

Design principles: Tufte's view

Edward R. Tufte (2001) *The Visual Display of Quantitative Information*

“Evidence is evidence. The information doesn’t care what form it is. ”



**Edward Tufte on
[visual thinking and design.](#)**

Tufte's expertise includes political science, statistics, CS, and art.

1942 born in Kansas City, Missouri

1964 BS & MS Stanford University, Statistics

1968 PhD Yale University, Political Science

Academic career at Princeton & Yale

including Senior Critic in School of Art

**Consulting on data analysis and display design: NASA, Apple,
The New York Times, IBM, Consumer Reports, Bose, Fidelity Investments,
Centers for Disease Control and Prevention, Google, Hewlett-Packard, Medtronic,
Bloomberg, President's Commission on Federal Statistics, Bureau of Justice Statistics,...**



Chapter 4 of the VDQI states five principles of design.

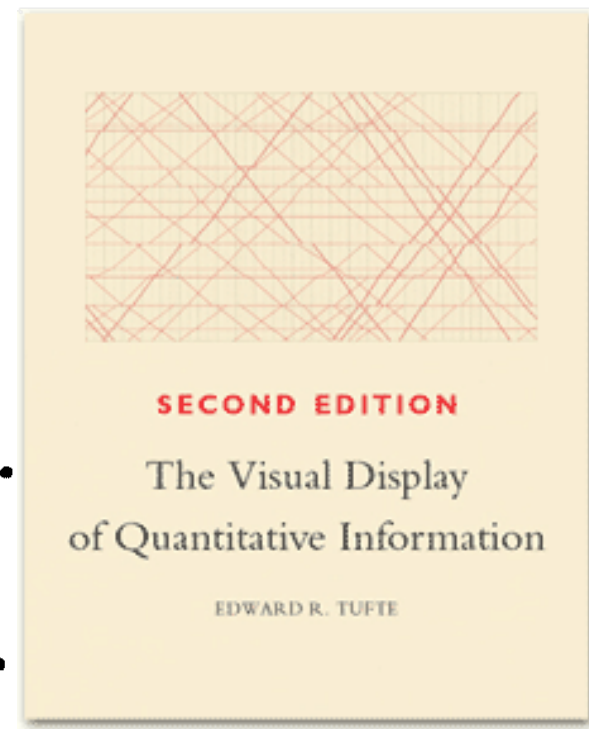
Above all else show the data.

Maximize the data-ink ratio.

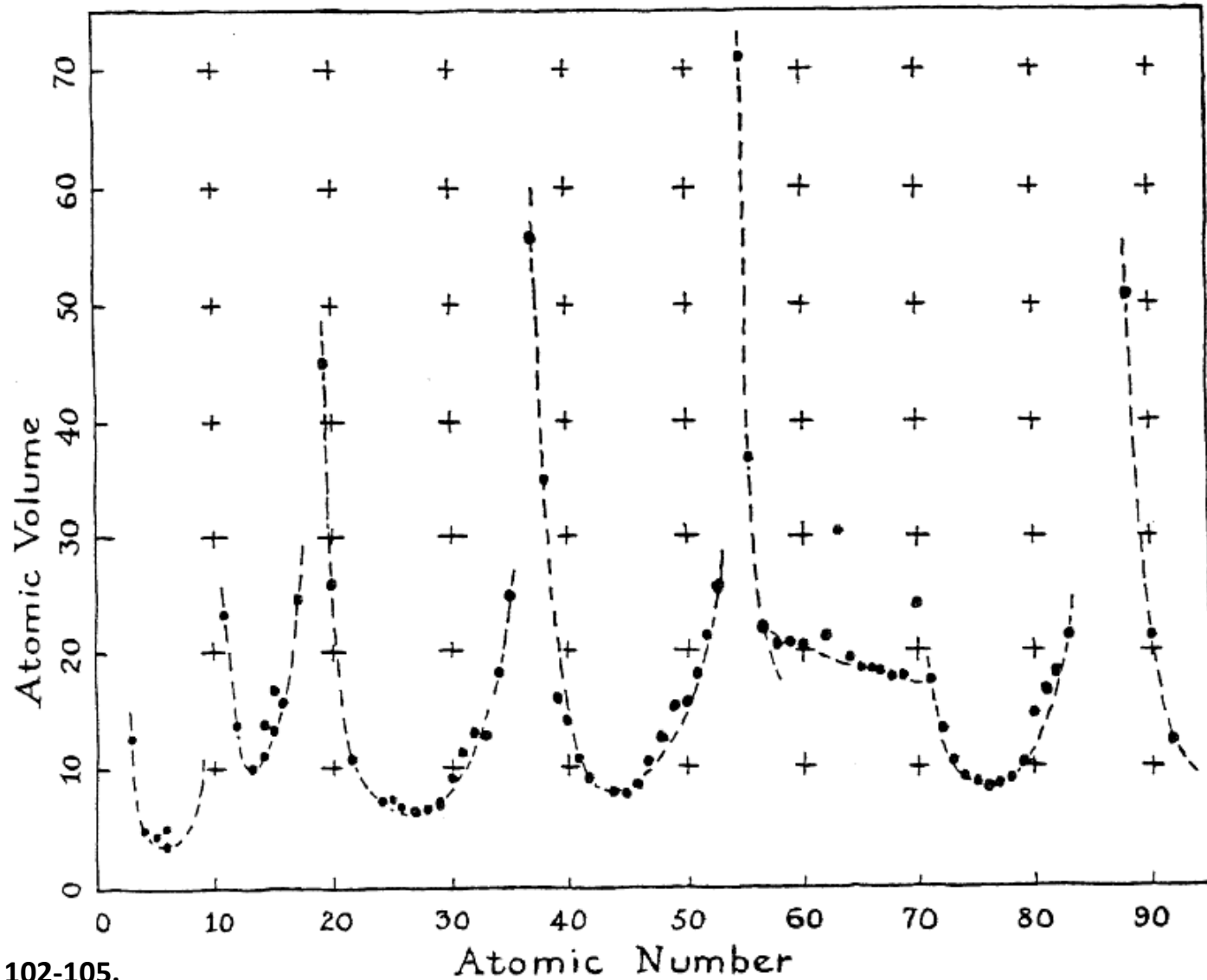
Erase non-data-ink.

Erase redundant data-ink.

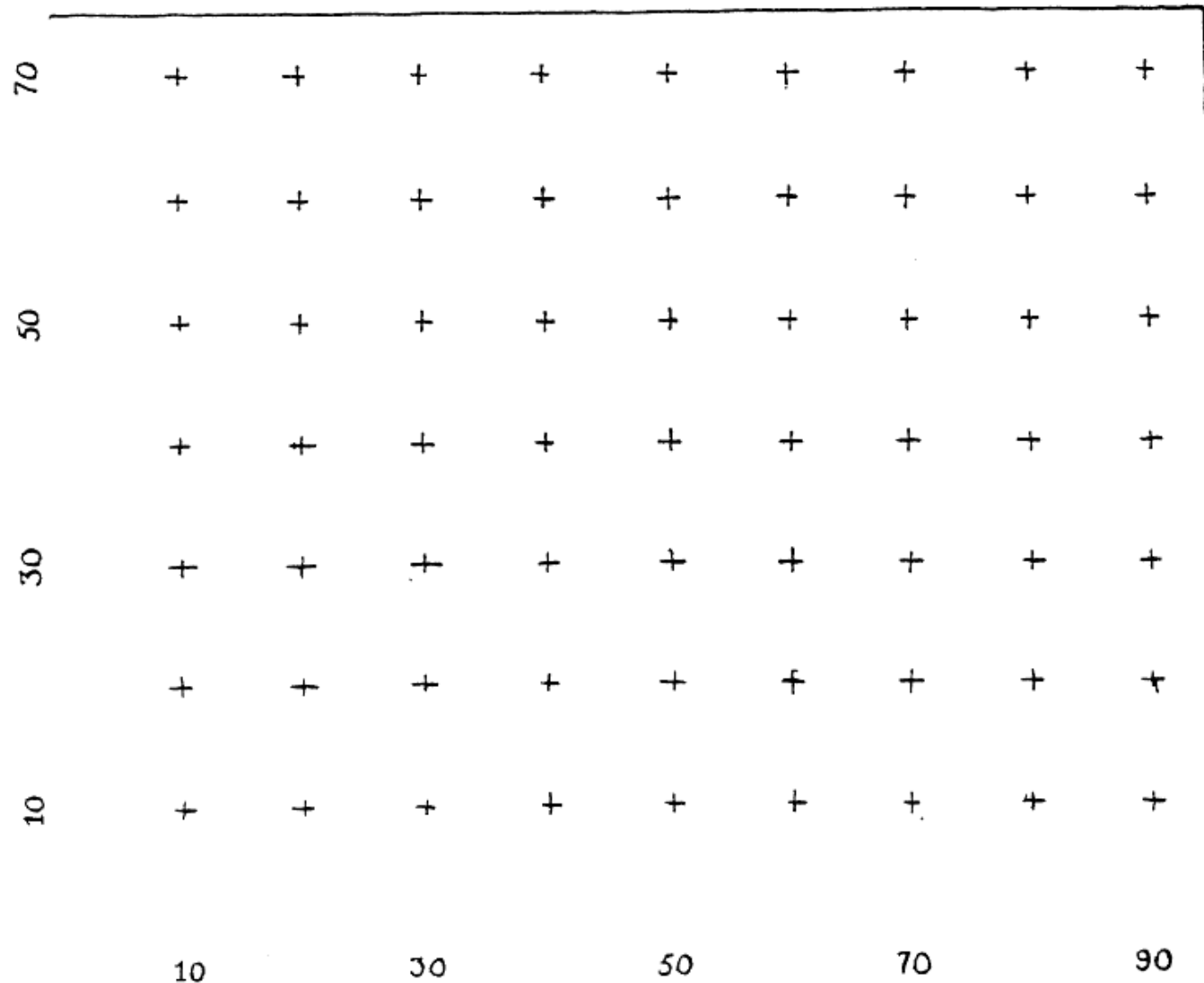
Revise and edit.



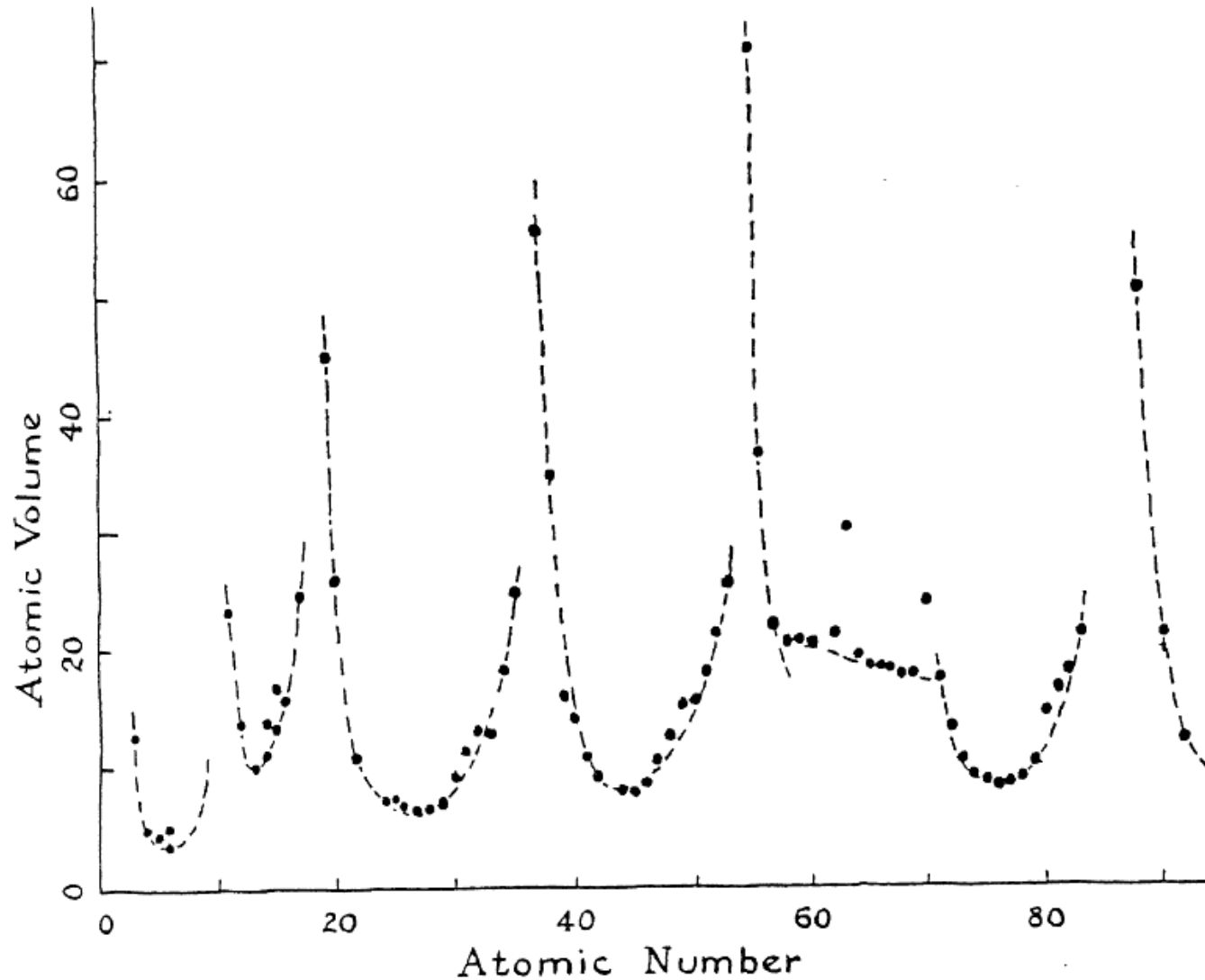
Atomic volume as a function of atomic number shows periodic behavior.



