

# Data Visualization

# Introduction

GIS and Spatial Data Center  
University of Maryland Libraries

# GIS Services in the Libraries

- **Workshops**

- 10 offerings now, more in the works (Remote Sensing, Python, R, and more)

- **Consulting, Collaboration**

- **Guest lecturing – bring your class in!**

- Lectures/labs can be customized for your class

- **GIS lab open for use during Library hours (4120)**

- Can also be reserved

- **Access to free online tutorials and software trials**



# Add'l Research Services

- **General research assistance**
    - Proposals, ORAA requirements, presentations, etc.
  - **Data management**
  - **IT consulting for grant writing**
  - **Statistical consulting**
  - **3D scanning and printing; video editing**
  - **Funding for open access publishing**
  - **See [www.lib.umd.edu/rc](http://www.lib.umd.edu/rc) for more information**
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# Workshop Outline

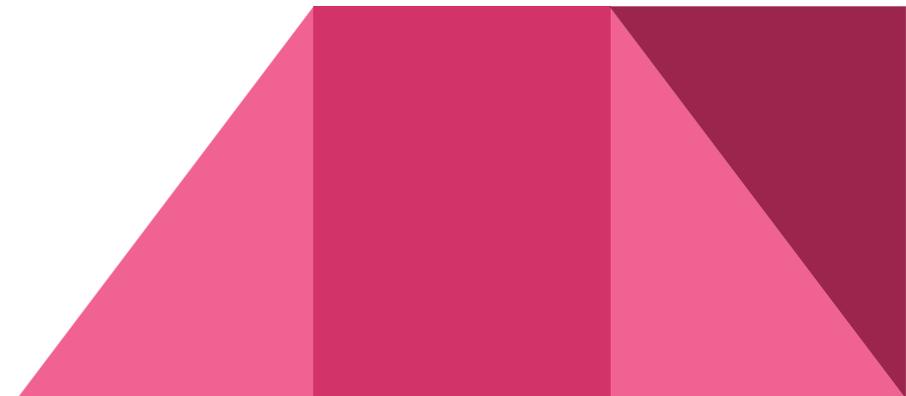
## 1. Presentation

- Data Visualization(What, Why)
- Data Vis Tools Introduction

## 2. Exercise

- Tableau Public
- Gephi
- Plot.ly
- RAW
- Carto
- Infographics Exercise

## 3. Q&A?

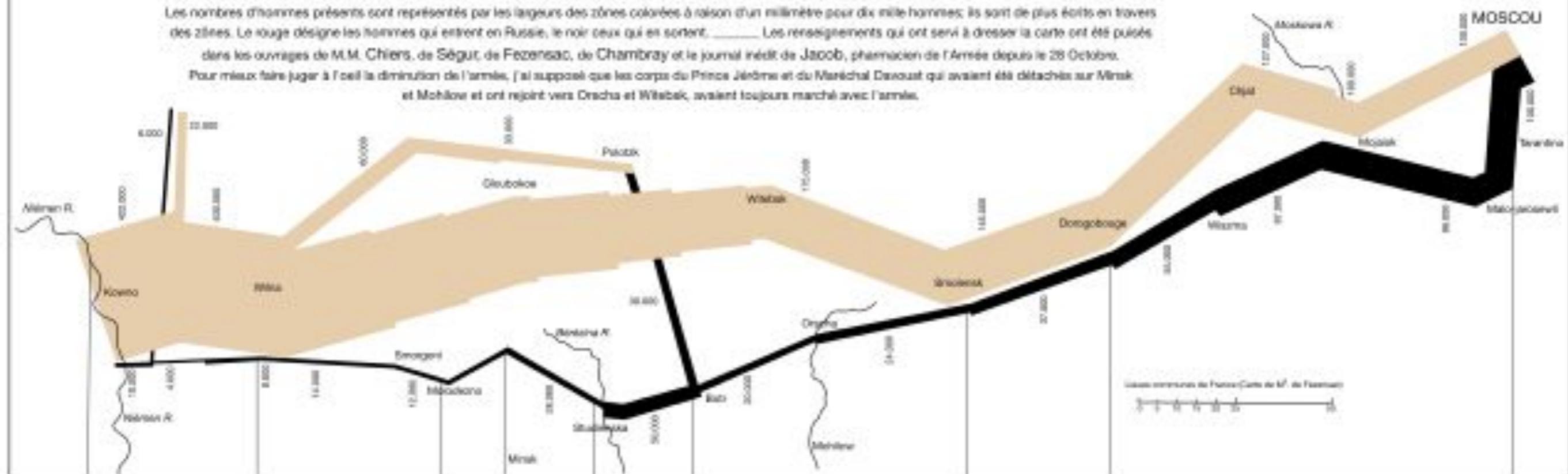


# The first data visualization

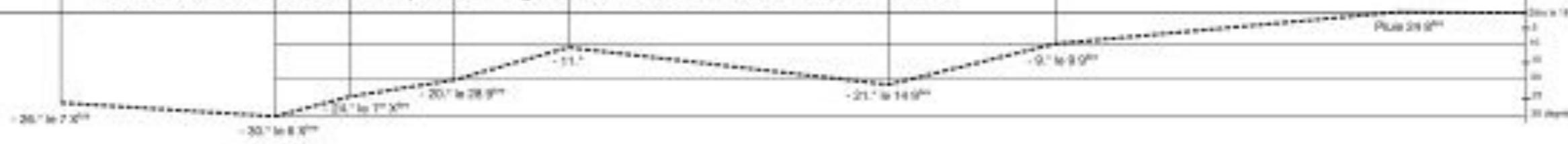
## Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite. Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Chiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.



## TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Imprimé par Pagnerre, à Paris, 31-Mars 1870 à Paris.

[Visualisation CC-BY-SA de [www.gutenberg.org/files/20110/20110-h/20110-h.htm](https://www.gutenberg.org/files/20110/20110-h/20110-h.htm) 2011]

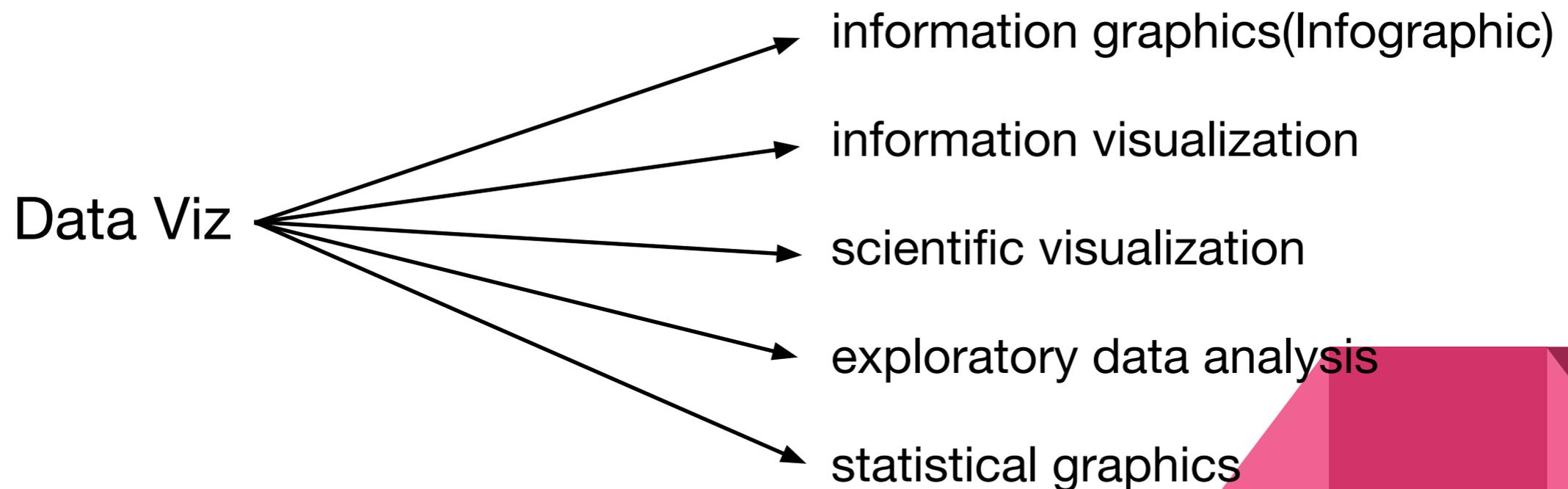
Imp. Loh. Pagnerre et Co.

# More about First Data.....

- The figurative map of [Charles Joseph Minard](#) (1869) shows the path of Napoleon's troops across the Russian Empire of Alexander I.
- Using amazingly simple and modern graphical codes, this map displays the progress of the troops in the form of a stream whose width indicates the size of the "Great Army", which will dramatically decrease throughout the campaign
- Although it is reasonable to ask whether this Figurative Map of the successive losses in men of the French Army in the Russian campaign 1812-1813 is indeed a "data visualization" (in itself, it is a drawing that summarizes information)

# What is Data Visualiz(s)ation

- **View** by many disciplines as a modern equivalent of visual communication.
- It involves the creation and study of the visual representation of data, meaning "information that has been abstracted in some schematic form, including attributes or variables for the units of information"

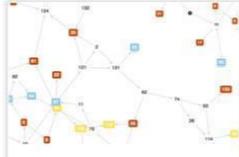
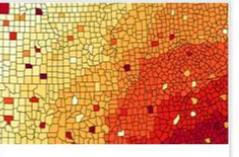
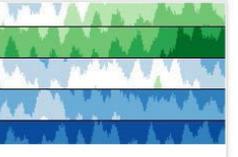
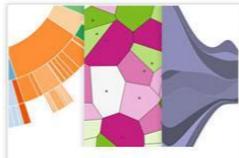
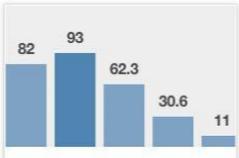
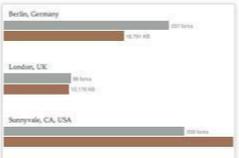
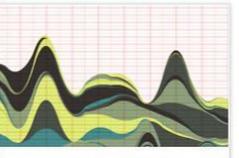
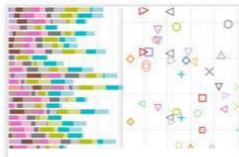
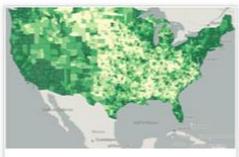
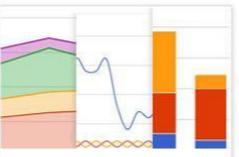
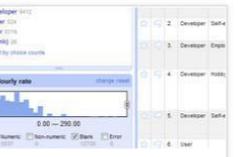
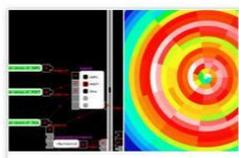
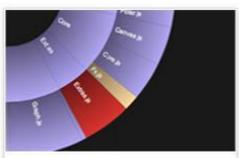
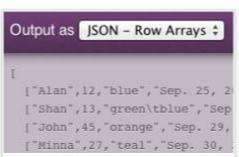
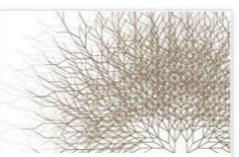
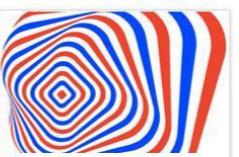
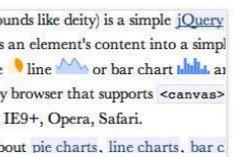
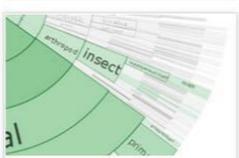
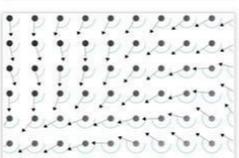


