Graphical Theory

Professors David Ruth and David Puelz

The University of Austin

Visual Displays – Theory of Data Graphics

- Data Ink and Graphical Redesign
- Data-Ink Maximization and Graphical Design
- Aesthetics and Technique in Data Graphical Design

Data Ink and Graphical Redesign

- When designing a graph, focusing on the data-relevant information is essential.

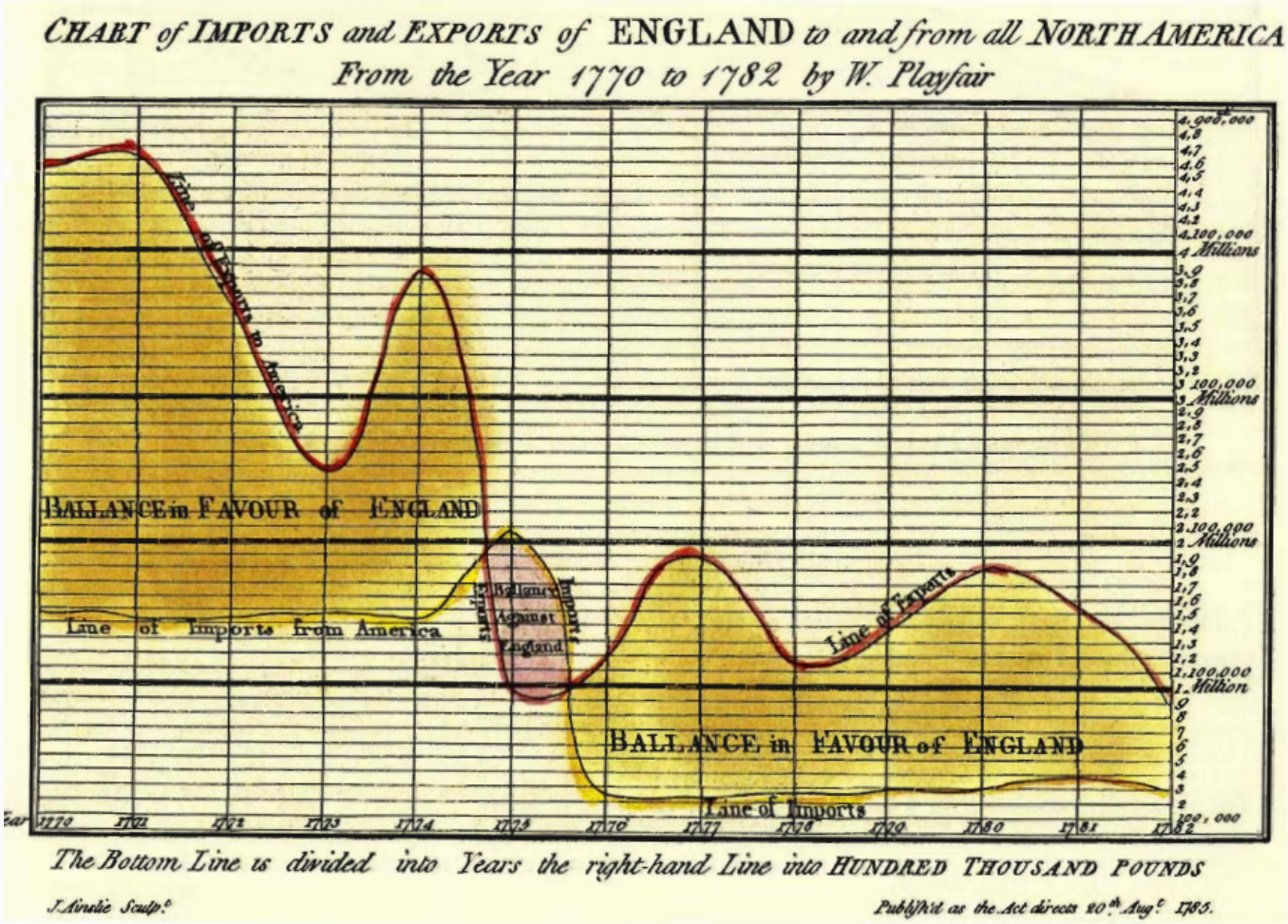
Data Ink and Graphical Redesign

- When designing a graph, focusing on the data-relevant information is essential.
- Main Goal: Reason about quantitative information.

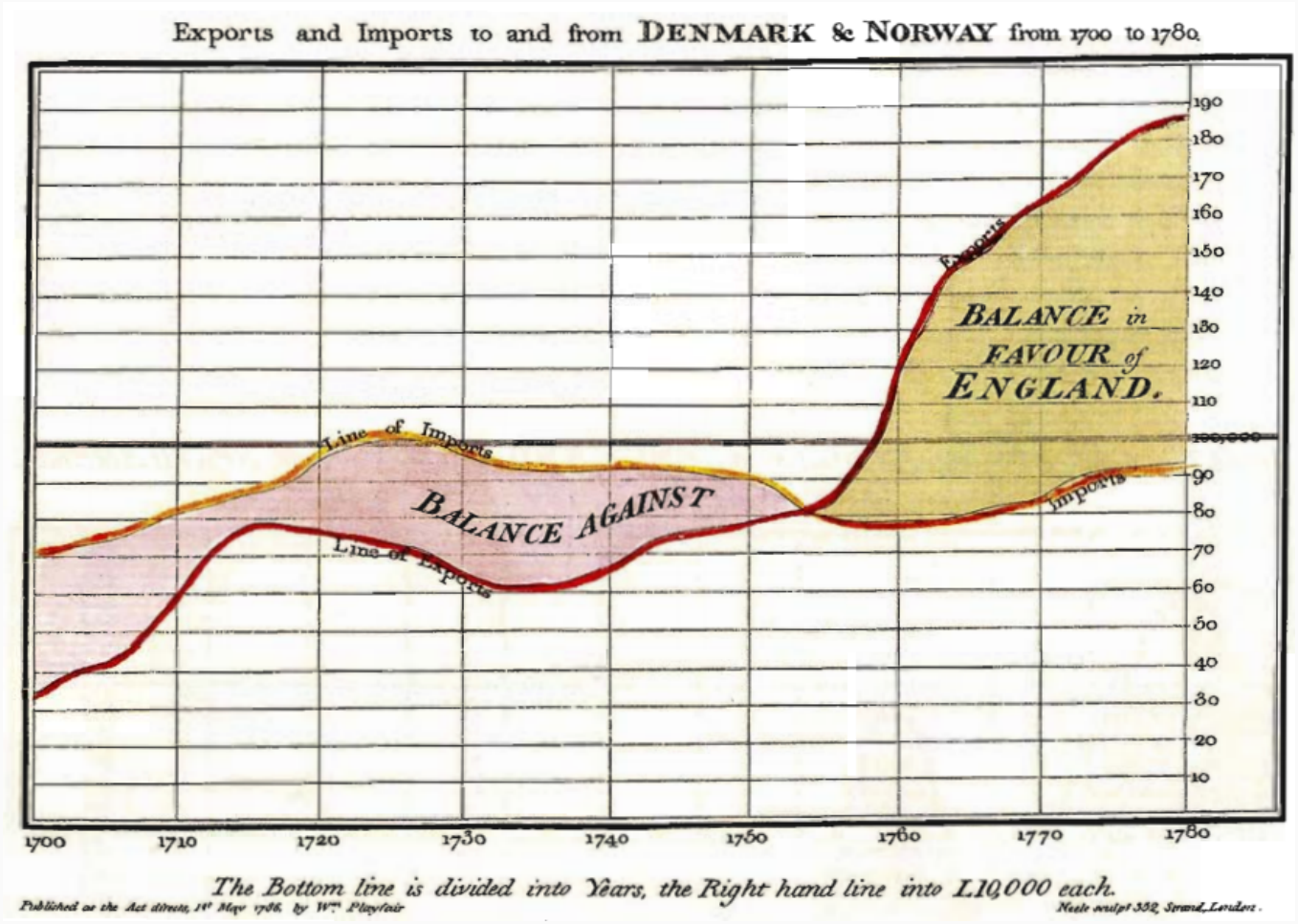
Data Ink and Graphical Redesign

- When designing a graph, focusing on the data-relevant information is essential.
- Main Goal: Reason about quantitative information.
- Main Principle: Show the data.

Data Ink and Graphical Redesign



Data Ink and Graphical Redesign

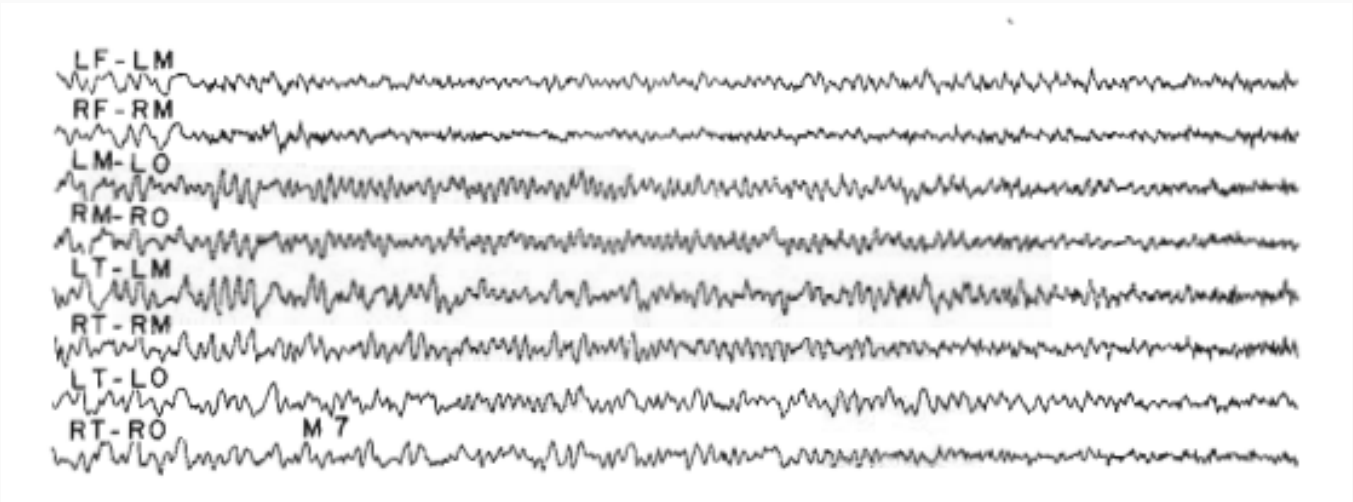


Data Ink and Graphical Redesign

$$\text{DIR} = (\text{amount of data-ink}) \,/\, (\text{total ink in the graph})$$