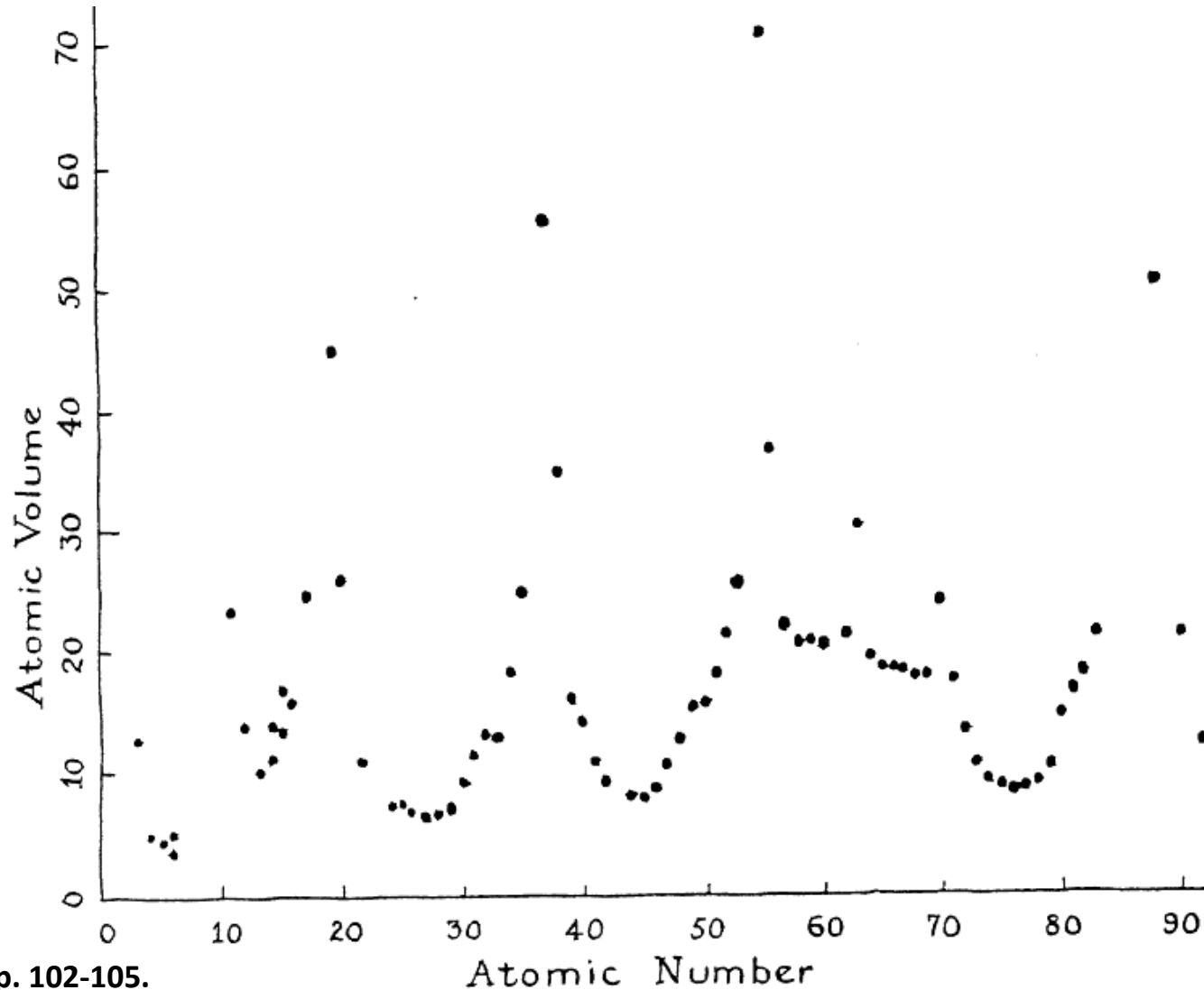
Erase the non-data ink...



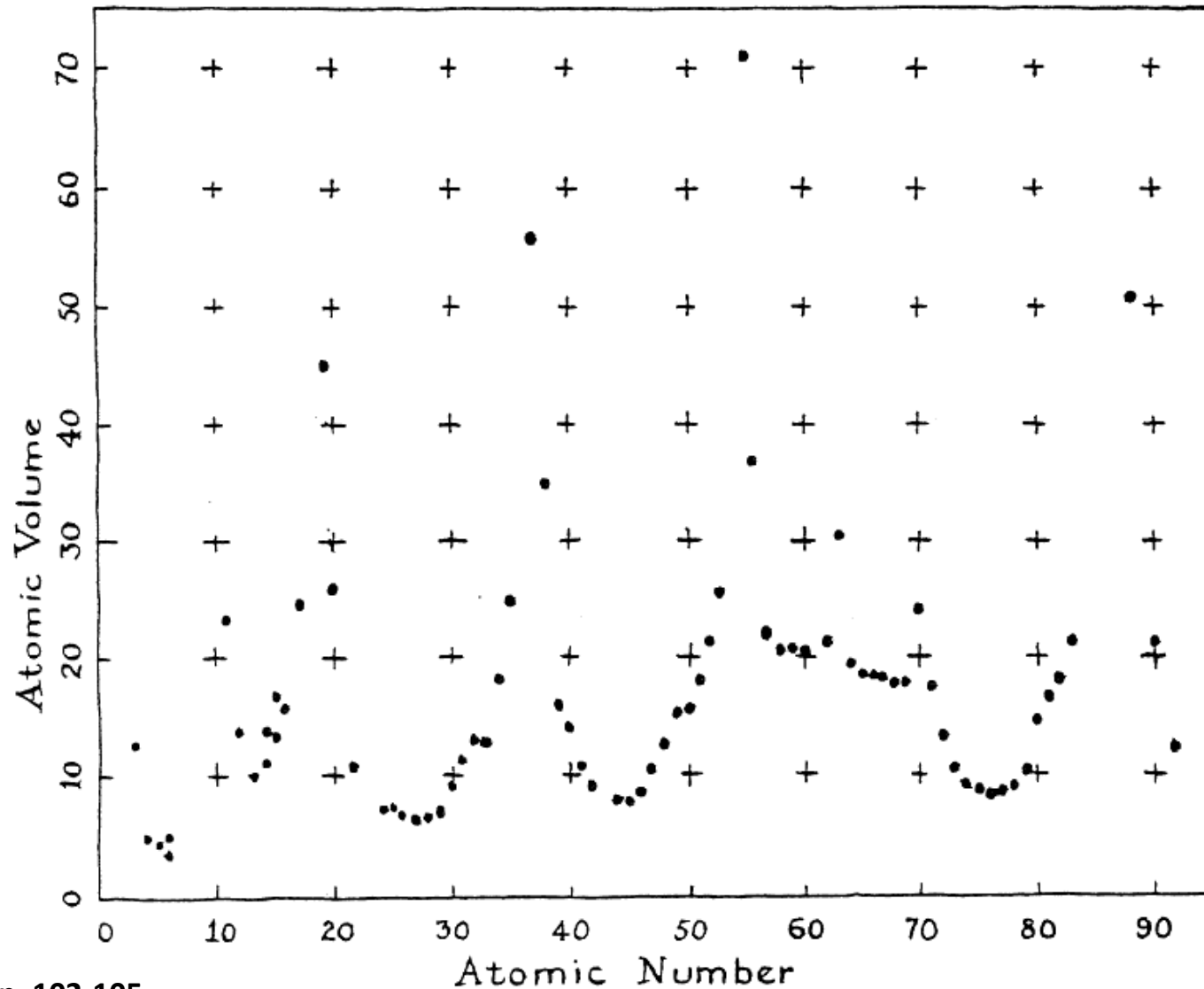
...leaving this. Any non-data ink?



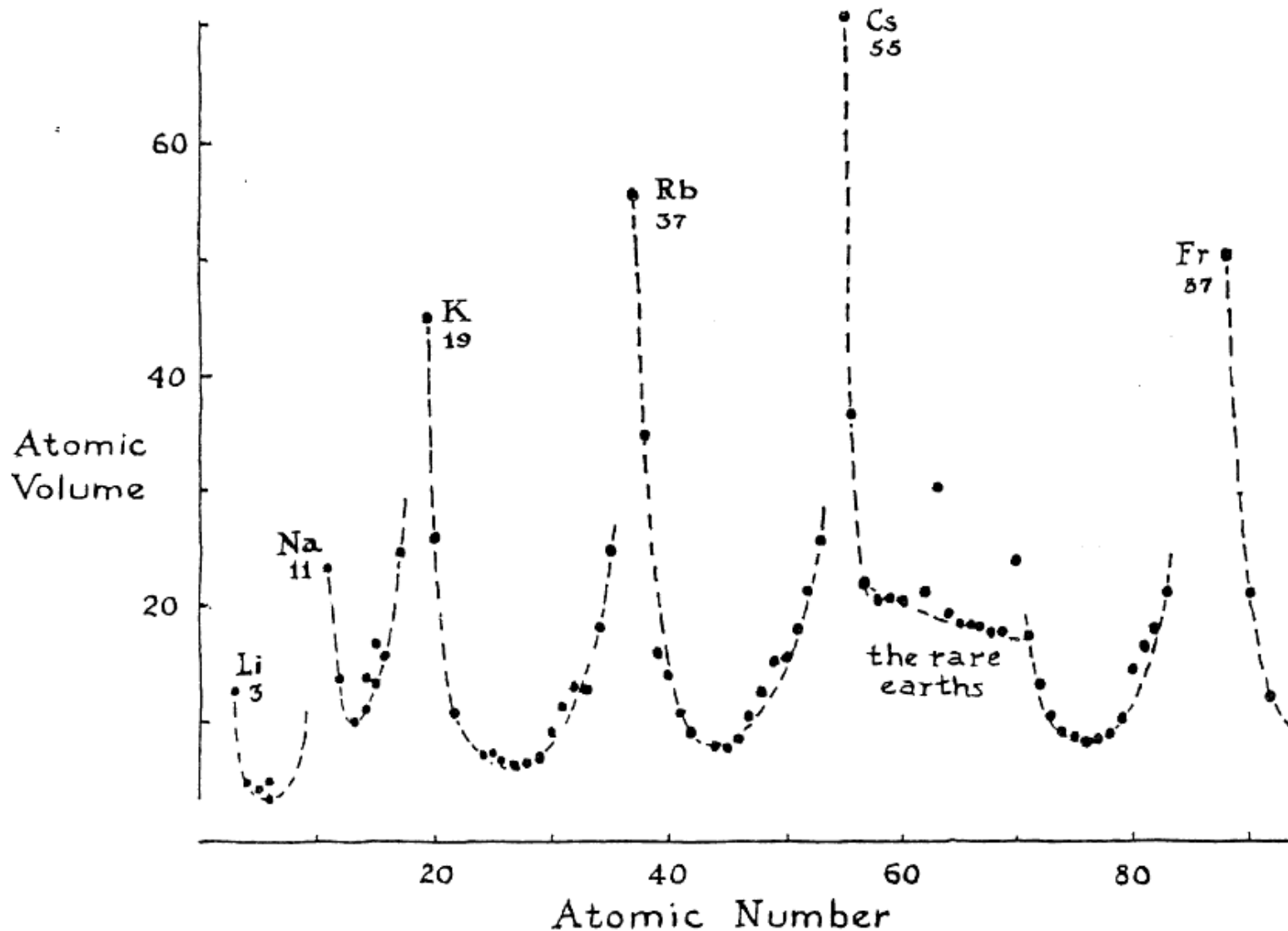
The reference curves are not data, so we could erase them, but... (?)



