

Image Resolution

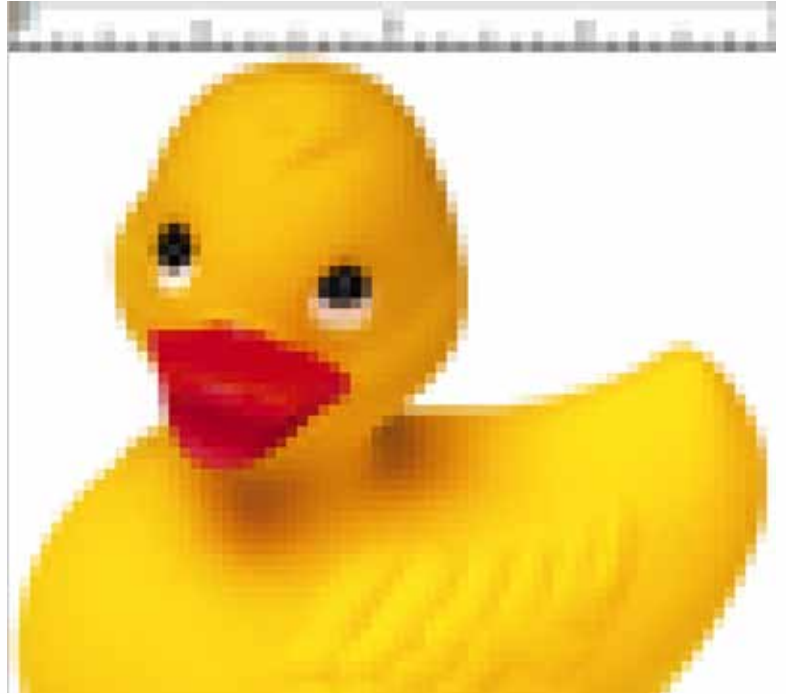
Resolution is the degree to which an image or device can record or reproduce detail. This is commonly stated as dots per inch, dpi, or, more correctly, pixels per inch, ppi (see footnote next page). A pixel (picture element) is a display point. The image dimensions are inversely related to the resolution: if one goes up the other goes down:

Resized without sampling



All three images have the same file size, 37.9 KB. At 0.24" wide the image is 300 ppi, at 1" wide, it is 72 ppi, and at 4" wide, it is 18 ppi.

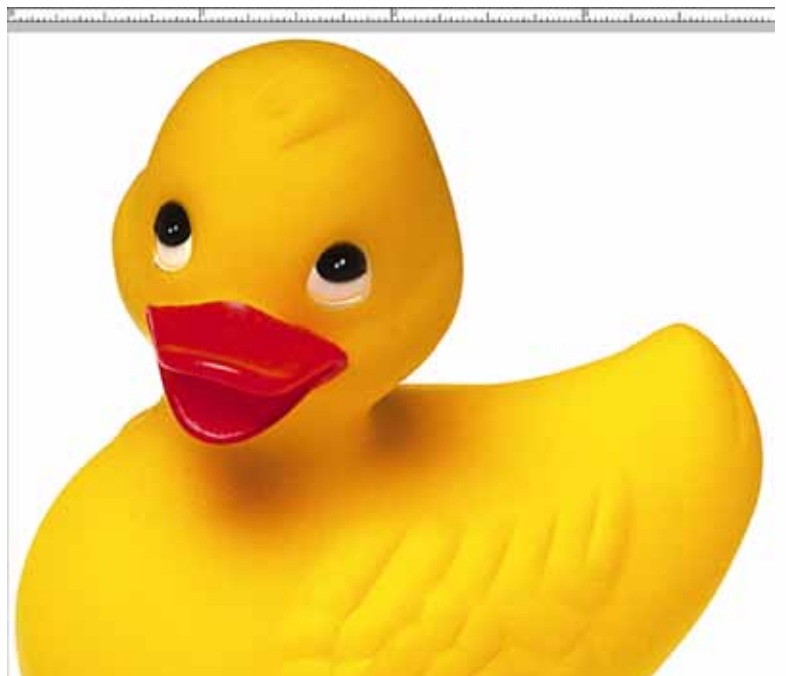
Except in graphics editing programs, when an image is resized, this is what happens. The image is pixelated.



