Adobe Illustrator Tutorial

Setting Up
I don't like some of the Illustrator defaults, and I also like to open a few tools that are useful in scientific illustration. Having these tools set up this way can help make it easier to ensure proper figure style (size, line thickness, fonts, etc).

1. I like to make the "tools" bar double-width, so it looks more or less like below. If it is single-file, I fix it by clicking and dragging around the window bar until it gets rearranged from single-file to double.

2. Open up several tool windows (under the Window menu), including: color, stroke, paragraph, swatches, transform. Then you should have a collection of tool windows that looks like this:
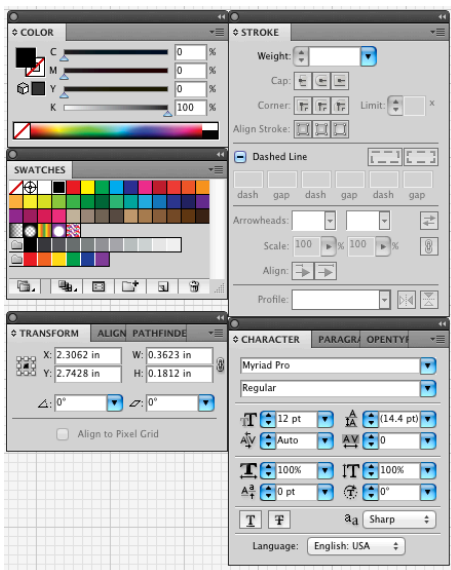
3. Do View->Rulers->Show Rulers. Go to Preferences->Units, and set General to Inches (cm OK), then Stroke and Type to "points" units. Then View->Show Grid. Also make sure that View->Snap to Point is set, but not Snap to Grid (occasionally useful, but not one of my default

settings, since it won't let you nudge by a mm or so). Now you should have a nice grid, with 4 grid lines per inch, to help guide you with figure size issues.

Now you're ready to start!

Some basic style guidelines
* Figures should typically be 3-3.5 inches wide (~8 cm). This is why I like to show the grid, so I can keep track of figure size. I typically make a 3 inch by 2 inch white rectangle first and use this as my background for the figure, to help me in scaling and organizing the various pieces of the figure.
* Line widths should be as consistent as possible, and should be between 0.7 pt and 1.5 pt. I usually use 0.9-1.0 pt.
* Be careful about asymmetric scaling--you should hold down the shift key when manually scaling, to make it symmetric, or use the scaling dialog.
* Fonts should be as consistent as possible within a given figure and between figures in a document, and be sized between 7 pt and 11 pt. Try to always use **Helvetica** (also **Symbol** sometimes when you need Greek characters). Check your fonts by selecting individual text elements one-at-a-time using the open-arrow select tool and looking at the Character tool-window.
* Make sure your fonts are not stretched. Check the Character window, select "show options", and make sure the scaling section looks like:

* Make sure your text (axis labels, etc) has fill but no stroke (see section on stroke and fill), or it will get an ugly, bolded look.
* Don't have too many tick labels on a given axis. Typically 2-6 labels. Since Matlab often uses more like 6-10 labels per axis, this could require some additional work on your part.
* If there are data markers (data as squares, triangles, etc) make sure they are big enough to be legible, but not so big that they overlap. I suggest using filled data markers, and adjust their size to 1.5-3pt.
* Choose your axis limits carefully. You do not want to include meaningless/empty parts of the spectrum, or kinetics trace.
* Consider what you are trying to show or prove. For example, if you are trying to compare two spectra or kinetics traces, consider combining them in a single stack plot.
* Don't make stack plots too busy. 20 spectra in a stack plot is usually too many--consider omitting some of the spectra.
* You should occasionally do a "select all" and visually check to see if you have left around any orphaned anchor points.
* Always save as PDF. EPS is OK, too. These are Illustrator native/editable formats, conform to graphics file format standards used by journals, have perfect resolution (no pixelation), and can also be displayed by other programs.

A few pointers on stroke and fill
* Make sure your text has fill, but no stroke, otherwise it looks wrong. The stroke/fill part of the toolbar should look like:

* Make sure your lines (data lines in plots, plot borders, tick marks) have a stroke but no fill. The stroke/fill part of the toolbar should look like

 * Polygons, shapes, and Bezier curves sometimes have stroke, or fill, or both, depending on what you are trying to draw.