# Why Visualize?

## Communication, Exploration



# Data Visualization Tools

 <p><b>Arbor.js</b> A library of force-directed layout algorithms plus abstractions for graph organization and refresh handling.</p>	 <p><b>CartoDB</b> A web service for mapping, analyzing and building applications with data.</p>	 <p><b>Chroma.js</b> Interactive color space explorer that allows to preview a set of linear interpolated equidistant colors.</p>	 <p><b>Circos</b> A software package for visualizing data in a circular layout.</p>	 <p><b>ColorBrewer</b> A web tool for selecting colors for maps.</p>	 <p><b>Cubism.js</b> A library for creating interactive time series and horizon graphs based on D3.js</p>
 <p><b>D3.js</b> An small, flexible and efficient library to create and manipulate interactive documents based on data.</p>	 <p><b>Dance.js</b> A simple data-driven visualization framework based on Data.js and Underscore.js</p>	 <p><b>Data.js</b> A data representation framework providing a uniform interface to domain data.</p>	 <p><b>DataWrangler</b> An interactive web application for data cleaning and transformation.</p>	 <p><b>Degrafa</b> A powerful declarative graphics framework for rich user interfaces, data visualizations and mapping.</p>	 <p><b>Envision.js</b> A library for creating fast, dynamic and interactive time series visualizations.</p>
 <p><b>Flare</b> A set of software tools for creating rich interactive data visualizations in ActionScript.</p>	 <p><b>GeoCommons</b> A public community and set of tools to access, visualize and analyze data with compelling map visualizations.</p>	 <p><b>Gephi</b> A visualization and exploration platform for networks with dynamic and hierarchical graphs.</p>	 <p><b>Google Chart Tools</b> A collection of simple to use, customizable and free to use interactive charts and data tools.</p>	 <p><b>Google Fusion Tables</b> A web application that makes it easy to host, manage, collaborate on, visualize, and publish data tables.</p>	 <p><b>Google Refine</b> A tool for working with data, cleaning it up, reformatting it or extending it with web services.</p>
 <p><b>Impure / Quadrigram</b> A visual programming language aimed to gather, process and visualize information.</p>	 <p><b>JavaScript InfoVis Toolkit</b> A Javascript library that provides tools for creating interactive data visualizations for the web.</p>	 <p><b>Kartograph</b> A simple and lightweight framework for creating beautiful, interactive vector maps.</p>	 <p><b>Leaflet</b> A lightweight JavaScript library for making tile-based interactive maps for desktop and mobile browsers.</p>	 <p><b>Many Eyes</b> A web application to build, share and discuss graphic representation of user uploaded data.</p>	 <p><b>MapBox</b> A web platform for hosting custom designed map tiles and a set of open source tools to produce them.</p>
 <p><b>Miso Dataset</b> A client-side data transformation and management library to load, parse, sorte, query &amp; manipulate data.</p>	 <p><b>Modest Maps</b> A display and interaction library for tile-based maps in Flash, JavaScript and Python.</p>	 <p><b>Mr. Data Converter</b> A web application that converts Excel data into one of several web-friendly formats, including HTML, JSON and XML.</p>	 <p><b>NodeBox</b> A desktop application that lets you create generative, static, animated or interactive visuals.</p>	 <p><b>Paper.js</b> A vector graphics scripting framework in a well designed, consistent and clean programming interface.</p>	 <p><b>Peity</b> Peity is a simple jQuery plugin that converts an elements content into a simple mini pie, line or bar chart.</p>
 <p><b>Polymaps</b> A library for making dynamic, interactive maps with image- and vector-based tiles.</p>	 <p><b>Prefuse</b> A set of software tools for creating rich interactive data visualizations in Java.</p>	 <p><b>Processing</b> An open source programming language and environment to create images, animations, and interactions.</p>	 <p><b>Processing.js</b> The sister project of Processing that makes projects work using web standards and without any plug-ins.</p>	 <p><b>Protovis</b> A library that composes custom views of data with simple marks such as bars and dots.</p>	 <p><b>R</b> A software environment for statistical computing and graphical techniques.</p>

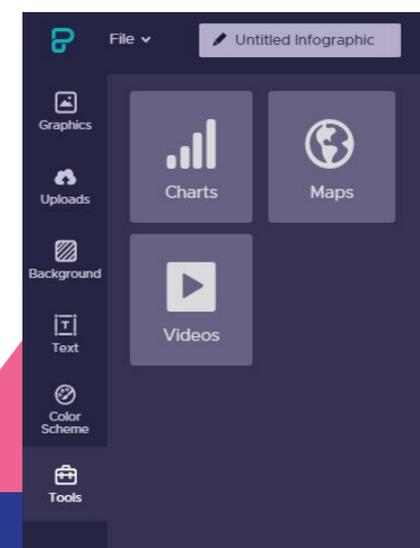
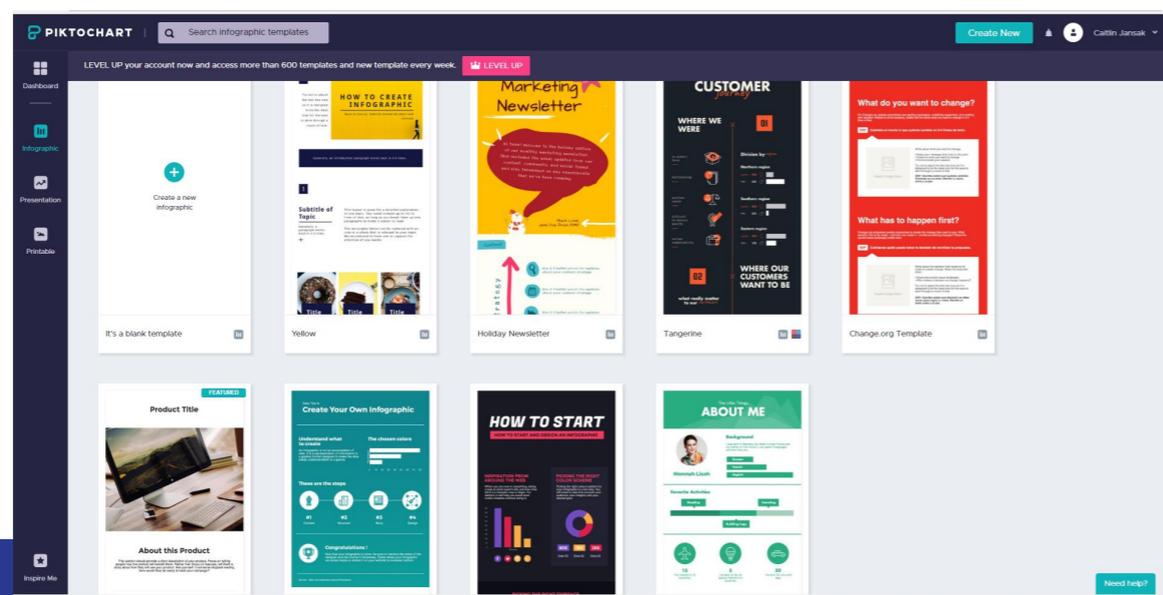
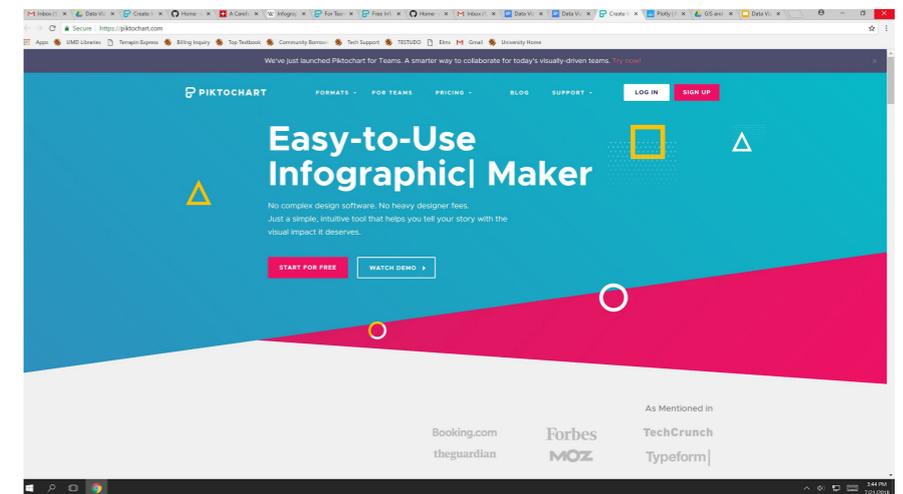


