

Editorial: Commemorating William Playfair's 250th Birthday

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1 William Playfair's Legacy

In this editorial, we want to commemorate the 250th birthday of William Playfair. According to pages 564 to 566 of the June 1823 issue of the *Gentleman's Magazine* and to Scott (1925, p. 348), Playfair was born on September 22, 1759, near the city of Dundee in Scotland, and he died on February 11, 1823, in London. For readers not familiar with William Playfair and his work, we would suggest to first refer to Appendix 1 and then continue with the main editorial.

Towards the end of the 19th century, Playfair and his work were mostly forgotten. In the discussion of a paper on tabular analysis by William A. Guy (an editor, physician, and statistician), the English economist and statistician W. Stanley Jevons said (see

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Jevons' comment on p. 657 of Guy, 1879) that "*Englishmen lost sight of the fact that William Playfair, who had never been heard of in this generation, produced statistical atlases and statistical curves that ought to be treated by some writer in the same way that Dr. Guy had treated the method of Dr. Todd.*" This citation frequently has been quoted, e.g., in Funkhouser (1937, p. 293), in FitzPatrick (1960, p. 39), and in Maas and Morgan (2002/2, p. 98). Funkhouser (1937, footnote (5) on p. 293) even stated that "*JEVONS suggestion did not bear fruit until almost sixty years later*" and then he referred to Funkhouser and Walker (1935). However, some credit needs to be given to Guy. In his 1885 paper, Guy followed up on Jevon's comment and stated (Guy, 1885, p. 79):

"Nor should I be doing justice to ourselves did I omit a passing notice of the works of William Playfair of Dundee, who made such early, free, and skilful use of the graphic method in his statistical, historical, and political works published towards the end of the last century and beginning of this — to be more exact, between the years 1786 and 1805. This graphic method, which owes so much to M. Guerry and William Playfair, has been largely used here in England by Dr. Farr, in the shape of curves, columns, rectangular and circular forms."

Nowadays, such comments are common. Playfair is recognized as the "*man who invented outright the graphic method of representing statistical data*" (Funkhouser and Walker, 1935, p. 103), the "*Apparent Inventor of Statistical Graphics*" (Funkhouser, 1937, p. 280), the "*founder of graphic methods in statistics*" (FitzPatrick, 1960, p. 39), the "*father of modern graphical display*" (Wainer, 2005, p. 5), the "*progenitor of modern statistical graphics*" (Wainer, 2005, p. 9), and the "*great pioneer of statistical graphics*" (Stephen Stigler, introducing Playfair, 2005, opening page), to quote just a few of the accolades he received over the last 80 years.

Numerous articles and books have been published describing Playfair's contributions to and inventions in the field of statistical graphics, most recently Spence (2004), Wainer (2005), and Playfair (2005), that also contain detailed references related to Playfair's work. Just in brief, Playfair deserves credit for the development of the line graph, the bar chart, the pie chart, and the circle graph. All of these, except the line graph, can be seen in Fig. 1 and on the accompanying Web page at http://www.math.usu.edu/~symanzik/papers/2009_cost/editorial.html.

As two of Playfair's works, the third edition of *The Commercial and Political Atlas* and the first edition of *The Statistical Breviary* recently have been republished as Playfair (2005), high-quality versions of some of Playfair's graphics now are easily accessible to interested readers. Unfortunately, many of Playfair's original publications and figures are unpublished manuscripts or parts of rare book and special collections at a few distinguished libraries. By chance, when teaching a graduate course on Statistical Graphics in the Spring 2009 semester, the first author ran into a rarely cited booklet (Wenzlick, 1950) that contained three excellent reproductions of Playfair's graphics. One of its few citations in a statistical source appears in FitzPatrick (1960, p. 39), but FitzPatrick does not further comment on the excellent quality of the Playfair graphics reproduced in Wenzlick's booklet.

We really hope that several traditional commemoratives regarding Playfair, similar to Droesbeke (2009), will be published in late 2009 and early 2010. In our version, we will follow a less traditional approach and will primarily focus on Wenzlick (1950), reproduced in Appendix 1, and use this as the basis to correct some factual errors regarding Playfair's life and work that are frequently found in the Playfair literature.

Fig. 1 *Chart Representing the Extent, Population & Revenue of the Principal Nations in Europe in 1804.* Plate 2 (labeled No. 3) from Playfair (1805). Courtesy of the Thomas Fisher Rare Book Library, University of Toronto.

