



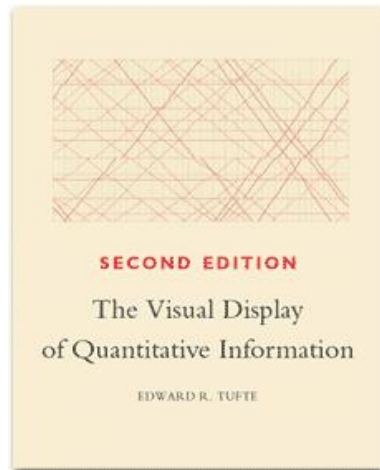
UNIVERSITY OF
BIRMINGHAM

Visualisation

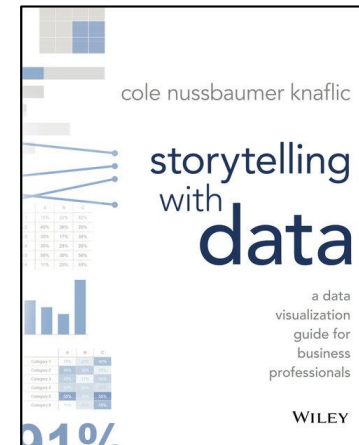
Week 2

How to Make Better Charts

Two very Different Books



Edward Tufte (2001)[1983]



Nussbaumer Knaflic (2015)

The Visual Display of Quantitative Information

Edward Tufte (2001)[1983]

Excellence in statistical graphics consists of complex ideas communicated with clarity, precision, and efficiency. Graphical displays should

- show the data
- induce the viewer to think about the substance rather than about methodology, graphic design, the technology of graphic production, or something else
- avoid distorting what the data have to say



Edward Tufte

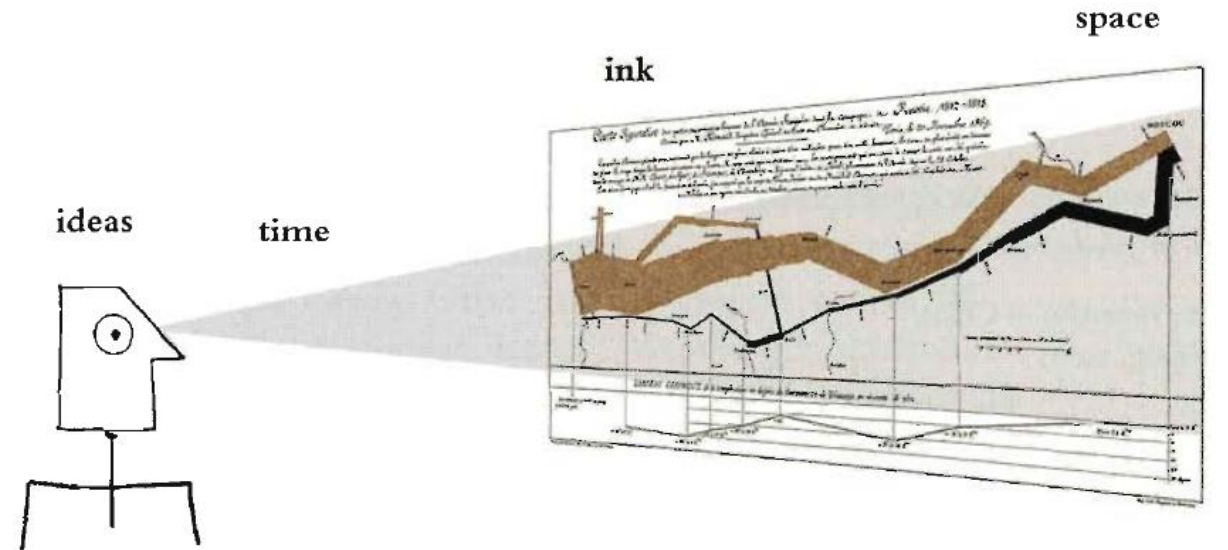
Principles of Graphical Excellence

Graphical excellence is the well-designed presentation of interesting data—a matter of *substance*, of *statistics*, and of *design*.

Graphical excellence consists of complex ideas communicated with clarity, precision, and efficiency.

Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.

Edward Tufte



Edward Tufte



Napoleon's Retreat
Vasili Vereschagin

Carte Figurative

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Chiers, de L'égur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

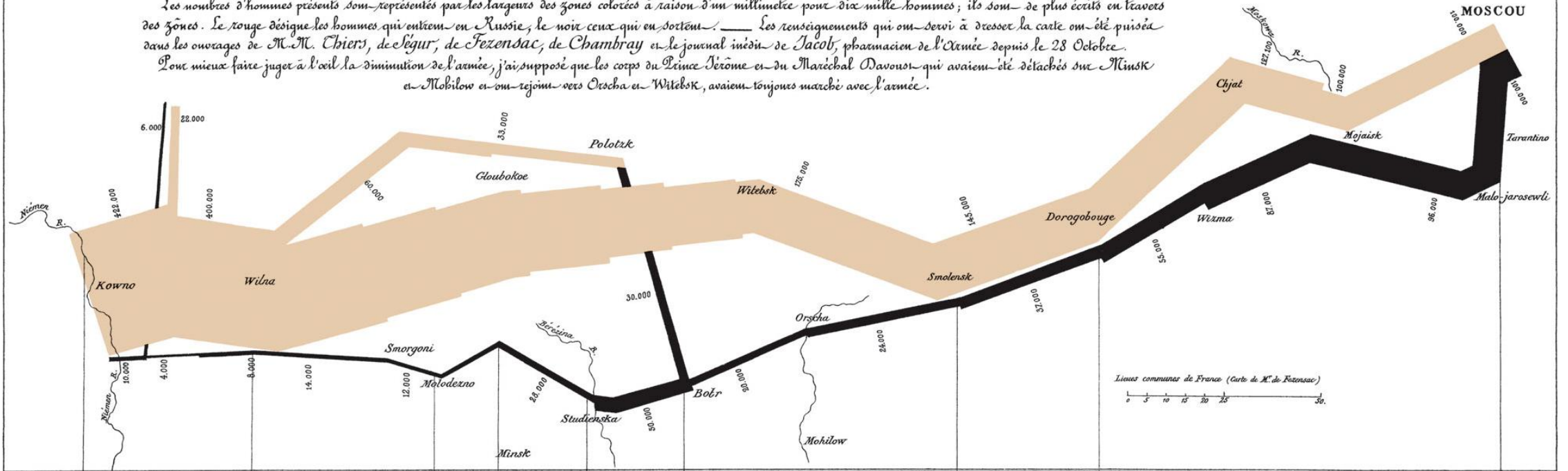
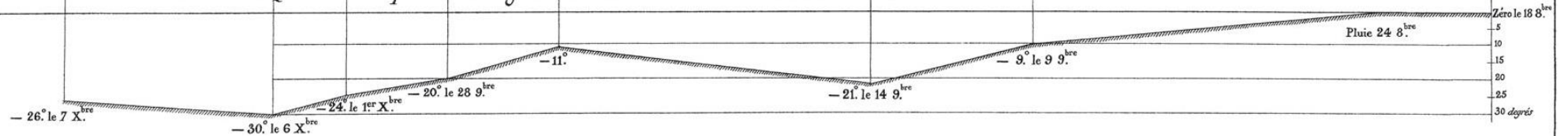


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

Les Cosaques passent au galop le Niemen gelé.



