



**Data
Community**



Making Maps in Power BI

Andrea Martorana Tusa



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About me | First name: **Andrea**

Last name: **Martorana Tusa**

- Senior BI developer working in IT department of **Banco Popolare**. Focused on all the applications involved in Human Resources management.
- SQL Server & Oracle development, data warehousing, reporting, BI, Analysis Services, C#, R.
- MCTS “SQL Server Developer”.
- Speaker at SQL Saturdays, and other community-driven events in Europe, (MS Cloud Summit, SQL Konferenz, SQL Nexus, ...)
- Speaker for PASS Italian VC, DW/BI VC.
- Author on sqlservercentral.com, sqlshack.com, UGISS (User Group Italiano SQL Server).



Agenda

Introduction

1. Bubble maps
2. Filled maps
3. Shape maps
4. ArcGIS
5. GlobeMap
6. R
7. Flow map
8. Synoptic panel
9. Geocoding

DISCLAIMER

1. I assume that you already know or tried Power BI
2. The session is going to last more than 1 hour



Stay tuned

Twitter: @bruco441

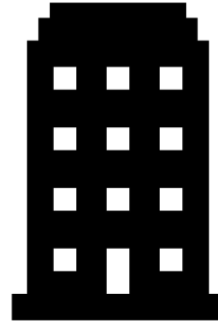
E-mail: andrea.martoranatusa@gmail.com

Series named «**How to create geographic maps using Power BI**» on
www.sqlshack.com

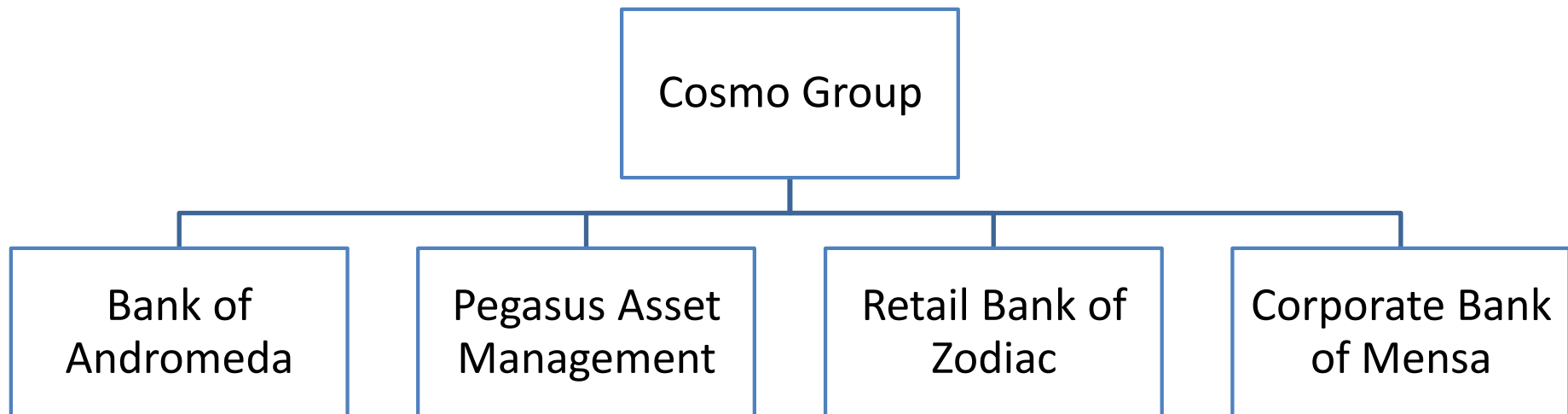


Fancy a fictional group ...

290 Employees



16 Departments



... with a very angry boss!!!

Every month we
spend too much
money in travel
expenses!

I want to know where
and why our employees
are travelling!
Bring me a complete
analysis of our costs!



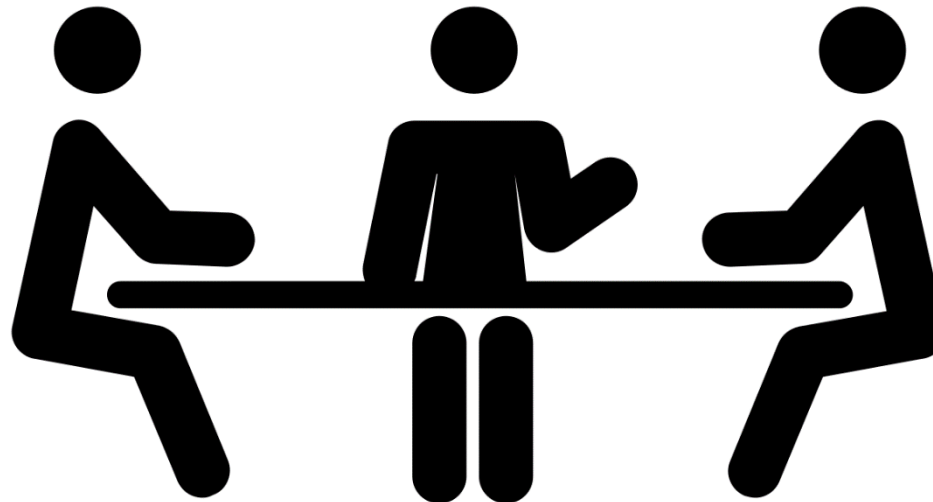
What to do?

We must perform a deep analysis on our travel expenses. Which countries our employees visit and why.

I think we'd better to prepare a report to summarize data at a glance. We must be simple but effective.

Ok, I know the right tool. Let's use **Power BI**.

We create a dashboard with little data and many maps, to highlight the correlation among travels and costs.



