

```
In [1]: from IPython.display import Image
```

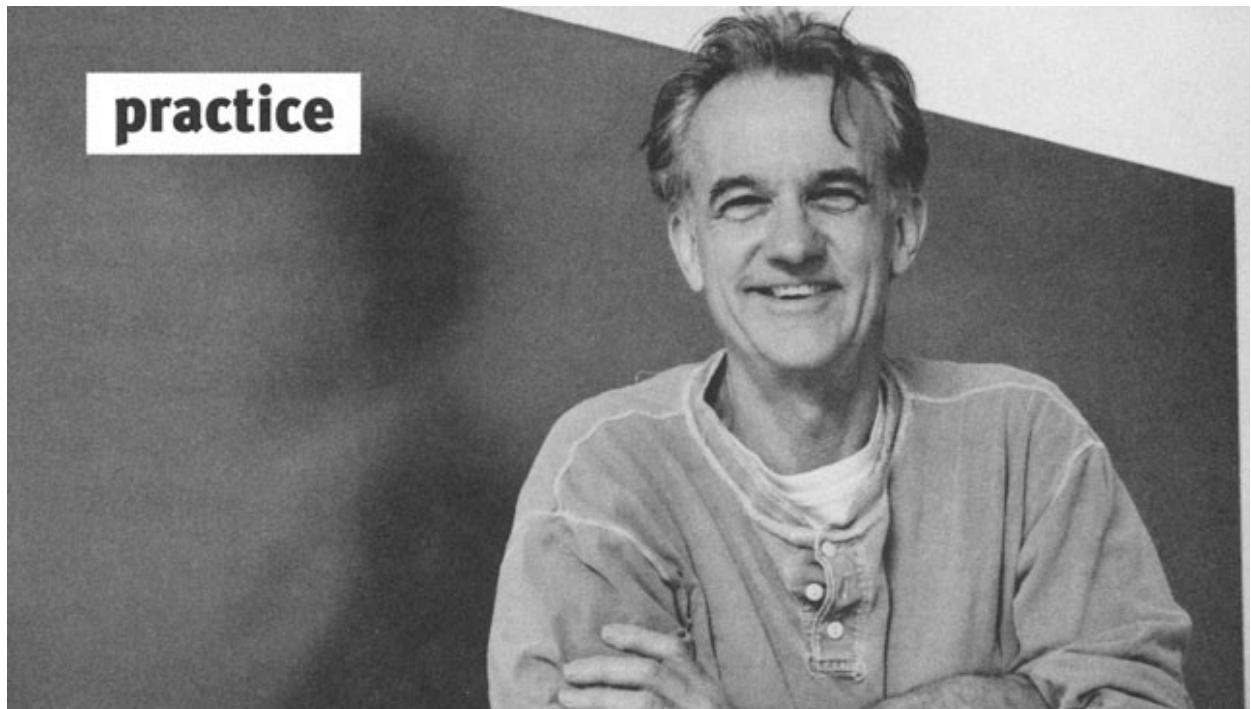
## Edward Tufte

<https://www.edwardtufte.com> (<https://www.edwardtufte.com>)

is an American statistician and professor emeritus of political science, statistics, and computer science at Yale University. He is a pioneer in the field of data visualization and noted for his writings on information design.

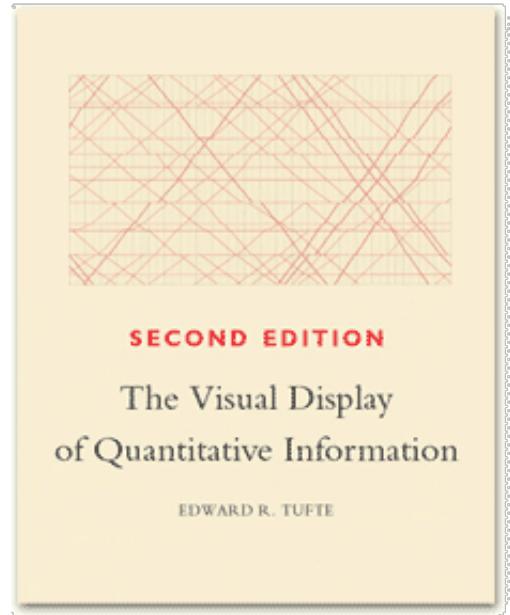
```
In [2]: Image("img/ET.jpg")
```

Out[2]:



In [3]: `Image("img/vdq1_bookcover.gif")`

Out[3]:



## Excellence in statistical graphics

consists of complex ideas communicated with clarity, precision and efficiency.

