

## 02.221 – Lab 4: Map (Post) Production & Projections


### Goals

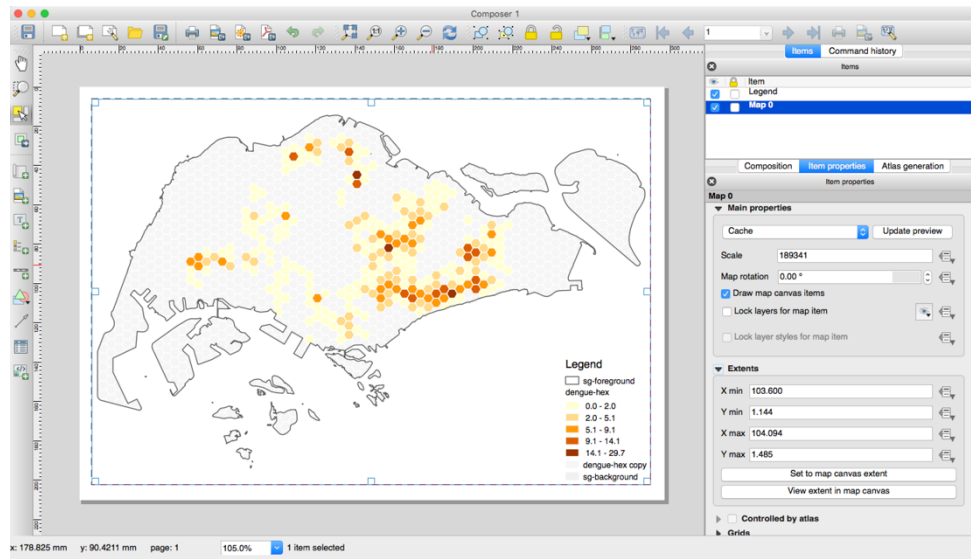
The primary goal of this lab to learn how maps are often polished and finalized in a ‘post-production’ stage, in which the raw output is taken from, for example, GIS software and then polished and contextualized in vector editing software such as Adobe Illustrator.

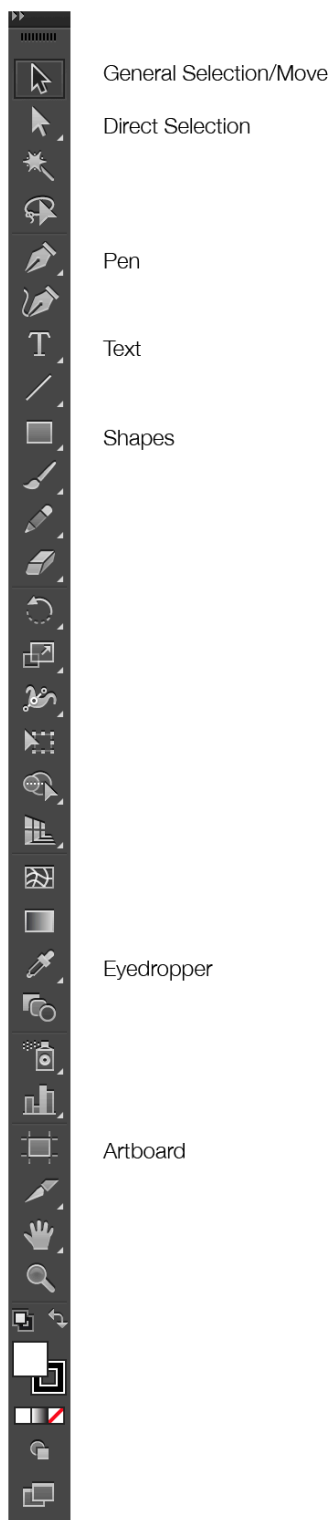
### Exporting for Post-Production

In the previous lab, we used data.gov.sg as a data source for dengue cases that happened in the last 2 weeks. However, as of now, dengue cases are relatively sparse. To get a better sense of potential dengue clusters that might happen later in 2017, we can look at the historic data for 2016. Data.gov.sg does not make this data easily accessible but with a little bit of elbow grease we can download data going back to late April 2016. I have already completed this work for you and you can download a .csv file with all cases between late April and December 2016 from <https://git.io/vDD9n>. You will also find a short R script there that was used to collect the data (if you’re interested). Download the .csv file and join the data to the sg-hex layer from the previous lab (the ID field in the .csv refers to the hexagon ID). After joining, process and style the resulting map in the same way as you did in Lab 3.

