoshop's Image > Mode palette provides a choice of 8, 16 or 32-bit depth.

An 8-bit/channel color image has the potential to be produced from 16.7 million colors. All continuous tone color images consist of 256 shades of red, green, and blue. The math indicates (256 x 256 x 256) that 16.7 millon colors contributed to their creation. A 16-bit/channel color image has the potential of being created from over one trillion colors (512 x 512 x 512).

Since a person can only see about 10 million colors, it doesn't seem necessary to work with a bit depth of over eight, and in most cases, it isn't. But, it is best to make layer adjustments and retouch in 16-bits/channel.

Most folks scan in 8-bit, and all digital cameras are limited to 8-bit when they are set to capture in one of the JPG file resolutions—JPG does not support 16-bit. Cameras that save in the RAW format offer a 12-bit option and even 14-bit. So if you have the RAW capability, it should be used for the format's resolution and adjustment ability.

When making layer adjustments and retouching, it is best to work in 16-bit. Just open the 8-bit image in Photoshop and go to Image > Mode and convert it to 16-bit. After working in 16-bit, the image can be converted back to 8-bit and flattened to make the size smaller *(Figure 7)*. There is no reason to keep random data. Making layer adjustments and retouching at 16-bit image eliminates banding and file corruption. You may not see the difference, but the computer and the printer will. Also, be aware of filter support at 16-bit if you are using an older version of Photoshop.

File size will naturally be larger for 16-bit than 8-bit. For example, a 4 x 5-inch, 8-bit image @ 300 ppi will be

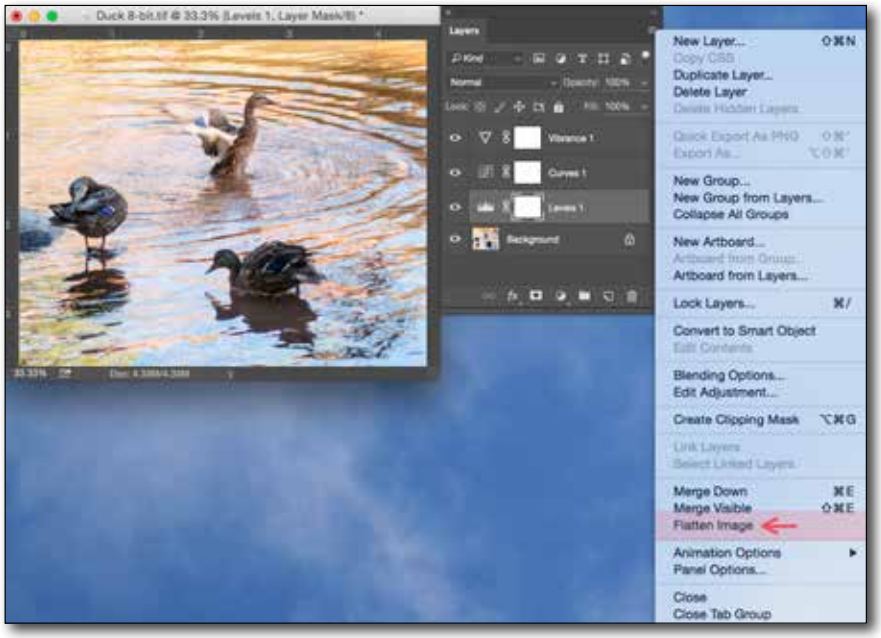

Figure 7: After converting back to 8-bit be sure to flatten the image to reduce the file size.

three megabytes, and a 16-bit image @ 300 ppi will be about 12 megabytes. If converted to CMYK it will be even larger. But again, the image can be converted back to 8-bit and flattened to make it smaller.

Image Resolution

Achieving the correct resolution will determine image quality. The first step is knowing what a pixel is. Next, it is important to understand how pixels are used to describe images. Every system requires a specific number of pixels to describe a picture. There is an exact reason video images may be 72 ppi (pixels per inch), or a photo for a magazine is 300 ppi. A continuous tone image depends on its number of pixels per inch. If it appears continuous tone, it is because you cannot see the individual pixels that were used to create the image. If pixels are perceived, or the edge of the picture appears jaggy, a less than required resolution was used to create the image *(Figure 8a–8d)*. In other words, the number of pixels in the picture does not meet the minimum number required for the selected output device—such as a monitor, printer, or publishing system. When preparing pictures for display on a monitor (web or presentation images for example), 72 ppi is adequate because a screen displays around 72 ppi or higher. Adding additional resolution does not improve quality. It only increases file size. A much larger resolution is required for prints since the resolution demands of the printer is much higher than a monitor. Downloading a picture from the web (about 2-inches wide at 72 ppi) and making an enlargement would produce an extremely pixelized or jaggy image *(Figure 9)*.

Resolution: The measure of fineness and detail in a digital image. Images are measured in pixels per inch (PPI). In most cases, the higher the ppi, the more detailed the image.

Jaggy: Digital images that appear staircase or jagged rather than smooth. Often the result of low resolution.

Figure 8a: 36 pixels per inch.

Figure 8b: 72 pixels per inch.

Figure 8c: 150 pixels per inch.

Figure 8d: 300 pixels per inch.

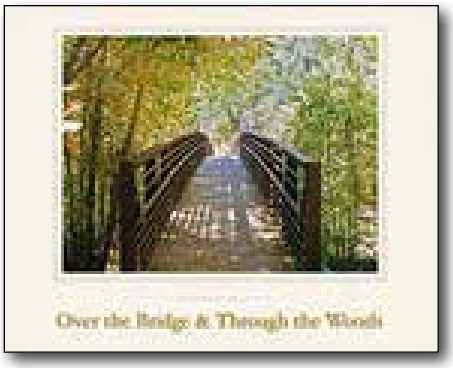

Figure 9: A 2-inch image captured from the internet.

