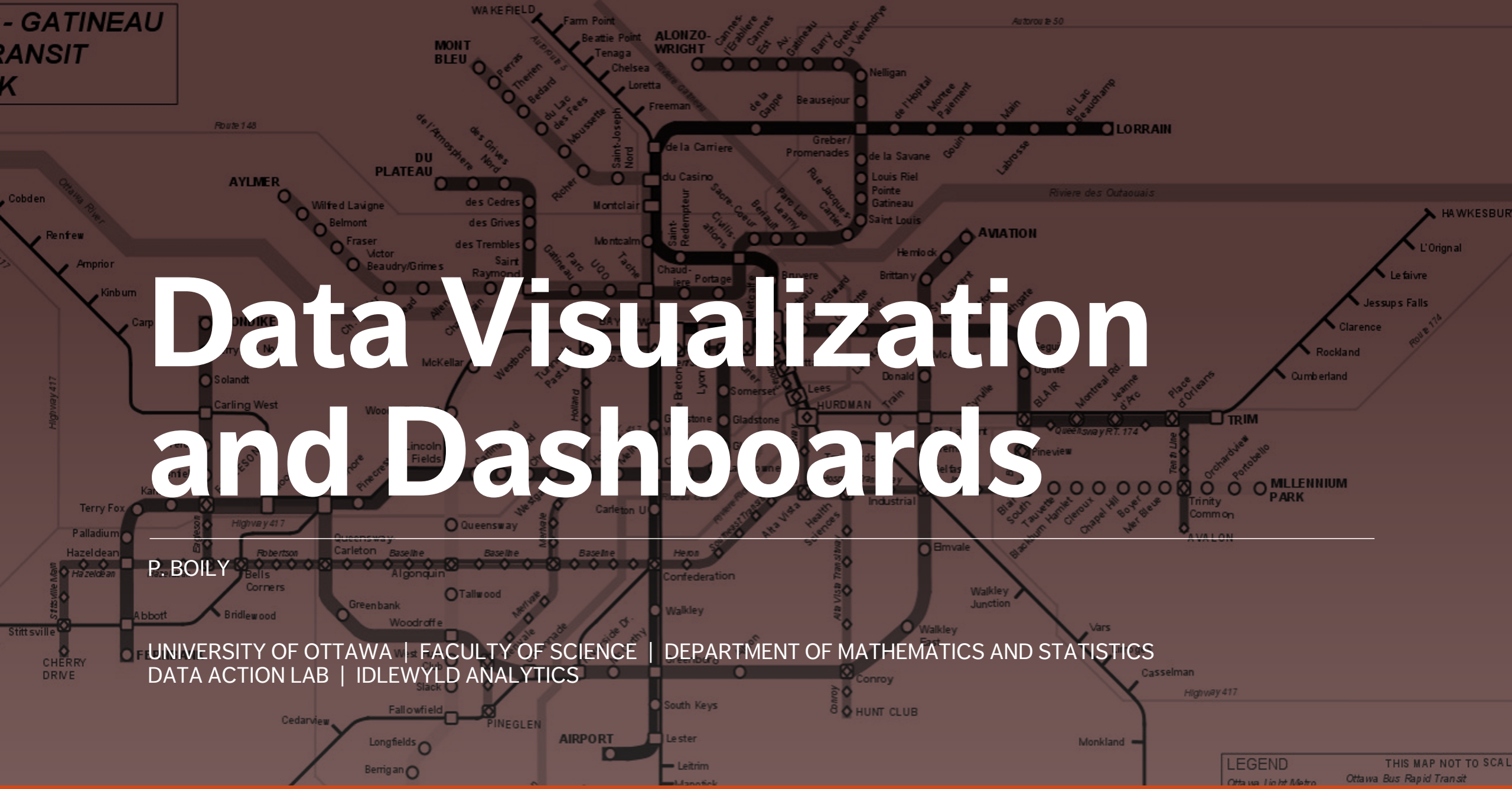


Data Visualization and Dashboards

P. BOILY

UNIVERSITY OF OTTAWA | FACULTY OF SCIENCE | DEPARTMENT OF MATHEMATICS AND STATISTICS
DATA ACTION LAB | IDLEWYLD ANALYTICS

Instructor – Patrick Boily

Employment

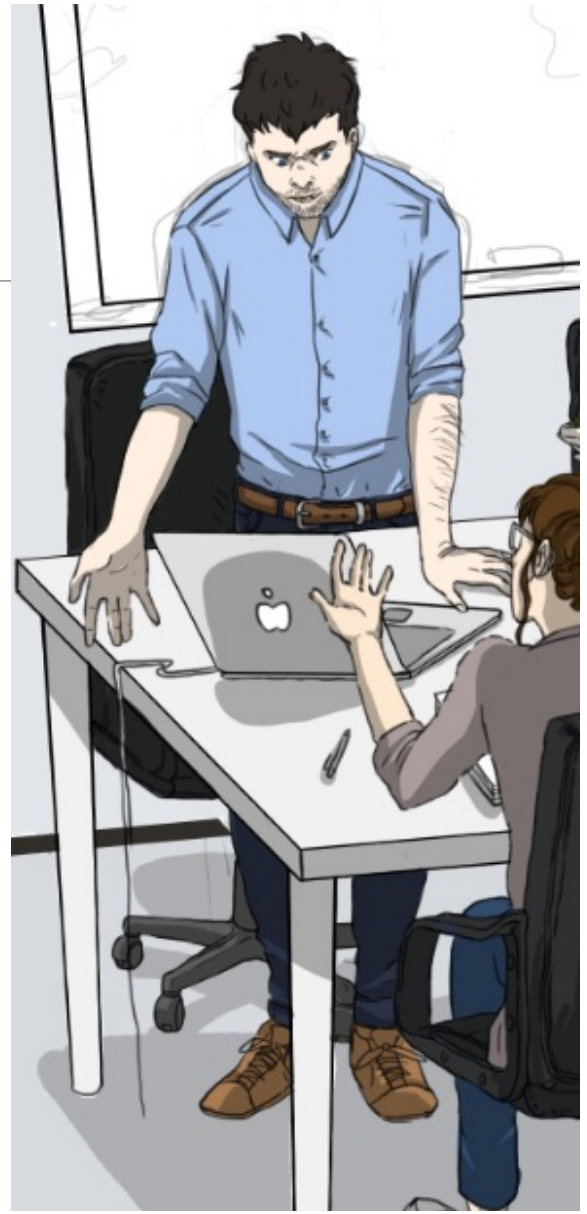
- Professor Math/Stat [‘19 – now, uOttawa]
- President [‘16 – now, Idlewyld Analytics]
- Manager and Senior Consultant [’12 – ‘19, CQADS, Carleton]
- Public Service [’08 – ’12, ASFC | StatCan | TC | TPSGC]
- 60+ uni course; 250+ workshop days