2 Roy Wenzlick's and his Playfair Booklet

Roy Wenzlick (1894–1989) published the *Real Estate Analyst* from 1932 until his retirement in 1973. Investors and others involved in the real estate business considered the publication a must have subscription. Wenzlick and his staff compiled huge amounts of data and predicted trends in the housing and construction business. Much of the statistics and information that was analyzed by Wenzlick and his employees appeared in the form of graphs and charts.

An average issue of the *Real Estate Analyst* contained from 15 to 25 charts relating statistics on building costs, real estate sales, foreclosures, interest rates and many other subjects. Huge charts became a part of every Wenzlick talk. As a hobby Wenzlick collected antique maps and charts. An interesting feature in Wenzlick's *coat of arms* that is published in some of his works (here on the back page — and therefore on the first page of the scan of his 1950 booklet) is a slide rule instead of a sword and a statistical graph in semi-log scale drawn on a shield.

Thus, it should be of no big surprise that Wenzlick, after he purchased a historic book with one of Playfair's graphics, "*started a long but very interesting investigation of the life and work of the man whose name was attached to the chart*" (Wenzlick, 1950). The result is his unpublished booklet reproduced in full at the end of this editorial in Appendix 1. High-resolution scans of the booklet, including all three of Playfair's figures republished in the booklet, can be accessed at http://www.math.usu.edu/~symanzik/papers/2009_cost/editorial.html. An accompanying card (see Appendix 2) indicates that Wenzlick's booklet was distributed as a Christmas gift to friends and colleagues working in the real estate business.

It should be noted that Wenzlick's booklet is more than just a brief summary of the previously existing articles on Playfair and his work. Most notable are the Playfair graphics Wenzlick was able to obtain and republish in excellent quality (even by today's standards) in his booklet.

There are some factual errors in Wenzlick's text that probably would have been noticed in a peer-reviewed article, but that slipped unnoticed into the printed version of his booklet:

In the second paragraph of Wenzlick (1950), it is stated: "*His father died when William was 13 years old.*" The same information can be found in FitzPatrick (1960, p. 41). However, William's father, James Playfair, a minister of the united parishes of Liff and Benvie, died on May 28, 1772, as reported in Rogers (1872, footnote on p. 376) and Scott (1925, p. 348). Thus, William was still twelve years old when his father died.

Also in the same paragraph, it is stated: "*At 21 William Playfair became a draftsman for James Watt.*" Similarly, Hankins and Silverman (2006, p. 127) state that "*William Playfair had had a career as a machinist and had worked as a draftsman for Boulton and Watt beginning in 1780.*" Based on a letter reproduced in Appendix 3, Playfair most likely joined Boulton & Watt in 1777 when he was 17 or 18 years old (see also Playfair, 2005, p. 5). Moreover, Costigan-Eaves and Macdonald-Ross (1990, p. 324) quote a letter from Watt to Boulton from June 27, 1778, where it becomes evident that, at least initially, Watt did not have a very high opinion of Playfair.

In the third paragraph of Wenzlick (1950), it is stated: "*In 1798 William Playfair published Lineal Arithmetic, the first book ever published on charting.*" *Lineal Arithmetic* indeed was published in 1798. However, Playfair's *Commercial and Political Atlas* of 1786 (Playfair, 1786) was the first book to contain statistical charts, as commonly

recognized, e.g., in Funkhouser and Walker (1935, p. 105–106) and in FitzPatrick (1960, p. 39). The *Lineal Arithmetic* was an edited revision of the *Atlas*.

Regarding the partial figure on the title page of his booklet, Wenzlick (1950) wrote: “The cover of this booklet shows a portion of one of his charts published in 1801, undoubtedly the first “pie chart” ever drawn. This chart attempted to combine bar charts and pie charts in the same presentation.” Variants of this figure have been extensively discussed and republished, e.g., in Funkhouser and Walker (1935, p. 107–108 and Fig. 4), in Funkhouser (1937, p. 283–285), in Spence (2005, p. 353–356 and Fig. 1), in Spence (2006, p. 2432 and Fig. 18), and as Chart 1 and Chart 2 from *The Statistical Breviary*, as republished in Playfair (2005). However, Wenzlick did not use the original 1801 version as he assumed, but rather the 1805 version, shown in Fig. 1. In this later version, the United States are overlaid to the circle depicting the Turkish Empire. After the Louisiana Purchase of about 828,000 square miles in 1803, the United States approximately doubled their size. This would roughly match the area for the United States in this figure that is roughly 2.7 times the area of the Turkish Empire (representing 790,000 square miles), in particular as the exact boundaries of the purchase were established only much later.

