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How to Customize and Improve MATLAB Figures for Publication

By Riley Porter on Sep 13, 2007 filed under Guides, Tips

In this post I will be showing how to produce a publication quality figure using MATLAB (2007a). To fully appreciate the content presented here you will need some working knowledge of MATLAB, meaning that you should know how to create a basic plot. If you need some help in this department you can reference this Guide from MathWorks. But, if you're ready to create a publication quality figure (i.e., one that doesn't look like it was made in Excel), then keep reading.

Suppose I am raising two different species of fruit flies in my lab, and once a day for 10 days I measure the size of both populations and record the numbers in two vectors called Species1 and Species2. Now I want to visually compare the growth of the two populations over the 10 days so I use the following basic plotting commands

h1 = plot(Days, Species1);

```
hold on;
h2 = plot( Days, Species2 );
```
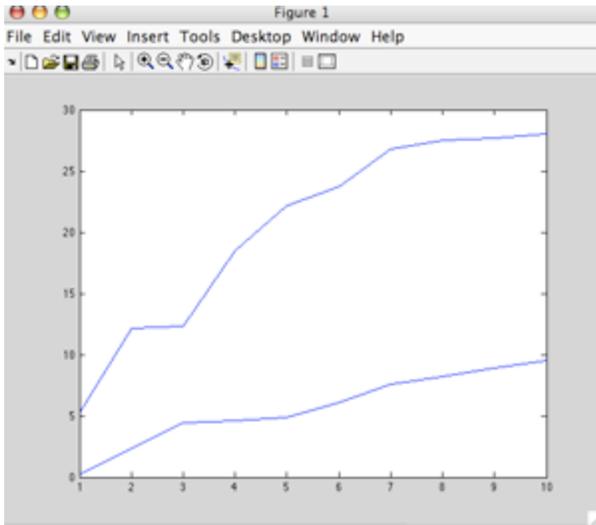

*Note that the vector 'Days' contains the numbers 1 through 10 which represents the days over which the experiment took place.

Step 1: Change the background from gray to white

The gray border that I'll call the "background" of the Figure 1 is not desirable for publication, so this gray can be changed to white with the two relatively simple lines of code shown below. I have appended each line with a comment (denoted by the percent % symbol standard in MATLAB.)

fh = figure(1); % returns the handle to the figure object

set(fh, 'color', 'white'); % sets the color to white
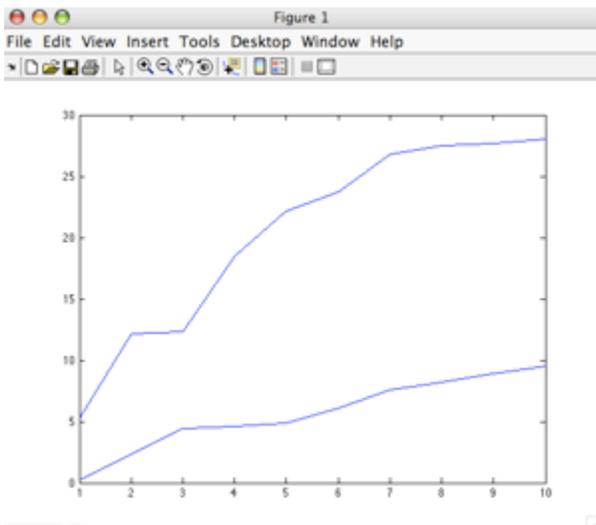
As you can see, Figure 1 is now one step closer to being ready for publication. Notice the set command in the lines of code shown above, which can be implemented in general by using the following syntax

set(H, 'PropertyName', PropertyValue, …);

