

"Know then thyself; pressure not god to scan." — Alexander Pope

**LECTURE NOTES,
HANDOUTS & REFERENCES**
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SCANNING & HALFTONES

References:

- Ihrig, Sybil & Emil Ihrig, Scanning: The Professional Way, Osborne/McGraw-Hill, 1996.
- Ashford, Janet and James Odam, Start with A Scan Berkeley: Peachpit Press, 1996.
- Miller, Marc and Randy Zaucha, The Color Mac: Production Techniques, Hayden Books, 1995.
- Real World Scanning and Halftones, Berkeley: Peachpit Press.
- Photoshop Wow! Book, Berkeley: Peachpit Press.

Ethics

It is strongly recommend that you observe the rights of the original artist or publisher of the images you scan. If you plan to use a previously published image, contact the artist or publisher for information on obtaining permission.

Scanning an Image

Scanning converts a continuous tone image into a bitmap. Original photographic prints and photographic transparencies (slides) are continuous tone. The scanning process captures picture data as pixels. Think of a pixel as one tile in a mosaic.

Bitmapped images

Three primary pieces of information are relevant to all bitmapped images.

1. Dimensions Example: 2" x 2"
2. Pixel depth Example: 256 grayscale scan
3. Resolution Example: 72 ppi

Resolution

Resolution is the amount of something.

<u>something</u>	<u>amount</u>	<u>amount over physical distance</u>
fabric	the number of stitches in fabric	the number of stitches per inch in a needlepoint
film	the amount of grain in film	the number of grains in a micro meter in film
digital image	the number of pixels	the number of pixels per inch in a digital image

Resolution is a unit of measure:

Input Resolution	the number of pixels per inch (ppi) of a scanned image or an image captured with a digital camera
On Screen Resolution	the number of pixels per inch displayed on your computer monitor (ppi or dpi)
Output Resolution	the number of dots per inch (dpi) printed by a laserprinter

dpi or ppi refer to square pixels per inch of a bitmap file.

The two terms are often used interchangeably although ppi more accurately describes scanning and image resolution. dpi more accurately describes the resolution of printing devises such as laserprinters or inkjet printers.

ppi = pixels per inch
dpi = dots per inch

Pixel Depth

<u>Type of Scan</u>	<u>Bit depth</u>	<u>Amount of Color</u>	<u>Common Use</u>
line art scan=	1- bit (2 ¹)	two values, black & white	to scan pen & ink drawings
grayscale scan=	8- bit (2 ⁸)	256 levels of gray	to scan black and white photographs
color scan =	8- bit (2 ⁸)	256 colors	low quality color, web graphics
color scan=	24 bit (2 ²⁴)	16.7 million colors	high quality color

Desired Resolution

Your desired resolution must evaluate many variables. Knowing how and where your image will be reproduced is important. "Preflighting" is a term used to describe working closely with other service providers (scanning, film preparation, proofing, printing) to determine what procedures and specifications are necessary to achieve your desired quality level.

Variables Include:

- Will the image be displayed on a computer monitor or used for printed material?
Computer Monitor= web graphics, interactive multimedia, kiosks
Printed Material= flyers, brochures, newspaper and magazine advertising
- What quality of print reproduction are you seeking?
Duplicating= photocopy of a laserprint
Low-end print= quick printing (low quality offset lithography)
Medium-end print= offset lithography or digital printing
High-end print= quality offset lithography
- What type of digital printer will you use for proofing?
- What are the requirements of your commercial printer?
- What type of paper or material will you be printing on?

<u>Display or Print Output</u>	<u>Scanning dpi</u>	<u>Halftone lpi</u>
web graphics	72	does not apply
laserprinter	72-100	default of laserprinter
dye sublimation printer	200	does not apply
imagesetter for newspaper	170	85
imagesetter for offset press	300	150

Resolution of Printed Images

Grayscale images (a grayscale scan of a black & white photograph) needs to be broken down into halftone dots for output from a laserprinter or for reproduction in a newspaper.

Why? Because newspapers only use black ink and laserprinters only use black toner.

Grayscale pixel information is automatically converted to halftone dot information when sent to the laserprinter.

The dots, called "halftone dots" produce the illusion of gray values found in the original photograph.

dots per inch = dpi A measure of the output resolution produced by output printers
laserprinter= 300- 600 dpi
imagesetter= 1270- 2450 dpi

lines per inch = lpi A measure of frequency of a halftone screen
lpi refers to the frequency of the horizontal and vertical lines in a halftone screen.
The higher the lpi, the finer the halftone screen.

Resolution of Computer Monitors

Macintosh computer monitors are generally 72 or 75 dpi. PC monitors are about 95 dpi.

What happens when you view a 150 dpi image on a 75 dpi monitor?

At 100% viewing size, the monitor will want to show you every pixel in the image, therefore your image will display 4 times larger.
(2 times larger in each direction)

Scaling

Determine your desired resolution and scale the image to size when you scan.

Resizing your image at a later time could produce undesired results.

Resizing an Image

Changing an image's resolution by adding or subtracting pixels from the image is called resampling.

Resampling down (decreasing the resolution) deletes information. Original pixel data is lost.

Resampling up (increasing the resolution) adds pixel information by interpolation. An image often appears out of focus after you resample up.

