

Inkscape Mini Tutorial

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Inkscape is a free, open source “professional quality vector graphics software which runs on Linux, Mac OS X, and Windows desktop computers”. It can be used for a wide variety of applications, including drawing cartoons, logos, and graphics - basically, anything you would like to draw that needs to maintain resolution when scaled. From a scientific perspective, Inkscape is very handy for altering graphs, diagrams, and scientific drawings. Inkscape excels in instances where you cannot figure out the R code to change figure aesthetics, such as colour, shape, size, orientation, and font or, if you would like to arrange figures and add objects in a way that is not easily achieved in R. In very broad terms, Inkscape can be used to create and manipulate objects, change the outline and fill colour of those objects, and add text. It can also do operations on paths (node editing, boolean operations, and bitmap tracing + more) and rendering, but that is not covered in this tutorial.

Before we go any further, it is important to understand a very general overview of the two types of files that can be manipulated in Inkscape: vector and raster.

- Vector files are made up of points and lines that can be scaled without losing resolution.
- Raster files are made up of many pixels that are great for showing colour gradients (like in photographs), but can become fuzzy or pixelated if scaled up.

Inkscape is a **vector** graphics software and primarily uses SVG (scalable vector graphics) format files. However, it can also use PDF, EPS, AI, and EMF vector file formats. Although it can import PNG, JPEG, and GIF raster files, it can only export PNG. This is not usually an issue because most applications that use JPEG files support PNG as well, but it is worth noting. This tutorial will use SVG, PDF, EMF, and PNG file formats so you can see how they differ.

This tutorial will walk you through a basic introduction to Inkscape to familiarize you with the most common tools you will need to alter graphs that have been exported from R. If you are stuck and what you need isn't covered below, please check out the ***Additional Resources*** at the end of the tutorial.

Disclaimer: We have used RStudio on a desktop computer using a Windows operating system while creating this tutorial, so features may be different on Mac OS X and Linux. Creating plots and exporting them from R in your preferred format is considered to be prerequisite knowledge; therefore, we only briefly cover how to do this.

1.0. Basic Navigation & Object Manipulation

1.1. Downloading, Installing, & Setting Up Inkscape

Navigate to <https://inkscape.org/> to download the most recent version of Inkscape. The version used for this tutorial can be found here: <https://inkscape.org/release/inkscape-1.1.2/>

Inkscape does not have an “update” feature, so check back frequently to see if there is a newer version available. When installing the program, accept all default settings. The computers in GSB 866 should already have Inkscape installed.

1.2. Exporting plots from R; Opening Plots in Inkscape

Choosing which file format to import is a bit confusing. There are many options, but most people recommend dealing with SVG or PDF files. However, metafiles (EMF) seem the most intuitive for editing graphs as Inkscape recognizes the text as text, making it easy to change font/size/etc. In the other formats, the text is just a series of squiggly lines that don't mean anything, so the text needs to be re-typed in Inkscape if you want to change the words. Also, all objects are ungrouped automatically, making it easy to work with/move objects around. One drawback we noticed with this file format is that alignments may suffer slightly (e.g., text no longer centered in boxes). If you only have to change a couple of things, and still want your figure to look exactly as it did upon exporting, use PDF and only ungroup the objects you'd like to change. Otherwise EMF alleviates some big headaches.

- Export from R as a PDF: Export > Save as PDF (choose desired size to save PDF)
- Export from R as a SVG OR metafile/EMF: Export > Save as Image (click and drag right corner or change width and height measurements to make plot desired size before saving)
- Copy from R as a metafile: Export > copy to clipboard (click and drag right corner or change width and height measurements to make plot desired size before copying as metafile). Paste the figure directly into Inkscape.
 - Troubleshooting tip: if you cannot resize the 'copy to clipboard' window to the dimensions you would like, try exiting that window and `Ctrl + -` (or View > Zoom Out) to zoom out of the main R window a bit and try again. This should give you more room to resize your plot.
- Other files: If you already have a file that is saved in a folder (either from R or some other program), open Inkscape > File > Open > select your file. If there are any warnings or options to edit the file prior to importing, select the default setting.
- You should now have your figure in Inkscape

1.3. Essential Navigation

Inkscape can look a little intimidating with all the different menus. This section will get you moving through the most basic and useful tools.