Pixels Per Inch vs. Lines Per Inch

Tone creates shape. A black-and-white photograph or one reproduced in a newspaper relies entirely on tone—not color *(Figure 10)*. The halftone dot size used in the printing process determines the tonal quality and also image resolution. Newspapers use 80–120 lines per inch (LPI) halftone screening technology to produce the dots that make up halftone reproduction. Most paper used for newspaper publishing is not capable of recording more than 120 lpi halftones *(Figure 11)*. The paper is very absorbent. The halftone dots spread or gain in size, as the ink soaks into the paper fibers, causing a considerable increase in density.

Figure 11: The coarse screening used for newspaper tone reproduction is often visible to the naked eye.

This dot gain can also cause a loss of detail through the midtones and into the shadow areas. Images printed at higher lpi are published on a special quality paper. Magazines are printed on a smooth, treated paper. They are usually printed at 133-, 150-, or 200-lpi *(Figure 12)*. Using better ink and paper allows a higher screen resolution in lines per inch. Rather than the ink soaking into blotter-like paper, as with newsprint, the ink stays more on the coated surface, and with less dot gain the image appears more continuous tone.

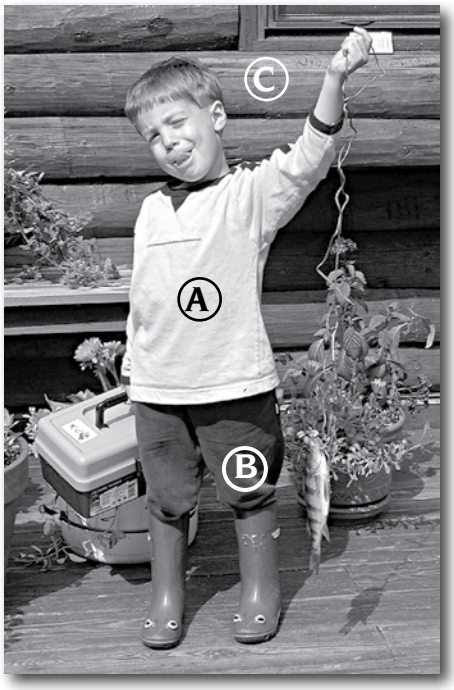

Figure 10: Tones—there are three major parts in a halftone or photographic image—highlights, midtones, and shadows. Highlights are the white or lighter parts (A). Shadows are the black or darker parts (B). Midtones are the range of tones, in the middle, between white and black (C).

It is established that image resolution is referred to as Pixels Per Inch (PPI), and Lines Per Inch (LPI) describe the number of halftone dots per inch that make up a black-and-white *(Figure 13)* or a color halftone *(Figure 14)*. A 150-line halftone, imaged by a high-resolution imagesetter or direct-to-plate system, contains 150 halftone dots per inch (DPI), and the image on the press-ready layout included a resolution of 300 ppi.

Figure 12: Copy of a black-and-white picture from a magazine.

Figure 13: Enlarged detail of the halftone dot pattern of a grayscale image.

The concepts of dpi and ppi complement one another. The relationship of pixels to halftone dots (lpi) is two to one. In other words, an image needs to consist of 300 ppi if it will be printed at 150 lpi. Also, an image must consist of 240 ppi if it will be printed at 120 lpi.

It is important to maintain this 2:1 ratio when scanning images or working with photographs from a digital camera. It is highly recommended to work with the company who will print the publication. Selecting the paper and lpi resolution, in advance, will ensure the quality of the reproduction, and the cost of printing the job.

A digital system can only generate 256 levels of tone—including white. It's more than enough to reproduce a black-and-white continuous tone photo — an 8-bit image. Or, a color photo which has three 8-bit channels for a total of 24-bits or 16.7 million colors from which to choose.

Figure 14: Enlarged detail of a halftone dot pattern of a color image. Note that a separate halftone is generated for cyan, magenta, yellow and black. Each halftone screen is rotated to form a "rosette" pattern.

Determining File Size

Pictures can quickly fill a hard drive, especially 24-bit color images (8-bit/channels of red, blue, and green). A 10″ x 7.6″ color photo at 300 ppi will occupy about 19.6 megabytes (MB) of storage. With the file open in Photoshop *(Figure 14)* go to Image >Image Size, and you will see the size in MBs (19.6), dimensions in pixels (3,000 x 2,280), and in inches (10″ x 7.6″).