Step 2: Cutomize Line Styles

There are still some serious problems with Figure 1, namely the fact that both data sets are currently represented by solid thin blue lines. We'll want make changes so that the individual data points (corresponding to each species) are shown in addition to lines connecting the points. For the first data set that corresponds to Species 1 I want to use gray circles connected by a solid black line. Species 2 will be shown as white squares connected by a dashed black line. Note that in both cases I plot the lines first, followed by the markers (circles or squares):

set(h1, 'LineStyle', '-', 'LineWidth', 1.0, 'Color', 'Black');
set(h1, 'Marker', 'o', 'MarkerFaceColor', [0.5 0.5 0.5], 'MarkerEdgeColor', [0 0 0], 'MarkerSize', 8.0);
set(h2, 'LineStyle', '--', 'LineWidth', 1.0, 'Color',' Black');
set(h2, 'Marker', 's', 'MarkerFaceColor', [1 1 1], 'MarkerEdgeColor', [0 0 0], 'MarkerSize', 8.0);
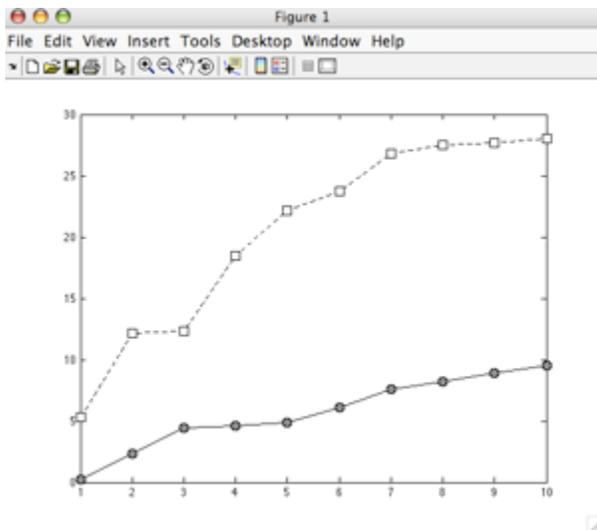
Notice that I've used the set command again to define the characteristics of the different properties I wanted to change. To get a full list of the property names it is nice to bring up the 'Property Inspector' panel associated with the MATLAB figure. In the menu bar of the Figure window click 'View-Property Editor'.
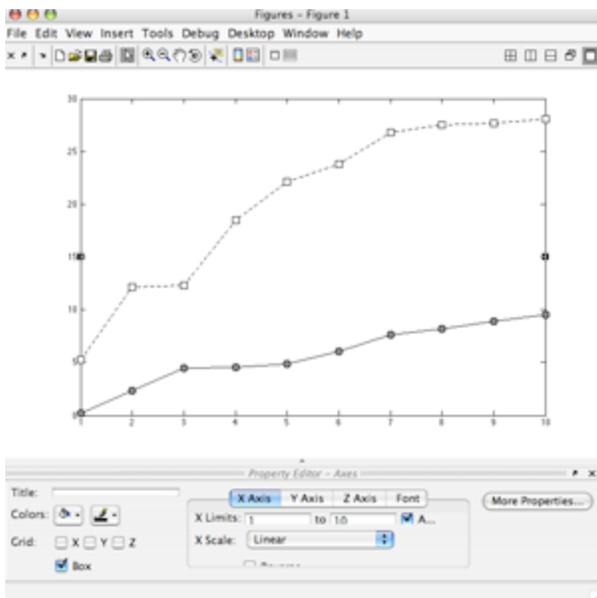
Once the property editor appears, highlight the aspect of the plot you wish to alter (e.g., the curve corresponding to Species 1 or the x- or y-axis), then click the 'More Properties' button to reveal the Inspector. This Property Inspector feature provides a long list of different property names and the values associated with whatever feature of the graph is highlighted. Notice that so far I have only altered properties associated with the data, so now I'll move on to some more changes.
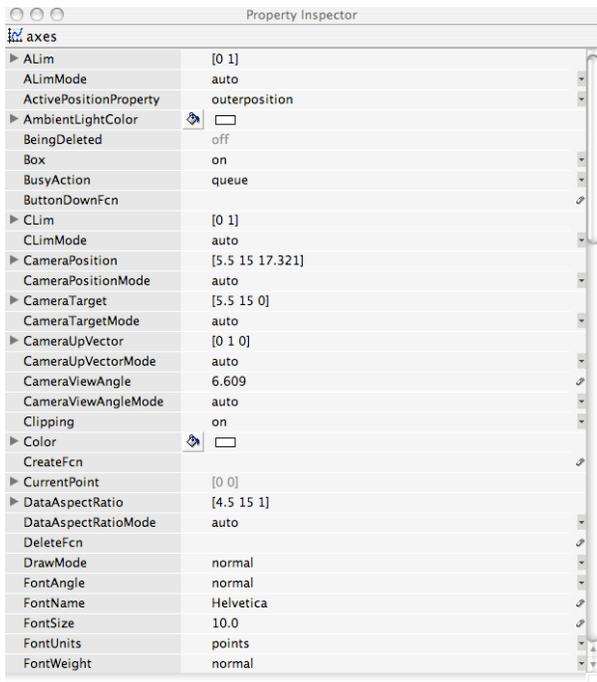
Step 3: Alter the axes

