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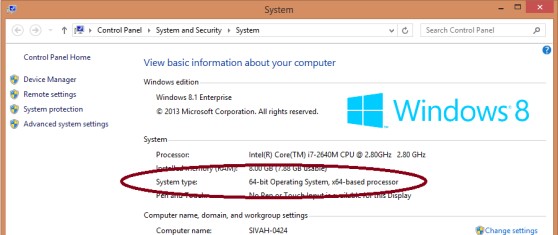
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# Lab Prerequisites

Following prerequisites and setup must be complete for successful completion of the exercise:

* You must have an internet connection.
* **Signup for Power BI:** Go to <http://aka.ms/pbidiadtraining>and sign up for Power BI with a business email address. If you cannot sign up for Power BI, let the instructor know.
* If you have an existing account, please go to [http://app.powerbi.com](http://app.powerbi.com/) and **Sign in** using your **Power BI Account.**
* At minimum, a computer with 2-cores and 4GB RAM running one of the following version of Windows: Windows 10, Windows 7, Windows 8 (64-bit preferred), Windows 8.1, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2.
* Microsoft Power BI Desktop requires Internet Explorer 9 or greater.
* Verify if you have 32-bit or 64-bit operating system to decide if you need to install the 32-bit or 64- bit applications.
  + Search for computer on your PC, right click properties for your computer.
* You will be able to identify if your operating system is 64 or 32 bit based on “system type”

as shown below.



* Download all our session content [here:](https://github.com/FreshBI/Maps-in-PowerBI-Training-Pack)
* **Download and install Power BI Desktop** using any one of the options listed below:
  + If you have Windows 10, use Microsoft App Store to download and install Power BI Desktop app.
  + Download and install Microsoft Power BI Desktop from [http://www.microsoft.com/en- us/download/details.aspx?id=45331.](http://www.microsoft.com/en-us/download/details.aspx?id=45331)

## Document Structure

This document has two main sections:

* **Mapping in PowerBI**: This section contains five subsections, each outline a different method of creating maps in PowerBI. While there are a few other options outside of the five covered, these are our foundational options.
* **Pros and Cons**: This is a brief summary visual created for you as a quick reference to review the ups and downsides of our reviewed visuals.

Throughout this document you will find all steps in a table on the left side. On the right will be screenshots or images to aid in following along.

# Overview

## Introduction

This training manual is all about maps. The main purpose in this is to embark to you an understanding of mapping options in PowerBI, along with the pros and cons of working with each of those options. A key concept in following along in this is exploration, similar to exploring the globe, we will be exploring maps. Each map has a variety of options that other don’t. Our goal is to expose these differences and extract the most value we can from each of our options.

## Data Set

This workbook uses a dataset from the government of Canada data catalog. It contained the locations of hospitals in BC along with a few other data points. I added fictitious patient hours, and regions to this data set in order to complete some examples.

Workshop Outline:

1. Mapping in PowerBI
2. Pros and Cons
3. Questions

# Mapping in PowerBI

PowerBI is well known for its flexibility. Among the many other things that PowerBI can enable, address and location mapping often sit in the background. The goal of this workshop is to enable you to create maps in exactly the way that you envision. The way we will do this is simply by creating example visuals and exploring the options they present to us. We will be working with all of address data, latitude/longitude data, and other abstractly defined regions.

## Mapping in PowerBI – Default Maps

The first visual we are going to look at is the default map visual in PowerBI, literally called ‘Map’. This visual is the first of the map visuals and thus may seem behind all the others when it comes to features. The upside, however, is that it is simple, and fast. This visual uses Bing to locate addresses.

Let’s dig in to an example of using this visual.