The simplest visuals - Bubbles



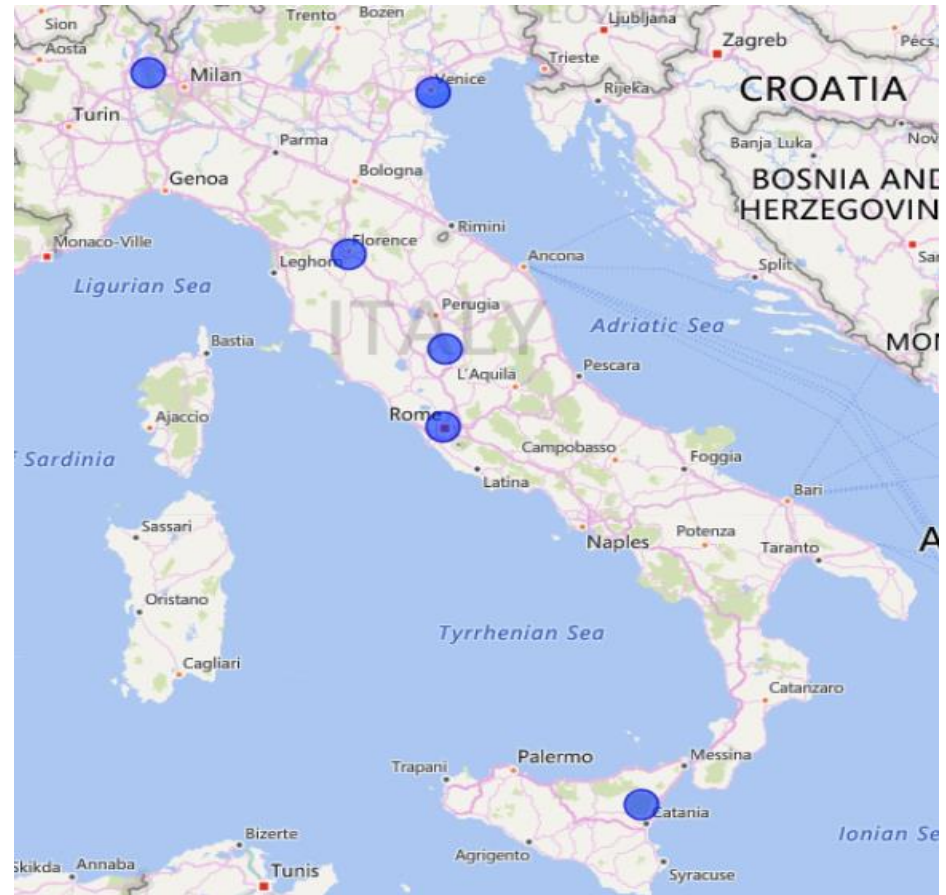
Let's start with the primitive visual available in Power BI: **Bubbles** and **Filled**.

Bubbles are simply filled points over a Bing maps. Points are identified by geographic coordinates (latitude, longitude) or by a significant geographic name (a city, a country code, a zip code, etc ...).

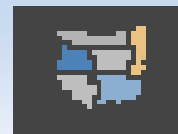
The simplest visuals - Bubbles



Here is how a bubble map looks like



The simplest visuals – Filled maps



Filled map visual creates **choropleth**, a thematic map in which areas are shaded and filled in proportion to the displayed measures.

The visual is based on Bing maps as well. It overlays regions with polygons and boundaries; again we have to pass an attribute that can be recognized as a significant geographic name. For example a city, a state, a country, ZIP code, etc.



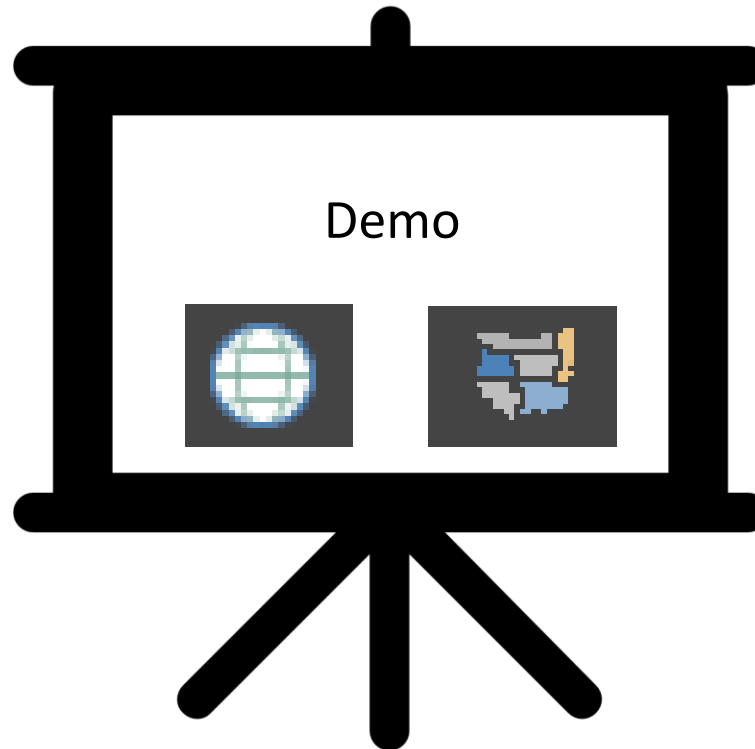
The simplest visuals – Filled maps



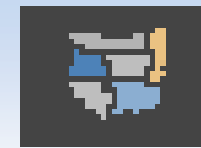
Here is how a filled map looks like



Bubble and filled maps



Use it or do not use it?



Are you fine with these
visuals?
Do you think we can
present the reports to
the boss?

