Microsoft Office Tips for Better Looking Graphs

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This document briefly explains quick scatter graph formatting in MS Office 2010. Table and figure captions include detailed instructions on how graphics were inserted into this Word document.

Quick Scatter Graph Formatting (Key point: use templates)

MS Excel is often the tool of choice for creating scientific graphs, but it was not designed for that purpose, and as a result the default settings do not produce a high quality graph. Consider the data given in Table 1. The default graph produced using Excel Scatter Graph is shown in Figure 1.   There are several undesirable formatting features of this graph:

1. There are horizontal gridlines. It is not standard to have horizontal gridlines in technical plots. Sometimes we choose to include both horizontal and vertical gridlines, but most of the time we do not use gridlines at all. These gridlines should be deleted (select the gridlines and click delete key; alternatively go to Chart Tools, Layout, Gridlines, and choose no gridlines).
2. There is no box around the plot area. Most papers in the literature have the plot area enclosed (right click on the graph, Format Plot Area, Border Color, Solid Line, Color Black Lighter 35%).
3. The axis labels and legend are too small, especially when reduced to fit in a report (Right click on each item, Font, 16 pt).

Table 1: Data for Scatter Graph Example (image in this table was created in Excel and pasted using Paste Special Picture (Windows metafile) so that it could be sized; this Table is a *Text Box* anchored near the words "Table 1" in the main text with *Text Wrapping* = Top and bottom and *Positioned* at the bottom of the page.) (Data From CBE346, Spring 2013, Cycle 1.)

		1.0 gpm		5.0 gpm		8.0 gpm	
	Material	**Re**	**Nu**	**Re**	**Nu**	**Re**	**Nu**
1 inch	Aluminum	0.5	13.7	2.6	44.1	4.1	51.1
	Copper	0.5	20.3	2.6	45.7	4.1	57.4
	PMMA	0.5	4.4	2.6	7.1	4.1	7.1
		1.0 gpm		5.0 gpm		8.0 gpm	
	Material	**Re**	**Nu**	**Re**	**Nu**	**Re**	**Nu**
2 inch	Aluminum	1.3	44.7	6.7	109.2	10.7	158.1
	Brass	1.3	44.7	6.7	111.3	10.7	155.8
	St.Steel	1.3	38.7	6.7	78.3	10.7	111.3
	Copper	1.3	58.6	6.7	121.8	10.7	163.0
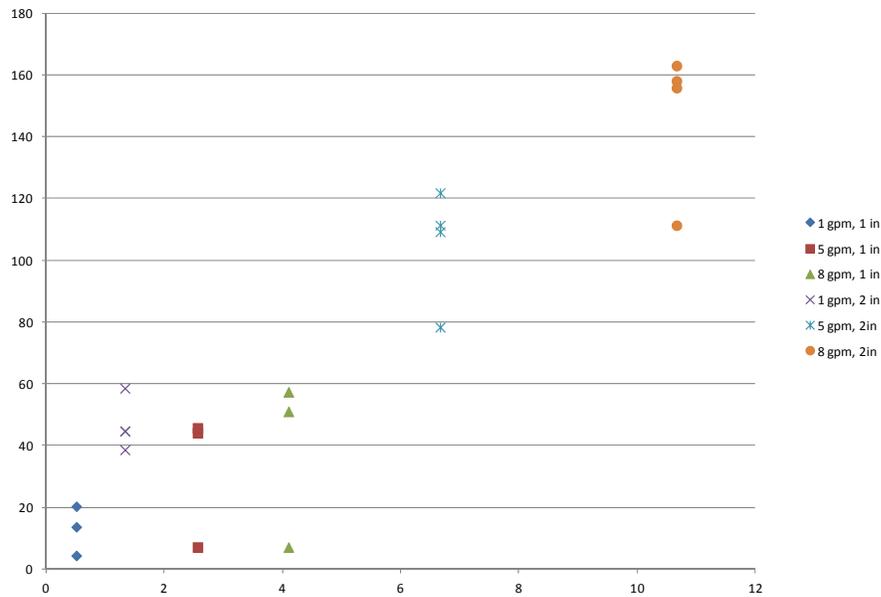
Figure 1: The default style of a Scatter Graph produced with the data in Table 1. The insertion method used is the same as described in the caption of Table 1.