Projects

- GAC; NWMO; CATSA; etc.
- 40+ projects

Specialization

- Data visualization; data cleaning (... unfortunately)
- Application of wide breadth of techniques to all kinds of data
- Mathematical/statistical modeling



Course Material

Course Webpage:

https://data-action-lab.com/102-dvd

Course Notes:

https://www.practicedataviz.com

Contact Info:

pboily@uottawa.ca

Slack Workspace:

https://dspdi.slack.com

Course Description

Prior to running analyses, data exploration is crucial to gain an understanding of the dataset and what it contains. Increasingly sophisticated visualization strategies can play an important role at this stage.

Visualization is also used at the end of the data analysis process to communicate data insights to an audience, often in the form of a dashboard.

In this course, participants will learn tool-agnostic fundamental strategies for visualizing and communicating data (storytelling) and be introduced to the grammar of graphics and the basics of dashboarding.

Following the course, the participants have the option of working on a guided project, getting feedback from the instructor.

Additional Information

Exposure to programming frameworks would be beneficial but not necessary. Participants must be comfortable (not necessarily experts) with the concepts introduced in *Data Science Essentials*.

Participants are required to bring a laptop/personal computer on which the current version of R/RStudio (Posit) are installed (for which they may require administrative authorisation to install packages).

Participants doing the guided project must be familiar with R, the tidyverse, and/or Python.

Learning Outcomes

At the end of this course, participants will be able to:

- develop strategies to explore a dataset using visual means
- discern which strategy and design to use to best represent the results from their data analysis
- create multivariate visualizations using ggplot2
- design simple conceptual dashboards
- learn how they can use storytelling notions to share their analysis insights

Course Outline

Data Visualization Concepts

1. Exploratory Data Analysis
2. Data Visualization for Communication
3. Visualization Catalogue
4. Chart Aesthetics
5. Dashboards

Storytelling with Data

6. Elements of Storytelling
7. Stories and Illustrations
8. Evolving a Storytelling Chart
9. Anatomy of Storytelling Dashboards

Session 1

Session 2

Session 3

Session 4

Course Outline

Visualizations with ggplot2

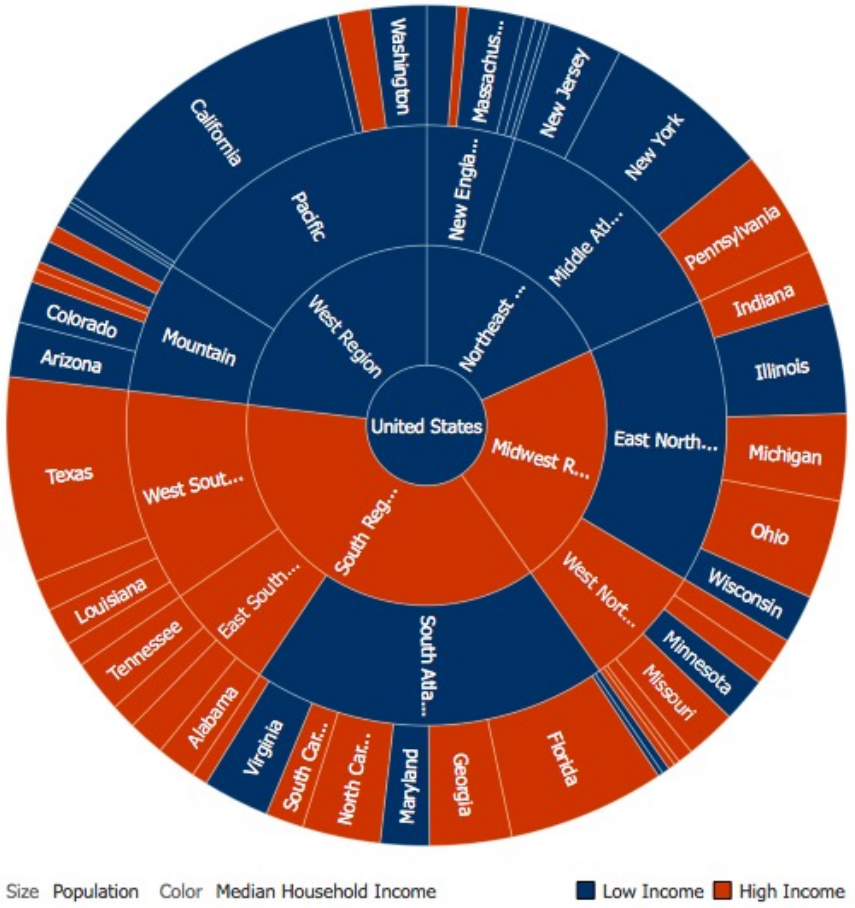
10. The Grammar of Graphics
11. Basics of ggplot2
12. Examples and Miscellanea

Session 1
Session 2
Session 3
Session 4

Data Visualization vs. Infographics

Data Visualization

- A **method**, as well as an item (**objective**)
- Typically focuses on the **quantifiable**
- Used to make sense of the data or to make it **accessible** (datasets can be massive and unwieldy)
- May be generated **automatically**
- The look and feel are less important than the **insights conveyed by the data**



[J.P. Blackard]

Data Visualization vs. Infographics

Infographics

- Created for **story-telling** purposes (**subjective**)
- Intended for a **specific** audience
- **Self-contained** and discrete
- **Graphic design** aspect is key
- **Cannot** usually be re-used with other data
- Can incorporate **unquantifiable** information