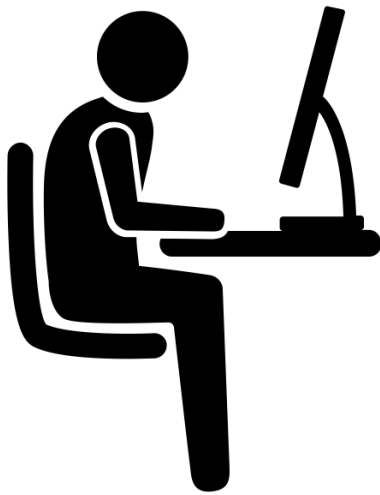
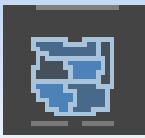
Hmm I see, they're
really **easy** and
immediate to use.
They allow interaction
with the other visuals
on the report ...

I agree. We'd
better to look for
another solution.

... but you
have **no map
configuration
options**, only
the base
standard tile.
**No markers
shaping.**
**No control on
geocoding
results**, we
must pay
attention to
wrong
locations.



Take control – Shape maps

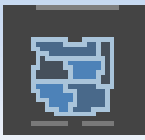


A **shape map** is a visual built to show comparisons of regions on a map by applying different colors to each region.

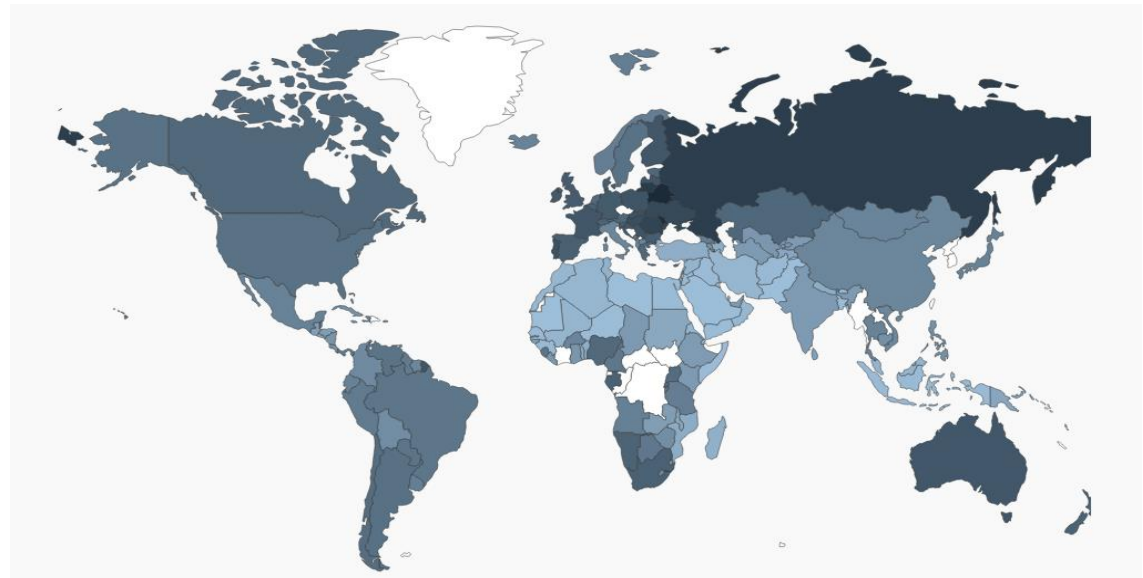
It is based on **shapefile**, a storage format developed by **Esri**, nowadays universally recognized as standard for storing geospatial information.

A shapefile format spatially describe vector features: points, lines, polygons. It is therefore commonly used to represent geometric locations for data and its attributes.

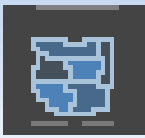
Take control – Shape maps



Here is how a shape map looks like



Take control – Shape maps



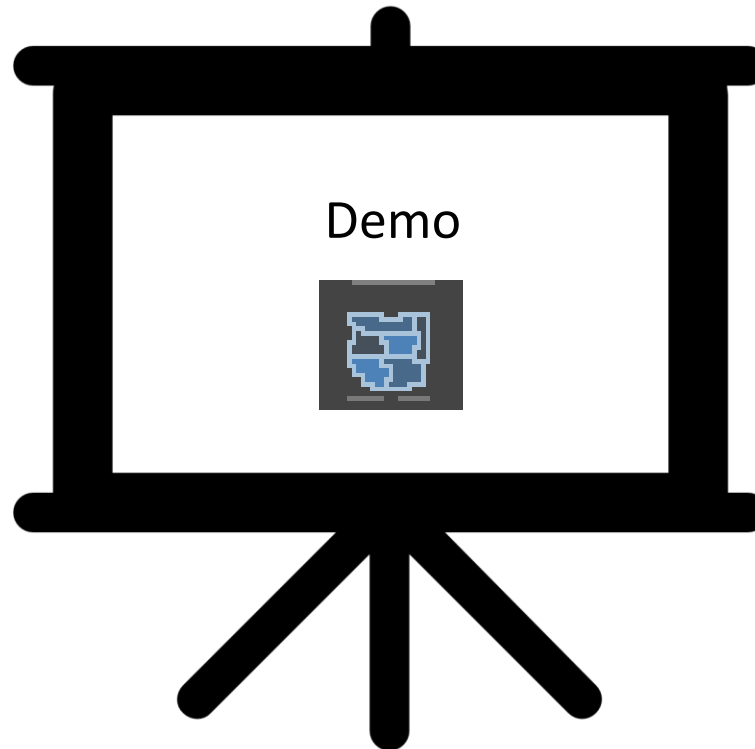
Power BI provides two ways for using shape maps:

- 1) **Default built-in maps**
- 2) **Custom maps**

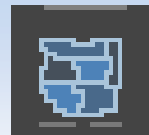
Few built-in maps are supplied inside the visual itself, ready for use.