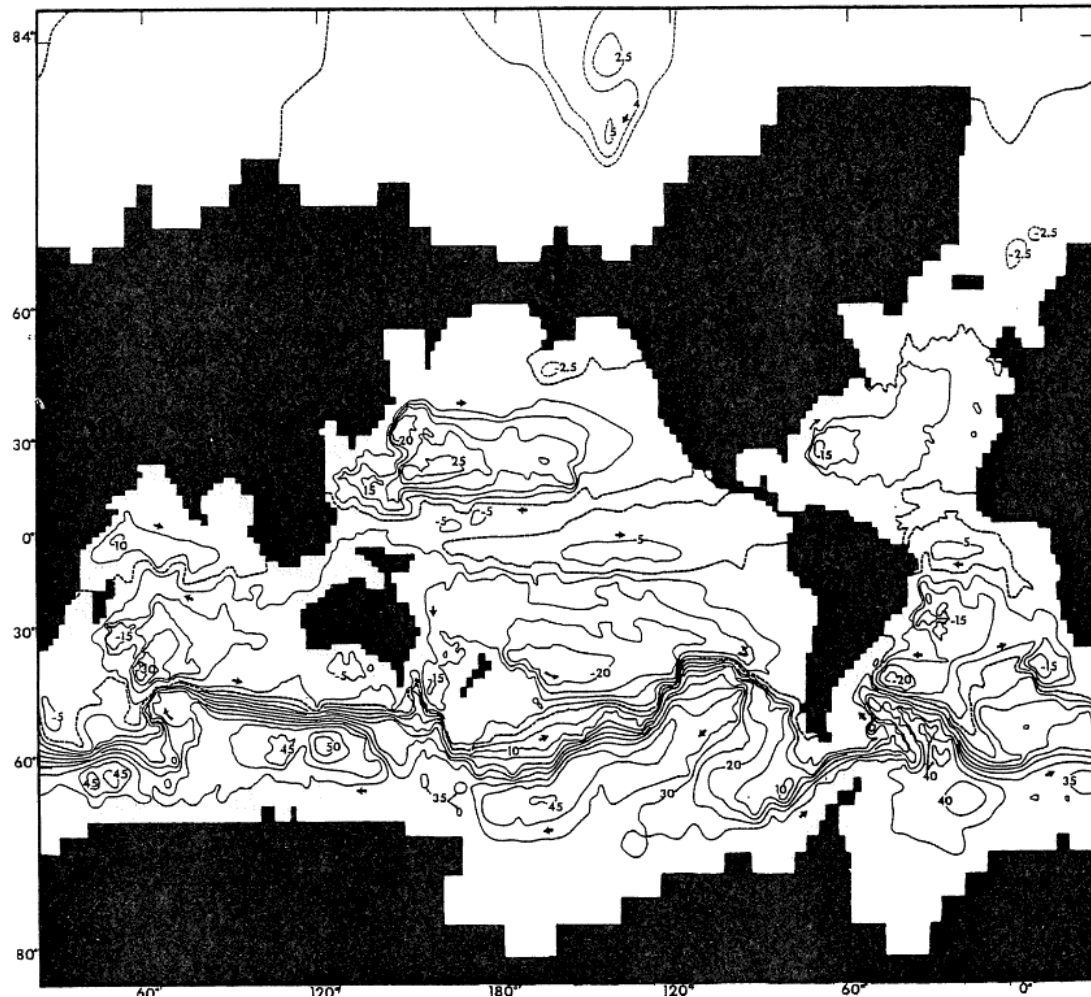
Perhaps adding the grid helps?



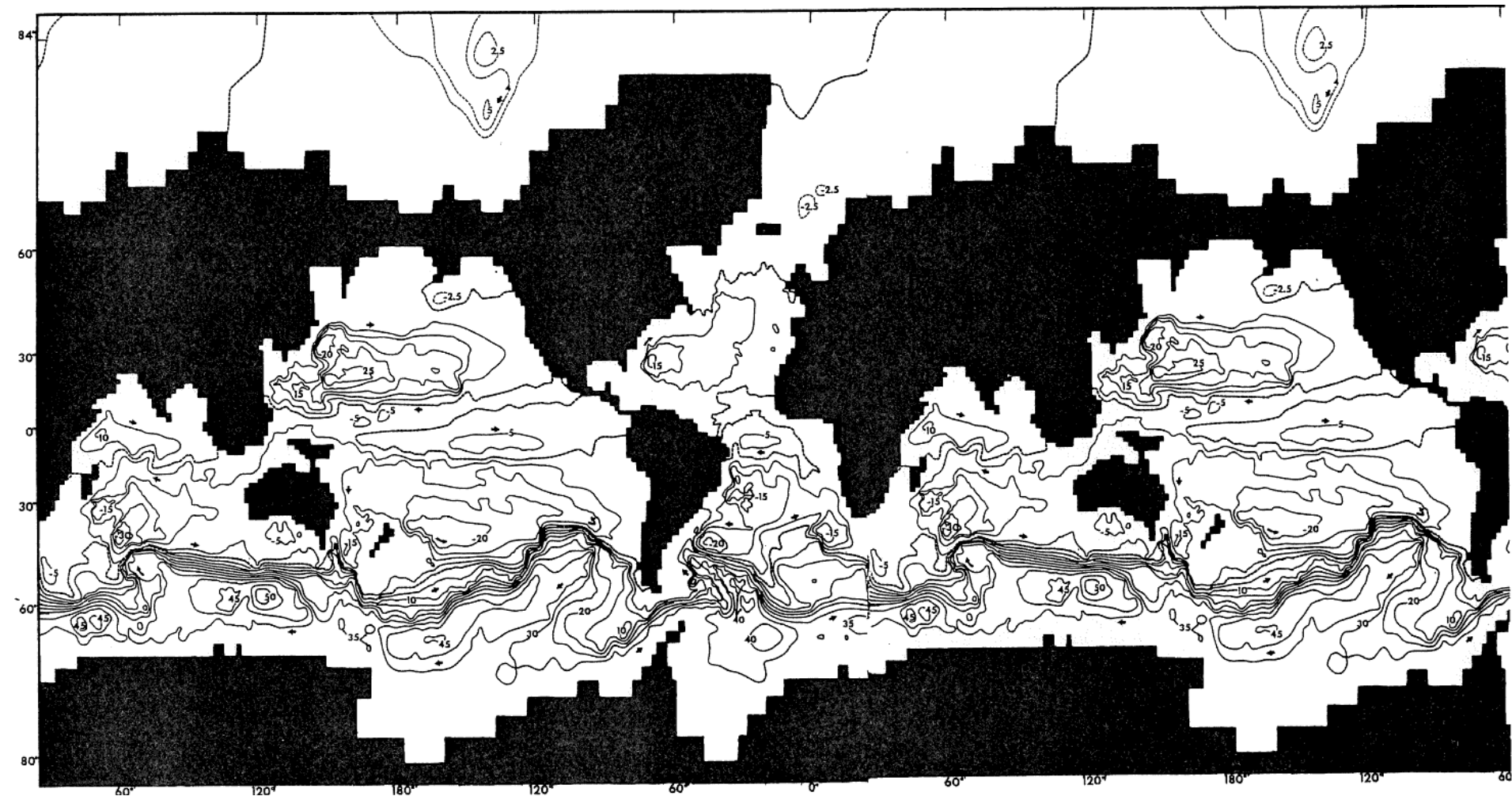
Final revision includes the reference lines and annotations.



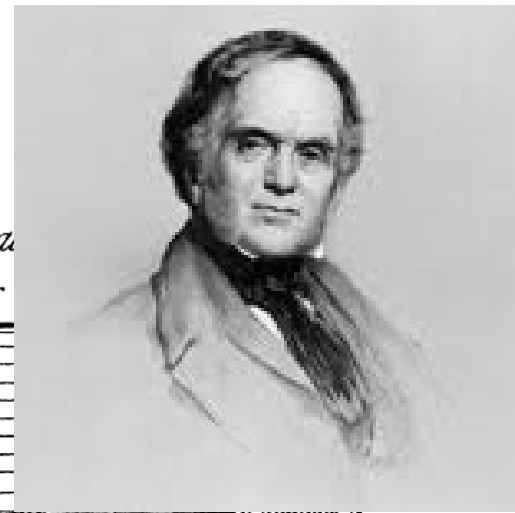
In this display of surface ocean currents, what cognitive task is most difficult?



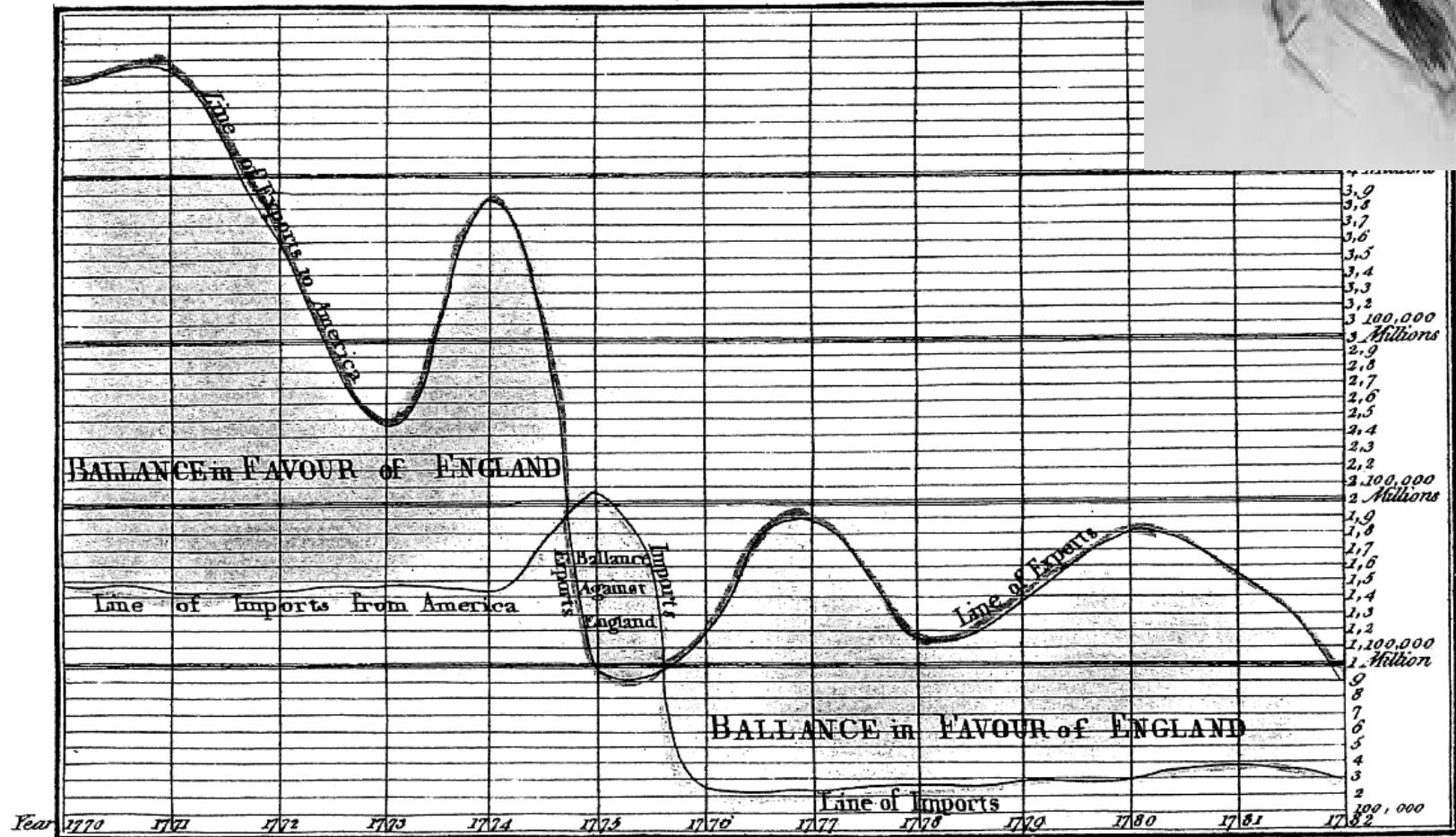
Go around the world 1 and 2/3 times.