Historical Charts

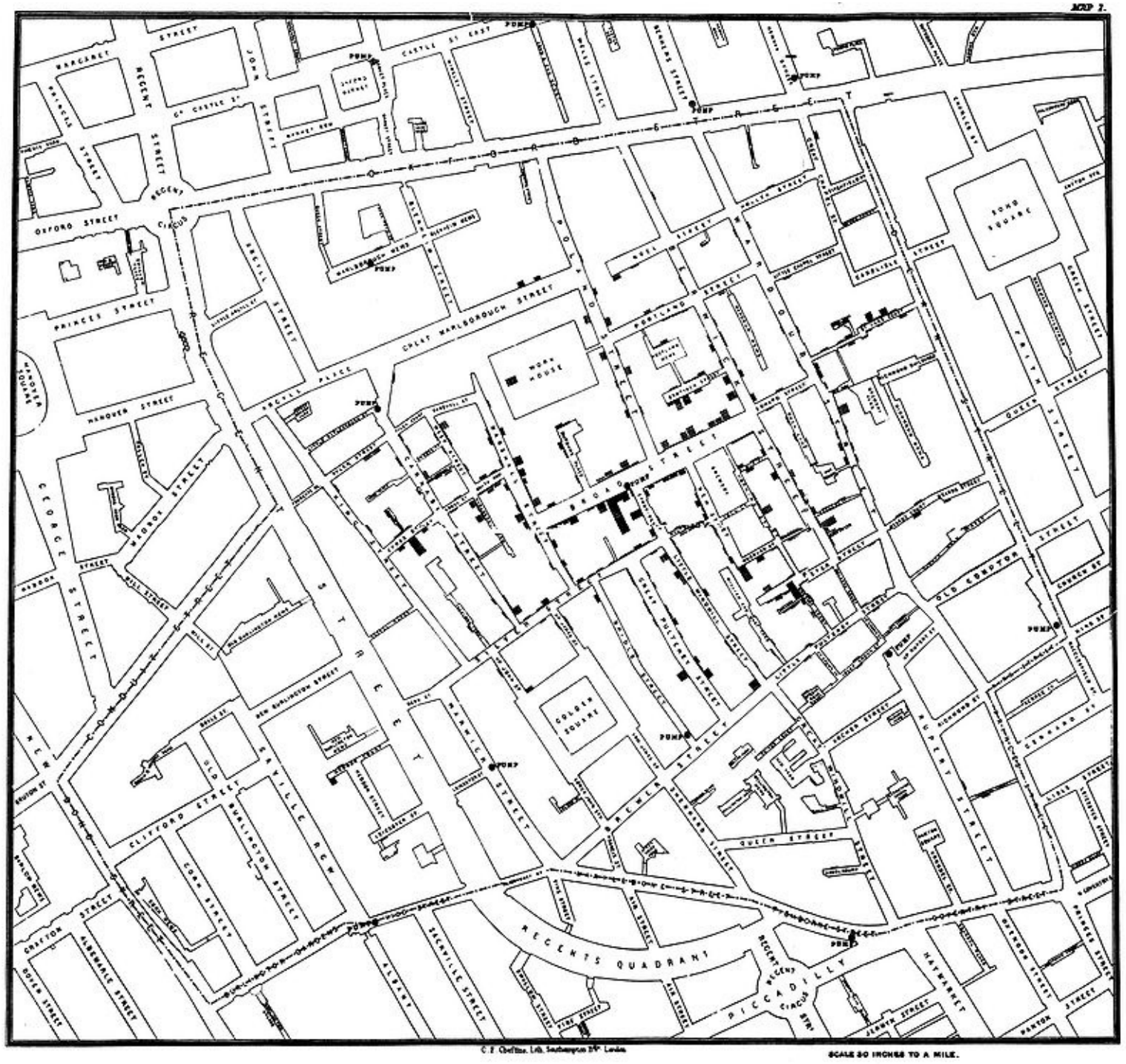
Data visualization is not confined to the recent past: charts have been used for many years to help **communicate information** and **tell stories**.

Due to the absence of technical tools, a lot of thought had to go into the design and creation of these visualizations.

Consequently, there is a lot we can (and **should**) learn to bring into the development of charts from a **design and storytelling perspective**.

London's Cholera Outbreak of 1854

Physician John Snow links the outbreak to a contaminated well by plotting number of cases on a map, jump-starting the science of epidemiology.