Custom maps must be in *TopoJson*, a geographic format inherited from the most common *GeoJson*. *TopoJson* files are not very widespread. You can create your own file, converting from other formats (shapefile, geojson, ecc.), using for example an online tool such as *MapShaper* (mapshaper.org).

Take control – Shape maps



Use it or do not use it?



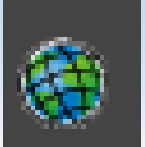
Now, what's your opinion with this visual?
Do you think we can use it in our reports?

Well don't stop our investigation.
Let's test another visual to find out whether we have more options.

Yes I think we could
you can create **maps of any shape**, and any size.
You **can control data to display**, and you can manipulate them with GIS software ...

... but you have to pay attention to **key matching**, files must be converted in **TopoJson**, adding a legend or a value range is tricky, and **layers** aren't supported natively.



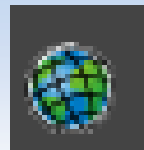


A **GIS** (Geographic Information System) is a computer-based tool that analyzes, stores, manipulates and visualizes geographic information on a map.

ArcGIS is the software developed by **Esri**, for creating and using maps, performing spatial analysis, sharing and discovering geographic information.

There's a visual for using **ArcGIS Maps in Power BI**. The visual includes a set of map tools that let you use powerful spatial capabilities to go beyond the simple representation, such as clustering, adding reference layer, infographics, time changing pattern, ecc.

Go spatial – ArcGIS



Using ArcGIS, you can also publish your own reference layer and reuse it in Power BI.

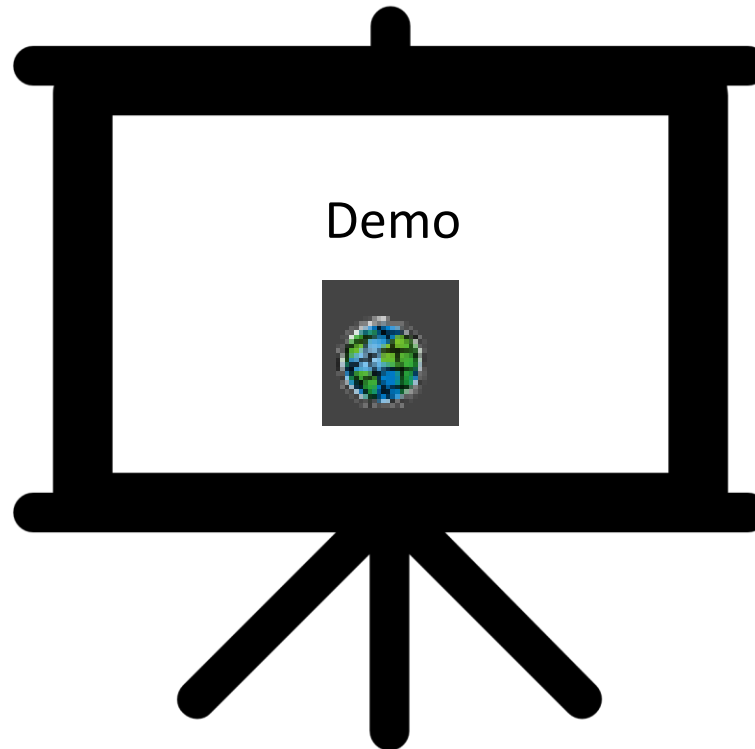


Create a custom *shape* or *GeoJson* file with a GIS software (ArcGIS Desktop, QGIS, ...)

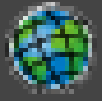
Publish and share the file in ArcGIS online as hosted feature layer

Look for the reference file and reuse it in ArcGIS for Power BI visual

Go spatial – ArcGIS



Use it or do not use it?



So what's your feeling with ArcGIS?
Do you think we can arrange anything good?

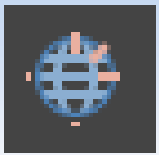
Yeah, I believe it's the mapping visual on which we should head. Not only you can have **full control on your map's layout**, but else you can **perform geospatial analysis** ...

I agree. To display geographical map we should rely on it.
Now, let's go on with the other tools to discover what else we can do for our reports.

... I know that is actually **in preview**, but I think it's the tool with most future improvements.
We only be aware that we need an **ArcGIS account** to create and add our customized layers.



Add some fun – Globe 3D



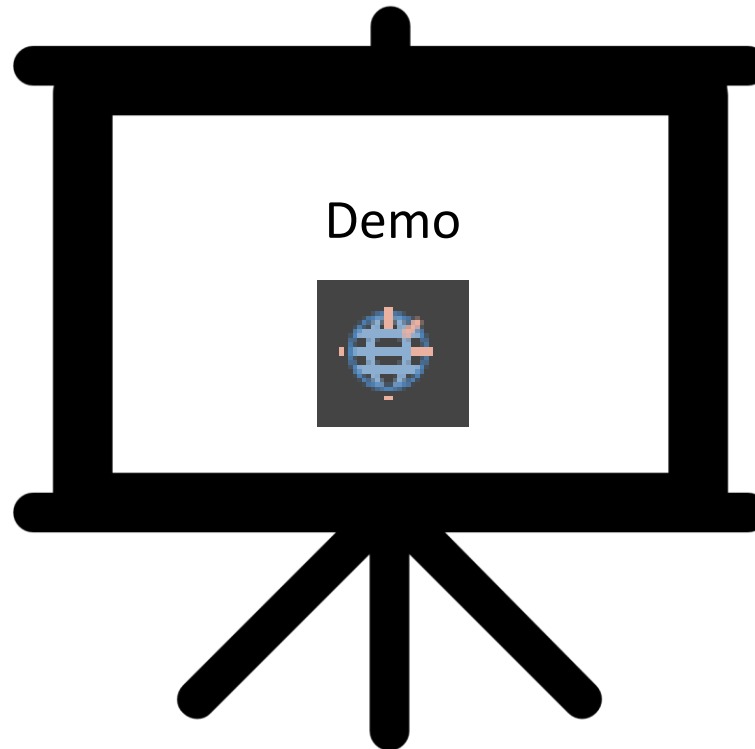
GlobeMap is a custom visual available in Power BI to represent data in 3D format.