Resized with sampling



Here, all three images are 300 ppi at the same dimensions as above. However, the file sizes are 37.9 KB, 309.4 KB, and 4.62 MB, left to right.



flush left

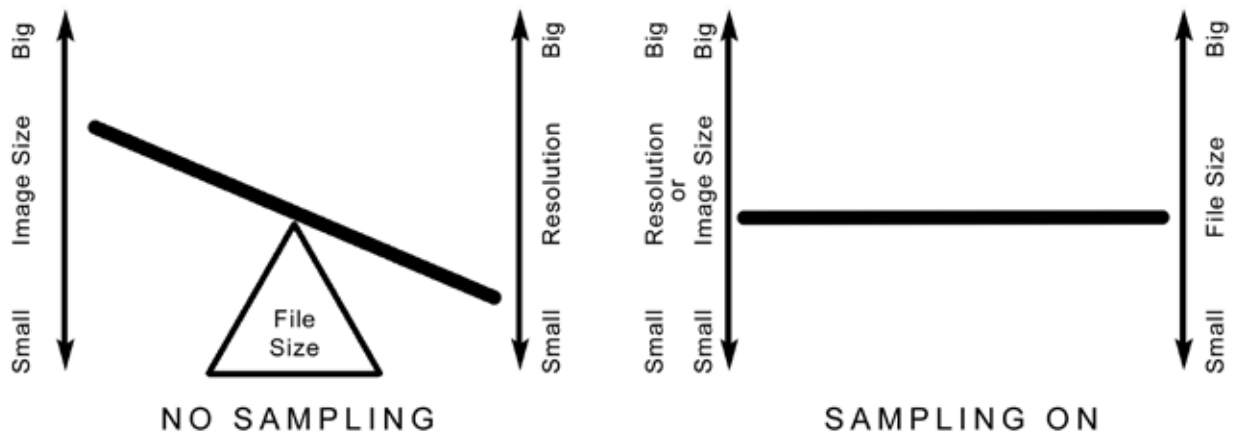
14/26 Times
Justified10/12 Times
Justified

ctr

For most printing, 300ppi (again, most people will say 300 dpi)¹ is the norm. This is true for ink jet and laser jet printers, as well as large, commercial presses, digital or non-digital. Although some images might print well at lower resolutions, and some better at higher resolutions, 300 is a safe number.

Regardless of whether you work in InDesign, Word, or OpenOffice, resizing the image inside the program will usually keep the file size the same and the resolution will change. In some programs, such as Word, some people have experienced catastrophic downsizing (for example, 300ppi > 96ppi).²

Roughly, a digital pocket camera produces a good quality image that is 12" x 9" at 300 ppi, but it often opens up in software as 50" x 37.5" at 72 ppi. Reduced to standard print sizes, the image quality is perfectly adequate.



This is the basic relationship between image size and resolution with and without sampling on. Without sampling, nothing new is invented; and if one increases the other decreases. Whereas, with sampling you can control both size and resolution.

As noted above, changing the dimensions and the resolution requires sampling. Graphics programs have sophisticated algorithms that sample (also called resampling or interpolation) the original file, calculating either new, additional pixels when enlarging, or what to remove and how to alter the remaining pixels when reducing, so that the enlarged or reduced images appears otherwise unchanged.