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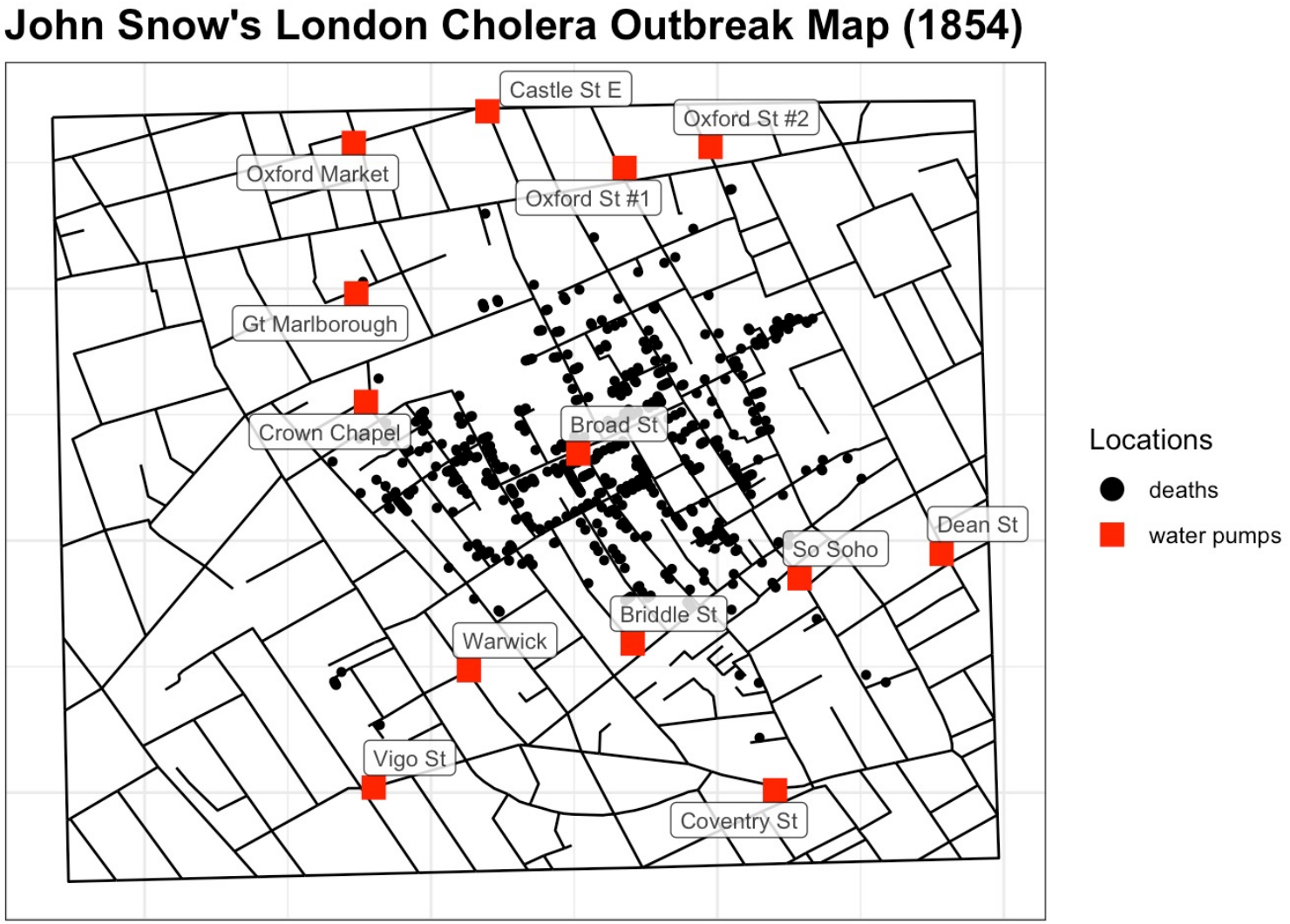
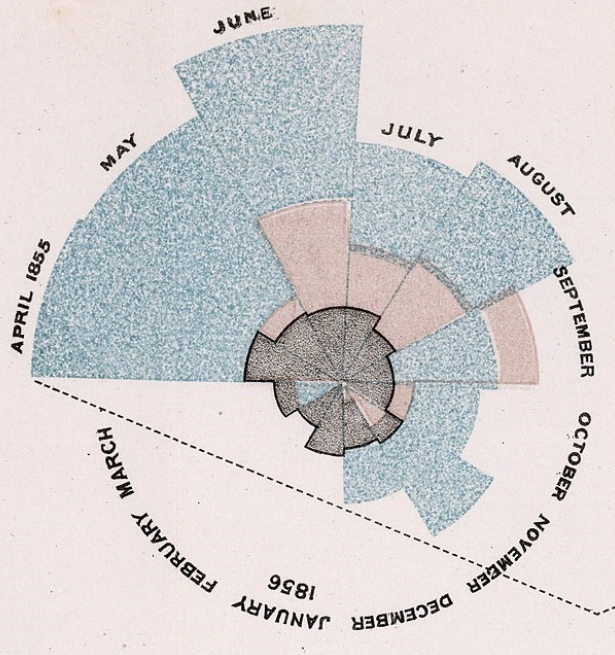


[F. Nightingale]

DIAGRAM of the CAUSES of MORTALITY IN THE ARMY IN THE EAST.

2.
APRIL 1855 to MARCH 1856.



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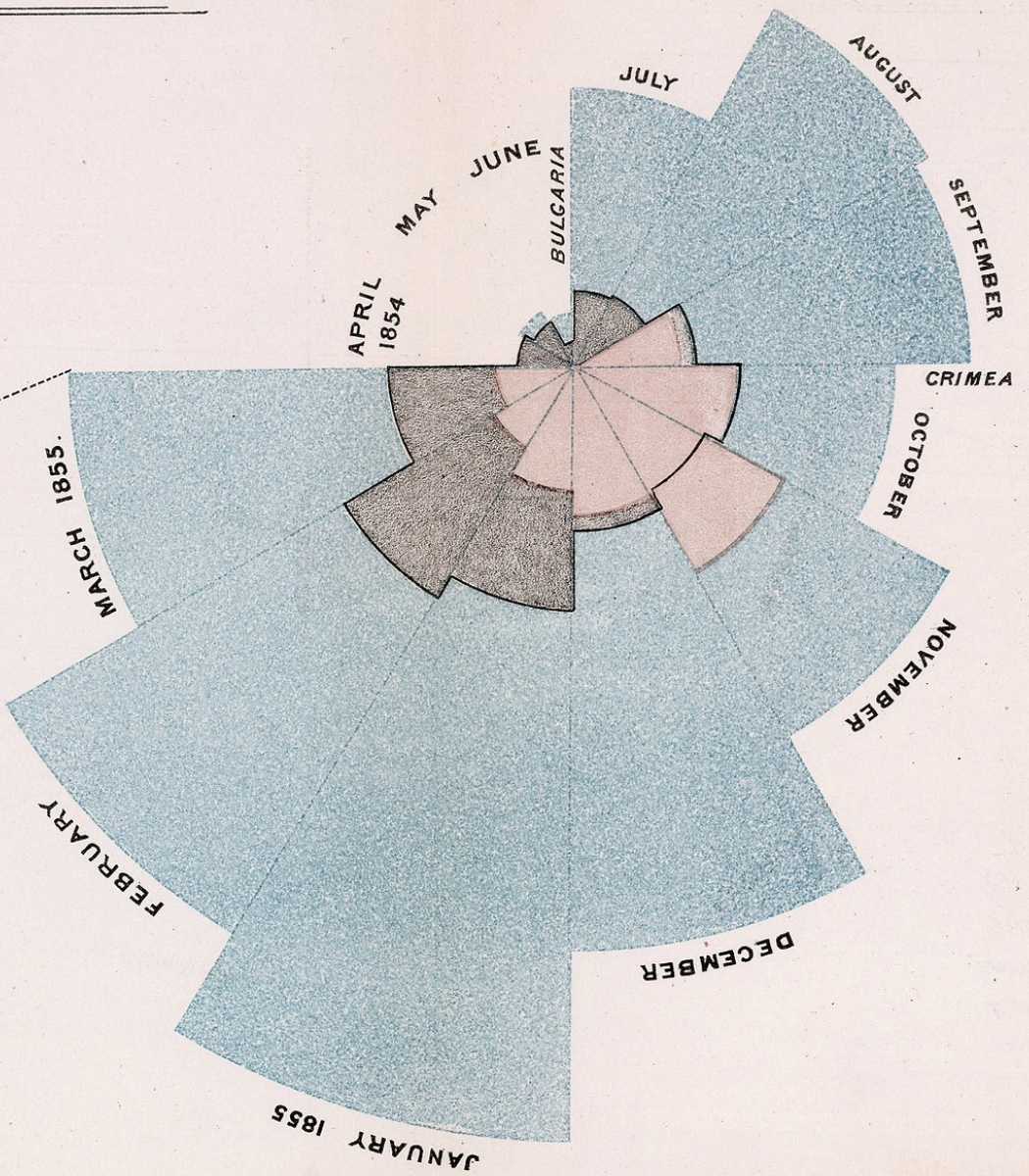
APRIL 1854 to MARCH 1855.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases; the red wedges measured from the centre the deaths from wounds; & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov.r 1854 marks the boundary of the deaths from all other causes during the month.