With GlobeMap you can plot location with category values displayed as bar heights and heat maps. The 3D bars allow you to get instant insight and give an immediate perception of what data represents and its outliers.

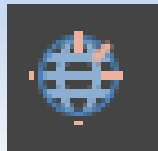
You can also rotate the Globe and see it from different angles.



Add some fun – Globe 3D



Use it or do not use it?



Now it's time to play! Do you agree using Globe map?

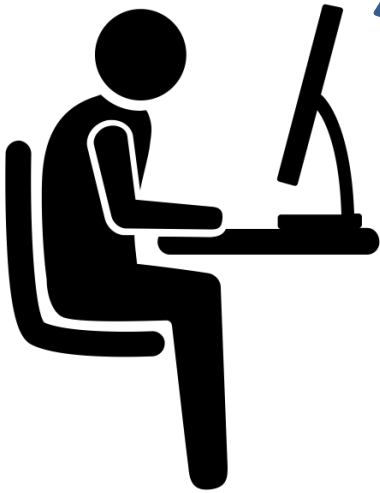
Oh yeah, we can add more fun to our reports. Globe map is **easy** to understand and can have a **stunning effect** on our users ...

... but remember that it's a different visual than Excel's Power Map. It's more **limited** and mostly, **isn't supported** in Power BI service.

Ok. I'll keep it in mind.

How about testing other custom visuals, to discover whether they offer mapping features?





R is the most common open source language for statistical computing and graphics.

R provides a wide variety of statistical and graphical techniques, and is highly extensible.

R scripts are fully supported in **Power BI**, offering the way to perform analytical and statistical analysis and to create compelling visuals.

The integration of R in PowerBI grants access to a rich array of data visualizations not present in the standard PowerBI set.

R is shipped with a huge number of packages for spatial data analysis and plotting.

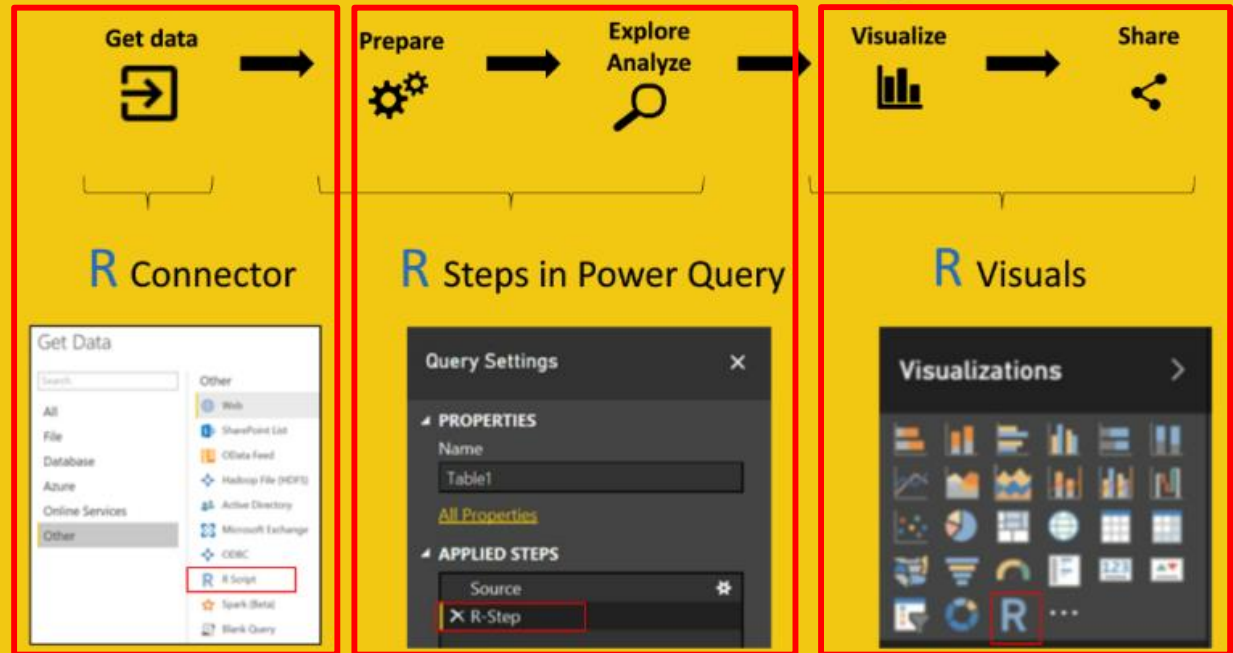
Many kind of maps (choropleths, map projections, topological maps, animated maps) and sketch options are available with R.

