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William Playfair (1759–1823)

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Abstract. William Playfair is a key figure in the history of quantitative graphics. He was a popularizer and propagandist, a prolific designer of charts, and a developer of economic and business graphics. He established the line graph (especially the simple surface chart) as an important alternative to the table for the nonspecialist reader. Although his charts were not quite so original as some have supposed, they do contain graphic design ideas of great interest and occasional brilliance. His *Commercial and Political Atlas* of 1786 was a notable venture; it began his 36-year career as a graphic communicator. Playfair's understanding of the psychology of the graphic method was remarkable; there was an inner coherence to his picture of the reader's psychological needs which is strikingly modern (the paper contains excerpts from his many publications).

Key words and phrases: Curves, quantitative graphics, graphic method, graphic design, tables.

William Playfair was an exponent of the method of curves and a key figure in the history of quantitative graphics. He was a popularizer and propagandist, and a developer of what later became economic and business graphics. In this paper we examine his life and work, and discuss some issues in the history of quantitative graphics.

On the whole, nineteenth century writers from Lueder (1817) to Meitzen (1891) list Playfair as one of several who contributed to the evolution of the graphic method, whereas twentieth century writers from Funkhouser (1937) to Biderman (1990) single out Playfair as the most influential innovator of all time. Below, we show how Playfair's own opinion of his graphic originality gradually became more cautious.

William Playfair was born in 1759 near Dundee, Scotland, the fourth son of a clergyman. His father died when he was young, and the burden of raising him fell on his eldest brother, John Playfair. John was a remarkable man: minister, geologist, mathematician, professor of natural philosophy at Edinburgh University and Fellow of the Royal Society. We know that John influenced his brother in the use of graphic devices, for we find William thanking him in 1805. William's activities were extremely varied. He was apprenticed to a millwright for a short period, and he was employed as a draughtsman by James Watt (we will return to this later). He invented several inconsequential items and claimed credit for another (Alger, 1896), and he was involved with some business deals that did not work out. From about 1795 until his death in 1823 he moved house frequently and earned his living primarily as a writer. His favorite topics were history, political economy and balance of trade statistics. He picked subjects that were current and controversial. He was cunning in the selection of book titles and was generally clever in simplifying complex material. He made a revealing statement in a letter to William Windham in 1795 on his philosopy of writing: "To act upon the minds of the people at large, a work must be entertaining, periodical and cheap." (Playfair, 1795).

Except for a report on his life found in the *Annual Biography and Obituary* of 1824, Playfair's early biographers do not mention his contributions to graphical methodology (Alger, 1896; *Edinburgh Annual Register*, 1823; Salisbury, 1823). Therefore, most of what we know about Playfair's graphical contributions is directly based on his own printed work, and what he says of it.

From what we have been able to ascertain, his graphical works span a period of 36 years. Out of the various books and pamphlets and their various

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editions, we discover 177 graphical displays. These graphical displays were not all original creations. Some of the later charts were revamped versions of earlier ones for new editions or new books. When we examine Playfair's work closely, we discover three clusters of graphical development (which we have analyzed in detail in a monograph that we are presently writing). The first cluster, from 1786 to 1801, covers Playfair's introduction and development of the method of curves to matters of finance. Playfair cycles his graphics through a book entitled *The Commercial and Political Atlas*, which first appeared in 1786 and went through three editions; it was also published under several titles (we refer to these editions as *Atlas I* or *II*, as the case may be). The second cluster, from 1801 to 1805, covers Playfair's experimentation with new graphic formats, that is, circles and sectored circles, an innovation we will not discuss in this paper. In the third cluster, from 1821 to 1822, Playfair demonstrates further experimentation with the design of the curves in a slim volume entitled *A Letter on Our Agricultural Distresses Their Causes and Remedies*, first published in 1821. This book went through three editions. Playfair also wrote a paper relating to the same theme and included one of his charts.

Playfair's philosophy of writing and graphing was to keep things simple and striking. He believed in the graphic method and was convinced that what proved so useful to him would prove useful to others, and so he pushed the graphic method into the public eye with passionate conviction. He says in 1786 of *Atlas I*:

> I was the more desirous of publishing a complete set of national accounts in this manner, that by fairly introducing this mode of statement, I might bring it into public notice, and prepare the way for bringing it into use in the affairs of the nation, and even of individuals, for it is equally applicable to both. (Advertisement on prelims.)

Indeed, with the exception of three charts and one horizontal bar chart, the rest of Playfair's graphical devices, including the circular devices, involve some sort of area comparison. Playfair designed his curves in such a way that the reader is encouraged to focus on the *area* between the designated curves or underneath a single curve. Thus the *simple line chart* (Carlsen and Vest, 1979) or *rectilinear coordinate chart* (Schmid and Schmid, 1979), to use more current terminology, is not a Playfair specialty. It is the *simple surface chart* and all its permutations that Playfair favored visually. Here are the ones he introduced: *simple surface step* (data averaged between two vertical grid lines); *band chart* (area between two curves enhanced); *net-difference surface chart* (areas differentiated when they occur above or below a designated line); *subdivided surface slope* (levels within the surface); *sub-divided surface step*; and *silhouette chart* (image appears more like a silhouette but virtually the same as a simple surface chart). These various terms we take from Schmid and Schmid (1979).