Autog. par Regnier, 8. Par. 5^{de} Marie 5^{de} 6^{de} à Paris.

Imp. Lith. Regnier et Dourdet.

Practical Advice for Friendly Graphics

Friendly

words are spelled out, mysterious and elaborate encoding avoided

words run from left to right, the usual direction for reading occidental languages

little messages help explain data

elaborately encoded shadings, cross-hatching, and colors are avoided; instead, labels are placed on the graphic itself; no legend is required

graphic attracts viewer, provokes curiosity

Unfriendly

abbreviations abound, requiring the viewer to sort through text to decode abbreviations

words run vertically, particularly along the Y-axis; words run in several different directions

graphic is cryptic, requires repeated references to scattered text

obscure codings require going back and forth between legend and graphic

graphic is repellent, filled with chartjunk

Above all else show the data.

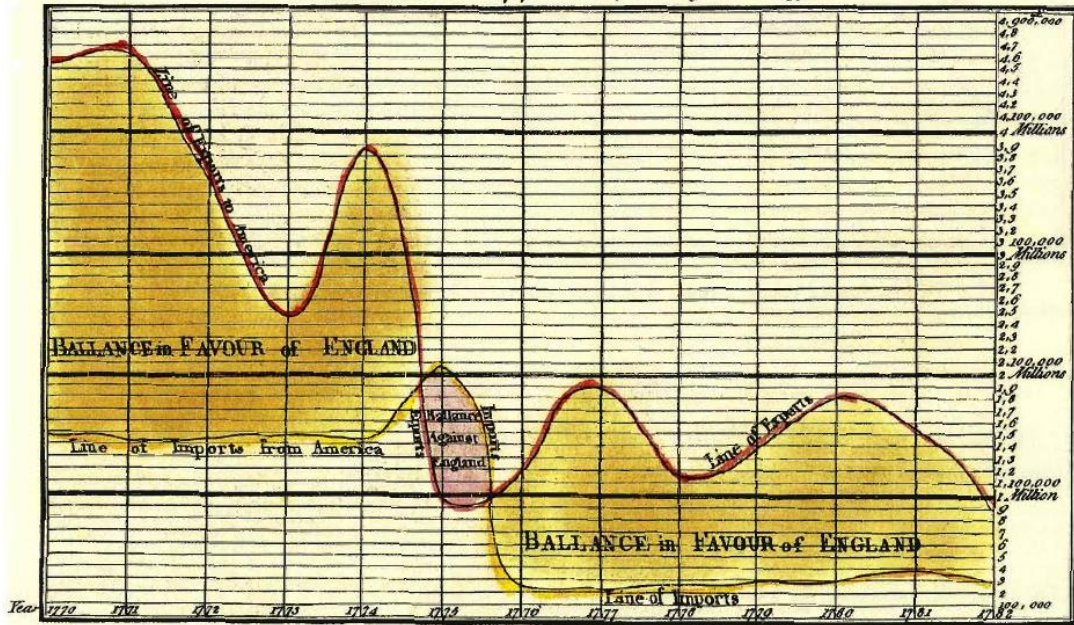
Maximize the data-ink ratio.

Erase non-data-ink.

Erase redundant data-ink.

Revise and edit. - Edward Tufte

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

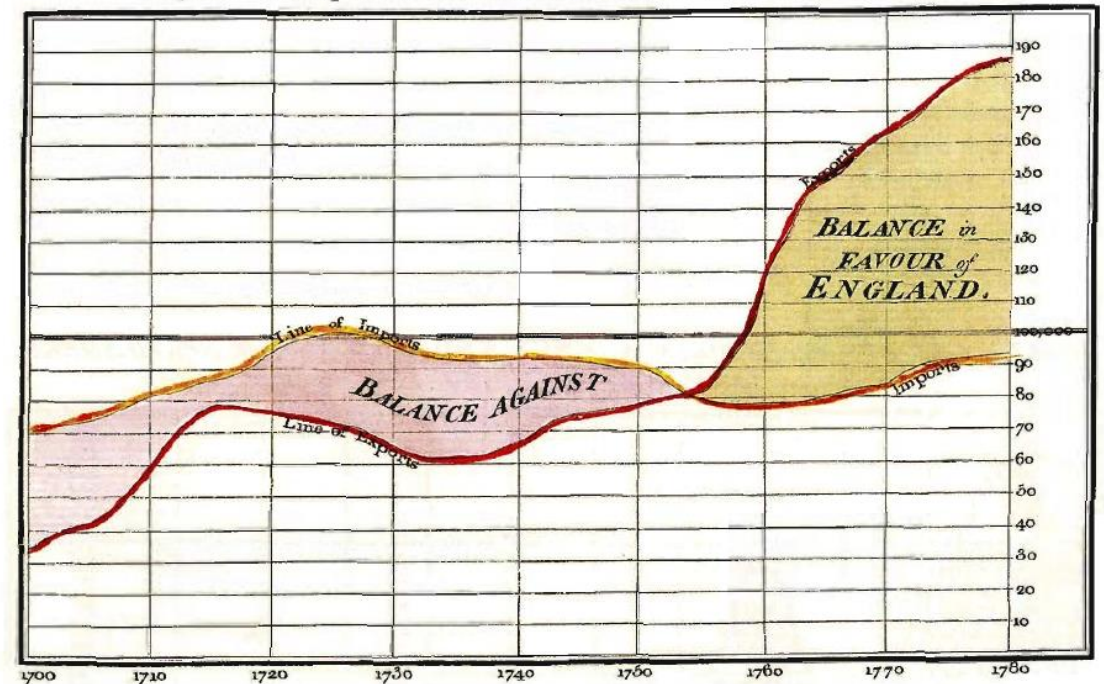


The Bottom Line is divided into Years the right-hand Line into HUNDRED THOUSAND POUNDS