# Infographics Data Visualization Tools We will use



- Graphic visual representation of information data or knowledge
- Represents information quickly and clearly
- The infographics integrated by text information and graphic information

- Piktochart is a web-based infographic application
- No need intensive experience as graphic designers
- Easily create professional-grade infographics using themed templates.

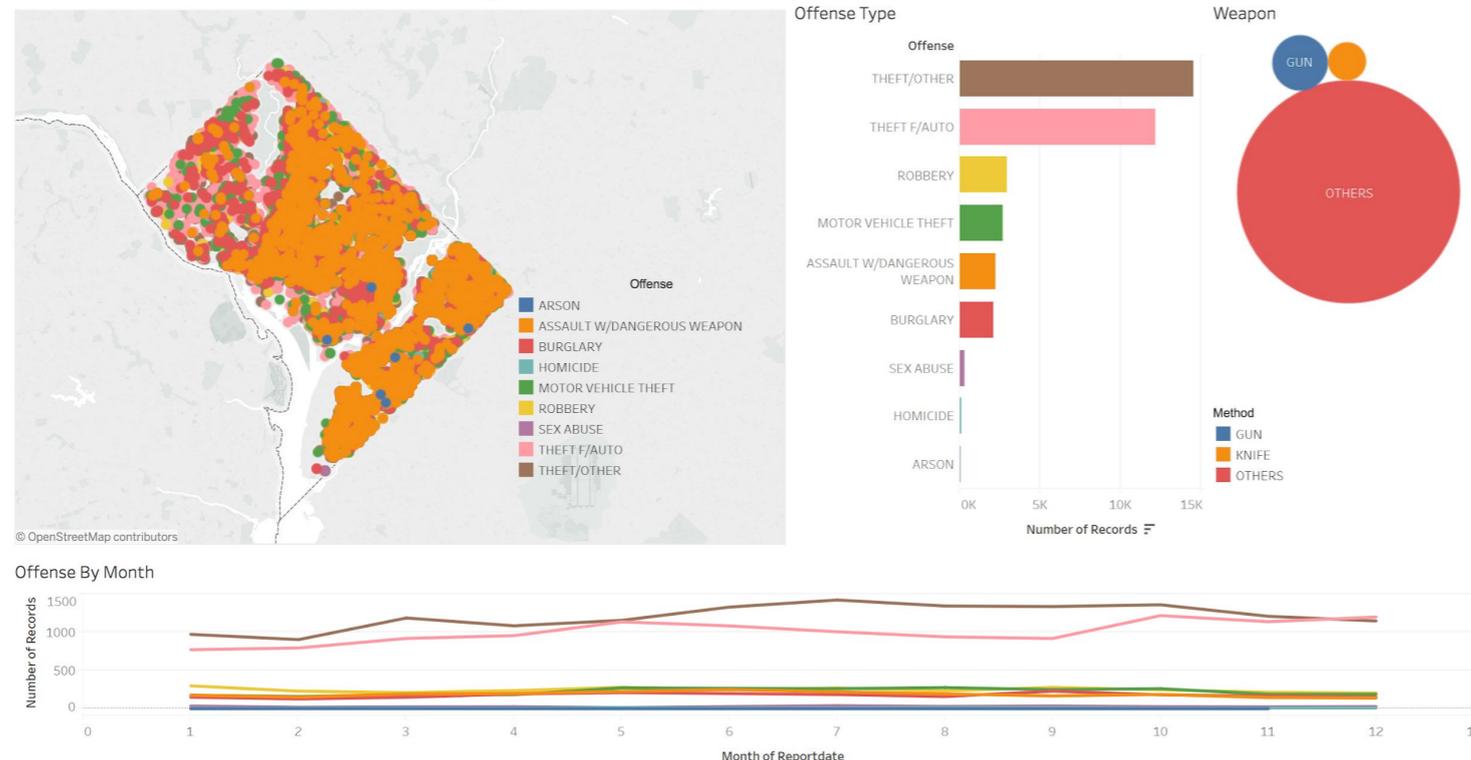


# Data Visualization Tools.....

## Tableau Public

- **Tableau Public** is a free software
- Use spreadsheet or file to create interactive data visualizations for the web
- Other people can view them through the URL
- You can share them via social media and email
- They can be downloaded by other users.
- No programming skills are required