* If a rectangle or other shape has no stroke and no fill, it is probably part of a **mask**.

* To swap the fill and stroke, click the little double-arrow in the upper right corner shown in the graphic above.

Typical workflow for importing a graphic from Matlab

1. Make your figure in Matlab. Be sure to use the **axis** command to set the axis limits the way you want them, and omit unnecessary or empty regions of the plot. Then **print -depsc filename.eps**, or choose to Save As Illustrator Format in the toolbar. Note: in several Matlab versions, saving as eps from the file menu does not work. It is better to use the command line print command.

2. Open the figure in Illustrator.

3. Next we try to carefully "take apart" the figure, which involves some ungrouping and removing masks and unnecessary elements. First Edit->Select All. Then Object->Ungroup. Then click somewhere outside the figure so that it is not selected. Then click in the figure and ungroup again, if needed.

4. Switch to the **Direct Selection** tool. This is the "open arrow" or white arrow, in the toolbox. Direct selection allows you to select individual anchor points and/or whole paths, and ignores grouping. First, we will remove the white background from the figure. Click on a blank area within the figure rectangle. This should select a rectangle, with a white fill and no stroke. Hit delete or backspace to delete it. There are often two white rectangles, one on top of the other, so repeat this step to remove the next white rectangle.

5. Now that the rectangles are out of the way, you can remove the unwanted ticks from the top and right-hand-side. You can try to click on the individual tick marks, but I find it saves time to drag a selection rectangle that encompasses several ticks, then hit delete twice. The first time deletes the actual anchor points you have directly selected, and the second time deletes other anchor points in the same path, which in this case are the other ends of the tick marks.

6. Now let's remove some masks. This is optional, but can help if you later want to change sizes of your data markers--this won't work if the masks are there. Do Select All, to show you where the "invisible" rectangles are, or switch to View->Outline, which also shows invisible paths. There should be some rectangles that are larger than your figure axes, and that have no stroke/fill. These are masks--they basically help make sure no data points are displayed outside the axis box. Delete them. Switch back to View->Preview.

7. There are also some masks that are the same size as the axis box. Fortunately, they are usually "on top", so you can select them by clicking on one of the corners of the axis box. If it has no stroke/fill, it is a mask, and you can delete it by hitting delete/BS twice. Then click on the corner again, to get the next mask. Continue until all masks are deleted. If you accidentally delete the axis box, just Undo (Ctrl-Z).

8. Scale your figure. First make a 3 inch wide, 2 inch tall white rectangle, by clicking the rectangle tool, then clicking in the figure space (if you drag, then you create a rectangle by hand, if you click, it brings up a dialog). Specify the width and height in the dialog. Then change the stroke to none, fill to white. Send to background by Object->Arrange->Send to Back. Then Object->Lock-Selection to lock it down to make it easier to continue working on your fig.

9. Now Select->All, and then double-click on the Scale tool. This will bring up a dialog. Enter the scaling. Inspect the width and height of the figure object using the **Transform** toolbox (see above) to help you decide on the scaling factor. For 2 data subfigures across, in a 3x2 inch figure,

you often need to scale by 20% (a factor of 5 smaller than the original). Then place your scaled artwork into the white figure box you made previously.

10. To change a line thickness, do "path selection" as follows. Hold down Alt, then click the line with the open arrow. This will select all anchor points and line segments that are part of the same path (sometimes, if a spectrum has many points, it will be made of multiple paths). Then change the thickness and/or color of the line. Also hold down Shift if you want to select multiple lines consecutively.

11. Then adjust font sizes by first selecting a text object and then changing the size. I suggest using ctrl-open-arrow to select multiple text objects.

12. You might need to move your axis labels around to center them underneath their tick marks. To move them, I usually select several of them and then use the arrow keys to move them all around together. I usually have the arrow keys set to move 1 pt (the default), but you can set to a different or smaller value, by setting the "keyboard increment" under general preferences.

13. To change from empty circle data markers to filled circle, first select one of the circles using alt-open-arrow (path selection). Then Select->Same Stroke/Fill Color. Then set the stroke to None, and set the fill to whatever color you want. Changing the size of multiple markers can be tricky, but sometimes the Object->Transform->Transform Each command works. You need to make sure the objects are ungrouped and not masked, and sometimes first you need to select the whole figure and Object->Transform->Reset Bounding Box, first.