Power on display - R



With R in Power BI you can:

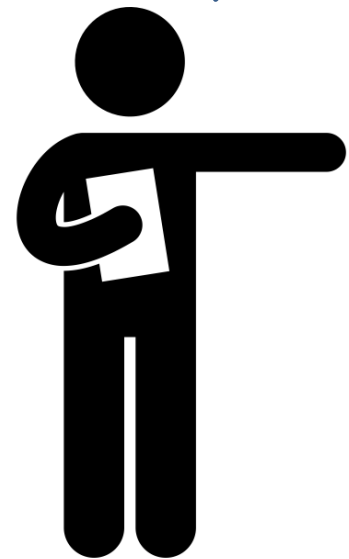
The R in Power BI Capabilities



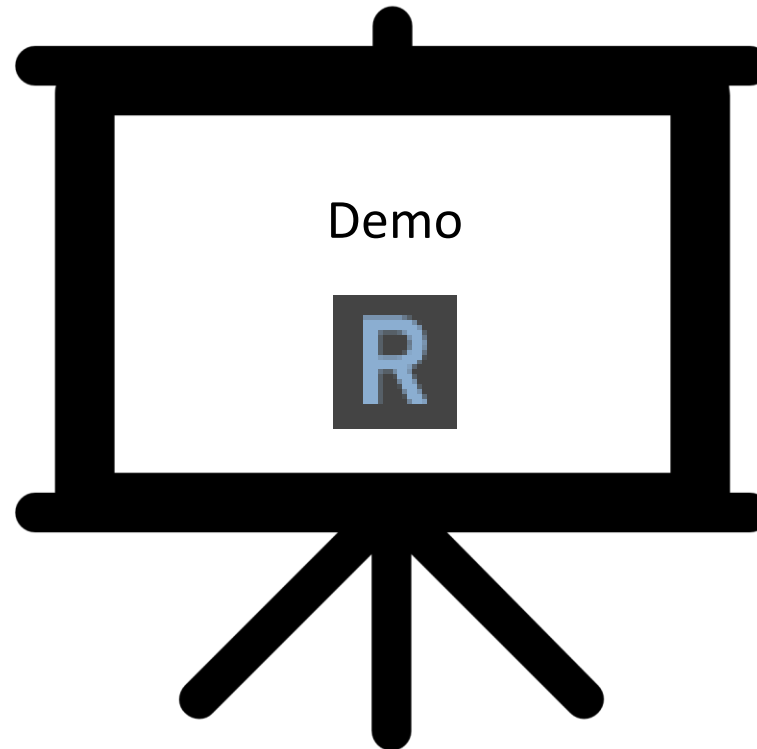
import data
using scripts

Cleanse and
transform data
sources, model,
shape, analyze data

Create charts, maps
and any kind of
interactive
visualization



Power on display - R



Use it or do not use it?

R

Wow R is awesome!
How many
interesting analysis
can we perform
now?

Totally agree, R is **pure
power** in your hands.
You have access to
many **analytics, plots,
charts, maps ...**

... but it's a
language.
**Learning it is
time-
consuming.**
And not all the
plots are
supported in
Power BI.

Well, I think we at
least can add one
or more charts to
our report.

Hey I've heard
about a new
released visual. Let's
take a look!



Show patterns – Flow map

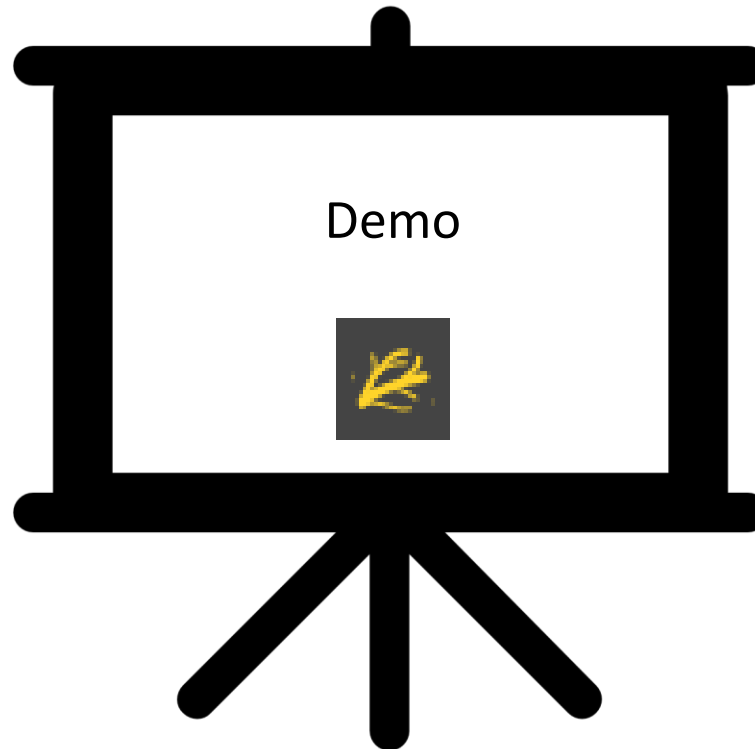


Flow map is a brand new visual (released on 1st of may!).

Flow traces paths on a map. A typical flow map, which contains one source and multiple targets, is visualized as a flow-style tree overlaid on top of a Bing map.



Show patterns – Flow map



Use it or do not use it?

R

Flow map looks very nice. Shall we use it?

Well the visual is **surprisingly easy to use**. We could think of replacing the same R visualization ...

... but it's the **first release** and it's based on **Bing maps**.

We'd better to wait for next releases with some improvements.

Good thinking.

While we're on the run, why don't fancy about what we could do with geocoding?



Make your own map – Synoptic panel



Synoptic Panel by OKViz is a custom visual that allows you to bound data to images such as geographic or plan map.

You can highlight some areas of an image, and color them to display data and other related information.

Synoptic Panel is powerful, flexible, and fully customizable. You can represent not only geographic maps, but also 2D images, such as a store plan, an airplane, a stadium etc.