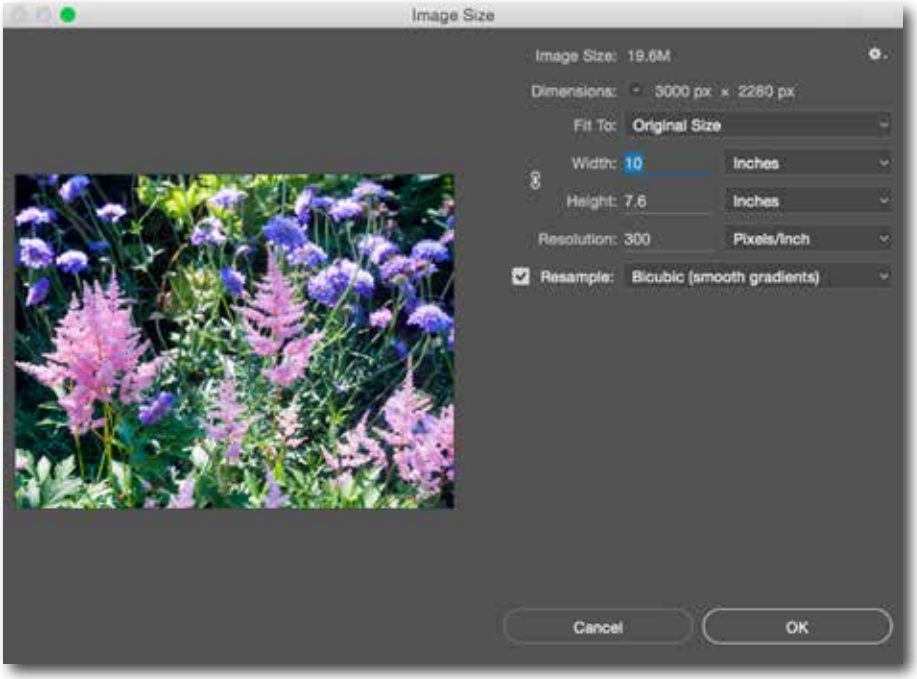

Figure 14: Photoshop's Image Size palette can be set to indicate Image Size, Dimensions, Inches and Resolution.

It is also possible to determine the file size mathematically. To compute the size of a file when the inch dimensions are known use the following formula (using 10″ x 7.6″):

File Size = (height x width x bit depth x ppi squared) ÷ 8

File Size = (10″ x 7.6″ x 24-bit x 300 ppi x 300 ppi) ÷ (8 bits per byte) = 20,520,000 bytes

File Size =(20,520,000 bytes) ÷ (1,024 bytes in one KB) = 20,039.0625 KB

File Size = (20,039.0625 KB) ÷(1,024 KB in one MB) = 19.56 or 19.6 MB

Note: 24-bit represents a color file—8-bits/RGB channel. If calculating a black and white continuous tone image use eight for the bit depth.

To compute the size of a file when the pixel dimensions are known use the following formula (using 3,000 x 2,280):

File Size = (pixel dimensions x bit depth) ÷ 8

File Size = (3,000 x 2,280 x 24-bit) ÷ 8 bits per byte = 20,520,000 bytes

File Size = (20,520,000 bytes) ÷ (1,024 bytes in one KB) = 20,039.0625 KB

File Size = (20,039.0625 KB) ÷ (1,024 KB in one MB) = 19.56 or 19.6 MB

Note: 24-bit represents a color file—8-bits/RGB channel. If calculating a black and white continuous tone image use eight for the bit depth.

Compression

Compression is used to reduce file size. Reduced file size has advantages and disadvantages. Benefits include better storage, faster processing, and transmission. Quality is the biggest problem. Compression schemes are either lossless or lossy. Lossless compression implies that no information will be discarded. Therefore, if saved using a lossless format, the final file will be the same size and quality as the original. It does so by identifying a repeating color, pattern, or texture and replaces it with code to reduce the file size *(Figure 15)*.

When the lossless file has reopened

Figure 15: A LOSSLESS file format at the proper size and resolution.

the colors, patterns or textures are decompressed to its original quality.

Lossy compression saves information by partially discarding data of the original that is not easily detected by the eye. But upon careful examination

Figure 16: A LOSSY file format at an improper degree of compression.

quality reduction can be seen when images are aggressively compressed at low resolution *(Figure 16)*. Is is critical to keep the high-resolution lossless file to edit and reuse for other media purposes.

Opening and closing lossy files continue to apply compression algorithms, and the file gradually degrades. Also, it is not possible to download small, highly compressed images from the internet and attempt to enlarge, up-sample or change resolution to revert to their original quality. It is best to create a master image with no compression. Then, modify or resample the original file to a compression format that meets the requirements of its intended use.

JPEG— Joint Photographic Experts Group

The JPEG format (lossy) is optimized for continuous tone images that contain many hue values. It achieves compression by discarding information that is not easily detected by the eye. It stores information as 24-bit color, and the degree of compression is adjustable. During the save process a degree of compression is selected *(Figure 17)*. Images look excellent if moderate compression levels are used *(Figure 18)*. Under extreme compression, images become pixelated or noisy *(Figure 19)*. JPEG is a lossy compression format, but its amount is selectable (Maximum 100, Very High 80, High 60, Medium 30, and Low 10) for higher quality and larger files, or lower quality and

Figure 18: JPEG format, 300 ppi, Very High–80 quality, file size = 142 KB.