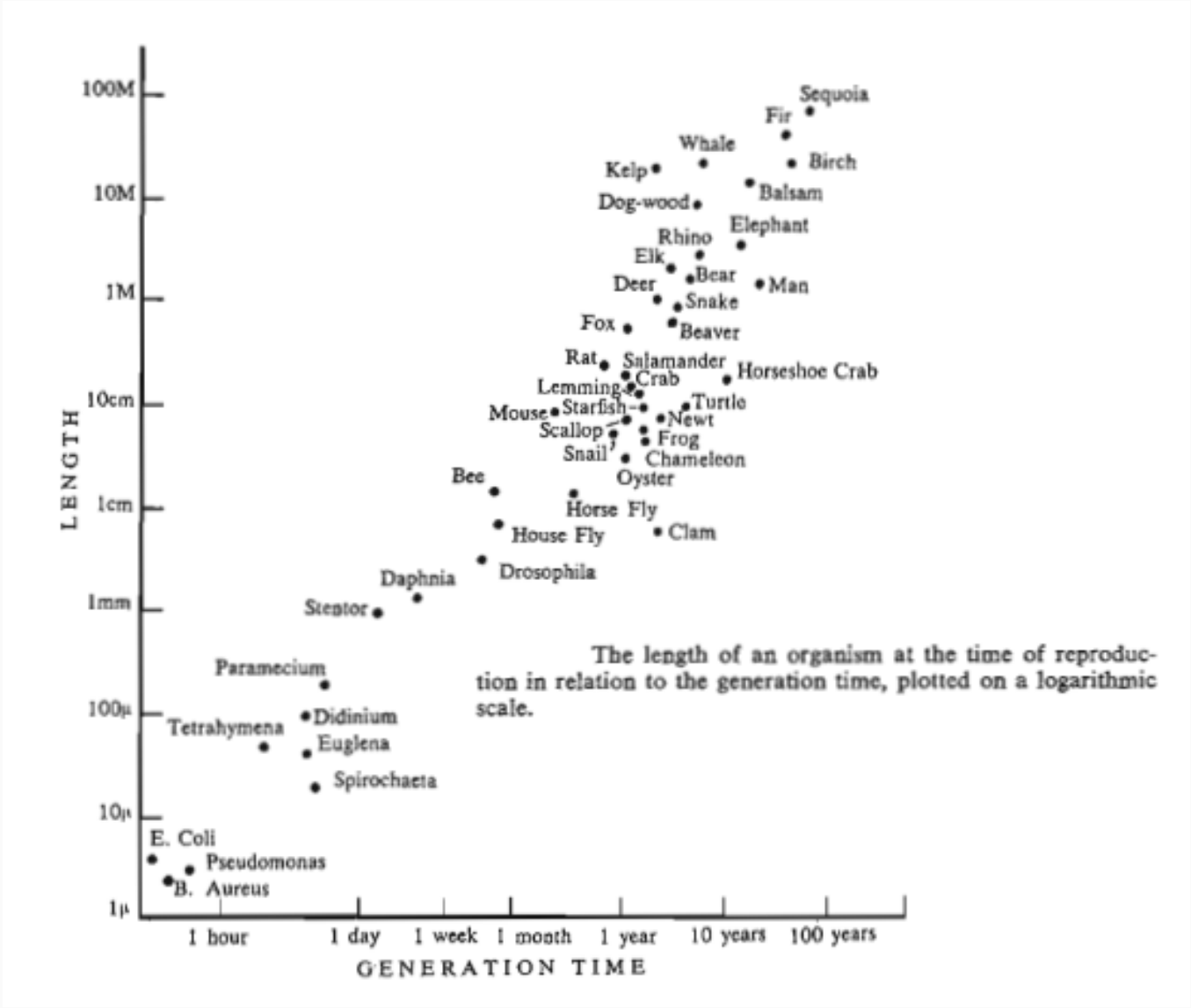
Data Ink and Graphical Redesign

Example: Electroencephalogram where all lines are relevant.



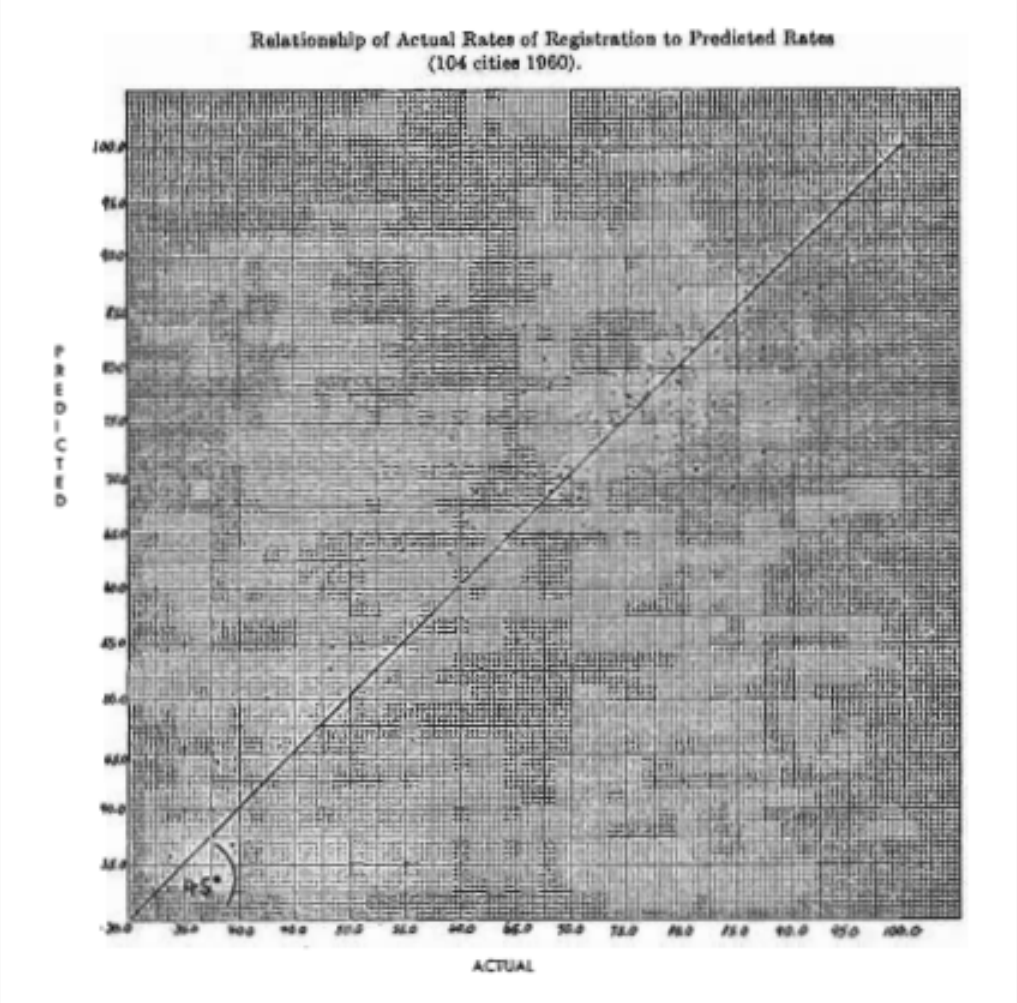
Data Ink and Graphical Redesign

Another example: almost all ink shows relevant information



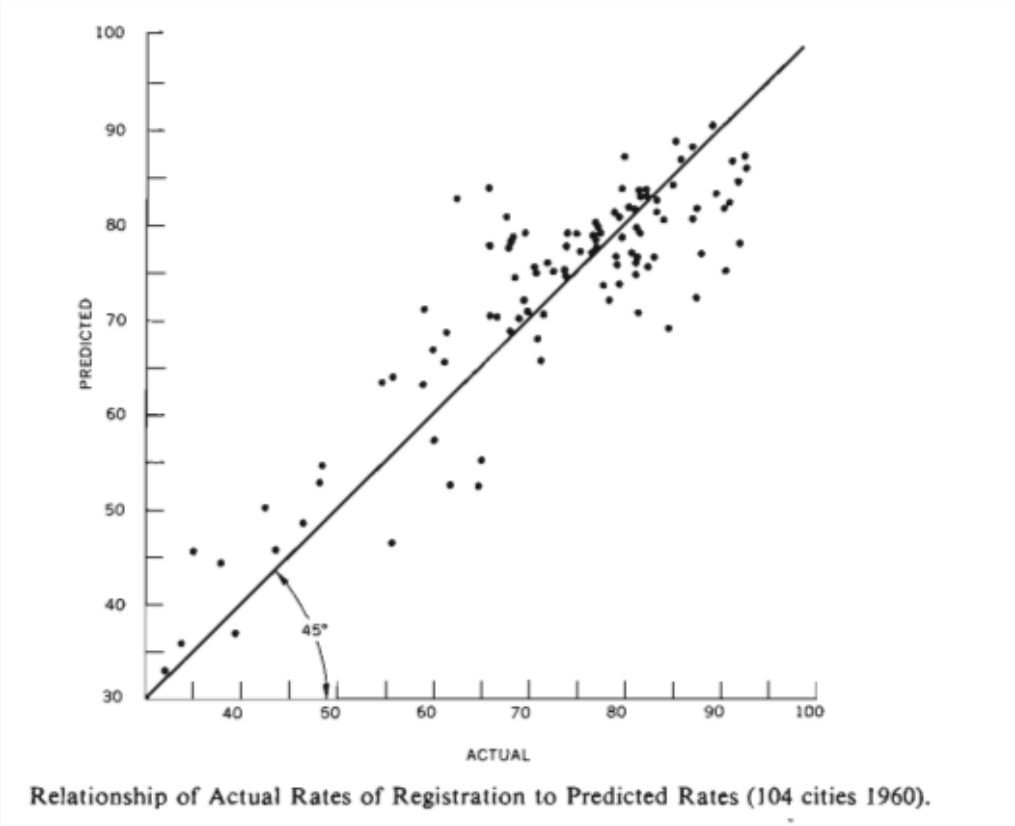
Data Ink and Graphical Redesign

Principle of graphic design: Maximize the Data-to-Ink Ratio.



Data Ink and Graphical Redesign

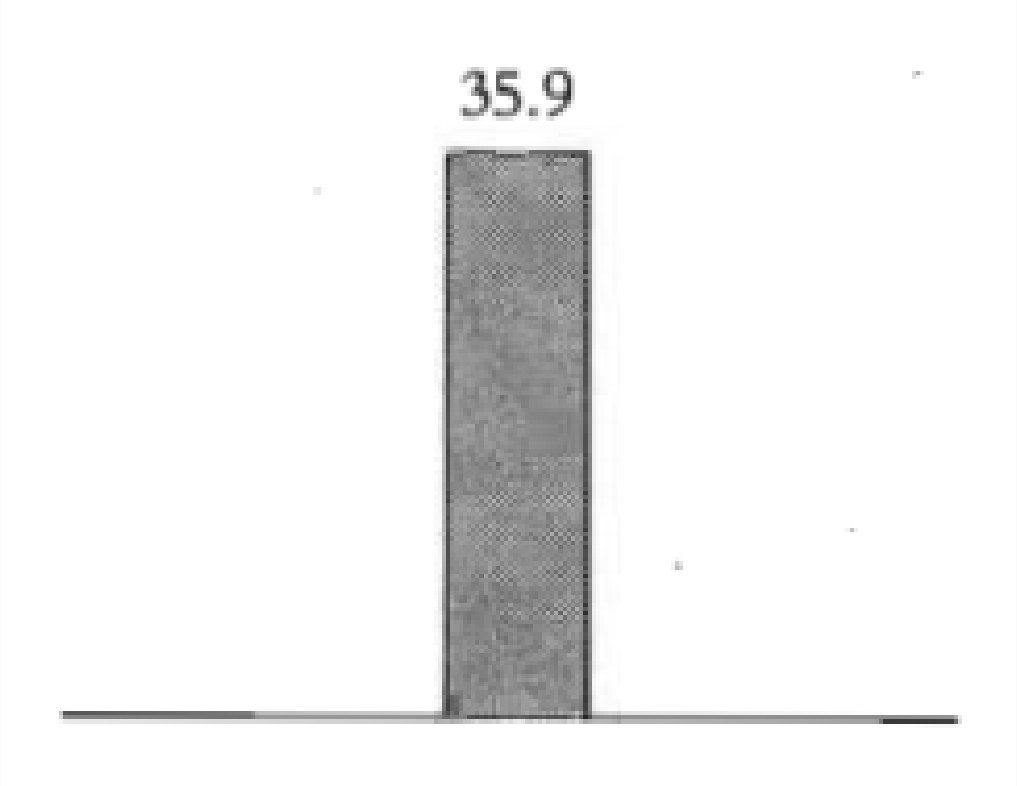
Principle of graphic design: Maximize the Data-to-Ink Ratio.



Relationship of Actual Rates of Registration to Predicted Rates (104 cities 1960).