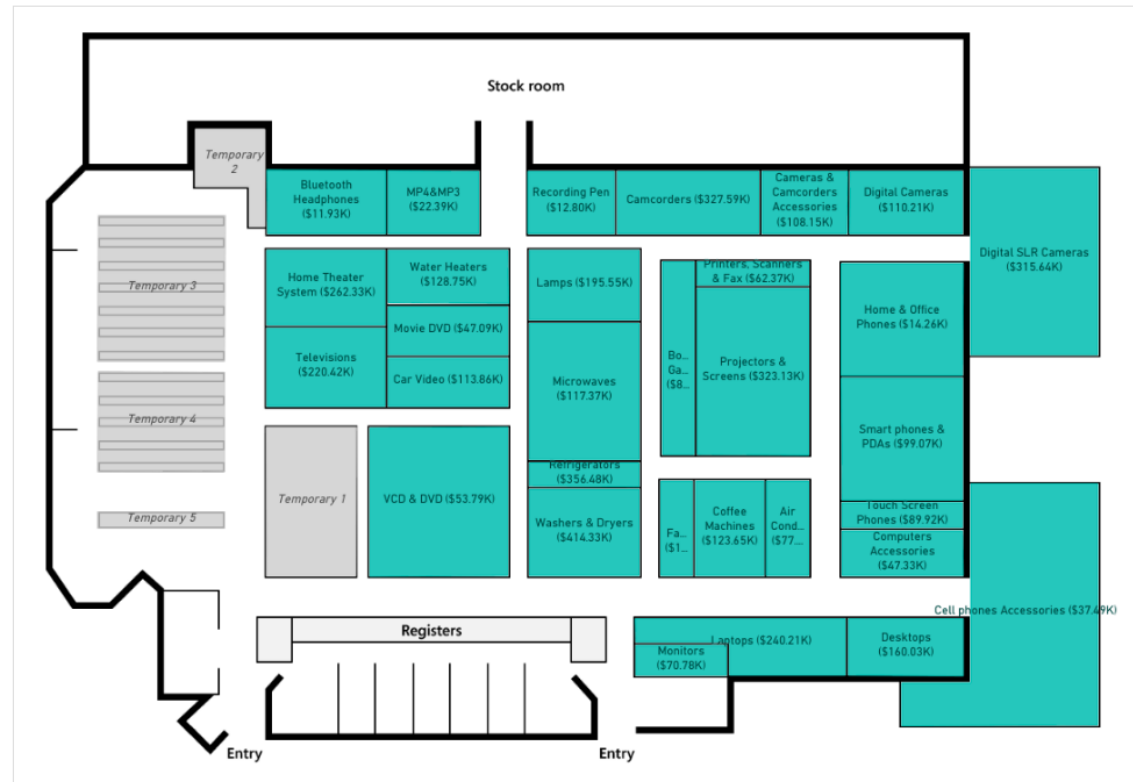
Every area is mapped and is linked to data for analysis and presentation purpose.

In 2015 Synoptic Panel has been voted by users as the **winner of the Power BI Visual Contest**, a competition for rewarding the best visual created straight from users.

Make your own map – Synoptic panel



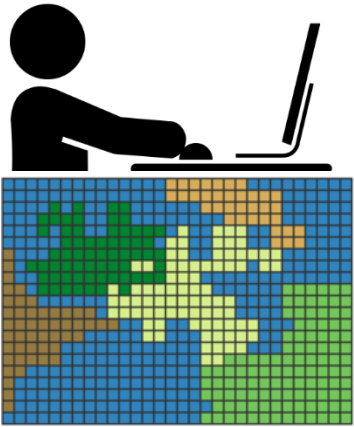
Here is how a
synoptic map looks
like



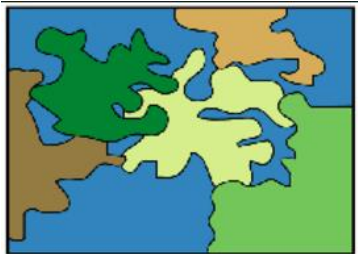
Make your own map – Synoptic panel



Before using the visual in Power BI you need to edit the map for defining the areas to highlight and assigning a unique name to each of them. There's an online tool called **Synoptic Designer** to accomplish this task.



If your map comes as a bitmap image you have to use Synoptic Designer.



If your map comes as a vector image (SVG, Scalable Vector Graphics), you can use either Synoptic Designer or a third-party tool that supports SVG files, such as Inkscape.

SYNOPTIC DESIGNER FOR POWER BI

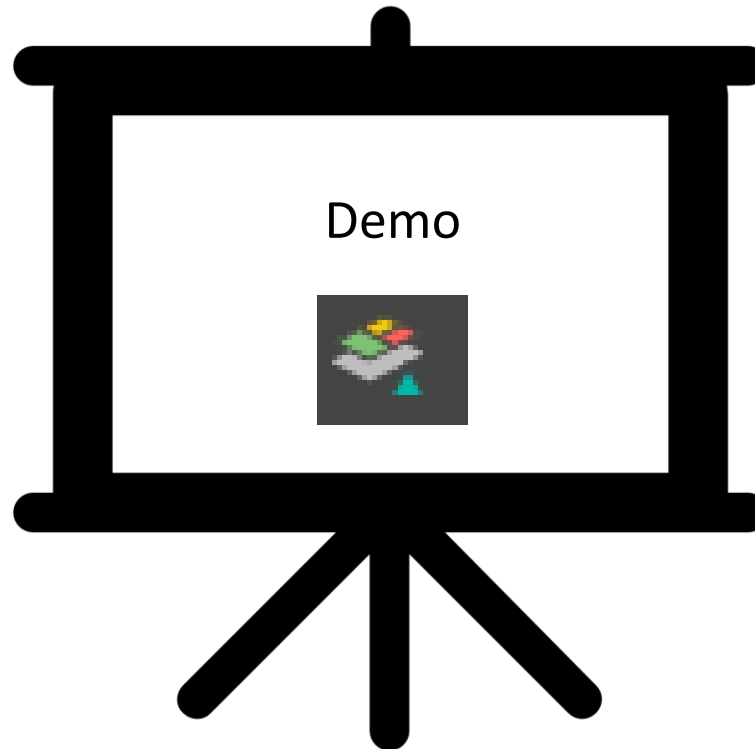
Synoptic Designer is the companion tool of **Synoptic Panel by OKViz**, grand prize winner of the first Power BI Best Visual contest. It allows you to draw custom areas over any map image and export it as SVG file to Power BI. Then, through our Synoptic Panel, you will be able to color the different areas based on your data.