4. There are no axis labels (Chart Tools from overhead menu; Layout; Axis Titles; change font size to 16pt).

The data adjusted as described above are shown in Figure 2. The graph is improved, and we can improve it further with the following steps:

1. The x-axis displays a single digit implying that our data have one significant figure; we should show two (right click on axis, Format Axis, Number, Number, 1 decimal place).
2. The symbols used are multicolored which will not photocopy well. We can improve this situation by adding a black border around the symbols that have a solid fill (right click on each data set, Format Data Series, Marker Line Color, Solid Line, Black). Also, for the data shown, there are two data sets, 1 inch and 2 inch. It would be nice if we chose the symbols so that one set is filled symbols and the other set is not filled (right click on data set; Format Data Series, Marker Options, Built-In, choose the symbols you want).

The improved graph is in Figure 3.

The final improvement to the graph is not related to Excel but rather related to an understanding of the type of data we are examining. The usual way of correlating Nusselt number and Reynolds number is through a power law. To see if the data follow a power law (and thus validate the dimensional analysis associated with Nu and Re) we need to plot them on a log-log graph (Figure 4). To make a good looking log-log graph we followed these steps:

1. Change the axes to logarithmic (right click on the axis, Format Axis, Logarithmic).
2. Move the y-axis so that it is located on the left edge (Excel formats it so that the two axes intersect at point 1,1). To make this adjustment: right click on x-axis, Format Axis, Vertical Axis
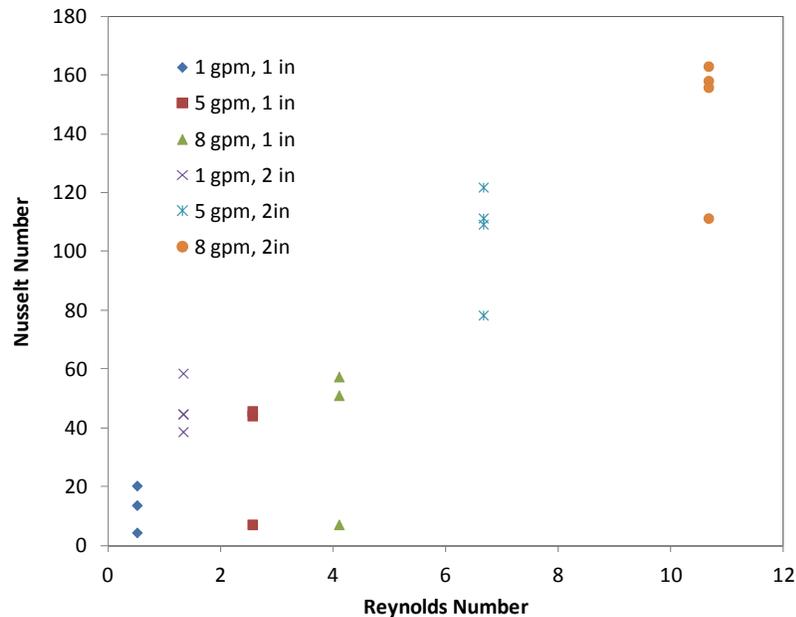
Figure 2: The data from Table 1in a Scatter Graph as adjusted by the steps indicated in the text. Changes include: gridlines removed; labels increased in size; box inserted to enclose plot area; axes labeled.

> Crosses, 1e-9 (I use this small number all the time; the number just needs to be smaller than the lower limit of the x-axis).

3. A nice touch on log-log graphs is to add minor logarithmic tic marks: Right click on axis; Format Axis, Minor Tic Mark Type: Inside.
4. On log-log graphs the number type should be General so that an extra decimal place is not added (right click on axis, Format Axis, Number, General.

The final graph in Figure 4 shows that some of the data show a power-law trend, but three points fall outside of the trend. When we examine the data in Table 1 we see that the noncompliant data are all from the plastic test device (PMMA), while the ones following the power-law trend are all metals. By creating a well designed graph, we draw important conclusions that we did not see previously.