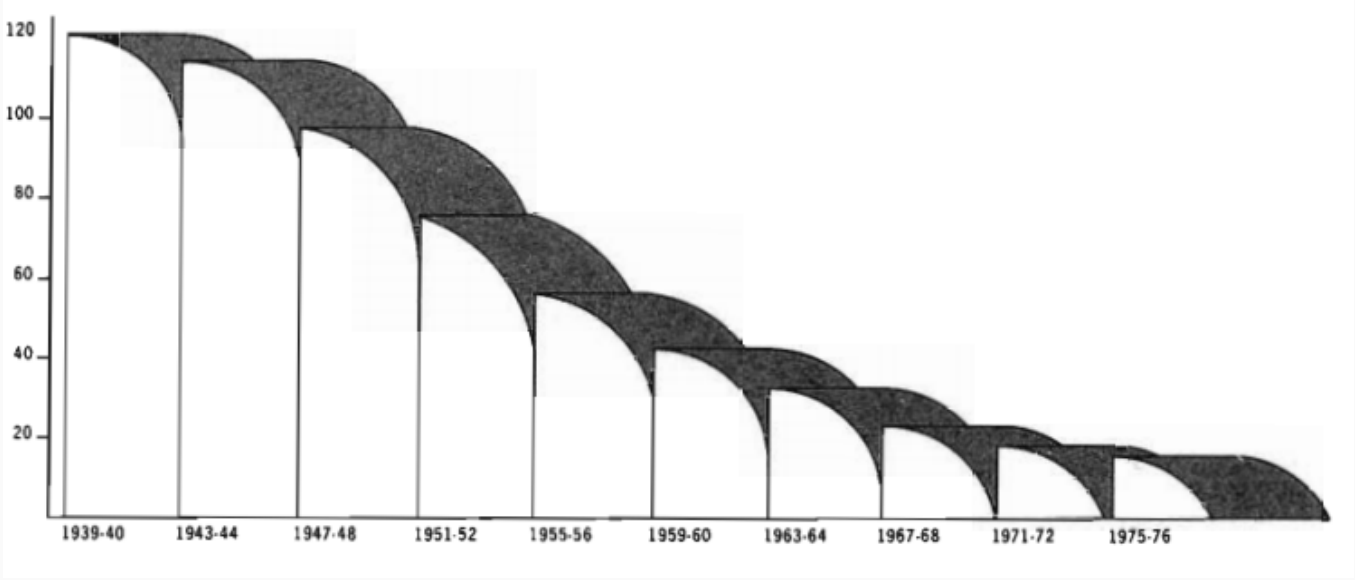
Data Ink and Graphical Redesign

Another principle: Erase Non-Data Ink.



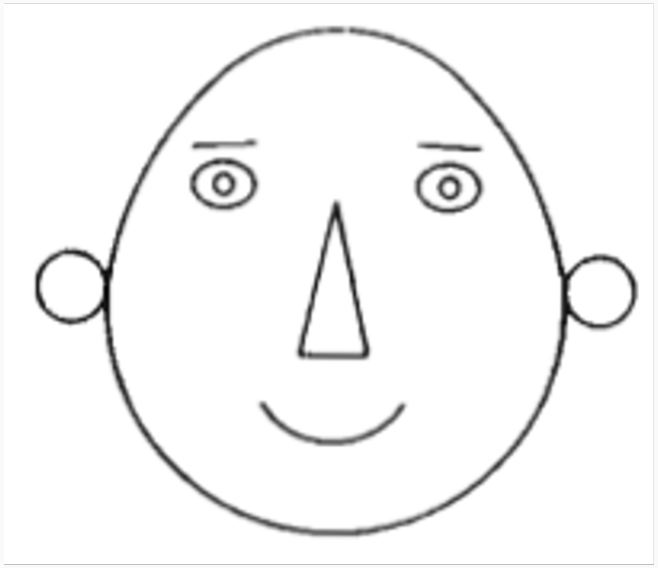
Data Ink and Graphical Redesign

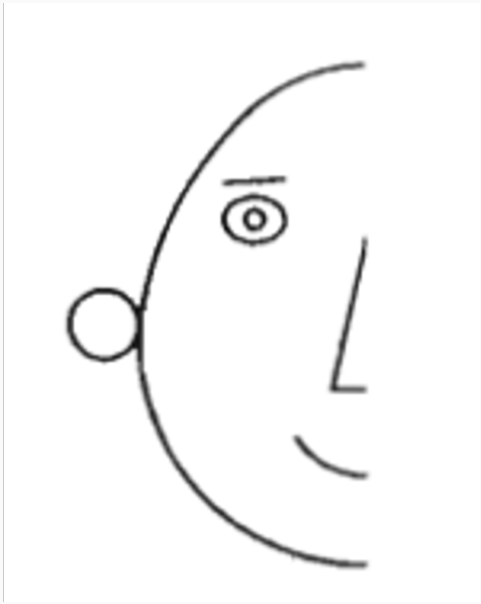
Another principle: Erase Non-Data Ink.



Data Ink and Graphical Redesign

Bilateral symmetry can redundancy.



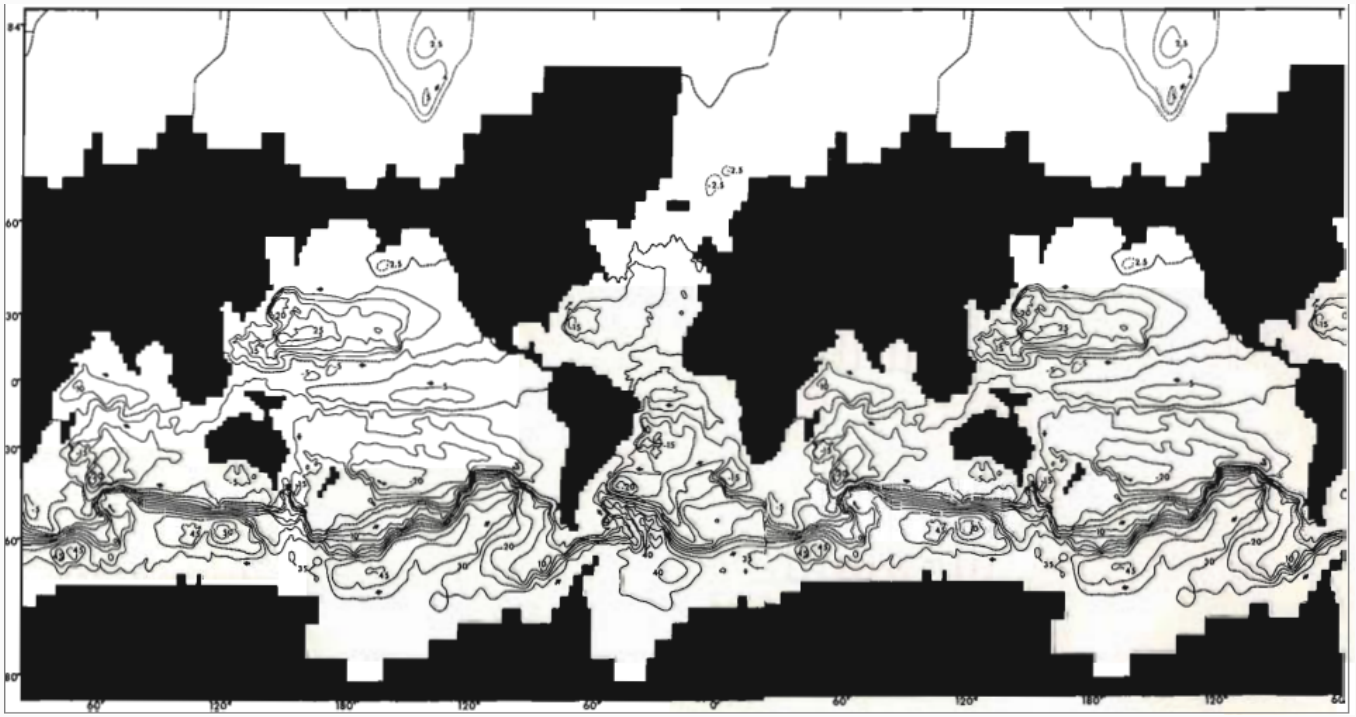


(However, in some cases maintaining symmetry avoids confusion.)

Data Ink and Graphical Redesign

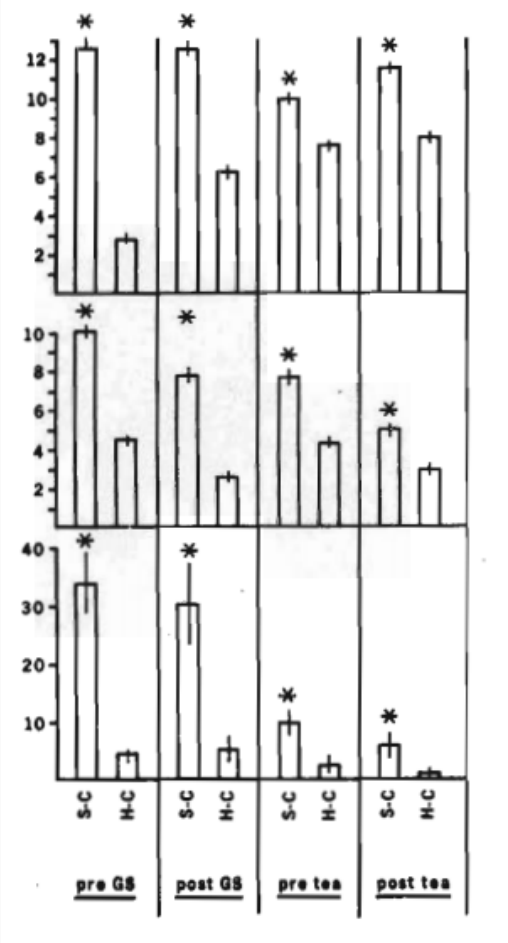
Another principle: Erase Redundant Data-Ink.

Exception: redundancy to show patterns and cycles



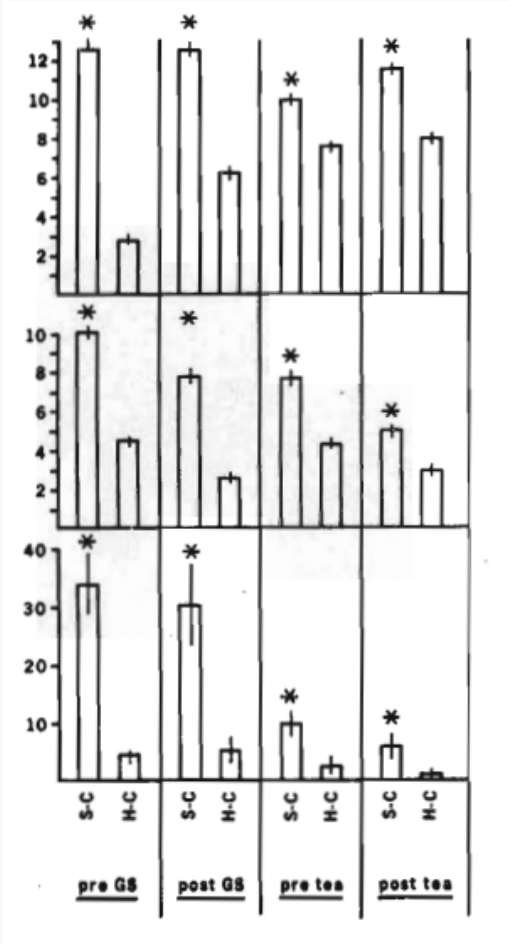
Data Ink and Graphical Redesign

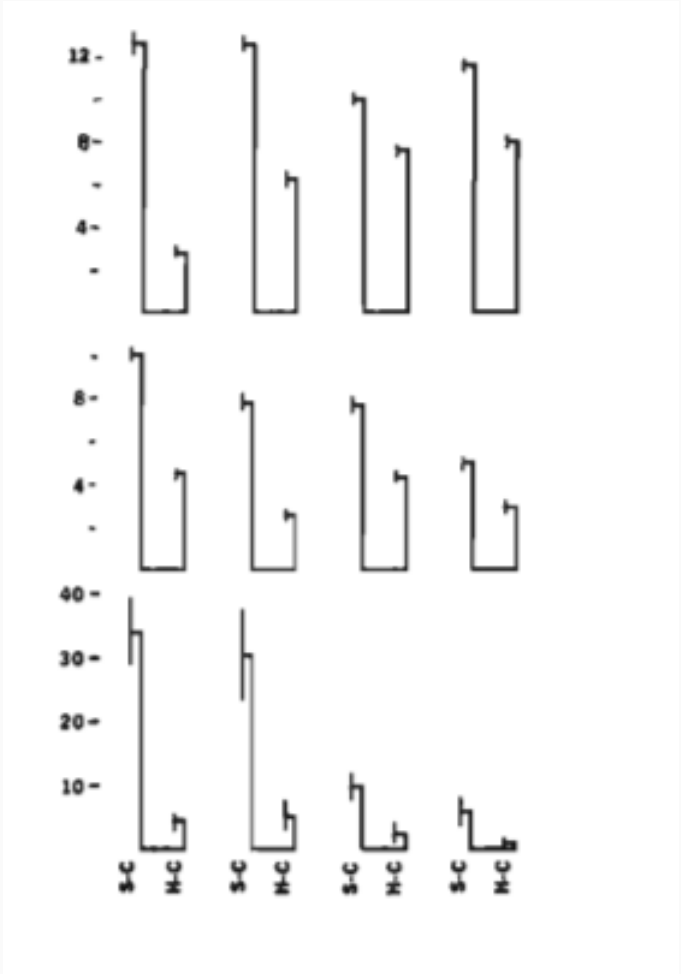
Edit and redesign to minimize redundant, non-data info.



