

# POWER BI CUSTOM VISUAL USING D3.JS

To have powerful business insights with charts and dashboards using Power BI Custom Visual with d3.js



Cognitive Convergence

<http://www.cognitiveconvergence.com>

# ABOUT US

Cognitive Convergence is a recognized expert that provides:

- ✓ Cognitive Convergence is Subject Matter Expert in Office 365, Dynamics 365, SharePoint, Project Server, SAAS, Power Platform: Power Apps-Power BI-Power Automate-Power Virtual Agents.
- ✓ Cognitive Convergence combines precision, extensive experience, expertise, and in-depth industry knowledge and provide wide range of custom visuals

Our team create custom visuals for Power BI using Typescript and d3.js and is able to

- ✓ Develop custom visuals for Power BI using the custom visuals SDK—an open-source, command-line tool.
- ✓ Test, debug, and package custom visuals
- ✓ Get custom visuals certified by Microsoft.
- ✓ Publish visuals on Marketplace.

**Current Location:** Lahore, Pakistan

**Planned Front-end Office:** California/Washington States- USA



# WHY POWER BI

A set of methodologies, processes, architecture and technologies that transfer raw data into meaningful and useful information used to enable more effective strategic, tactical and operational insights and decision making

- ✓ Cognitive Convergence leverages their expertise to offer services to develop custom visuals that give an amazing and user friendly customized visualization
- ✓ Cognitive Convergence use its expertise to develop breathtaking custom visuals in .pbviz file format. These Custom Power BI visuals are develop to meet visualization requirements beyond what is available today.

Microsoft Power BI provides nontechnical business users with tools for

- Aggregating
- Analyzing
- Visualizing
- Sharing data



# D3.JS



- ✓ D3.js is a JavaScript library for manipulating documents based on data.
- ✓ D3 helps bring data to life using HTML, SVG, and CSS.
- ✓ D3's emphasis on web standards gives the full capabilities of modern browsers without tying to a proprietary framework, combining powerful visualization components and a data-driven approach to DOM manipulation.
- ✓ D3.js is a JavaScript library of objects to produce sophisticated, interactive, dynamic data visualizations using modern web-based technologies.
- ✓ D3 is the connection point between a user interaction and the data underneath.

# POWER BI CUSTOM VISUAL

Cognitive Convergence leverages their expertise to offer services to develop custom visuals that give an amazing and user friendly customized visualization. Cognitive Convergence use its expertise to develop breathtaking custom visuals in .pbviz file format. These Custom Power BI visuals are develop to meet visualization requirements beyond what is available today.

Power BI provides a wide range of custom visuals. These visuals can be used by organization or by third parties. Power BI custom visuals provide the ability to create a new visuals that can be added to a report that are not included out of box.

Existing visuals developed by the community are available in the marketplace, or can be added from a file. There are over 200 existing visuals in the marketplace.



# WHY DEVELOP CUSTOM VISUAL

01

Build a unique expertise in the BI solution providers Domain.

02

Meet complex requirements of developer and data needs

03

Enrich Solution Portfolio

04

Eye catching reports and dashboards  
- Go beyond the basic built-in visuals.

05

These visuals can be used to develop rich reports, insights and interactive dashboards.

06

Provide flexibility to implementation of advance customization

07

Provides great deal of flexibility in terms of formatting, visual elements, and capabilities

08

Become right fit to graphical representation of your data

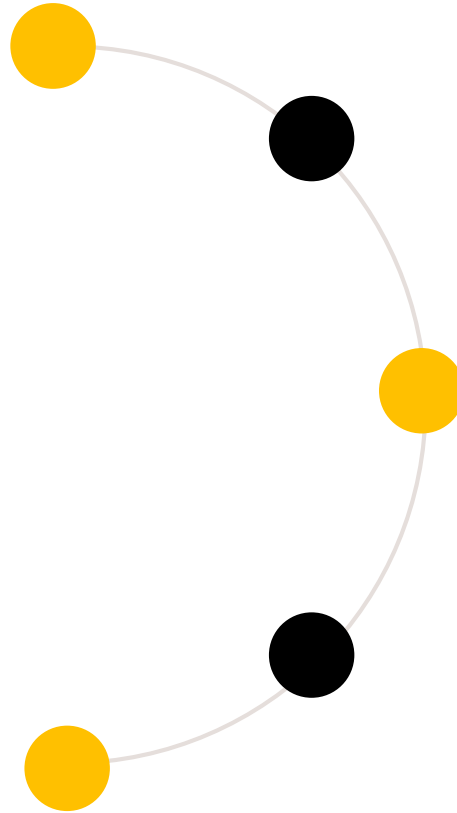
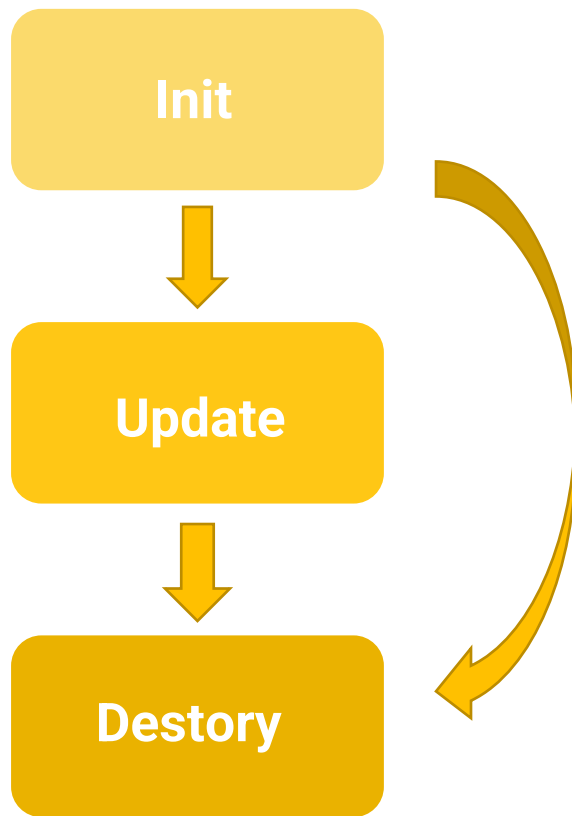
09

Meet advance and complex requirements of data representation

10

Power BI visuals are packages that include code for rendering the data served to them

# CUSTOM VISUAL DEVELOPMENT **LIFECYCLE**



## **Init**

The init method will be called in the beginning. The options parameter to get an Html element which visual will going to be rendered in. This is where all initial setup work for the required visual output.