Graphical Displays should:

- Show the data
- Induce the user to think about the substance rather than about methodology, graphic design, the technology of graphic production, or something else
- Avoid distorting what the data have to say
- Present many numbers in a small space
- Make large data set coherent
- Encourage the eye to compare different pieces of data
- Reveal the data at several levels of detail, from a broad overview to the fine structure
- Serve a reasonably clear purpose: description, exploration, tabulation, or decoration
- Be closely integrated with the statistical and verbal descriptions of a data set.

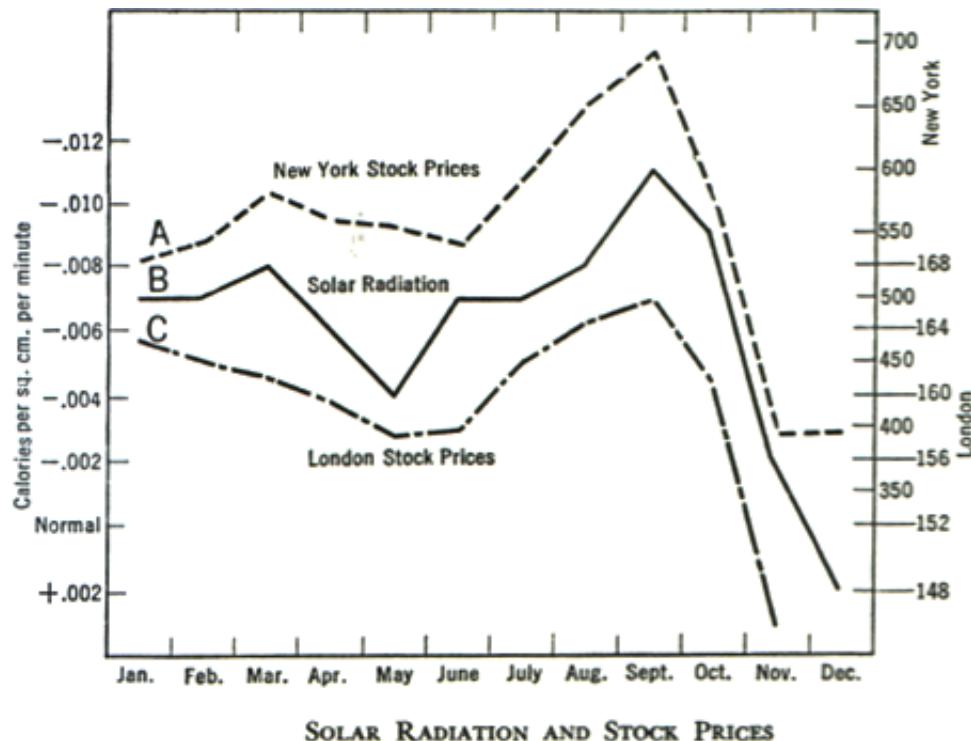
Graphics *reveal* data.

## Solar Radiation and Stock Prices

Statistical graphs are only as good as what goes into them.

In [4]: `Image("img/ET_NYStockPrices_SolarRadiation.png")`

Out[4]:



p. 15

- A. New York Stock Prices (Barron's average).
- B. Solar radiation, inverted.
- C. London stock prices.

Of course, statistical graphics, just like statistical calculations, are only as good as what goes into them. An ill-specified or preposterous model... or a puny (small and weak) data set cannot be rescued by a graphic (or by calculation), no matter how clever or fancy. **A silly theory means a silly graphic.**