Washington D.C. Crime incidents 2016



Data Source: <http://opendata.dc.gov/>

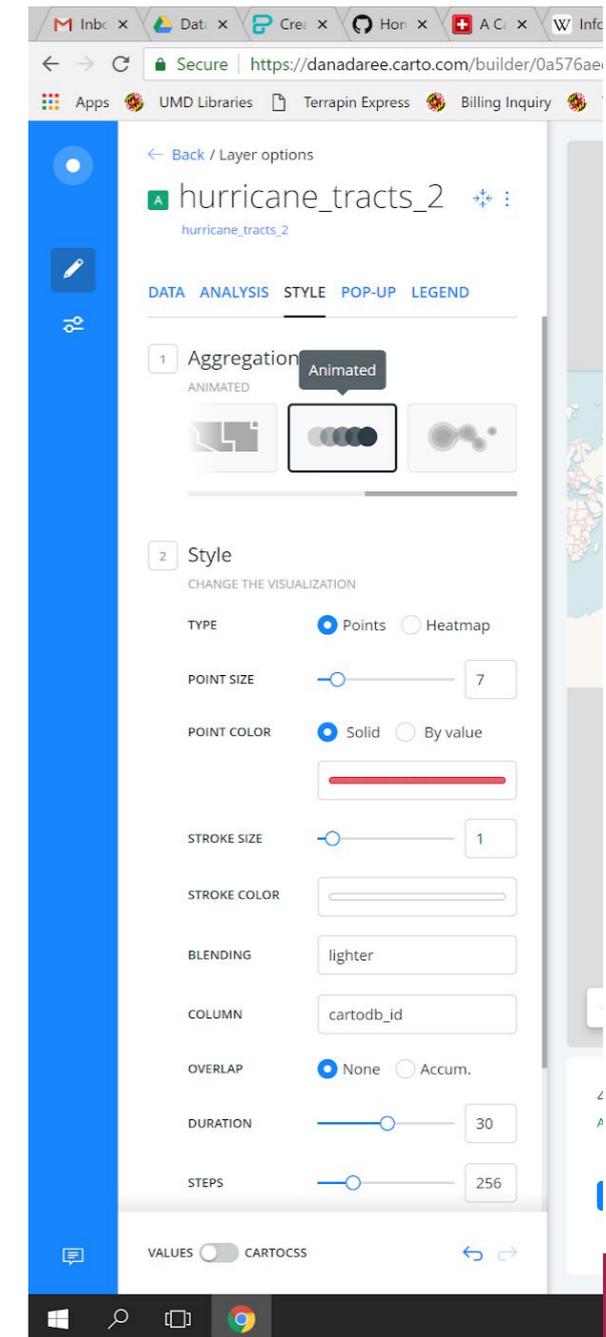
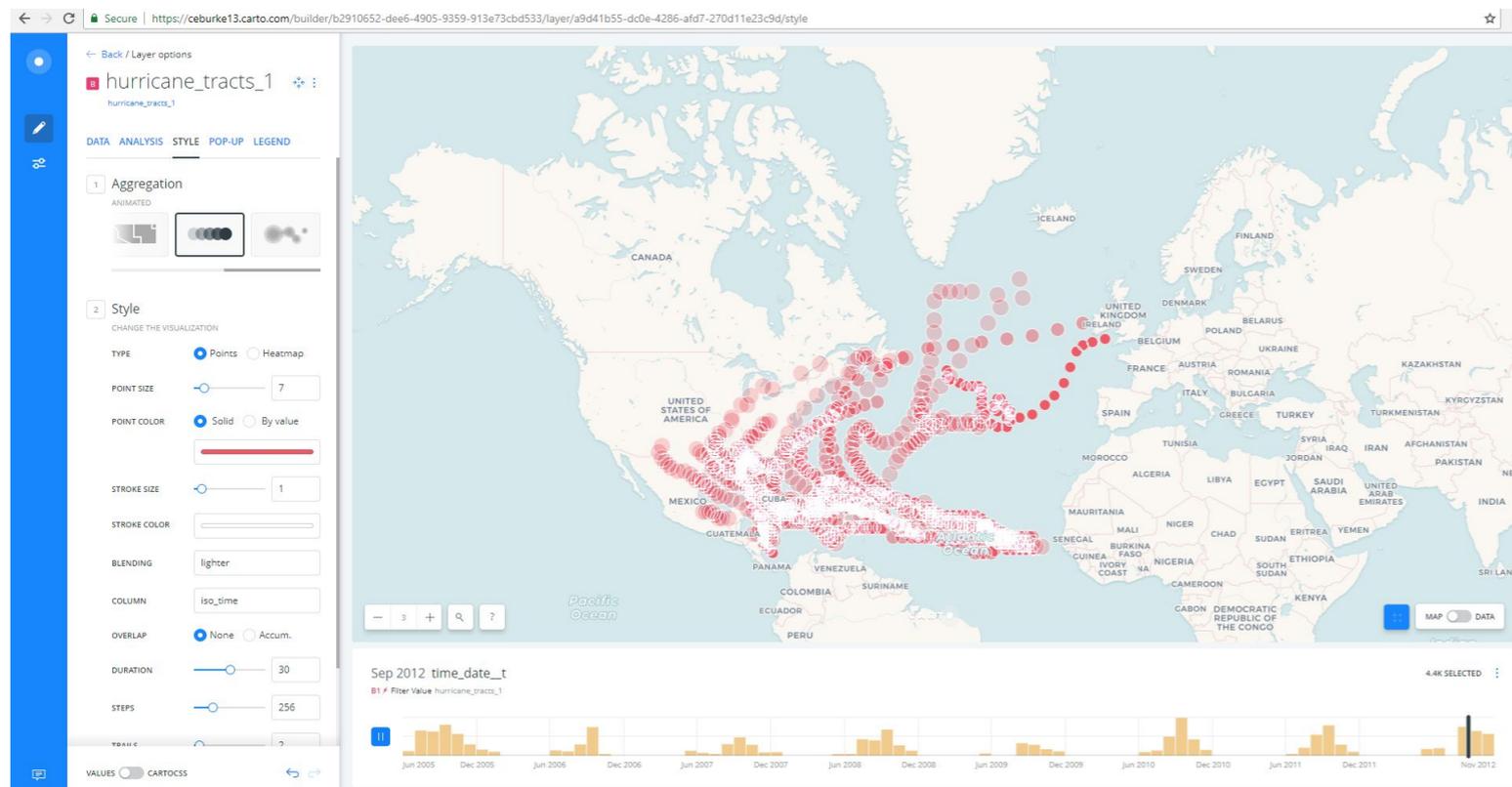
The screenshot shows the Tableau interface for a data source named 'Crime\_2016'. The 'Dimensions' pane on the left lists various fields, with 'Offense' highlighted. The 'Marks' pane on the right shows 'Color' and 'Size' selected, with 'Offense' and 'Objectid' mapped to them. The 'Filters' pane shows 'YEAR(Reportdate 1)' and 'YEAR(Reportdate)'. The 'Measures' pane shows 'Number of Records' and 'Measure Values'. The 'Data Source' pane at the bottom shows 'Crime\_2016' selected.