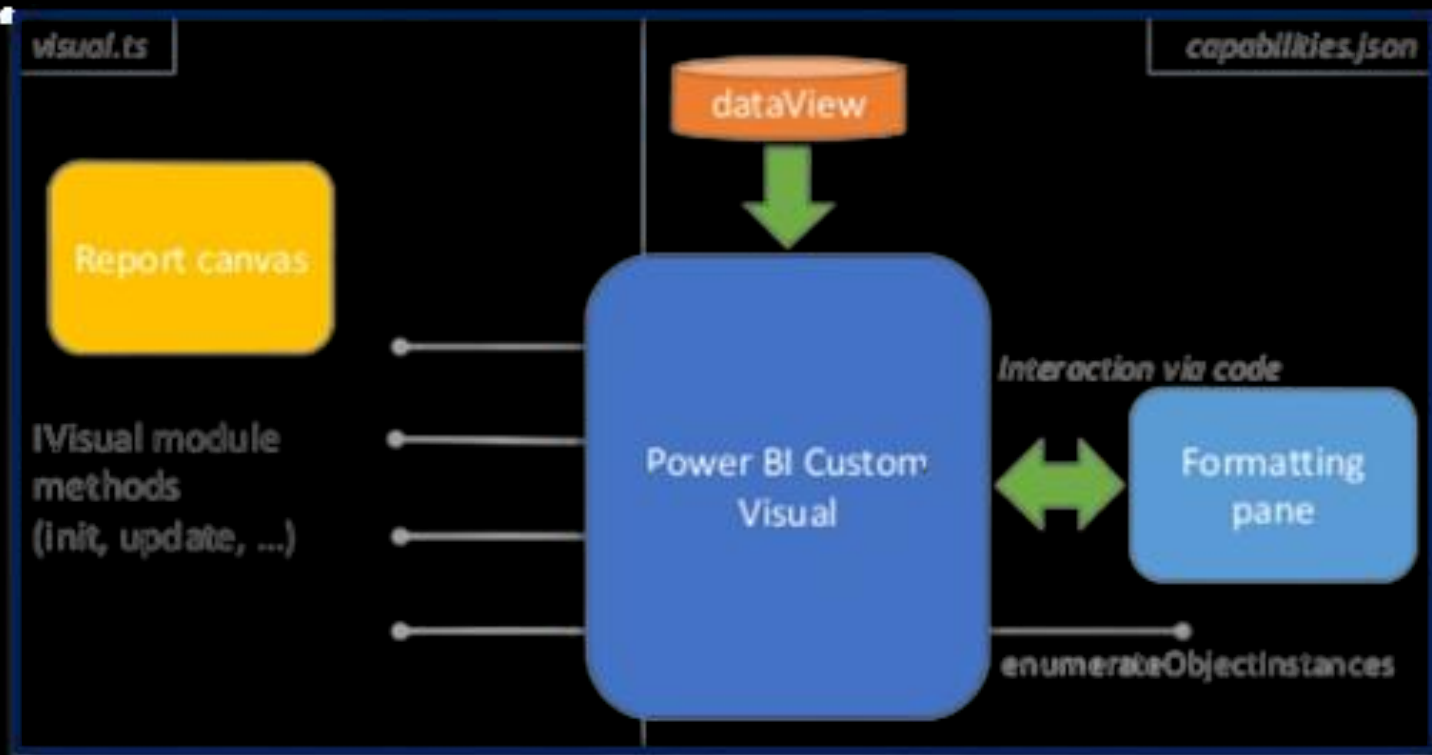
## **Update**

Update method will be the where the main logic will be implemented on. This VisualUpdateOptions parameter will contains the data for the visual and the viewport. Data will be passed in a form of a DataView.

## **Destroy**

Destroy method will be called when our visual is been removed from the view. This might be useful to deallocate any unused resources when which are no longer required.

# SOLUTION ARCHITECTURE OF POWERBI CUSTOM VISUAL



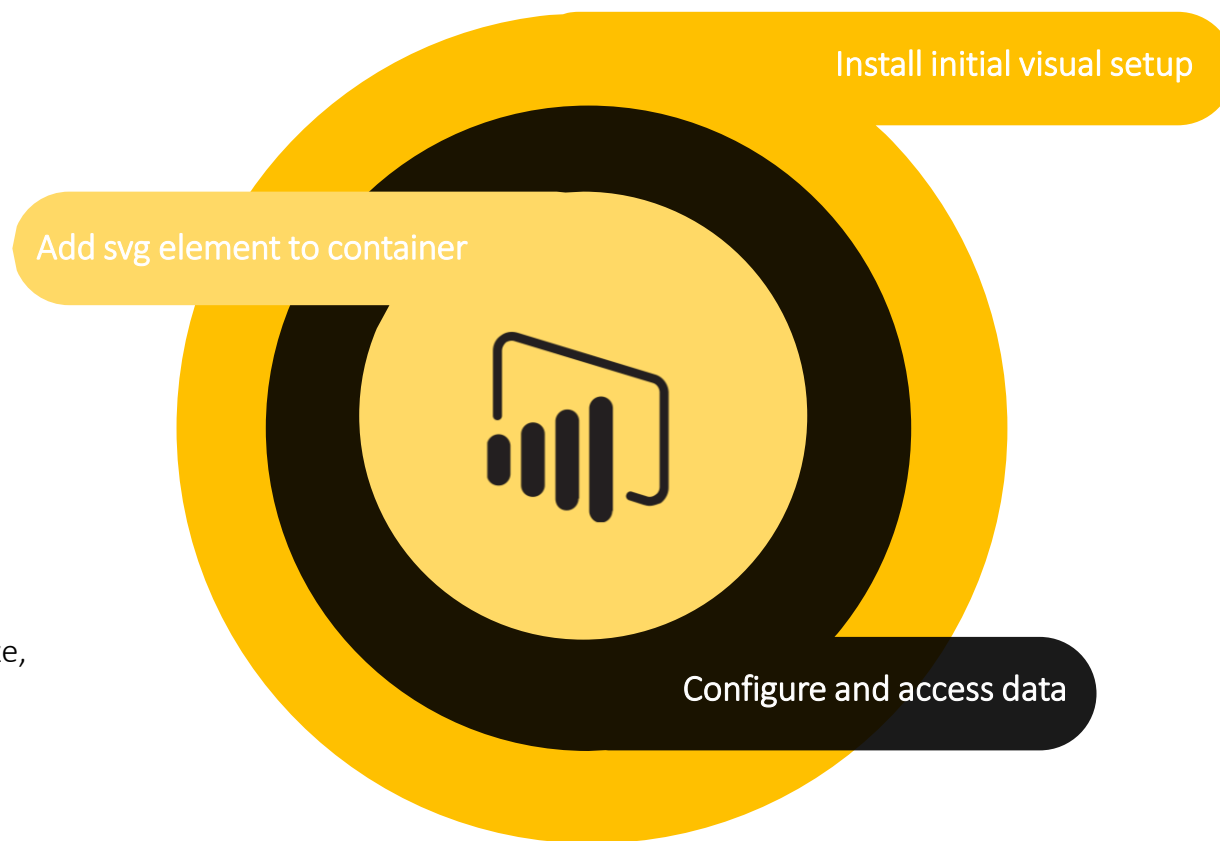
## ❑ Project

- **.vscode** (contains the VS code project settings)
  - **launch.json**
  - **settings.json**
- **assets** (contains the icon.png file)
  - **icon.png**
- **node\_modules**
- **src** (contains the visual's source code)
  - **settings.ts** (code of the visual's settings)
  - **visual.ts** (visual's main source code.)
- **style**
  - **visual.less** (holds visual styles)
- **capabilities.json** (allows the visual to declare supported features, objects, properties, and data view mapping)
- **package-lock.json**
- **package.json** (contains information about the project )
- **pbviz.json** (contain information about project)
- **tsconfig.json** (configuration file for typescript)
- **tslint.json** (file contains the TSLint configuration)



# CUSTOM VISUAL DEVELOPMENT USING D3.JS

- Install Power BI visual API tools and libraries.
- Configure data and manage dataRoles and dataMappings
- This data is accessed through dataview and use in visual.
- The visual is added and the constructor event runs. This adds the div element to the canvas (this.container).
- When any change happens in the report page - that can be a resize, data change, cross filter or other interaction, the update event in visual is fired.
- The update method adds a child svg element to the div added in constructor.



# D3.JS ELEMENTS FOR VISUAL DEVELOPMENT



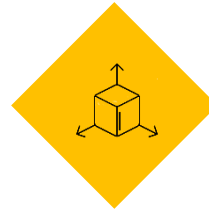
## Library

- ✓ Ensuring that d3 is loaded in our visual by importing it in code
- ✓ This d3 use to add new element to the container



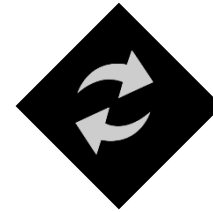
## Visual Container

- ✓ SVG is a way to render images
- ✓ Select the SVG container using the select() method and inject the SVG element using the append() method.
- ✓ Add the attributes and styles using the attr() and the style() methods
- ✓ Add the attributes and styles using the attr() and the style() methods



## Dimensions of Visual

- ✓ Visual need to define margins and then sets the usable width and height of the chart based on a container size of 460 x 460 pixels.