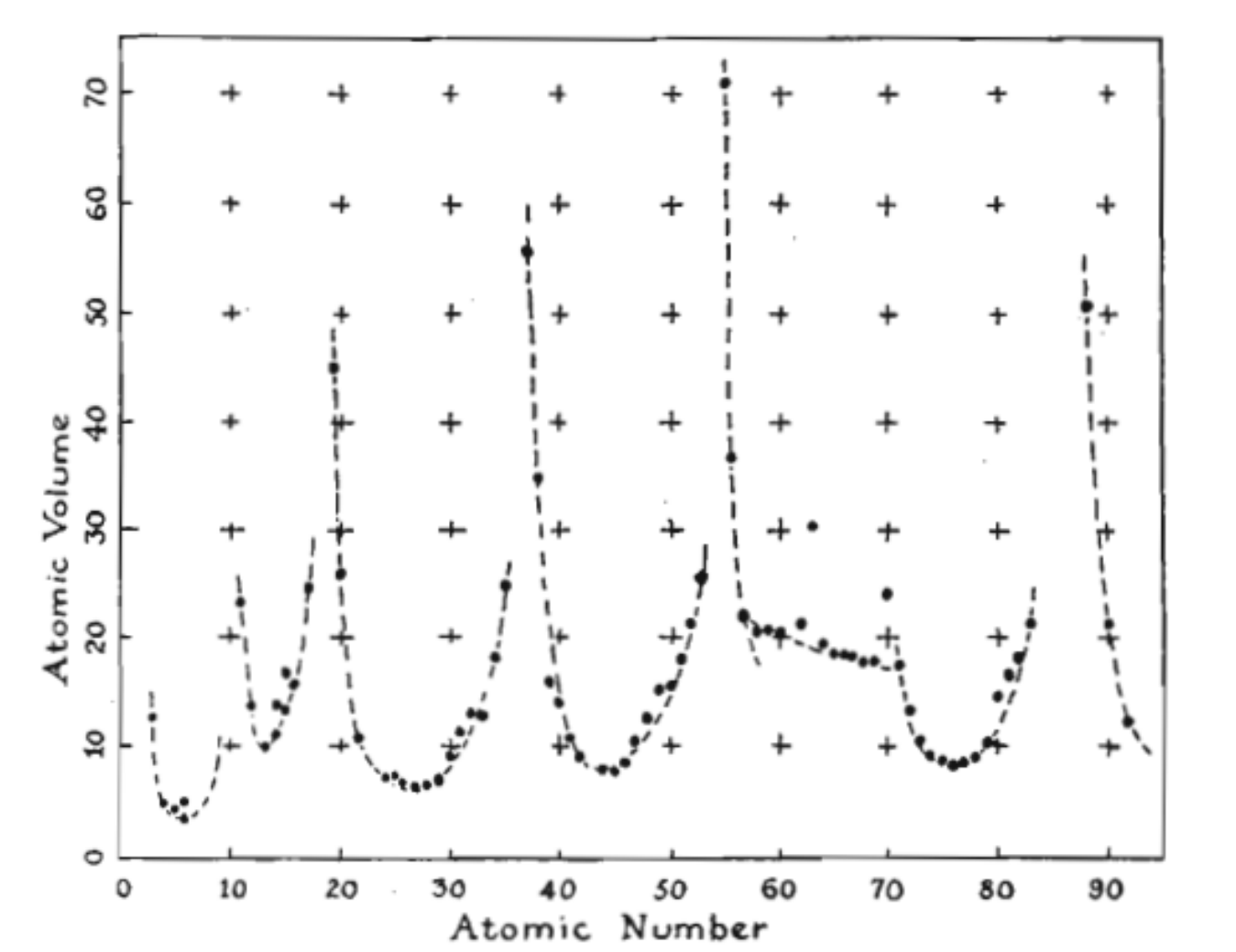
Data Ink and Graphical Redesign

Edit and redesign to minimize redundant, non-data info.

