**Making figures: from MatLab to Adobe Illustrator**

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Date: 07 Mar 2022

Getting nice figures out of MatLab is annoying and unintuitive. This training covers the basic process that I use regularly.

Download examples: <https://github.com/SamuelAcunaPhD/tutorial_makingFigures>

**The Basic Steps:**

1. Get MatLab to do as much formatting as possible
2. Export figure to a vector file
3. Touch up figure in Adobe Illustrator

**Step 1: Get MatLab to do as much formatting as possible**

* Some frustrating issues with MatLab Figures
  + Figure saved differently than it looked like on the scree
  + Inconsistent figure sizes
  + Font and axis scaling changes
* You will probably need to regenerate you figure, and you don’t want to re-work manual edits by hand.
* Use code to automate figure formatting. Not manually through Plot Tools or the Property Inspector.
* But how do I know what properties can be changed?
  + Use >> plottools or >> inspect to explore how properties can be changed, and learn the property names.
  + Can use file > generate code to create some bloated code that automates these changes.
* Use **handles** to modify plot elements
* **Key things to automate:**
  + Figure background color
  + Line widths and styles
  + Sizing: plots, axes, fonts
  + Axis limits & ticks
  + Leave room for a legend
  + Legends and Marker Styles
  + Marker Size
  + Layout of how data is presented
* **Don’t worry too much about automating:**
  + Fonts (Arial vs Times)
  + Legend Locations
  + Colors
  + Exact spacing between subplots, labels, titles
  + Font Styles (bold, italics, underline)
* Pro tip: match the publication requirements for figures.
  + Elsevier: font size should be 7 pt
* Pro tip: set default figure preferences, either:
  + At the start of the script
  + In a startup.m file

**Step 2: Export figure to a vector file**

* Note: Vector files use equations, raster files use dot matrices. Thus vector files will look crisp at and size, and raster files may look pixelated.
* Do NOT save using the menu
  + MatLab often exports a file with the “boxes” error, which randomly divides up your figure elements into weird unusable chunks. Usually when you have subplots.
  + Unable to accurately specific size and dimensions of figure
  + Imaged saved is proportional to size of figure window, and can be messed up if you resize the window
* **Key things to automate:**
  + PaperUnits (centimeters, inches, …)
  + PaperPosition (use to set size of image)
  + Use print to save as ’-depsc’, a colorized .eps file
  + better than .pdf
* Pro Tip: Match the figure size to the publication requirements
  + 1 column = 90 mm
  + 1.5 columns = 140 mm
  + 2 columns = 190 mm

*Note: everything we do* ***after*** *this point is* ***not automated****. If you need to regenerate your figure, you will need to manually repeat almost everything you do from this point on.*

**Step 3: Touch up figure in Adobe Illustrator**

Use a vector graphics editor. Most apps all have the same basic functionality, but the layout of the tools will differ. Example apps: Adobe Illustrator, Inkscape, Affinity Designer

My process for touching up figures:

1. Create new document. Set artboard size (width is most important)
   1. by creating a new document, I have better control over the size and layers. So, I prefer this over opening my MatLab generated .eps file directly in Illustrator.
2. Set up workspace. Show rulers. Important elements
   1. Layers
   2. Selection Tool (v) vs Direct Selection Tool (a)
   3. Type tool (t)
   4. Pen tool (p)
   5. Eyedropper tool (i)
   6. Fill Color vs Line Color
   7. Stroke
   8. Artboard tool
3. Place your figure (*File > Place*)
   1. It will appear as a group (*see Layers panel*). With various subgroupings, with no obvious reason why they were grouped that way.
   2. Structures you probably don’t want:
      1. Right click to Ungroup weird **Groups**
      2. Right click to Release **Clipping Masks**
      3. Right click to Release **Compound Paths**
   3. *Optional*: Regroup logical groupings.
   4. Delete unnecessary background elements:
      1. White background rectangles
      2. Extra legend entries
      3. Unused plot elements
4. Resize plots (if needed) to fill width of artboard.
   1. Leave plenty of white space. It helps tremendously.
   2. Adjust spacing between subplots
   3. Adjust spacing between titles, labels, and plots.
   4. Align and distribute tools come in handy here
   5. Finalize fonts: type, size, and styles
   6. Finalize title and label names
   7. Use **artboard tool** to set bottom height of figure
   8. *Pro tip*: create multiple layers, so you can try out different drafts of your layouts
5. Probably should reduce size of legend
   1. Put legend in a new layer.
   2. Remove unnecessary features (error bars)
   3. Shorten width of symbols.
   4. Slightly reduce font size, if desired (size: 6)
   5. Finalize location of legend
6. Finalize colors and line styles
   1. Eyedropper tool works really well to transfer formatting across plot elements
   2. Make sure it matches your legend!
7. Add significance stars as new layer
   1. Can also add *p-*values
   2. Use font ‘symbol’ for asterisks [\* vs \*]
   3. Simpler is better here
   4. Pro tip: create multiple layers, so you can try out different drafts of your stars
8. Clean up little details
   1. Check axis lines are in front of plot lines
   2. Make sure axes scale numbers are aligned
   3. I recommend printing a hard copy, so you can examine figure at scale
9. *Save As…* a .eps file for publication
   1. Check “Use Artboards”, to keep it cropped to your artboard boundaries
   2. I haven’t had great success saving as .PDF, because it tries to fit image on 8.5x11

This takes practice and patience, but have fun!

What about figures that aren’t plots? For example, a representative schematic of the experimental setup.

* Place a photograph on the bottom layer, then adjust transparency of layer to about 50% or so. Lock layer to prevent editing.
* On new layer, manually trace the outline of the photograph using the **pen tool**. This is tricky to learn at first, but really quick once you know the functions of the pen tool.
* May need a separate layer for fills, and a layer for outlines.