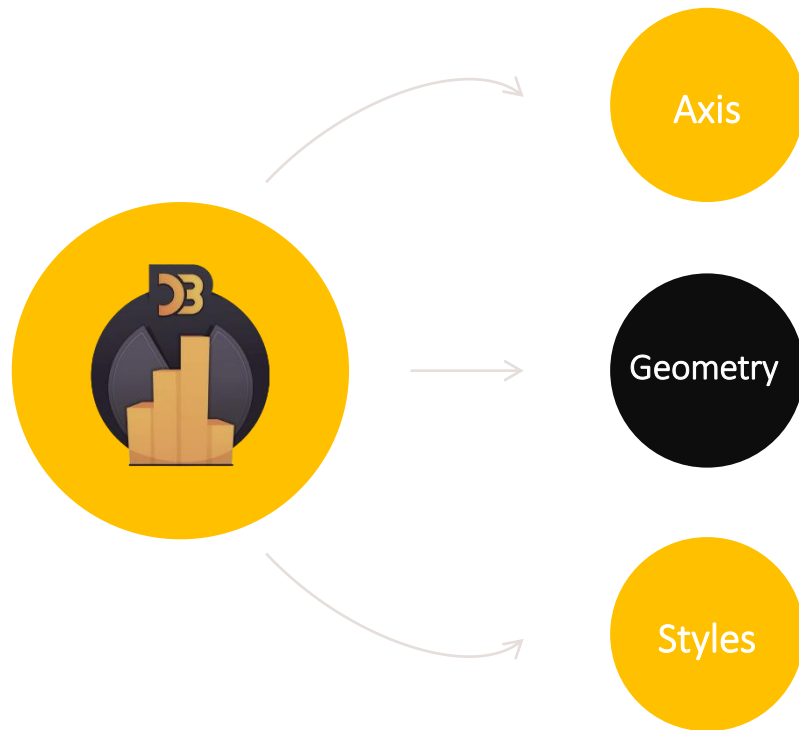


## Update method

- ✓ In update function the visual container and canvas is managed.
- ✓ For a variable size container, options, viewport object is used in visual's update method to dynamically size container.



# OTHER D3.JS VISUAL ELEMENTS



## Axis

- The axes renders human-readable reference marks for scales.
- Graphs have two axes: the horizontal axis or the x-axis and the vertical axis or the y-axis. D3 provides functions to draw axes.
- An axis is made of lines, ticks and labels.
- An axis uses scale, so each axis will need to be given a scale to work with.

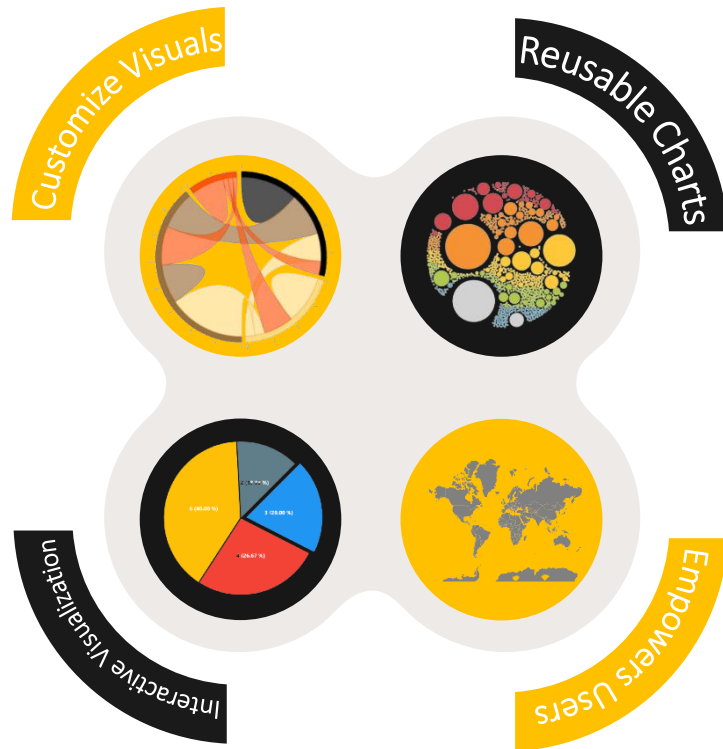
## Geometry

- SVG needs absolute positions with respect to the origin.
- Along with width and height, location where these elements would be located on screen also need to be provided. For this transformation is used called translate.
- It essentially provides position coordinates for the elements relative to the origin.
- Other transform definitions are scale, rotate, skewX, and skewY.

## Styles

- When it comes to styles, classes are used to give styles to elements.
- SVG has a <text> element that can be used to display text output.
- Fill is used to apply colors.
- text-anchor is used to position text towards the right end of the bars.

# USE CASE OF CUSTOM VISUAL WITH D3.JS



## Data Visualization

- D3.js most successful library comes in that already tells half of the story when we start developing the code for it.
- Storytelling with customized and visualizations the most crucial use case can also be achieved with d3.

## Reusable charts with D3.js

- Reusable code that can be used again in other visualizations
- Instantiate the chart more than one time, as chart visualizing chart with different datasets.
- Source code of charts can be easily be refactored by other developers according to different needs
- We need to modify only the appearance and behavior of the graph without changing the code

## Interactive visualizations

- D3.js interactive and beautiful visualizations help in the fantastic narration of data.

## Customize Visuals

- D3 is not a graphics library or a data processing utility. Instead, it could be considered a bridge between the two.
- Interactive visualizations can make plain and boring datasets impressive.
- It allows users to select specific data points to visualize the story in the way they choose

## Separates Power BI from the Competition

- With Power BI, D3 is at the heart of the visual and layered on top of it.
- Whether deployed in Power BI Desktop or in the PowerBI.com Service, it becomes much easier for users and developers to take advantage of the new capabilities.

## Empowers Users

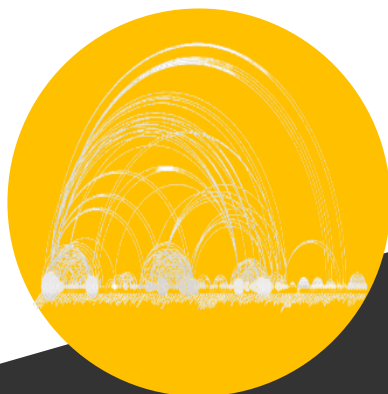
- D3.js created Power BI visuals can also be packaged as a "pbviz" file and distributed privately outside of the Gallery.
- It puts greater control in the hands of users.
- D3 stands out due to its adaptability, ease of use