Playfair, in 1785, engraved this.



*CHART of IMPORTS and EXPORTS of ENGLAND to and from America
From the Year 1770 to 1782 by W. Playfair*



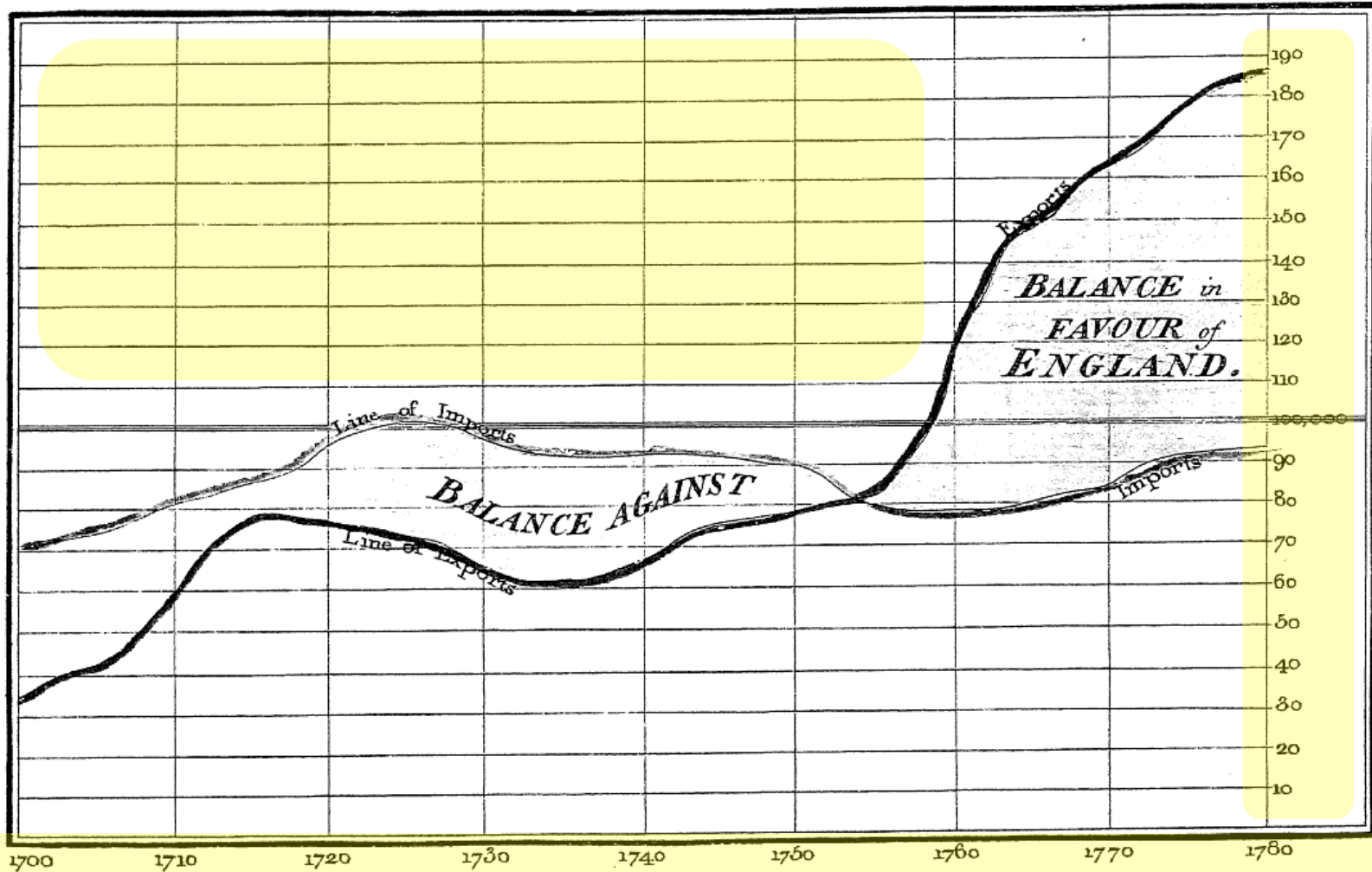
The Bottom Line is divided into Years the right-hand Line into HUNDRED THOUSAND POUNDS

J. Ainslie Sculp.

Published as the Act directs 20th Aug^r 1785.

One year later,

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



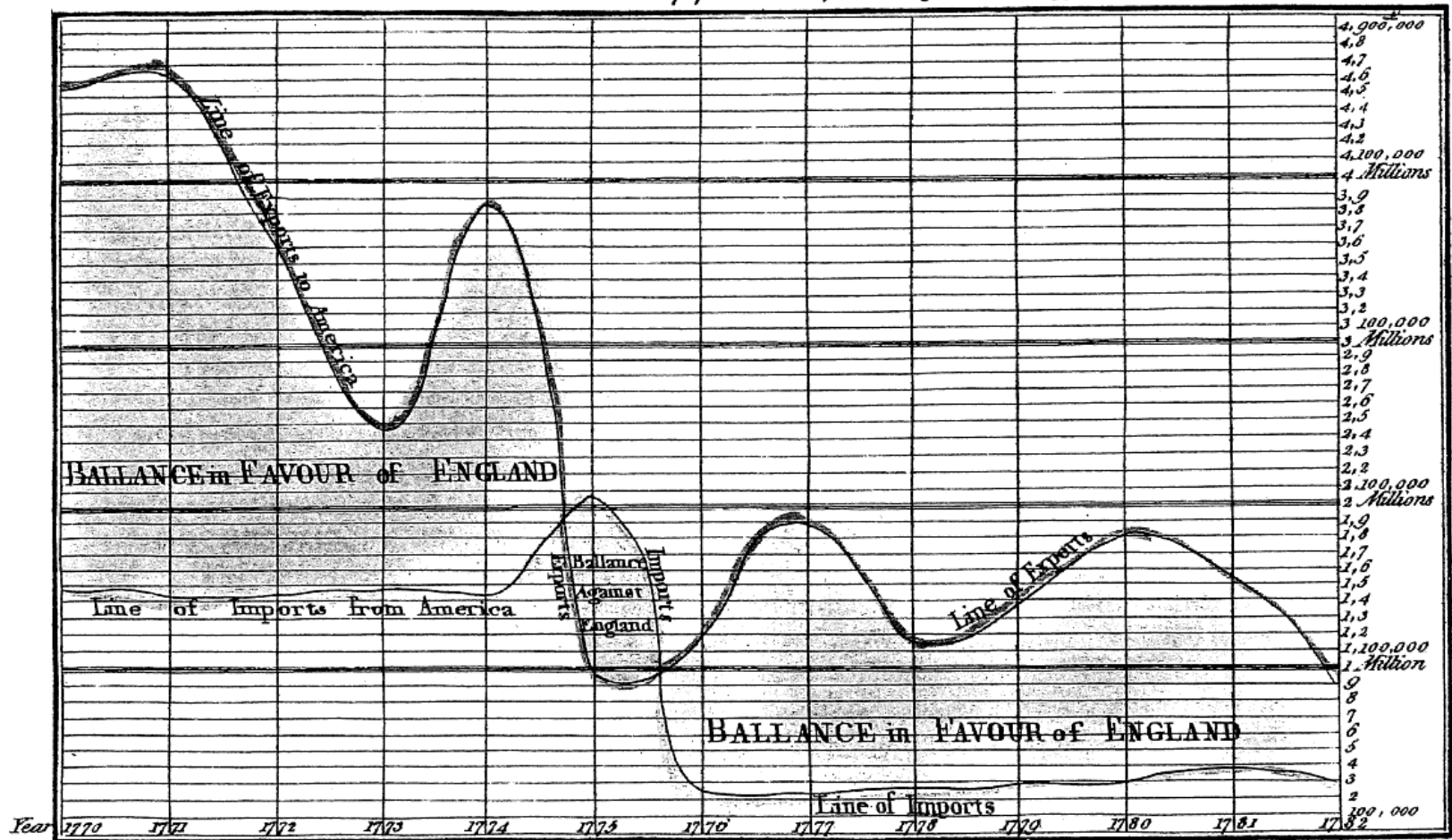
The Bottom line is divided into Years, the Right hand line into £10,000 each.

Published as the Act directs, 1st May 1786, by W^m. Playfair

Keble sculpt 352, Strand, London.

Playfair, in 1785, engraved this.

*CHART of IMPORTS and EXPORTS of ENGLAND to and from all NORTH AMERICA
From the Year 1770 to 1782 by W. Playfair*