It is well known that different versions of the same work of Playfair exist, see for example Playfair (2005, p. 20–23). Although only four countries (Russia, the Turkish Empire, the United States, and Sweden) are shown in Wenzlick’s adaptation of Playfair (1805) for his cover page, several differences are noticeable when compared with a version of the same chart that is held at the Thomas Fisher Rare Book Library, University of Toronto (see Fig. 1). In Wenzlick’s version, the European part of the Turkish Empire is stained in red, representing a land power; the Asiatic part is stained in green, representing a maritime power; and the African part is not stained at all. In the Toronto version, the stainings for the European and Asiatic parts are swapped; and the African part is stained in yellow. Compared to Chart 1 and Chart 2 from *The Statistical Breviary*, as republished in Playfair (2005), where Sweden is stained in green, Sweden is now stained in red in both versions. Both versions show different omissions of colors: In Wenzlick’s version, there is no yellow coloring of the line to the right of Sweden that represents revenues. Similarly, in the Toronto version, there is no red coloring of the line to the left of Sweden that represents population. Some of these color changes may be intentional, but some seem to be mistakes. It should be remembered that the charts were hand colored, probably by Playfair himself, and that without a comparison of several volumes, taken from other rare book libraries, it is difficult to be sure of Playfair’s intentions when he colored these figures.

The second figure in the middle of Wenzlick’s booklet shows the “*Chart of Universal Commercial History from the Year 1500 before the Christian Era to the present Year 1805*” and also was first published in Playfair (1805). This figure recently has been republished and discussed in Spence (2006, p. 2431–2432 and Fig. 15). There are two small differences in the Wenzlick version: (1) no label “*FRONTISPIECE*” at the top left outer margin of the figure; and (2) no text “*The Explanation of this Plate is at p. 78*” at the bottom underneath the figure. These may have been edited out by Wenzlick so as not to confuse readers of his booklet.

The last figure is a fold-out insert at the end of Wenzlick’s booklet and shows the “*Linear Chronology, Exhibiting the Revenues, Expenditure, Debt, Price of Stocks & Bread, from 1770 to 1820.*” This is really the most interesting of the Playfair charts republished by Wenzlick. First, from a purely technical standpoint, the quality of the reproduction clearly shows the original solid (Revenue), dotted (Bread), and various

dashed lines (Expenditure, Debt, Exports, Stocks) of the copperplate engraving overlaid by the hand colored lines. Second, this might actually be Playfair's final finished and published graph.

This chart does not appear in any of the editions of Playfair (1821, 1822a,b) or Playfair (1822?), which are Playfair's only generally known publications from after 1820. The obituary on pages 564 to 566 of the June 1823 issue of the *Gentleman's Magazine* lists 41 of Playfair's publications and states that "*we doubt not that Mr. Playfair (including pamphlets) was the author at least of one hundred distinct works*". The first paragraph of Wenzlick (1950) where he stated that he "*purchased a book published in London in 1823. A folded chart was pasted into the front of the book*" is a first hint that this chart did not appear in any of Playfair's letters or books. Although we have not yet located the volume purchased by Wenzlick, we now believe that we know the source of the chart and this will be the subject of a forthcoming article.

3 Computational Statistics and Graphics

Computational Statistics has a long history in publishing new developments in the field of statistical graphics. In addition to numerous excellent articles on graphical methods and graphical software in its regular issues, special editions of *Computational Statistics* have been dedicated to various DataViz conferences, such as Volume 13, Issue 1 (1998), and Volume 14, Issue 1 (1999). Forthcoming are issues dedicated to the work of the winners of the 2006 Data Exposition, sponsored by the Sections on Statistical Graphics, Statistical Computing, and Statistics and the Environment of the American Statistical Association (ASA) (<http://stat-computing.org/dataexpo/2006/>) and to the 2008 DataViz Workshop held in Bremen, Germany (<http://www.jacobs-university.de/schools/shss/awilhelm/>).