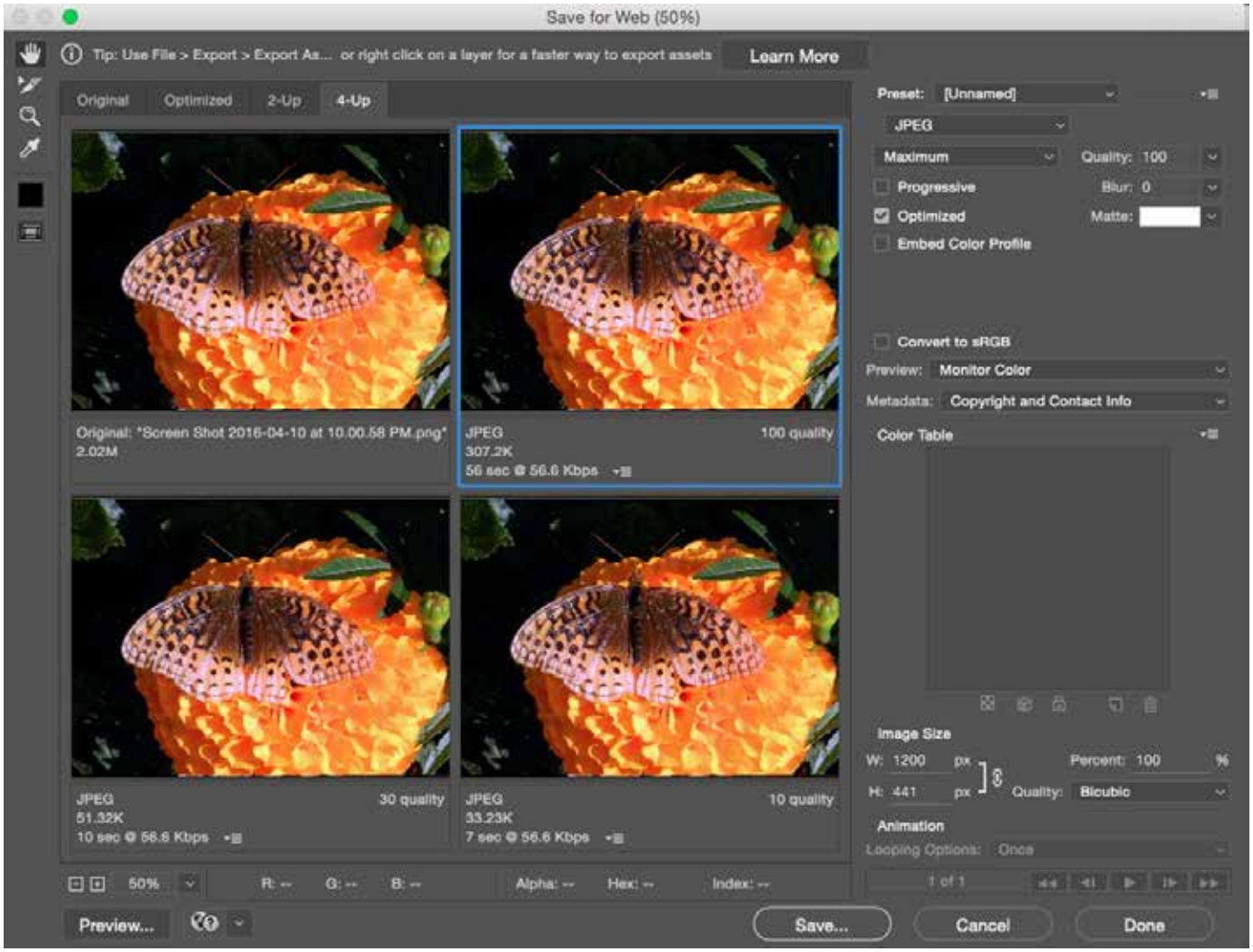

Figure 17: Instead of Saving or Save As go to File > Export > Save for Web and levels of compression and format can be selected. JPEG at a Maximum Quality of 100 was selected compressing the original from 2.02 MB to 307.3 KB

smaller files. JPEG compression is appropriate for Web images and e-mail files that must be small and may not need maximum quality. These files are not suited for print production because the quality is degraded each time they are opened and closed. After compressing six or more times, they are less than suited for publication.

In summary, JPEG files can be small in size and still look crisp. Up to 16.7 million colors are supported for complex images with a broad range of colors without a large file size. JPEGs can also be saved as a progressive file that loads gradually as a web image.

Figure 19: JPEG format, 72 ppi, Low–10 quality, file size = 4 KB.

PNG— Portable Network Graphics

PNG (pronounced ping) is a file format that supports lossless data compression. It is the most frequently used compression format on the Internet. When PNG files are compressed and decompressed, there is no data loss which makes them ideal for images requiring frequent editing as opposed to JPEG images that degrade over time as they are opened and closed during editing. PNGs support transparency, but they do not support animation because more than one image in a file is not supported—a GIF file does support animation (see page 12).

During the save process of a PNG (File > Export > Save for the Web) a choice

Figure 21: A 1.75 x 1.75-inch, PNG-24 @ 300 ppi, file size–301 KB.

Figure 20: The original image was a PSD (Photoshop) file at 5.83 MB. If saved as a PNG-24 it will be 1.6 MB. If the PNG-8 option were chosen the file size would be 457.7 MB.

is made between PNG-24 or PNG-8 *(Figure 21)*. The 1.75 x 1.75-inch file (*Figure 21)* was saved as PNG-24 @ 300 ppi with a file size of 301 KB. The 1.75 x 1.75-inch file *(Figure 22)* was saved as PNG-8 @ 300 ppi with a file size of 88 KB.

Figure 22: A 1.75 x 1.75-inch, PNG-8 @ 300 ppi, file size–88 KB.

TIFF — Tagged Image File Format

Aldus created the TIFF format for use in desktop publishing. Adobe purchased Aldus and currently holds the copyright to TIFF specifications. It is the leading format for archiving lossless images supported by all platforms, most color spaces, and handles data up to 48 bits. TIFF files are saved with no compression or in a variety of settings *(Figure 23)*.

It is best to use the TIFF Format to maintain high quality on original files and then convert later to a more appropriate format for the intended purpose. The main reason is that large images, without compression, make them difficult to move or send, but the quality is never lost regardless of the number of times the files are opened and closed. The quality of a maximum JPEG is not noticeably different but will degrade each time it is opened and closed for manipulation. Therefore it is best to archive TIFFs and repurpose when needed.