Playfair shifted his design somewhat from *Atlas I* (1786) to *Atlas III* (1801). In Figures 1 and 2 we see the changeover in general design. *Atlas I* (1786), *Atlas II* (1787) and *Lineal Arithmetic* (1798) contain the same graphic formats. Only some elements of design change: in *Atlas I* he used color, in *Atlas II* he used stippling and hatching instead of color, and in *Lineal Arithmetic* he used both color and stippling and hatching. Figure 1 is found as Plate 3 in *Atlas I*. J. Ainslie, the engraver's name, appears on the lower left of the plate. The color blue is used to encode the area between the line of exports and the line of imports with the export line appearing red and the import line appearing yellow.

Figure 2 is a chart from *Atlas III* based on the same data as Figure 1, with a 20-year addition from 1780 to 1800. The color codes are the same but there are other differences: the title is placed inside the frame, both horizontal and vertical axes have single words as labels, and the numerals are placed outside the grid. The other charts in this volume follow the same pattern. This volume unquestionably shows improvement in graphic design method, but if we examine the placement of the curves in relationship to the scales (the actual data) we see many discrepancies and errors (Costigan-Eaves, 1990). So, there is improvement in graphic design and carelessness with the plotted data. Also, we notice the absence of Playfair's name on any of the plates in *Atlas III*, though the engraver's name, Neele, does appear on all of the charts. We cannot help but wonder if Playfair might have handed his graphical work over to the engraver and let it go to press unchecked.

Playfair also manipulated the positioning and shape of his charts and experimented in expanding and contracting the vertical scales. Another aspect that is worth focusing on is the amount of text Playfair includes in his charts. There is a paucity of textual codes in the graphs of previous designer-scientists, but with Playfair the situation is different. Although his graphic devices usually can be read alone without any reference back to the main body of the text, he does incorporate titles, scales and labels. Clearly, Playfair wanted his charts to be self-sufficient, and so they had to include adequate textual coding.

Along with Playfair's desire to tell the story of history graphically was the desire to tell it dramatically. Playfair says of a quasi-historical chart:

> I first drew the Chart in order to clear up my own ideas on the subject, finding it very troublesome