In previous labs, we always exported the final maps as PNG file. PNG files are raster images that, after initial creation, cannot be edited or scaled to different formats. QGIS can also export your maps as vector images. In this way, you can both scale and edit whatever QGIS outputs. You can do so by going to the Print Composer. Make sure all the relevant layers and items (i.e. legend) are visible. When you are

happy with the map, click the ‘Export PDF’  button and give your file an appropriate name. For publishing purposes, PDF is a much better format than PNG as, for example, a newspaper might need to print the visualization in full-page. A PNG is created at a certain resolution and cannot be scaled up indefinitely. If you export at with too low resolution, you will not be able to print at large size. As vectors are just shapes and not pixels, they can be scaled to whatever size.



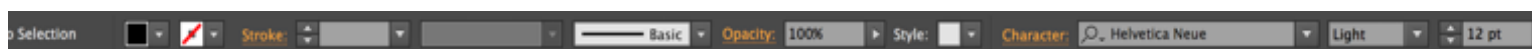


## Getting Familiar with Illustrator & Selecting Objects

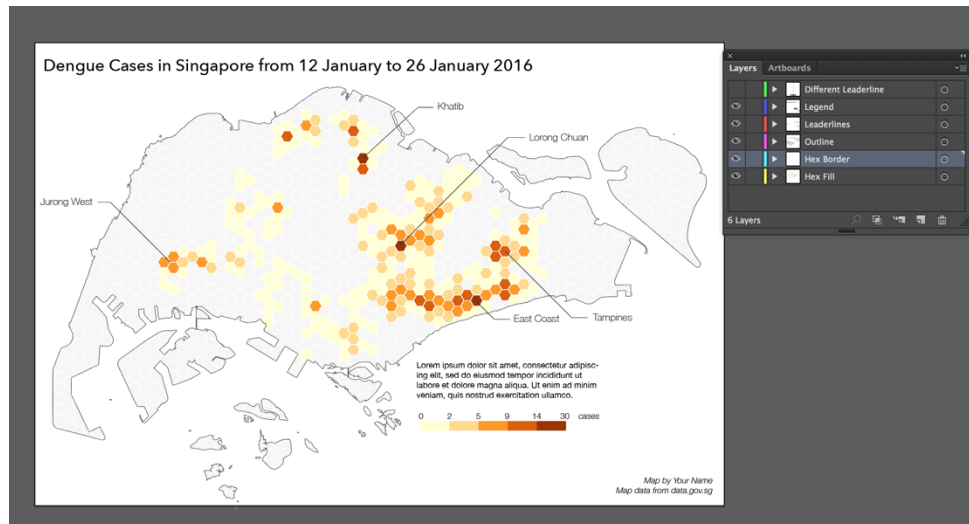
Once your PDF is exported, open the file in Illustrator. Let's cover the basic structure of the program first. On the left hand side, you will see a toolbar. This is where you select the different tools to interact with your illustration. You'll find the most important ones annotated in the left-hand figure. The General Selection/move tool is used to move different vectors and layers around and to select individual objects. However, objects are sometimes grouped together. If objects are grouped, individual elements cannot be selected. This is where the Direct Selection tool comes in, which does allow for selecting of individual objects within a group. Next is the Pen Tool. This is one of the most versatile tools in Illustrator. Quite literally, it allows you to create line segments, lines and entire polygons. It requires some practice to get used to so in this lab we will only use it to create some straightforward leader lines. The Text tool is used to create and edit text objects. The Line and Shapes tools can be used to create static lines, rectangles, circles and assorted other shapes. The Eyedropper allows you to copy styling (color, line weight etc.) from another object (e.g. if you want to replicate the styling). Finally, the artboard allows you to set the boundaries of your illustration. In Illustrator, you can actually have objects exist outside of the artboard. They will not be printed but might be useful in other ways!