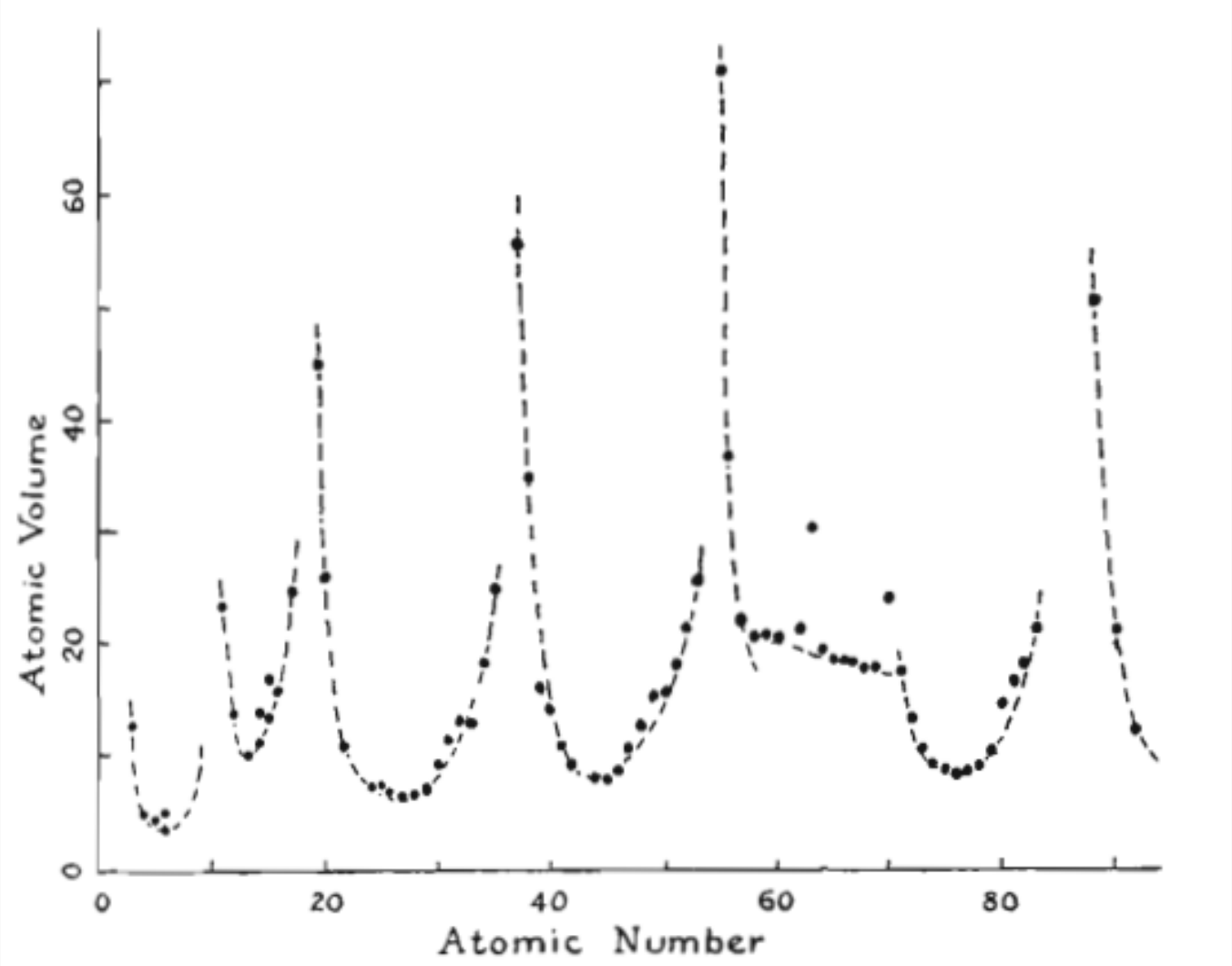




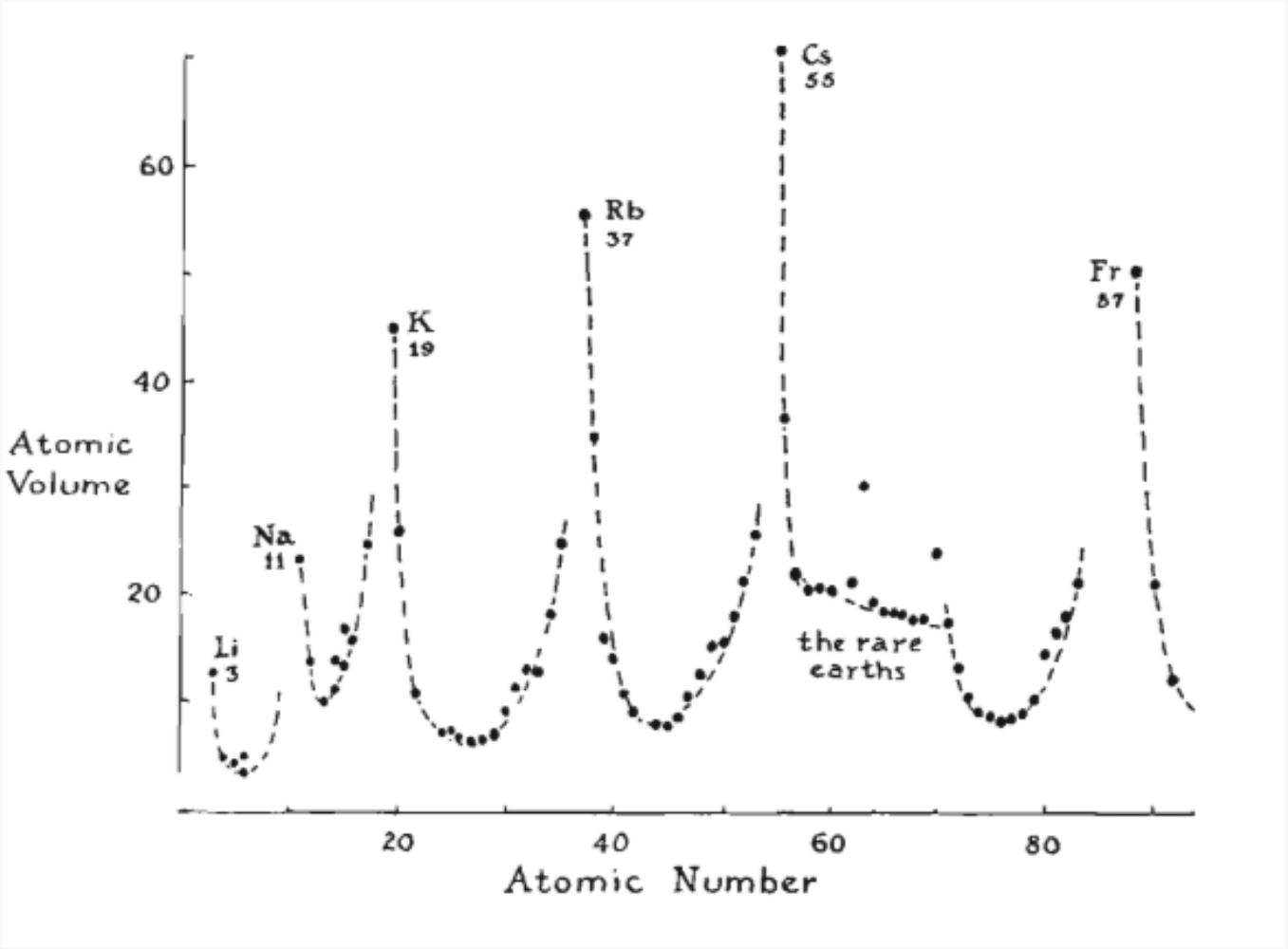
Data Ink and Graphical Redesign



Data Ink and Graphical Redesign



Data Ink and Graphical Redesign



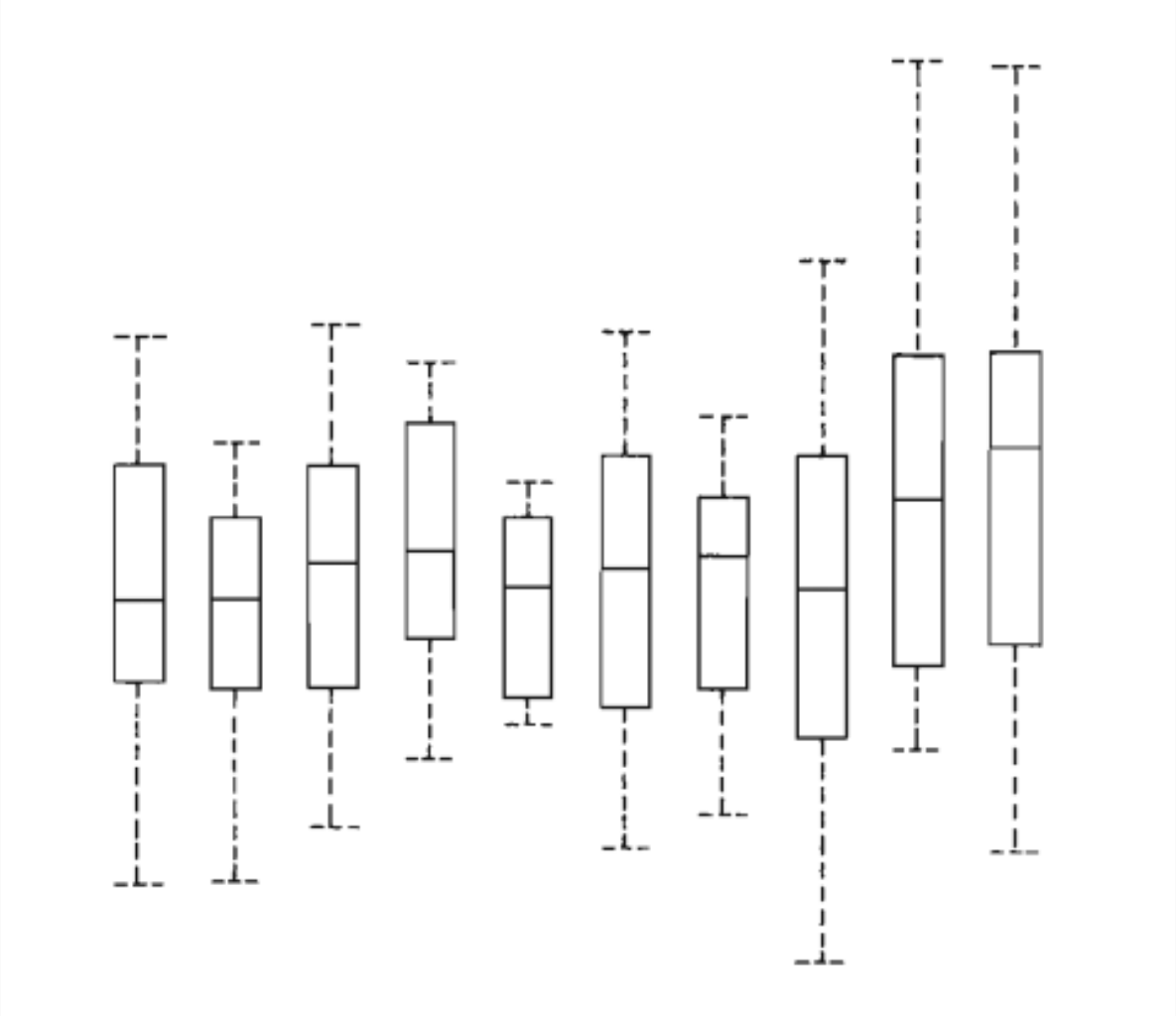
Conclusion

Principles to remember:

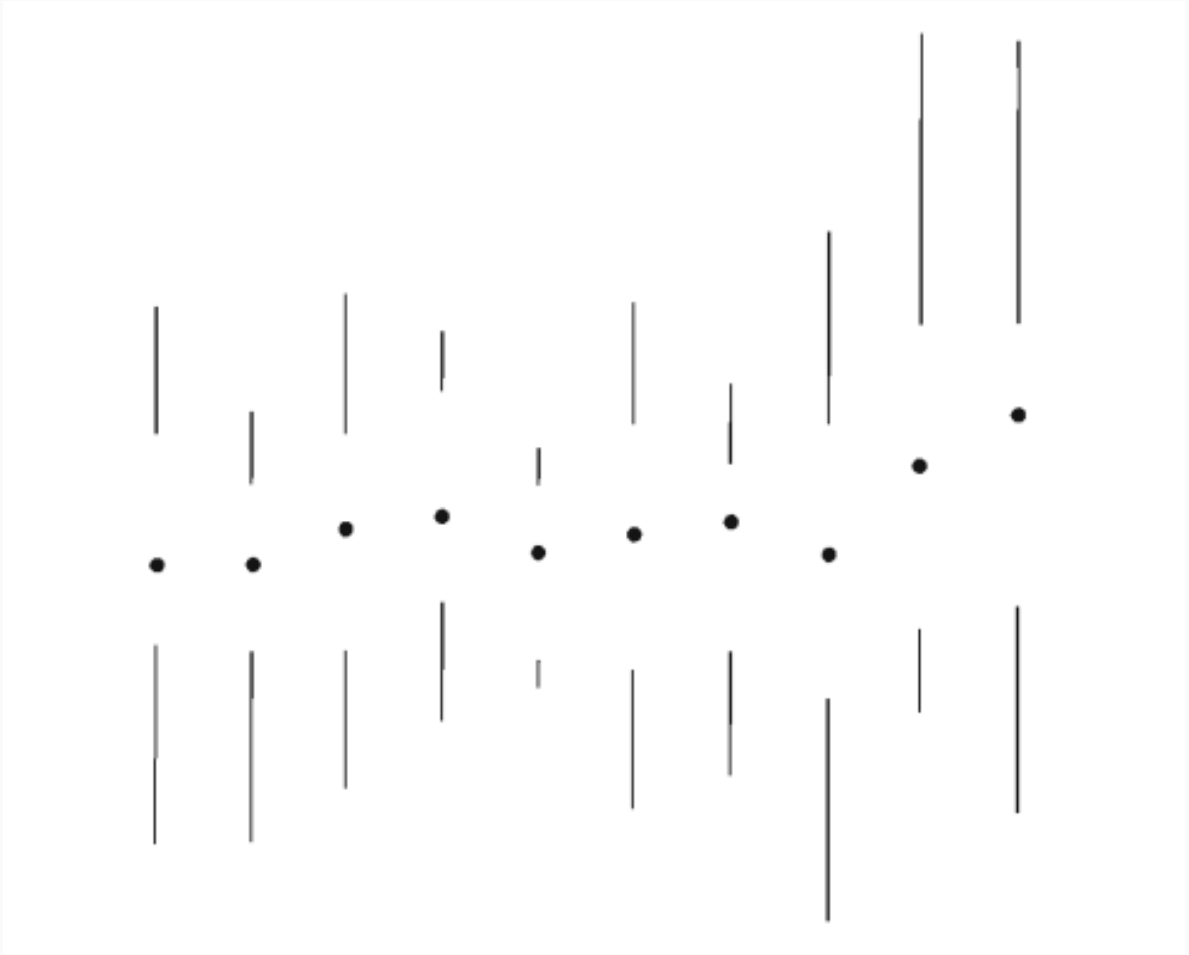
- Show data-related information
- Maximize data-ink ratio
- Erase non-relevant data
- Erase redundancies
- Practice the idea of editing and revisiting.

Data Ink Maximization and Graphical Design

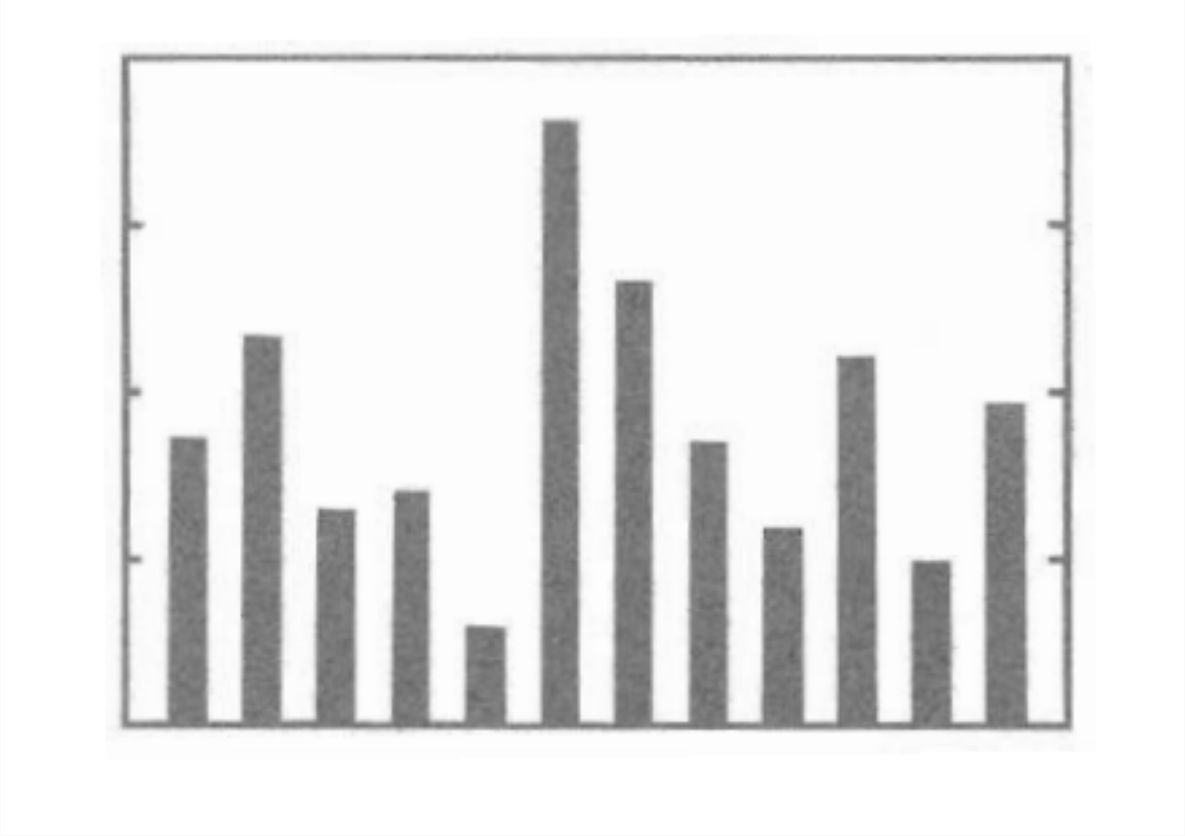
Consider applying these principles to NEW designs.



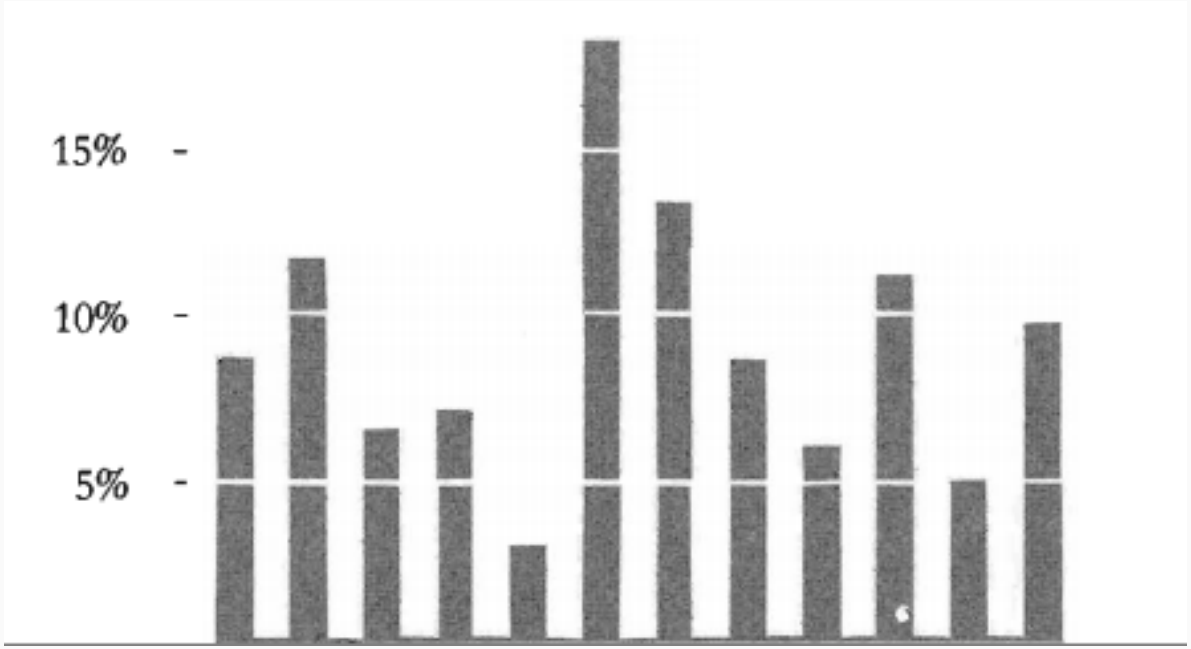
Data Ink Maximization and Graphical Design