# Data Visualization Tools....

## Carto



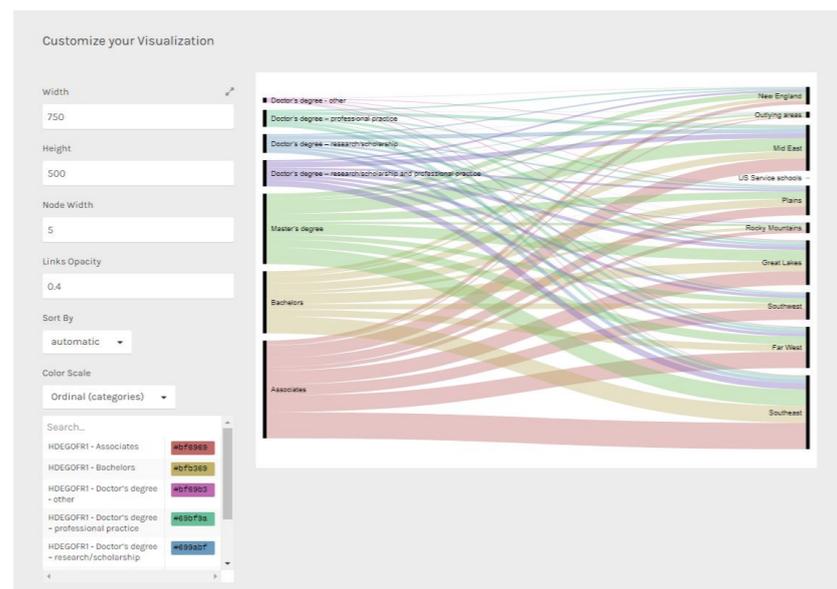
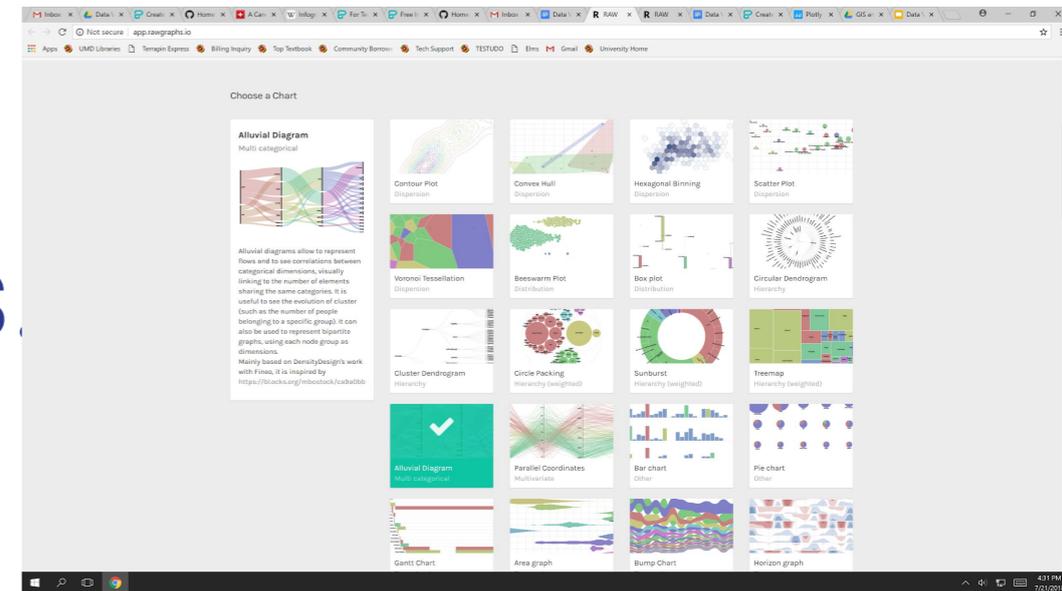
- **Carto** is an open source software platform
- Provides GIS applications and web mapping tools to display in a web browser
- No GIS or developmental experience needed to data analysis and data visualization
- It uses JavaScript intensely



- Can be created time series maps
- Can be represented animation maps using aggregation styles

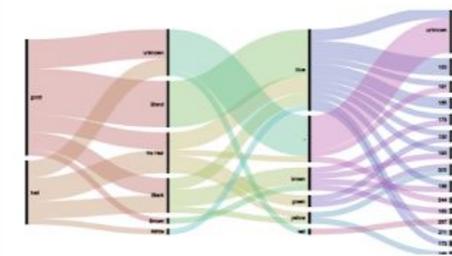
# RAW Data Visualization Tools

- **Raw** is an open source data visualization framework for complex data
- Raw graphs provide a missing link between spreadsheet applications(e.g. Microsoft Excel )and Vector graphics editors(e.g. Adobe Illustrator.)
- You can pick a model, use your data, map your dimensions, and then customize your visualization
- They can be easily imported and edited by vector graphics
- They can be embedded to web pages