One of my pet peeves with MATLAB's figure making capabilities is the way the axes look by default. I'll want to remove the 'box' so that only the standard x- and y-axes are shown.

set(gca, 'Box', 'off'); % here gca means get current axis
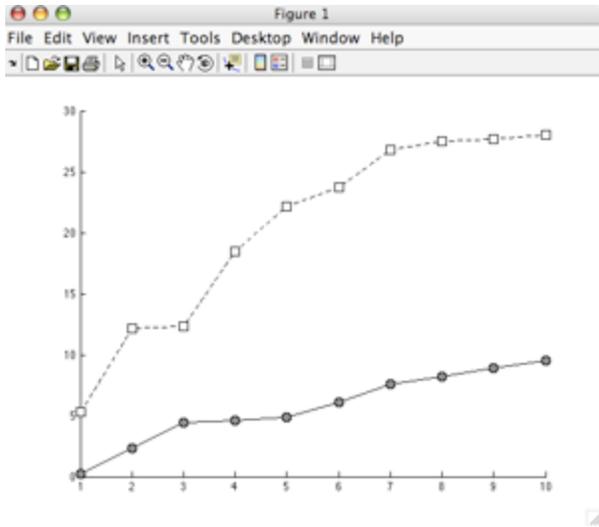
Conveniently the default axis limits are such that I don't need to change them. But, if I had needed to change the axis limits I would use the following command

axis([XMin XMax YMin YMax]);

Next I want to change the tick marks. Right now there tick marks on the y-axis are shown for every multiple of 5 and there is a tick mark at every integer value shown along the x- axis. In both cases the tick marks point in.
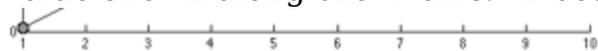
I prefer the tick marks to point outward, and I want to choose where the Tick Marks are positioned.

set(gca, 'TickDir', 'out', 'XTick', [1:10], 'YTick', [0 10 20 30]);
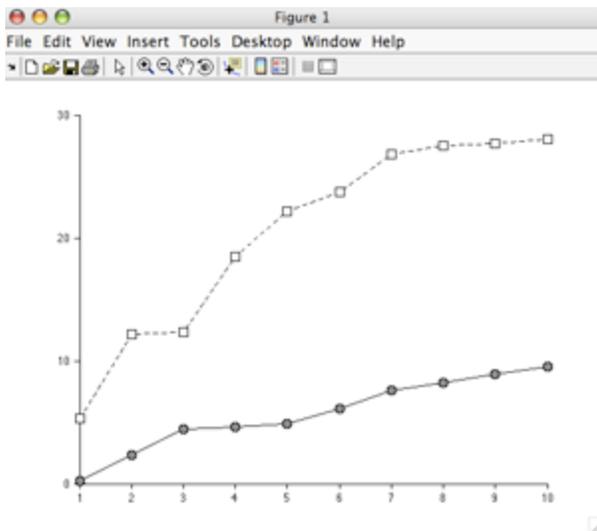
Notice the tick marks along the y-axis are now positioned at y = {0, 10, 20, 30} and the tick mark positions the x-axis haven't changed. Both sets of tick marks also point outward.