# POSSIBILITIES OF POWER BI CUSTOM VISUAL WITH D3.JS

Interactivity



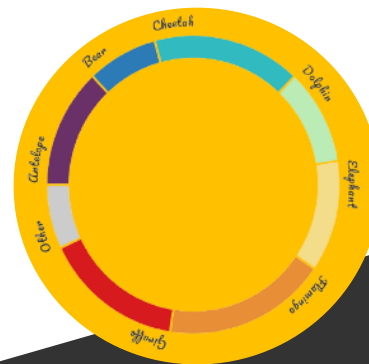
Hierarches/Analysis



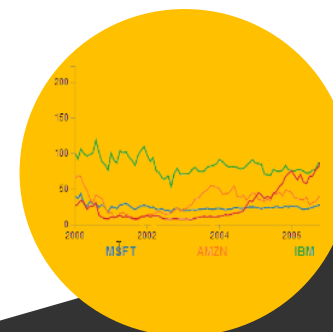
Maps



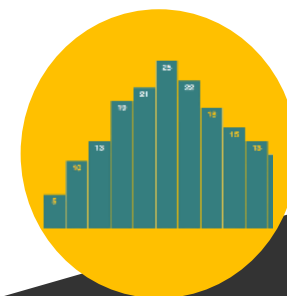
Radial/Circle

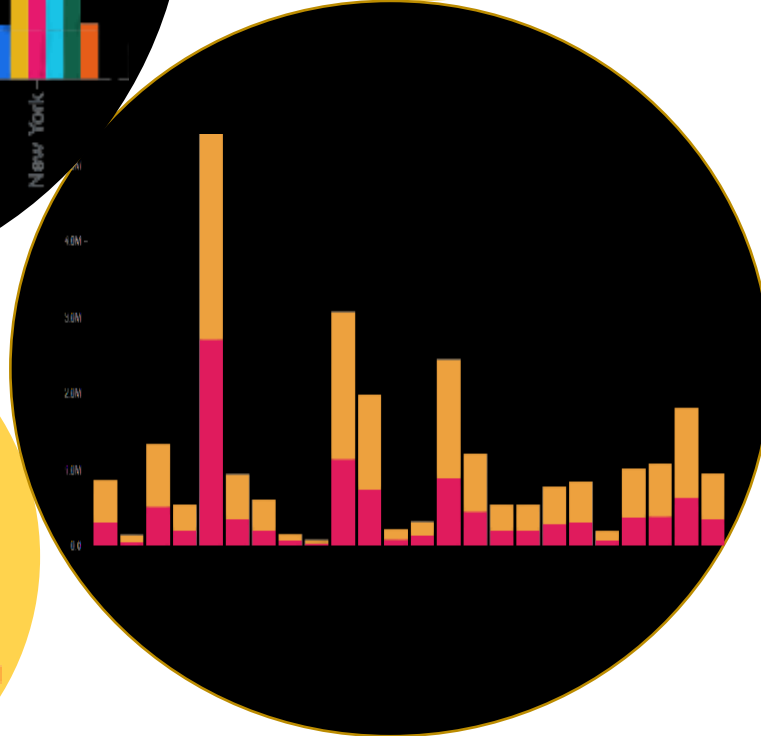
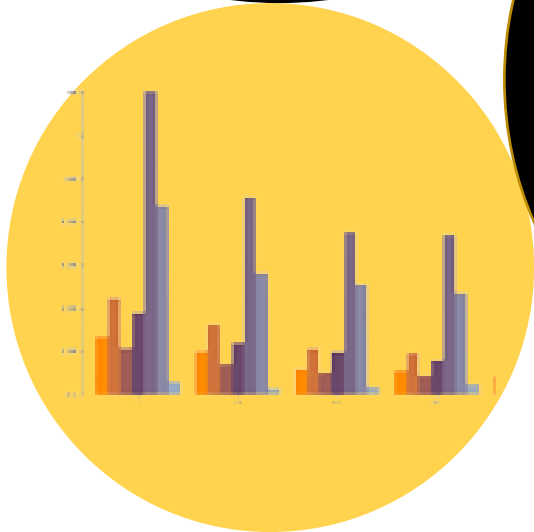
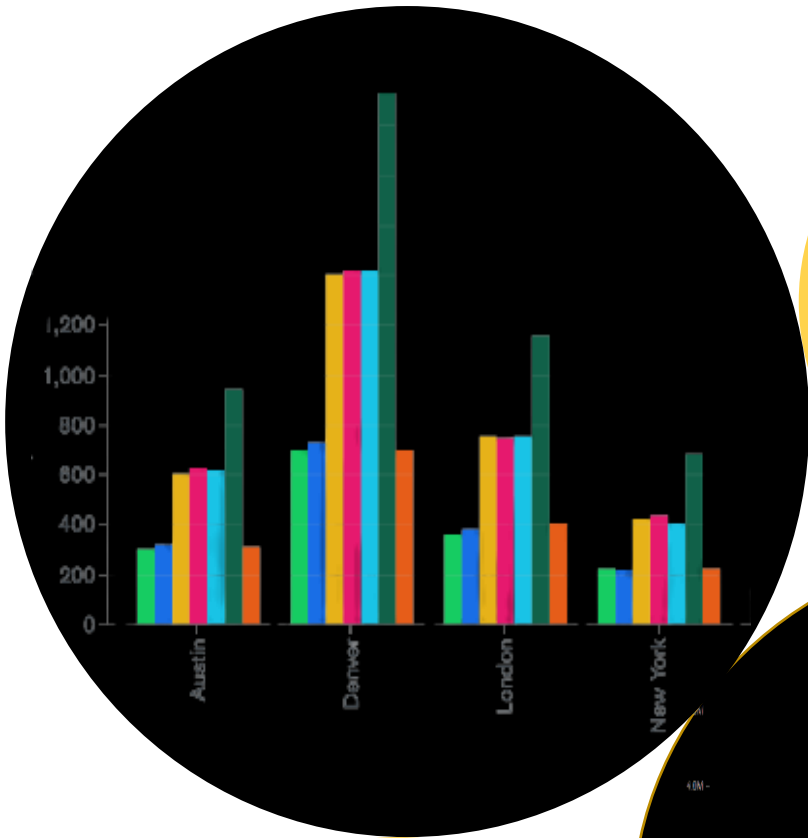


Area/Line



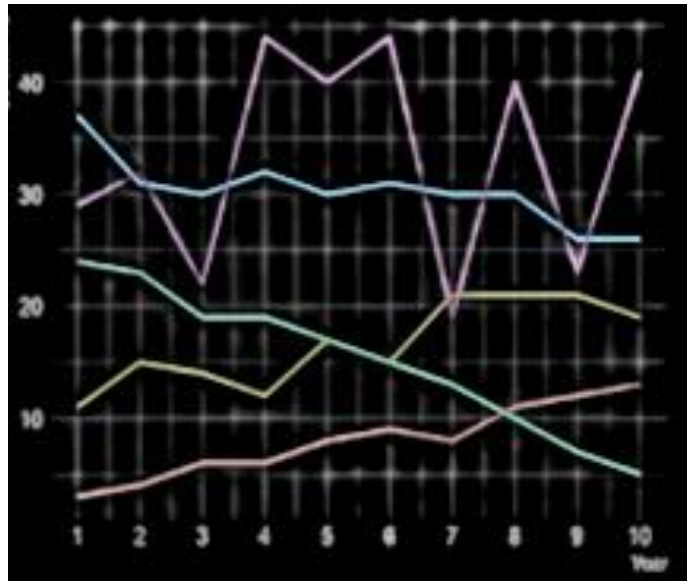
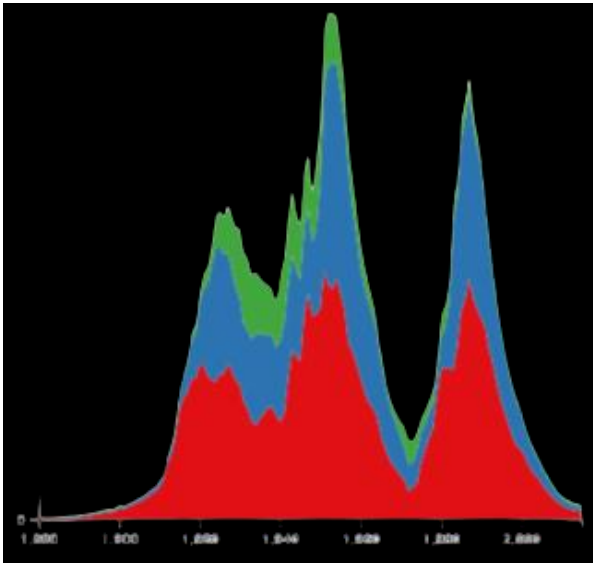
Bar