### Mapping in PowerBI – Default Maps

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| The first step for us to complete as we get into maps is to import our data set. A copy of the data set I will be using is located in the Maps in PowerBI Training Pack located [here](https://github.com/FreshBI/Maps-in-PowerBI-Training-Pack). I suggest you download all the material here and follow along in these steps.  The first step in exploring default PowerBI maps is to import data.   1. Open a new PowerBI report and click get data. Choose Text /CSV as your data type option. Locate and select hospitals.csv, then click Load when prompted. 2. Now create a Map visual by clicking the map icon in the Visualizations Pane.      1. Now we have two options for location mapping. We can map based on addresses or based on latitude/longitude. For this first visual we are going to do both, starting with addresses. 2. Observing our data, we see four relevant pieces of data for addresses. Let’s try and plug STREET\_NUMBER into our map. Do this by dragging the field into the values of our map visual.   You will observe in our map that all our addresses appear to be in the USA. Remember though that this data is all BC hospital data. It turns our STREET\_NUMBER is not specific enough. We need to create as detailed an address as we can. We will make a calculated column to do this for us by concatenating all four of our address fields.   1. Right click our table in the Fields pane and click New column. Enter the following:   Detailed Address = hospitals[STREET\_NUMBER]&", "&hospitals[CITY]&", "&hospitals[PROVINCE]&", "&hospitals[POSTAL\_CODE]  This measure concatenates our four location fields with commas in between.   1. Drag this new column into the map and have a look at the difference. This is much better!   You may still notice though, that this is not perfect. Let’s try latitude and longitude now and compare.   1. To do this create a new map and drag LATTITUDE and LONGITUDE to their respective values in our map fields.   Have a look at this map. Not only do all points land in BC (as they should) but there are more. Zoom in and have a look for yourself.  This here highlights a very important insight when dealing with Maps. Addresses are almost always easier to acquire, data-wise. But coordinates are **always** better, so long as they are accurate.   1. The next steps we are going to make in this section are all formatting. Click on our map and click the formatting tab in the Visualizations pane (the little paint brush).   Have a look at the formatting options. A quick review will show that there are almost no relevant options beyond map style and bubble colours.  This is all we get using the default map in PowerBI.   1. Before we move onto some other visuals, I want to look at some of the other fields we have available. Drag the PATIENT\_HOURS into the Color saturation field (this is completely fictitious data).   In the formatting tab we can change the colour range of these data points. You will also see the size value. This is similar. |  |

## Mapping in PowerBI – ESRI/ArcGIS

Our next example of a map visual in Power BI is the ArcGIS map provided by ESRI. ArcGIS takes maps in PowerBI beyond points and into next level. As we work with this visual you will immediately see the upgrade that it is to the default map in PowerBI. A key feature with ArcGIS maps in PowerBI is the different display options. These include heat mapping and many choices of backgrounds.

### Mapping in PowerBI – ESRI/ArcGIS

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| We are going to start this section in a similar way as the last. We are going to see if there is any address located differences between the default map and the ArcGIS map using ESRI.   1. Create am ArcGIS map by clicking its Icon in the Visualization pane. And then drag our Detailed Addresses field into the visuals Location value.   Wow! You should immediately notice the extreme difference in accuracy between ESRI address location, and the Bing address location in the default map.   1. Let’s create a new ArcGIS map and plug in our coordinate fields by dragging them into their respective visual values.     Doing this confirms for us that ESRI is far more accurate. I can’t see any points that are missing or out of place in our first map.  Now that we’ve seen how much more accurate this visual is. There are a few things to note.   * This visual seems slower. Notice it takes a while to think before it displays our points. * There is extra stuff in the top right. What is this?   ESRI is not 100% free. Depending on your use case, you may need to run on a payed subscription with ESRI.  The other two items are zoom and select options. Zooming is how you’d expect. The select options has buttons that let you switch between single select to filter on items, and box select. Experiment with this!   1. Now onto features: Lets delete our map with coordinate fields and go to the formatting tab in our other one.   Hint… There is nearly nothing there!  We must go to a different place for this map. Many of the more advanced custom visuals in PowerBI have a custom edit function. Click on the ellipses at the top right of the visual and click edit to navigate there.  Wow, lots of options to choose from. Let’s have a gander at some of the stand out options.   1. As a free user we have four options for our Basemap. Look and see which ones you like. 2. The ArcGIS map in PowerBI does have the capability of mapping boundaries. We are going to skip this, since we are going to use a different map for this later on. 3. We then have the option to change the theme. Here we can choose the heatmap option which is very nice. 4. Symbol style options change depending on your map theme. 5. You can pin important locations on your map 6. The next three options are more specific. Drive times lets you highlight how far a specified time driving will get you. And the reference layer and infographics allow for comparative analysis on the go. In the free version they are limited to US demographics. 7. As a last note, this map does also have the Size and Color value fields. We can place metrics in here to the same effect as the pervious visual.   You can see how much more powerful this map is versus the pervious. In most cases you will absolutely want to work with this map over the default. The only cases will be if you have lots and lots of data. |  |