J. Aikin Sculp^r

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

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

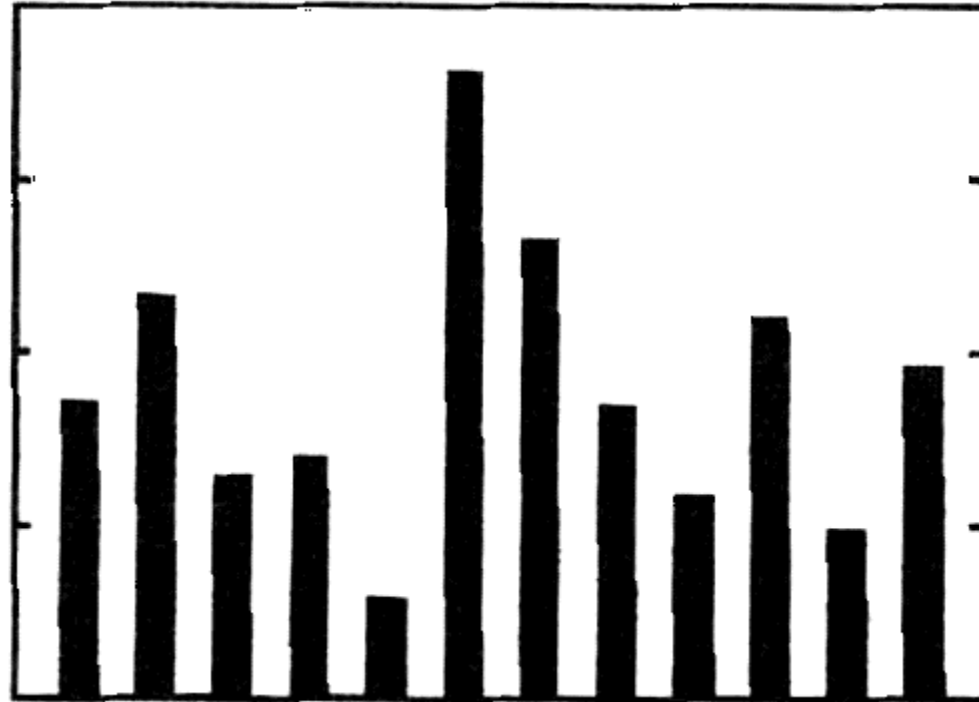


The Bottom line is divided into Years, the Right hand line into £10,000 each.

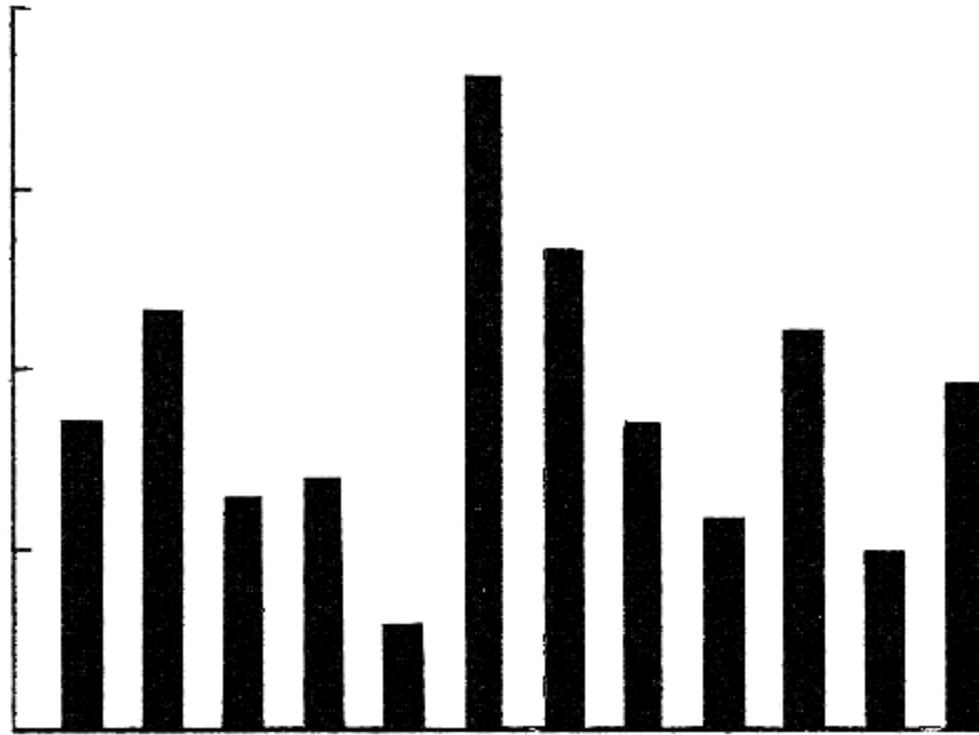
Published as the Act directs 1st May 1786. by W^m Playfair

Steel engr^d 352 Strand, London.