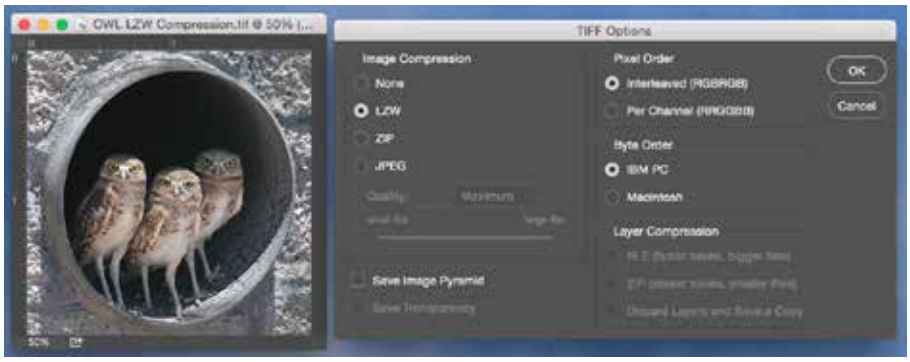

Figure 23: TIFF Save Options include None, LZW, ZIP, and JPEG.

As noticed in *Figure 23* there are forms of compression such as LZW, ZIP, and JPEG. LZW was named for the developers Abraham Lempel, Jacob Ziv and Terry Welch. This compression recognizes repeated data and replaces all instances without loss. Although an excellent compression algorithm it is not supported by all software. But, it is supported by professional graphic media applications.

Zip compression stores and reduces size. It was originally designed to save storage space and is used as a practical way to share files. When choosing the ZIP algorithm, you will get the message that it is not supported in older TIFF readers (*Figure 24)*. You will get a similar message when using the JPEG algorithm as well.

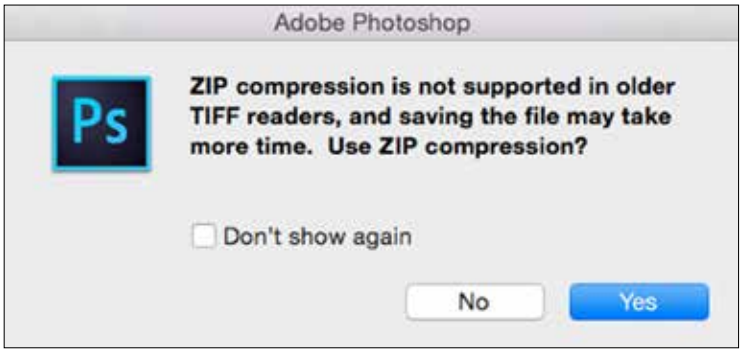

Figure 24: Warning message when saving a TIFF using ZIP compression.

It may be best, as previously stated, to keep the original in TIFF and just "save as" to the desired format and amount of compression based on the intended use. *Figure 25 A, B, and C* demonstrate the different file sizes of a 2″ x 2″ image at 300 ppi when saved as a TIFF image.

25A: TIFF saved with no compression—1.1 MB.

25B: TIFF saved with LZW compression—897 MB.

25C: TIFF saved with JPEG Maximum—254 KB.

RAW File Format

RAW files contain data that has not been altered or manipulated in any way by an image capture device. The RAW format might be explained using a bag of marbles as an example. Since the marbles are loose, they may be rearranged in many ways. But, if glue were mixed with the marbles they would eventually solidify not having the original parts to be manipulated—RAW retains the original data for total manipulation. For example, most good digital cameras can be set to record in many levels of JPEG plus TIFF and RAW. If any one of the JPEG (lossy) compression levels is selected, the captured file will be manipulated by the camera's imaging process losing some original data during compression. A RAW file contains all image detail captured through the camera's sensor with no processing of any kind, providing a software user an opportunity to adjust all aspects of the original data using a program such as Adobe's Photoshop or any RAW application. Adobe's programs will also allow JPEG files to be manipulated and be somewhat improved even though lost data cannot be retrieved.

Figure 26 illustrates the manipulations such as white balance, exposure, highlight, shadow, white, clarity, vibrance and sharpness that was done to the original raw file *(Figure 27)* to produce the final image *(Figure 28)*.

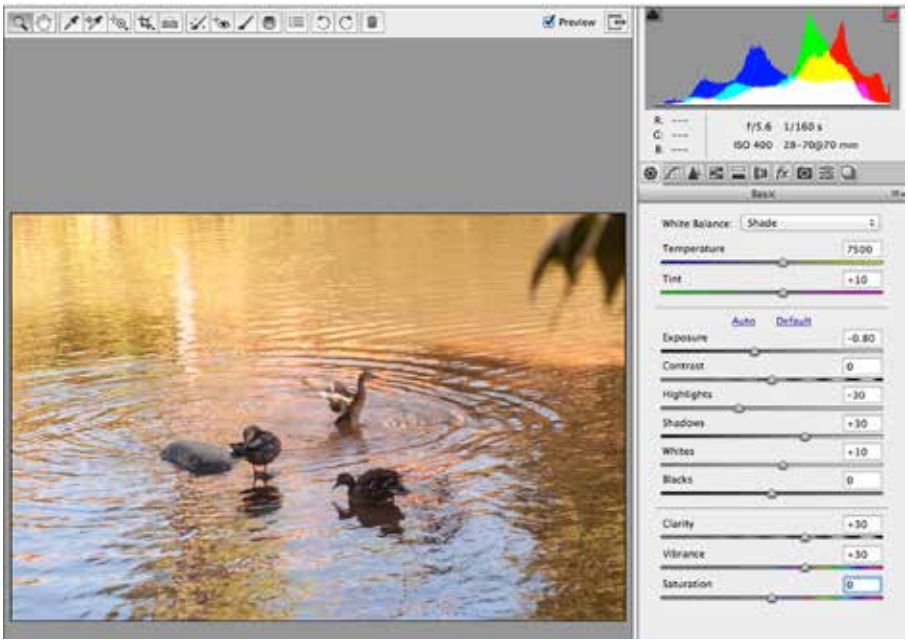

Figure 26: The Photoshop Raw Pallet.

Figure 27: RAW uncorrected image.