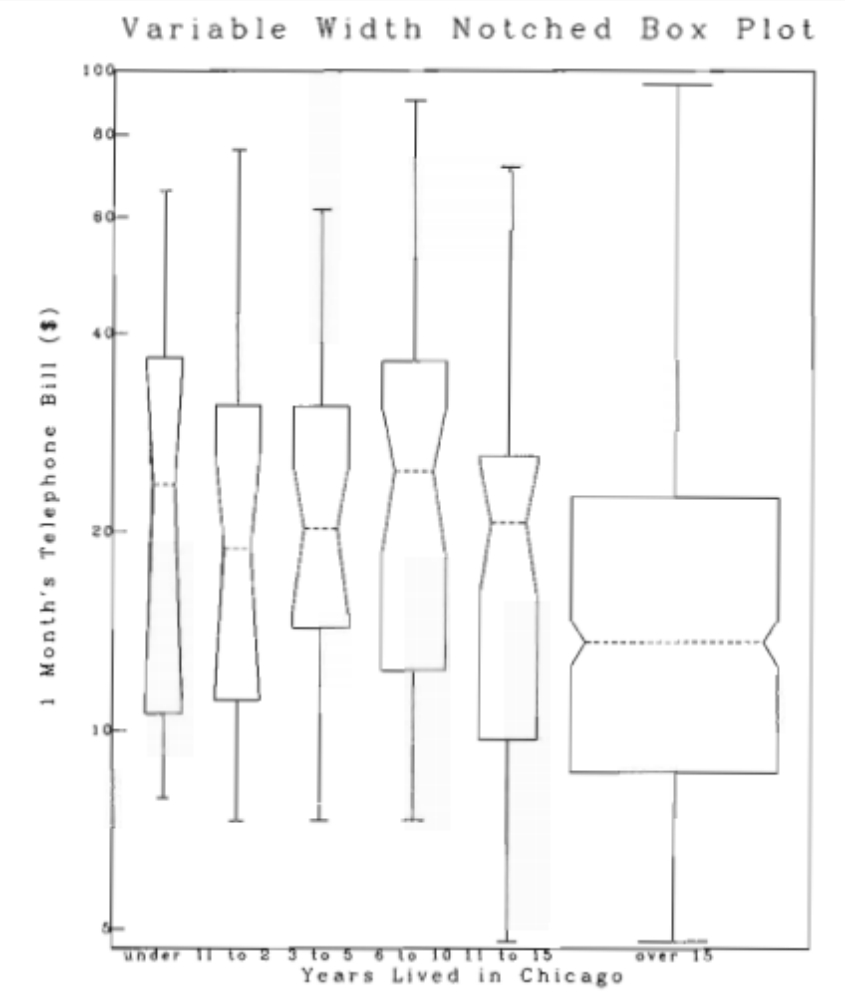
Data Ink Maximization and Graphical Design



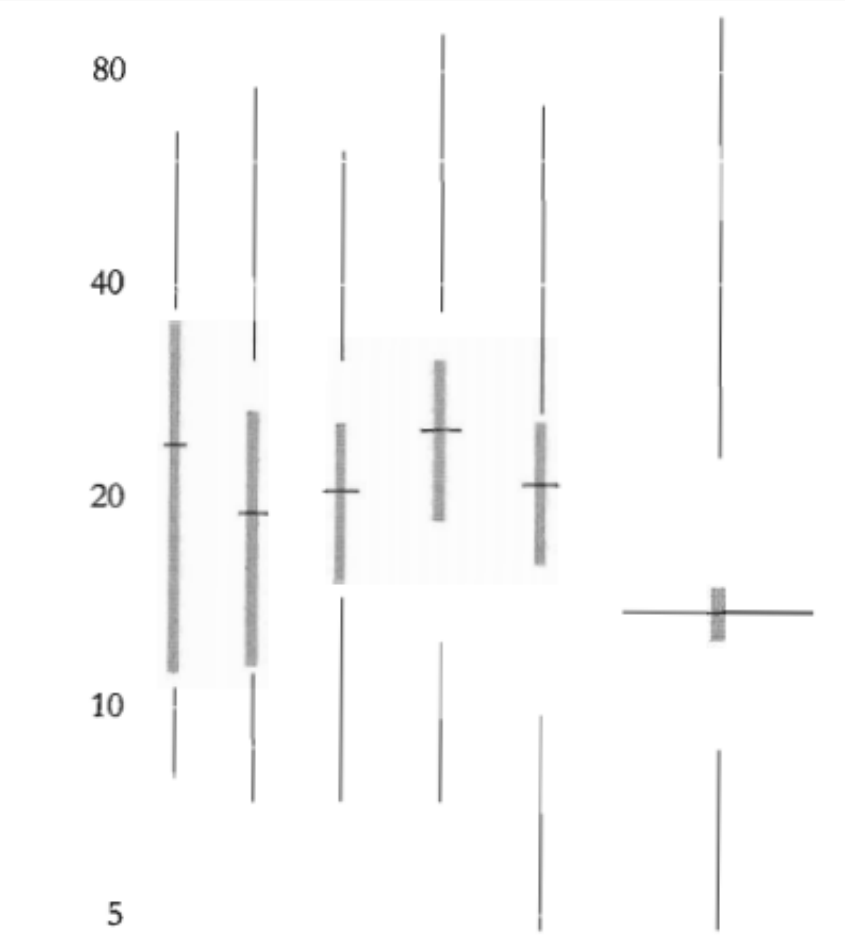
Data Ink Maximization and Graphical Design



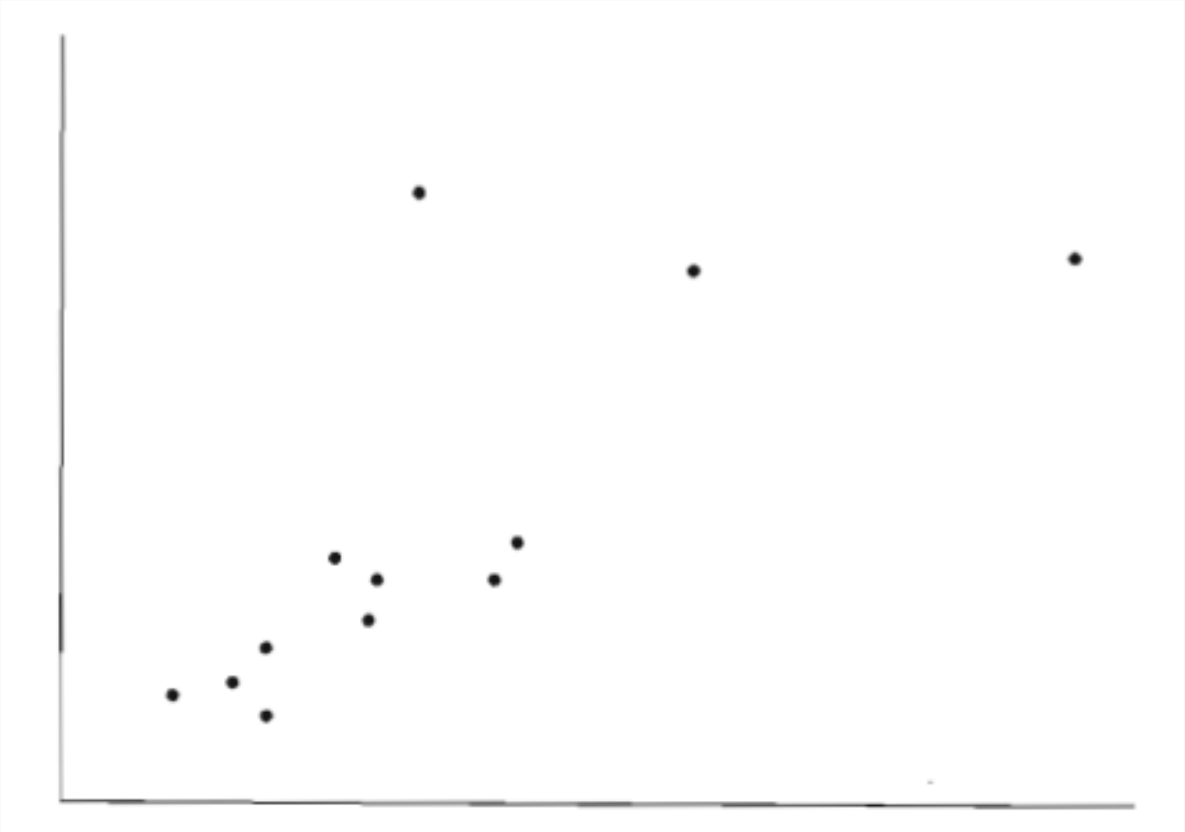
Data Ink Maximization and Graphical Design



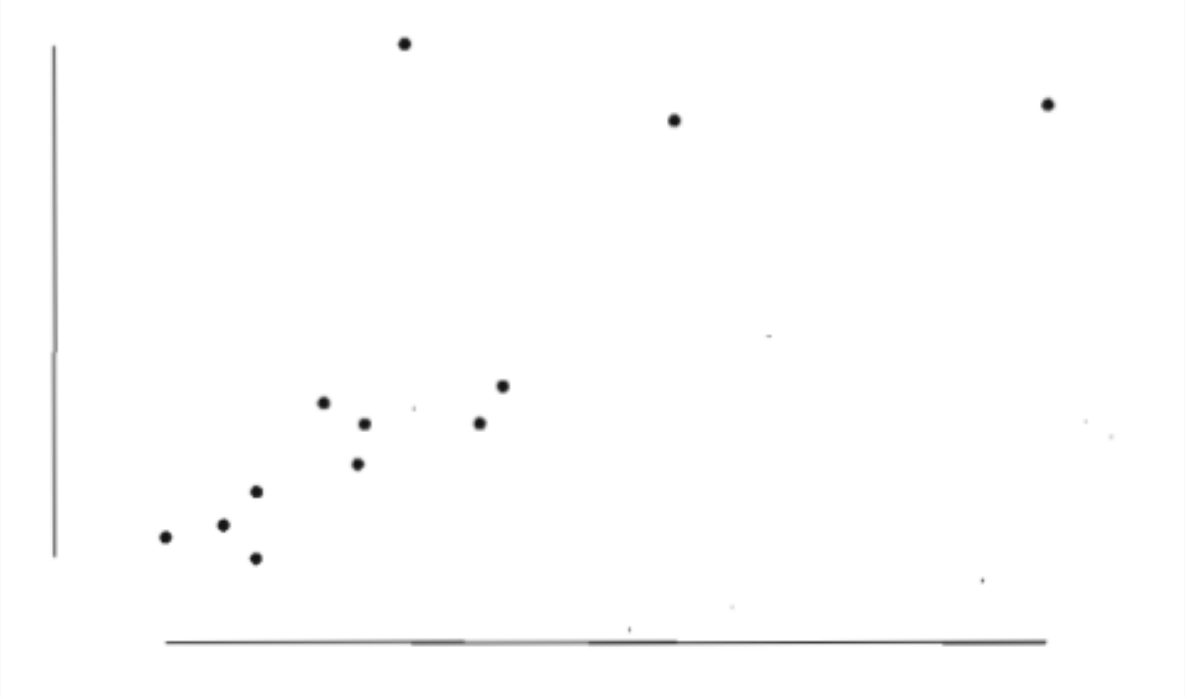
Data Ink Maximization and Graphical Design



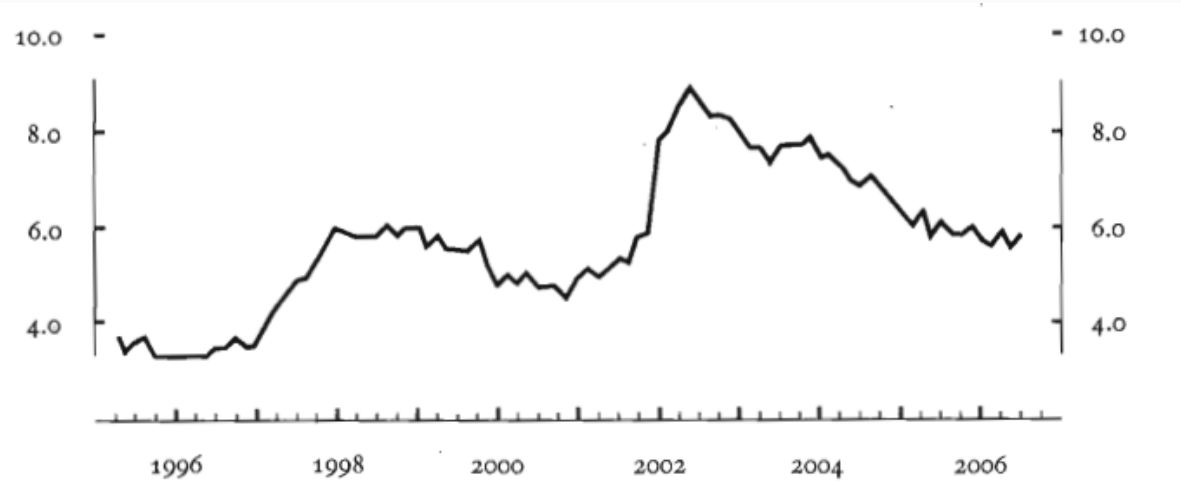
Data Ink Maximization and Graphical Design



Data Ink Maximization and Graphical Design



Data Ink Maximization and Graphical Design



Conclusions

- Graphical design eliminates unnecessary information.
- It adds new ideas to maximize efficiency (leading to new designs).
- Data-Ink ratio should be close to 1.
- Efficiency should be gained in communication and production.
- Consider that some designs may be hard to understand.
- Use your criteria to decide how to present a graph according to the audience.