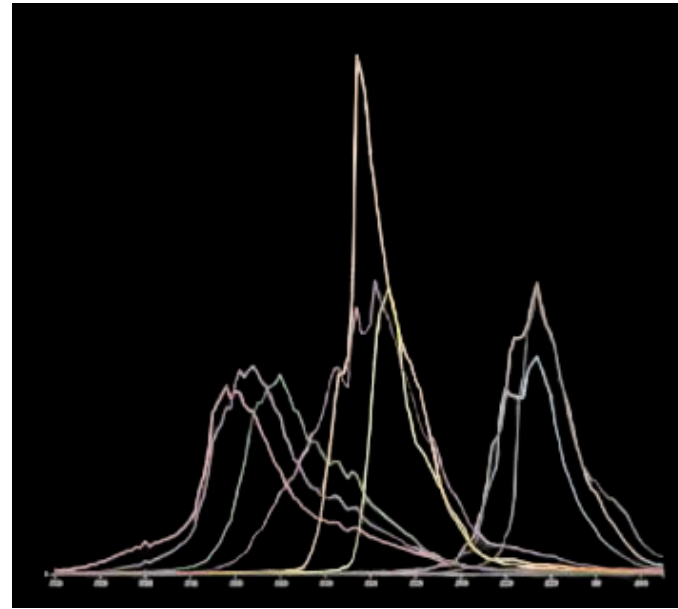
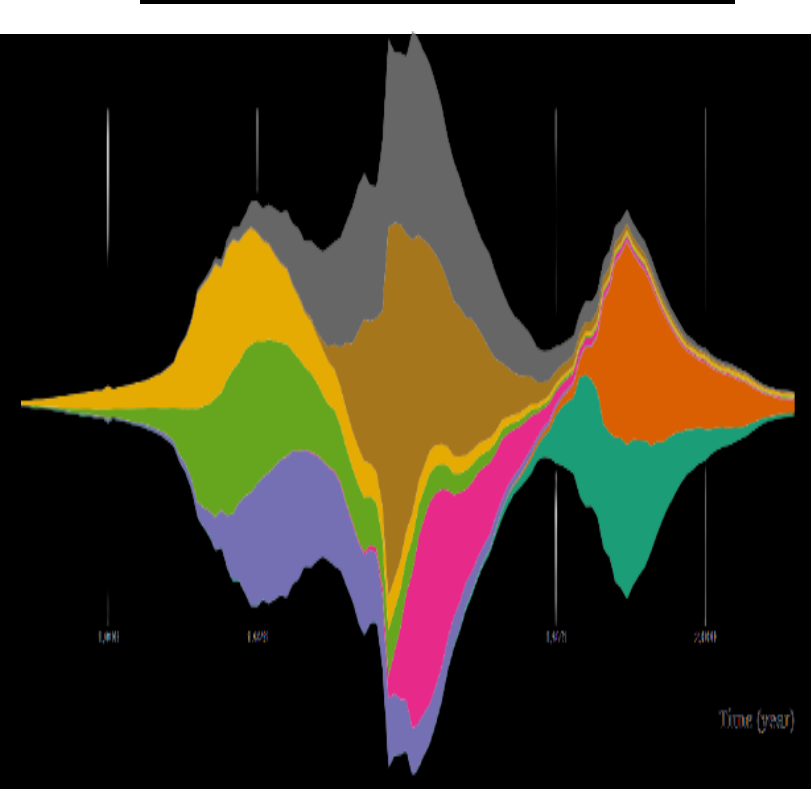
# D3.JS BAR CHART

➤ Bar charts are one of the most commonly used types of graph and are used to display and compare the number, frequency or other measure for different discrete categories or groups.

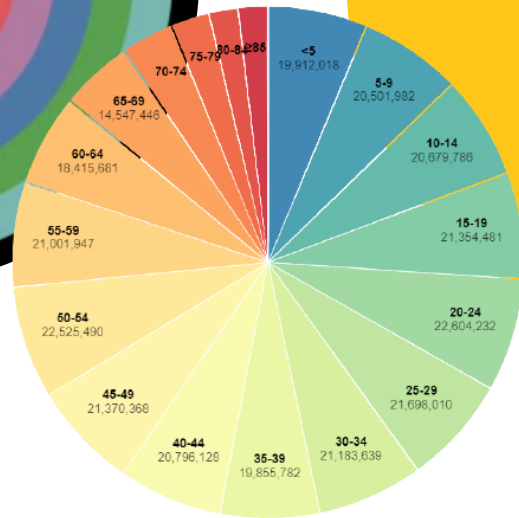
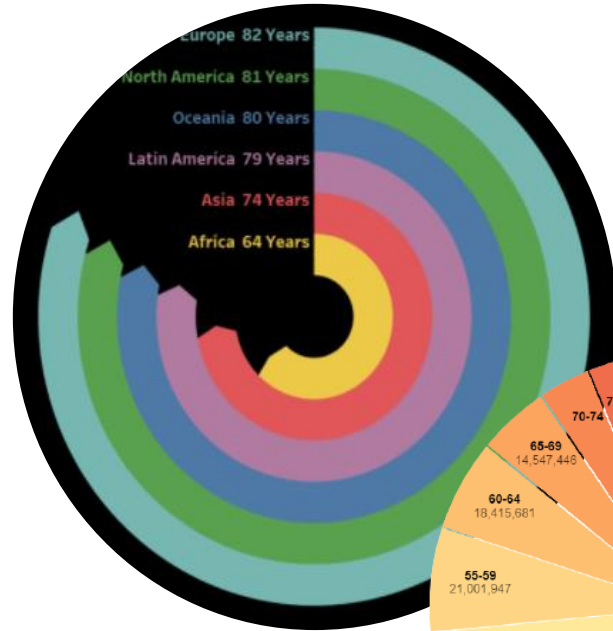


# D3.JS AREA/LINE CHART

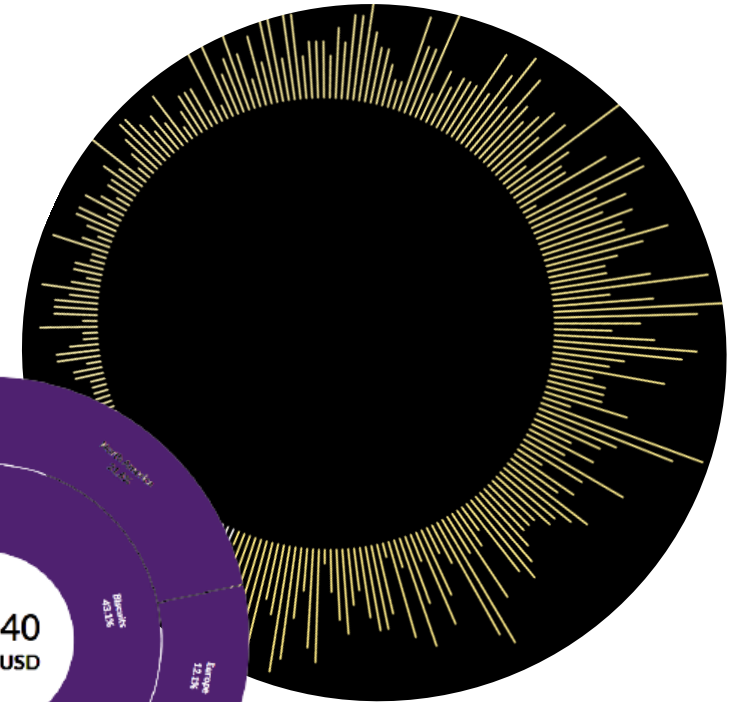
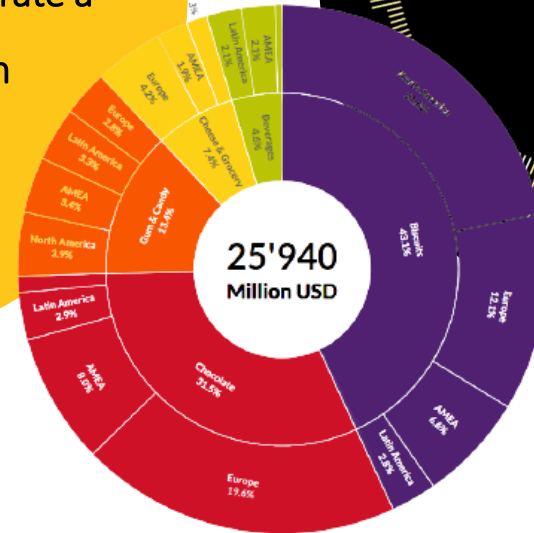
- A line chart or area chart displays the evolution of one or several numerical variables. Data Points are connected by straight line segments.
- Area chart represents the evolution of numeric variable. Data points are connected by straight line segments and the area between the x-axis and the line is filled with color and shading.