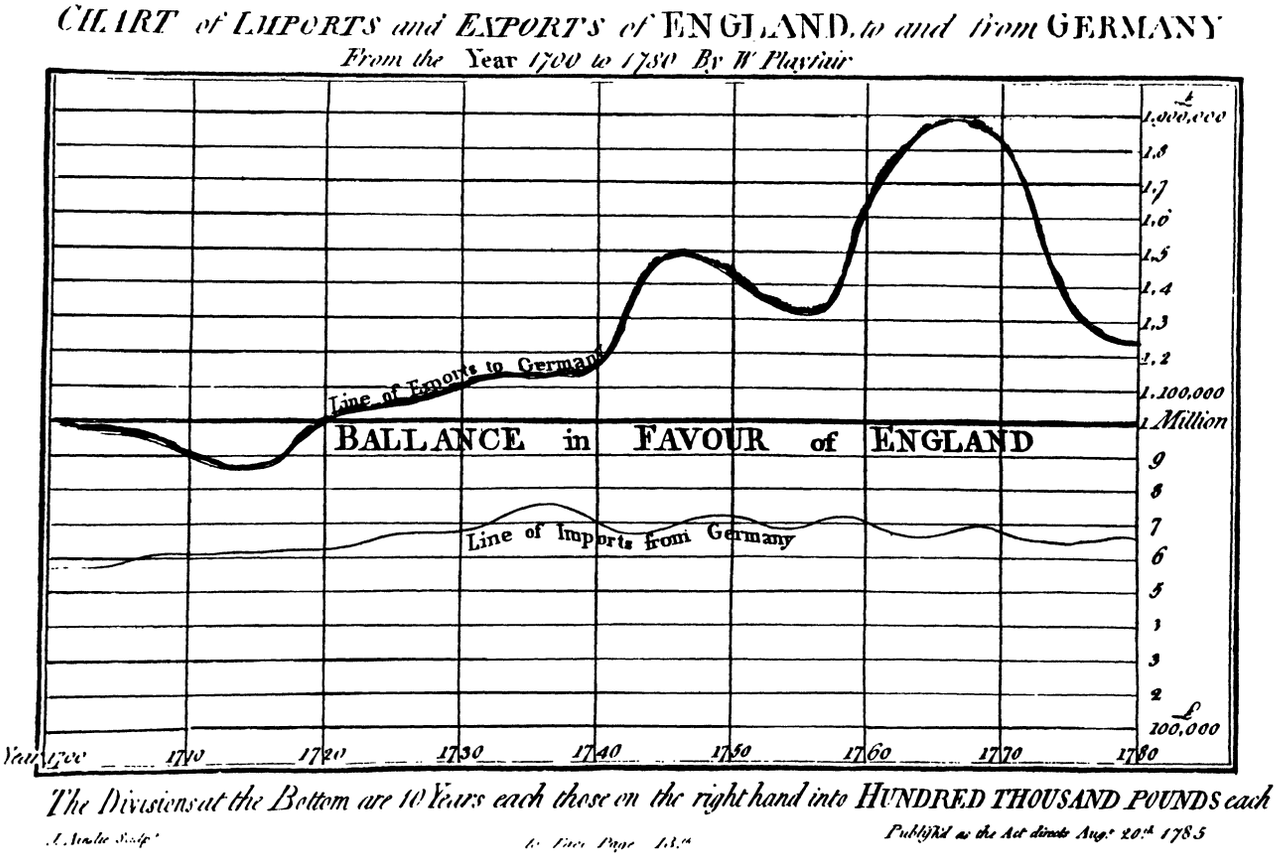

FIG. 1. *An example of a* band chart, *with the area between the two curves colored* (Atlas I, 1786, *plate* 3). (Acknowledgment is given to the Goldsmith Library in Senate House at the University of London for kindly allowing us to have the chart in their copy photographed.)

to retain a distinct notion of the changes that had taken place. I found it answer[ed] the purpose beyond my expectation, by bringing into one view the result of details that are dispersed over a very wide and intricate field of universal history; facts sometimes connected with each other, sometimes not, and always requiring reflection each time they were referred to. I found the first rough draft g[a]ve me a better comprehension of the subject, than all that I had learnt from occasional reading, for half of my lifetime: and, on the supposition that what was of so much use to me, might be of some to others, I have given it with a tolerable degree of accuracy. [Advertisement on prelims, *An Inquiry*, 1805.]

In Figure 3 (from *Agricultural Distresses*, Playfair, 1821), we see more drama in design. At first sight we think we see the stark and fluctuating climb of the price of a quarter of wheat as it overshadows the humble slope of the weekly wages of a "good mechanic" (in fact, this is an illusion; the cost of wheat relative to wages gradually fell throughout the two centuries up to 1800). Playfair achieves his illusion by plotting the data values in two different ways. For the wheat data he takes a five-year average and runs a horizontal line between the two vertical lines which mark the beginning and ending of the five-year period. Thus the staircase image is generated, a design Plot used in 1685. We also find Alexander von Humboldt using it in 1812 and Tertius Galton in 1813, eight to nine years before Playfair uses it. This technique of plotting is contrasted to the more typical technique of plotting data on the vertical grid line that corresponds to the relevant date thus generating a smoother curve. The position of the staircase plot above the curve and the dark infill of the columns contribute to the illusion.

In Playfair we are blessed with a generous amount of comment on the value of the graphic method. Playfair never missed an opportunity to applaud the virtues of graphics. His self-conscious understanding of the power of graphics is hard to parallel in any who came before him or in most who came after (only well into the nineteenth century do we find others writing at length about graphical methods). His philosophy of graphics is to be found scattered in the introductions to his numerous books and their many editions and comprise the following tenets.

1. *The graphic method is a way of simplifying the tedious and complex.* Playfair was aware that he lived