Aesthetics and Technique in Data Graphical Design

Graphical design should look for elegance and simplicity.

This is particularly important when the data are complex.

Guidelines:

- Combine words, numbers and graph together.
- Provide a story behind the data.
- The design should avoid irrelevant information and be done professionally.

Aesthetics and Technique in Data Graphical Design

Combine graphical elements when appropriate.

Aesthetics and Technique in Data Graphical Design

Combine graphical elements when appropriate.

Nearly 53 percent of the type A group did something or other compared to 46 percent of B and slightly more than 57 percent of C.

Aesthetics and Technique in Data Graphical Design

Combine graphical elements when appropriate.

Nearly 53 percent of the type A group did something or other compared to 46 percent of B and slightly more than 57 percent of C.

The three groups differed in how they did something or other:

Group A	53%
Group B	46%
Group C	57%

Aesthetics and Technique in Data Graphical Design

Combine graphical elements when appropriate.

Nearly 53 percent of the type A group did something or other compared to 46 percent of B and slightly more than 57 percent of C.

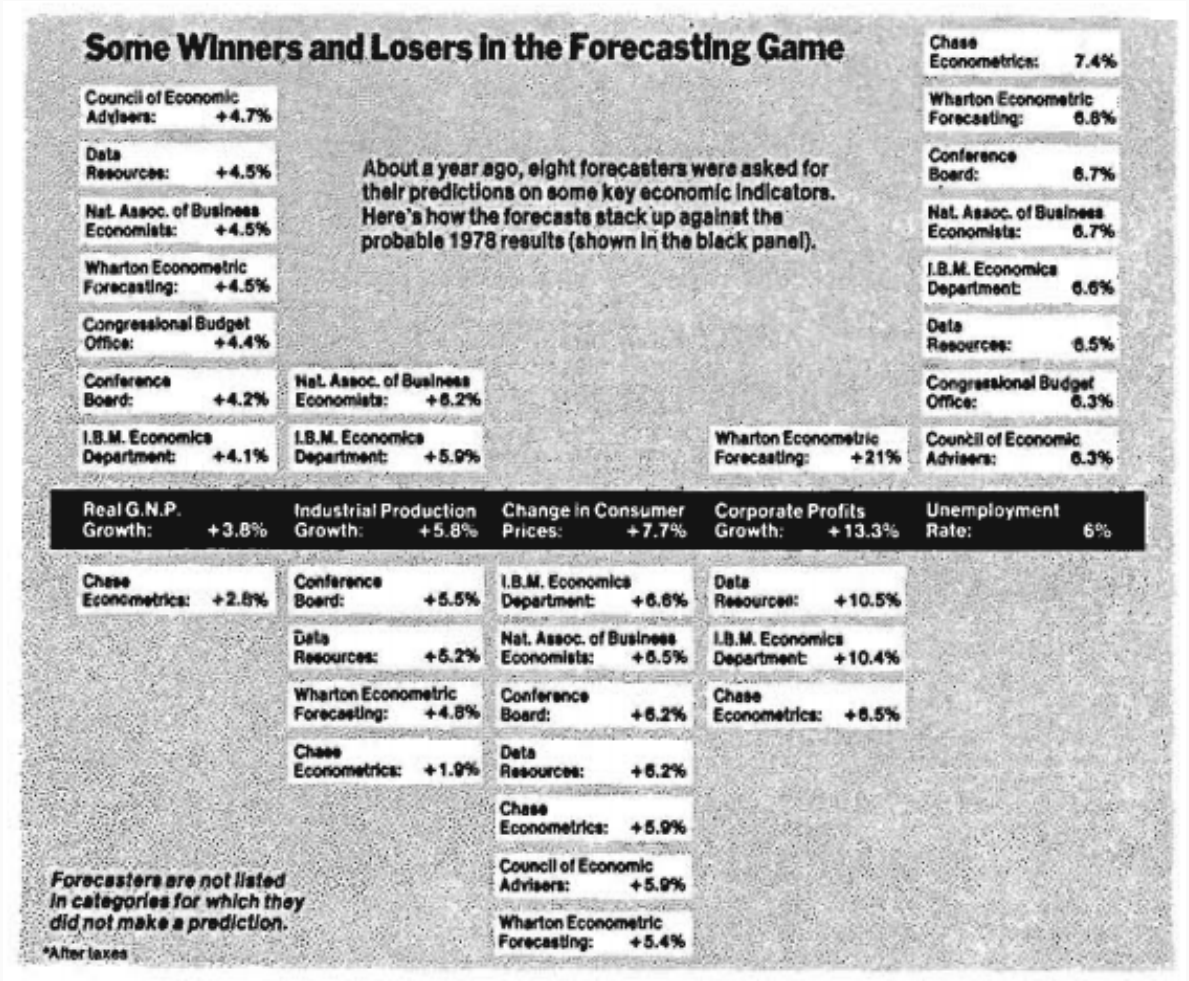
The three groups differed in how they did something or other:

Group A	53%
Group B	46%
Group C	57%

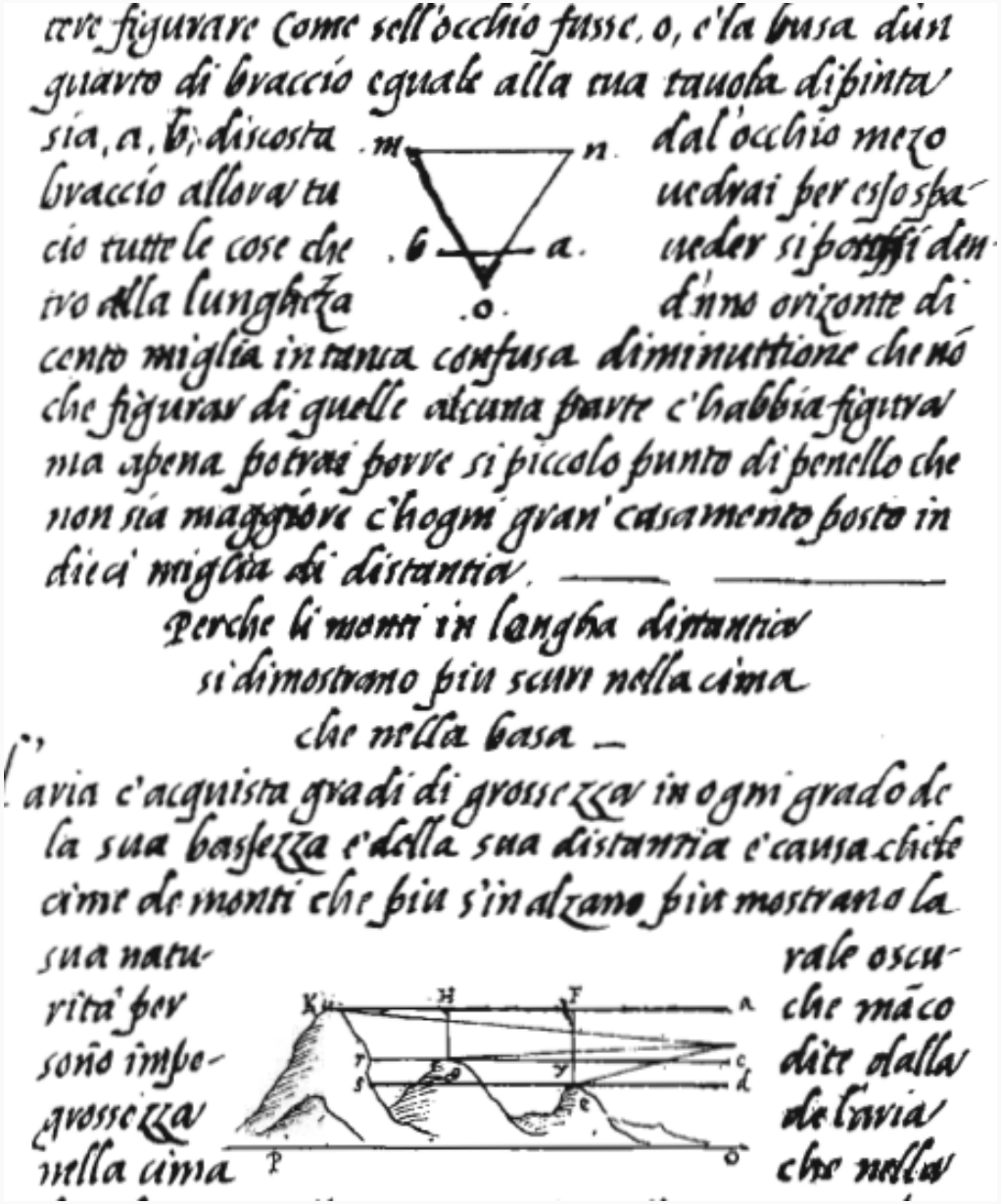
Tables are:

- ideal for small datasets.
- preferable to pie charts.

Aesthetics and Technique in Data Graphical Design



Aesthetics and Technique in Data Graphical Design



ere figurare come sell'occhio fusse, o, c'la busa dun
quarto di braccio eguale alla tua tauola dipinta
sia, a, b, discosta . m n . dal'occhio mezo
braccio allora tu uedrai per esso spa
cio tutte le cose che . 6 a . ueder si possi dem
tro alla lunghezza . o . d'uno orizonte di
cento miglia in tanta confusa diminuttione che nó
che figurar di quelle alcuna parte c'habbia figura
mia 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 longha distantia
si dimostrano piu scuri nella cima
che nella basa —

l'aria c'acquista gradi di grossezza in ogni grado de
la sua bassezza e della sua distantia e causa che le
cime de monti che piu s'inalzano piu mostrano la
sua natu- rale oscu-
rita' per che mãco
soño impe- dite dalla
grossezza de l'aria
nella cima che nella

Aesthetics and Technique in Data Graphical Design

Friendly Graphs:

- Words are clear and informative (avoid abbreviations).
- Words should be read left to right (not vertically).
- Avoid legends or elaborated colors. Put clear labels.
- Graph is attractive.
- Use a few colors (clearly distinguishable).
- Type clearly and precisely (avoid all capitals).

Aesthetics and Technique in Data Graphical Design

There should be a sense of balance and proportion.

Aesthetics and Technique in Data Graphical Design

There should be a sense of balance and proportion.