## Mapping in PowerBI – Mapbox

Mapbox is another major upgrade to the default map in Power BI. While Mapbox and ESRI maps are similar they each offer a slightly different set of pros and cons. Mapbox has many options and may be more versatile than ArcGIS. A key thing to note despite this is that Mapbox does require an account to be made and may not be free depending on your use case. [Here](https://www.mapbox.com/signup/?route-to=https://www.mapbox.com/studio/signup/) is where to go to create an account.

### Mapping in PowerBI – Mapbox

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| Let’s get straight into this one.   1. First is to get the Mapbox Visual from the marketplace. Click the ellipses in the visualizations tab and click Import from marketplace. Search for “Mapbox”, click add. 2. Next, we will create a Mapbox Visual and drag our Detailed Addresses field into the location value. The visual is now asking for an access code! 3. We now need to create a Mapbox account to continue. Click the link presented and proceed to sign up. Once you sign up copy the access token. 4. Now the visual says we need to have our coordinate fields entered to continue. The location fields are for an additional layer. Let’s add our coordinates now.   Now we can see our map! Let’s highlight the first two differences.  The first difference is the compass below the zoom in and out icon, click and drag to use.  The second difference is in the top left corner. Recall the ArcGIS map had a box select option. Mapbox has this option in addition to a ‘lasso’ option. Click this and try it out. Click once to trace you line, double click when you are finished.   1. Now we can continue looking at formatting options. This visual has all options in the formatting tab as we are used to. In the first drop down we have some basic settings. Map style is the main setting here. 2. The next drop down encompasses our options around our ‘circles’ these are just our points on the map. If we open the tab up we see Min Color, Med Color, Max Color. Go ahead and drag our PATIENT\_HOURS into our Color value. Experiment with some of the other options in this dropdown. 3. The next option enables the heatmap option. Click the drop down to view all our options. 4. The last two drop downs are cluster and choropleth. The cluster option identifies items within close proximity of each other with matching ‘cluster’ and groups them into clusters. This requires you to enter a value in to the cluster field. When we enter city we notice that this only has the option to be a count of city. Cluster keys are limited to numeric |  |

## Mapping in PowerBI – Shape Map

Now we are going to go in a completely different direction. Shape Map is a new visual in the PowerBI Preview features. Its goal is to enable a different kind of map visual in PowerBI. Previously, all map visuals have regions defined by province or city. But, the need will sometimes arise to define our own regions. This is where the shape map comes in. We can use various tools to create regions on a map, and assign them keys, we can then place data with the associated keys into our shape map and it will highlight regions as we specify.