Now that the basic figure properties are looking pretty good, I want to add axis labels so that my figure can be interpreted. This is achieved with two lines of code.

xlabel('Time (Days)', 'FontSize', 16);
ylabel('Population in Millions', 'FontSize', 16, 'Rotation', 90);

and my resulting figure looks like
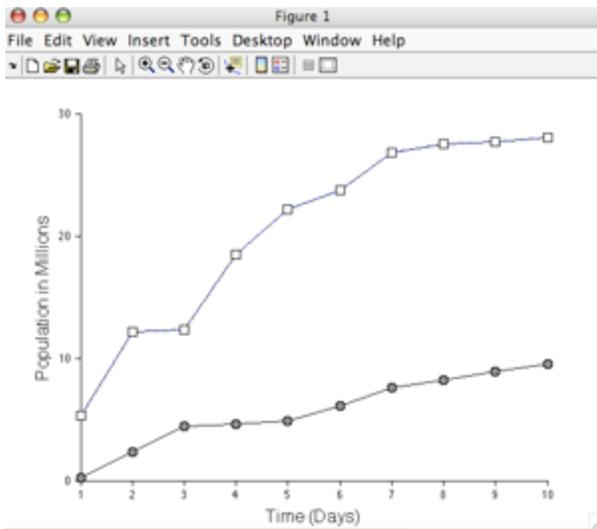
Notice that I am able to control the size of the font, and I also can change the rotation of the y-axis label. If I had not included the 90 degree rotation factor, then the y-axis label would have overrun the plot. Zooming in on the x-axis

shows the full effect
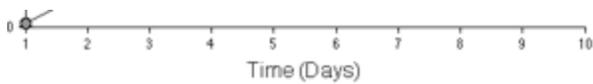
Step 4: Save the figure as an eps file

Once you are happy with the figure you have produced in MATLAB you'll need to save it as an eps file (especially if you are writing your paper in LaTeX). Note that if you are using MS Word, it is best to save your figure as a jpg file.

saveas(fh, 'FruitflyPopulation', 'epsc');

Recall that 'fh' is the figure handle of Figure 1, and note that the 'epsc' command saves a color eps file. Yes, I know that my figure doesn't use colors, but for some reason using the 'epsc' command produces the nicest looking figures. Now I don't have to look at that MATLAB Figure window, and I am left with a nice looking (publication quality!) figure made in MATLAB.
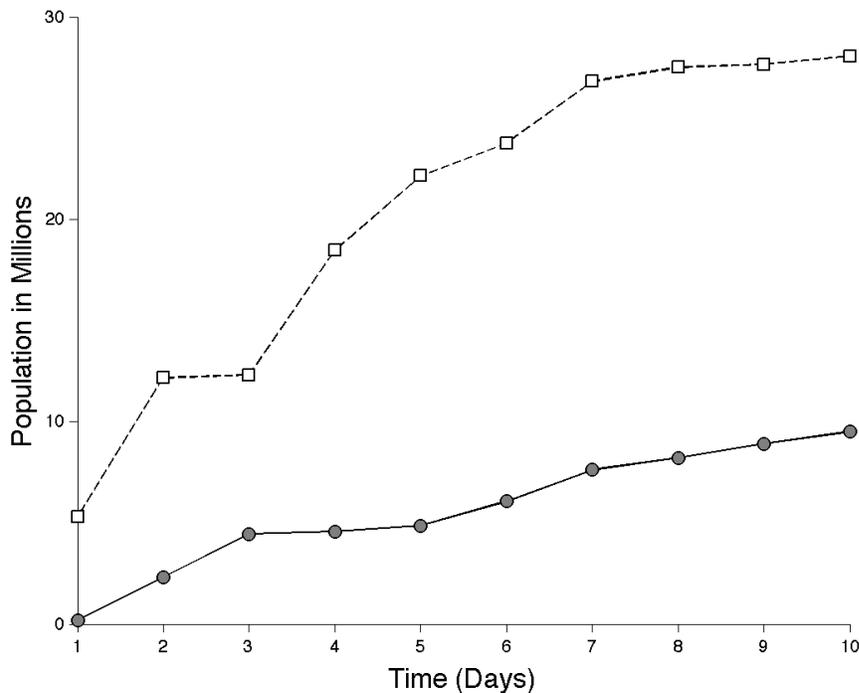
Now, using all (or any combination) of the commands described above you can create your own publication quality figure. Simply place the commands in a one M-file and with a single click of the mouse you'll have a great looking figure for your next paper.

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