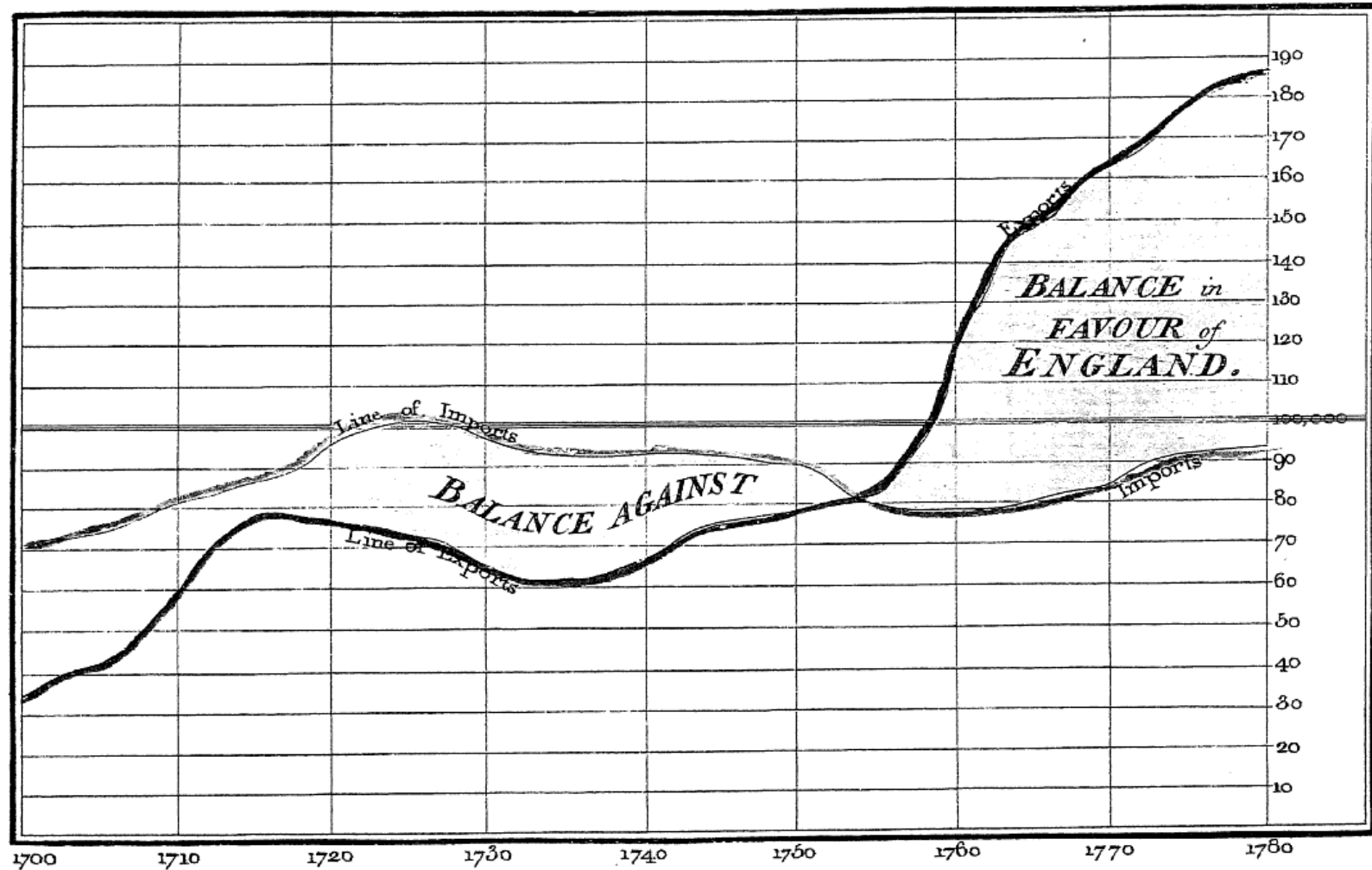
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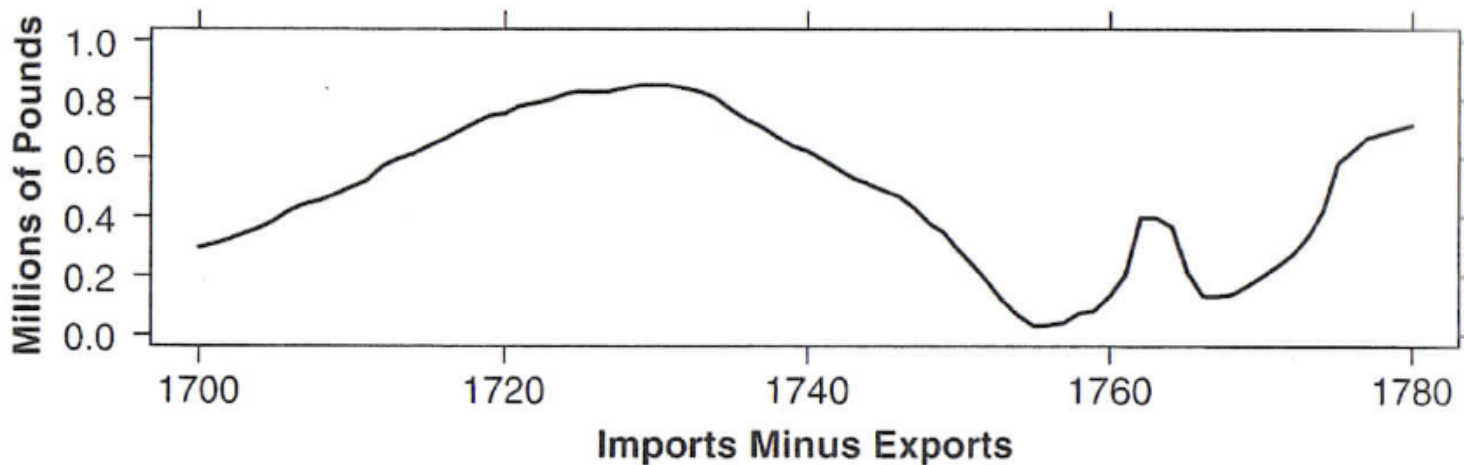
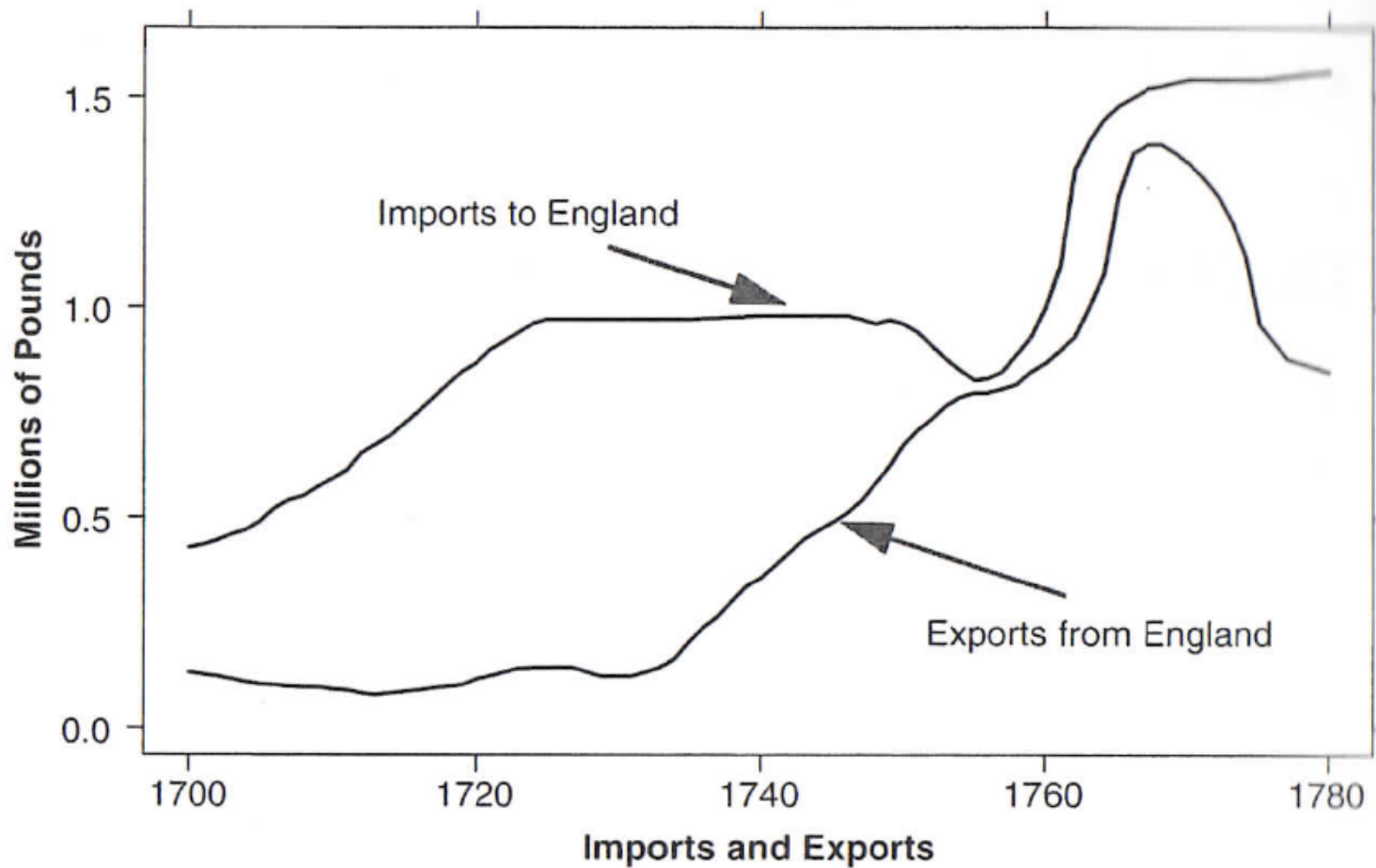


The Bottom line is divided into Years, the Right hand line into £10,000 each.

Published as the Act directs, 1st May 1786, by W^m. Playfair

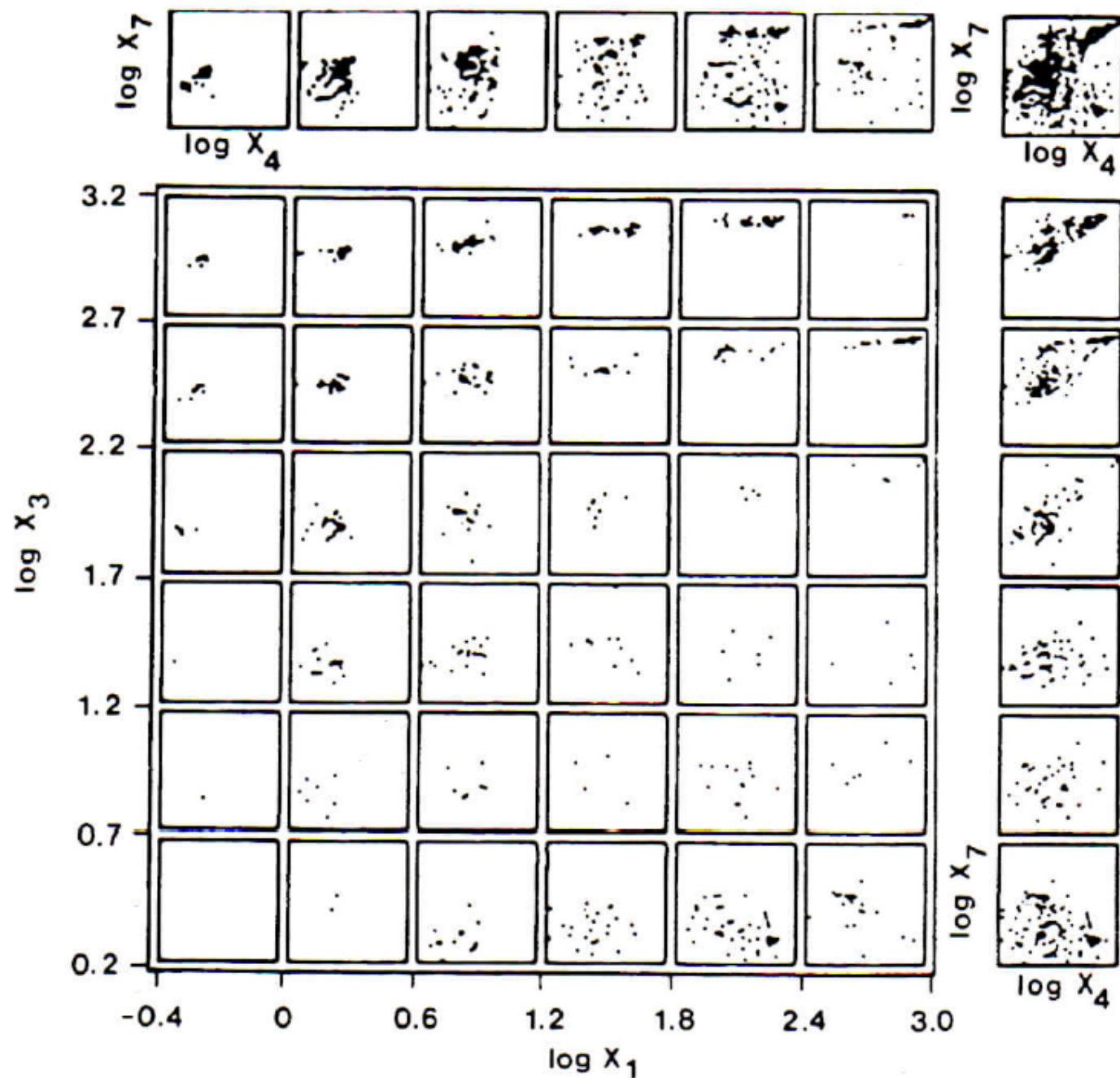
Keble sculpt 352, Strand, London.