### Mapping in PowerBI – Shape Map

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| The process for working with PowerBI’s Shape Map is going to be very different than the processes we have worked with so far. By far the most important aspect of Shape Map, is having the ability to define our own regions on a map to display. There are many ways to do this, in this tutorial I will show you one relatively simple way to do this, though we will have to jump through some hoops to get there.  If we have a look at our data, we’ll see a region field. Let’s make a new report page, create a new default map, and draft our coordinates in as normal, then drag region into the legend. This is another fictitious data field created for demonstration purposes. The idea, is we are going to make a new map with these regions filled, rather than as coloured points.   1. We are going to build our map by overlaying regions on google map. Open google maps and in the top left click Menu -> Your Places -> Maps -> CREATE MAP 2. Now we have map open for us to add layers to. Double click the title at the top left and rename this map. 3. Now we are going to draw some regions. Click on “Untitled Layer” and rename it “Regions”. 4. Now under the search bar click the button “Draw a line” and make sure “Add a line or shape” is checked. 5. Now we use this draw a line tool to outline the regions we wish to display. I recommend you display PowerBI and maps side by side to help. Create polygons surrounding each region one at a time. **It is very important that you name your region exactly how it in your data. Look at our legend in PowerBI to see these names.** 6. Once we have our regions outlined, we must do a bit of leg work to get this into a format that we can use. Click the three dots at the top by our map title and select Export to KML/KMZ. Chose our layer “Regions”, check the box for “Export to a .KML format” and click download. 7. Now we need to convert our .KML to a .GeoJSON format. Go to your downloads folder, right click our newly downloaded .kml file and choose to edit in notepad. Copy the contents. Now navigate [**here**](https://mapbox.github.io/togeojson/). Paste our kml into the left box, the right will now contain your GeoJSON, copy this now 8. Now we need to save our GeoJSOn as a file. Create a new test document, paste our contents, and then save a Regions.txt to your desktop. Close your text editor, navigate to your desktop, right click Regions.txt and rename it to Regions.GeoJSON. 9. Now our last step is to convert this to a TopoJSON (I know so many steps.) Navigate [**here**](https://mapbox.github.io/togeojson/) and import Regions.GeoJSON. 10. Click Export, located in the top right corner, and choose TopoJSON. **Finally, back to PowerBI.** 11. Now in PowerBI, we need to enable Shape Map. Click File –> Options and Settings -> Options -> Preview features -> enable Shape map visual. 12. You will need to restart PowerBI for this to take effect. Save this report as PowerBI Maps and close PowerBI. Reopen it afterward. 13. Now create a shape map visual. Drag REGION into the Location Value, and drag PATIENT\_HOURS into the Color saturation value. 14. Lastly, we need to upload our TopoJSON. In the formatting tab, expand Shape, click Add Map, and choose Regions.TopoJson   Have a look! We can now adjust colours and experiment with other formatting options. This example is quite simple. But using other ways of creating TopoJSONs, or by downloading and using pre-created TopoJSONs we can get absolutely use this tool to great success.  As an quick interactive example we will create a column chart. Place CENCUS\_REGION in the axis, and PATIENT\_HOURS, in the value. Click on a region and notice how the Column chart is responding! Click on different columns in the chart and observe. | \ |

## Mapping in PowerBI – R Script Maps

Now we get into using R script for maps in PowerBI. The reason we highlight this option in this workbook is because R is extremely flexible. There are so many customizations and options that R presents that simply no other visual can offer so far. An example of this is drawing clusters. The real downside with working with R to create your maps is the complexity involved. Creating maps with R is so much more work that using any of the above options. Sometimes it is not worth it; sometimes it will be worth it, it really depends on what you are looking to do. We are going to move very quick through this section, as this work with R is quite hard to follow without much experience.

