Appendix C Transporting Figures

Overview:

Almost every laboratory report needs figures of some sort. These may be needed to describe an experimental apparatus, the schematic of a system to be tested, graphs of laboratory instrument data results, and plots of interpreted or mathematically manipulated results. All of these kinds of figures ultimately need to be transported into the writer's word processing program (here assumed to be Microsoft Word). Porting figures from one program to another can be tricky. There are usually multiple ways you can do it, including the following methods for getting a file or clip that you can paste into your laboratory report document:

1. Take a photo of the figure on the computer screen with a camera. (Usually bad!)
2. Take a screen shot (using "clipping tool") on the computer to get an image file.
3. Do a "copy" from the source program and "paste" directly into your document.
4. Do a copy from the source and paste into a graphics program, fix it up a bit, then paste or insert it into your document.

Complicating the issue is the fact that there are two very different forms of computer graphics: pixelated images, and line drawings. An image composed of pixels is essentially a grid of points, each of which has a color. This is typical for things like photographs. The image is characterized by a resolution, typically given in "dots per inch" (dpi). If such an image is stretched or zoomed too much, the individual pixels are apparent and the figure looks bad, possibly very bad. (About 300 dpi is the normal standard for acceptable quality in print media, though lower resolution down to 100 dpi is sometimes OK.) Graphics produced by digital photographs, screen shots, and many graphics pasted from other programs, are in the form of such images. File formats such as .jpg, .tif, .png, etc. directly support pixelated images. Figure C-1 shows the upper left corner of Figure 2 from Appendix E zoomed to 500%. The pixels are quite visible.

The other alternative is line drawings, in which the information is not stored as pixels, but as a list of lines and other shapes that compose the graphic. An Excel chart is a line graphic, and so are drawings done in PowerPoint. Line drawings are the basic representational principle in CADD software used for engineering. The advantage is that you can zoom an arbitrary amount and sharpness is not lost. Ultimately the drawings must be "rendered" to turn them into pixelated images for printing and display on a screen, but that transformation is made during display; the underlying representation remains line art that can be pressed to arbitrarily fine resolution. In practice, software applications that support line art also allow integration of the two, with drawings including both pixelated images and line art together. The problem with line art is that, except for other Microsoft applications Excel and PowerPoint, it is difficult to paste line drawings into Word. Usually they have to be rendered to pixelated images first. Figure C-2 shows the same zoomed graph as Figure C-1, but pasted in as a .pdf, which preserves the line art properties. It looks a lot better! At a normal 100% zoom, both would probably be acceptable. But if you need to enlarge a figure, starting with a line art representation is much, much better. Line drawings also typically take much less computer storage space than equivalent high resolution image files.