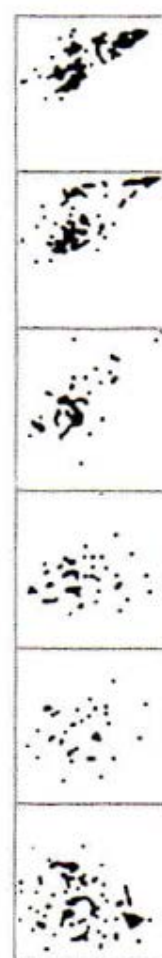
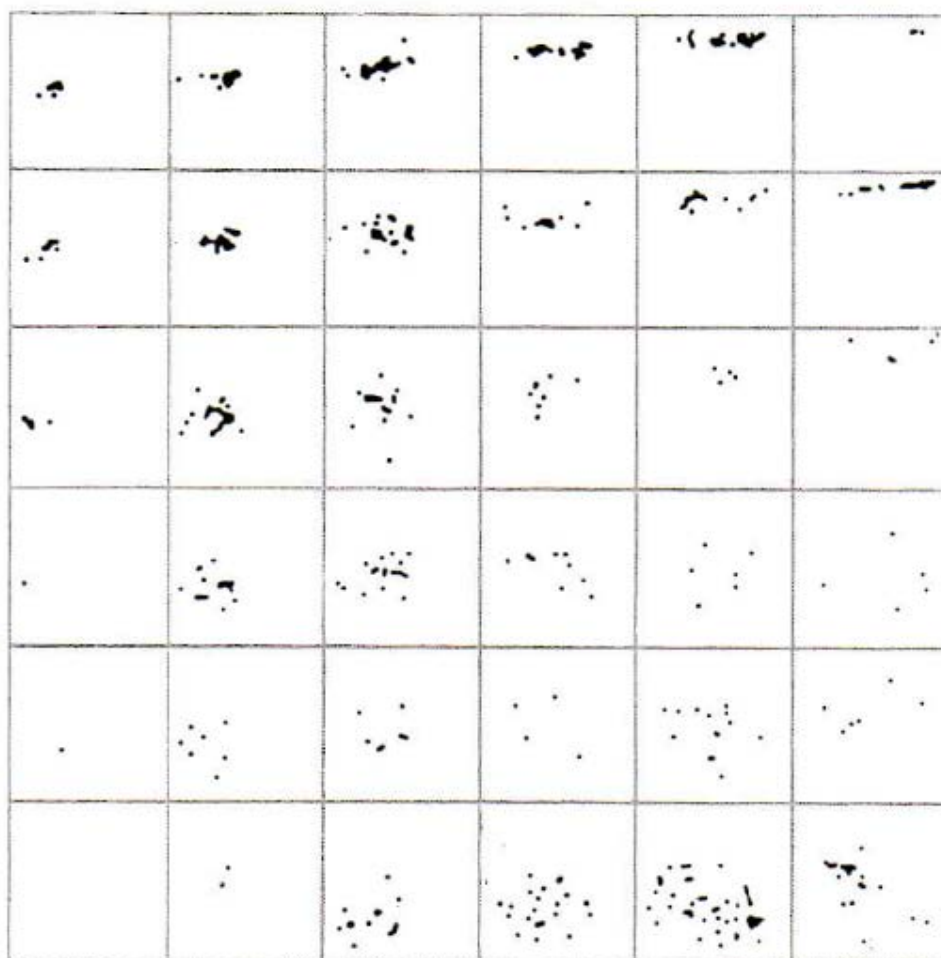
**Robbins
modernizes
Playfair's
graph.**

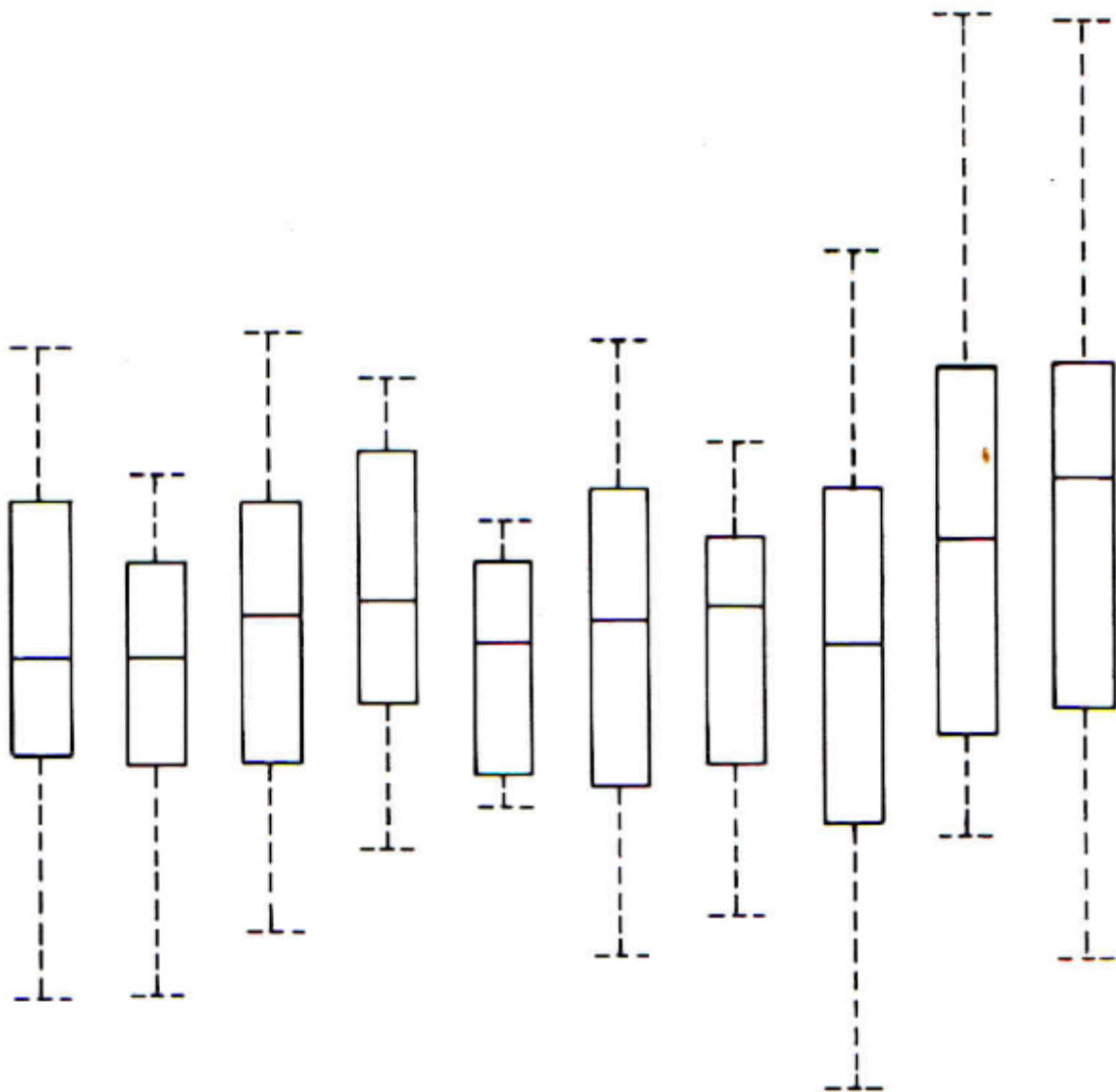


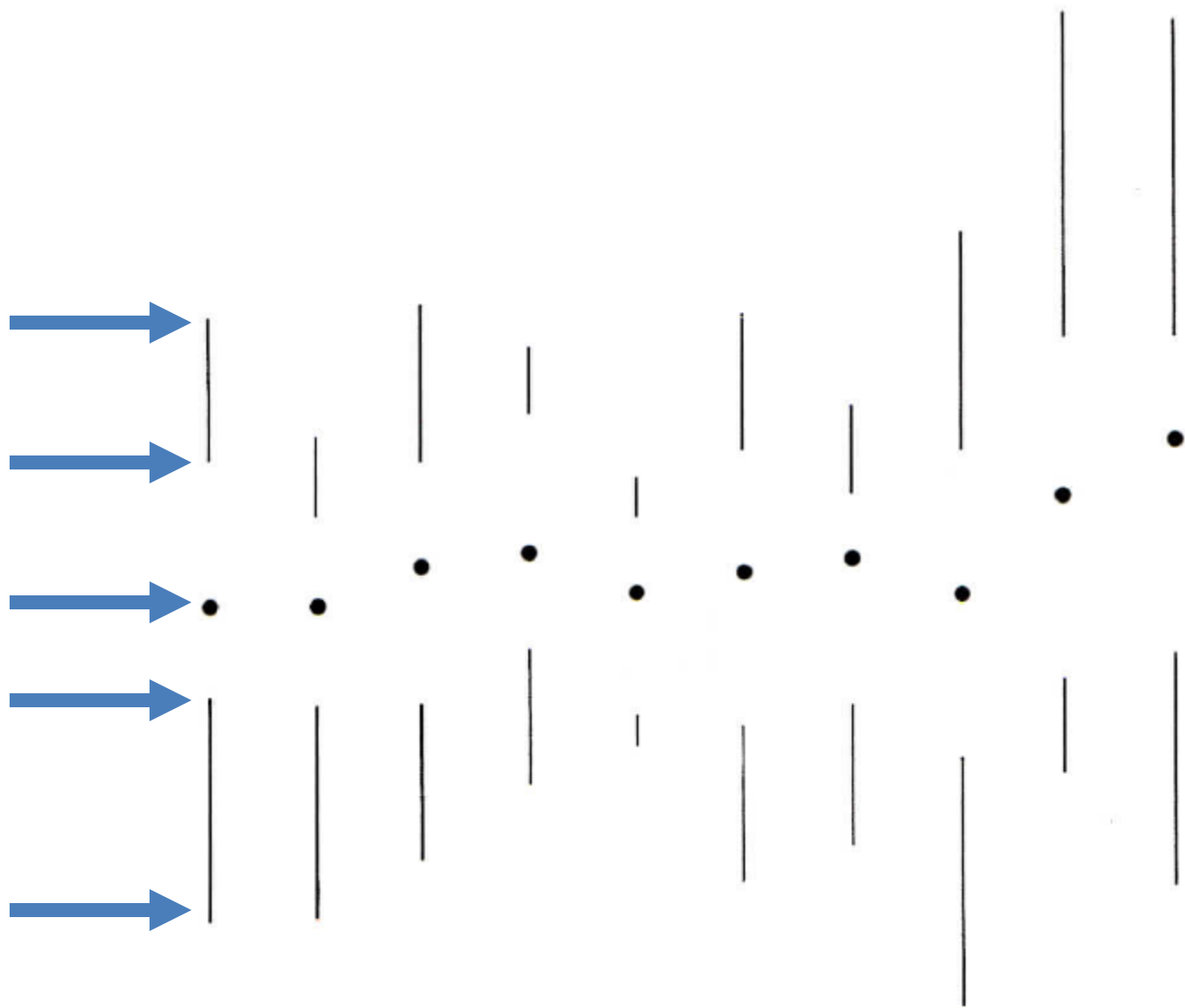
Applying Tufte's principles.

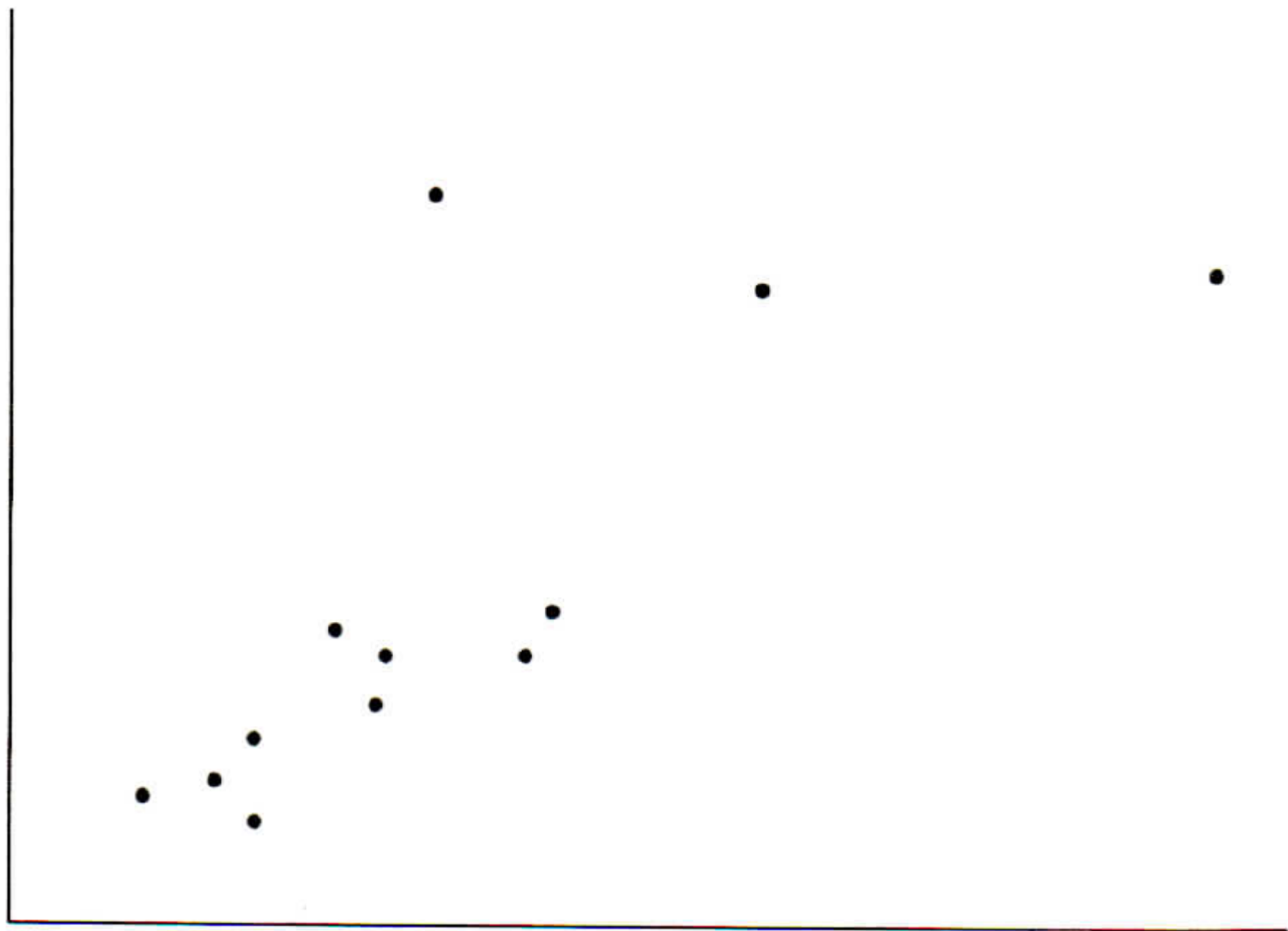
MULTIWINDOW PLOT OF PARTICLE PHYSICS MOMENTUM DATA