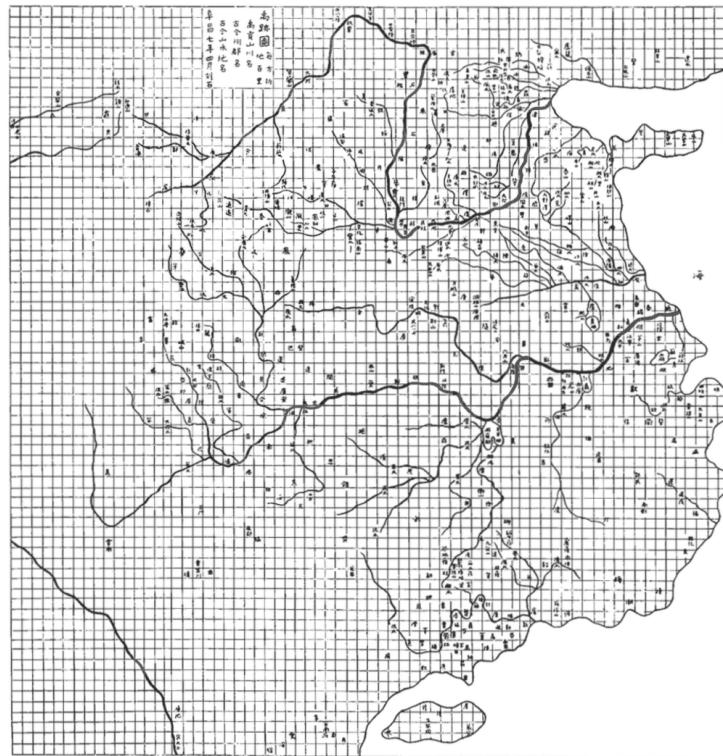
## Map of China's Coastal Land using 'Li' (1137)

Chinese geography was at that time ahead of the West... There was nothing like it in Europe till the Escorial MS. map of about +1550...

...The coastal outline is relatively firm and the precision of the network of river systems is extraordinary.

In [5]: `Image("img/ET_ChinasCostalLand.png", width="60%")`

Out[5]:



E. Chavannes, "Les Deux Plus Anciens Spécimens de la Cartographie Chinoise,"  
*Bulletin de l'École Française de l'Extrême Orient*, 3 (1903), 1–35, Carte B.

(Chavannes 1903; Nelson 1974; Hapgood

p.21

A detailed map with a full grid was carved in stone in +1137 (but probably dating before 1100). The name of the geographer is unknown. The size of the original is about 3 feet square (.83 square meters).

## New York weather

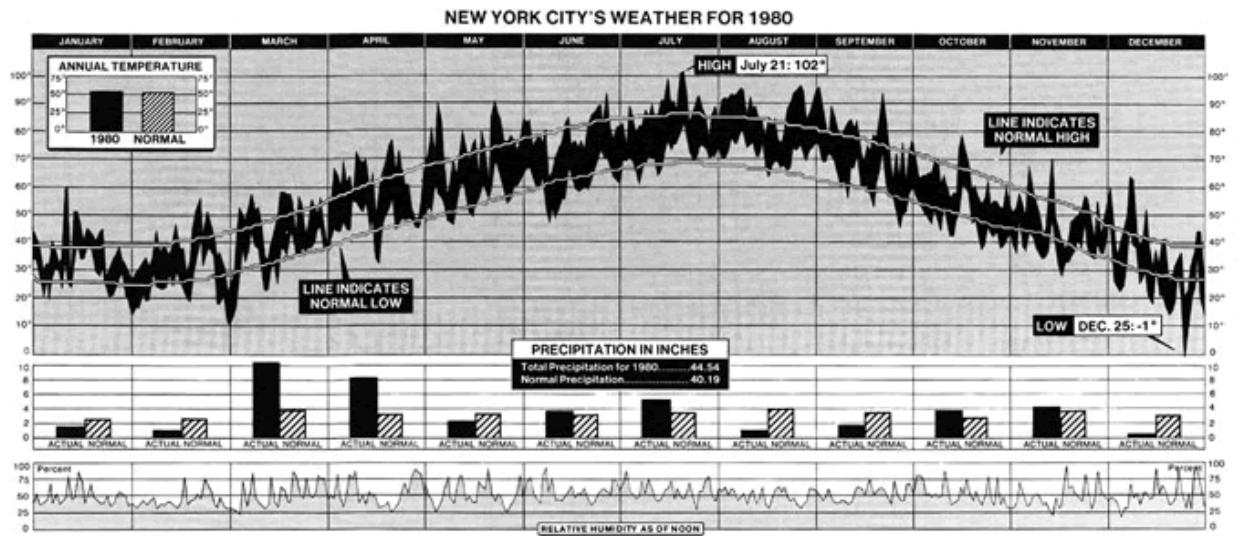
[\(https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg\\_id=00014g\)](https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=00014g)

This diagram was commended by Edward Tufte as a graphic that is extremely rich in data but is still easily understandable.