Perhaps, in some 200 or 250 years, someone may revisit an issue of *Computational Statistics* and detect a graphical method introduced these days that is still in frequent use at that point. Good luck to all of our authors who are working in the field of Statistical Graphics — and let's not forget what our discipline owes to William Playfair!

Acknowledgements Permission to reprint Roy Wenzlick's booklet was granted by the Western Historical Manuscript Collection, University of Missouri-St. Louis, on March 12, 2009. This booklet is part of the Roy Wenzlick collection, archived as Box 4, Series 5, Item 108 (<http://www.ums1.edu/~whmc/guides/whm0574.htm>). Fig. 1, Plate 2 (labeled No. 3) from Playfair (1805), Courtesy of the Thomas Fisher Rare Book Library, University of Toronto, with minor additional electronic enhancements made for publication. Thanks are due to Michael Friendly, Friedrich Leisch, and Howard Wainer for their helpful suggestions and comments that considerably helped to improve this editorial. Additional thanks are due to James Odei and Abbass Sharif for proofreading and carefully checking the links and figures on the accompanying Web page.

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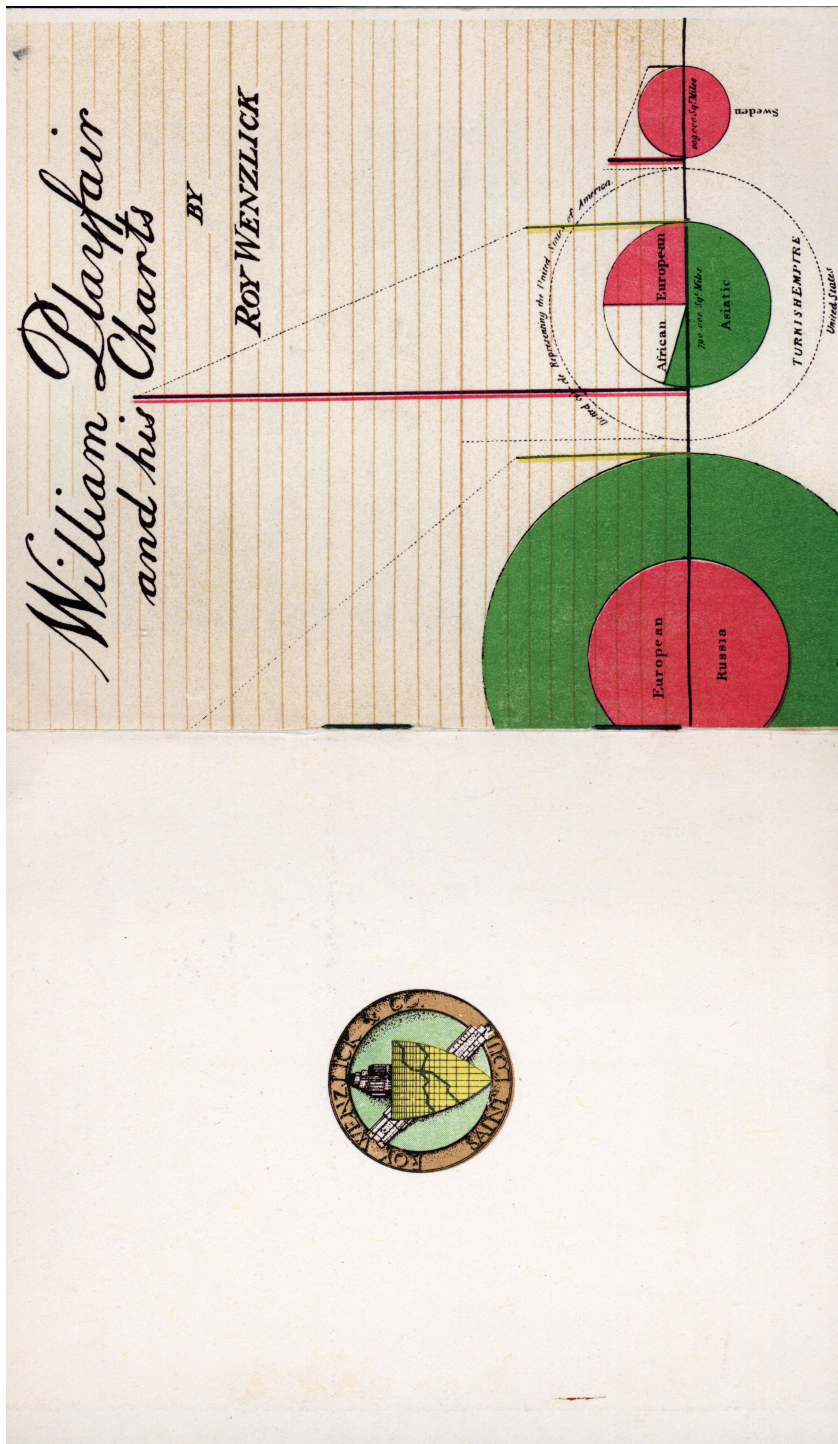
`industrial_revolution/`

