

Potentially the most dangerous dialog box in Adobe Photoshop™

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In the *Photoshop for Dummies* books, author Deke McClelland refers to the IMAGE SIZE dialog box as perhaps the most confusing window in Photoshop. The capability for creating artifacts by using this tool with a scientific image lead to one of the most important “rules” for digital imaging. **Always perform image manipulations on a copy of the original image.** The original image is your raw data. If you make a mistake, you can always go back to the original image and start again. The original image can be used as a benchmark to verify that the image manipulations you performed have not significantly altered the data.

What makes this window so confusing is the use of the poorly defined term “resolution”. Forget for a moment that monitors & printers have dpi (*dots per inch*) and halftone screens are measured in LPI (*lines per inch*). What scientific users of Photoshop need to preserve is the magnification factor and the biological detail in their image.

A common mistake that we have seen occur is when users change the resolution value in this window from 72 to 300 so that they can “paste up” publication figures that will be printed on a high resolution printer. By choosing this setting, the user has instructed the software to use the bicubic algorithm to increase the number of pixels by a factor of 16.79 in X and Y. In the example at the right, the image was enlarged, but being “upsampled” has altered the direct relationship between pixels and inches. No additional detail is present. In fact, the edges of the dark blocks have been blurred because the interpolation was not a power of 2 (*the software has to “guess”*). “Downsampling” the resolution value from 300 to 72 causes a complete loss of the ability to distinguish between the dark and light colored blocks. In addition, the reduction by a factor 4.17 has resulted in a rounding error, the value of 5.76 pixels has to be rounded up to 6 because the software cannot create fractional pixels. These sorts of artifacts can easily turn a crisp looking biological image into a muddy mess.

To change the resolution value without changing the number of pixels in the image, uncheck the RESAMPLE IMAGE box at the bottom of the dialog box. The PIXEL DIMENSIONS width & height values will change to gray, indicating that they can’t, and won’t, be changed. Now when you change the value in the RESOLUTION box, the DOCUMENT SIZE width & height values will reflect the new conversion factor.

Other cautions/comments:

- Do not uncheck the CONSTRAIN PROPORTIONS box. This feature ensures that if you want to reduce/enlarge an image, the reduction/enlargement factor will be the same in both the X and Y dimensions.
- Reducing/enlarging an image should be one of the last things you do and should only be done **once** to reduce the possibility of compounding any rounding or interpolation errors inherent in the process.
- Including a scalebar on an image will ensure that, when the journal publisher reduces or enlarges an image to fit the page, the magnification will be scaled in the same manner as the image.

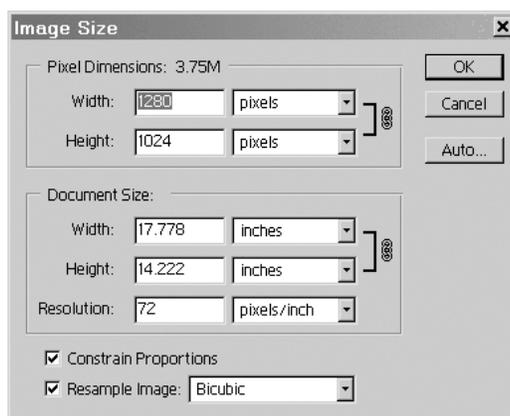
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Mr. Cromey is the manager of the Cellular Imaging Core, a service that provides training & technical expertise to SWEHSC investigators interested in using microscopy and scientific imaging in their research. The SWEHSC is funded by the NIEHS, grant # ES06694. The Cellular Imaging Core is also host to [Microscopy & Imaging Resources on the WWW](http://swehsc.pharmacy.arizona.edu/exppath/), located at: <http://swehsc.pharmacy.arizona.edu/exppath/>

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