1.3.1. Zooming In/Out:

- `Ctrl +` scroll mouse up (to zoom in) or down (to zoom out)

1.3.2. Scrolling Up/Down/Sideways:

- Scroll up/down to move page up/down
- `Shift +` scroll mouse up (to move left) or down (to move right)

1.3.3. Undo/Redo:


- Undo: `Ctrl + z`
- Redo: `Ctrl + y`

1.3.4. Guides: Inkscape has a very useful guide function that can be used to line up objects in straight lines. There are horizontal, vertical, and diagonal guides. You can have multiple on the page at any one time.

- Hover your mouse over the ruler at the top of the page
- Click and drag down. A blue line will appear. This can be moved anywhere up and down the page. You can click and drag from the ruler again to get another line.
- To remove the line, hover over it until it turns red and a little hand appears. Click and drag it back up to the top of the page.
- The same guide is available on the left ruler.


- Move your mouse to the top left corner where the two rulers intersect.
- Click and drag down to add a diagonal ruler.

1.3.5. Drawing Objects:

- Select the square or circle icon from the left menu
- Click and drag to create an object
- To stop drawing, select the pointer 
- Try out the different objects in the left menu. You can draw points, lines, and polygons. Double click to finish drawing lines.
- Pile a bunch of objects on top of each other to make a big mess. Use this to practice the next skill.



1.3.6. Selecting Objects:

- Select the pointer  from the left toolbar, click and hold down the left mouse button, and drag over objects you wish to select
- You can select multiple individual objects by holding down `shift` and clicking the left mouse button
- `Shift` + click and drag will select multiple objects without accidentally moving them
- `Alt` + click selects objects underneath the top object. If there are multiple objects stacked on top of each other, keep clicking and it will move down the “pile” of objects. If that still doesn’t work, zoom in really close (`Ctrl` + scroll up) to select it.

1.3.7. Duplicating Objects:

- Select object, `Ctrl` + `C` to copy to clipboard and `Ctrl` + `V` to insert
- Or select object, `Ctrl` + `D` to duplicate

1.3.8. Grouping Objects:

- Select what you want to group, Object (top drop down menu) > Group / Ungroup
- Or, select what you want to group > right-click > Group / Ungroup
- Depending on the type of file you have loaded into Inkscape, it may be grouped in multiple layers. To change anything associated with the figure, you will need to ungroup the figure (use the same procedure as above, but select *ungroup* instead)
- EMF file formats import without being grouped, but PDF and other vector file formats often have multiple layers of groupings that will need to be ungrouped before you can make any edits

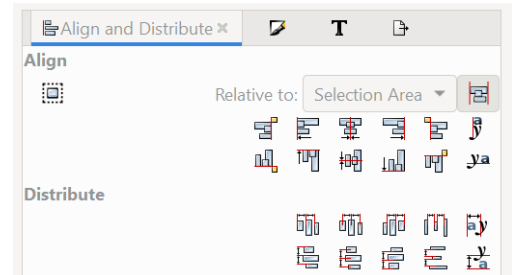
1.3.9. Resizing Objects:

- To maintain aspect ratio:
 - Select object you wish to resize
 - `Ctrl` + click and drag any arrow in/out to increase/decrease
- To resize (aspect ratio does not matter):
 - Select object you wish to resize
 - Click and drag any arrow in/out to increase/decrease

1.3.10. Moving Objects:





- Shifting position:
 - Select the objects you wish to move
 - Drag them to their new location OR use the `arrow` keys to move them up/down/left/right
- Aligning Objects: There are a few ways to align objects in Inkscape. Open the *Align and Distribute* menu: Object (top dropdown menu) > Align and Distribute. In the top

right, there is a dropdown menu called *Relative to*: This will align and distribute the objects relative to the selection made. For example, if *Biggest Object* is selected, all the objects you selected will order themselves around the biggest object.



- Select the object(s) you want to align
 - Select the *Relative to*: selection
 - Click on the pictogram showing how you want the objects to display
 - Play around with the different pictograms to see how they move the objects
- Rotating Objects:
 - Select the object(s) you want to rotate
 - To do generic rotations: Object (top dropdown menu) > Rotate/Flip Horizontally/Vertically
 - To rotate by a specific degree: Object (top dropdown menu) > Transform > Rotate (third tab in the transform menu) > specify the angle > click *Apply*


1.3.11. Snapping Objects: There is another awesome feature in inkscape that allows you to “snap” an object to a defined location. This is very helpful when you want to align multiple objects to a set location.