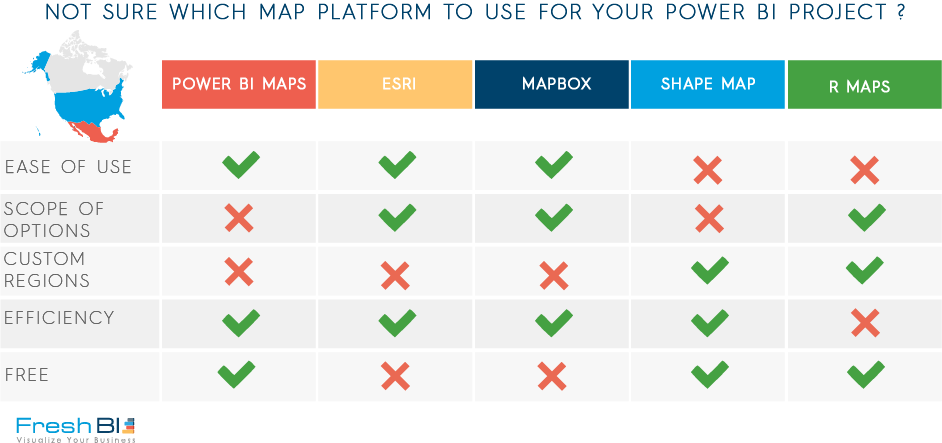
### Mapping in PowerBI – R Script Maps

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| Our purpose with this section is to explore the very basics of working with R maps in PowerBI. This is going to be very simple and will just outline the basics.   1. In R studio we will need to intall two packages. enter:   install.packages(“maps”, ”mapproj”)   1. In PowerBI, now, we must create an R visual and drag our data points into the value field. Drag our coordinates, and PATIENT\_HOURS into the visual. **Remember to set these to do not summarize.** 2. We will start very simple by including our two packages. Type:   library(maps)  library(mapproj)  map()  Then run our script. Have a look at the map that has been created.   1. Now we’re just going to spend a little while exploring the work flow of changing colours, locations, and adding points. The first thing we need to do is focus our map in on BC. To do this will calculate the maxima, and minima of latitude and longitude. Enter the following before our map call:   lat = c(min(dataset$LATITUDE,na.rm = TRUE)-1,max(dataset$LATITUDE,na.rm = TRUE)+1)  and:  lon = c(min(dataset$LONGITUDE,na.rm = TRUE)-1,max(dataset$LONGITUDE,na.rm = TRUE)+1)   1. Now we are going to create a new map canvas which focuses in on our data range. Replace our map() line with this.   map(ylim=lat, xlim=lon)   1. Next I want to change the colous of this. Replace the line above with:   map(ylim=lat, xlim=lon, col="#1289CA", bg="#374649", fill= TRUE)  This adds three parameters which choose the colours of this map.   1. Now we are going to display our data points. Type the following:   points(mapproject( dataset$LONGITUDE, dataset$LATITUDE))   1. Next we will add a few parameters to shape these points. Replace the above with this:   points(mapproject( dataset$LONGITUDE, dataset$LATITUDE), pch=21, bg= "#BAAA20", cex= dataset$PATIENT\_HOURS/60000, lwd=.4)   1. Now we can draw our own custom regions. This can be very labor intensive… But it is very flexible! Enter:   polygon(x = c(-122,-122,-128,-128),y=c(48,51,51,48),density = 30)  and:  polygon(x = c(-130.19,-131.42,-133.23,-133.14,-132.61,-131.47,-128.52,-126.65, -125.23,-123.25,-123.16, -121.80,-122.64,-127.82, -130.19), y=c(54.92,54.13,54.26,53.72,52.98,52.10,50.59,49.35,48.60,48.19,49.00,49.00,50.84,54.31,54.92), density = 12)  While this example is very rudimentary, the goal is that you will be confident to try working with R maps. R is by far the least accessible and flashy solution when it comes to building maps in PowerBI. But R has literally **thousands** of options.  There may be a case that comes up that no map in PowerBI can handle. Once we reach this point, it may be necessary to build your map in R. |  |

# Pros and Cons

We have not gone through examples and explored everything there is to know about five mapping visuals in PowerBI. This sections purpose is to summarize each of our options to help you decide which visual to use on the fly.

### Pros and Cons – Visual Reference



# Conclusion:

And that concludes our Maps in PowerBI training manual. We hope that the experience you gained from working through these examples and exercises will help you as you work in the future with maps of all kinds.

## Conclusion: Questions

Now is the time for your questions and requests. Let me know if you have any projects you wish to work with while I am available. Or, let me know if you have any higher-level questions about maps in PowerBI and where to start.