Making Maps in Power BI

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• 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.

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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

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Series named «How to create geographic maps using Power BI» on www.sqlshack.com
Fancy a fictional group ...

290 Employees

16 Departments

Cosmo Group

- Bank of Andromeda
- Pegasus Asset Management
- Retail Bank of Zodiac
- Corporate Bank of Mensa
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.
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.
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

Demo
Use it or do not use it?

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

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

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

... 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.

I agree. We’d better to look for another solution.
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.
Here is how a shape map looks like
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, etc.), 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?

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.

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.
Go spatial – ArcGIS

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.
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?

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.

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 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 a 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?

Ok. I’ll keep it in mind.

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

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.
With R in Power BI you can:

- 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?

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 ...

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!

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

Demo
Use it or do not use it?

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.

Good thinking.

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

We’d better to wait for next releases with some improvements.
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.
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.
Make your own map – Synoptic panel

Demo
Use it or do not use it?

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

Good thinking.

Keep on our research to other visuals.

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.
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.
Geocoding

Demo
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 …

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

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

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