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Appendix 1: Reproduction of Wenzlick (1950)

The following pages contain scans of the Wenzlick (1950) booklet and have been reproduced without any modification. Two pages were scanned at a time. The left side of the first scanned page shows the last page of the booklet.





number of years ago in an old book store on Royal Street in New Orleans I purchased a book published in London in 1823. A folded chart was pasted into the front of the book. Our organization had been drawing charts for years and I had always thought that charting was of relatively recent origin. The one reproduced on the last page of this booklet was so similar to modern charts that it immediately caught my attention. I started a long but very interesting investigation of the life and work of the man whose name was attached to the chart.

William Playfair was born in Scotland in 1759, the son of a minister. His father died when William was 13 years old, and he was apprenticed for a short time to a millwright, Andrew Meikle, later the inventor of the threshing machine. At 21 William Playfair became a draftsman for James Watt, the inventor of the first practical steam engine.

In 1798 William Playfair published *Lineal Arithmetic*, the first book ever published on charting. It contained 33 charts. In the chart forming the center spread of this booklet it will be noticed that William Playfair described himself as "the inventor of lineal arithmetic."

Although Descartes in 1637 had established the method of rectangular coordinates when used for

mathematical formulas, no one prior to Playfair had used charts to show the fluctuations and trends of economic data.

William Playfair, in his *An Inquiry Into the Permanent Causes of the Decline and Fall of Powerful and Wealthy Nations*, published in 1805, said that his brother, Dr. John Playfair, professor of mathematics at the University of Edinburgh, taught him "that whatever can be expressed in numbers can be expressed by lines." To the inspiration of his brother he attributes "the invention of these Charts."

In recent years a number of people have become interested in the early works of Playfair, with the result that a few of the Playfair charts have come to light.