At the top of the screen, you will see the Control bar. This is where you set the parameters and options for whatever tool you have selected. Try activating different tools and see how the options in the Control bar change based on the tool you have selected. It is with these two bars, you will spend most time.

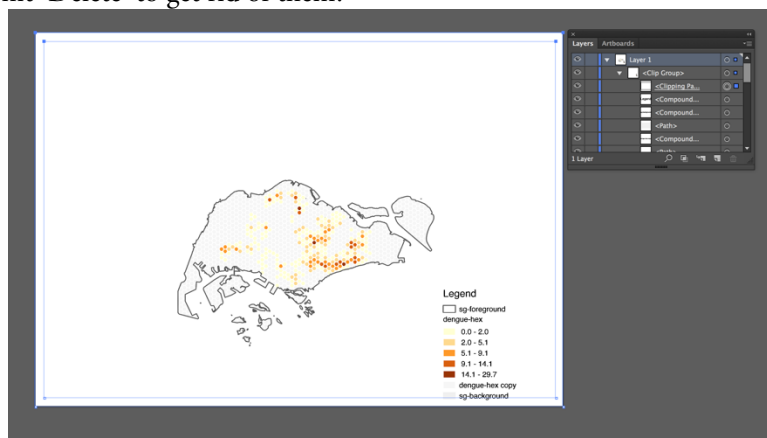
Just like in QGIS, Illustrator works based on Layers. You can activate the Layers panel by going to Window | Layers. In general, if you lost a



particular tool or bar, this is where you can re-activate it. The Layers window shows all the layers within the current document. It is good practice to separate different kinds of objects in different layers so it becomes easier to work with and update your document. For example, for the final product, your layers might look something like the below.

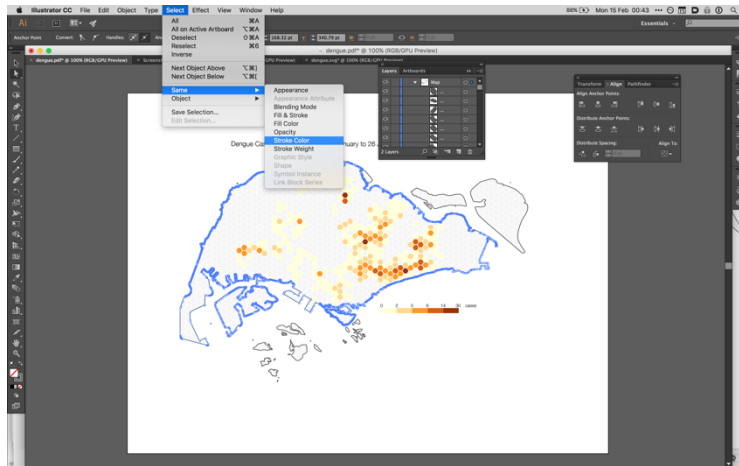


However, the output from QGIS is not as neat yet. We need to do some quick housekeeping first. To get started, use the Direct Selection tool and draw a rectangle that includes all the whitespace above your map but does not actually include the map itself. There are a number of weird rectangles and border embedded within your document and this should select all of them (see the blue lines below). Once selected, hit 'Delete' to get rid of them.



We now just need to isolate some individual features and put them into their own layers. For example, assume we want to select all the hexagons of the lightest class. We don't need to do so one-by-one. We can actually use the Direct Selection tool to select one and then go to Select | Same | Fill Color to select all of them. You can now

simply Edit | Cut the selection, create a new layer, and use Edit | Paste in Place to paste the selection into the new layer all by itself.