14. You might want to replace the ticks with 1 pt or 2-pt long lines, since the original ticks are often too small to see after scaling the figure and then increasing the line thickness.

15. If you are assembling 2-4 Matlab plots into a figure, you can save yourself some work and ensure uniform scaling by placing them close together first, then doing the scaling and font changes, etc. on all figures together.

16. Often the corners of the figure do not look neat, because the lines making the figure box are not properly joined, like this:

to fix this, delete the two sides by clicking on the lines and hitting delete twice. Make sure there are only two lines left, and no stray anchor points, possibly by selecting the two lines and moving them a bit using the arrow keys (you can move them back later, or press Ctrl-Z). Then select two of the end anchor points, and use Ctrl-J to join them. Then join it to the other side. Then edit the stroke panel to give square corners and "limit: 2x", like this:
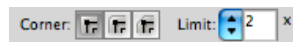
Now your square should have neat corners:

Selection tips
* You can select an object by clicking on an anchor point or on a line, or within the object, if it is a filled object.
* Object Selection (black-filled arrow) selects a whole object or group of objects.
* Direct Selection (open-white arrow) selects individual anchor points or lines/curves, depending on where you clicked.
* Path Selection (alt-white-arrow) selects all anchor points that are connected to make a path.

* Group and Ungroup are useful for grouping items that you want to change together (e.g., changing line thickness, moving, changing color).
* You can select additional anchor points, lines/curves, or objects by holding down shift and clicking on them.

Some general drawing tips
* You can make a straight horizontal or vertical line using the pen tool by clicking, then moving the pointer some distance, then holding shift and clicking again.
* You can make bezier curves by clicking and dragging with the pen tool. You can tweak the shape of the curve by clicking on an anchor point, and then dragging one of the bezier handles.
* Snap-to-point can be very useful for assembling complex shapes out of simpler shapes.
* Making many copies of an object: Alt+drag an object to duplicate it. Then Ctrl-D to do it again and again, making many copies, with equal spacing between each.
* You can rotate a specific amount using the rotate dialog. You can also constrain rotation to increments of 45 degrees, by holding down the shift key while dragging to rotate.
* Sometimes turning on snap-to-grid temporarily can help with getting figure placement exactly right.

Making special shapes
* To use the rotate tool, you first select the object, then switch to the rotate tool, click once on the point about which you wish to rotate, then move the pointer some distance away, and click+drag to rotate.
* You can make squiggly lines, for photons, etc, by first turning on Snap to Grid, and using the pen tool, clicking and dragging to make it look like this:
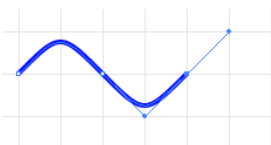
then add an arrowhead (this moved to the stroke palette in recent versions):
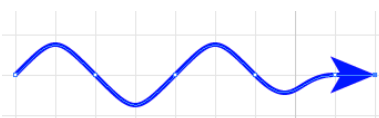
* You can quickly make a micelle-like structure by using Alt+rotate to rotate-and-copy your detergent molecule, then Ctrl-D to make more copies.
* I often build molecules by copying and moving around bits of existing molecules, or I start with a hexagon (grouped under the ellipse/rectangle tool).
* You can make symmetric shapes by first making one side, then
* Use the Snap to Point feature to help align parts of your figures. For example, if you want to have one figure 10 pt to the right of another, first select the figure you want to place, by dragging a selection rectangle around it. Then click and drag on the anchor point at one corner of the figure and snap-to the corner of the other figure. Then press the right-arrow 10 times to move it, or use Object->Transform->Move dialog.
* You can rotate an object by 45 degrees by holding down shift while rotating.

Machine-shop drawing tips
* You can make circles and rectangles with exact dimensions, by selecting the ellipse or rectangle tool, then clicking once in the workspace. This brings up a dialog, and you can enter the exact size. You can make a line of exact size by first making a square of the desired size, then selecting

on one of the sides of the square (open-arrow), and then copy/paste (Ctrl-C-Ctrl-V). Or, select two of the anchor points of the square and delete them, leaving a line.

* The transform tool window tells you the height, width, and position of any object you select. This is useful for making an exact scale drawing.