In October 1854, & April 1855, the black area coincides with the red; in January & February 1855, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

Harrison & Sons, St. Martin's Lane.

[F. Nightingale]

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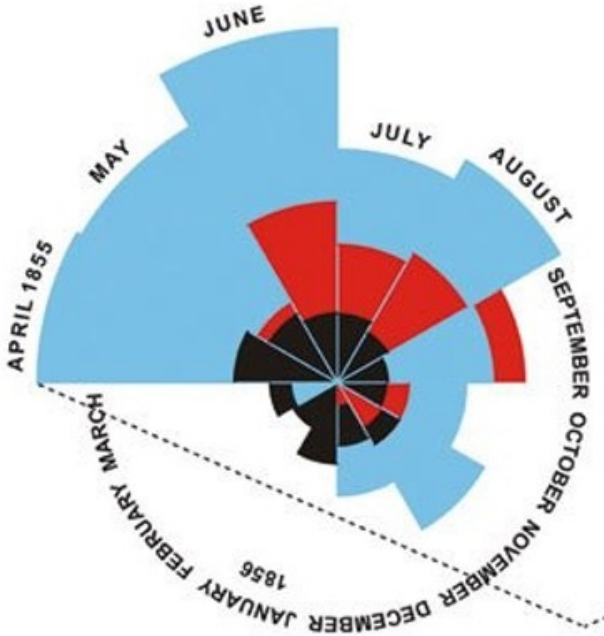

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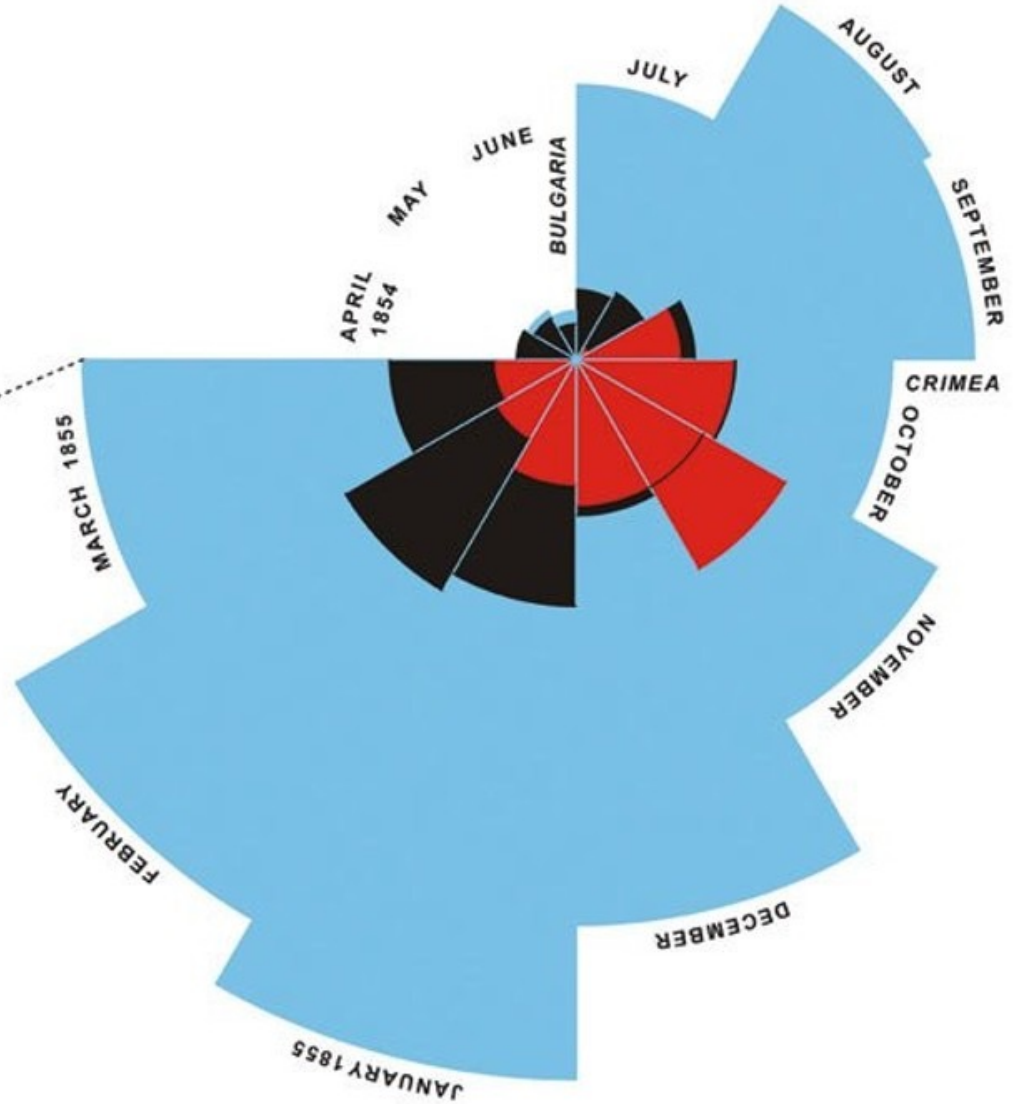