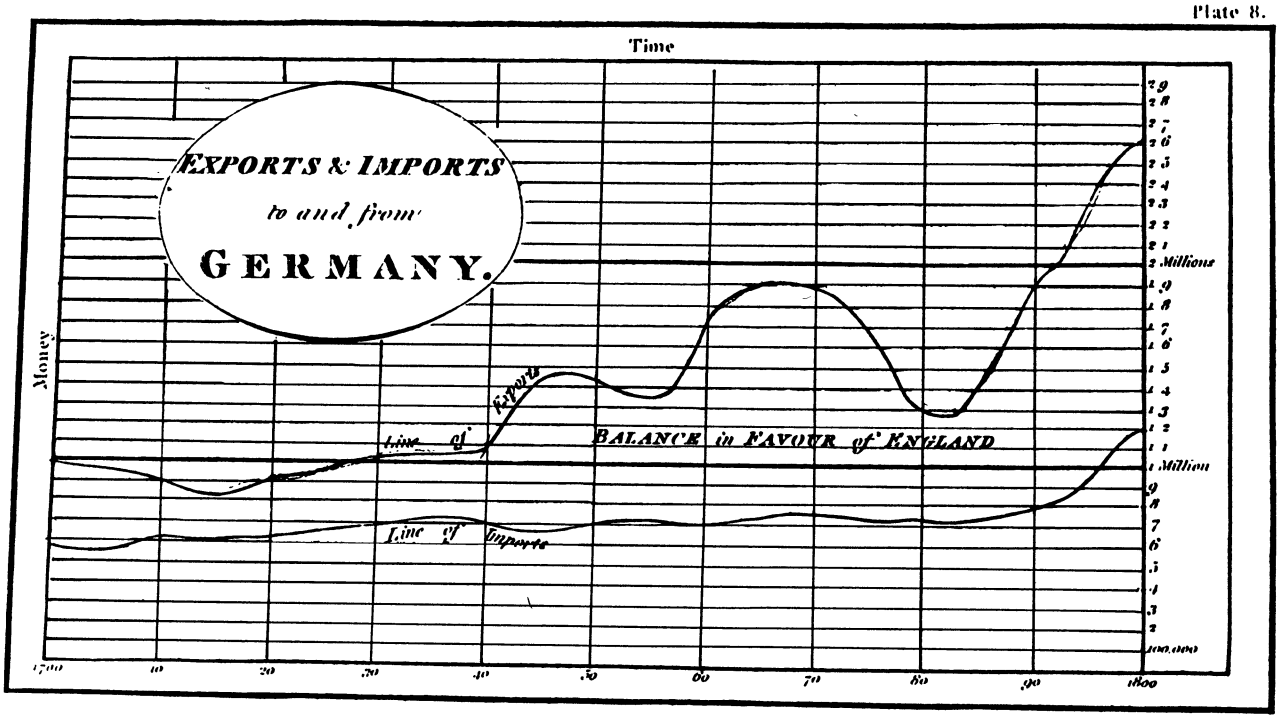

FIG. 2. *Identical theme as in Figure* 1. *This chart appears as plate* 8 *in* Atlas III *of* 1801, *but the data given by this curve do not correspond with the data in Figure* 1. *Similar inconsistencies occur in all curves in* Atlas III *when compared with those of* Atlas I. (Acknowledgment is given to the Goldsmith Library in Senate House at the University of London for kindly allowing us to have the chart in their copy photographed.)

in a world where data were already being collected in abundance. People must be encouraged to absorb this information in a helpful format for:

> no study is less alluring or more dry and tedious than statistics, unless the mind and imagination are set to work, or that the person studying is particularly interested in the subject; which last can seldom be the case with young men in any rank of life. [*Statistical Breviary*, 1801, page 16.]

> The human mind has been so acted upon for a number of years past, and the same subjects have been so frequently brought forward, that it is necessary to produce novelty, but above all to aim at facility, in communicating information; for the desire of obtaining it has diminished in proportion as disgust and satiety have increased. [*Atlas III*, 1801, page xii.]

> It is hoped that, with the assistance of these Charts, such information will be got, without the fatigue and trouble of studying the particulars of which it is composed. [*Atlas III*, 1801, page xv.]

2. *Busy men need some sort of visual aid.* This view comes out a bit in the above quotations but we find Playfair saying even more specifically:

> Men of great rank, or active business, can only pay attention to general outlines; nor is attention to particulars of use, any farther than as they give a general information: And it is hoped, that, with the assistance of these Charts, such information will be got, without the fatigue and trouble of studying the particulars of which it is composed. [*Atlas I*, 1786, page 4.]

3. *The graphic method is more accessible than a table.* Playfair declared war on tables. He wrote in the era of German writers on statistical matters who were adherents of the "Tabellen-Statistik" (Westergaard, 1916). These men wrote prolifically and used many tables. Playfair did not object to their method of interpretation but to their method of presentation. Boetticher was one of the exponents of the "Tabellen-Statistik" and Playfair was asked to do an additional table in English to supplement Boetticher's work. Playfair (1801) describes this situation and offers his opinion on tables:

> Having about a year ago been requested by the English editor of Mr. Boetticher's Statistical Tables, to consider of some method of bringing them down to that period, without injuring the original work, I proposed to make a *supplementary* table, comprehending all the countries which have undergone any material change since the publication of the book. I then undertook to make out such a supplementary table; which I did, and it is