EDITOR GALLERY



INKSCAPE

Make your own map – Synoptic panel



Use it or do not use it?



As you've seen with Synoptic Panel you can draw and display geographical maps too.

Yes, but I think we could make the most of the visual in another flavor. We can **customize every kind of image ...**

... even though the **preparation is time-consuming.**

But I think the result worths the effort.

Good thinking.

Keep on our research to other visuals.





Geocoding is the process of converting addresses into geographic coordinates, which you can use to place markers on a map, or position the map*.

With Power BI you can geocode addresses or reverse geocode coordinates, by introducing some workarounds. It isn't a native feature but in a little tricky way you can get the goal.

There are mainly two ways for geocoding in Power BI:

- **Custom functions**
- **R package**

*Source: <https://developers.google.com/maps/documentation/geocoding/intro>



Custom function

Get data from web in the form of a static Google geocoding API, or Bing Maps API

Remember that you need a *Google API/Bing Maps Key* (in the form of Free or Business license).

Create a **custom function in Power BI**. Once created, you can invoke the function by applying it to a dataset with some locations (addresses, cities, countries, etc.) For every row, the function calls the Google API and returns the geocoded coordinates.



Geocoding with R packages

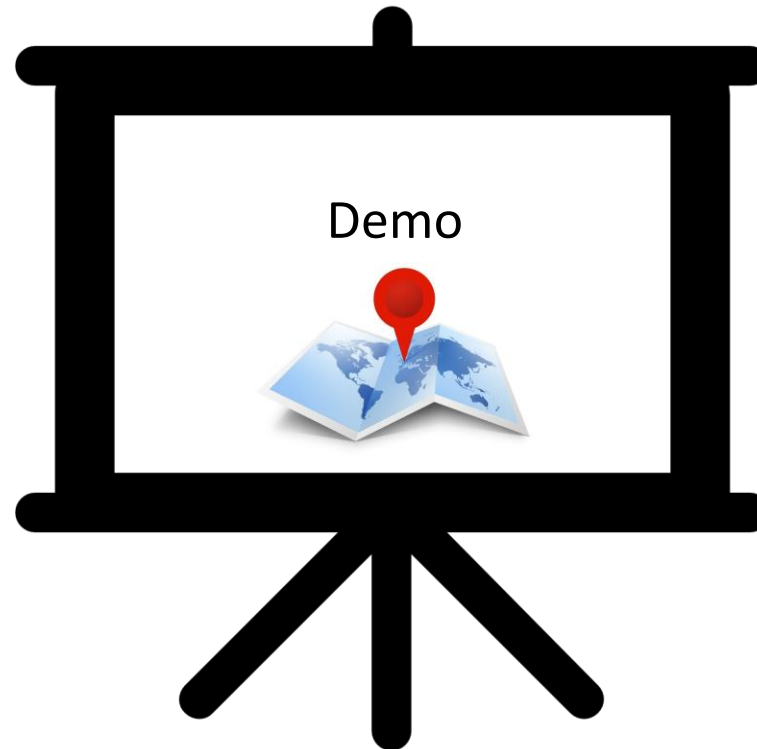
Many R packages offer geocoding features, usually with Google Maps. But other sources are available like, for example, Open Street Maps.

Call the API url into a function and get the result in a form of variables that you can use for plotting.



```
5 library(RCurl)
6 library(RJSONIO)
7 library(plyr)
8 url <- function(address, return.call = "json", sensor = "false") {
9   root <- "http://maps.google.com/maps/api/geocode/"
10  u <- paste(root, return.call, "?address=", address, "&sensor=", sensor, sep = "")
11  return(URLEncode(u))
12 }
13
14 geoCode <- function(address, verbose=FALSE) {
15   if(verbose) cat(address, "\n")
16   u <- url(address)
17   doc <- getURL(u)
18   x <- fromJSON(doc, simplify = FALSE)
19   if(x$status=="OK") {
20     lat <- x$results[[1]]$geometry$location$lat
21     lng <- x$results[[1]]$geometry$location$lng
22     location_type <- x$results[[1]]$geometry$location_type
23     formatted_address <- x$results[[1]]$formatted_address
24     return(c(lat, lng, location_type, formatted_address))
25   } else {
26     Sys.sleep(0.5)
27     return(c(NA, NA, NA, NA))
28   }
29 }
```

Geocoding



Use it or do not use it?



Geocoding isn't strictly «mapping», but it can help us in our analysis.

Absolutely; not only we can **mark points** to plot on our maps but also we can **calculate distances** to find patterns and bad habits from our employees ...

... but we usually **need a license** for business purposes.

It's an issue we have to face with the boss!

So we're at the end of our inquiry. Let's make the final report and present data to the boss.



The end – remember that your boss is never satisfied ...

We've prepared a report in Power BI with evidence of travels and costs.

Power BI offers many native mapping features, but we went beyond, taking advantage of the amazing visuals developed by the community.

Excellent!
You guys did a great job.
Now I can have a complete overview of our costs.
And the conclusion is that **we spend too much!!!!**

In the report we added:

- Shape map
- ArcGIS maps with reference layer
- Globe 3D visual
- R visuals
- Images from Synoptic Panel
- Some geocoded points



Thanks!
Dzięki!
Grazie!





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