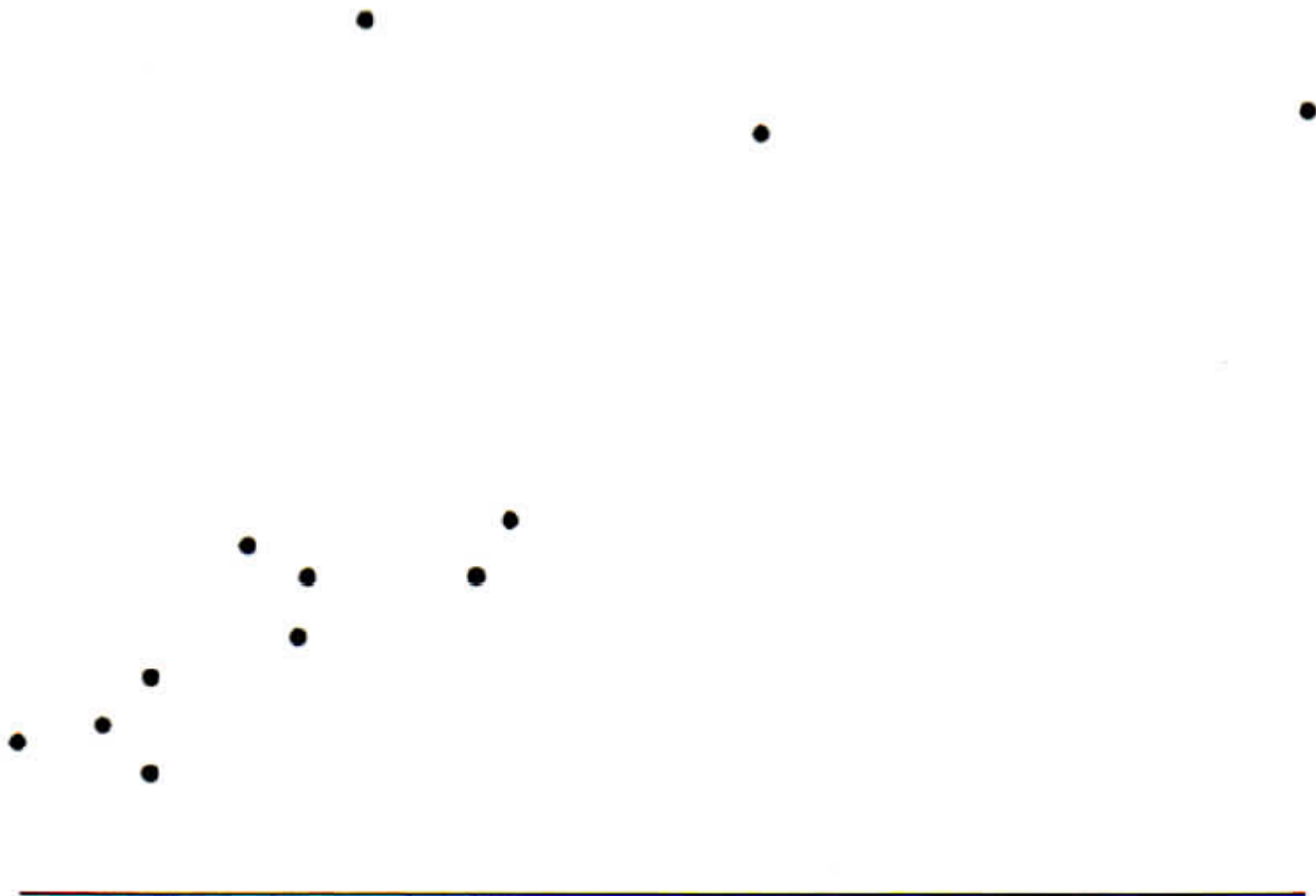


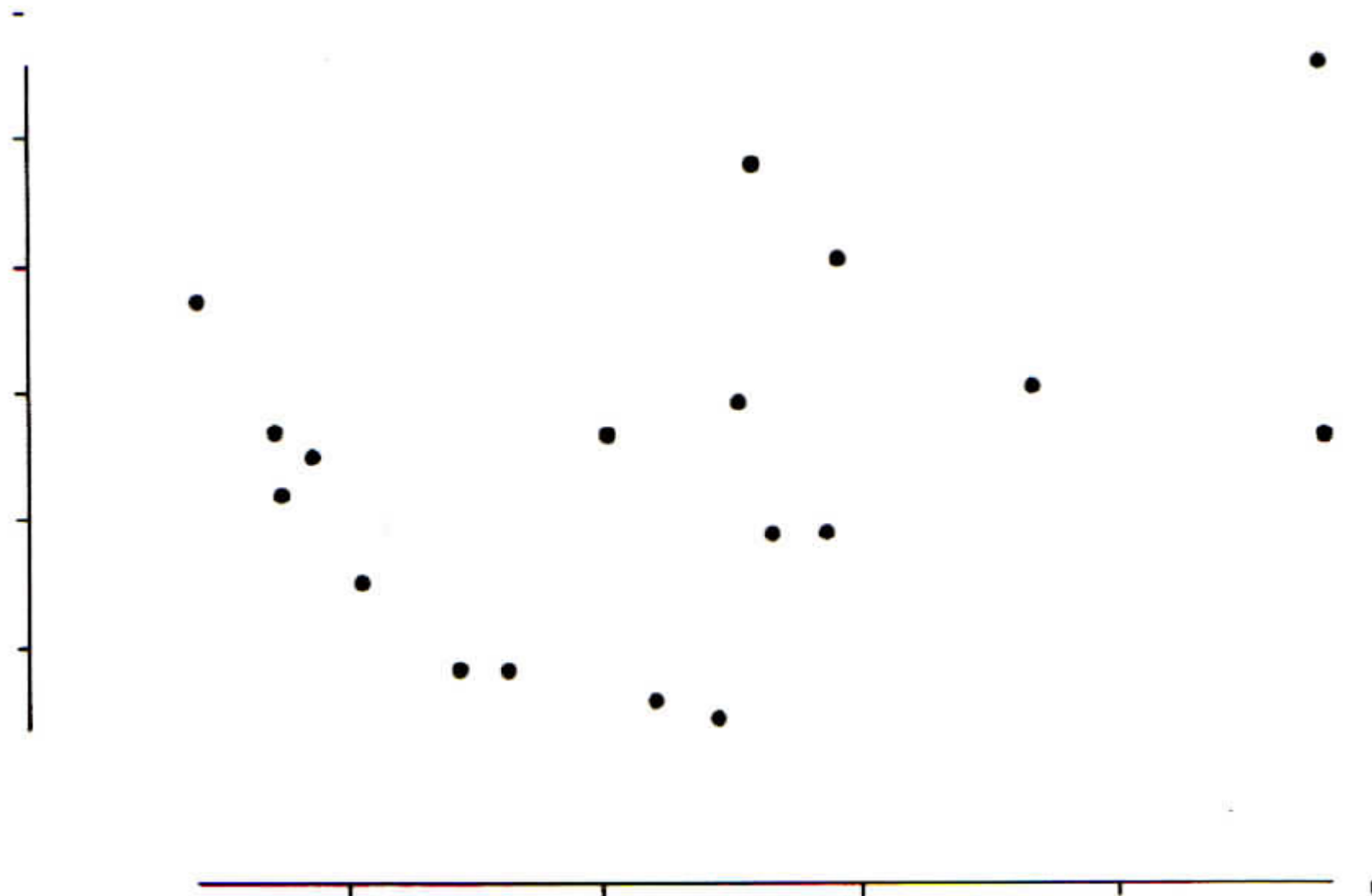


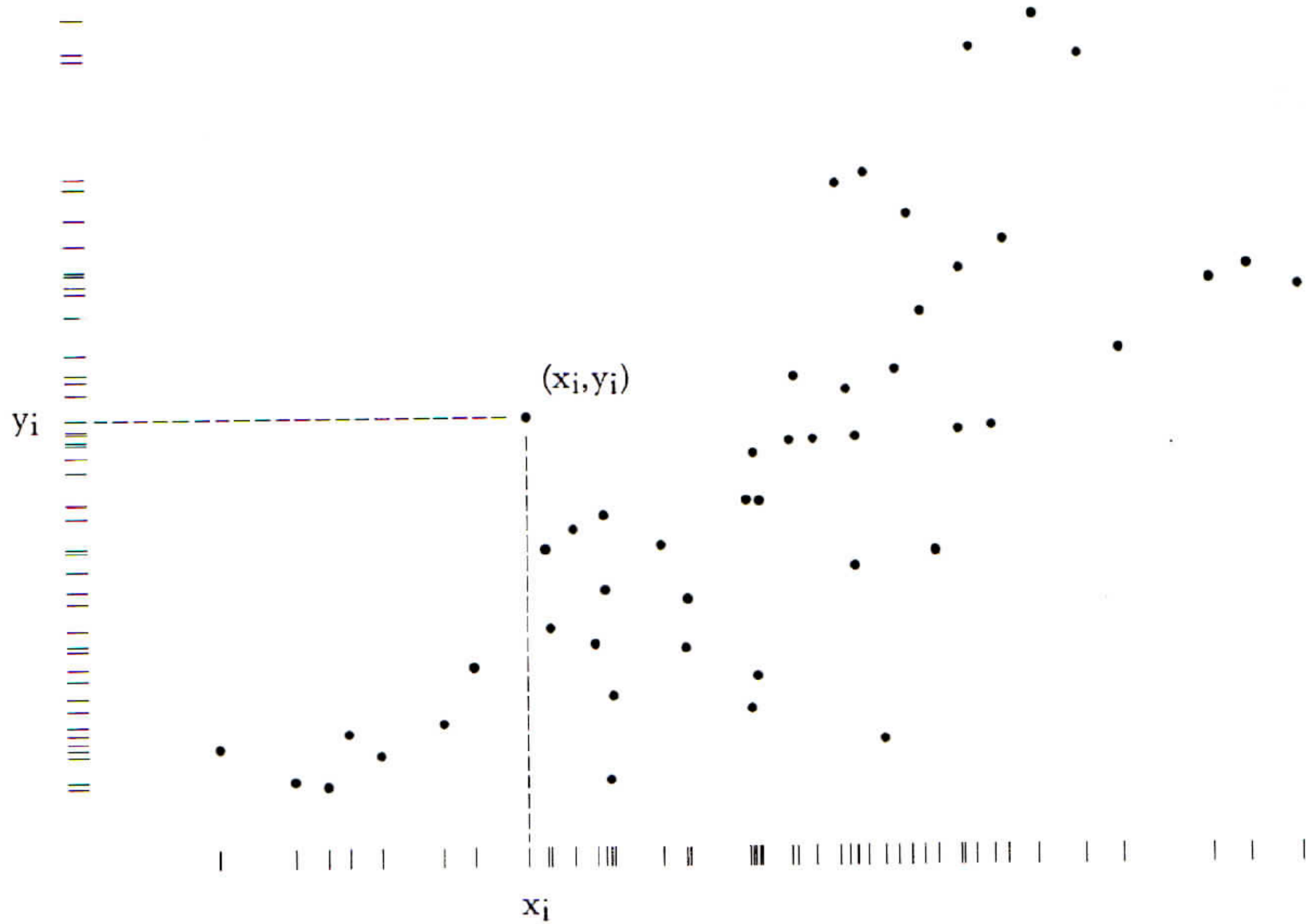


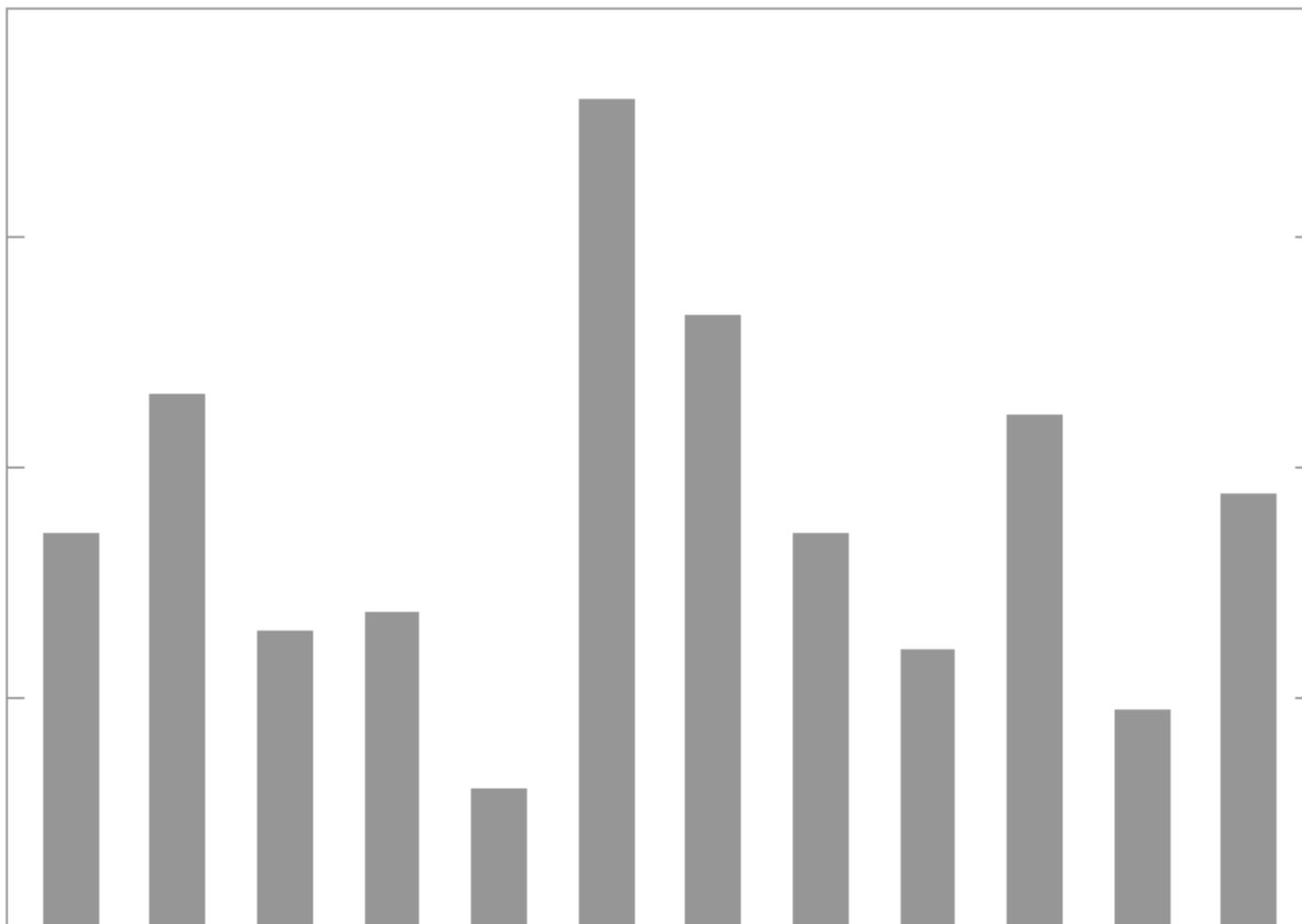


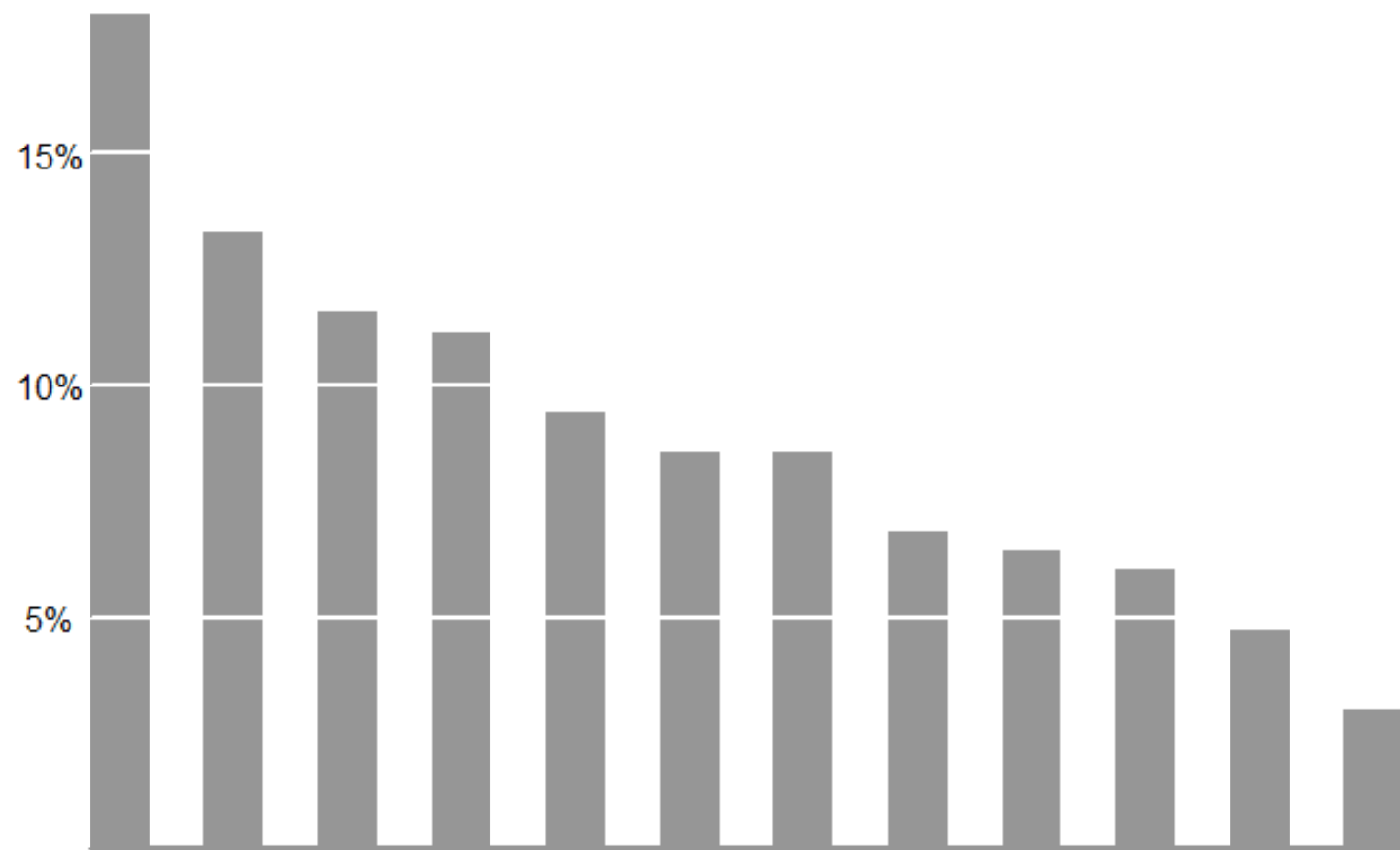












Some Winners and Losers in the Forecasting Game

Council of Economic
Advisers: +4.7%

Data
Resources: +4.5%

Nat. Assoc. of Business
Economists: +4.5%

Wharton Econometric
Forecasting: +4.5%

Congressional Budget
Office: +4.4%

Conference
Board: +4.2%

I.B.M. Economics
Department: +4.1%

About a year ago, eight forecasters were asked for their predictions on some key economic indicators. Here's how the forecasts stack up against the probable 1978 results (shown in the black panel).

Nat. Assoc. of Business
Economists: +6.2%

I.B.M. Economics
Department: +5.9%

Wharton Econometric
Forecasting: +21%

Chase
Econometrics: 7.4%

Wharton Econometric
Forecasting: 6.8%

Conference
Board: 6.7%

Nat. Assoc. of Business
Economists: 6.7%

I.B.M. Economics
Department: 6.6%

Data
Resources: 6.5%

Congressional Budget
Office: 6.3%

Council of Economic
Advisers: 6.3%

Real G.N.P.
Growth: +3.8%

Industrial Production
Growth: +5.8%

Change in Consumer
Prices: +7.7%

Corporate Profits
Growth: +13.3%

Unemployment
Rate: 6%

Chase
Econometrics: +2.8%

Conference
Board: +5.5%

I.B.M. Economics
Department: +6.6%

Data
Resources: +10.5%

Data
Resources: +5.2%

Nat. Assoc. of Business
Economists: +6.5%

I.B.M. Economics
Department: +10.4%

Wharton Econometric
Forecasting: +4.8%

Conference
Board: +6.2%

Chase
Econometrics: +6.5%

Chase
Econometrics: +1.9%

Data
Resources: +6.2%

Chase
Econometrics: +5.9%

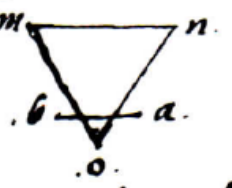
Council of Economic
Advisers: +5.9%

Wharton Econometric
Forecasting: +5.4%

Forecasters are not listed in categories for which they did not make a prediction.

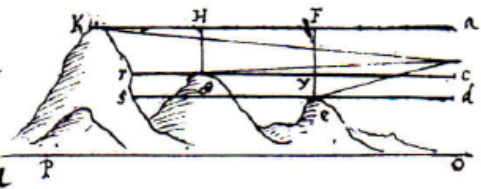
*After taxes

cherai le cose uedute essere tanto minuire che nò che