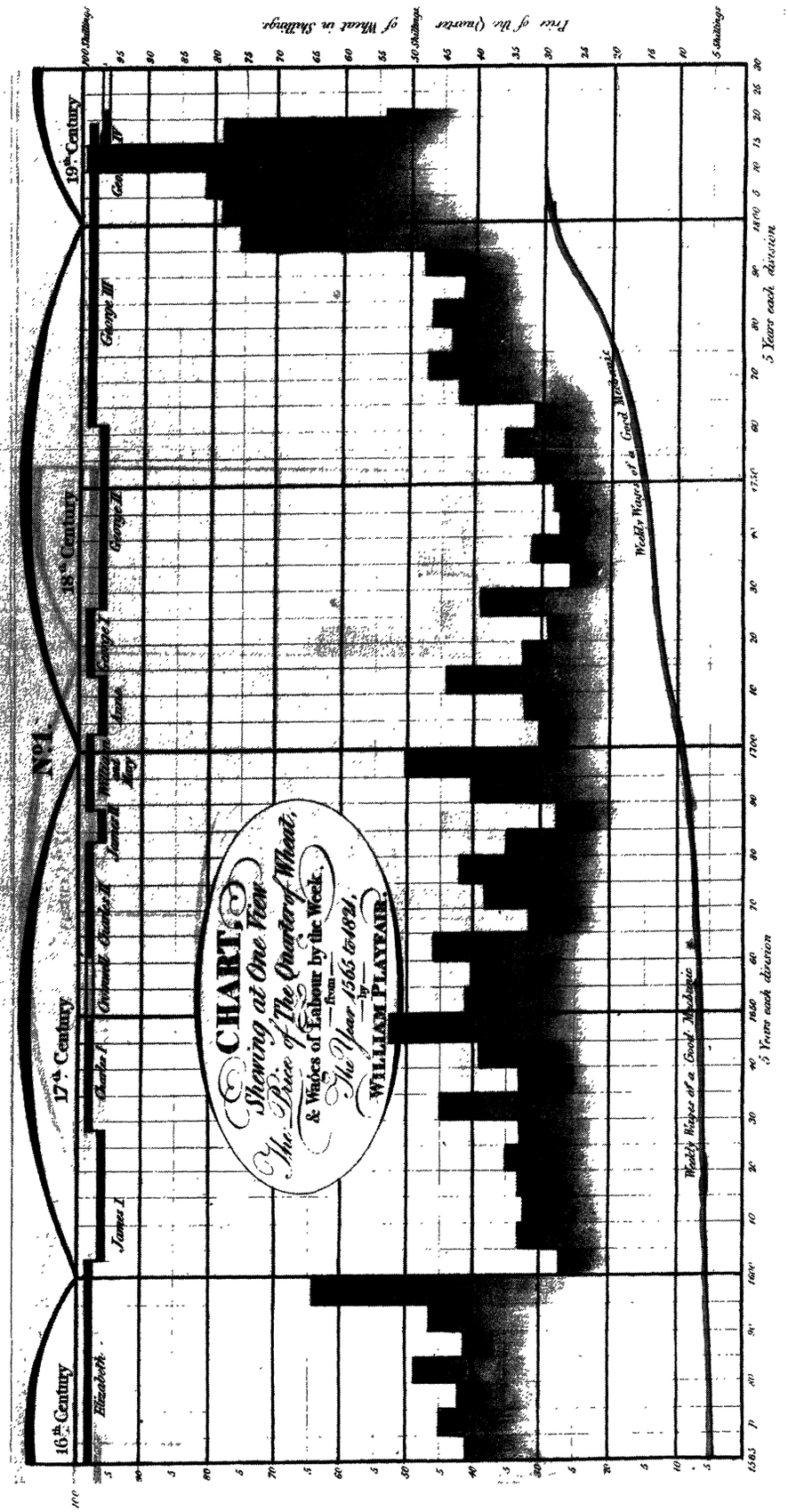

FIG. 3. *One of Playfair's drama graphics designed to show the unfair prices of a quarter of wheat compared with the humble wages of a "good mechanic." In the original, the curve for the wages of the "good mechanic" appears red and the area underneath is stained blue. This chart appears in all three editions of* Agricultural Distresses [*Playfair* (1821, 1822)].

published at the end of that work. In the course of executing that design, it occurred to me, that tables are by no means a good form for conveying such information, unless where a number of different countries are intended to be exhibited at once. Where there is only one to be set forth, I can see no kind of advantage in that sort of representation, while the inconveniency of a large size, in a book that is intended to be frequently referred to is obvious. [*Statistical Breviary*, 1801, first page of Preface.]

Information, that is imperfectly acquired, is generally as imperfectly retained; and a man who has carefully investigated a printed table, finds, when done, that he has only a very faint and partial idea of what he has read; and that like a figure imprinted on sand, is soon totally erased and defaced. [*Atlas I*, 1786, page 3.]

That I have succeeded in proposing and putting in practice a new and useful mode of stating accounts, has been so generally acknowledged, that it remains only for me to request that those who do not, at the first sight, understand the manner of inspecting the Charts, will read with attention the few lines of directions facing the first Chart, after which they will find all the difficulty entirely vanish, and as much information may be *obtained in five minutes as would require whole days to imprint on the memory, in a lasting manner, by a table of figures.* [*Atlas III*, 1801, page xii, italics ours.]

4. *The graphic method appeals to the eye.* Playfair continually pointed out that the eye was the thing appealed to in the design of his charts. He asserted that the visual system was most useful in making judgments of proportion and magnitude. Although such an assertion may appear naive to our present-day understanding of how people make area and slope judgments when reading graphs (Cleveland, 1985; Cleveland and McGill, 1987), for Playfair, however, it was a conviction that what was visually easy for him would also be easy for others:

The advantage proposed, by this method, is not that of giving a more accurate statement than by figures, but it is to give a more simple and permanent idea of the gradual progress and comparative amounts, at different periods, by presenting to the eye a figure, the proportions of which correspond with the amount of the sums intended to be expressed .... As the eye is the best judge of proportion, being able to estimate it with more quickness and accuracy than any other of our organs, it follows, that wherever relative quantities are in question, a gradual increase or decrease of any revenue, receipt, or expenditure, of money, or other value, is to be stated, this mode of representing it is peculiarly applicable; it gives a simple, accurate, and permanent idea, by giving form and shape to a number of separate ideas, which are otherwise abstract and unconnected. [*Atlas III*, 1801, page ix–x.]