We can save the style of graph that we just made and apply all the changes at once to any future graph we make. This is a great labor saving trick. To create a template, select the graph and then choose Chart Tools, Save as Template, choose name (for example, Nu-Re). Now when making a new graph, make the default graph, then select it and choose Change Chart Type, Template, choose the one we saved. The new graph now has all the formatting choices of the old graph (Figure 5).

One final comment on boxes around graphs. The box around the Plot Area is desirable (Figures 2-4). The plot around the Chart Area is undesirable (Figure 6, top). To remove the box around the Chart Area, right click on the Chart Area (outside the Plot Area in Excel but on the same page), Format Chart Area, Border Color, No Line. The result is shown in Figure 6, bottom.
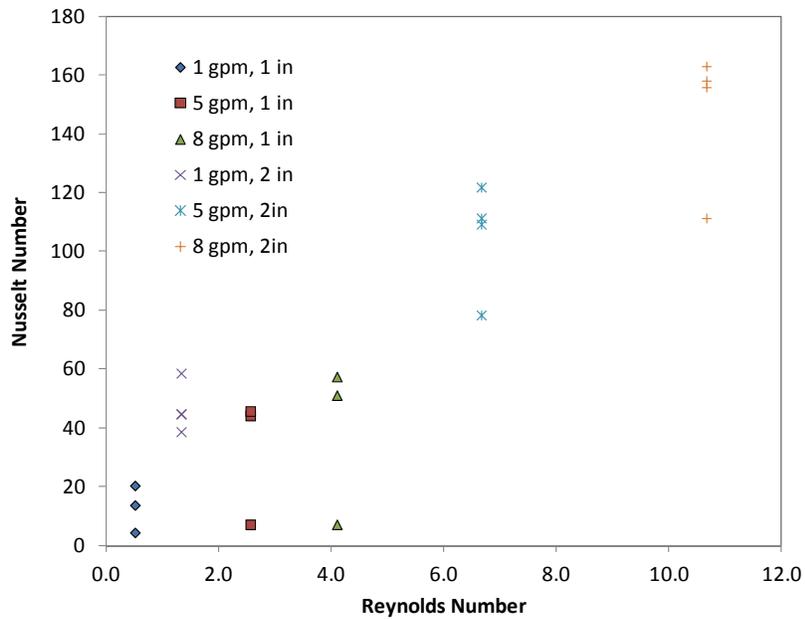
Figure 3: The data from Table 1 in a Scatter Graph as adjusted by the additional steps indicated in the text. Changes include: significant figures corrected on x-axis and black outline added to filled data points to improve how they will show up when photocopied.
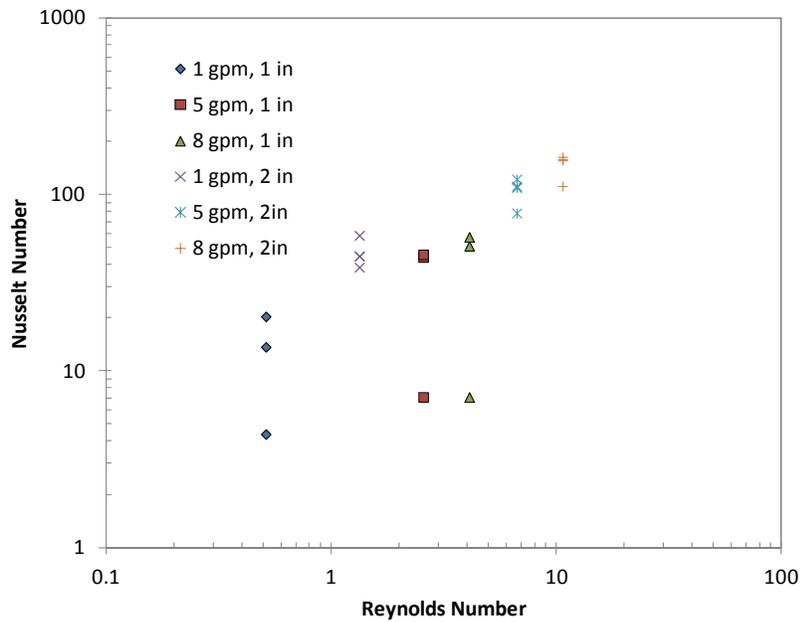
Figure 4: The data from Table 1 in a log-log Scatter Graph; this is the final form of our graph. Plotting the data this way has revealed that one data set (PMMA) does not