 le membra ma il tutto quasi ripara impossibile a po-
 tere figurare come sell'occhio fusse, o, c'la busa d'un
 quarto di braccio eguale alla tua tauola dipinta
 sia, a, b, discosta m. dal'occhio mezo
 braccio allora tu uedrai per esso spa-
 cio tutte le cose che ueder si possi den-
 tro alla lunghezza d'uno orizzonte di
 cento miglia in tanta confusa diminutione che nò
 che figurar di quelle alcuna parte c'habbia figurar
 ma apena potrai porre si piccolo punto di penello che
 non sia maggiore c'hogni gran' casamento posto in
 dieci miglia di distantia.



Perche li monti in langha distantia
 si dimostrano piu scuri nella cima
 che nella basa —

L'aria c'acquista gradi di grossezza in ogni grado de
 la sua bassezza c'della sua distantia c'causa ch'ite
 cime de monti che piu s'in alzano piu mostrano la
 sua natu-
 rita' per
 sono impe-
 grossezza
 nella cima
 loro basa o nella uicinita' che nella remotione, Pro-
 uasi, o, p, d, s, c, v, a, k, sono gradi dell'aria che sem-
 pre s'asottiglian' quanto piu s'in alzano, a, f, f, h, h, k.
 sono li altri gradi transuersali doue l'aria acquista



uale oscu-
 che ma'co
 dite dalla
 de l'aria
 che nella

Tufte concludes:

Five principles in the theory of data graphics produce substantial changes in graphical design. The principles apply to many graphics and yield a series of design options through cycles of graphical revision and editing.

Above all else show the data.

Maximize the data-ink ratio.

Erase non-data-ink.

Erase redundant data-ink.

→ Revise and edit.

Tufte concludes:

Design is choice.

Design principles generate design options.

Principles should not be applied rigidly or in a peevish spirit.

It is better to violate a principle than to place graceless or inelegant marks on paper.

Principles of design should be greeted with some skepticism.

What is to be sought in design is the clear portrayal of complexity...visual access to the subtle and difficult...the