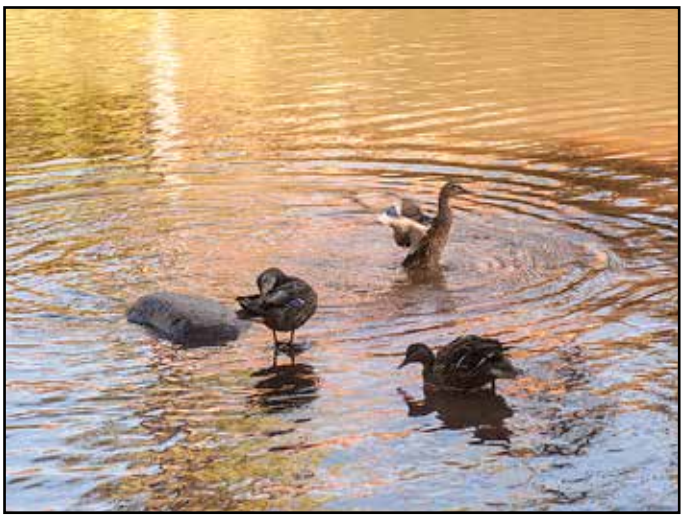

Figure 28: RAW corrected image.

GIF—Graphic Interchange Format

GIF is an image format created by Bob Berry and Steve Wilhite and was introduced by CompuServe in 1987. These bitmap images are composed of a matrix of dots that are assigned different colors and can represent an image at a small size. It's commonly pronounced JIF (soft "g") and is used for both animated and static images for fast transfer. GIF supports 8 bits per pixel and allows an image to create a palette of 256 or fewer colors from the color palette of 16,777,216, and also does the same for animations allowing 256 colors for each frame. Although GIF images are ideal for solid color pictures, they are not the best for print reproduction of photographs or any continuous tone image. *Figure 29* shows the Photoshop Save for Web option palette that limits the number of colors to create the continuous tone image. The original size of *Figure 30's* images is 8.33 inches square at 72 ppi or two-inch images at 300 ppi. They demonstrate the loss of color and file size as the file is reduced to a lower color palette. If you use the GIF format for solid/flat color or animations, you will be very pleased with the results.

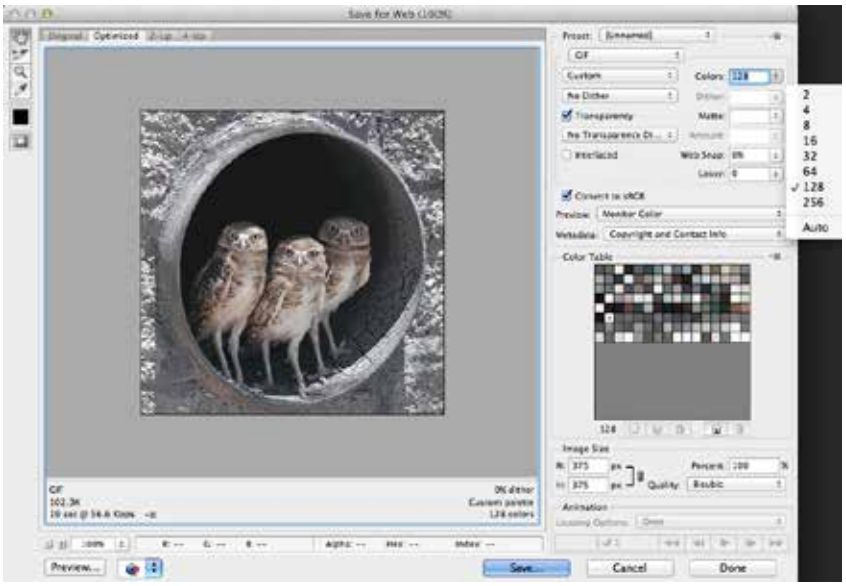

Figure 29: The Photoshop Save for Web option palette that limits the number of colors to create the continuous tone image.

256 color palette, 314 KB

128 color palette, 259 KB

64 color palette, 212 KB

32 color palette, 155 KB

16 color palette, 119 KB

8 color palette, 80 KB

4 color palette, 48 KB

2 color palette, 25 KB

Figure 30: Demonstrates the loss of color and file size as the file is reduced to a lower color palette.

PDF—Portable Document Format

A created PDF maintains the fonts, graphics, and layout of the original file. This embedded data allows the transmission and printing of the PDF file regardless of the initial application, hardware, or operating system. It can be opened and printed by anyone using Adobe Reader, a free download from the Internet.

PDF, maintained by the International Organization for Standardization, is improved to include links from fields, audio, and binding electronic signatures with password protected files.

To prepare a PDF file, using InDesign, go to File > Adobe PDF Presets > and select the type of PDF you would like to create *(Figure 31)*. When one of these presets is selected it will dictate the file's creation and the settings that balance size and quality for its intended use. As you can see from the figure, there are seven default choices and two that were defined or created by the author.

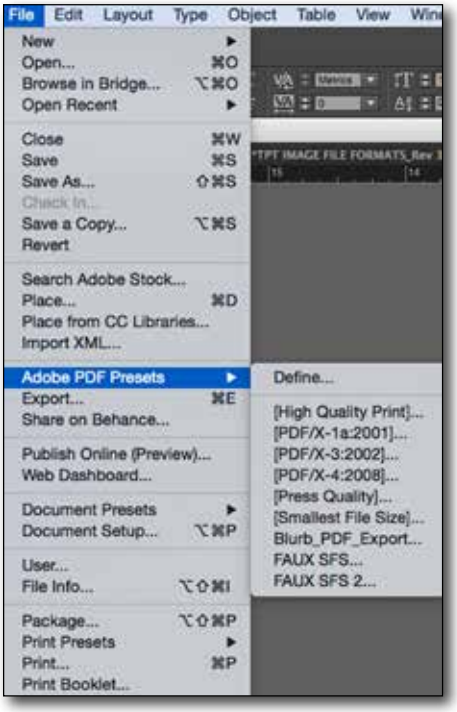

Figure 31: To select Adobe PDF Presets, go to File > Adobe PDF Presets > and choose the file of choice.