## Choose a Chart

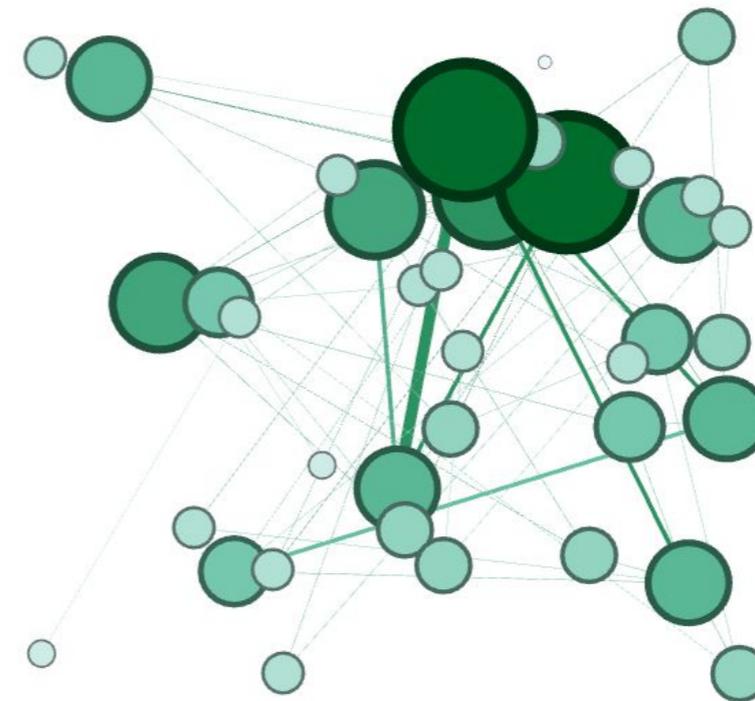
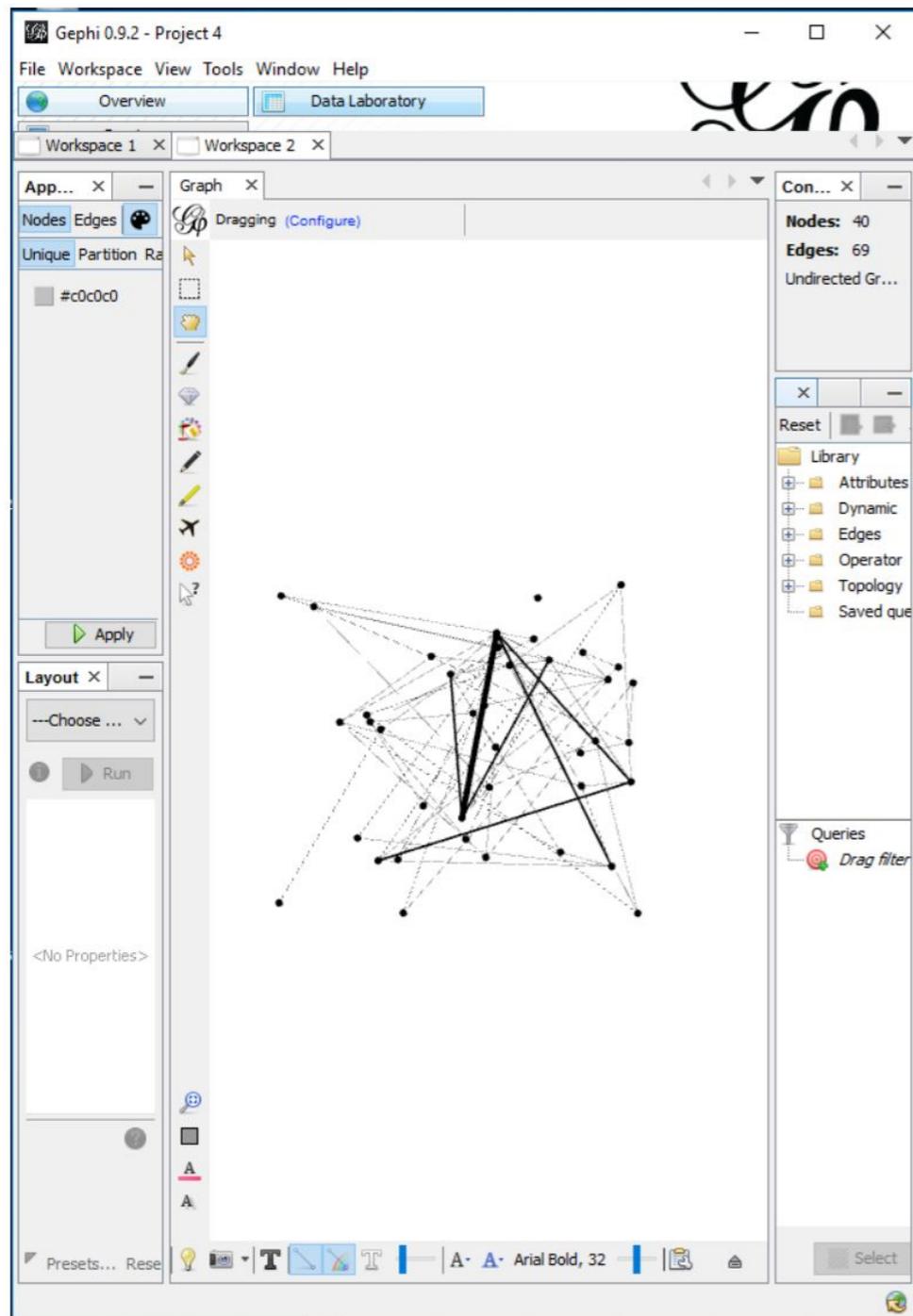
### Alluvial Diagram Multi categorical



Alluvial diagrams allow to represent flows and to see correlations between categorical dimensions, visually linking to the number of elements sharing the same categories. It is useful to see the evolution of cluster (such as the number of people belonging to a specific group). It can also be used to represent bipartite graphs, using each node group as dimensions.