# D3.JS RADIAL CHARTS



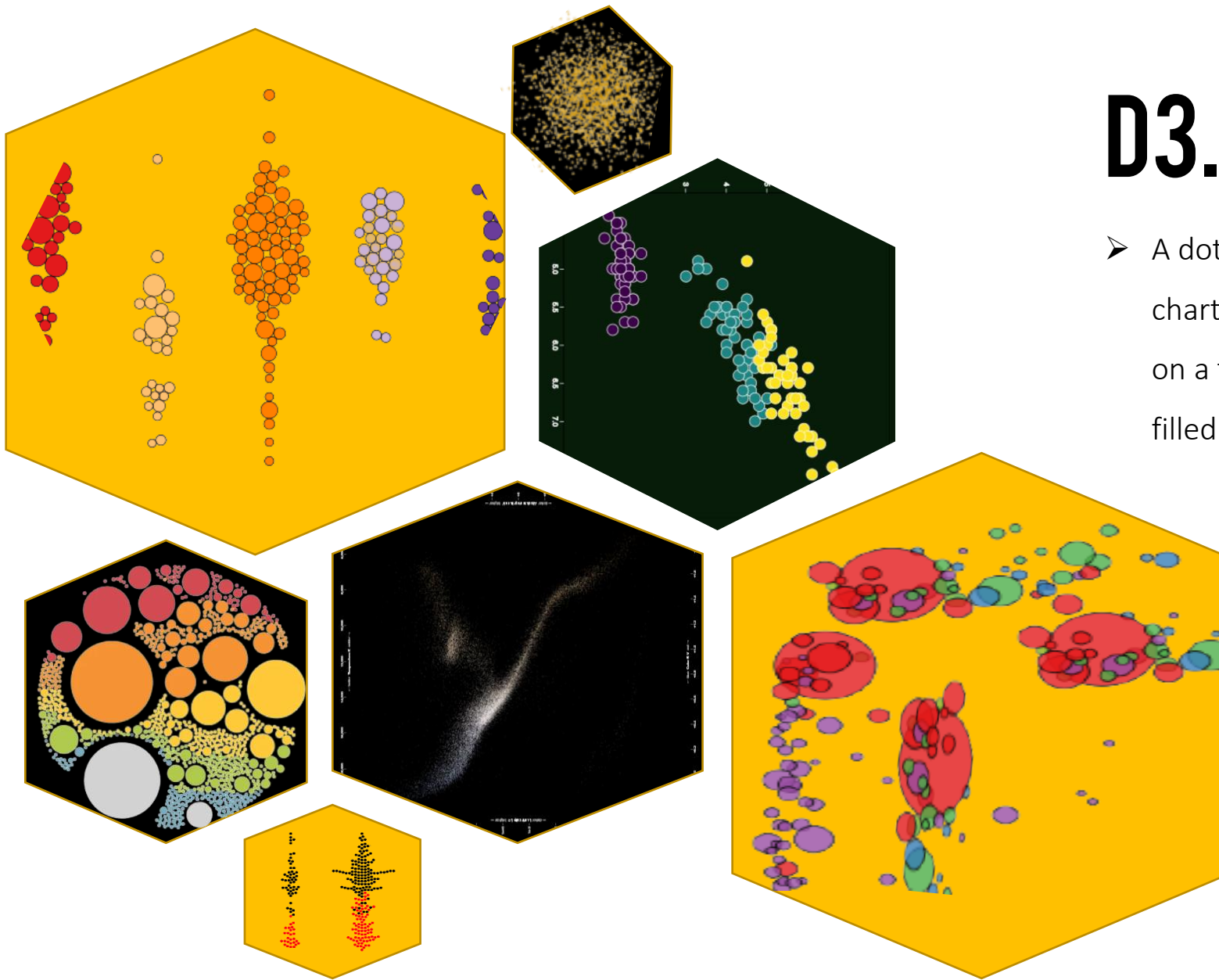
A Radial chart is a circular statistical graphic, which is divided into slices to illustrate a numerical proportion





# D3.JS DOT CHART

- A dot chart or dot plot is a statistical chart consisting of data points plotted on a fairly simple scale, typically using filled in circles