First, a review of the three most commonly used presets—High-Quality Print, Press Quality, and Smallest File Size.

High-Quality Print (HQP)

An HQP PDF preset generates a file appropriate for proofing and printing to a desktop or digital printer. Creating jobs for different situations require that the processing of color is unique to the print system. This HQP preset will retain the original color space of all RGB or spot color files. They will not change to CMYK, and the images would contain a larger gamut than if converted. It keeps RGB data in its original color space to preserve unique tones, shades and color saturation of its original RGB gamut.

Printing with the HQP preset will not match final, traditionally printed output. To accurately match reproductions from a four-color printing press the job must be proofed using a custom or the Press Quality preset.

In summary, the HQP preset is compatible with Acrobat 5 (pdf 1.4) or later, downsamples color and black & white images to 300 dpi, uses maximum JPEG compression, and does not convert color space.

Press Quality (PQ)

When preparing a PQ PDF for a commercial printer, all color images get converted to CMYK because of the print configuration of a digital press or a four color imagesetter or platesetter separations. The file produced will maintain what a print provider needs to reproduce the job successfully.

Both HQP and PQ PDFs will compress all files based on the settings of *(Figure 32)* unless physically changed.

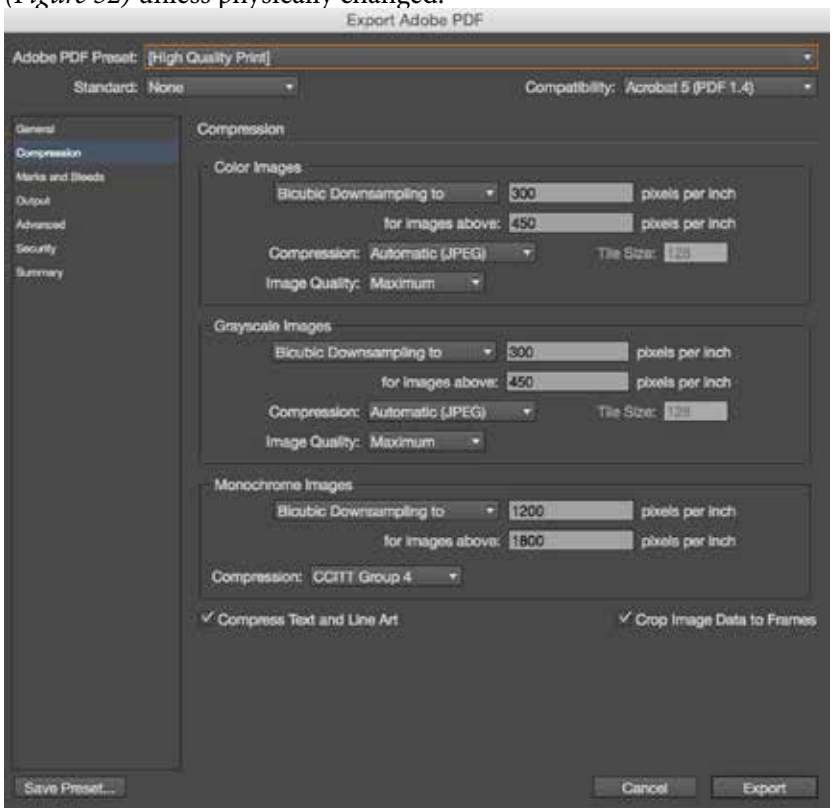

Figure 32: Default compression settings for both High Quality Print and Press Quality PDFs.

In Summary, the PQ format is compatible with Acrobat 5.0 (PDF 1.4), downsamples all continuous tone images to 300 dpi, downsamples monochrome images to 1200 dpi, embeds fonts, maintains transparency, and converts output with profiles to the destination device. Acrobat or Acrobat Reader 5.0 are required to open the PDF file.

Some print vendors will use this preset but prefer the use of their custom joboptions file that was created to produce the best possible output on their presses—it requires particular image resolutions and other settings. Consult with your print provider before beginning major projects. Ease of production, fewer customer alterations, and quality output will be enhanced.

Smallest File Size (SFS)

The SFS PDF compresses and resamples content for web use and email attachments. It embeds fonts, converts images to low resolution, and converts all images (RGB, CMYK, and Grayscale) to sRGB. Due to these conversions, color shifts and image clarity will result which makes it a poor choice for commercial viewing, proofing, and quality print production.

In summary, these files can be opened in Acrobat 5.0 and Acrobat Reader 5.0 and later, color images downsampled to 100 dpi, grayscale images to 150 dpi, and image quality is a low JPEG.

Change image dpi and JPEG compression if higher or lower quality is necessary for distribution. Save these changes for future use in the presets as was done by the author in *(Figure 33)*.