Vocabulary

Continuous Tone:

An image containing gradient tones from black to white.

*Example: A black and white photographic print made from a 35mm negative.
A grayscale scan of a black & white photograph.*

Grayscale:

The depiction of gray tones between black and white.

Example: A grayscale scan of a photo.

Scanning as grayscale is the breaking down of a continuous tone image (such as a black and white photograph) into pixels where each pixel has a mathematical gray value. Grayscale images are converted into halftone dots when printed on a laserprinter.

Line Art:

An image void of gray values.

Example: A pen and ink drawing.

A pen and ink drawing scanned as line art (pixel information is either black or white, containing no gray values).

Halftone:

A pattern of dots of different sizes used to simulate a continuous tone photograph.

Example: A photograph reproduced in a newspaper.

A grayscale photograph printed on a laserprinter.

Halftoning is the breaking down of a continuous tone image (such as a black and white photograph) or a grayscale image (a photograph scanned as grayscale) into halftone dots (black cells of various sizes) so the image can be reproduced. By halftoning a grayscale image you create the illusion of continuous tone by printing black cells that vary in size depending on how dark an area is.

Resolution:

A unit of measure.

Scaling:

Changing size without changing ratio of dimensions.

Cropping:

To eliminate certain areas of an image.

Reflective copy:

Art such as a drawing or photograph that must be scanned on a flatbed scanner.

Transparent copy:

Art such as a photographic slide or 4" x 5" transparency that must be scanned using a transparency scanner.

Image Size:

Describes the physical dimensions of an image.

Canvas Size:

The Canvas size command in Photoshop allows you to add work space, or extra canvas area, around an existing image without changing the dimensions of the image.



Line art scan
printed as line art on laserprinter



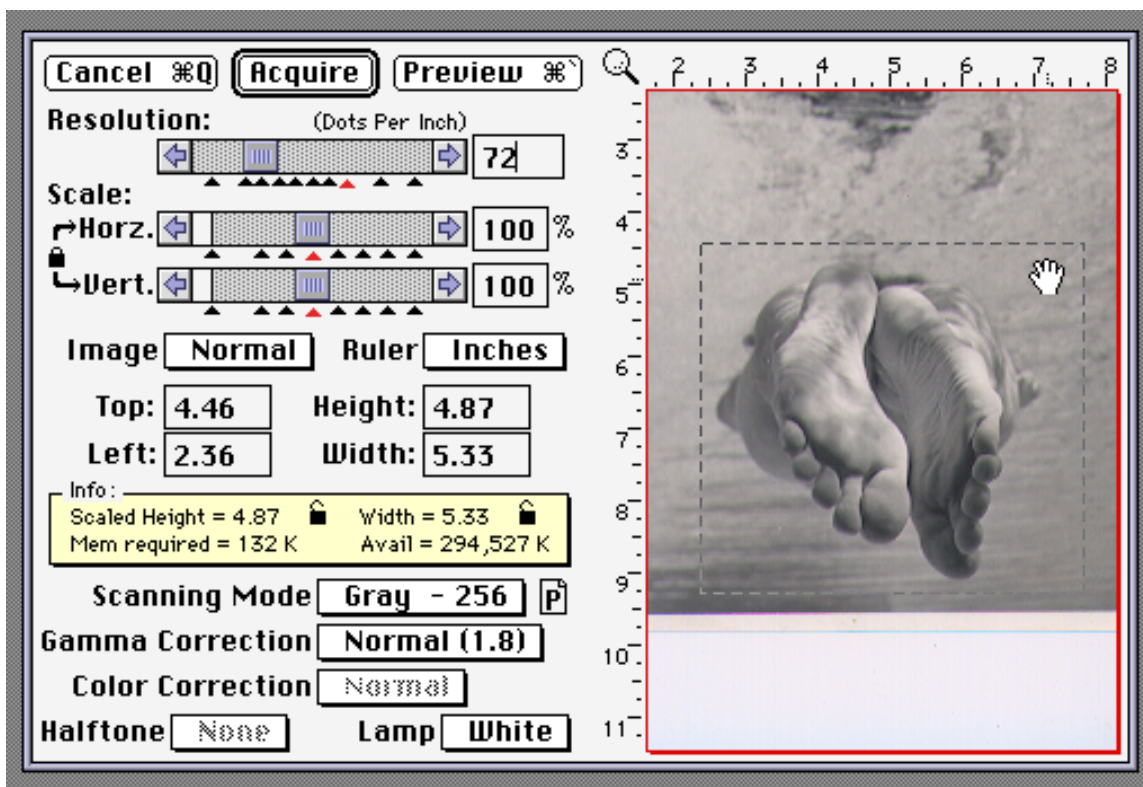
Grayscale scan
printed as a 85 lpi halftone on laserprinter



Grayscale scan
printed as a 30 lpi halftone on laserprinter

Note:

Because this publication was then duplicated on a copy machine, these images have gone through another generation of reproduction. Each successive generation of reproduction can lead to image degradation and loss of integrity to the original image.



A Typical Dialog Box for Scanning Images

Basic Steps

1. Preview elements on the scanner bed
2. Select area to be scanned
3. Determine scan resolution (dpi or ppi)
4. Determine mode and pixel depth (grayscale, color, line art)
5. Scale to desired dimensions (% of original)
6. Scan (or Acquire)