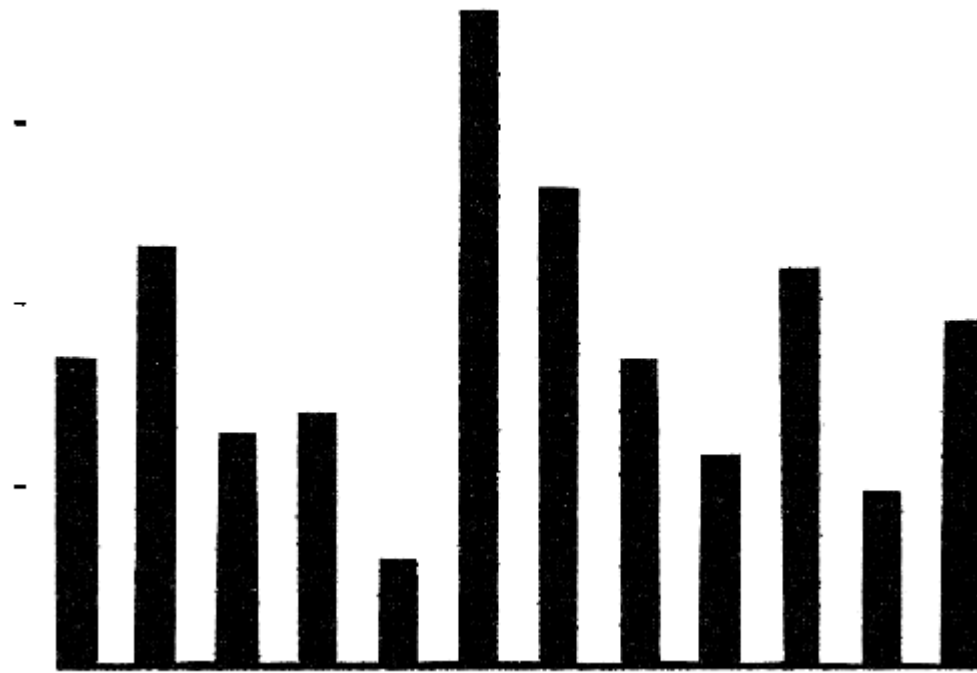
Maximizing Data-Ink Ratio



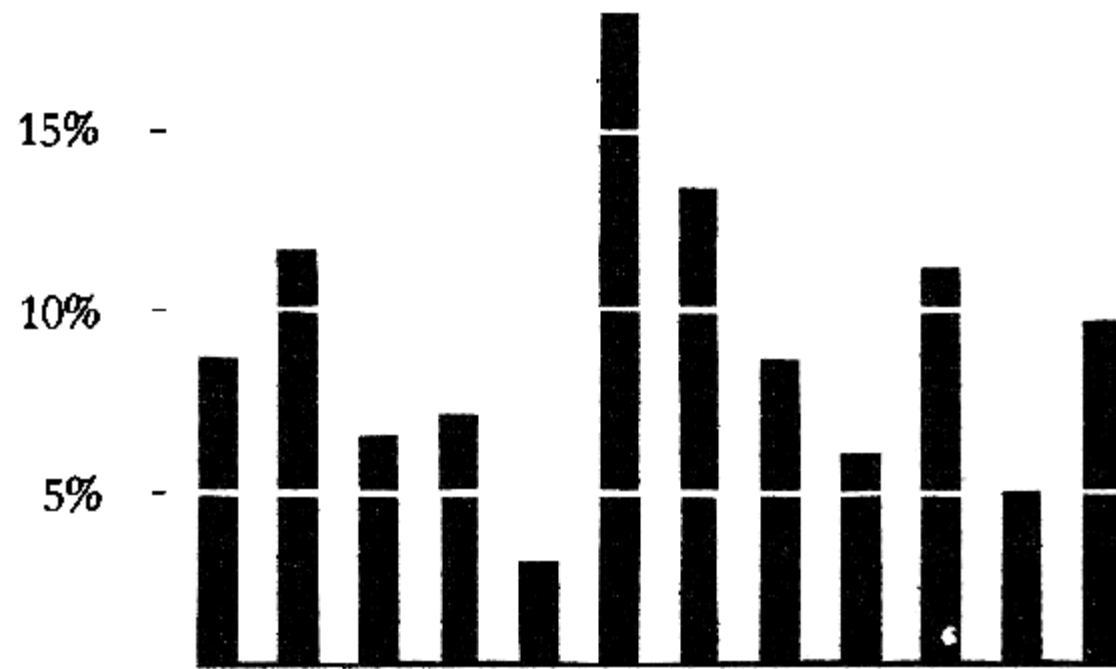
Maximizing Data-Ink Ratio



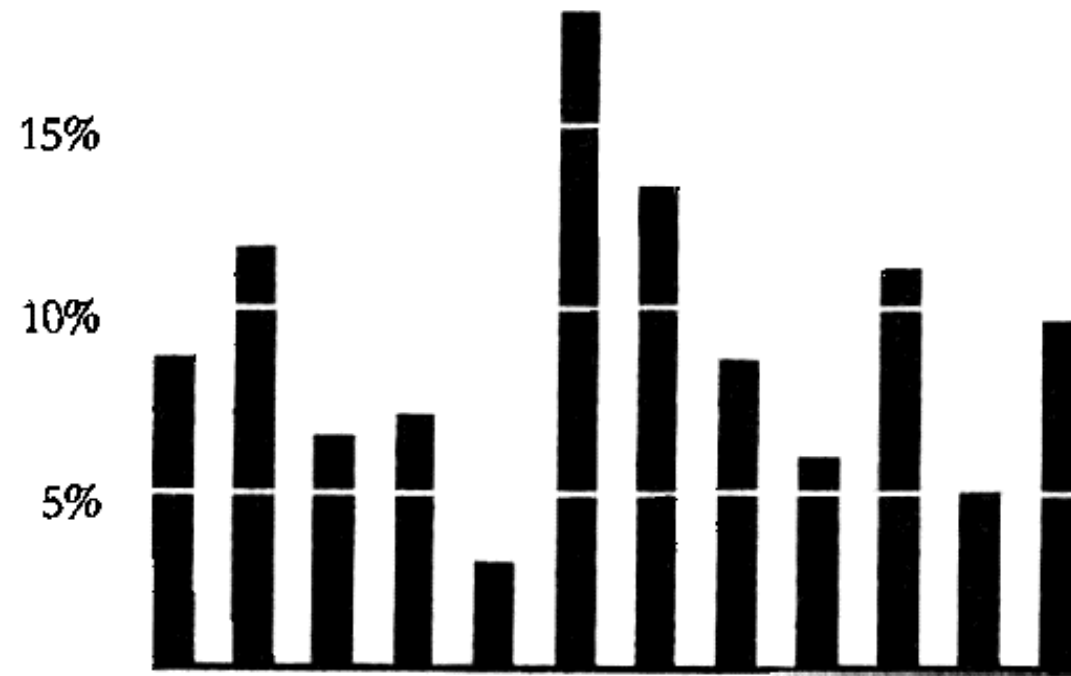
Maximizing Data-Ink Ratio