follow the same trend as the other data sets. We may now choose to replot the data with different symbols for different materials so that it is easier to discuss this point.
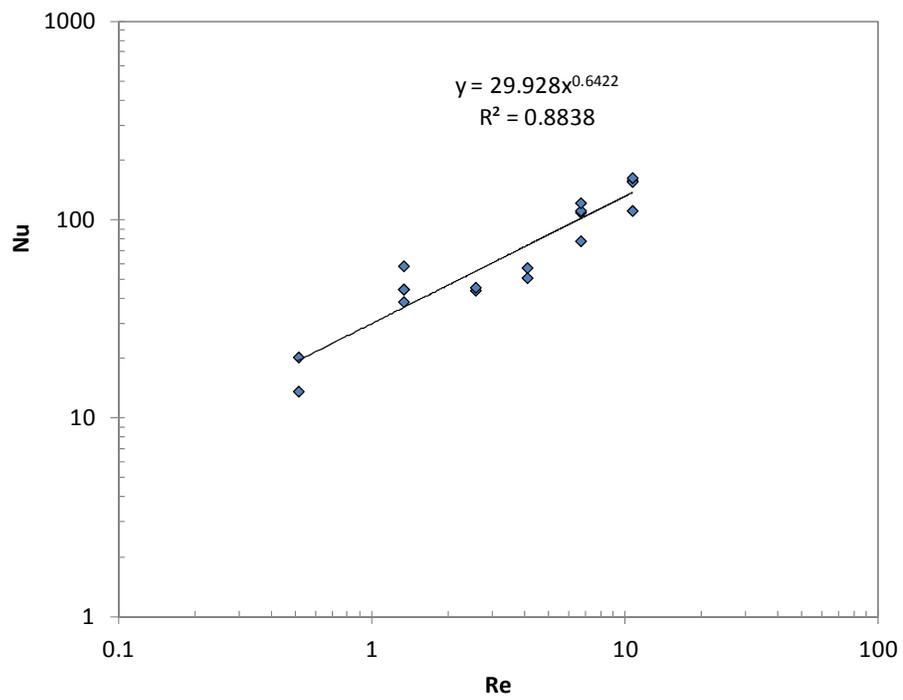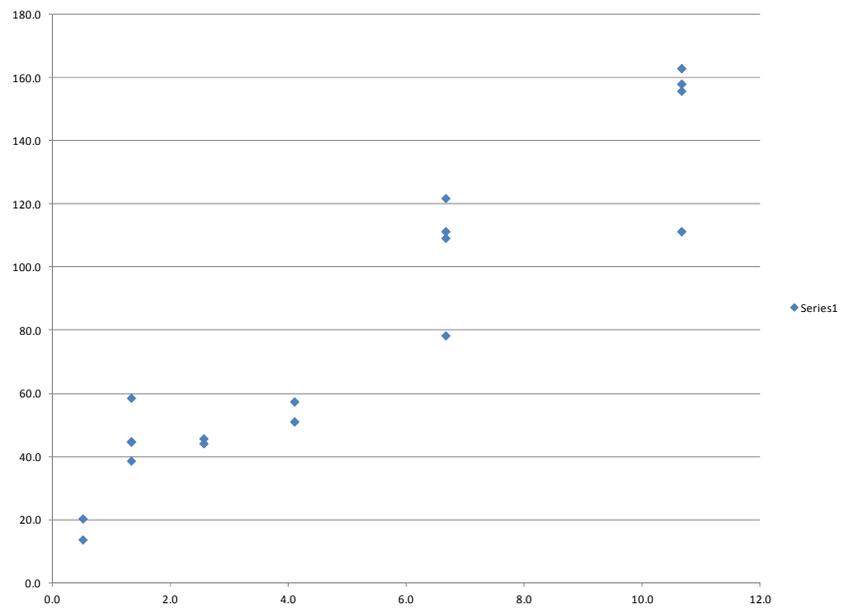
Figure 5: Using a template to format a graph makes transforming the default graph (top) to the final graph (bottom) a matter of a few clicks. The data shown are the data for metals from Table 1.
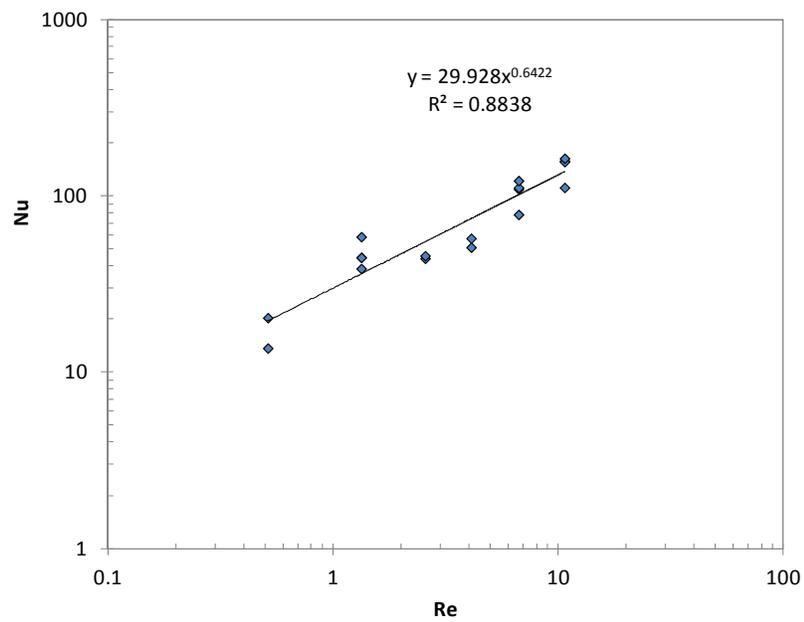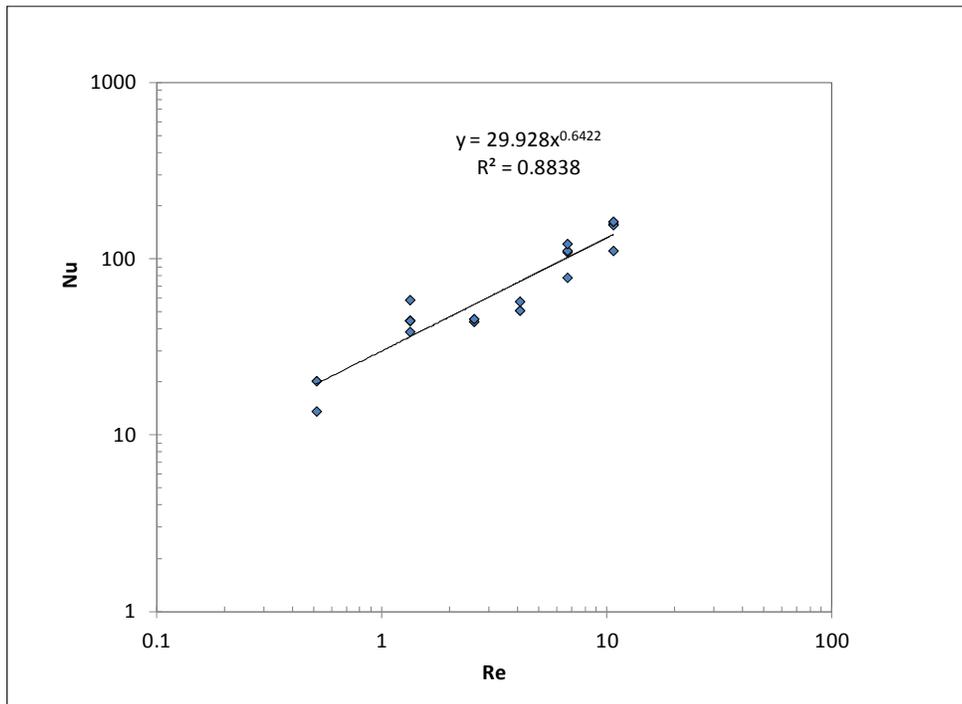
Figure 6: The box around the Chart Area (top) is undesirable. A better presentation is that shown at the bottom. The power-law trendline was added separately.