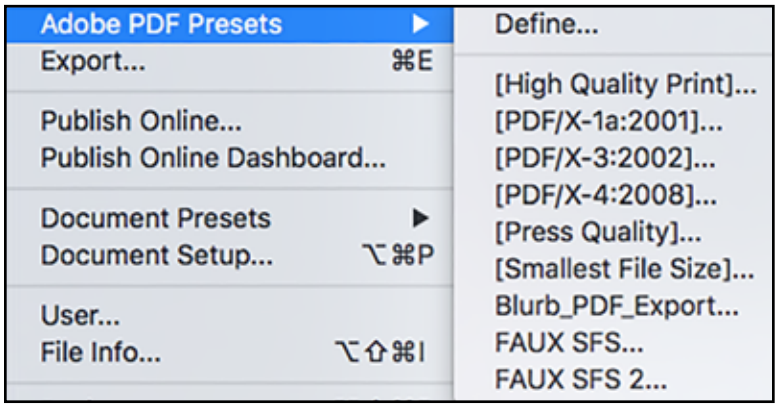

Figure 33: Close-up of InDesign's Adobe PDF Presets.

The PDF/X-1a file format

The PDF/X series of presets is designed to prevent the development of corrupt prepress files by eliminating functions that are not necessary for the print process.

The PDF/X-1a:2001 (must be a PDF 1.3 file format) requires the following:

- All data must be CMYK, grayscale or named spot colors
- Files cannot contain non-printable data such as music or movies
- Fonts must be file-embedded
- Limited compression algorithms supported
- OPI (not allowed) permits the use of low-resolution images in a file to save storage space. This date is exchanged with high-res files later in the prepress workflow.
- Trapping identification—on or off
- Bleed and Trim must be defined
- Any notation must be outside the bleed area
- No forms or code allowed
- No Encryption or transfer curves
- TrimBox defines the printable area, and MediaBox represents document size
- Describe output intent—ICC color profile for example

There is also a PDF/X-1a:2003 (PDF 1.4 file required). Its creation was due to software changes that do not support the 1.3 file format.

PDF/X-3:2002 & 4:2008

These are updated versions that allow the reproduction and support of spot color and transparency.

To summarize PDF/X the quote from Adobe will be used. "PDF/X standards are defined by the International Organization for Standardization (ISO). PDF/X standards apply to graphic content exchange. During PDF conversion, the file that is being processed is checked against the specified standard. If the PDF will not meet the selected ISO standard, a message appears, asking you to choose between canceling the conversion or going ahead with the creation of a non-compliant file. The PDF/X-4 format is reliable for live transparency and color management. This format is optimal for RIP processing, digital printers that use the Adobe PDF Print Engine, and any PDF file to be printed in Acrobat."

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Glossary

Bitmap: The grid on which digital pixels exist. This grid is why digital images are often called bitmap images. When you work with a digital image you are not moving pixels, you are modifying the value of pixels. Bitmap images are also called raster images. Video enthusiasts use the term raster because video images are made up of rows or raster lines of horizontal pixels which are displayed line by line.

Bit Depth: The number of potential tones or color values. A 1-bit image contains only two values—black-and-white—line art for example. The other two most common bit or color depths are 8-bit— 256 values, and 24-bit (8-bits per each R, G, & B channel— 16.7 million color choices. All digital black-and-white continuous tone pictures are 8-bit images. Also, all digital full-color images are 24-bit. Bit depth is the major contributor to file size.

File Size: Equals (height x width x bit depth x ppi squared) ÷ 8

GIF— Graphic Interchange Format: These bitmap images are composed of a matrix of dots that are assigned different colors and can represent an image at a small size. It's commonly pronounced JIF (soft "g") and is used for both animated and static images for fast transfer.

Halftone Dot: The dot size determines the tonal quality and image resolution on a printed page.

JPEG Format (lossy): Joint Photographic Experts Group. Optimized for continuous tone images that contain many hue values. It achieves compression by discarding information that is not easily detected by the eye. It stores information as 24-bit color, and the degree of compression is adjustable.

Jaggy: Digital images that appear staircase or jagged rather than smooth. Often the result of low resolution.

Lines Per Inch (LPI) describe the number of halftone dots per inch that make up a black-and-white or a color halftone. A 150-line halftone, imaged by a high-resolution imagesetter or direct-to-plate system, contains 150 halftone dots per inch (DPI), and the image on the press-ready layout contained 300 ppi

Lossy Compression: Saves file information by partially discarding data of the original that is not easily detected by the eye. But upon careful examination quality reduction can be seen when images are aggressively compressed at low resolution.

Lossless Compression: Implies that no information will be discarded. Therefore, if saved using a lossless format, the final file will be the same size and quality as the original. It does so by identifying a repeating color, pattern, or texture and replaces it with code to reduce the file size.

PDF—Portable Document Format: A file format that maintains the fonts, graphics, and layout of the original file. This embedded data allows the transmission and printing of the PDF file regardless of the initial application, hardware, or operating system. It can be opened and printed by anyone using Adobe Reader, a free download from the Internet.

PNG— Portable Network Graphics Pronounced ping. It is a lossless data compression and the most frequently used format on the Internet. When PNG files are compressed and decompressed, there is no data loss which makes them ideal for images requiring frequent editing as opposed to JPEG images that degrade over time.

Pixel: Short for the words picture and element separated by an x and is one dot of digital data in a web, video or still image. It is an individual unit that cannot be divided. In a color image, it occupies an exact location and has an absolute color value.

Pixels Per Inch (PPI): Determines image resolution.

RAW File Format: These files contain data that have not been altered or manipulated in any way by an image capture device. RAW retains the original data for total manipulation.

Resolution: The measure of fineness and detail in a digital representation. Pictures are measured in pixels per inch (PPI). In most cases, the higher the PPI, the more detailed the image.

TIFF — Tagged Image File Format: It is the leading format for archiving lossless images supported by all platforms, most color spaces, and handles data up to 48 bits. TIFF files are saved with no compression or in a variety of compressions.

Tone: Creates shape. A black-and-white photograph or one reproduced in a newspaper relies entirely on tone—not color. The halftone dot size used in the printing process determines the tonal quality and also image resolution.

How to

prepare and *save* image files