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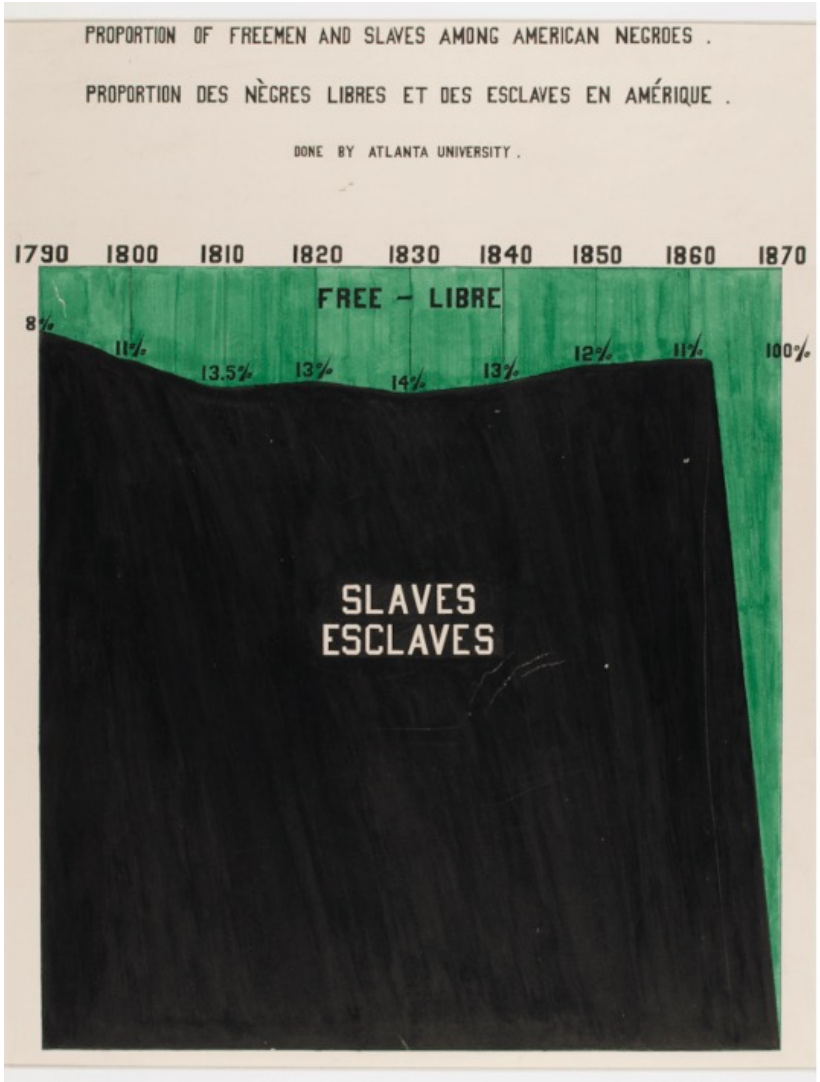
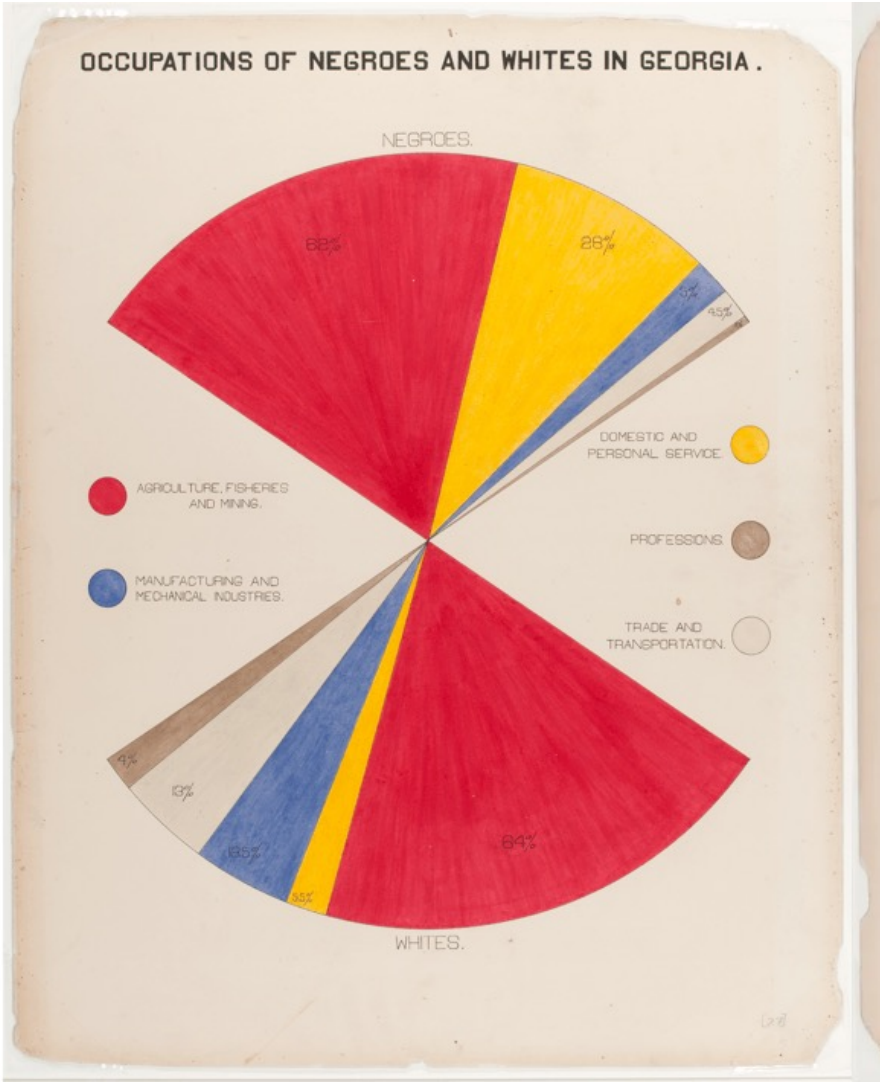