# D3.JS MAPS



Choropleth map



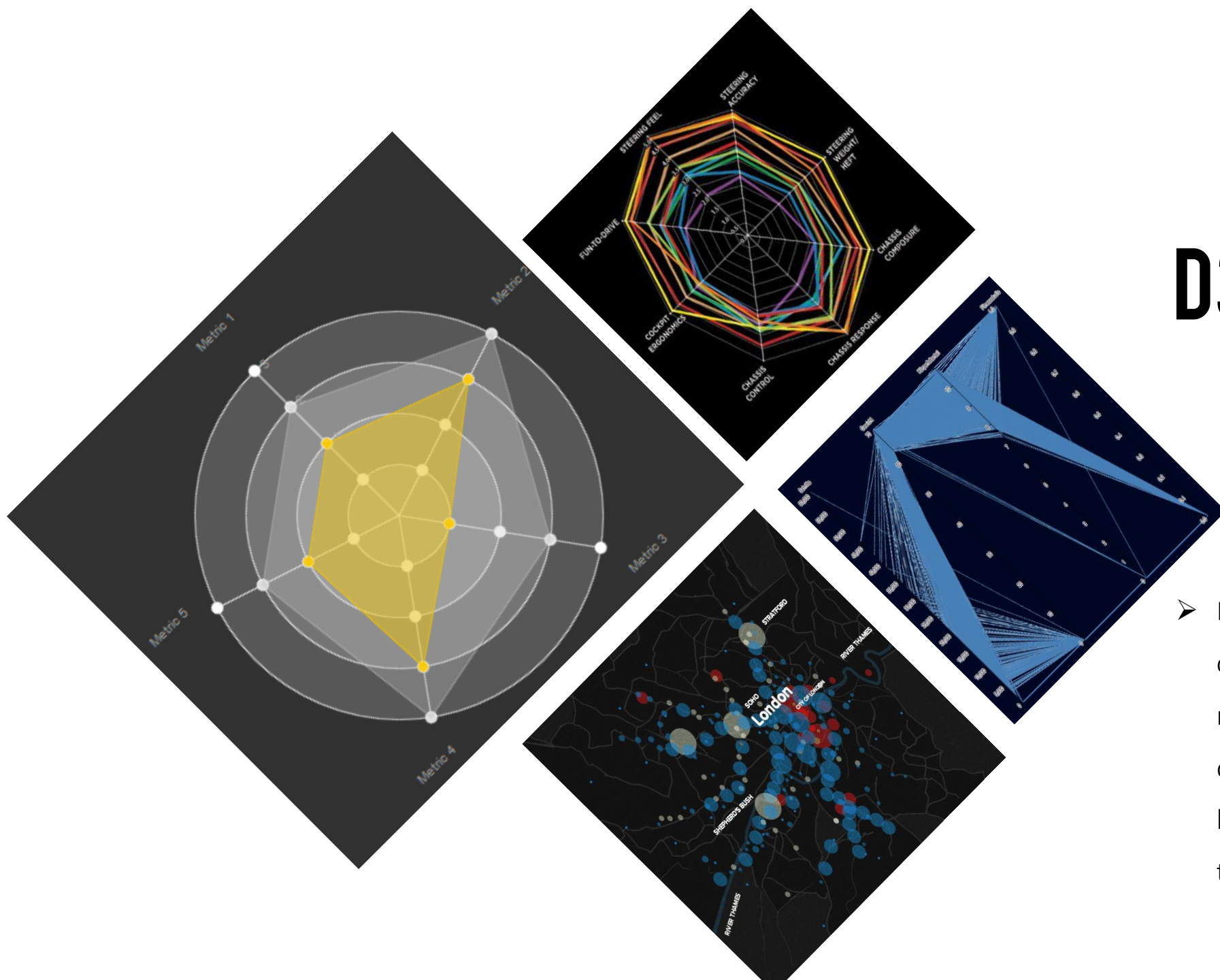
Hexbin map



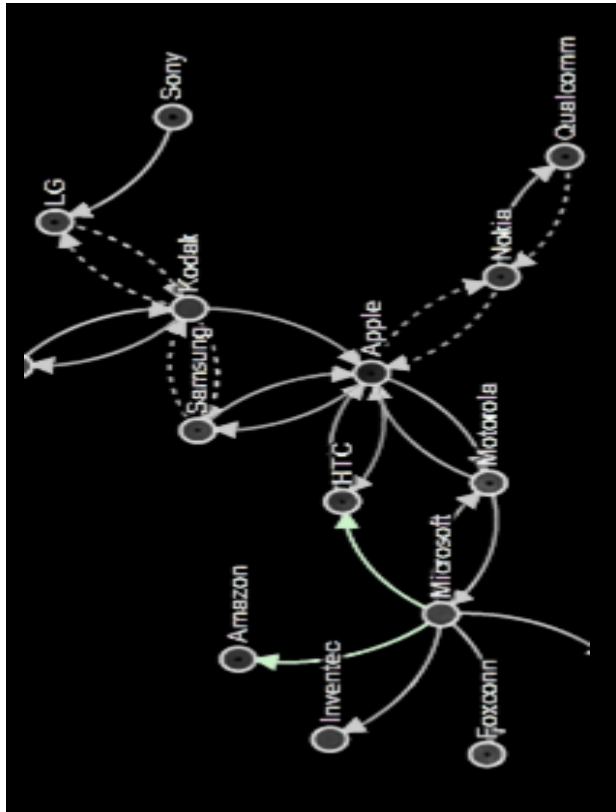
Choropleth

# D3.JS RANKING CHARTS

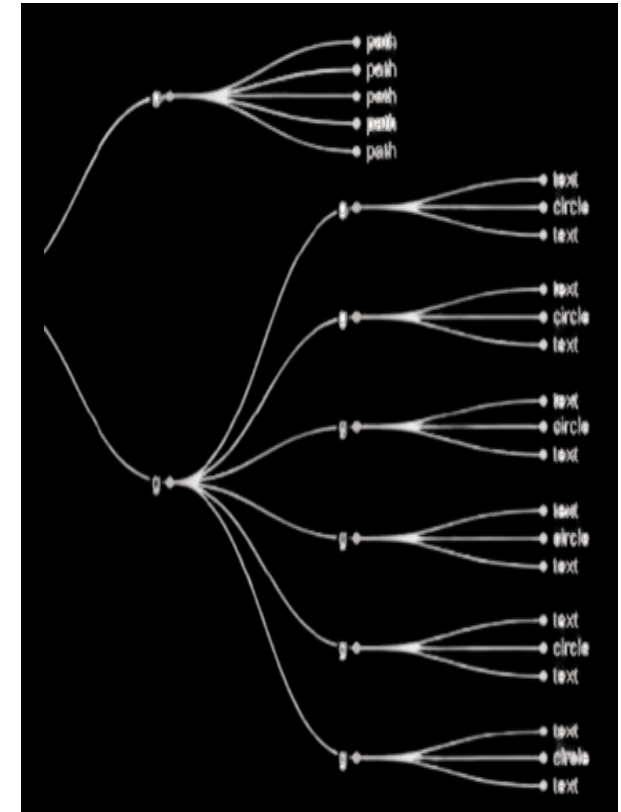
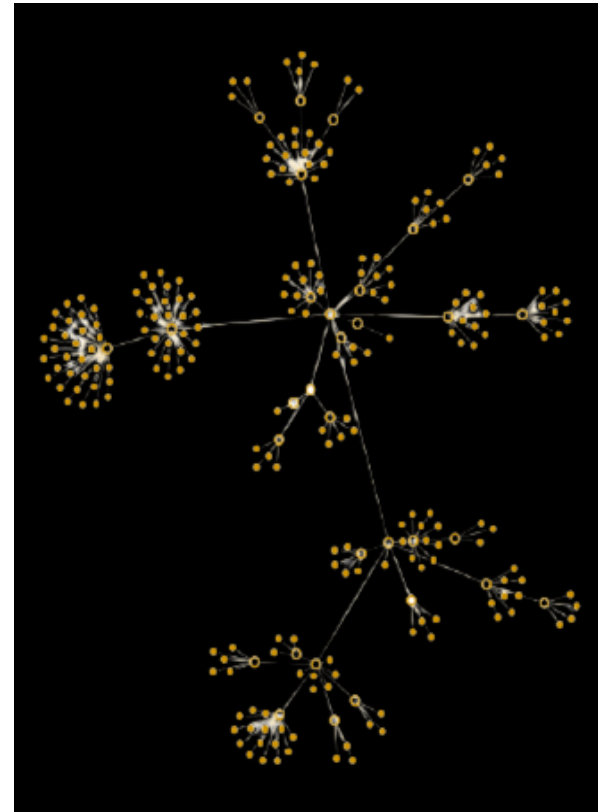
- Ranking chart is two-dimensional chart type designed to plot one or more series of values over multiple quantitative variables. Each variable has its own axis, all axes are joined in the center of the figure.



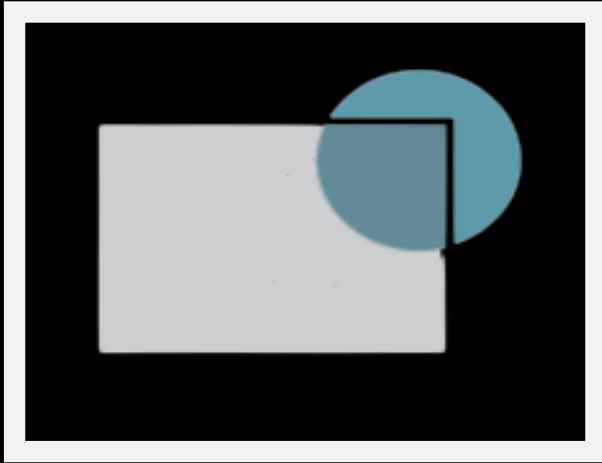
# D3.JS HIERARCHES



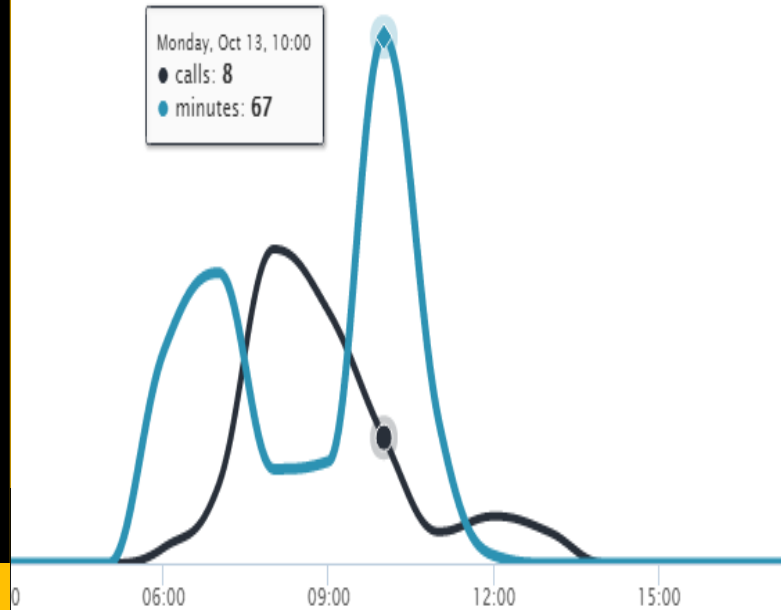
D3 supports hierarchical data, too, with popular layouts such as treemaps, tidy trees, and packed circles. And you retain complete control over how the data is displayed.



