



University of Minho
School of Engineering



Data Viz

Autonomous Systems

Perfil Sistemas Inteligentes @ MEI/MiEI 1º/4º - 2º semestre

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Data Viz

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CONCEPTS

Examples

Hands On

Data Visualization (aka **Data Viz**) deals with the graphical representation of information and data:

- Using **visual elements** like charts, graphs, and maps
- Data Viz provides an accessible way to **see** and **understand** trends and patterns in **data**
- Essential to analyze massive amounts of information and make data-driven decisions
- Now a big field of study...! How to be effective?

“It is storytelling with a purpose.”

Data Viz

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Takes advantage of **pre-attentive processing**:

- The human being can distinguish differences in line length, shape, orientation, and color without significant processing effort
- Data viz are **created** for **human consumption**!

Interactivity is important:

- Filter
- Scaling
- Linking
- Labeling
- Navigation

Old But Beautiful!

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CONCEPTS

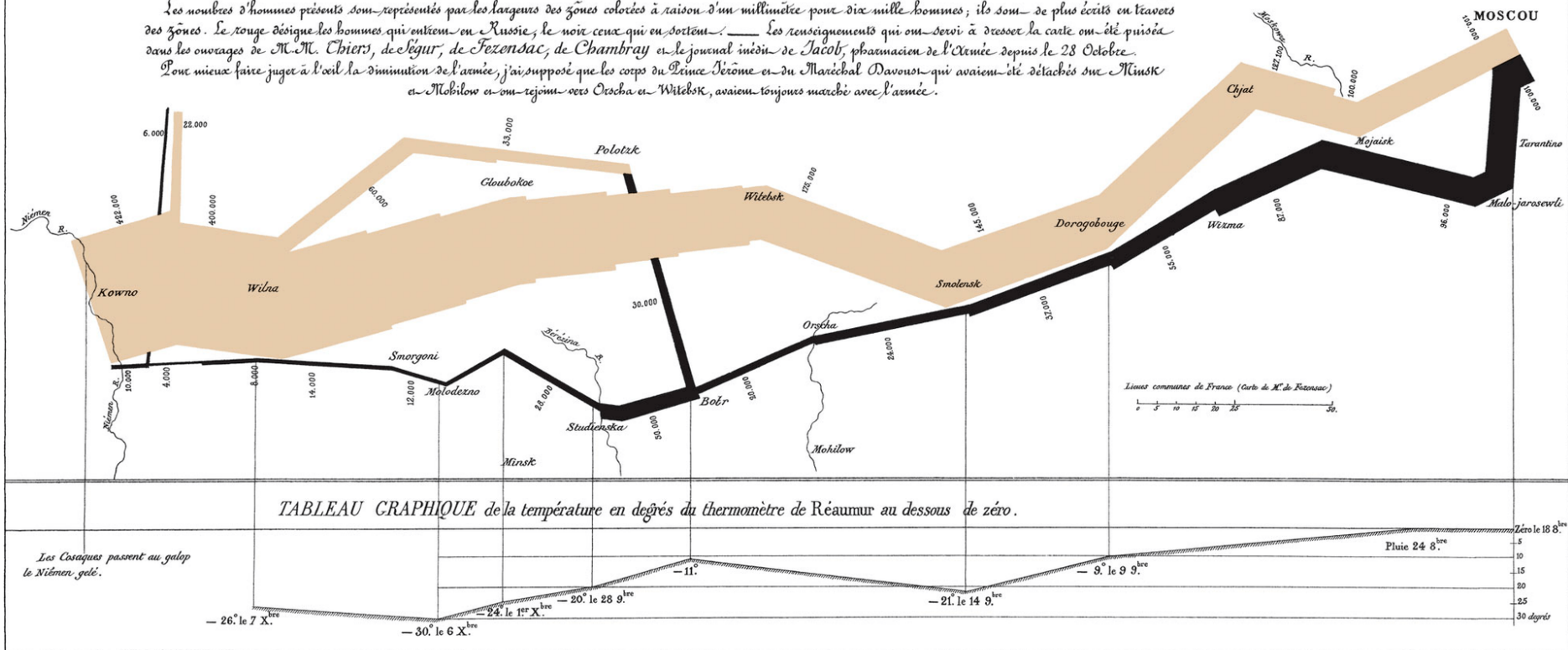
Examples

Hands On

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 ont été en Russie; le noir ceux qui ont sorté. Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Thiers, de Legu, 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.



Auég. par Regnier, 3. Par. 5^{te} Marie 5^{te} 0^{te} à Paris.

Imp. Lith. Regnier et Bourdot.

By Charles Joseph Minard, in 1869.

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Hands On



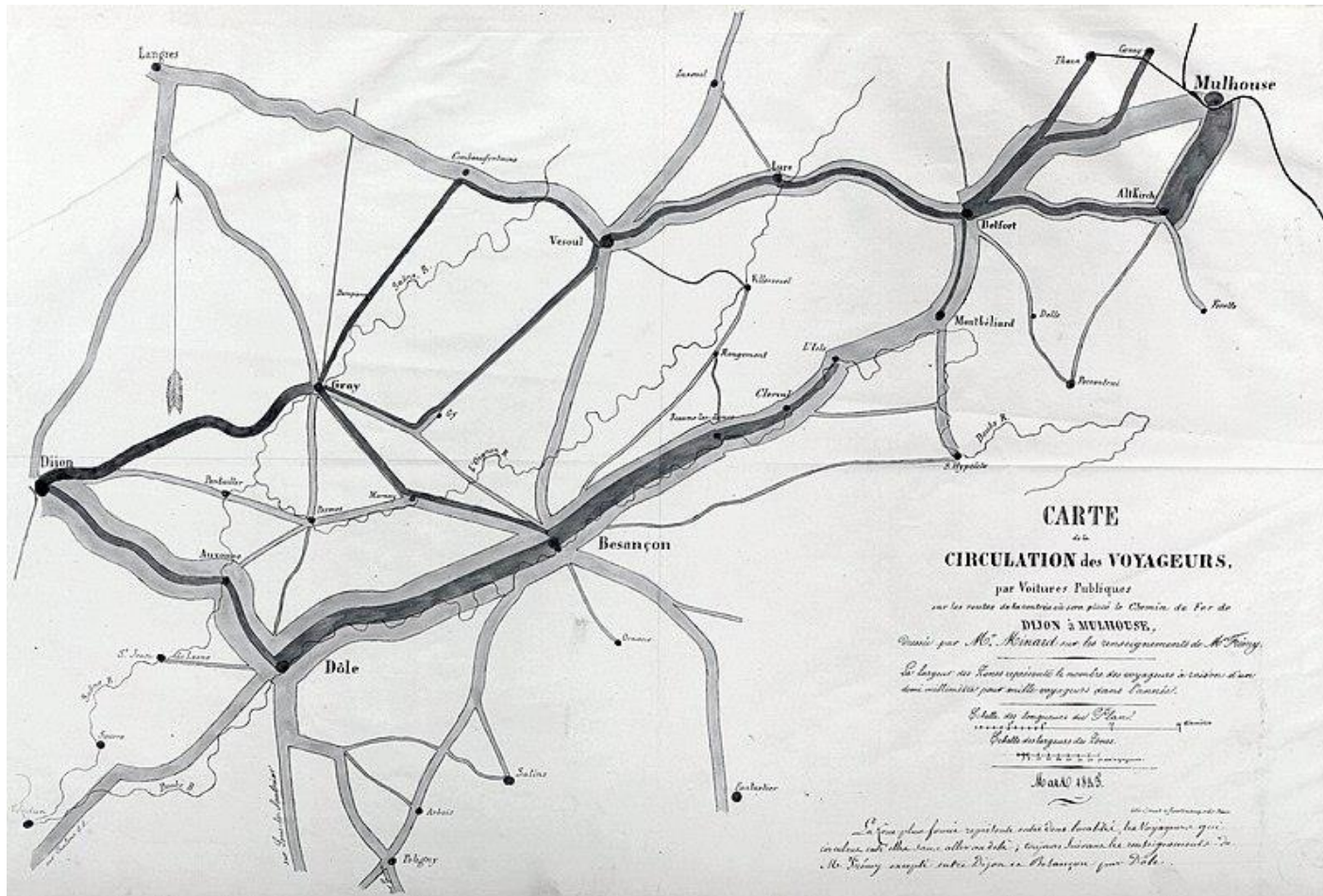
Old But Beautiful!

