

**STAT 6560**  
**Graphical Methods**

**Spring Semester 2009**

**Project Work**

**James B. Odei**

Utah State University

Department of Mathematics and Statistics

3900 Old Main Hill

Logan, UT 84322-3900

# WILLIAM PLAYFAIR (1759-1823)

A Graphical Pioneer of the 18th Century

Citations: *How others rate William Playfair.*

- “*the father of modern graphical display*” - (Wainer (2005), p. 5)
- “*the great pioneer of statistical graphics*” - (Playfair (2005), p. v)
- “*the founder of graphical methods of statistics*” - ([http://en.wikipedia.org/wiki/William\\_Playfair](http://en.wikipedia.org/wiki/William_Playfair))
- “*the inventor of statistical graphs and writer on political economy*” - (Spence (2004), <http://www.oxforddnb.com/view/printable/22370>)
- “*the pioneer of information graphics*” - ([http://en.wikipedia.org/wiki/William\\_Henry\\_Playfair](http://en.wikipedia.org/wiki/William_Henry_Playfair))
- “*an engineer, political economist and scoundrel*” - (Spence and Wainer in *Statisticians of the Centuries*, [http://bibleproudate2.com/Definitions/William\\_Playfair](http://bibleproudate2.com/Definitions/William_Playfair))
- “*an ingenious mechanic and miscellaneous writer*” - (Eminent Scotsmen, [http://bibleproudate2.com/Definitions/William\\_Playfair](http://bibleproudate2.com/Definitions/William_Playfair))

## Brief background

- Born on September 22, 1759.
- Was the fourth son of the Reverend James Playfair of the parish of Liff & Benvie near the city of Dundee, Scotland.
- Much of his early education was the responsibility of his brother John Playfair (1748-1819), a professor of mathematics and natural philosophy at Edinburgh University.
- He pursued variety of careers with such passion, ambition, industry, and optimism that even without his great innovations he would be judged a colorful figure.

- He was in turn apprenticed (1774-1747) under Andrew Meikle (inventor of the threshing machine), millwright to the Rennie family, draftsman for James Watt (inventor of the steam engine), engineer, accountant, inventor, silversmiths, merchant, investment broker, economist, statistician, pamphleteer, translator, publicist, land speculator, convict, banker, ardent royalist, editor, blackmailer, and journalist.

## What was done before Playfair?

### Examples:

- **Pre-1600:** *Early maps and diagrams.*
- **Christiaan Huygens' 1669** "ligne de vie" (*chart of mortality*).
  - Based on Graunt's mortality tables from city of London, the chart plots the expected number of survivors from a hypothetical pool of 100 persons as a function of age (a graph of a continuous function).
  - The horizontal axis is graduated and indexed by decades but it has no descriptive label (such as "Age") and the vertical axis lacks tick marks and labeling.
  - Demonstrates how to find the median remaining lifetime for a person of given age.
- **Edmond Harley's 1686 graph** (*of atmospheric pressure verses altitude*).
  - Bivariate plot of a theoretical curve derived from observations (barometric pressure vs. altitude), graphical analysis based on empirical data
  - Curve was fit in some unspecified fashion to observations which are not shown. He used the diagram to motivate a mathematical, and not a statistical argument (Weisberg (1979)).
  - The construction is more in the style of Cartesian graphs of mathematical functions than a modern statistical graph. If data had been shown, the chart might have almost merited the priority as the first published scatterplot.
- **Joseph Priestley's 1765** *Chart of Biography*.
  - Historical timeline (life spans of 2,000 famous people, 1200 B.C. to 1750 A.D.), quantitative comparison by means of bars.

- In which “a longer or a shorter space of time may be most commodiously and advantageously represented by a longer or a shorter line”.
- His chronological diagrams inspired the bar chart.
- **Johann H. Lambert’s 1779 chart** (*of soil temperatures at various latitudes and dates*).
  - Graphical analysis of periodic variation (in soil temperature), and the first semi-graphic display combining tabular and graphical formats.
  - Chart contained no data and the plotted functions seemed far too regular to have been directly based on empirical observations.
  - A fine example that contains many of the elements present in modern statistical graphs.