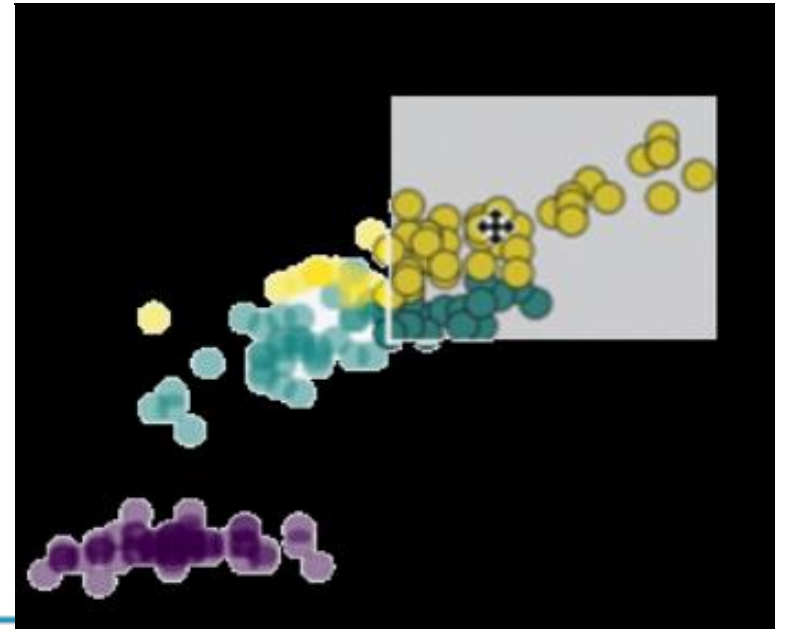
# D3.JS INTERACTIVITY



A post on the basic of brushing with d3.js.



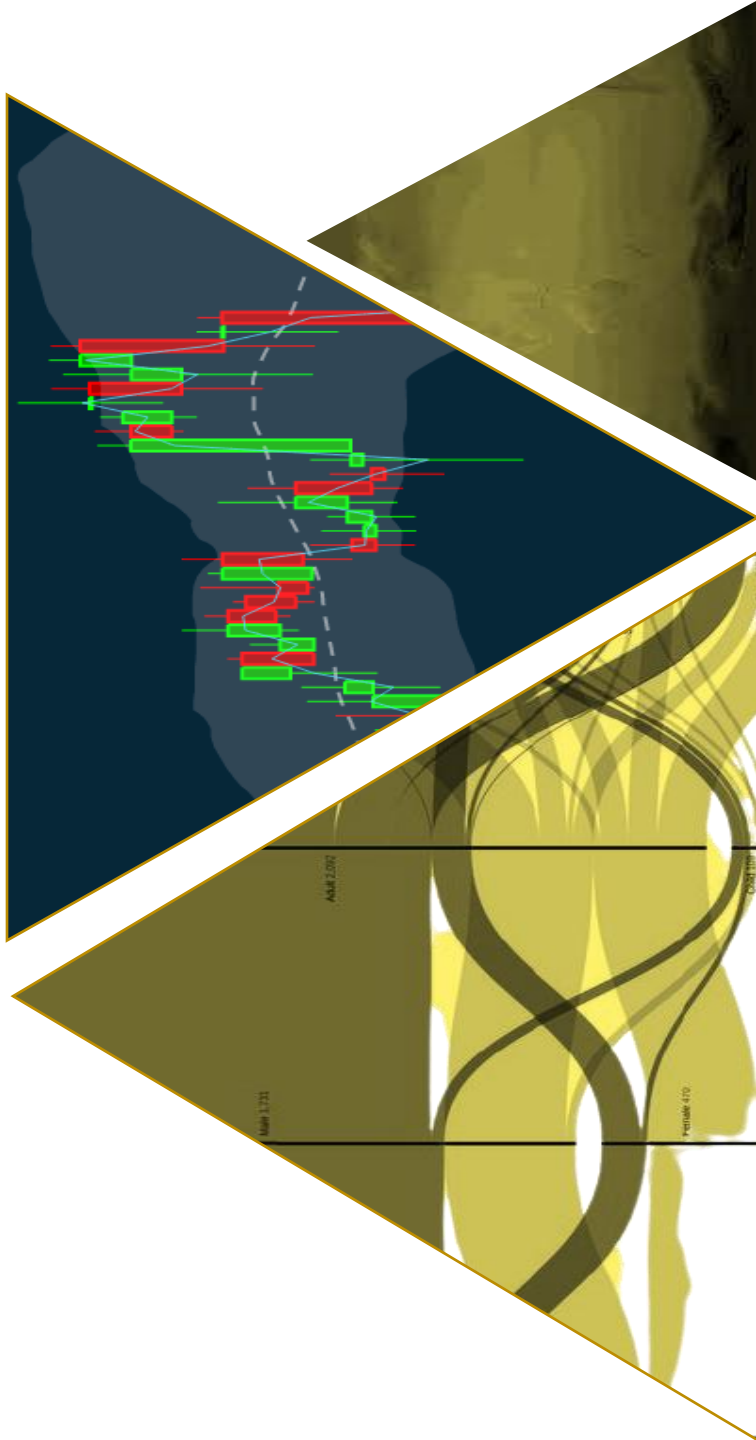
Interactive d3.js Line  
Chart to show data plots



Zooming on  
selected Area

# D3.JS ANALYSIS CHARTS

- D3 is for more than visualization; it includes tools for quantitative analysis, such as data transformation, random number generation, hexagonal binning, and contours via marching squares.





# D3.JS ADVANCED CHARTS

- Advanced charts describe implementation of charts in order to improve the look of d3.js chart. It does not target any particular chart type, but give general examples about axis legends, colors, annotation, small multiple and more.



# POWER BI CUSTOM VISUAL – D3.JS

## PUBLISHED TO APPSOURCE

### Custom Visual Approval

- Submit pbviz file, return manifest file for AppSource listing
- Manual process, general 2-3 business days
- Tested against Chrome, Firefox, Edge, and Internet Explorer, Microsoft Power BI Desktop
- Tested to provide expected behavior
- After approval support Power BI is a moving target

### Custom Visual Licensing

- Enable licensing to Power BI Custom Visual that call Rest API
- Validate key and thus allow only authorized users to use custom visual.
- IAP visuals offer optional in-app purchases for advanced features.
- Necessary capabilities are added to allow the user to input a license key that is provided offsite through a licensing/mechanism.

### Custom Visual Certification

- Microsoft Appsource approved
- Custom visual is written with Versioned API 2.5 or higher.
- Code repository available for review
- Uses only public reviewable OSS components
- Does not access external services or resource.



# THANK YOU

Cognitive Convergence combines precision, extensive experience, expertise to provide Power BI Custom Visual with D3.js which provide breathtaking business insights and all that visual development lifecycle and possibilities are discussed. You can contact at following for consulting services

Shahzad Sarwar  
Cognitive Convergence

<http://www.cognitiveconvergence.com>

