Video (Screen) Resolution - How to Scan for the Web

The scan resolution setting in your scanner software merely determines the size of the output, the on-screen image size.

We tend to think of greater resolution as showing more detail, and while that's generally true in the case of scanned images (within limits), it's solely because the scan resolution makes the image larger. At some point, it becomes so large that not only are all the details apparent, so are all the flaws in a photograph and so are all the dots that make up a printed image. Very high "resolution," scan resolution that is, makes for huge image dimensions on the monitor, and more detail than is useful for on-screen viewing, which includes viewing web pages.

Computer (video) monitors are relatively low resolution devices. If a 17 inch monitor measures 12.5 inches horizontally, and its screen resolution (unrelated to the resolution setting you choose in your scanner software) is set at 1024x768 pixels, then the monitor would have a per inch resolution of 1024 (pixels horizontally) divided by 12.5 (inches horizontally) or 82 ppi (pixels per inch monitor resolution).

However, while this ppi number is correct, it is largely irrelevant, and certainly has no significance when scanning. Neither the monitor's video driver nor its video board has any concept of screen size in inches, and therefore pixels per *inch* (or dots per inch for that matter) has no meaning to the computer system. Printers, however, are very different from monitors. Printers love inches, people love inches, but video systems, like your computer monitor, "don't know, and couldn't care less" about inches.

The only inches we need to care about are the inches of the photographic or printed image lying in the scanner bed. Its dimensions, in inches, multiplied by the dot per inch scan resolution that you choose in the scanning software, will determine the pixel dimensions of the image that is displayed on the monitor.

The equation is as follows: Dimension of image to be scanned in inches multiplied by the Scan Resolution of the scanning software in dpi (dots per inch) equals the On-Screen Dimension in pixels.

For example, if you had an 8 inch by 10 inch photograph and you scanned it into Photoshop at a resolution of 72 dpi, the resulting image would measure 576 pixels (8 x 72) by 720 pixels (10 x 72) on screen. However, if you took a tape measure and measured the image on the monitor, it might be larger or smaller than 8 inches by 10 inches, depending on the total number of pixels on the monitor (the monitor resolution setting) and the size of the monitor. When 72 pixels equal one inch on the monitor, the monitor resolution may be said to be at its optimum or "default" resolution setting. Why? Because 72 pixels per inch is an objective standard of measurement, just as 100 centimeters per meter is an objective standard of measurement. If there are 72 pixels per inch on the monitor, your on-screen image would be 8 inches (576/72=8) by ten inches (720/72=10) If you had the same monitor set at a higher monitor resolution, e.g. the 82 ppi in the example above, you'd have a somewhat smaller on-screen image size.

While the exact "inch size" of an on-screen image at different monitor resolutions is unpredictable, because it depends on both the end-user's ppi setting and the physical dimensions of the monitor screen over which the pixels are spread, the important point here is that you can easily predict the scan input and output numbers just by using a simple equation. Since you can measure the paper image to be scanned, that's a given. As noted, to determine the output or on-screen pixel size of the image, multiply the paper dimension in inches by the scan resolution number, which is the dpi setting of your choice. Often, however, you know the paper size, and have a good idea how much of the screen you want the on-screen image to occupy, but don't know what scan resolution to use to get that result. The same for-

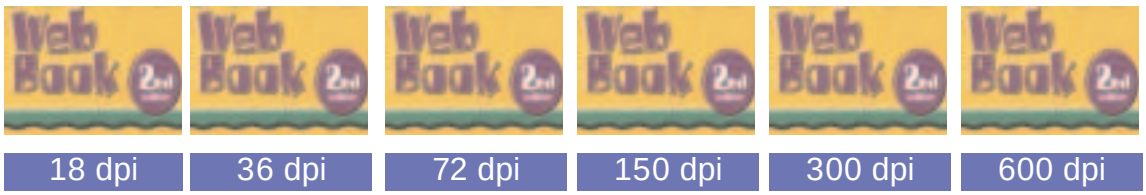
mula provides the answer, only here you divide the output dimension you want on-screen in pixels by the number of inches you have in your paper image. The result is the dpi scan resolution setting you should use.

