
Understanding the Resolution of Digital Images

and its impact on their utilization and their long-term preservation.

For the Community Digitization Program of

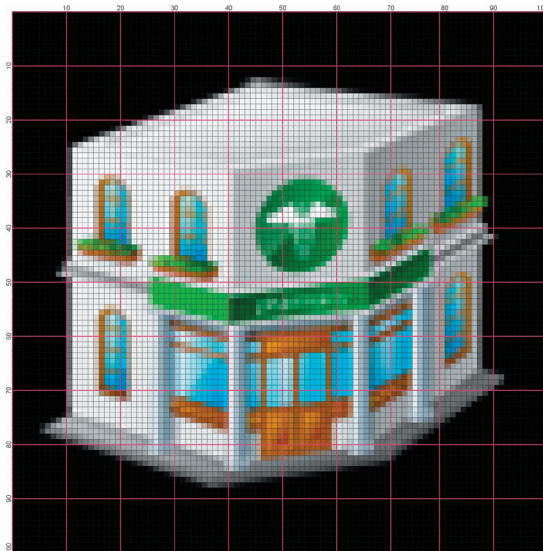
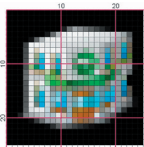
Prescott-Russell

The resolution expressed in megapixels (MPX)

In embroidery, the pattern of an image is created by placing colored dots on a grid, composed of a certain amount of squares.

Example

A pattern on a grid of 25 x 25 squares (625 squares)
and 100 x 100 squares (10 000 squares).



It is also the case for a digital image. The color dots, or pixels, are saved by a certain number of sensors, arranged on a grid. The more pixels, the greater the image details are fine. The “resolution” of the image corresponds to its size in pixels, often expressed in megapixels (MPX). It is calculated by multiplying the number of pixels in height by the number of pixels in width.

Thus, for two images to the same “density” of pixels, the image at higher resolution will be of better “quality”, because it provides finer details.

Example

The same image 600 x 900 px (0.54 mpx)
and 1 200 x 1800 px (2.2 mpx).



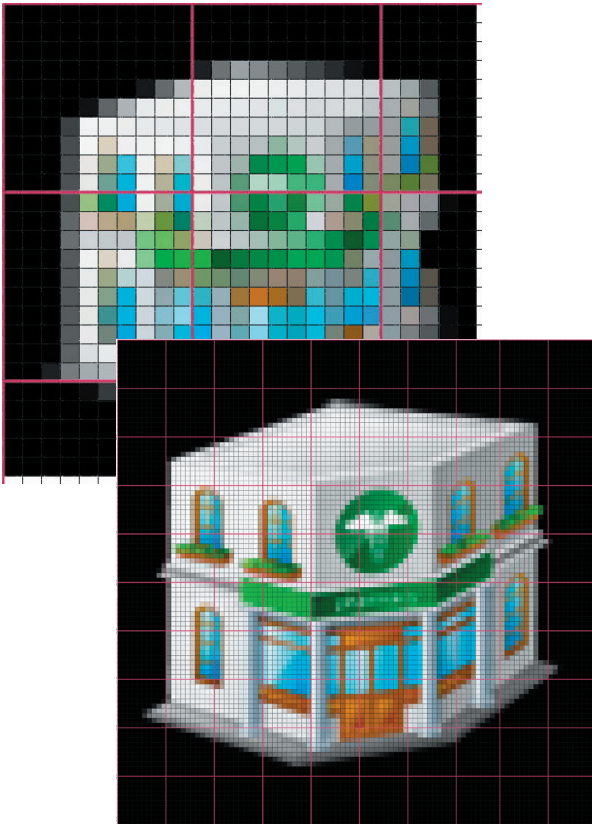
Understanding the Resolution of Digital Images

The resolution expressed in dpi or ppi

In embroidery, more the squares of a grid are smaller, a certain amount per unit of measure, and the more image details are fine.

Example

An embroidery pattern of 2.5 x 2.5 inches on a grid of 10 squares per inch and 40 squares per inch.