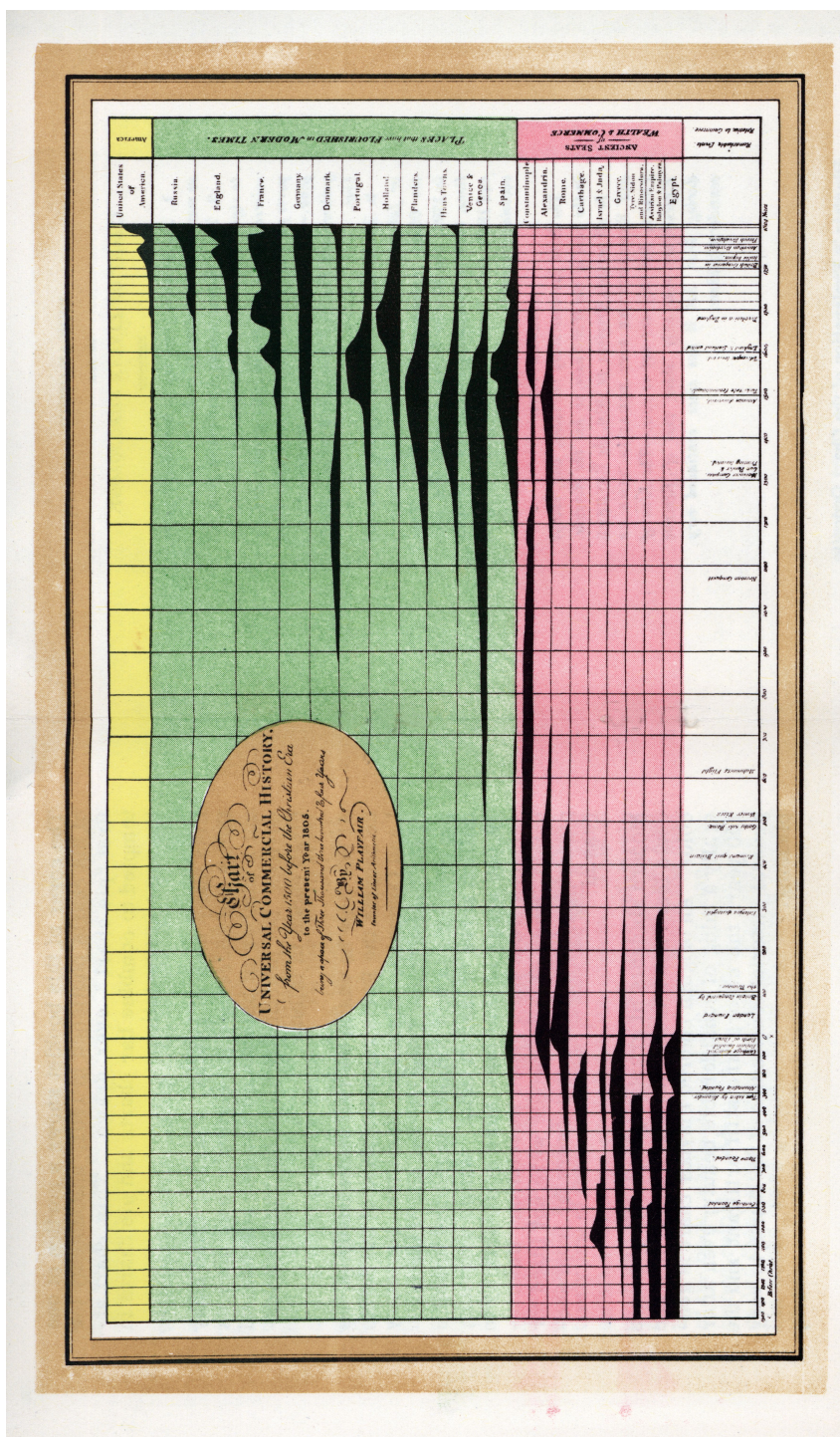
There are more than 100 titles of books and pamphlets written by William Playfair, but relatively few of these have been preserved and a still smaller number contained his charts. This is probably due to the fact that there were relatively few statistical series available to chart and that the inclusion of a chart or map increased the cost of the book, particularly if the chart or map contained colors. All colors ("stains" they were called then) were added by hand. The charts in his books were printed from engraved copper plates.

The cover of this booklet shows a portion of one of his charts published in 1801, undoubtedly the first "pie chart" ever drawn. This chart attempted to combine bar charts and pie charts in the same presentation.

Like many men of genius, Playfair tried many things and succeeded in relatively few. He took out a number of patents on various mechanical devices, but practically all of his business ventures ended in failure.

At one time he was in the real estate business, as he became the Paris representative of the Scioto Land Company. Alexander Hamilton, Secretary of the United States Treasury, was one of the leading members in this company organized to sell 3 million acres of land in Ohio. Within 2 months, 50,000 acres of this land were sold, largely to refugees from the French Revolution. Unfortunately, many of these people were not fitted for pioneering life and the colonies were far from successful.

Modern students of graphic portrayal of trends could learn much from Playfair's use of line and color. An original colored Playfair chart is generally a thing of considerable beauty; even after 150 years the colors are still brilliant and the general pictorial composition of the charts is very pleasing.



EXPLANATION
OF THE

CHART OF LINEAR CHRONOLOGY.