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Again, by Charles Joseph Minard, in 1845.

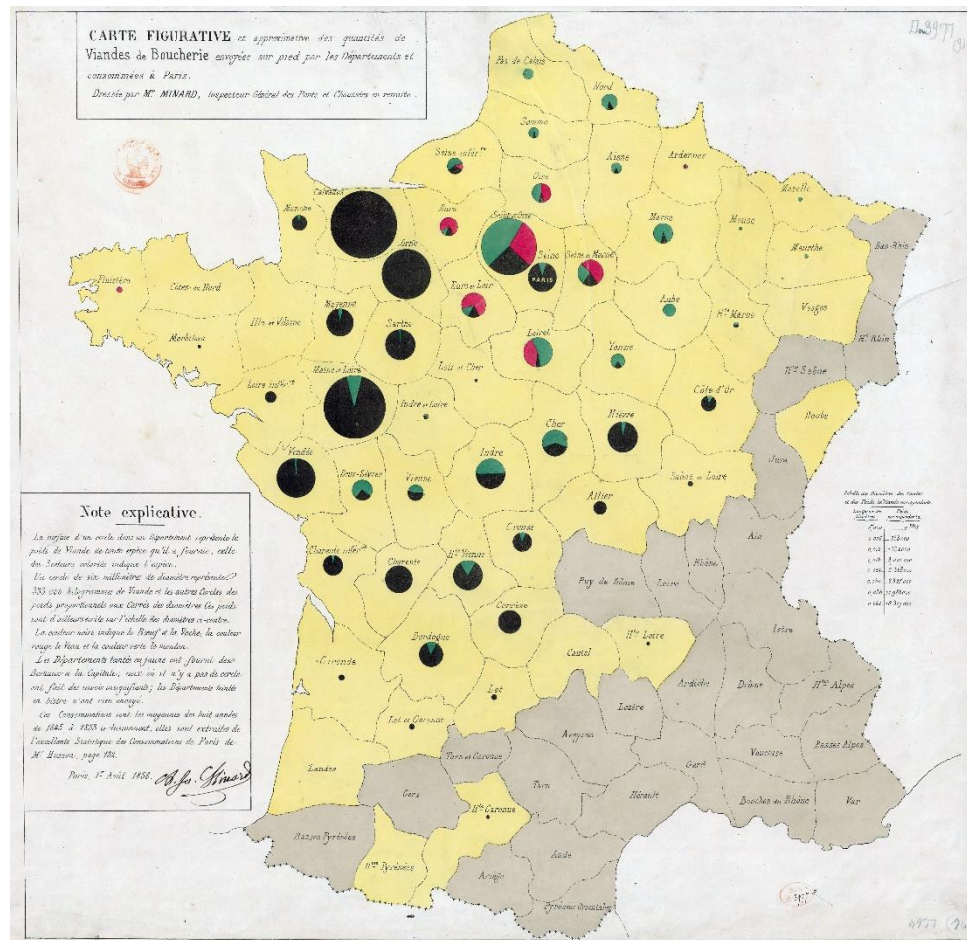
Old But Beautiful!

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By Charles Joseph Minard, in 1858.

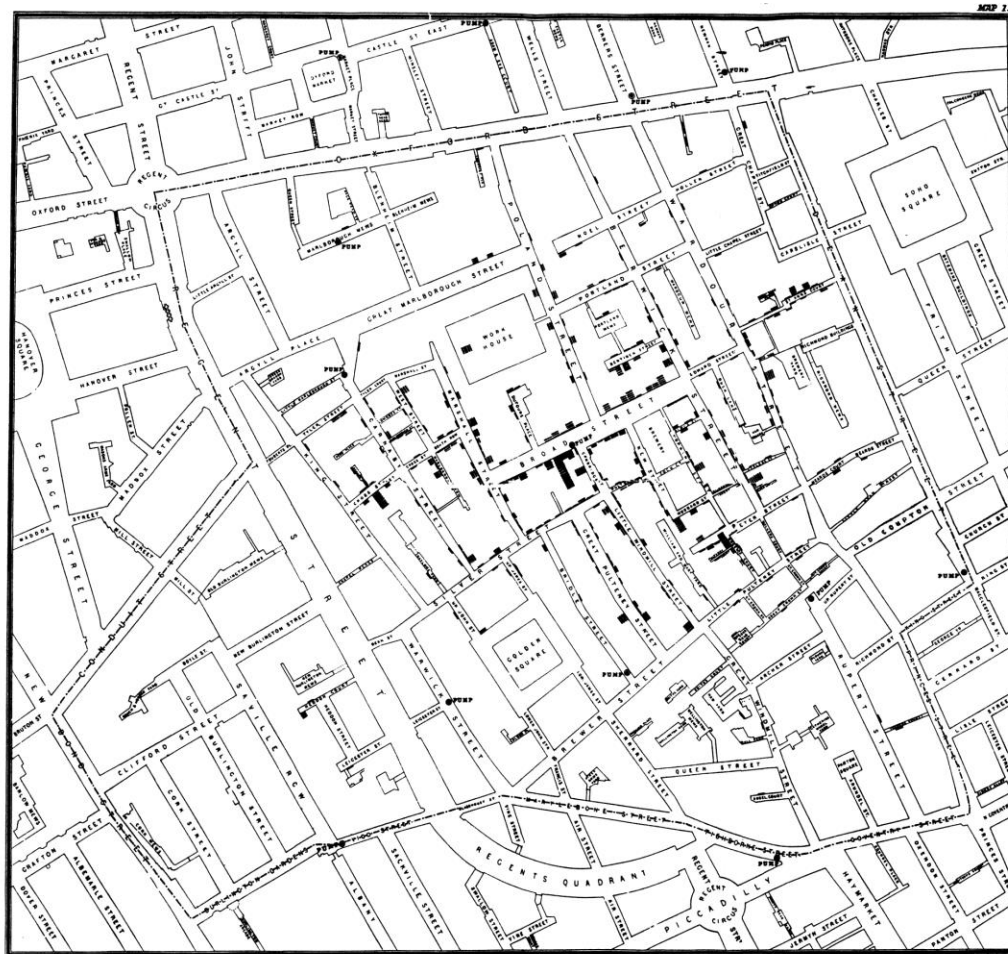
Old But Beautiful!

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By John Snow, in 1854.