Published by the NY Times, NYC weather for 1980:

In [6]: `Image("img/ET_NY_Weather_Chart_1980.gif")`

Out[6]:



p.30

The graphic shows:

- The minimum and maximum temperatures each day in the year (black zig-zag band)
- The normal minimum and maximum temperatures throughout the year (curves on top of actual temperature band)
- Actual and normal rainfall each month (bar charts in centre)
- Relative humidity each day (bottom of diagram)
- Annual summaries of temperature and rainfall compared to normal (two boxes)

The format encourages the reader to look for relationships between temperature, rainfall and humidity. For example, the daily temperature range (maximum – minimum) was typically lower in the winter than in the summer (shaded vertical distance between the minimum and maximum time series). Also, the period from late August to early September was much warmer than normal. (Both maximum and minimum daily temperatures tended to be higher than normal during this period.)

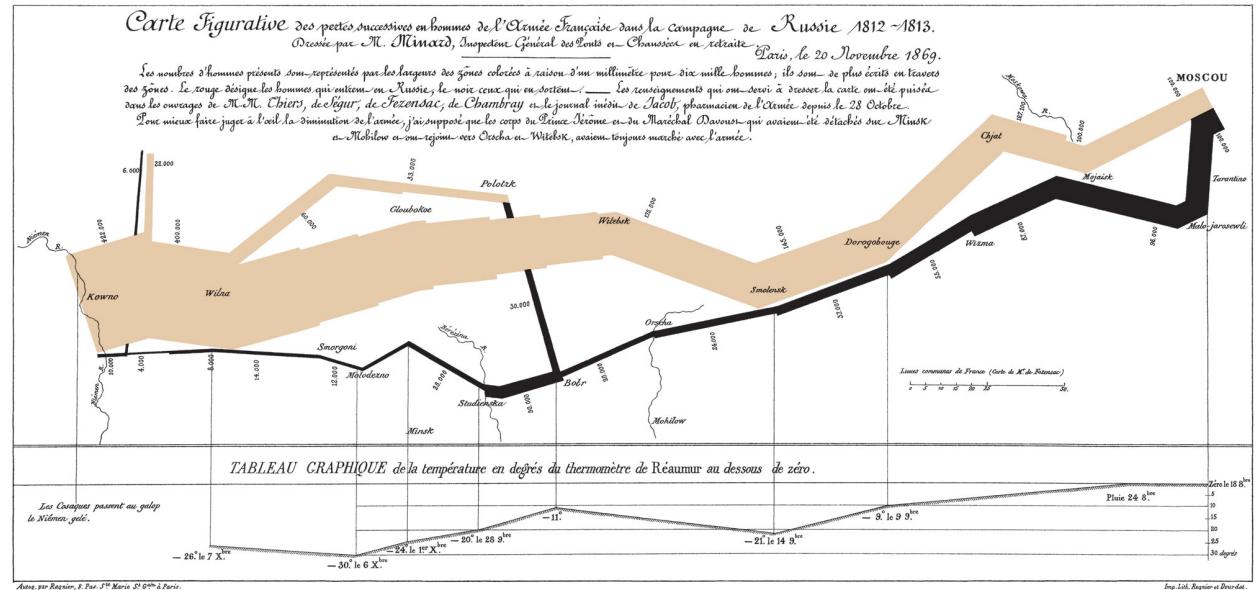
Also note the use of annotations to indicate the warmest and coldest days in the year.

## Charles Joseph Minard: Napoleon's Retreat From Moscow

(The Russian Campaign 1812-1813)

In [7]: `Image("img/ET_Minard.png")`

Out[7]:



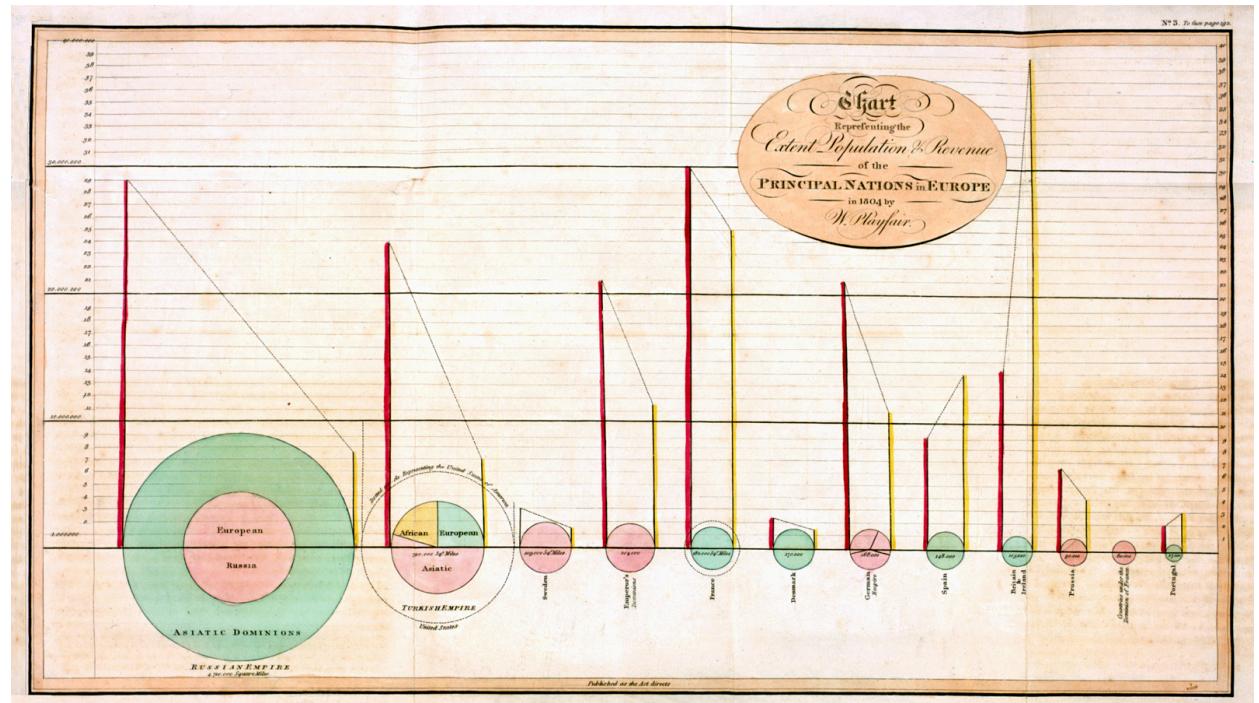
p.41

## Principal Nations of Europe

By William Playfair in 1801

In [8]: `Image("img/ET_playfair_chimera.jpg")`

Out[8]:



p.44

This graphic is distinguished by its multivariate data, the use of area to depict quantity, and the pie chart - in apparently the first application of these devices.

- The circle represents the area of each country;
- The line on the left - the **population** in millions, read on the vertical scales;
- The line on the right - the **revenue (taxes)** collected in millions of pound sterling, read also on the vertical scales;
- The dotted lines drawn between the population and the revenue, are merely intended to connect together the lines belonging to the same country; the ascent of those lines being from right to left, or from left to right, shows whether in proportion to its population the country is burdened with high taxes or otherwise. **The slope of the dotted line is uninformative**, since it is dependent on the diameter of the circle as well as the height of the two verticals. However, **the sign of the slope does make sense**, taking Playfair to his familiar point about what he regarded as excessive taxation in Britain (fourth circle from the right, with the slope running opposite to most countries).

## The dot map of Dr John Snow

Dr. Snow (1813-58) is frequently referred to as the 'father of public health.' In 1854 he conducted a study that helped identify the source of cholera outbreak - a contaminated well. John Snow's 1854 map of the Soho cholera outbreak shows the concentration of cholera cases near the Broad Street pump. <https://www.wired.com/2009/09/0908london-cholera-pump/> (<https://www.wired.com/2009/09/0908london-cholera-pump/>)

[https://en.wikipedia.org/wiki/John\\_Snow](https://en.wikipedia.org/wiki/John_Snow) ([https://en.wikipedia.org/wiki/John\\_Snow](https://en.wikipedia.org/wiki/John_Snow))