It is also the case for a digital image. More pixels are smaller, a certain amount per unit of measure, and more image details are fine. The “resolution” of the image corresponds to the “density” of pixels when viewing or printing. It is expressed in terms of number of points (printing) or pixels (computer) on a given length (1 inch). It is noted as dpi (dots per inch) or ppi (pixels per inch).

Thus, for two images displayed or printed the same size, the image at higher resolution will be better of “quality” because it provides finer details.



Example

A digital image of 2 x 3 inches at 30 dpi and 150 dpi.



What is the resolution of an image of archival “quality” ?

To qualify archival images, who will use them and how (in what type of media or technology) they will be used must be predicted. The progress of these media and technologies must be also anticipated to allow them to be still usable in the longer term, without having to rescan them again. However, there are also constraints to their preservation, including the purchase and maintenance of storage of master files and backup copies on secure media. The level of resolution for archival images should then, at least, provide the best possible flexibility of use and impose the fewest possible restrictions.

As the quality of an image depends on the quantity of pixels captured and their density, these two factors then must be considered determining the best level of “quality”. So it is not recommended to focus only on the density of images, by scanning them all at the same resolution (eg 600 dpi), without considering also the size of the original documents. Rather, it is recommended to scan images at resolutions adapted to the original’s dimensions, to obtain digital copies of standard dimensions.

It is generally considered, in digital preservation, as images containing 3000 pixels on their longest side, offer enough flexibility for various uses, without generating too large electronic files (about 20 Megs). With advances in technology and lower cost to buy it, these standards can even be doubled (6000 px longest side), but the generated image files are then larger (about 80 Megs).

In general, scanning at a minimum of 3000 px (longest side) is sufficient when the originals are common, recent and in good condition. Digital copies produced allow 8 x 10 prints at 300 dpi.

However, if the originals are rare, old or fragile, it may be better to scan at 6000 px (longest side). This captures in one shot, a maximum of information, and avoids handling them again in the short term.

The “performance” of the equipment shall not affect the level of desired “quality”, but may still be considered for their potential to facilitate the processing of different types of originals.

Whatever the chosen standard, this approach also has the advantage to facilitate the calculation of required space to store images (ex: 100 files @ 20 Megs = 2 gigs).

Understanding the Resolution of Digital Images

What is the resolution of an image of “quality” for the Community Digitization Program?

Some program partners already have images of various formats, often copies of a second or third generation. In this case, digital copies at 3000 px (longest side) are sufficient. However, when collections of rare or of first generation images are offered to partners, it is better to scan at higher resolution. Thus, since the original documents will be more or less well preserved by their owners, partners ensure at least to keep digital copies of high quality (4500 or 6000 px longest side).



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3000 px (longest side)

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< ----- 3000 px (longest side) ----- >



How to calculate the resolution to apply when scanning??

As an image of 3000 px (longest side) can be printed in 8 x 10 to 300 dpi, apply the following formulas;

1- When the longest side is smaller than 10 inches:

5 x 7 inches Print

$3000 \div \text{longest side (7 inches)} = \text{number of dpi, scanned at 100\%}$

$3000 \div 7 = 429 \text{ ppi at 100\% (round up to 450 ppi)*}$

35 mm Slide (0.9448 x 1.417 inches)

$3000 \div \text{longest side (1,4 inches)} = \text{number of dpi, scanned at 100\%}$

$3000 \div 1,4 = 2143 \text{ ppi at 100\% (round up to 2400 ppi)*}$

2- When the longest side is greater than 10 inches, but smaller than the scan area, scan at 300 dpi (ppi) to 100 %.

3- When the longest side is larger than 10 inches and larger than the scan area, scan the document into sections at 300 dpi (ppi) to 100%.

Then assemble the sections into a single image in editing software like Photoshop. It can then be saved in its final dimensions, or reduced to 10 inches (3000 px longest side) when saved. In both cases, it is also important to keep each section as independent images.