### Playfair’s main graphical innovations

- **1786:** Bar chart , line graphs of economic data.
- **1801:** Inventor of the pie chart, and circle graph, used to show part-whole relations.
- **Things to note about his charts:**
  - His designs were constructed in such a fashion that that low-level pre-attentive processes are easily completed by the human visual system.
  - Where it is important to for the reader to notice differences in rates of change, he constructs the chart with an aspect ratio appropriate to the comparison of adjacent slopes.
  - His charts are almost always constructed so that comparisons in different domains (lines, colors, labels, etc) do not exceed attentional and working memory capacity.
  - *His Intuitive psychology* (Spence (2006), pp. 2431–2432):
    - \* Color to code (and compare) categories.
    - \* Slope to code (and compare) trends.
    - \* Length to code (and compare) quantities.
    - \* Similar figures (areas) to code quantities.
    - \* The use of areas to code quantity.

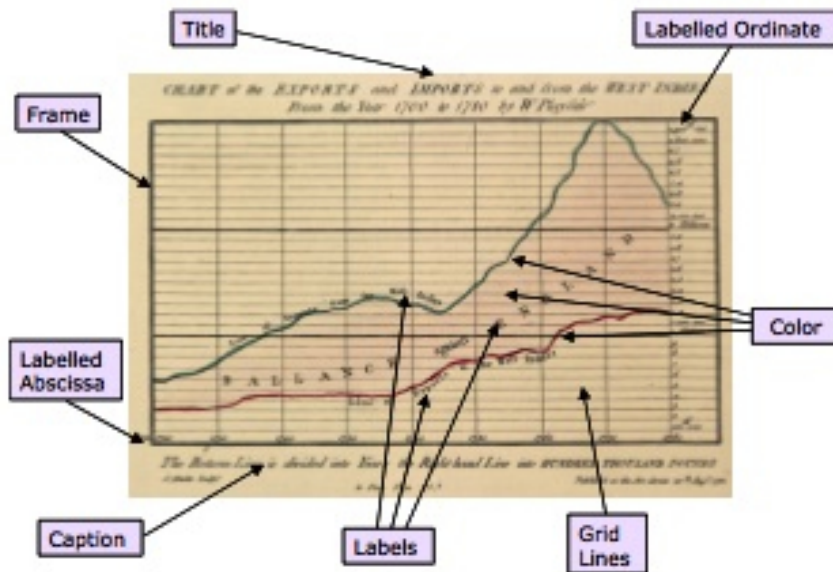


Figure 1: Common basic elements in Playfair’s chart. Spence (2006), Figure 13, p. 2431.

### Some flaws in Playfair’s graphics (Playfair (2005), pp. 18–23)

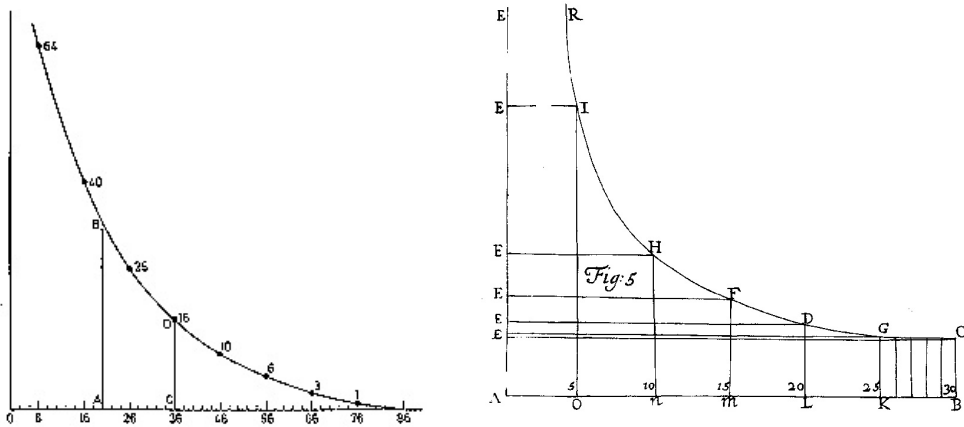
- Several arithmetical errors and careless drawings (evidence of rush production of publication).
- Curves that connect data points seemed to have derived their shapes from Playfair’s opinion of how the intervening data should look.
- His curves were drawn freehand, often somewhat crudely, betraying a lack of practice in the demanding skills of engraving.