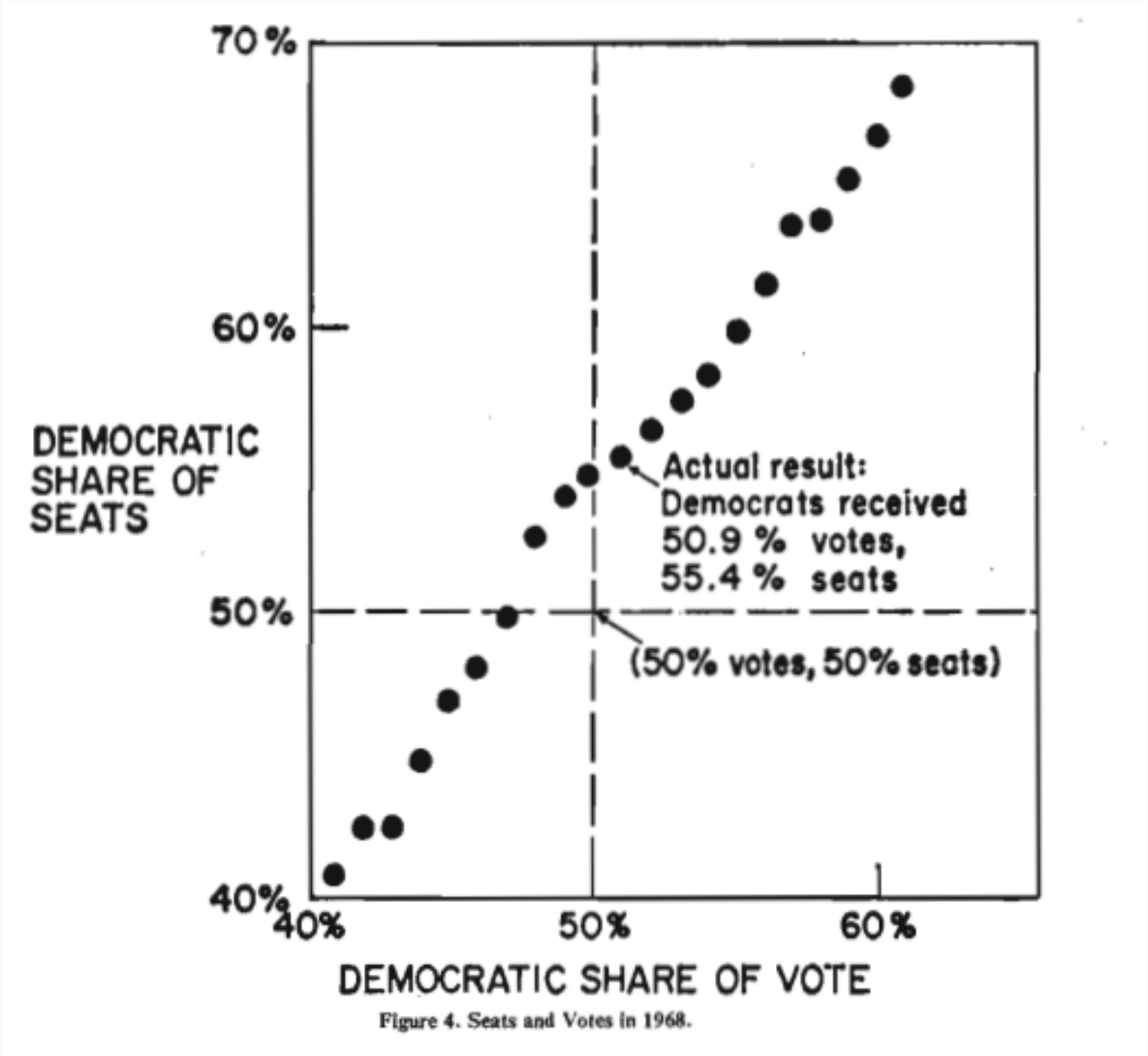
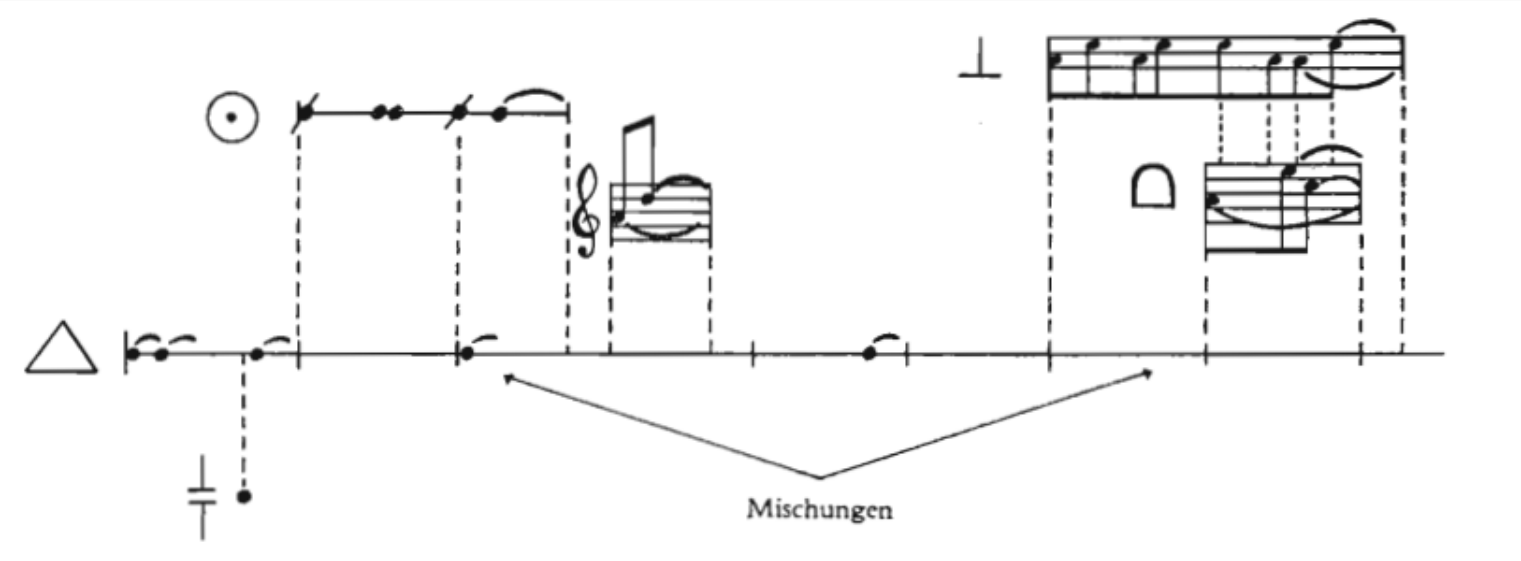


Figure 4. Seats and Votes in 1968.

Aesthetics and Technique in Data Graphical Design

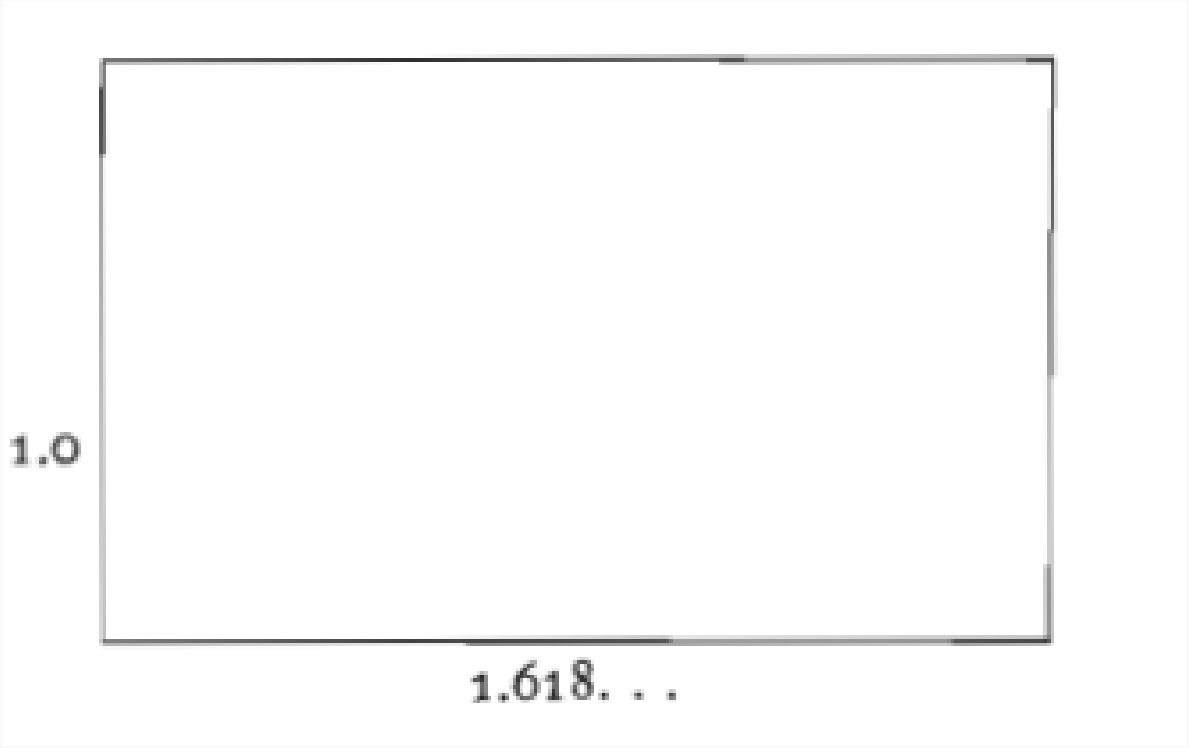


Aesthetics and Technique in Data Graphical Design

Graphs should tend toward the horizontal direction (wider not longer), because humans process information in the horizontal direction.

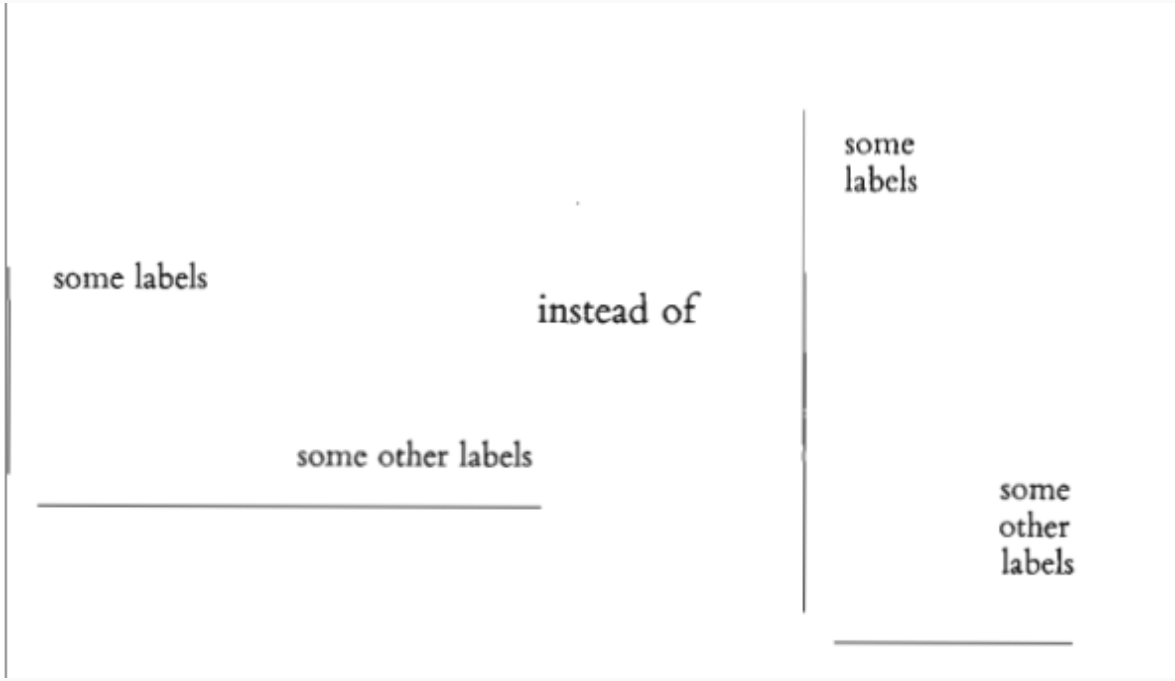
Aesthetics and Technique in Data Graphical Design

An ideal example is the Golden Rectangle:



Aesthetics and Technique in Data Graphical Design

Labeling should also tend toward the horizontal line:



Epilogue

"What is to be sought in designs for the display of quantitative information is the clear portrayal of complexity. Not the complication of the simple; rather the task of the designer is to give visual access to the subtle and the difficult – that is,

the revelation of the complex.