For example, you have an 8 x10 inch photo and you are designing your page for a 15 inch monitor typically set at 800 x 600 pixels, and you want your photo to occupy just one quarter of the available screen. You can use either screen width or height, since the scan resolution will affect both equally. Let's take the width of 800 pixels. First, we'd divide that by four, to find out what one quarter of the screen width would be in pixels. 800 divided by 4 equals 200 pixels. So we know we want our image to be 200 pixels wide on screen.

Since paper inches times scan resolution equals the on-screen pixel dimension, in this case 200 pixels, the on-screen pixel dimension divided by the paper dimension in inches will provide the dpi number needed to obtain the desired result. In this case, 200 divided by 8 equals 25, you would use a scan resolution of 25 dpi to reduce the size of the 8 by 10 photo.

There's no direct increase in quality to be had from scanning any image at a scan resolution greater than 72 dpi, you just get a larger on-screen image, which indirectly may look better (up to a point). Conversely, there is no direct loss in quality to scan at less than 72 dpi (up to a point), you just get a smaller on-screen image. The qualification "up to a point" comes from the simple fact that if you make a large detailed image very small, you necessarily lose detail in the on-screen image. Likewise if you make the output image much larger than its paper and inch version, you may get more detail than you've bargained for.

The following images link to a pages that show the same image scanned into Photoshop from 18 dpi scan resolution up to 600 dpi, then saved out of Photoshop as jpegs at maximum quality. You can see that at the extremes, there is indeed a loss of quality, but this is indirectly due to the output image size relative to the size of the original, rather than its scan resolution per se.



There is one additional variable to factor into your choice of scan resolution when scanning a paper image into Photoshop, and that is the superior sampling engine of Photoshop itself over that of most common scanning software and scanner hardware capabilities. To make a long story short, once you have determined the scan resolution that will output a digital image at the desired on-screen size using the formula provided above, you can substantially increase the ultimate quality of the scanned on-screen image by setting your scan resolution in the scan software at double what the formula suggests, then after the scan is complete, "resampling" or reducing the on-screen resolution in Photoshop back again to half., i.e., to the resolution that the formula originally suggested.

For example, say you have a paper image that is 4 inches wide by 5 inches high. You know you want an on-screen size of about half that, i.e., 2 inches wide by 2.5 inches high. To estimate the desired on-screen width, you could simply multiply the 2 inches by the standard measure of 72 pixels per inch, which is 144 pixels desired width. Or, as noted in the example above, you could choose a fraction of the total number of pixels of you monitor resolution setting. If set at 800 x 600, you might decide that one

fifth of the width is what will suit your design, so 800 divided by 5 will give you 160 pixels. Remember, that number, 144 or 160, will be the result of multiplying the paper width times a specific scan resolution, so you would divide the desired on-screen width of 144 (or 160) by the width in inches of the paper image, here 4, to arrive at the appropriate scan resolution. The requisite scan resolution here is 144 divided by 4, or 36 dpi (or 160/4=40 dpi). However, because you have the benefit of Photoshop's superior resampling capabilities, you know that you will get a much higher quality end result if you scan at double that 36, or 72 dpi (or double 40=80 dpi), and then when the scan is complete go to the Image Menu in Photoshop and select Image Size. There, you can return the image resolution to the 36 (or 40) ppi size, and have much better quality than if you had simply scanned it directly in at the lower dpi setting.

The following link shows an image scanned in directly at 72 dpi, and the same scanned in at 150 dpi, and then reduced in Photoshop to 72 ppi. Quite a difference in quality.

Image scanned in directly @ 72 dpi and the same scanned in @ 150 dpi, then reduced in Photoshop to 72 ppi.

If you don't know what size you ultimately will want the on-screen image to be, or anticipate that you may be resizing a copy of an original scan, bear in mind that you will *usually* get better quality when reducing the image size than increasing the image size. The reason for this is that when resizing to make an image smaller you discard excess pixels, but when resizing to make an image bigger, the software must create new interpolated pixels, fake pixels as it were, which were not in the original scan. If you don't know what your future sizing intentions are for the image, or if you won't be able to scan it again, you should err on the large size (at least 150 dpi) when scanning, regardless of what the formula may suggest.