### Links to Data file and R-code:

- [http://www.math.usu.edu/~symanzik/teaching/2009\\_stat6560/RDataAndScripts/odei\\_james\\_project1\\_Playfair.csv](http://www.math.usu.edu/~symanzik/teaching/2009_stat6560/RDataAndScripts/odei_james_project1_Playfair.csv)
- [http://www.math.usu.edu/~symanzik/teaching/2009\\_stat6560/RDataAndScripts/odei\\_james\\_project1\\_Playfair.R](http://www.math.usu.edu/~symanzik/teaching/2009_stat6560/RDataAndScripts/odei_james_project1_Playfair.R)

## References

- Playfair, W. (2005), *The Commercial and Political Atlas and Statistical Breviary, Edited and Introduced by Howard Wainer and Ian Spence*, Cambridge University Press, New York, NY.
- Spence, I. (2004), “Playfair William (1759–1823)”, *Oxford Dictionary of National Biography* **44**, 562–563.
- Spence, I. (2006), William Playfair and the Psychology of Graphs, in ‘2006 JSM Proceedings’, American Statistical Association, Alexandria, VA, pp. 2426–2436. (CD).
- Wainer, H. (2005), *Graphic Discovery: A Trout in the Milk and Other Visual Adventures*, Princeton University Press, Princeton, NJ.
- Weisberg, S. (1979), “Letter re: Quantitative Graphic in Statistics: a Brief History”, *The American Statistician* **33**(3), 163.



*A Specimen of a Chart of Biography.*

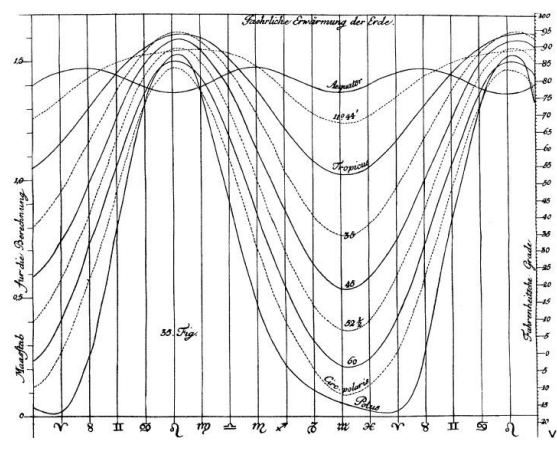
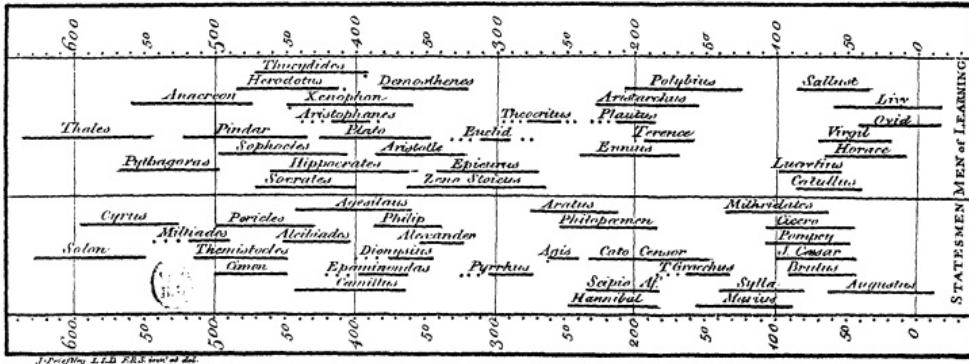


Figure 2: Huygen’s chart of motality (top left), Harley’s 1686 graph (top right), Priestley’s Chart of Biography (middle), and Lambert’s 1779 chart (bottom). *Source:* Figures taken from <http://www.math.yorku.ca/SCS/Gallery/images/huygens-graph.gif>, <http://www.math.yorku.ca/SCS/Gallery/images/halleygraph.gif>, <http://www.math.yorku.ca/SCS/Gallery/images/priestley.gif> and <http://www.math.yorku.ca/SCS/Gallery/images/lambert1779-graph.jpg> on 2/2/2009.