This method has struct several persons as being fallacious, because geometrical measurement has not any relation to money or to time; yet here it is made to represent both. The most familiar and simple answer to this objection is by giving an example. Suppose the money received by a man in trade were all in guineas, and that every evening he made a single pile of all the guineas received during the day, each pile would represent a day, and its height would be proportioned to the receipts of that day; so that by this plain operation, *time*, *proportion*, and *amount*, would all be physically combined .... Lineal arithmetic then, it may be averred, is nothing more than those piles of guineas represented on paper, and on a small scale, in which an inch (suppose) represents the thickness of five millions of guineas, as in geography it does the breadth of a river, or any other extent of country. [*Atlas III*, 1801, page xi.]

5. *The graphic method appeals to the mind.* Playfair maintained that his charts not only facilitated the perception of patterns and relationships but also the ability to remember those patterns and relationships:

In a numerical table there are as many distinct ideas given, and to be remembered, as there are sums, the order and progression, therefore, of those sums are also to be recollected by another effort of memory, while this mode unites *proportion*, *progression*, and *quantity*, all under one simple impression of vision, and consequently one act of memory. [*Atlas III*, 1801, page x.]

The advantages proposed by this mode of representation, are to facilitate the attainment of information, and aid the memory in retaining it: which two points form the principal business in what we call learning, or the acquisition of knowledge. [*Statistical Breviary*, 1801, page 14.]

Whatever presents itself quickly and clearly to the mind, sets it to work, to reason, and think; whereas, it often happens, that in learning a number of detached facts, the mind is merely passive, and makes no effort further than an attempt to retain such knowledge. [*Statistical Breviary*, 1801, page 7.]

We see that Playfair had well-developed views which anticipated in a rather remarkable way some of

the key concerns of modern psychology. The views above cover attention, motivation, perception, cognition and memory in a way that is completely intelligible to us today.

In an earlier section we said that Playfair's methods did have precedents. Let us now examine three problem domains (topics) that influenced him.

1. *Physical sciences.* There are two sources of influence that must be mentioned here. The first source of influence on Playfair was the study of the weather. This study he was encouraged to do as a boy under the supervision of his brother. Playfair is often cited as having credited his brother for giving him the idea of using lineal arithmetic. Let us look at that quote to see how John got William to use graphics:

> I think it well to embrace this opportunity, the best I have had, and, perhaps, the last I ever shall have, of making some return, (as far as acknowledgment is a return,) for an obligation, of a nature never to be repaid, by acknowledging publicly, that, to the best and most affectionate of brothers, I owe the invention of those Charts.
>
> At a very early period of my life, my brother, who, in a most exemplary manner, maintained and educated the family his father left, made me keep a register of a thermometer, expressing the variations by lines on a divided scale. He taught me to know, that, *whatever can be expressed in numbers, may be represented by lines.* The Chart of the thermometer was on the same principle with those given here; the application only is different. The brother to whom I owe this, now fills the Natural Philosophy Chair in the University of Edinburgh. [*An Inquiry*, 1805, page xvi, italics ours.]

Thus we discover that the first curve Playfair ever drew was to show weather data. The idea for charting economic data developed, we think, from problems dealing with the weather, a domain where the graphic codes of a coordinate system, two scales, the placement of points in relation to the scales and the plotting of one or more lines had already proved useful.

The second influence on Playfair was his experience with Boulton and Watt. If we go back to the beginning of Playfair's early career development as a young man, we discover that between 1778 and 1781 he worked as a draughtsman for Boulton and Watt. In this period, James Watt is reported to have used graphic devices in the work on his indicator to check the variation of water pressure in the steam engine. The evolution of this particular graphic device is obscure; the invention probably occurred some time after 1790. This date is based on the research of Dickinson and Jenkins (1927) who examined letters in the Boulton and Watt collection which refer to experiments made with the indicator. The earliest indicator diagrams first appeared in 1803 (Dickinson and Jenkins, 1927). Watt is also reported to have used curves to find the relationship between steam pressure and boiling point as early as 1764 (Muirhead, 1854). Unfortunately these graphic displays do not seem to have survived. In a 1782 specification for a patent, Watt did use a theoretical curve which may be seen in Muirhead (1854). It is therefore likely that Playfair in his association with Watt saw graphic displays of physical phenomena or even draw some as part of his job as a draughtsman.

(We are not the first to speculate about the Playfair–Watt connection. Our search yielded this disconcerting/amusing discovery from Dickinson and Jenkins (1927): "letter from Watt to Boulton (June 27, 1778) 'I would recall Playfair who can do part of the business, and I think now that you are at home you can contrive to give him proper assistance. I must warn you that Playfair is a blunderer.' Evidently Watt had not a high opinion of him; however, he was brought back, but again he was with the firm for but a limited time, and his connection ceased in 1781, when we find Boulton writing (Oct. 23rd) that he is sorry Playfair is going, only on account of Watt not having any proper assistant in drawing." (page 285).)