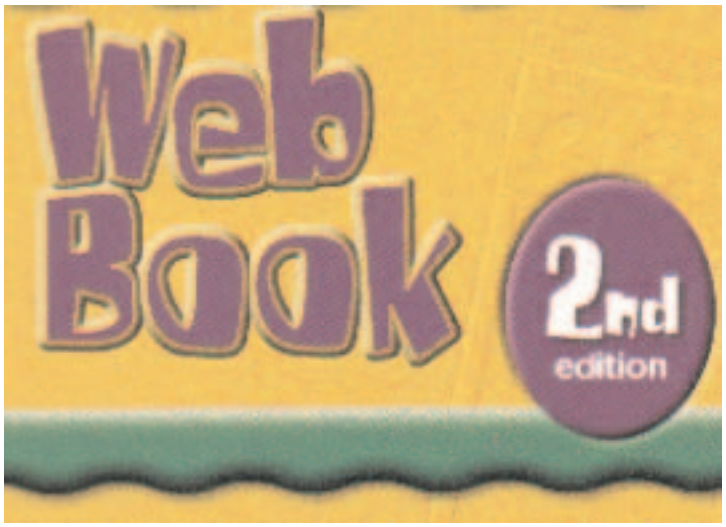
One last item to take note of, is that when you save your new Photoshop image out as a jpeg or gif, the conversion process automatically changes the image resolution to 72 ppi, normal screen resolution, but it does so without changing the dimensions of the image. So, if you had a large Photoshop image set at 150 ppi after the scan (in the Photoshop menu see Image >> Image Size), when you "save for web" and convert the image into a jpeg or gif, Photoshop keeps the size information, but changes the resolution to screen resolution, 72 ppi, automatically. So don't be confused if you open a jpeg you had saved out of a Photoshop document (extension .psd) that is set at 150 ppi or 300 ppi or whatever, only to find its .jpg child is now defined as 72 ppi with no difference in size from the .psd image. It's the magic of Photoshop at work.

18 dpi

Note the loss of detail at the lower scan resolutions.