- On the top right corner, click on the snapping button 
- Now if you move an object up to another object, grid, or guide, it will “snap” in place
- To snap to the page border, select 
- To snap to the gridlines, select the icon to the right. You can view gridlines by going to View (top dropdown menu) > check the *Page Grid* checkbox 
- To snap to the guidelines, select 
- Play around with the different snapping options

1.4. Changing Colours

Colours are very easy to change in Inkscape. Depending on the type of object, you can colour the border and the fill differently. There is a colour menu where you can select a specific RGB or HEX value, but you can also use the band of colours at the bottom of the page. If you don't want the object to have a colour, select the square with the red X on the far left.

1.4.1. Fill (the middle part of the object)

- Select the object(s) you want to fill 
- `Ctrl` + select the colour you want from the band at the bottom of the page
- Notice that the little box in the far bottom-left corner shows the fill colour for the object

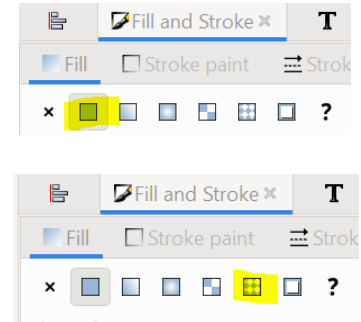


1.4.2. Stroke (the object border)

- With the same object selected, use `shift` + the colour you want to change the object border
- Notice that the little box in the far bottom-left corner now shows the updated stroke colour for the object

1.4.3. Patterns and Specific Colour selection

- Select objects you would like to fill with a pattern or give a specific colour
- Specific colour: select Objects (top menu) > Fill and Stroke > Fill > Flat colour (icon highlighted on the right) > choose or type in desired colour code
- Patterns: select Objects (top menu) > Fill and Stroke > Fill > Patterns (icon highlighted on the right) > choose desired pattern from drop down menu
- Practice selecting different fill and stroke colours for your objects using the colours at the bottom of the screen and the keyboard shortcuts. Play around with the patterns and choose specific colours.



1.5. Selecting Objects: Advanced

Sometimes you have A LOT of tiny little points that need to be changed to another colour (or re-sized based on the colour). Selecting every single one by hand will make you cry and never want to use Inkscape again. Thankfully there is a really nice way to save your sanity.

1.5.1. Select by:

- Edit (top dropdown menu) > Select same > Select desired objects
 - Fill and stroke: Selects all objects that have the same fill AND stroke colour
 - Fill colour: Selects all objects that have the same fill colour
 - Stroke colour: Selects all objects that have the same stroke colour
 - Stroke style: Selects all objects with the same stroke properties (e.g., line width, line type)enter
 - Object type: Selects all objects that are the same (e.g., circle, rectangle, star, spiral)


1.5.2. Replace by colour:

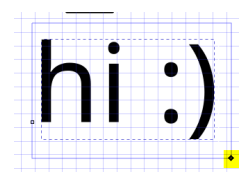
- Extensions (top dropdown menu) > Colour > Replace colour
- Select the colour you want to replace
- Select the new colour
- Click *Apply*

1.6. Adding Text Objects

Text counts as another type of object in Inkscape, so all the manipulations (resizing, grouping, orientation, selecting, colour, etc.) you just learned above also apply to text. There are a few other things to consider that can make dealing with text easier.

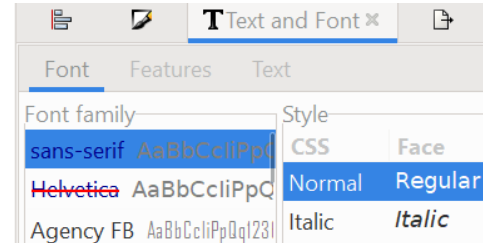
1.6.1. Drawing a textbox:

- Select the text object (capital A with cursor symbol) from the left menu 
- Click and drag to make a textbox, release the mouse button to type in the box.
- Notice how the box turns red and your text disappears if it doesn't fit into the box you just drew. The text box needs to be the same size as the text.
- Click and drag the box to resize it. Notice how the textbox doesn't resize like you might expect. The text becomes stretched. To resize the textbox, double click on the box. A small diamond will appear in the bottom right. Use this to resize the textbox (highlighted in right hand textbox image).