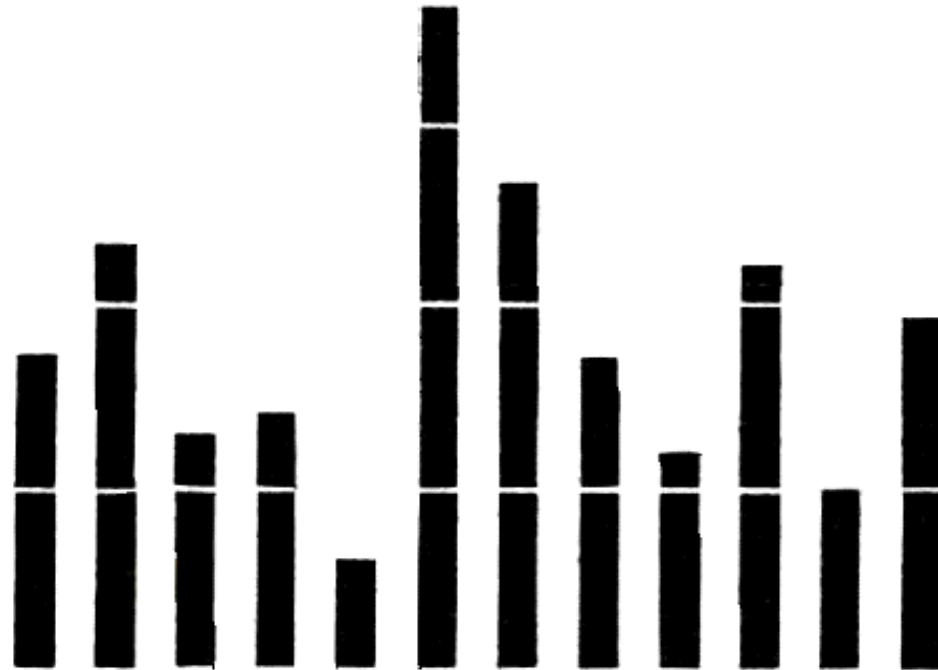
Maximizing Data-Ink Ratio



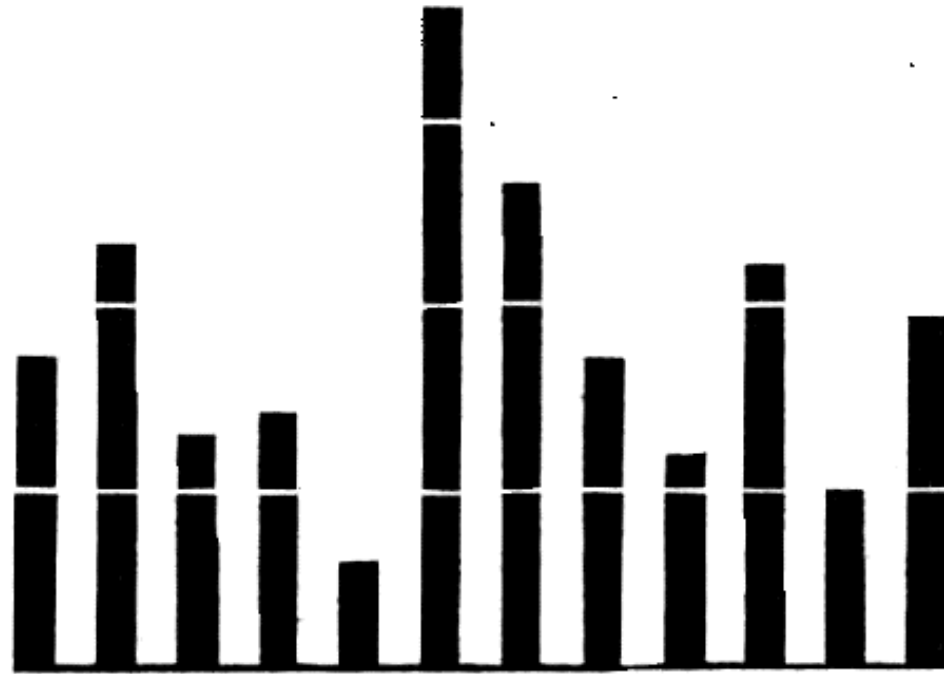
Maximizing Data-Ink Ratio



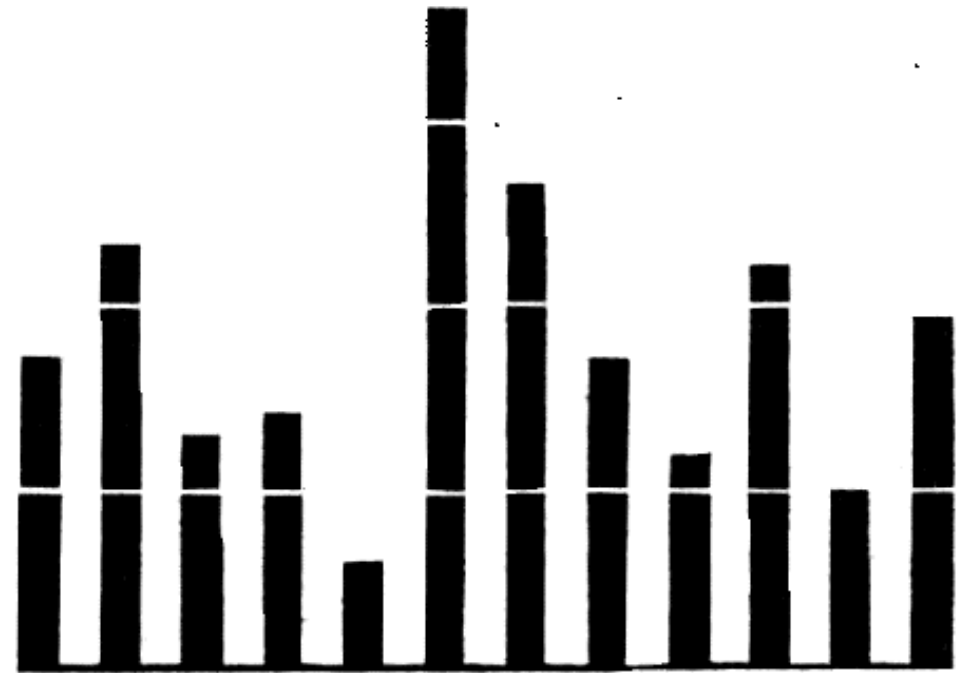
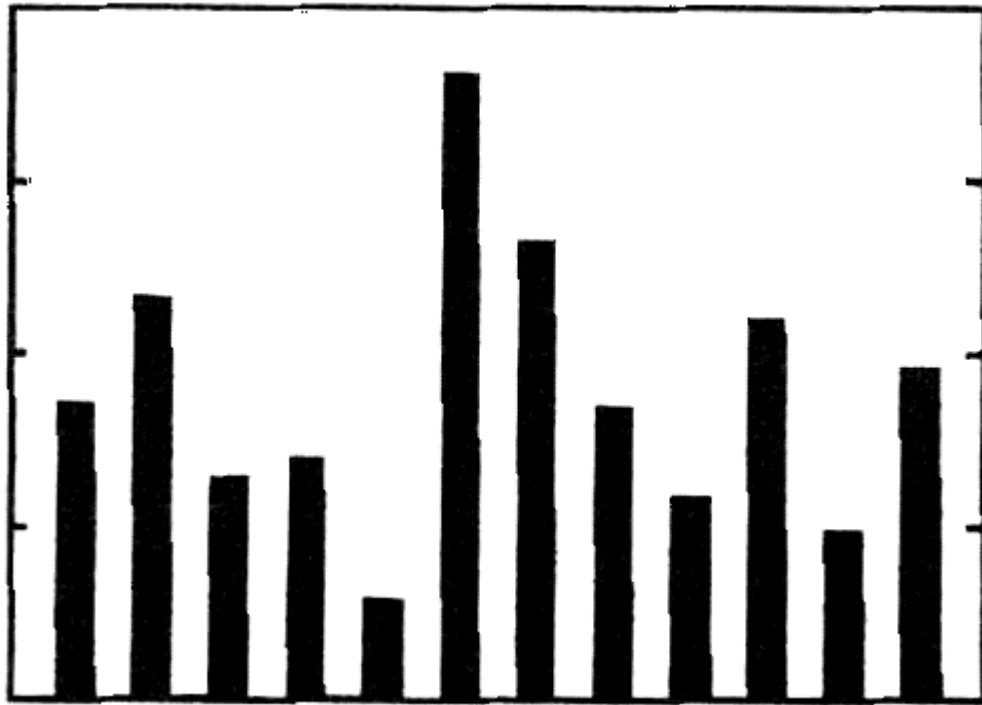
Maximizing Data-Ink Ratio