Data Viz

Possibilities

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Data Viz

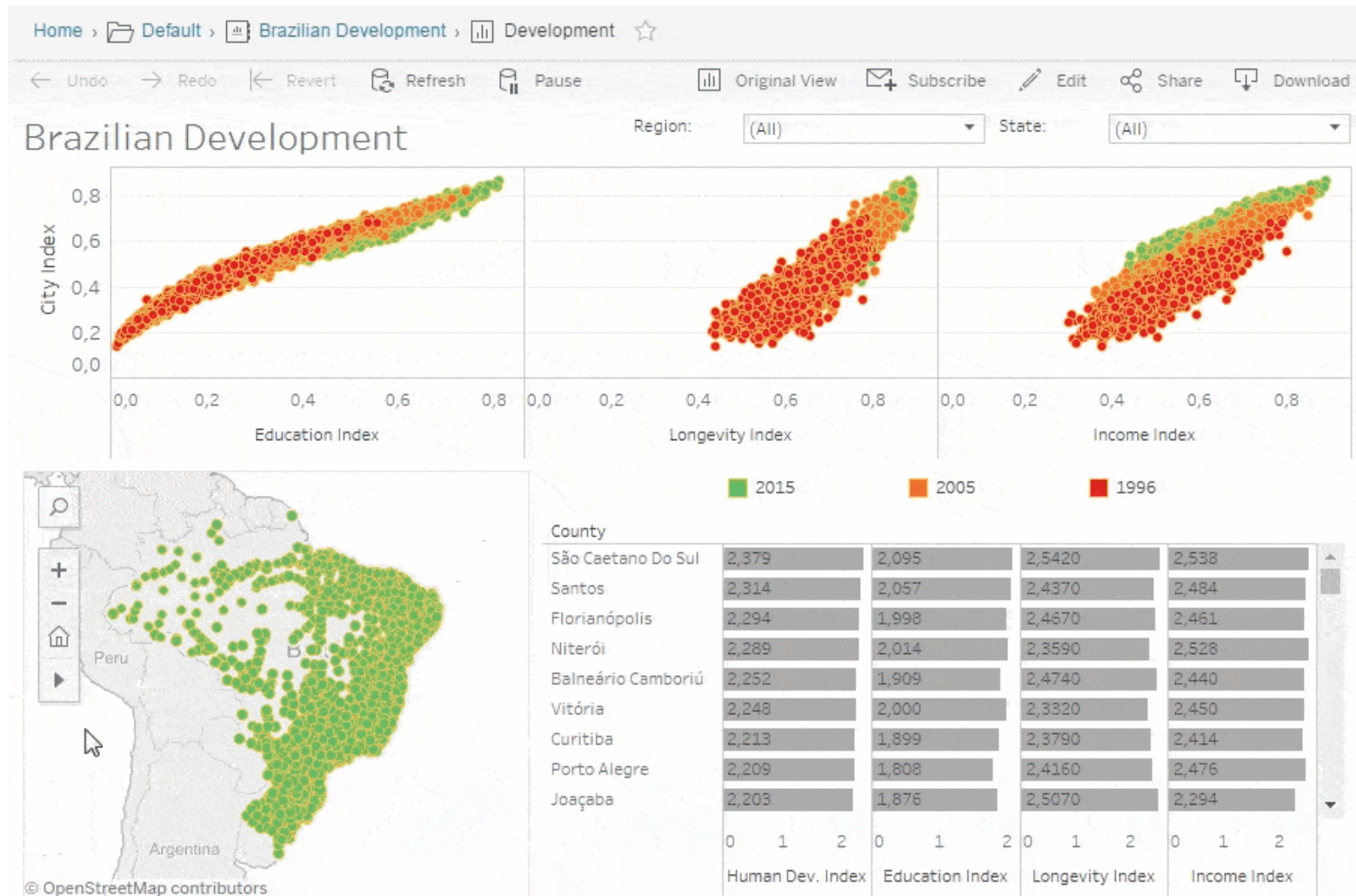
Example 1

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Data Viz

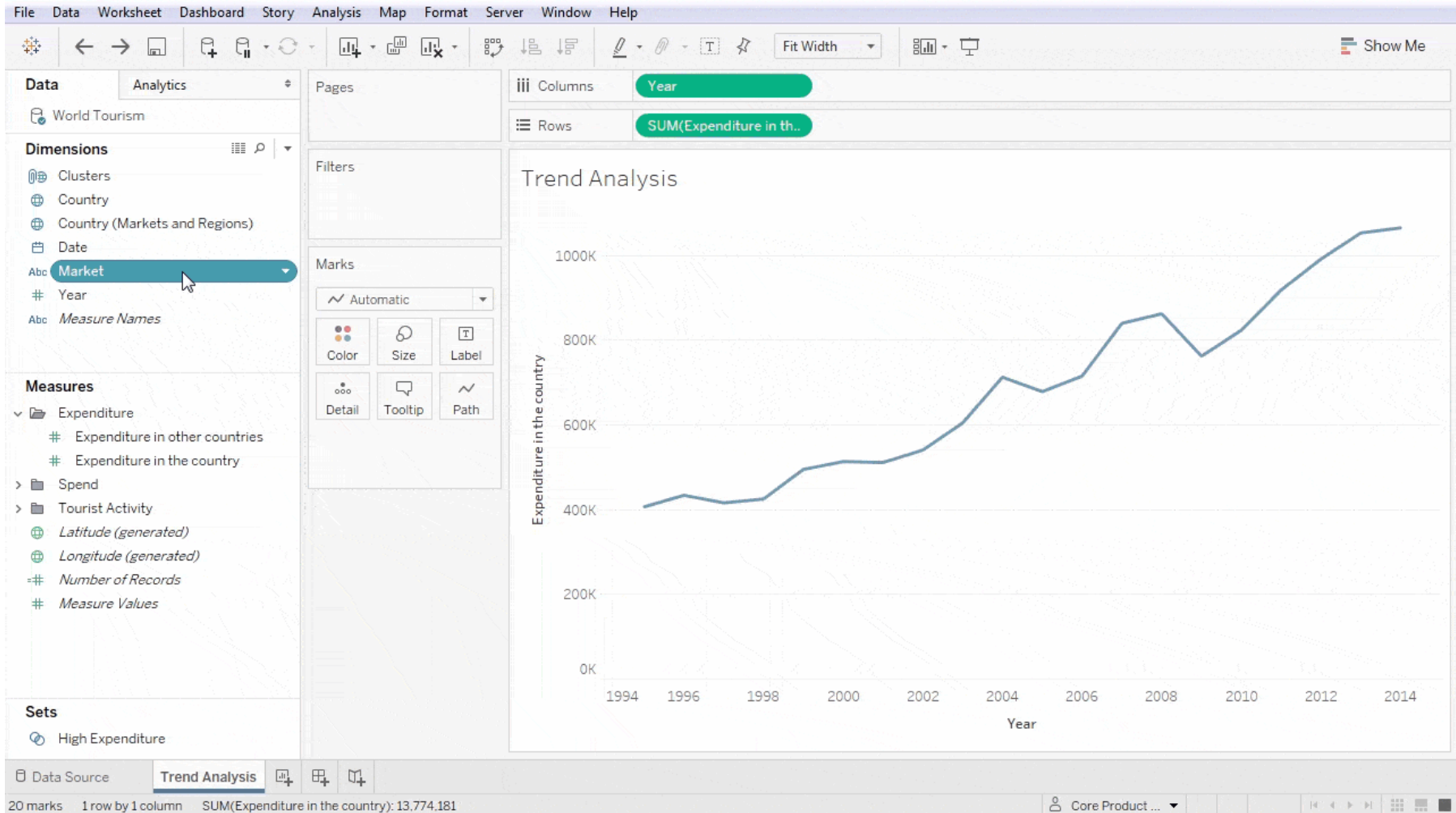