(Note: these figures were made by pasting into Word, zooming, then screen capture.)
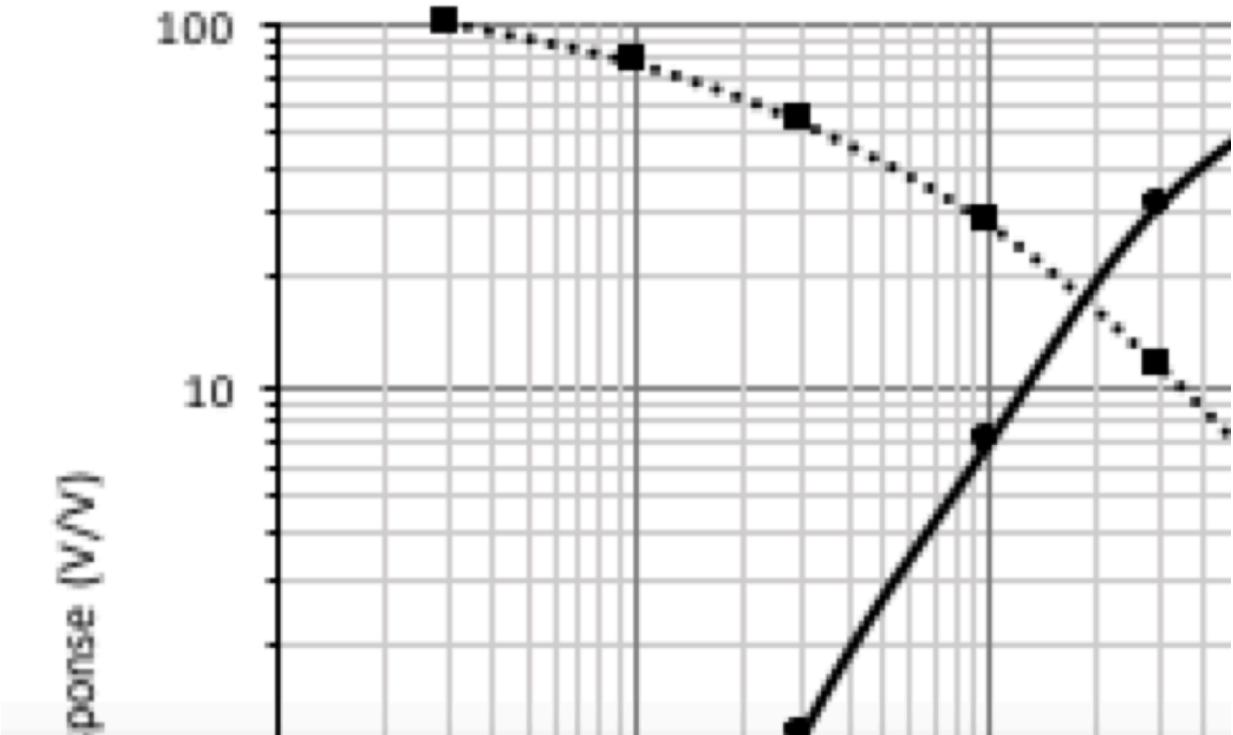

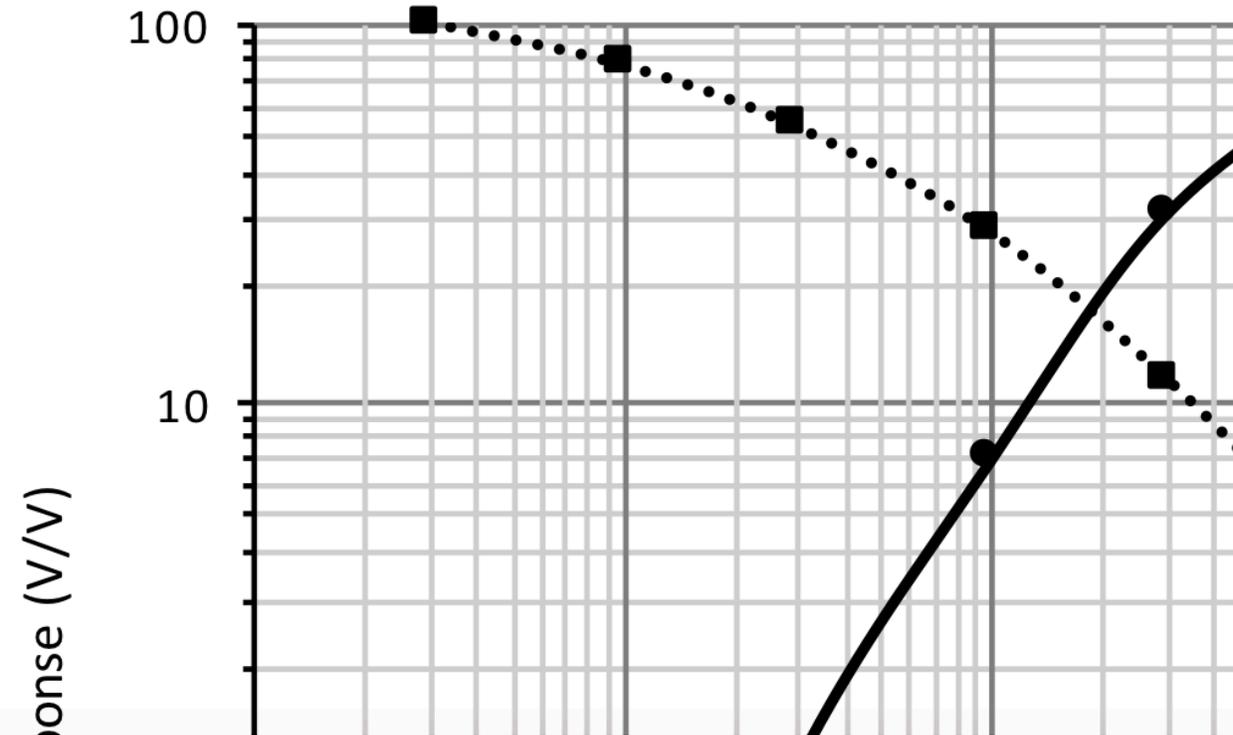Figure C-1 Zoom 500% of figure pasted in as a pixelated image (.tiff)