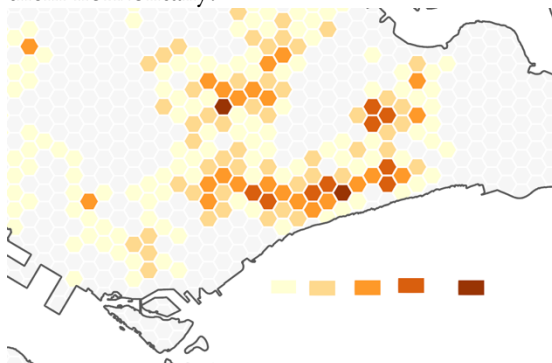
Use the same process to separate all the objects into convenient layers.

### Legends & Aligning Objects

The current legend is quite clunky. We can use the direct selection tool again to delete all the extra legend items but in this case, it might be appropriate to create a new legend all together. For example, since we are dealing with a range of continuous values, perhaps something like this would be a better legend (and it would save a lot of space too!).



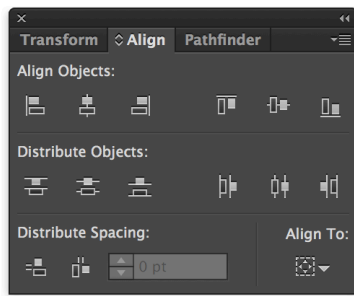
To start, select the individual colored rectangles in the legend and drag distribute them horizontally.



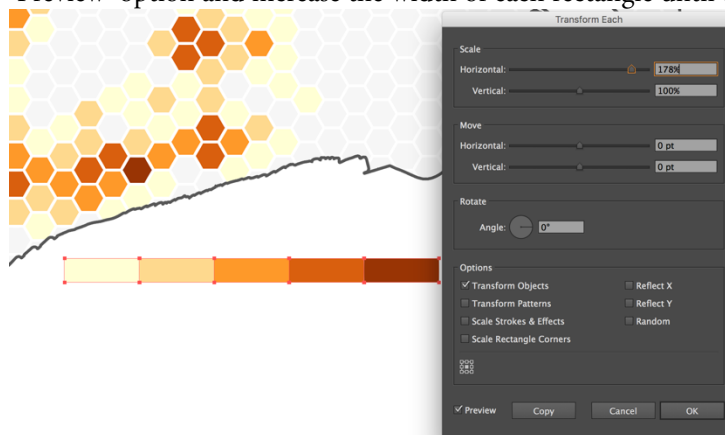
Don't worry about aligning them properly as we can do so automatically in our next step. Imagine yours are aligned so:



Select all the rectangles and open the Align tool (Window | Align). You can now use the Vertical Align Bottom and Horizontal Distribute Space to align and distribute the rectangles.



Since we changed from a vertical to a horizontal legend, we can make the individual rectangles a bit wider. Go to Object | Transform | Transform Each. Activate the 'Preview' option and increase the width of each rectangle until they touch each other.



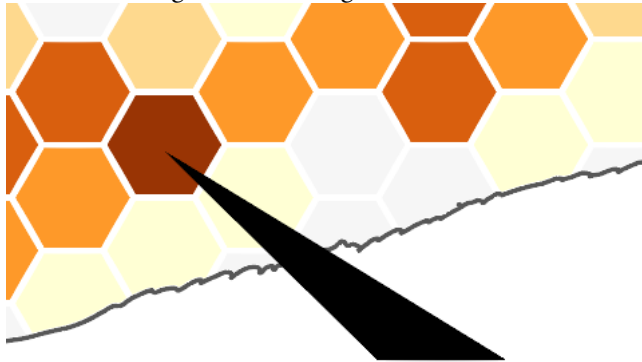
All that is left to do is include labels at each class break. Use the Text tool to do so and use the Align tools to properly align your text labels with each other and the rectangles.