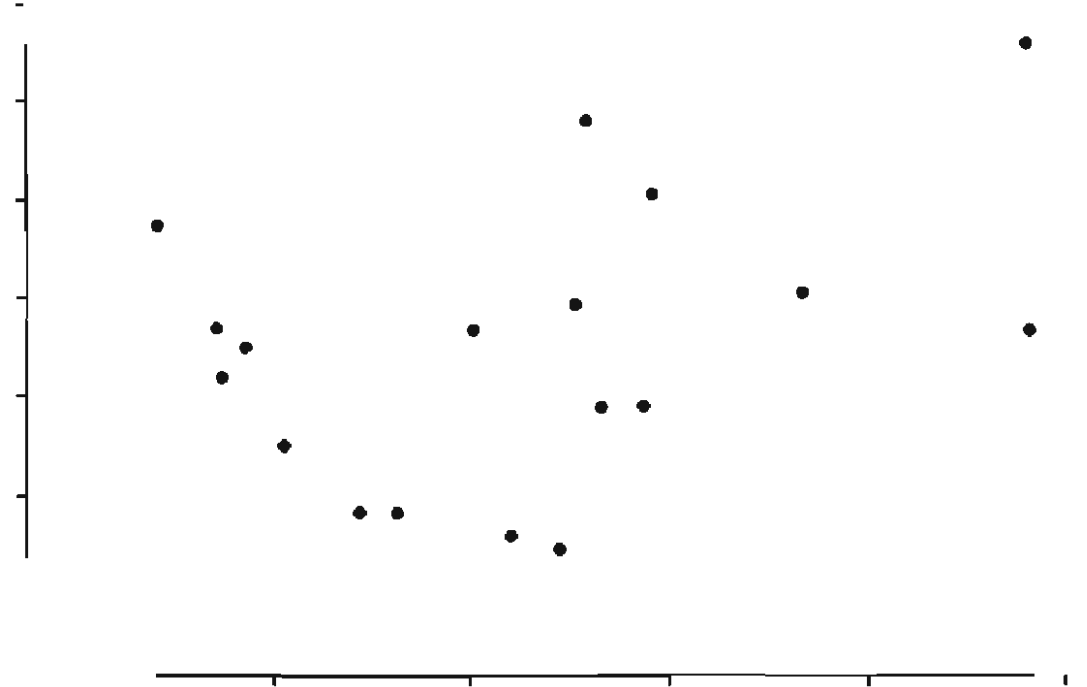
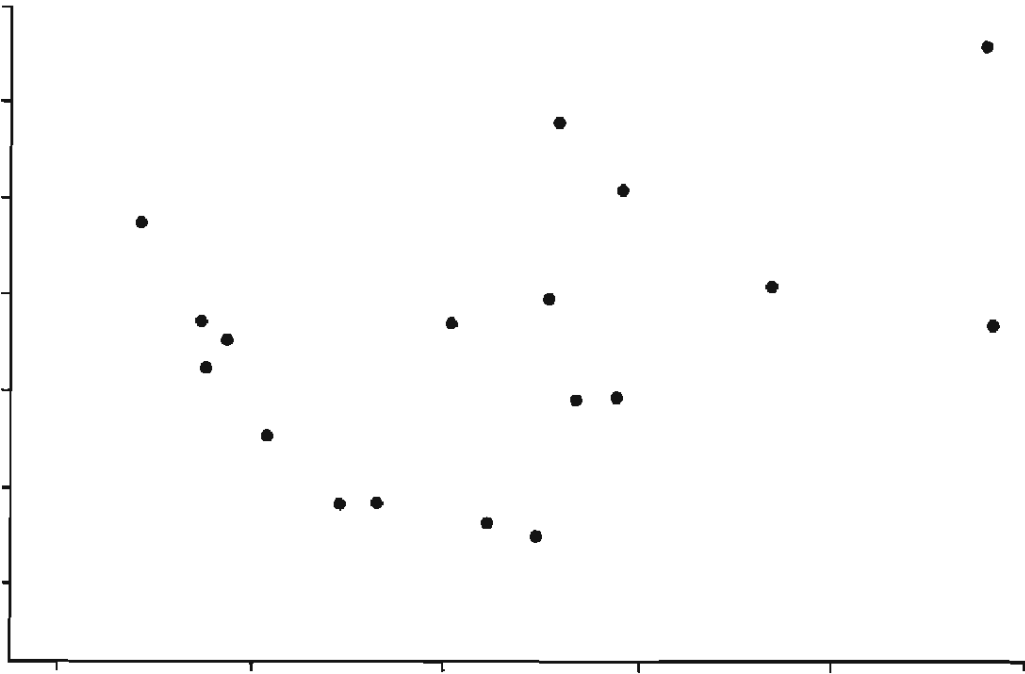
Maximizing Data-Ink Ratio