Example 2

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Data Viz

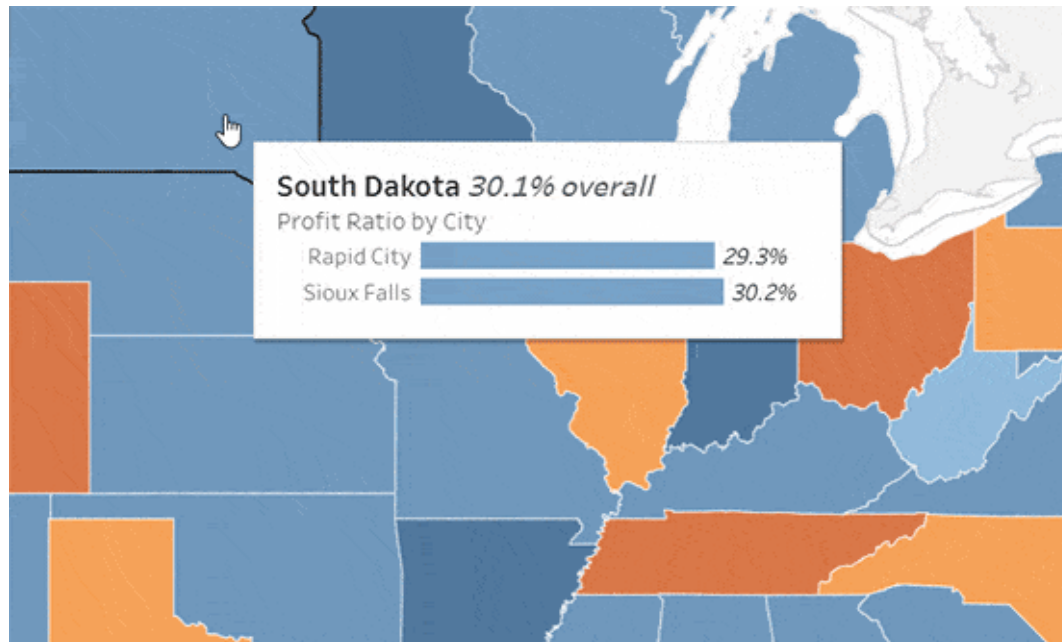
Example 3

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Data Viz

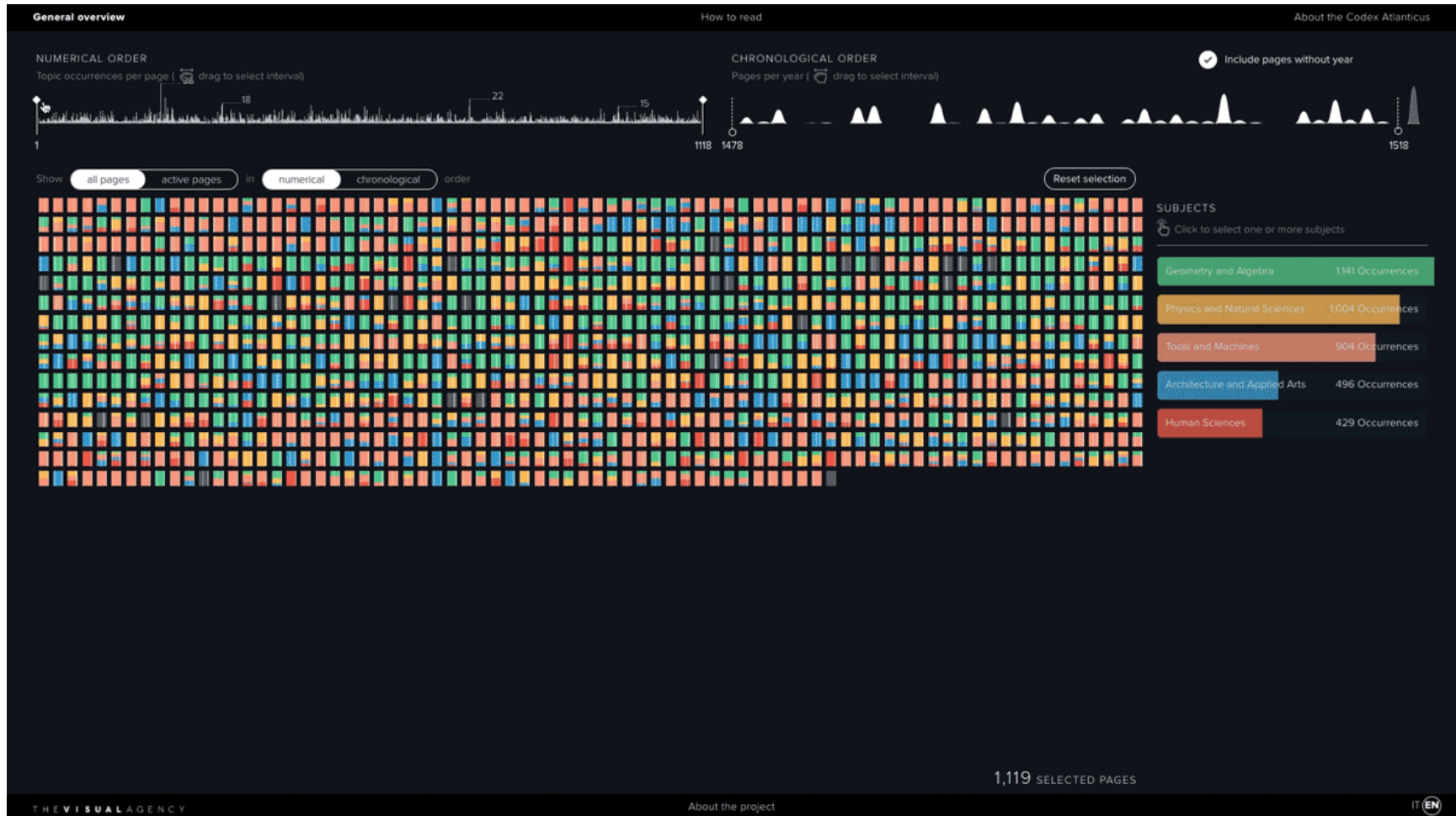