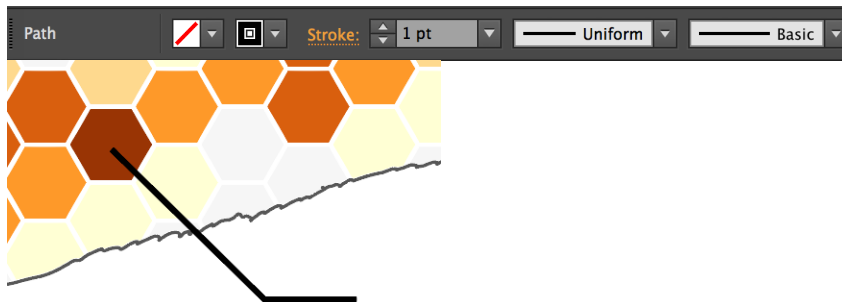
That looks much cleaner than the original legend!

### Leader Lines and the Pen Tool

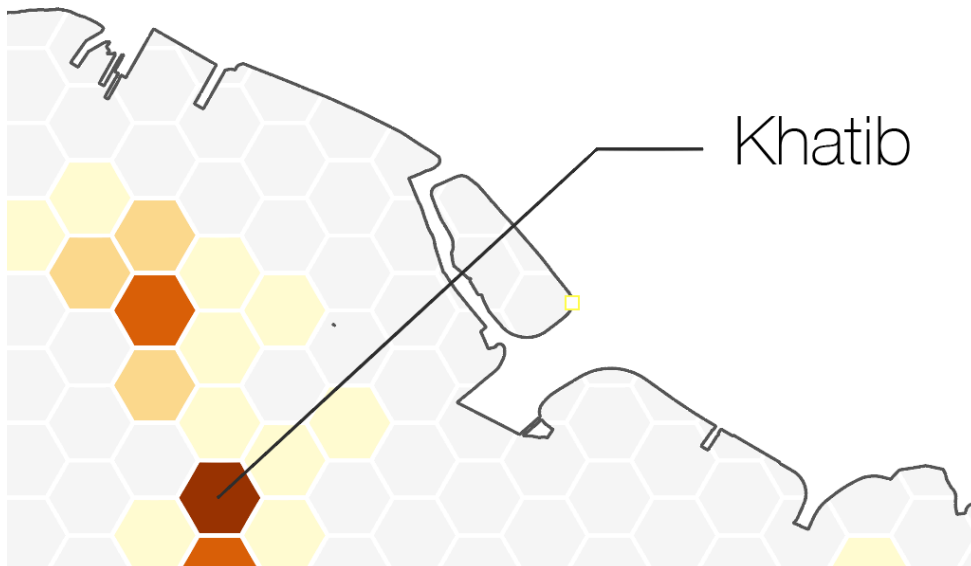
In the previous assignment, your editor asked you which locations were home to a cluster of dengue cases. Instead of only writing about this in the article, it would make sense to point these locations out on the map. We can do so by providing a label directly next to the cluster. However, that often obscures other parts of the map and can also be difficult to read. In this case, you can use a *leader line* to do something similar. We are going to use the Pen Tool to create one. Click inside of one of your cluster and start dragging your mouse to just outside of the map. If you hit 'Shift' while moving the mouse, the Pen tool will only create lines at 45/90 degree angles, which is useful in this case. Once outside the map, click and then create another line segment at an angle, like so:



By default, the Pen tool creates paths with a Fill but no Stroke. We need it the other way around: we want no fill, but do want a Stroke. Select the object and use the Control bar to change this similar to the screenshot below. Whenever you have selected an object, the first dropdown is used to set the fill color, the subsequent drop-downs are for setting the stroke color and width. If you shift-click on the first two drop-downs, this will show a color picker tool. The white rectangle with red line means 'no fill/stroke'.



Proceed to create leader lines for all the clusters on your map and add a label to each line using the Text tool. Remember to separate your work in logical layers as you go!