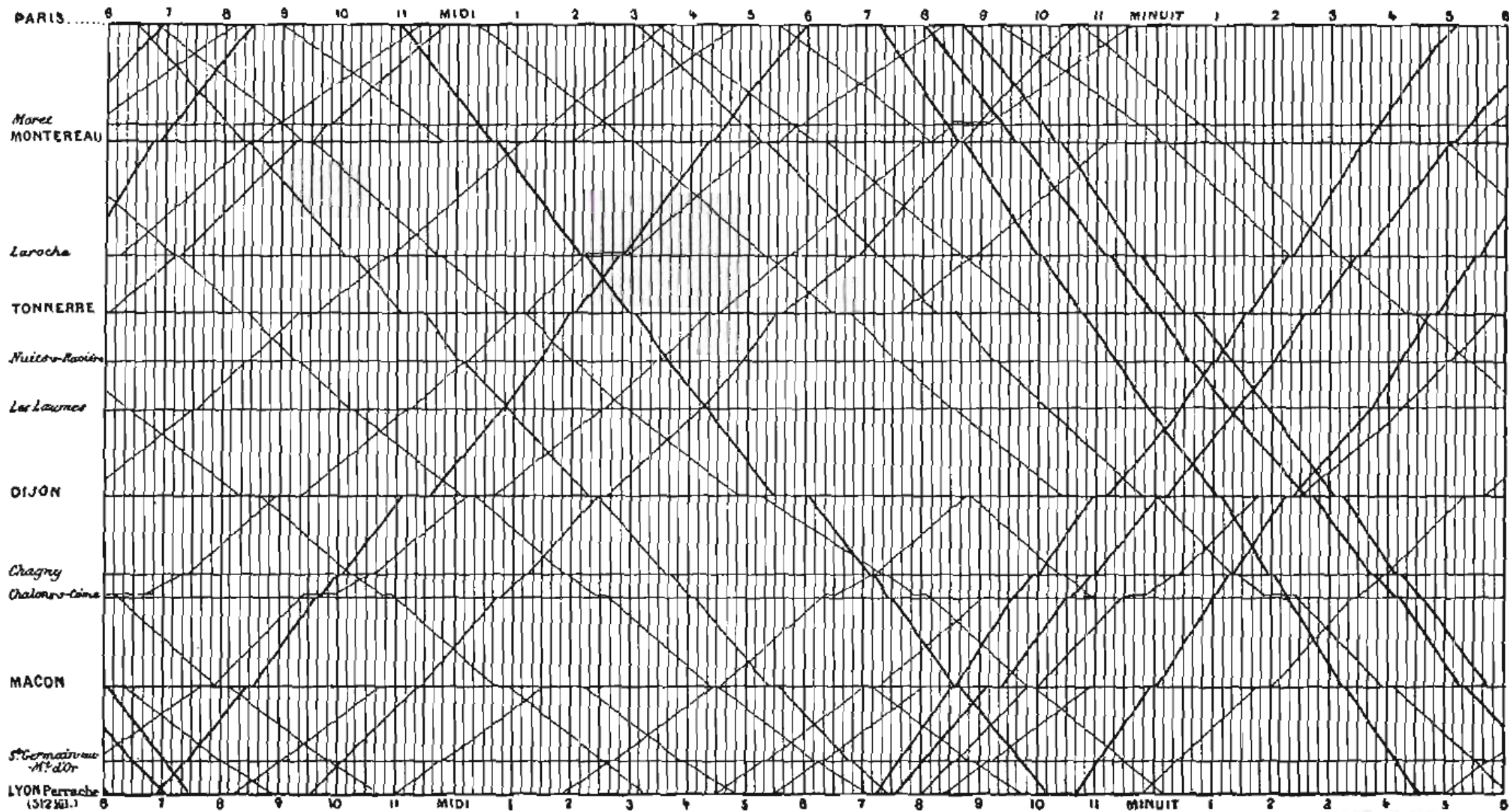


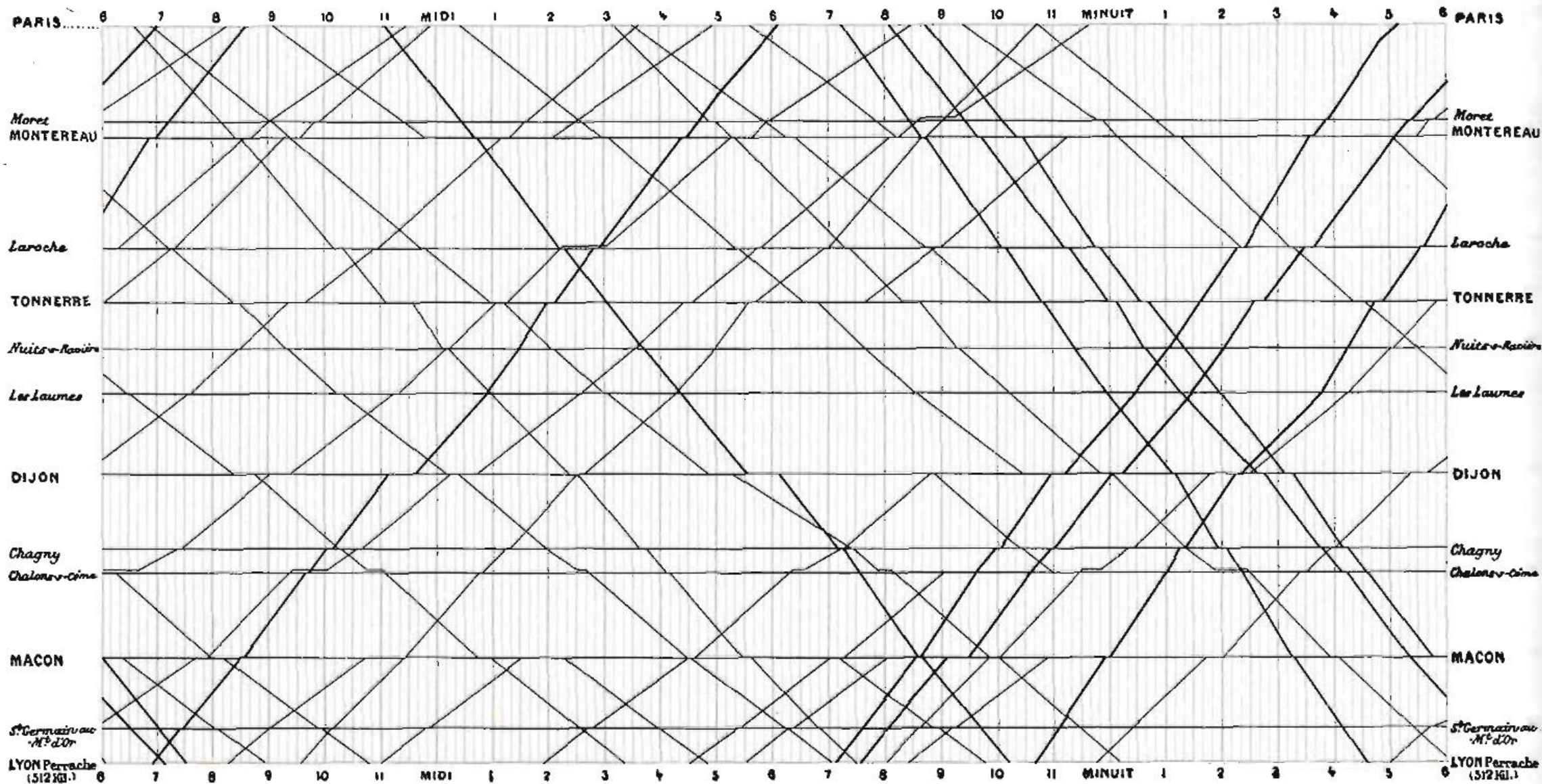
Maximizing Data-Ink Ratio



Maximizing Data-Ink Ratio





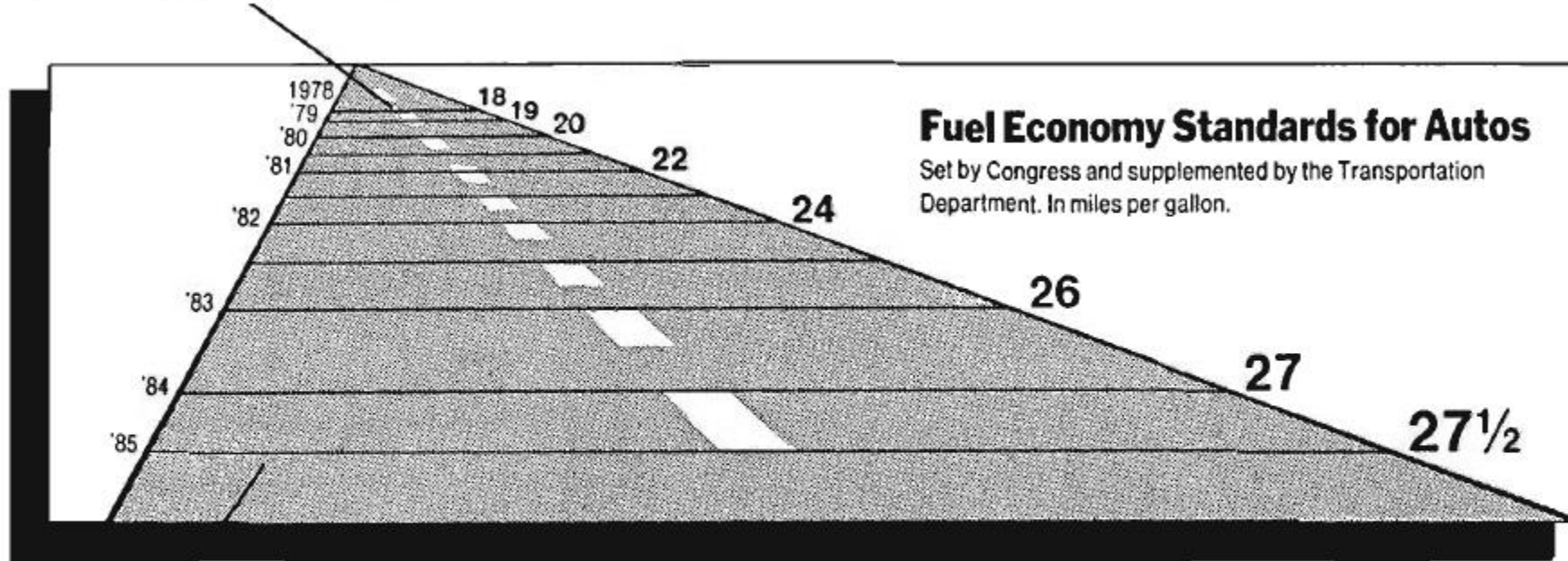


Graphical Integrity

The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the numerical quantities represented.

