As Clayton observes, let there be wedding of science and spirituality, but let it begin with real partners, with all their faults and blemishes – but also with their real strengths.

The most significant outcome from reading this stimulating book would be for serious scientists to gain a feeling that there are bigger questions about science than the ones they love to tackle in the laboratories – but one has to approach them with customary caution and scepticism.

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Graphic Discovery – A Trout in the Milk and Other Visual Adventures. Howard Wainer. Princeton University Press, 41 William Street, Princeton, NJ 08450, USA. 2005. 192 pp. Price: US$ 18.95.

When dealing with numerical data, whether from experiments or surveys or computations, we take it for granted that we are likely to benefit from analysing the data graphically. In fact, nowadays, graphical analysis is almost made a fetish of in contemporary pedagogy. It therefore came as a surprise to me to learn that graphing of data is an invention just about two and half centuries old. Wainer forcefully emphasizes this by showing in figure 1 of this book, a plot of the christenings in London between 1630 to 1710, the data being taken from a table published by John Arbuthnot in 1710. There is a sharp dip in the data in 1704, when there were no wars or plagues or other epidemics to account for this. If the data had been graphed, Arbuthnot would surely have noticed the unusual datapoint and suspected and corrected the clerical error. But graphing had not yet been invented and the error remained uncorrected.

While a number of people contributed to the discovery of modern graphical display, in Wainer's view, it is William Playfair who should get the major credit. Born in 1759, Playfair was a colourful character who was in turn, among other things, millwright, engineer, draftsman, accountant, inventor, economist, land speculator, convict, blackmailer and journalist. A remarkable man of passion, ambition and industry, Playfair was also a bit of a rogue and scoundrel. A man of considerable practical inventiveness, he took out several patents and made a number of improvements to existing machinery. He also recorded his inventiveness; on his arrival in Germany in 1793 he wrote:

> 'When I was in Germany, I was surprised that in a country where the milk is excellent the butter was little better than common grease without anything, either of the colour or taste that butter possesses. But one day in changing horses where the post master spoke a little French and had a farm, I asked to see the dairy when I found that the milk was kept in deep narrow jars about three feet deep and eight or nine inches wide. The cream that rose to the top was about three inches in depth before it was taken off and though not quite rancid had a disagreeable smell. I advised him to get wide shallow vessels and keep them very clean, but he smiled as if I knew nothing of the business.'

Between 1786 and 1801, Playfair invented or perfected three of the four fundamental types of statistical graphs: the pie chart, the line and bar graphs; the scatterplot did not appear till the middle of the nineteenth century. These inventions were put to good use in producing his influential *Commercial and Political Atlas.* Each chapter begins with a well-produced graph, which is used in the following discussion to highlight some aspect of the revenues, expenditures, debts and commerce of England. It says something about that country, that at that time a man such as Playfair could produce on his own a book of this type and that there was a demand for it. No wonder they were able, within a century, to control so much of the world.

We have all come across instances where a graph provides the evidence for a plausible conclusion, even though the evidence may only be circumstantial. Figure 13.1 of the book shows a graph of young bald eagles per breeding area as a function of the year. The mean line dips to a minimum around 1973, the year that DDT was banned, and then starts to rise again. Even though the evidence is circumstantial, it hard not to connect the sad fate of the eagles to DDT prior to its banning and their remarkable recovery after the 1973 ban. The subtitle of this book comes from a similar story of the middle of the nineteenth century. Apparently, there was a dairymen's strike in New England at that time and there was suspicion that the limited supplies of milk were being watered down for wider distribution. In commenting on the reliability of the evidence being cited, Thoreau wrote in his journal (11 November 1850): 'Sometimes circumstantial evidence can be quite convincing; like when you find a trout in the milk'.

But, Wainer points out that such arguments are not always valid. Take for instance the winning times in the Boston Marathon for men and women. Men have competed since around 1900 and there is clearly a general reduction in the times over the century. Women were first allowed to compete in 1972 and they have been making rapid progress since then. If the data are plotted on the same graph (figure 13.2 in the book) for the period 1900–90, and if linear fits are drawn, one finds that the line for women intersects the one for men around 1996. One might draw the conclusion, as apparently some sports reporters actually did, that women would out perform men by 2000 and that their timings would approach the 2 h mark! Thus, one has to be careful with circumstantial evidence, this time obtained by linear extrapolation.

This is a nice and interesting book with many stories and examples of the uses, misuses and abuses of graphical display. There are twenty-two chapters, most of them being just 4–8 pages long, with fine illustrations, as befits a book on graphical display. The book is not just for teachers or scientists. Like all people who are passionate about their work, Wainer writes so that he can convey his love for his subject to all readers. If the book is left on your coffee table, it is quite likely that at least some of your visitors will pick it up and browse through it. On the other hand, if you teach students or are interested in science or in history, you will certainly benefit from reading this well-written book.

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