1.6.2. Changing existing text:

- Select the textbox with the text you want to alter
- Text (top drop down menu) > Text and Font
- There are three tabs in this tool:
 - You can change the font, style and size in the *Font* tab
 - Ignore the *Features* tab
 - You can type the new text you want in the *Text* tab
 - Use `Ctrl + Enter` to get the text to go onto the next line if you don't want one long string of text
 - After you have made your changes, click *Apply*
- You can also do all of the above (plus superscript/subscript) using the text toolbar that pops up when the textbox is selected and the cursor is present inside the box. It will show up at the top of the page.



- Orientation: See the *Moving Objects* section
- Colour: See the *Changing Colours* section. When changing the text colour, the stroke (border) is usually set to no colour unless you want the text to have an outline.

1.7. Saving your Work

Inkscape is quite stable, however, crashes can happen. The best way to protect yourself from losing your work is to regularly save (`Ctrl + S`). When you first go to save (`File > Save`, `File > Save as`), name your file and select one of these extensions. This will be your “working file”:

- 1) `.svg` (Inkscape SVG) to keep all the data in your file, even the data that is only useful for editing with Inkscape and no other editor (*recommended*)
- 2) `.svg` (Plain SVG) for sharing your drawing with other people who might not use Inkscape, but use SVG, for example, when they view a web page that uses a picture you created
- 3) `.svgz` (Compressed Inkscape/Plain SVG) compressed to save space on your harddisk
- 4) `.pdf` (Portable Document Format) vector- based files that can also hold raster images. To save as a PDF, go to `File > Save a Copy`, and select Portable Document Format (`*.pdf`)
 - **CAUTION:** never save as PDF only for your *working file*. PDF file format supports a different set of features from the SVG file format and you may lose data in the process. ALWAYS keep an SVG file as well.

1.8. Exporting Graphs

Once you are happy with how your figure looks it is time to export it from Inkscape for use in your 690 project, thesis, publications, etc.

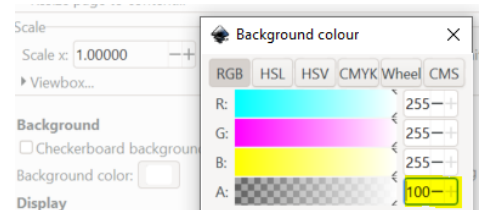
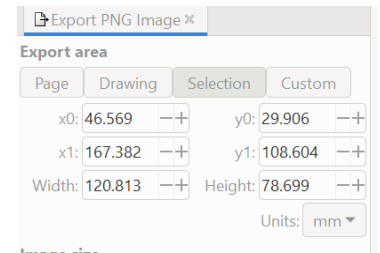
1.8.1. Exporting vector files: For most applications, exporting your file as a vector is preferred. This will make sure that your figure does appear blurry or pixelated when resized.

- To export a figure in a vector format, select the figure you want to export (make sure it is grouped first)
- Go to `File > Save as >` select your preferred file format (PDF, EMF, SVG, etc.) > name the file > Save

- Take a look at your exported figure. Is there a lot of white space? You can change the page area in Inkscape so that only the figure is exported.
- Go to File > Document Properties > under custom size, select *Resize page to drawing or selection*. This will resize the page so it is the same as the figure. Now you can export the figure using Save as. The white space should be gone.

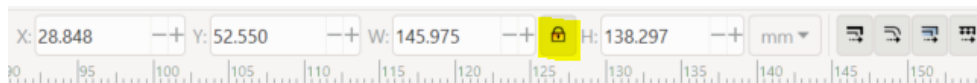
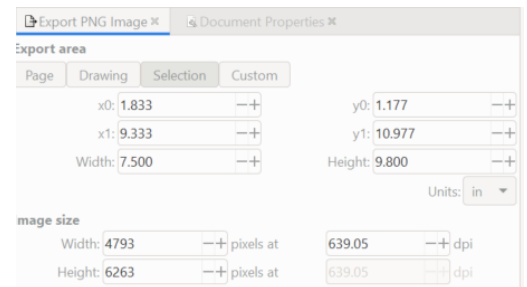
1.8.2. Exporting raster files: To export your figure in raster file format: Go to File > Export PNG Image (this will open the export window)

- Page: will export everything within the page border (anything sitting outside the page border will be cut off)
- Drawing: will export everything inside and outside the page border (i.e., everything on the canvas)
- Selection: notice how you cannot choose this option unless you have something selected. Try selecting your graph or an object and then this option. It will then give you the option to export whatever you have selected.
- Custom: will export according to the coordinates that you enter into the fields at the top
- Exported images default to having a transparent background. To change this go to File > Document Properties. For a white background, click on the background color field and set the alpha channel of the background color to 255.