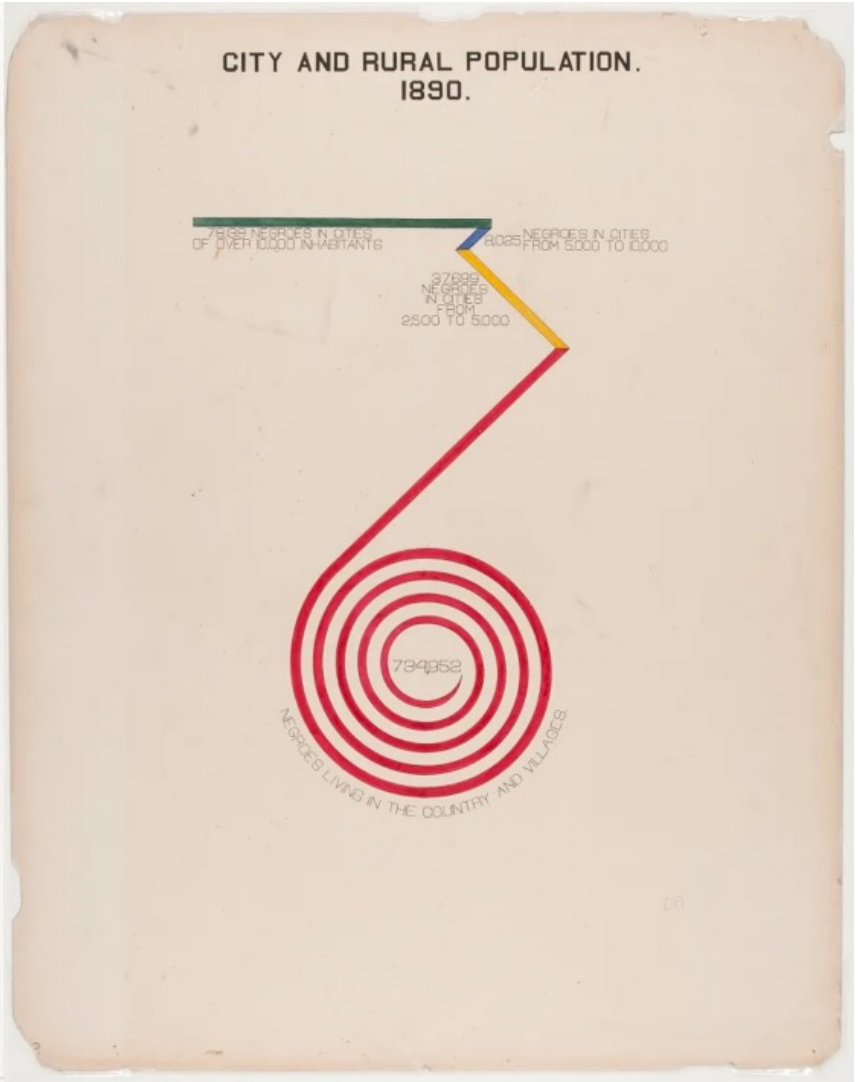
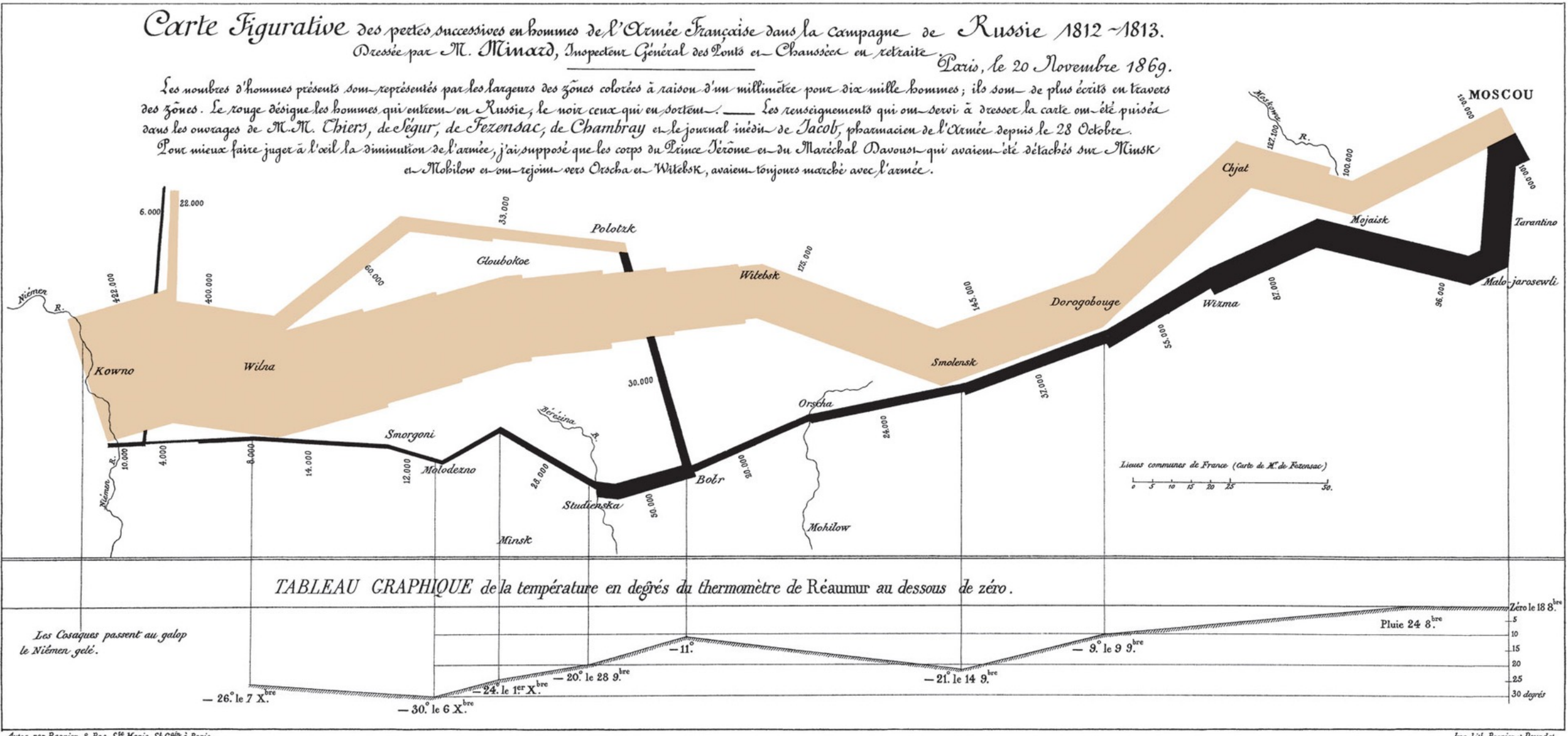
[W.E.B. DuBois]