Mainly based on DensityDesign's work with Fineo, it is inspired by <https://bl.ocks.org/mbostock/ca9a0bb>

# Data Visualization Tools.....



Gephi

## Gephi

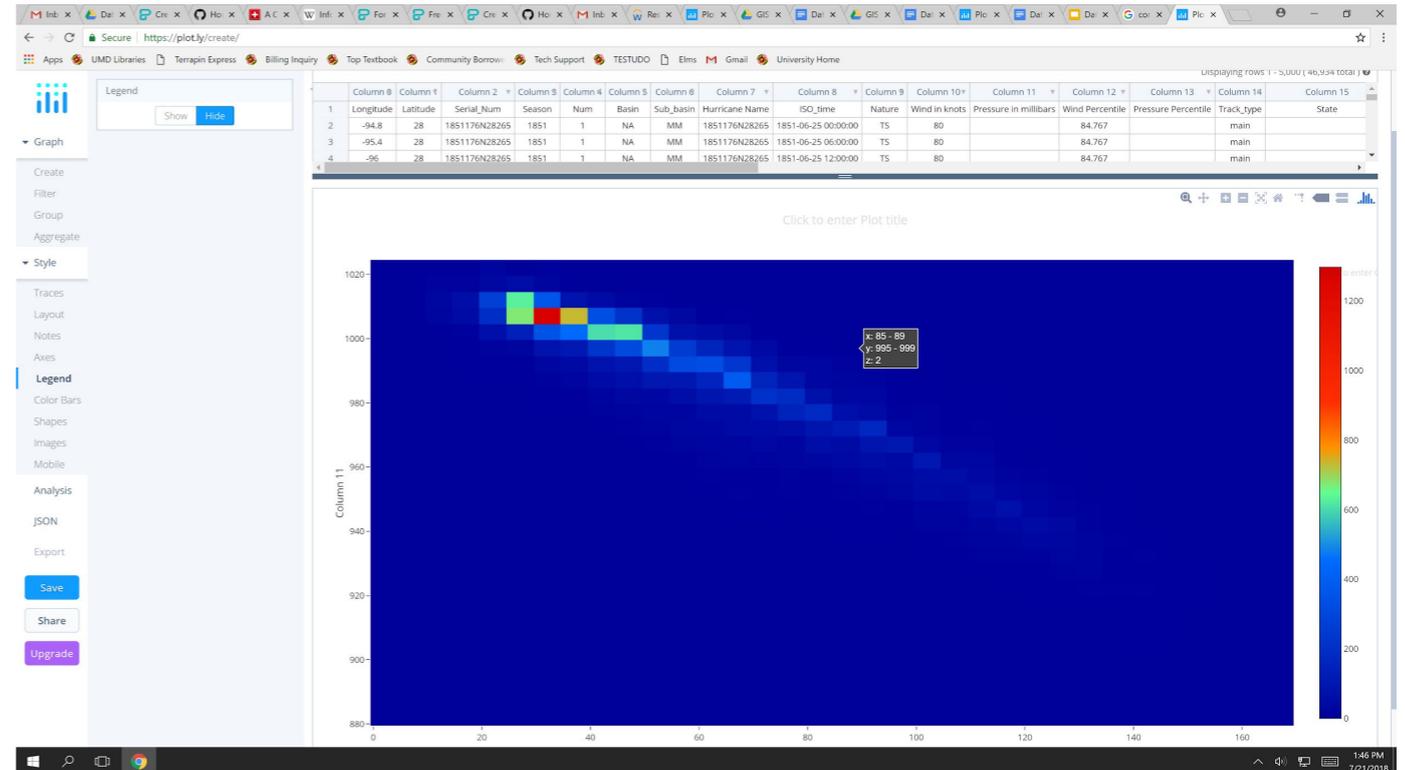
- **Gephi** is a open source network analysis, graph visualization, manipulation, and exploration software
- It is modular and extensible so that easier to maintain and work on independent parts
- It uses a 3D render engine to display graphs and speed up exploration
- Gephi is for all kinds of graphs and networks.

# Data Visualization Tools.....

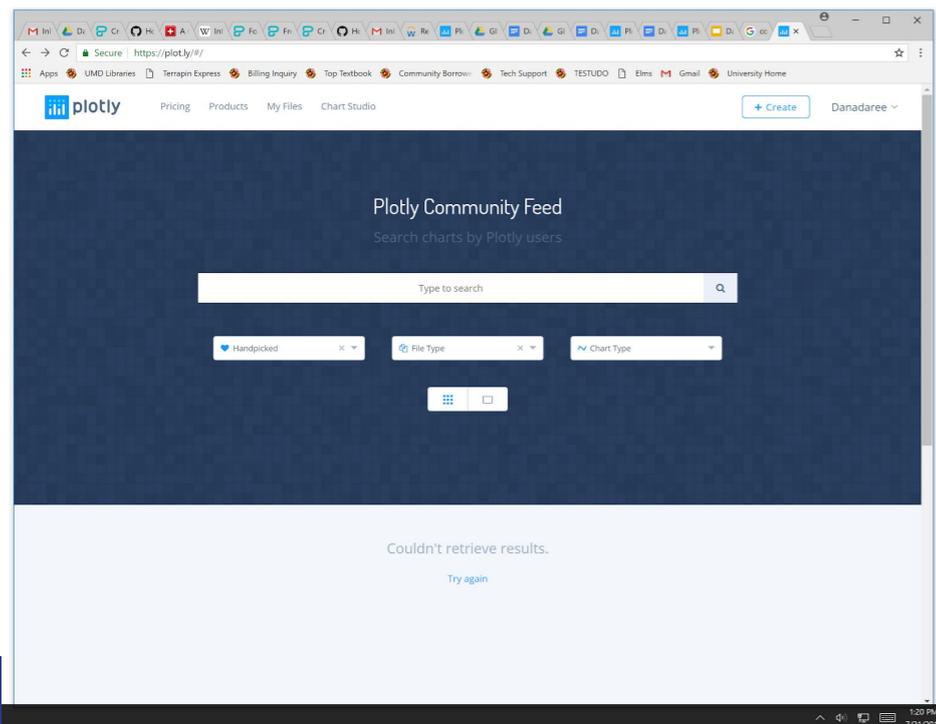
Plot.ly



- **Plot.ly** is an open source graphing tool for composing, editing, and sharing interactive data visualization via the Web
- Useful for scientists to showcase their work, make graphs without coding, and collaborate with business analysts, designers, executives, and clients



- Can be imported any data file from any format
  - Upload file from your computer
  - Drag and drop a file
  - Import from Google drive and Dropbox
- Can be applied any custom functions
  - (integrals or descriptive basic statistics are included)
- Can be chosen many graphs
  - Scatter, line, bar, area, error bar, heatmap, box, and histogram
- Can be shared and edited them with coworkers or to the world



## References

<https://datavisualization.ch/tools/selected-tools/>

<https://github.com/densitydesign/raw/wiki>

<https://gephi.org/users/>

<https://help.github.com/categories/github-pages-basics/>

<https://www.google.com/search>

<https://piktochart.com/>