1.8.3. Image size:

- For raster files: indicate the desired size of your image in pixels or resolution (dpi stands for dots per square inch) in the export window. For example, *Nature* accepts images at a minimum of 300 dpi. The width and height fields are linked in order to constrain the proportions of the exported area. If you change the value of one dimension, the other one changes automatically to maintain the proportions.
- For vector files: before going to Save As, resize the image using the top resizing toolbar. Be sure to have the lock icon selected while resizing as having it unlocked will disrupt the aspect ratio of your graph. You can change the units used for resizing using the dropdown menu next to the height (H:) box. Try resizing your figure with and without the lock icon selected to see how the figure changes.



1.8.4. Exporting figures to journal size requirements:

- Each journal has specific size requirements for figures. For example, *Journal of Biological Methods* requires figures to have widths between 3.0" and 7.5" and heights not exceeding 9.8" when viewed at print size.

- You can change the width and height of your graphic in the export window (which will change the image size)

1.9. Inkscape Limitations

While Inkscape is amazing for many applications, there are still some limitations/drawbacks. Below are some limitations we identified when using Inkscape for scientific purposes.

- Practice caution when moving ungrouped objects around - you definitely do not want to mess up the integrity of your figures.
- If you change something in your graph in R, you will need to re-edit it in Inkscape. This is pretty obvious, but if you need to make a lot of changes, this can become frustrating and time-consuming. Try to finalize your figure in R, then edit the graph in Inkscape once you are pretty sure you won't make any further changes.

2.0. Practice Altering Graphs

Using the new tools you have learned above, practice making the provided graphs look publication-worthy. We have provided you with some graphs so you can get familiar with what Inkscape can and cannot do. The same graphs are provided in SVG, EMF (metafile), PDF, and PNG formats so you can play around with the different file types.

2.0.1 Uploading Different File Types:

- Download the provided ZIP file on eClass and practice uploading each bar plot file type one at a time into Inkscape. Zoom in and out to explore resolutions and practice grouping and ungrouping objects. Notice how resolution and grouping differs across file types.

2.0.2. Basic Manipulation of Simple Graphs:

- Stick with whichever file type of the bar plot you find easiest to work with (we recommend metafile if you want to make many changes), and practice changing and improving this very simplistic figure
- Change colors, move/realign the legend, rotate labels, etc. Go wild.

2.0.3. Manipulation of Complex Graphs:

- Import the "Iris" SVG file into Inkscape
- This figure is more complicated and some labels are jumbled
- See if you can use the "select all" and "replace by" color trick

2.0.4. Practice on your Own Graphs:

- Now that you are an Inkscape pro, import graphics of your own, play around with colors, sizing, exporting, etc. Have fun!

3.0. References and Additional Resources

- Inkscape > Help > Tutorials
- Inkscape > Help > FAQ
- The Inkscape Beginner's Guide: <https://inkscape-manuals.readthedocs.io/en/latest/>
- Inkscape for students: <https://www.ubuntubuzz.com/2020/08/inkscape-for-students.html>
- How to use “*select by*”:
https://wiki.inkscape.org/wiki/index.php?title=Release_notes/0.91#Find.2FSelect
- Designing Effective Scientific Figures:
https://bioinformatics-core-shared-training.github.io/effective-figure-design/DesigningEffectiveScientificFigures_Practical_INKSCAPE_Zabala_v00.pdf
- PNG vs. SVG:
<https://www.adobe.com/ca/creativecloud/file-types/image/comparison/png-vs-svg.html#:~:text=While%20PNGs%20are%20capable%20of.size%20without%20losing%20their%20resolution.>
- Exporting graphics from Inkscape:
<https://www.lifewire.com/export-graphics-from-inkscape-1701894>
- Nature final submission requirements:
<https://www.nature.com/nature/for-authors/final-submission>