Time Series Examples

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Data Viz

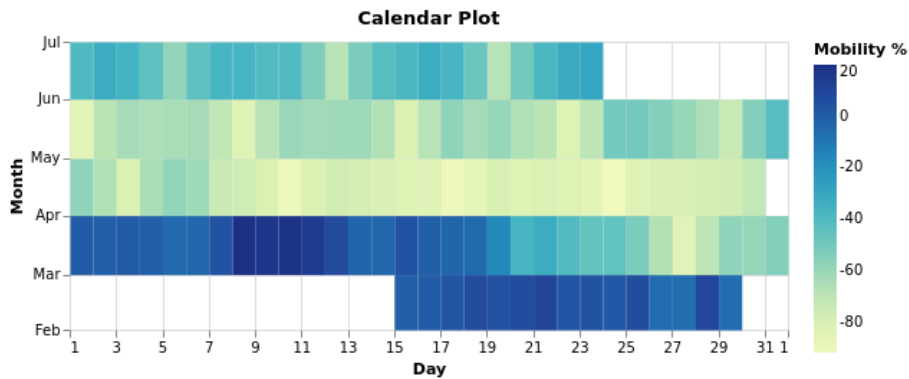
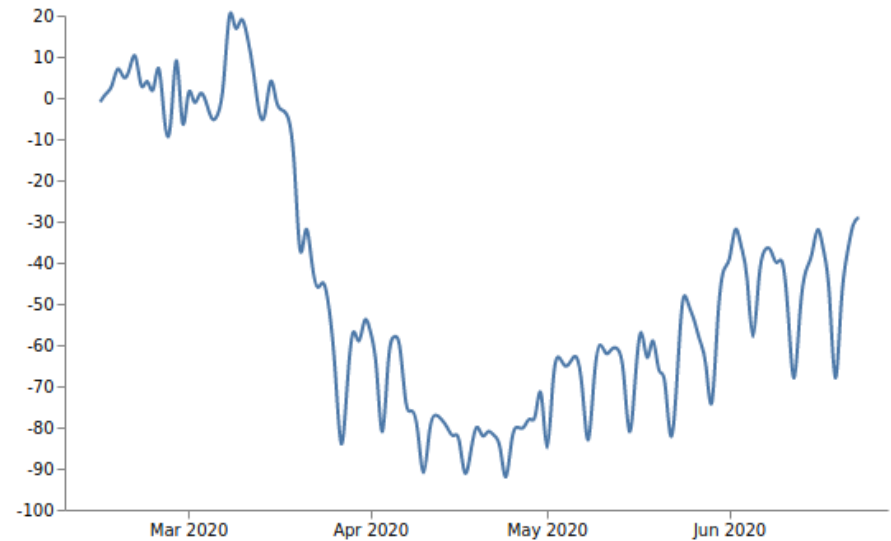
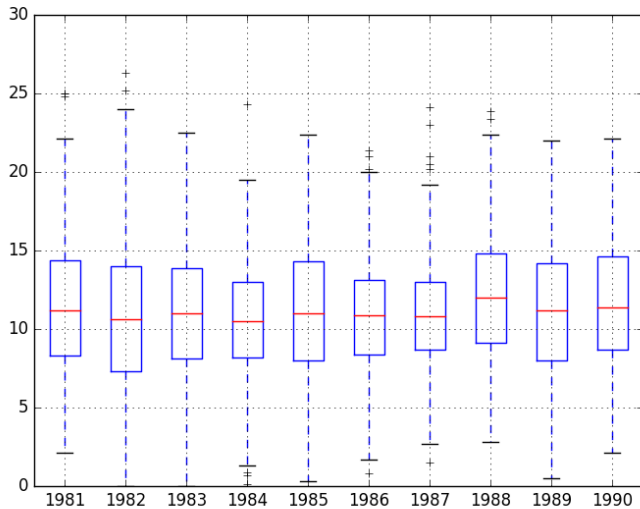
Time Series Examples