36 dpi

Back to PageTwo

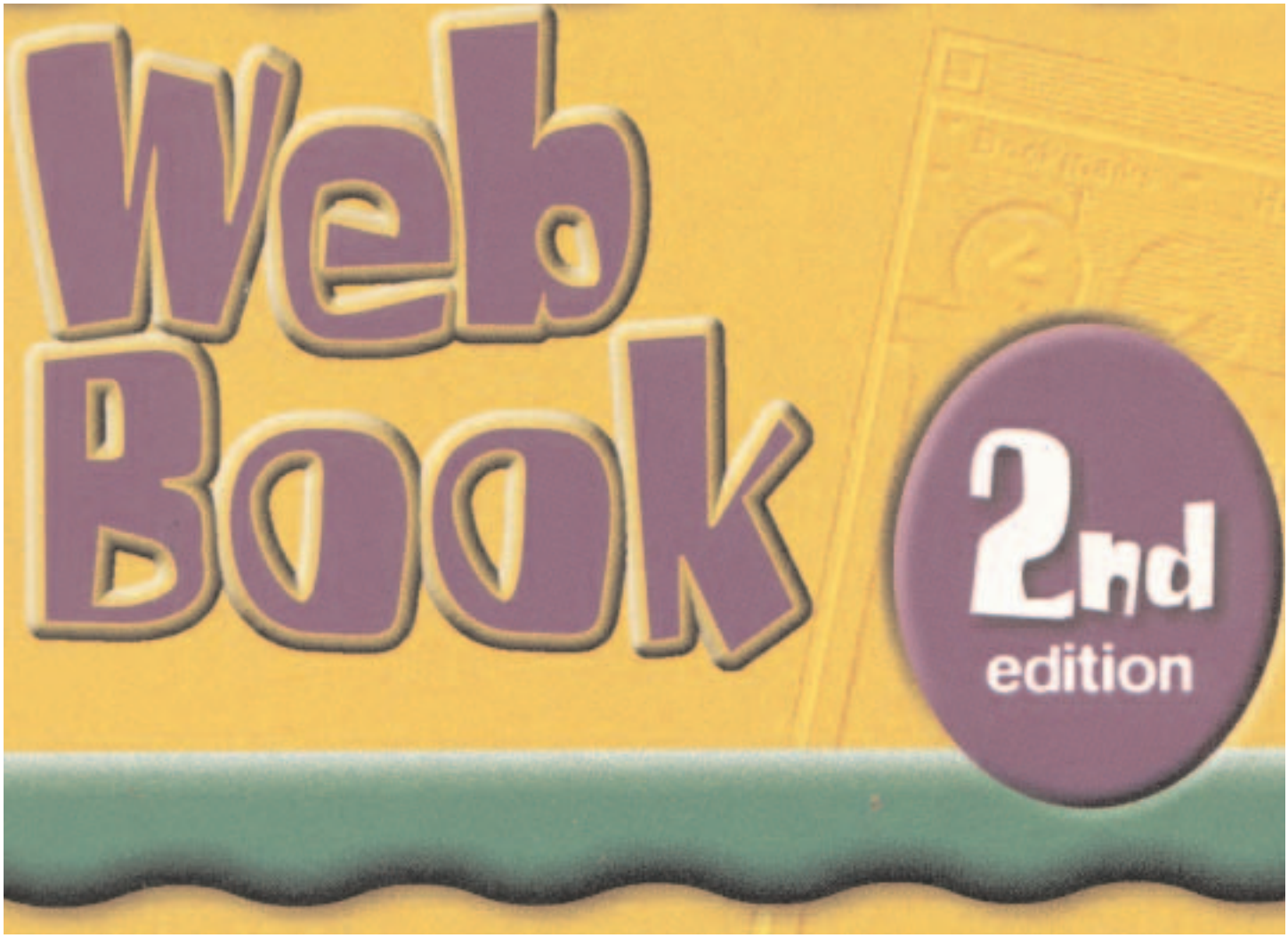


Compared to this.

72 dpi

Back to Page Two

Back to Page Two



150 dpi, slightly cropped

Back to Page Two

Again, the improved clarity comes from the increased size, not directly from higher "resolution."

At 300 we begin to see flaws in the original. Note the artifact on the lower right edge of the "W."

At 600, we can actually see the dots used in the printing process to produce the book cover.

Back to Page Two

Above 300 dpi, below 600 dpi, both significantly cropped

Image scanned in @ 150 dpi, then reduced in Photoshop to 72 ppi.

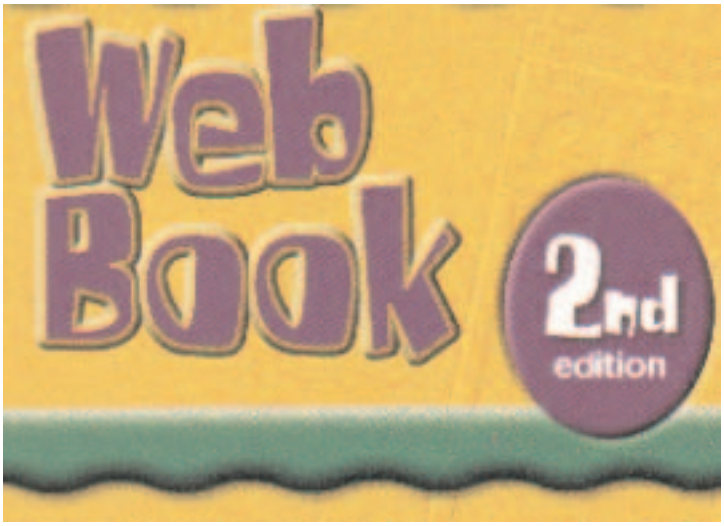


Image scanned in directly @ 72 dpi.

Notice the degraded edge on the left of the "b" in Web, and the pixelation and artifacts throughout, especially around and within "2nd edition."

Back to Page 3