2. *Geography and mapping.* We know that Playfair opted to call his first graphical work an atlas. We also know that he was visually in tune with geographic mapping for he made comparisons between the graphic codes and graphic elements deployed in his charts and those deployed in maps. One graphic code pertinent to his graphics and to geographic mapping was the use of a coordinate system to pinpoint the location of various phenomena in space. A graphic element used by Playfair and one equally used in mapping was color. Cartographers may be the earliest users of color coding in quantitative graphics (Robinson, 1982; Twyman, 1986). In 1801 Playfair says in *Atlas III*: "To those who have studied geography, or any branch of mathematics, these charts will be perfectly intelligible."

One idea Playfair latched on to very early was the notion that his graphic method captured the *shape* of a data problem and located that shape within space even as a map locates the shape and direction of a river.

> Figures and letters may express with accuracy, but they never can represent either number or space. A map of the river Thames, or of a large town, expressed in figures, would give but a very imperfect notion of either, though they might be perfectly exact in every dimension; most men

would prefer representations, though very indifferent ones, to such a mode of painting. [*Atlas I*, 1786, page 3.]

It was not just the location of a shape in space that his graphic methods and the methods of geographic mapping had in common, but also the focus on the shape and the area within the shape. We have illustrated that Playfair preferred using graphics to emphasize the area under the curve or the area between designated curves. Area encoding was his forte and he perceived his circle graphics to be an improvement on the area encoding used in geographic maps:

> The present charts are in like manner intended to aid statistical studies, by shewing to the eye the sizes of different countries represented by similar forms, for where forms are not similar, the eye cannot compare them easily nor accurately. From this circumstance it happens, that we have a more accurate idea of the sizes of the planets, which are spheres, than of the nations of Europe which we see on the maps, all of which are irregular forms in themselves as well as unlike to each other. [*Statistical Breviary*, 1801, page 15.]

3. *Chronology.* Joseph Priestley is to chronological diagrams what William Playfair is to line graphs. From Priestley, Playfair got the idea of running time along the horizontal axis (in a Cartesian graph, the x-axis or abscissa). Priestley exploited the code of time as a horizontal axis by running bars parallel to the x-axis to show lifespan (Twyman, 1986). Playfair used horizontal bars too, especially when he wanted to emphasize a particular period in time:

> The study of chronology has been much facilitated by making space represent time, and a line of proportional length, and in a suitable position, the life of a man, by means of which the remarkable men of past ages appear as it were before us in their proper time and place. [*Statistical Breviary*, 1801, page 15.]

So we see that Playfair's graphic ideas were not original. Instead, he picked and pulled ideas from previous examples in other problems domains, like a person weaving a blanket. The blanket is a single entity, but when we put the microscope on it we inspect many different weaves seen before in other blankets, in other places. We prefer to view Playfair as an imaginative developer and popularizer of the graphic method, but not as a graphic inventor. His originality lies in his exploitation and development of the method of curves in such problem domains as trade balances, where previously data had been presented in tabular form.

When Playfair first introduced his curves in 1786 he did refer to them as "new in nature ... both as an invention and as a book" (*Atlas I*, 1786, page iv), and some modern writers appear to have taken this claim at face value. However, in later years he qualified this claim, accepting that the graphic method of curves had been used earlier:

> It is now sixteen years since I first thought of *applying lines to subjects of Finance* .... At the time when this invention made its first appearance it was much approved of in England; ... I confess I was long anxious to find out, whether I was actually the first who applied the principles of geometry to matters of Finance, as it had long before been applied to chronology with great success. I am now satisfied, upon due inquiry, that I was the first; for during fifteen years I have not been able to learn that any thing of a similar nature had ever before been produced. [*Atlas III*, 1801, page vii–ix, italics ours.]

From 1801 onward Playfair always qualified the notion of invention. We find him saying in the *Statistical Breviary*:

> The author of this work *applied the use of lines to matters of commerce and finance* about sixteen years ago, with great success. His mode was generally approved of as not only facilitating, but rendering those studies more clear, and retained more easily by the memory. [1801, page 15, italics ours.]

In 1805 in a letter addressed to Thomas Jefferson in *Statistical Account of the United States* we find Playfair saying:

> When I had the honour of being introduced to your acquaintance, during your embassy in France, the approbation which you were then pleased to bestow on *my application of lines to matters of finance*, leads me to hope that you will not be offended at the liberty which I now presume to take, in dedicating to you a small work, on a plan somewhat similar, relative to the affairs of your own country. [1805, page ix, italics ours.]

We have by no means covered all aspects of Playfair's work, and see particularly Biderman (1990) for some other views. More systematic investigation is needed to help understand how his graphic work was viewed by his contemporaries and how it was followed. His graphical designs also need to be scrutinized more closely to evaluate visual distortions. We find it a bit ironic that he is lauded by some as the single most important inventor of all time, yet nowadays his graphical formats are not so highly thought of. Several

years ago (1985) we discovered a poster that was published as a supplement to *RCA Engineer* and entitled *GRAPHICS for the display of statistical data.* Every format that Playfair supposedly invented is under the "not recommended" column!