PROPORTION OF FREEMEN AND SLAVES AMONG AMERICAN NEGROES .
PROPORTION DES NÈGRES LIBRES ET DES ESCLAVES EN AMÉRIQUE .
DONE BY ATLANTA UNIVERSITY .
1790 1800 1810 1820 1830 1840 1850 1860 1870
FREE - LIBRE
8%
11%
13.5%
13%
14%
13%
12%
11%
100%
SLAVES
ESCLAVES


OCCUPATIONS OF NEGROES AND WHITES IN GEORGIA .
NEGROES.
WHITES.
AGRICULTURE, FISHERIES AND MINING.
MANUFACTURING AND MECHANICAL INDUSTRIES.
DOMESTIC AND PERSONAL SERVICE.
PROFESSIONS.
TRADE AND TRANSPORTATION.
68%
28%
5%
4%
4%
13%
35%
84%

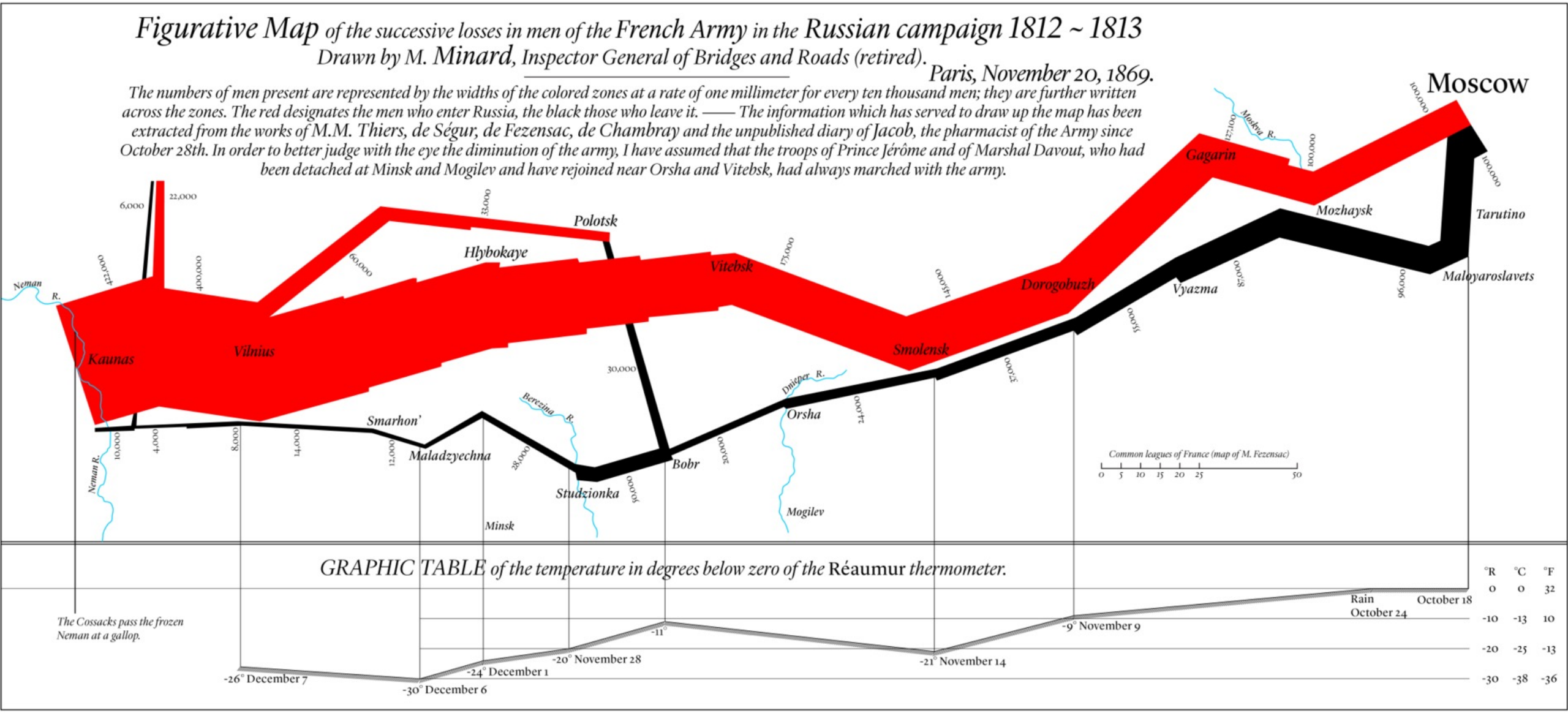

CITY AND RURAL POPULATION.
1890.
NEGROES IN CITIES FROM 5,000 TO 10,000
8,025
37,889 NEGROES IN CITIES FROM 2,500 TO 5,000
784,952
NEGROES LIVING IN THE COUNTRY AND VILLAGES

[Minard, 1869]



Minard's March to Moscow

[DAL Podcast #3: https://youtu.be/tS_2_lQ5gRw]



Minard's March to Moscow

Sister Courses

DATA SCIENCE ESSENTIALS

1. Non-Technical Aspects
2. Data Science Basics
3. Data Preparation
4. Data Engineering

INTRODUCTION TO MACHINE LEARNING

1. Statistical Learning
2. Classification
3. Clustering
4. Issues and Challenges