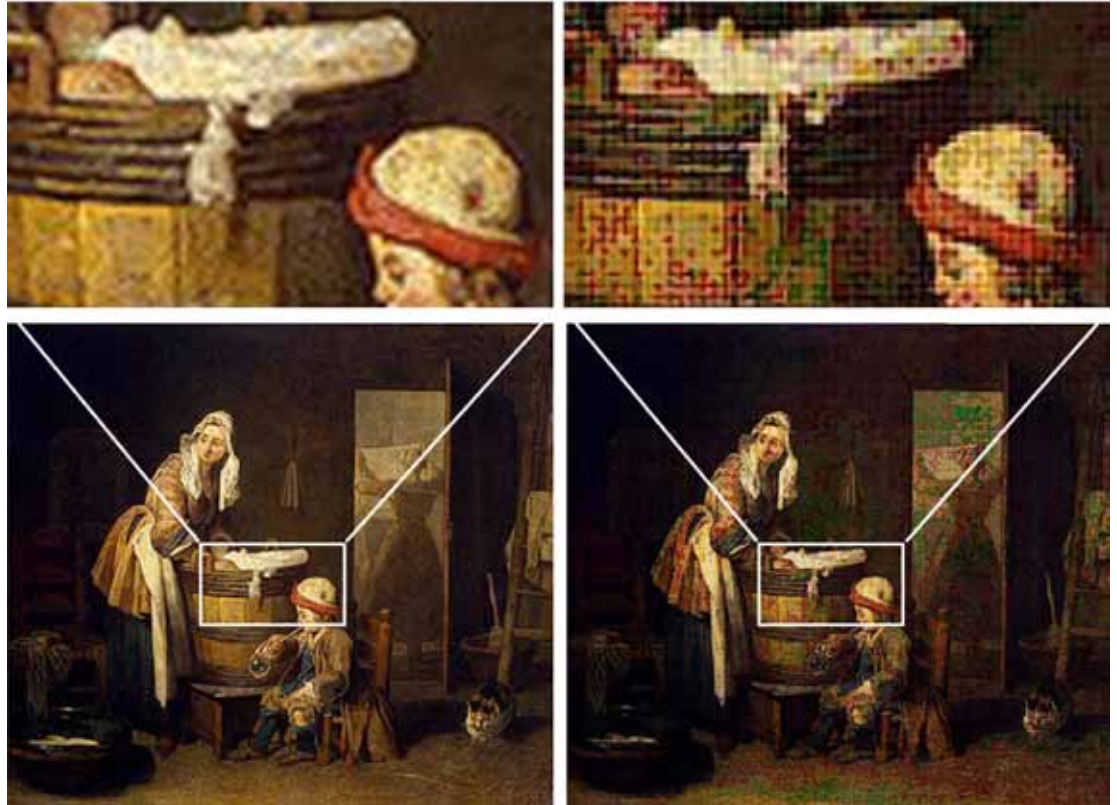
Although sampling can produce enlargements as much as 800% from good images, or even 2,000% from a very high quality image, if the original image does not have enough visual information, the interpolation process has nothing to work with. What often confuses people is images we see on our monitors.

Personal computers (PC and Mac) are designed to give the best possible online experience, which means the monitor, video card, and operating system produce unbelievably good monitor images from truly awful web image files. Here, left, is a screen shot of Chardin's *The Laundress*. The online images was about 3 x 4 inches, and as can be seen, isn't bad even with enlarged. The same images

1 A pixel at 300 ppi printed by a Canon Pixma printer requires 32 x 32 tiny dots of ink (1024 tiny droplets): the Pixma prints at 9600 dpi. In trying to promote "ppi" over "dpi" when talking about resolution, I know this is probably a losing battle, but for this little information piece, I will persist, but understand that most people will say "dpi."