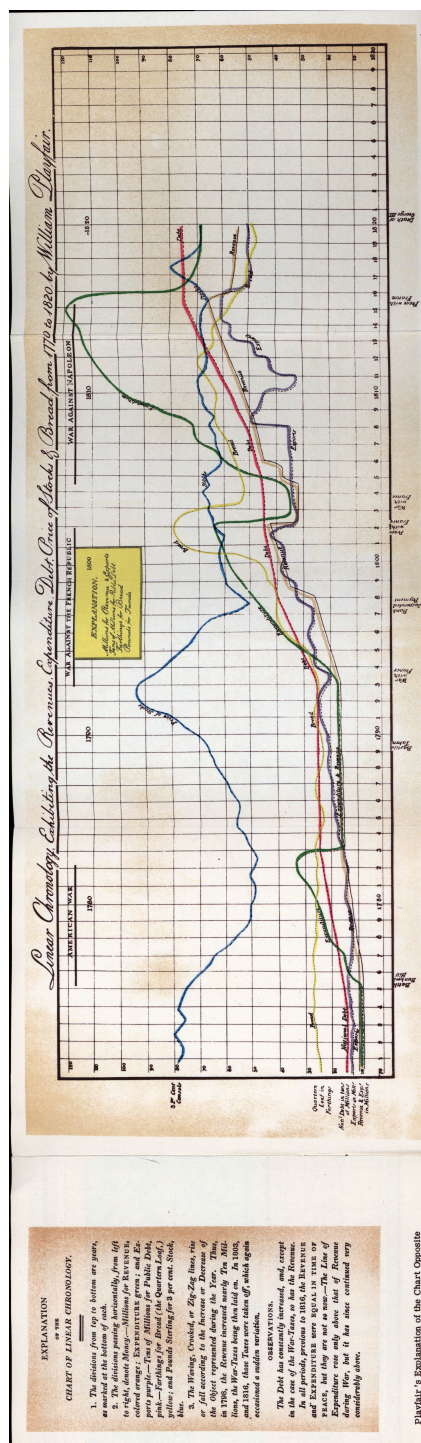
1. The divisions from top to bottom are years, as marked at the bottom of each.
2. The divisions passing horizontally, from left to right, denote Money.—Millions for REVENUE, colored orange; EXPENDITURE green; and Exports purple.—Tens of Millions for Public Debt, pink.—Farthings for Bread (the Quarter Loaf,) yellow; and Pounds Sterling for 3 per cent. Stock, blue.
3. The Waving, Crooked, or Zig-Zag lines, rise or fall according to the Increase or Decrease of the Object represented during the Year. Thus, in 1798, the Revenue increased nearly Ten Millions, the War-Taxes being then laid on. In 1803, and 1816, those Taxes were taken off, which again occasioned a sudden variation.

OBSERVATIONS.

The Debt has constantly increased, and, except in the case of the War-Taxes, so has the Revenue.

In all periods, previous to 1816, the REVENUE and EXPENDITURE were EQUAL IN TIME OF PEACE, but they are not so now.—The Line of Expenditure rose only above that of Revenue during War, but it has since continued very considerably above.

Playfair's Explanation of the Chart Opposite



Playfair's Explanation of the Chart Opposite

Appendix 2: Christmas Greetings Accompanying Wenzlick (1950)



ONE HUNDRED AND FORTY-ONE YEARS ago, William Playfair wrote: "My invention of Linear Arithmetic procured me the acquaintance of some men of great ability and high rank."

By applying to real estate the principles of charting which he first laid down, we, too, have made the acquaintance of many whose friendship and cooperation we prize highly.

To you as one of those, we dedicate this booklet, hoping that you will find it as interesting as the preparation of it has been to us.

CHRISTMAS GREETINGS
From the Staff of Roy Wenzlick & Co.

Appendix 3: Playfair at Boulton & Watt

In a letter to Matthew Boulton, apparently written in 1777 and republished in Tann (1993), James Keir, Scottish chemist, geologist, industrialist, inventor, and member of the Lunar Society (Smith, 2004) discusses Playfair's arrival at Boulton & Watt:

"You and Mr Watt desired to know on what expectations of Settlement Mr [William] Playfair came to Soho. I shall therefore copy the passages of one of Mr [Robert] Small's letters concerning him, and send you enclosed two others relating almost entirely to him —

'When I was at Birmingham Mr Boulton had some conversation with me on the subject of the Steam Engine &c, in particular said he doubted not but he might have use for some ingenious young man that might go to distant places and superintend the erection of them. There is a young man here [Dundee] with whom I am exceedingly pleased and whom I think might be very serviceable to Mr Boulton in that business, or in various other ones. His name is Playfair and his age 18 or 19.

His turn was always mechanical and he has served his apprenticeship to a Millwright in East Lothian. I have a very great opinion of his capacity and ingenuity, having seen many curious inventions and models of his, and his drawings are in my opinion remarkably good also. He is the son of a minister in this neighbourhood, who was a most intimate friend of mine. On his father's death his education was carried on by his brother [John Playfair], who besides being one of the best mathematicians and Philosophers in the island is one of the worthiest of men'."

The quotation above has been adapted from http://www.adam-matthew-publications.co.uk/digital_guides/industrial_revolution/detailed%20listing%20-%20part%201.aspx. Several additional references to Playfair related to his time at Boulton & Watt can be found in the same archive.