#### Map Title, Context and Balance

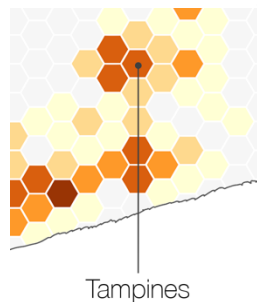
Now it is almost time to put the finishing touches on your map. Before you do, there is one last tool you should know about. The Artboard tool allows you to set the extent or crop of your illustration. Use it to properly frame your map, giving enough space for a title and some other map context. Finish up your map thinking about the following items:

- Have you chosen an appropriate background? One that perhaps gives some geographic context but does not distract too much?
- Is the color scheme of both fills and strokes appropriate and are the stroke widths not too distracting?
- Did you give your map an appropriate title (reflecting the time period data pertains to), legend, source information as well as your own name?

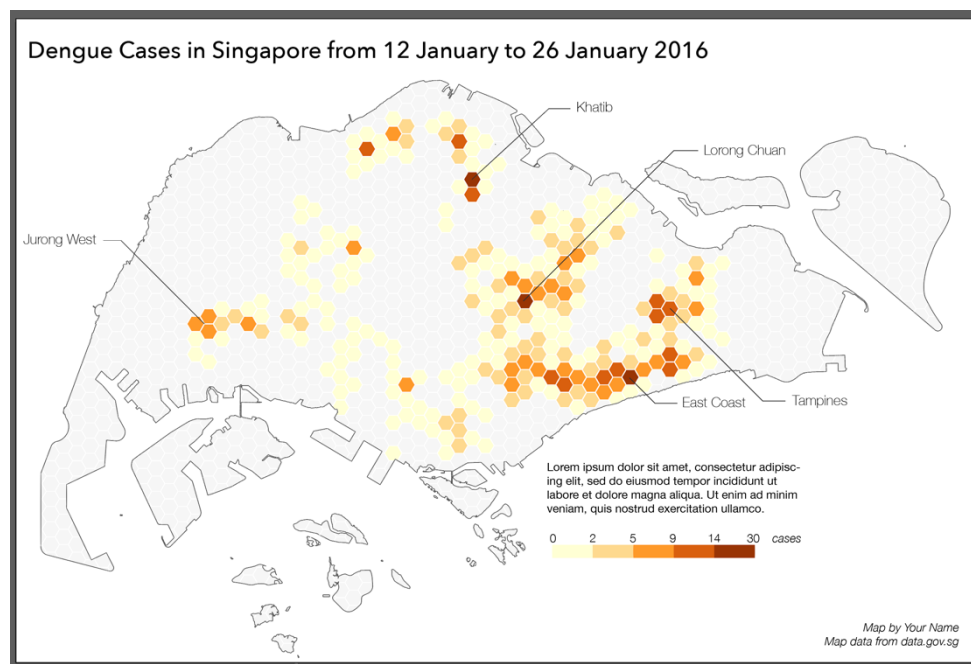


- Did you provide some context within the map itself (e.g. what's going on with dengue in Singapore that warrants this visualization)? This is useful so maps can stand on themselves and don't need an accompanying article
- Are the fonts you chose appropriate and is there a good distinction between important info (e.g. title) and less important objects (e.g. source citation)?

Your finished product could look something like the below (with different time period in the title, of course) but you should feel free to experiment here. Be creative with the basemap, fonts, colors and line work. For example, you could try to create a different leader line style:



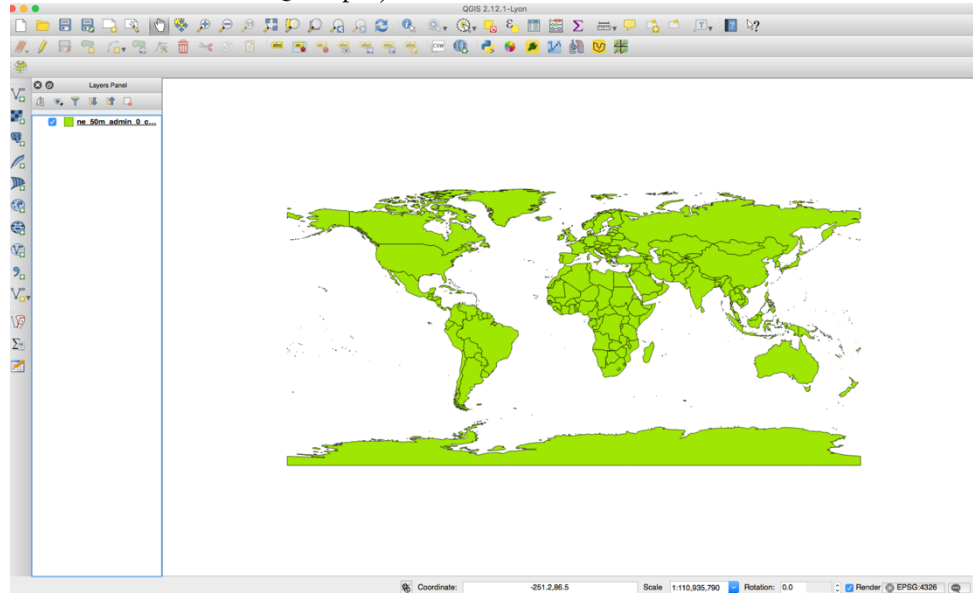
Once you are satisfied, save your file with an appropriate name and include it in your assignment.



## Projections

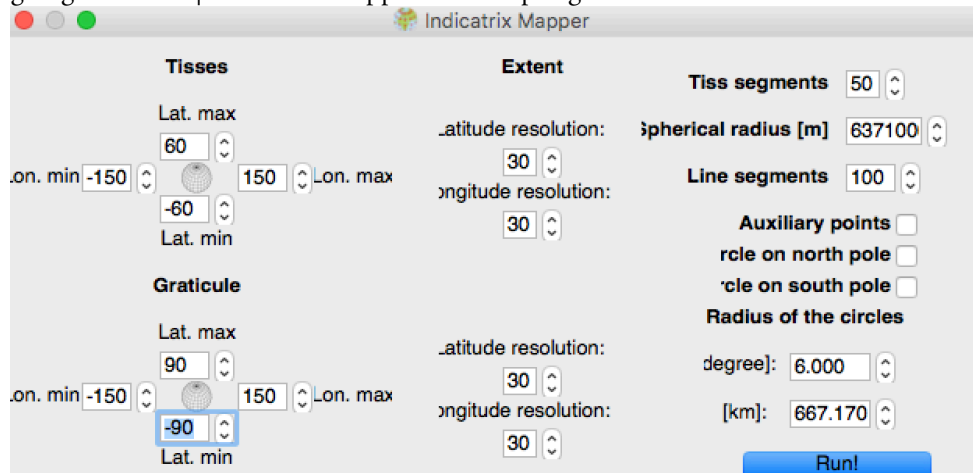
In this section, you will use different projections with the same global dataset. You will need to draw heavily on the two class readings (Kryger & Wood; Dent) as well as the Thursday lecture to complete this section successfully.

Download the 1:50m *Admin 0 Countries* Shapefile from [naturalearthdata.com](http://naturalearthdata.com) and add it to a blank, new QGIS project.