2 Word 2007+ will also "compress" images (downsize) unless the feature is turned off, see page 4.

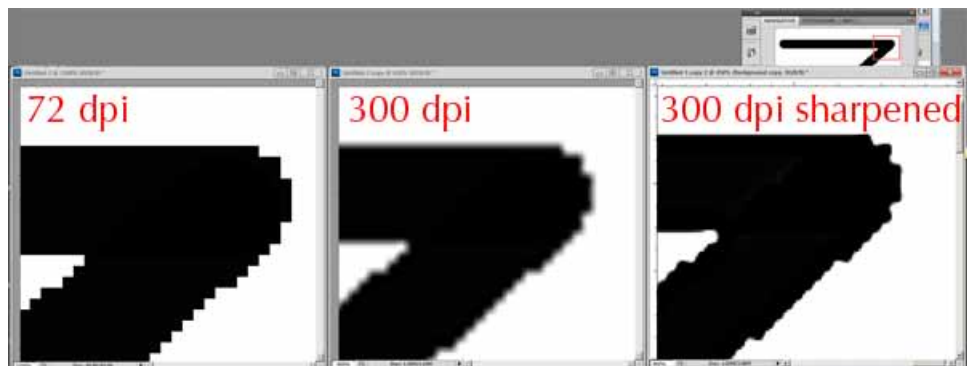
printed shows an entirely different story.



Simply looking at an image on the screen will not tell you how well it will print. This is why people are advised not to use web pictures for print.

Free programs like Irfanview and GIMP, have sampling. Generally, look under *Image > Image Size* or *Image > Scale*. (Canvas size—found under *Image*—refers to the overall dimension of the the image file. A 4 x 5 inch will open as a 4 x 5 image, but the overall size, the canvas could be changed, for example to 6 x 7. The image size would not change, but the background would be bigger by 1 inch all the way around.)

Note: Starting with a low resolution image, left below, and simply increasing the resolution produces a softening of lines and edges, middle. Some images may need to be sharpened, right, to bring back crisp edges. (The duck on the first page was not sharpened.)



General guidelines for printing images

- If images are to be used in print jobs, they should be 300 ppi.
- Most monitors are not only transmitted light (inherently brighter than reflective art), but are too bright. Images that look good on a bright screen will tend to look darker and muddier when printed.
- Print images to proof them.³
- Size images in graphics programs to the exact size required: do not resize inside any program that does not have sampling. Specifications requiring images at 100% mean:
 - at the size intended to printed
 - at 300 ppi (dpi)
- Insert or place images into files, do not drag and drop or copy and paste.
- Cameras, scanners, and monitors are sRGB devices (full color is created by varying amounts of Red, Green, and Blue). Most desktop printers are set up to work best from RGB color (although their ink-sets are CMYK, Cyan, Magenta, Yellow, Black). Some commercial printers (printing in CMYK) prefer images converted to CMYK, some do not. Check with your printer.⁴
- All digital images are soft. Most cameras sharpen the images, and make other adjustments. (Images that have not been manipulated in the camera are called camera raw.) Check your images for sharpness.
- It is rare for an image to get better when commercially printed. Shadow detail tends to plug up and highlight detail tends to blow out. Compensate when adjusting your images for print.

Images in Word

Word 2007 and up, has a compress images feature. Although Word says “compress” it is actually downsizing (that is, taking your 300 ppi images and downsizing them to 200 ppi or less). To disable this feature before inserting images:

Word 2007: Click an image to bring up the Picture Tools ribbon > Click Compress Pictures > Click options > Uncheck ‘Automatically perform basic compression on save > Click OK > Make sure ‘Apply to selected pictures only’ is unchecked and hit OK

Word 2010: File > Options > Advanced > Image Size and Quality > Tick “Do not compress images in file”

Once you have saved images in your Word file without removing downsizing, it is too late to remove it. Those images will have been downsized.

Do not resize images inside Word.

Do not drag and drop images into Word.

Avoid copying and pasting images into Word.

Do not use Word 2010’s Save as PDF feature. It will downsize your images.

Do not use PDF conversion plug-ins for Word, they will downsize your iamges.

³ Soft proofing, that is, looking at them on the monitor, requires a calibrated monitor and a good color management regime, including ICC profiles for print output devices.

⁴ Create Space prints with non-traditional process colors and proprietary ICC profiles. They accept RGB images, and, without going into detail, print best from RGB images. See *CS Digital Sampler*, by Walton Mendelson