In our opinion, Playfair should be remembered for two reasons. First of all, he understood, popularized and developed the graphic method. He took what existed in his day and exploited it vigorously. He was convinced that the merchant, the statesman and the nobleman needed help in digesting their diffused and dreary tables. Forty color charts in a book of 1786 was quite an accomplishment.

Playfair also realized that his reader needed coaching, textual coaching, so he exploited titles, captions and curve descriptions to their fullest advantage. He did not overdo grid lines. He experimented with the elements of design to make his graphical devices attractive. Occasionally, the quest for the attractive took over the design at the expense of the original data relationships. Although some of his area charts are difficult to decode, and a few of his charts are inaccurate or even misleading, nevertheless, he produced some remarkable designs and in some of his publications the graphics have equal or greater weight than the text—a rarity in those times.

The second noteworthy thing about Playfair is his understanding of the psychology of the graphic method. The excerpts of his views given above show that, despite their being scattered widely among his many publications, there was an inner coherence to his picture of the reader's psychological needs which is strikingly modern. Perhaps his views will stand the test of time rather better than his charts!

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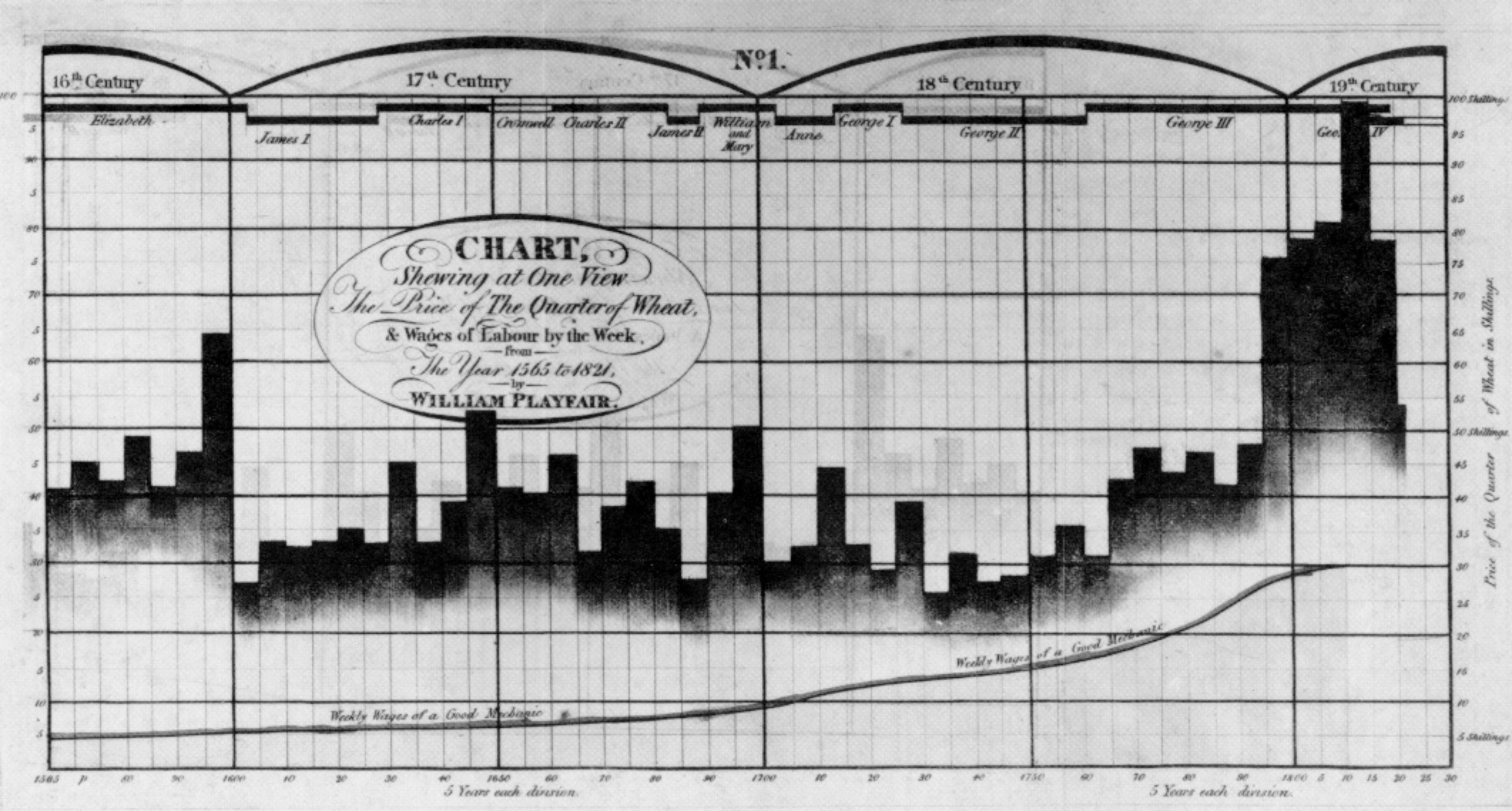

For a Particular Explanation, See Letter to the Lords & Commons