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Data Viz

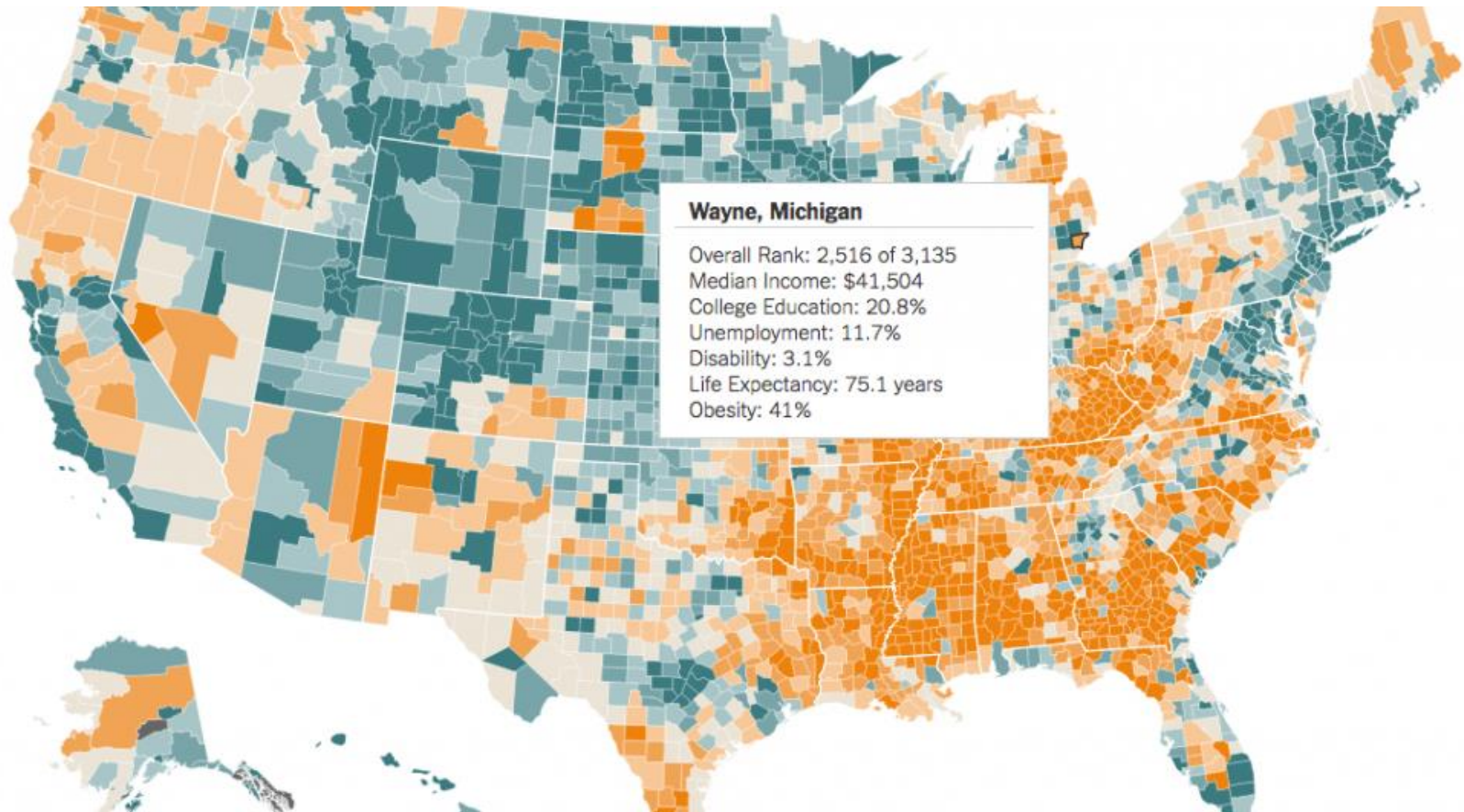
Geospatial Data Examples

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Data Viz

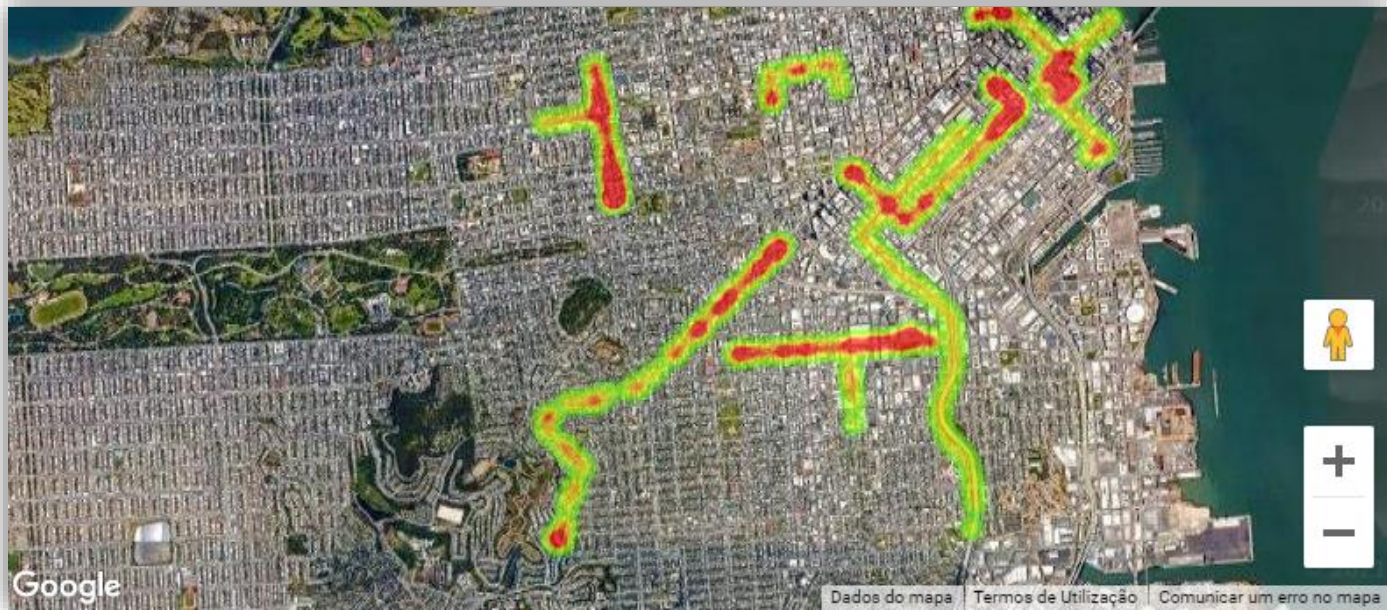
Geospatial Data Examples

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Check here:

<https://developers.google.com/maps/documentation/javascript/examples/layer-heatmap>

Data Viz

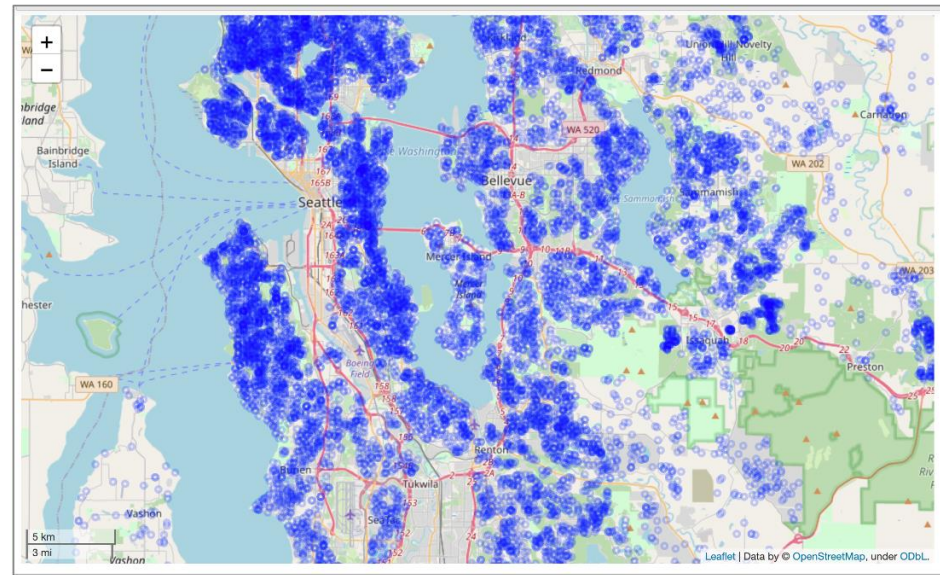
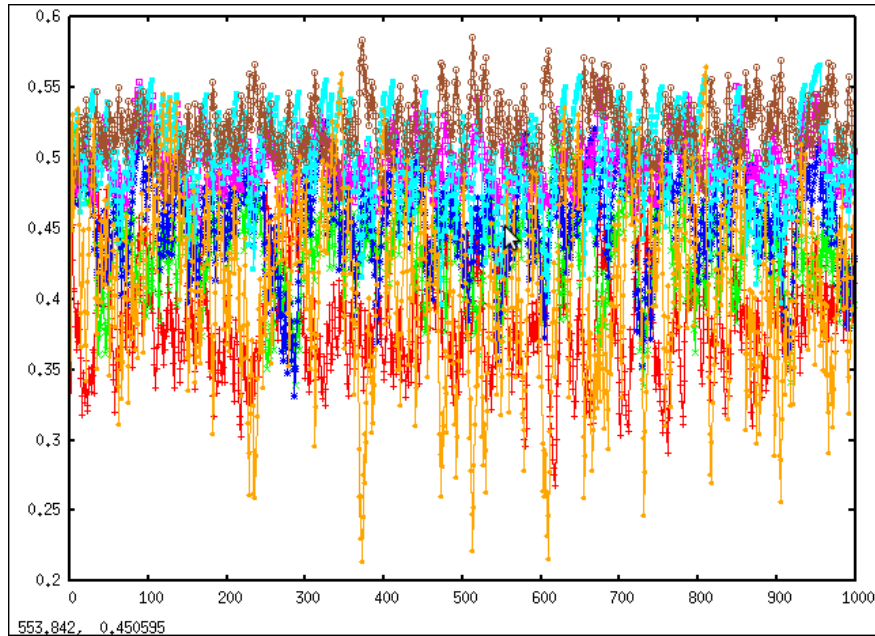
That don't work!