Figure C-2 Zoom 500% of figure pasted in as a Microsoft Office graphic (line art)

This appendix is concerned with the process of getting graphics data and images from various sources into Word. Editing those graphics into a form that is presentable is addressed in Chapter 4 concerning figures. Here the focus is on the porting process, so that those nicely constructed figures will also look good in your report. The assumption is that you are not a graphics professional; you are a student limited to the commonly available programs. If you were writing a book, your publisher would use professional grade (and expensive) software to do layout, and to port and render graphics to a quality expected at today's textbook prices. But as a student doing a laboratory report, you don't have the time or resources to do that. That is also true in the professional domain. If your report is sufficiently important, perhaps it will be given a makeover by your firm's publications department before it is disseminated to prospective clients. Your job is to make the contents as presentable and effective as you can within the means you have available.

The remainder of this appendix is in sections that address ports from particular software packages that you are likely to use.

Ports from Excel:
So, you have carefully constructed a graph in Excel and formatted it just how you want it to appear in your report. How do you get it there? The seemingly obvious answer is to "Copy" from Excel and "Paste" into Word. But there are important nuances.

In the Word "Edit" menu, you can find "Paste" and "Paste Special …". What "Paste" does depends on the defaults that are set for your version of Word. To fully control what happens, do "Paste Special" and choose the option that gives the result you want. The Paste Special dialog box is shown in Figure C-3 below.
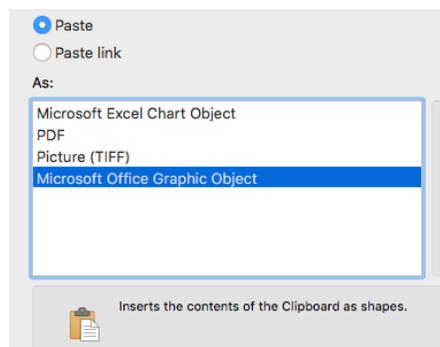

Figure C-3 Word Paste Special Dialog Box

There are two basic choices at the top: whether to paste in the graphic or whether to paste in a link to the graphic. A link to the graphic allows your Word file to display a graphic which actually remains in your Excel file. If you change the Excel data, the graph there will change, and you'll also see the change in your Word document. This can be useful, but it is also dangerous, since if you sent the Word document to your lab partner to review, but not the Excel file, the figure is missing. It also means that your

Word document may change between when you first print it and later when you have done some more with Excel without even having touched the Word document. Unless you are very careful and sure of your reasons for using a link, I'd recommend pasting the graph itself rather than just a link. (These same methods and issues also apply to pasting drawings in from PowerPoint.)

When pasting the graphic, you have choices. If you paste as an Excel Chart Object, you can continue to edit the chart after it is in Word using the same tools that you have in Excel. (But, why not do that in Excel before copying?) A Chart Object may be subject to version issues in the future, since it depends on a compatible version of Excel. The option to paste as a Microsoft Office Graphic object is usually best, in that the graphic remains in the form of "line art" that can be rendered at arbitrarily fine resolution. However, it may not port to other applications, such as other word processors. The safest ways to paste, if you are concerned with being able to read your file sometime in the future or on other platforms, is to paste as a pixelated image (.tiff) or as a PDF image. The PDF image should retain the qualities of line art as Figure C-2 shown above, while remaining a widely accessible format that should not disappear leaving your document with a hole where the figure should be.