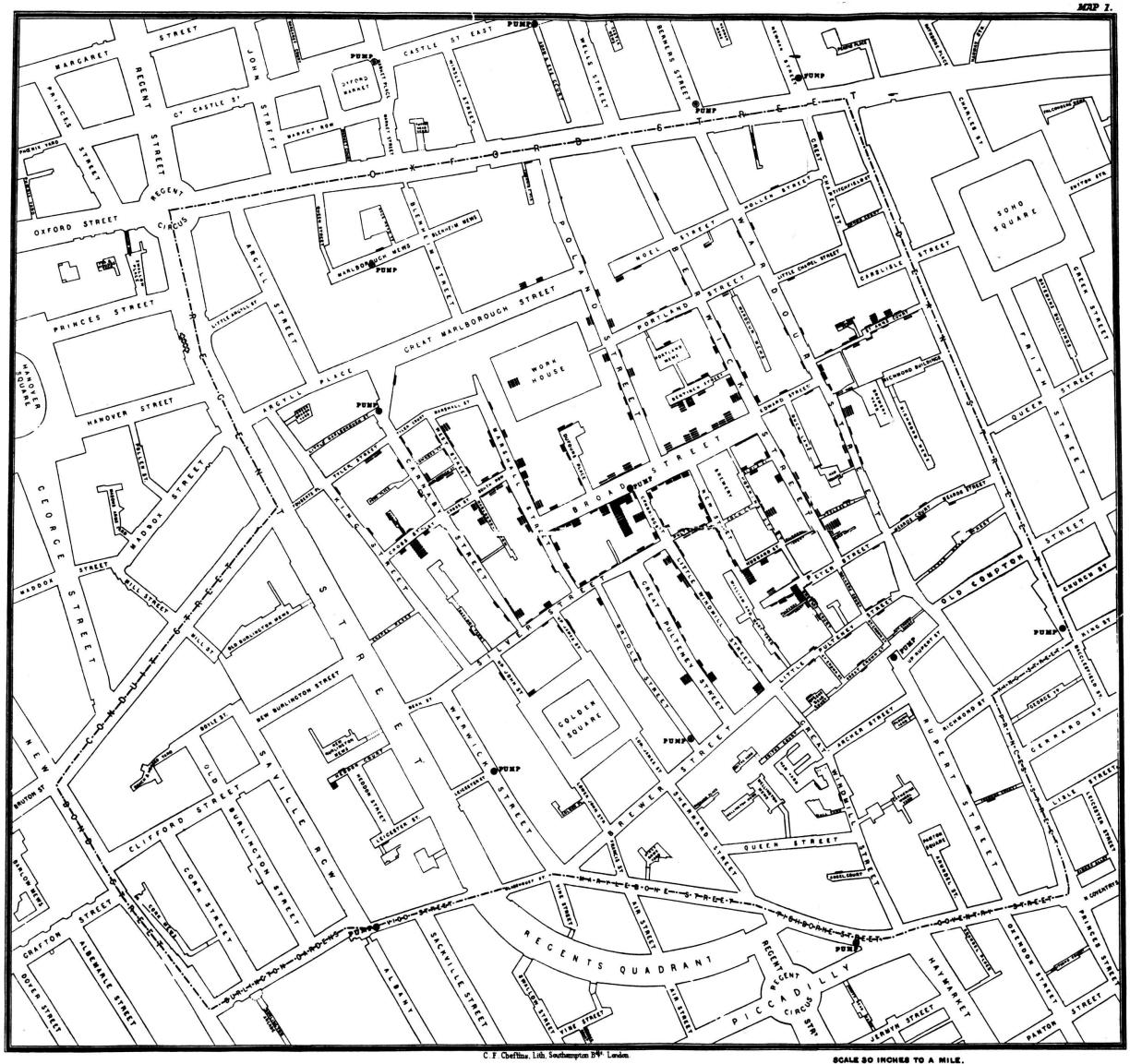
<https://johnsnow.matrix.msu.edu> (<https://johnsnow.matrix.msu.edu>)

[https://johnsnow.matrix.msu.edu/book\\_images12.php](https://johnsnow.matrix.msu.edu/book_images12.php)

([https://johnsnow.matrix.msu.edu/book\\_images12.php](https://johnsnow.matrix.msu.edu/book_images12.php))

In [10]: `Image("img/ET_london.jpg")`

Out[10]:



[https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg\\_id=0002Je](https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0002Je)

([https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg\\_id=0002Je](https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0002Je))

Edward Tufte 'Visual Explanations' p.27