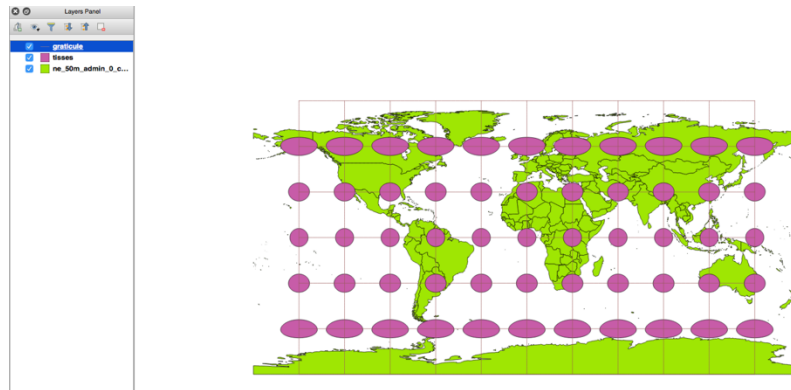


In the bottom-right of the program, you will see it says 'Render: EPSG:4326'. This is the coordinate system the data comes in. When you click on it, you can change the CRS and projection and QGIS will re-calculate the projection 'on the fly'. This is a really quick way to try out different projections.

Before we do so, we are going to add Tissot circles to our map so we can visualize the distortion of each projection better (similar to the Figures in both readings). Go to Plugins | Install Plugins and install the 'Indicatrix Mapper' plugin. Then use it by going to Vector | Indicatrix Mapper and accepting all the defaults.



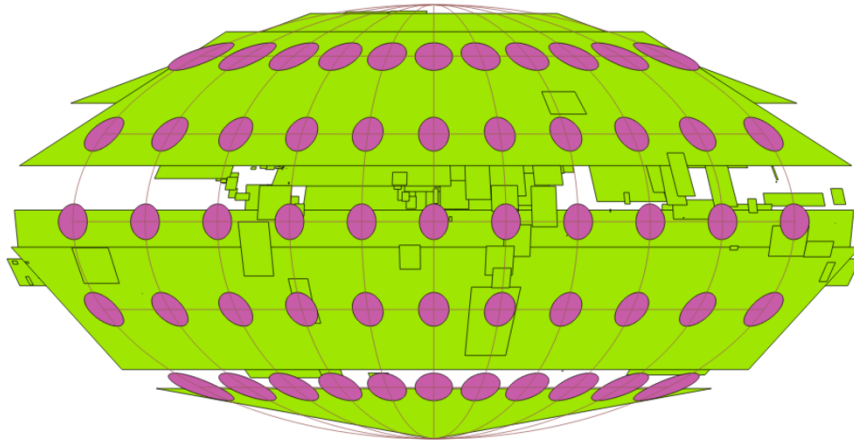
Once done, it will have added both a graticule as well as the Tissot circles to your map:



Make use of the readings, class lecture as well as online resources (<http://map-projections.net/index.php>; <https://xkcd.com/977/>; <http://www.spatialreference.org/>) to select at least four different projections. Three of them need to preserve a different aspect (area, shape, distance, direction) and the fourth and any additional ones can be whatever projection you prefer. Export each map/projection to a PDF file and use Illustrator to combine all four into a single document. Pay attention to the following:

- Align all four panels neatly in a 2x2 grid
- Add a title and a description (e.g. mention the projection, explain what attribute it preserves, how you can see that from the Indicatrix etc., why you chose this projection) to each panel (not dissimilar from XKCD)
- Include both your name as well as the data source
- If you are feeling up to it, try adding some additional data sources from [naturalearthdata.com](http://www.naturalearthdata.com/downloads/50m-raster-data/). For example, the background used at [map-projections.net](http://www.naturalearthdata.com/downloads/50m-raster-data/) is also available as raster here
- Not all projections are available within QGIS but everything you can find on [spatialreference.org](http://www.spatialreference.org/) you can use in QGIS by copying the proj4 string and adding it under Settings | Custom CRS.

N.B. Reprojecting data on the fly can be mathematically complex and some projections are not suitable for data spanning the entire globe. This is why you might see weird artifacts like this:



If this happens, try zooming in or out a little bit or pan the map. If nothing helps, you might need to try a different projection.

#### Assignment

The assignment for this week consists of the two polished map products discussed above. **The assignment needs to be submitted as one or two PDF files.** Please make sure you submit the assignment by **February 22.**