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Data Viz

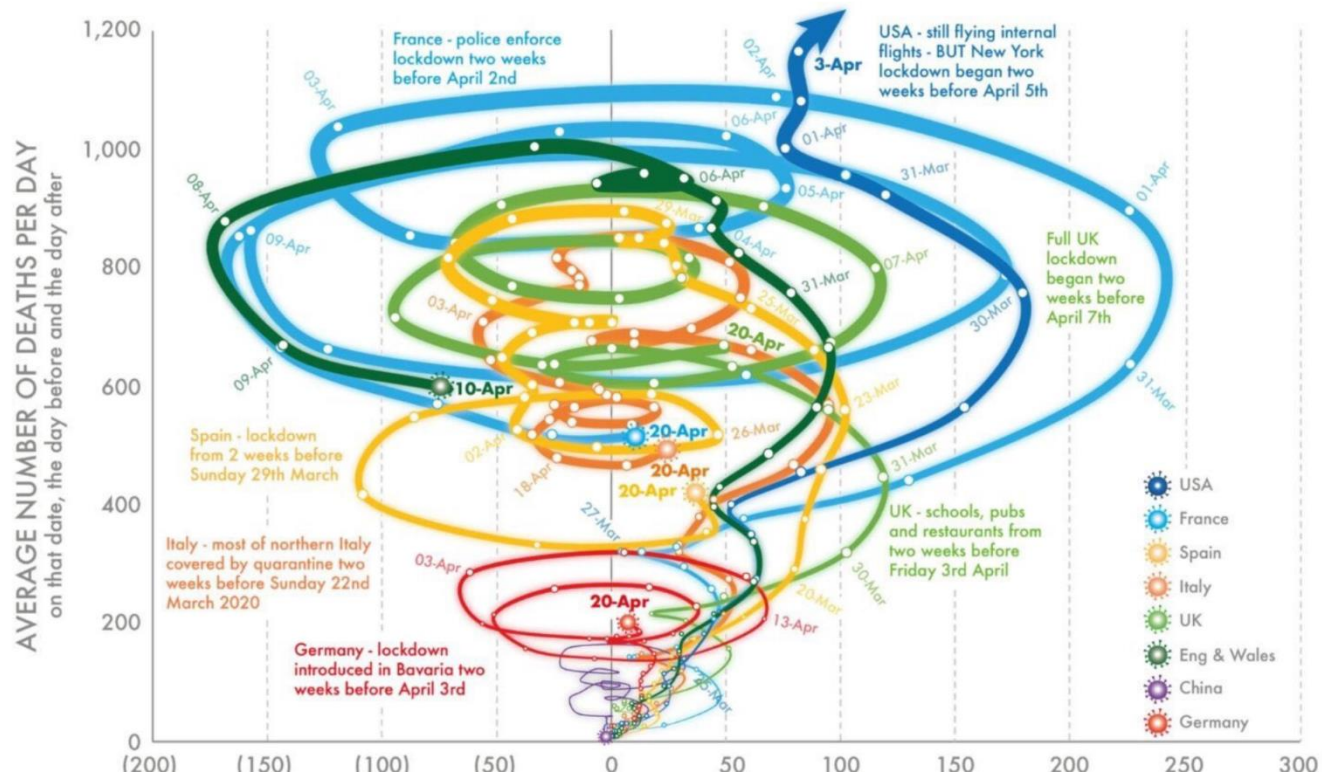
That don't work!

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Data Viz

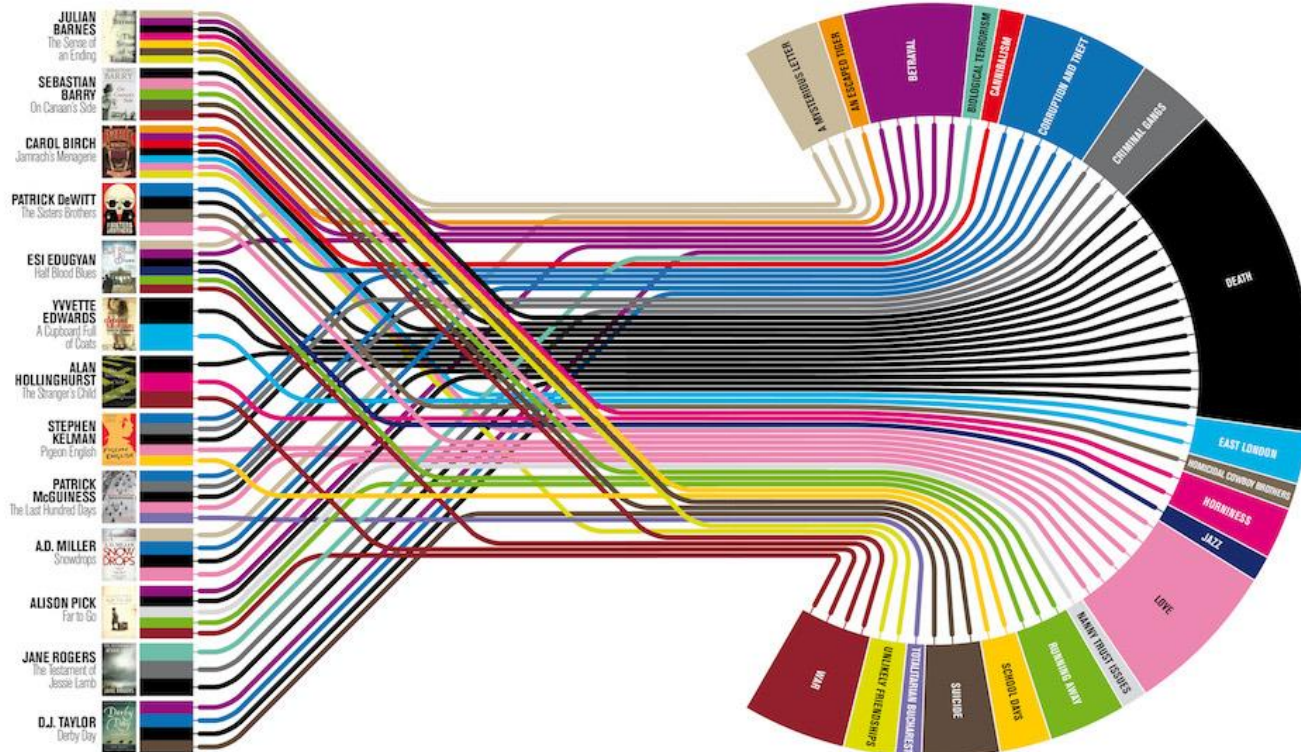
That don't work!

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Plot lines

What makes a prize-winning novel? As Julian Barnes wins the Booker Prize, Delayed Gratification's Johanna Kamradt charts the themes of this year's longlisters.

Illustration: Christian Tate



Libraries and Platforms

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HANDS ON



D3.js

A picture is worth a thousand words



Chart.js



Google
Developers
Charts



Streamlit

matplotlib



seaborn



plotly



Power BI



tableau



Google
Data Studio

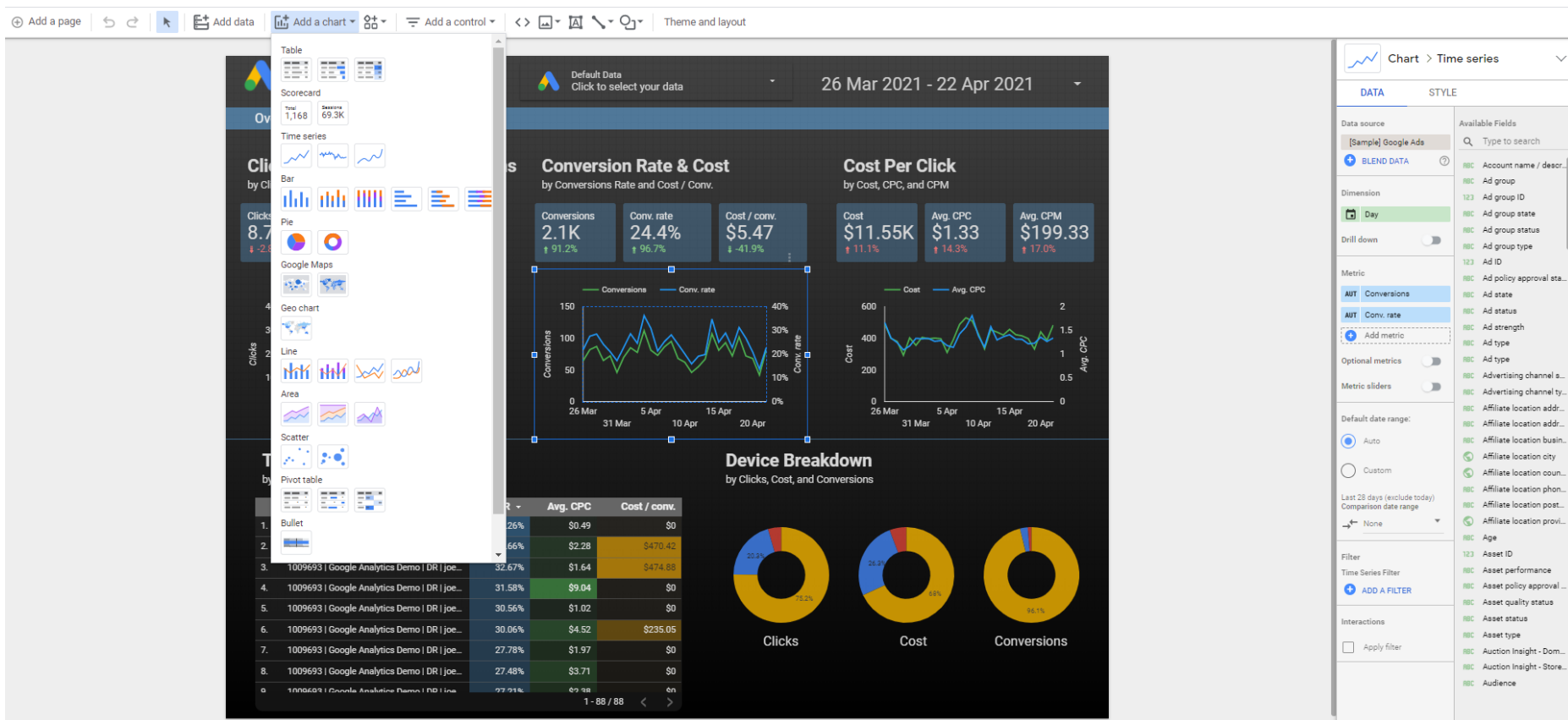
Google Data Studio

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Google Data Studio + Google Sites

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Google Data Studio + Google Sites

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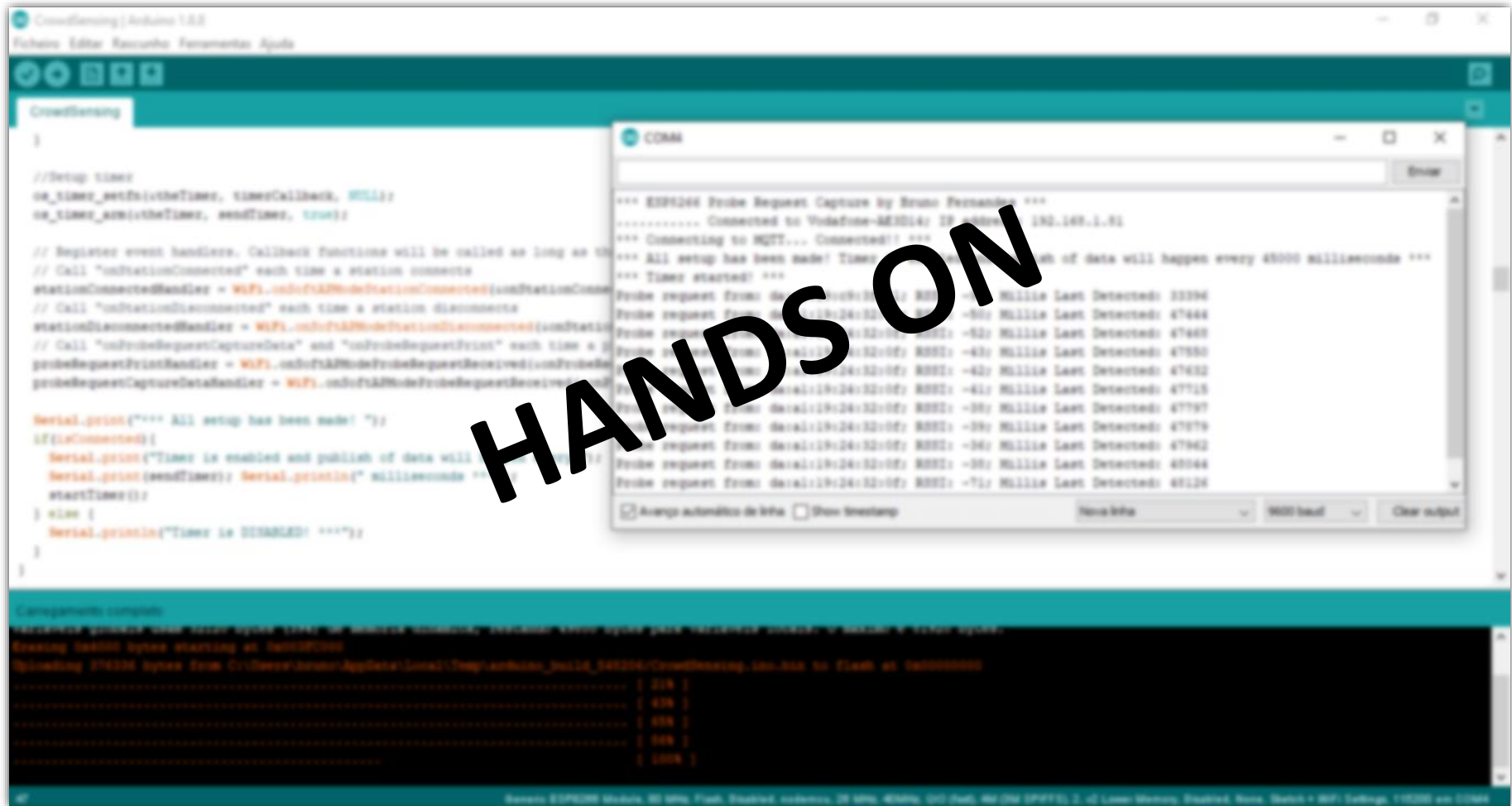
Hands On

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HANDS ON



The screenshot shows the Arduino IDE interface with a project named "Crowdfensing". The code in the main editor includes setup functions for a timer and event handlers for station connections and probe requests. A large "HANDS ON" watermark is overlaid on the code. A serial monitor window titled "COM1" is open, displaying the following output:

```
*** ESP8266 Probe Request Capture by Bruno Fernandez ***
***** Connected to Vodafone-ME3D14: IP address: 192.168.1.81
*** Connecting to MQTT... Connected! ***
*** All setup has been made! Timer of data will happen every 45000 milliseconds ***
*** Timer started! ***
Probe request from de:ca:19:24:32:0f: RSSI: -41; Millie Last Detected: 33396
Probe request from de:ca:19:24:32:0f: RSSI: -51; Millie Last Detected: 47444
Probe request from de:ca:19:24:32:0f: RSSI: -52; Millie Last Detected: 47449
Probe request from de:ca:19:24:32:0f: RSSI: -43; Millie Last Detected: 47550
Probe request from de:ca:19:24:32:0f: RSSI: -42; Millie Last Detected: 47632
Probe request from de:ca:19:24:32:0f: RSSI: -41; Millie Last Detected: 47715
Probe request from de:ca:19:24:32:0f: RSSI: -39; Millie Last Detected: 47797
Probe request from de:ca:19:24:32:0f: RSSI: -39; Millie Last Detected: 47879
Probe request from de:ca:19:24:32:0f: RSSI: -34; Millie Last Detected: 47942
Probe request from de:ca:19:24:32:0f: RSSI: -39; Millie Last Detected: 48044
Probe request from de:ca:19:24:32:0f: RSSI: -71; Millie Last Detected: 48126
```

At the bottom of the IDE, a progress bar shows the upload status: "Uploading 174334 bytes from C:\Users\bruno\AppData\Local\Temp\arduino_build_549296\Crowdfensing.ino.bin to Flash at 115200 baud".