Edward Tufte

This line, representing 18 miles per gallon in 1978, is 0.6 inches long.

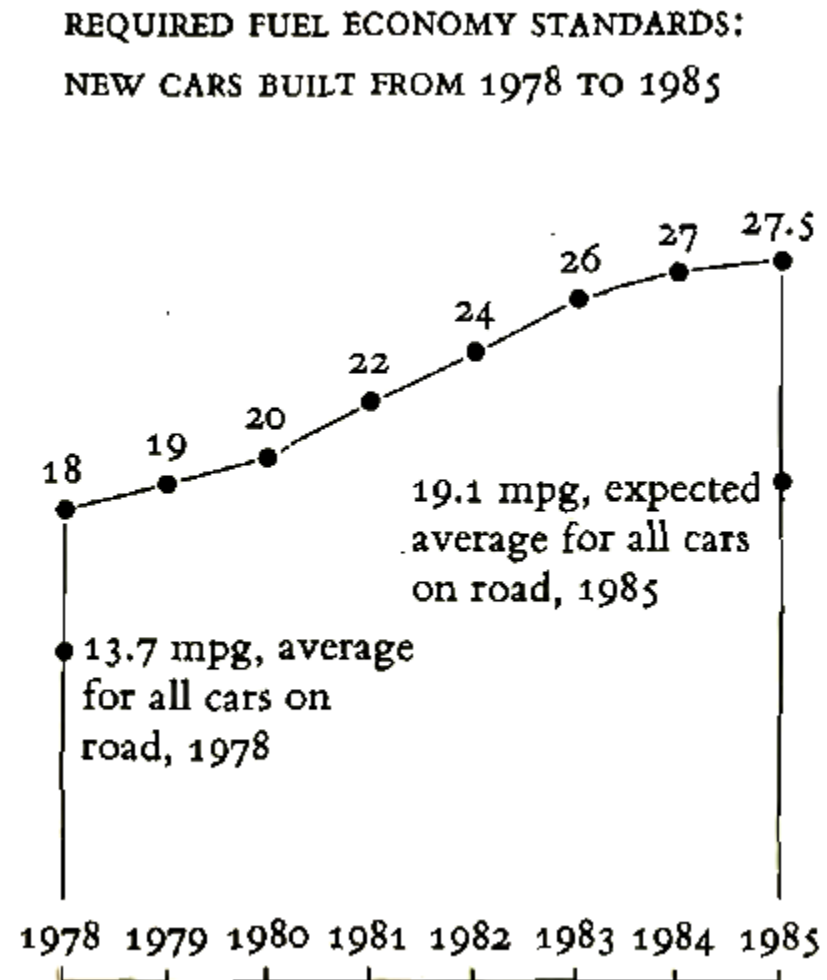


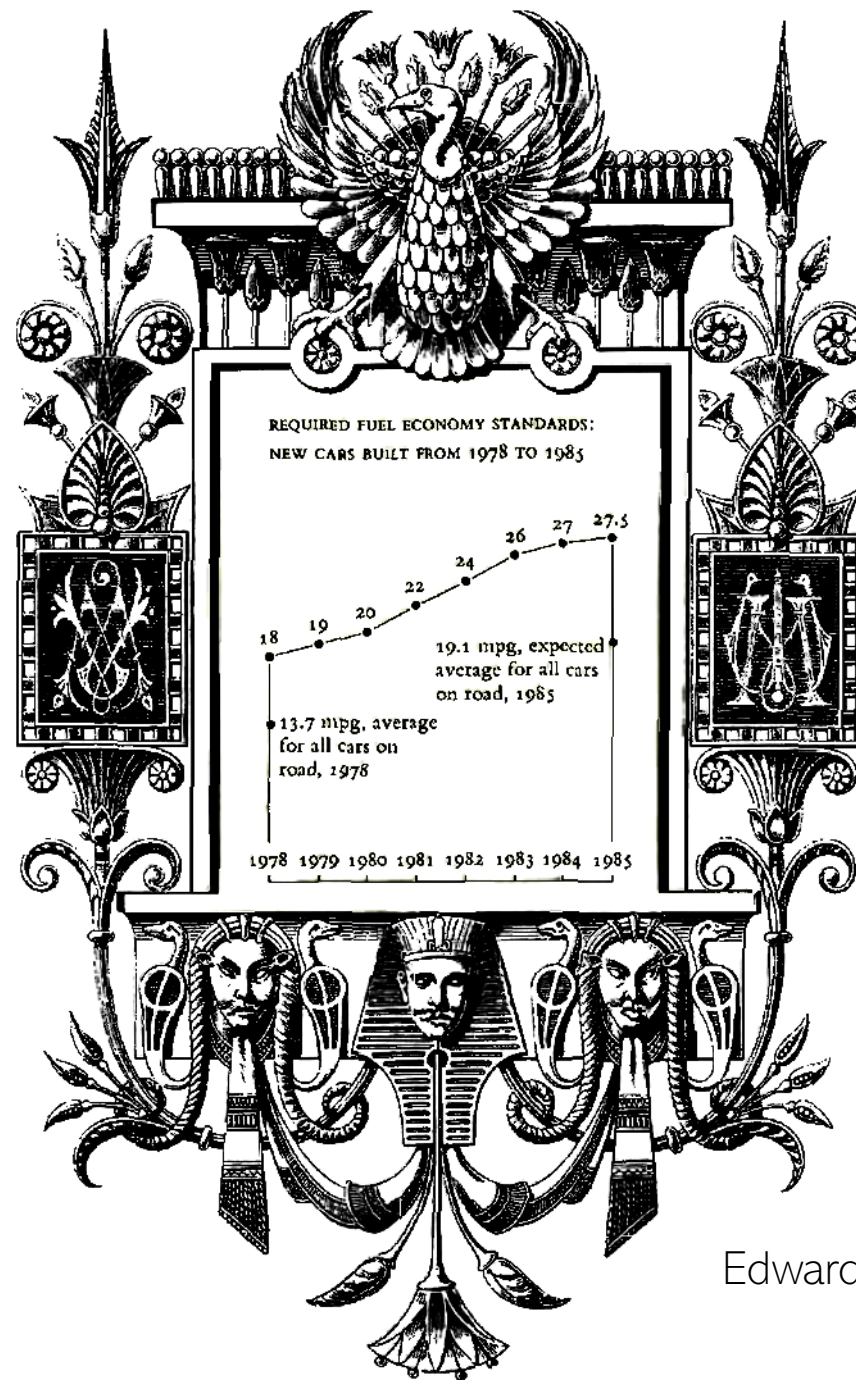
This line, representing 27.5 miles per gallon in 1985, is 5.3 inches long.

New York Times, August 9, 1978, p. D-2.

via Edward Tufte

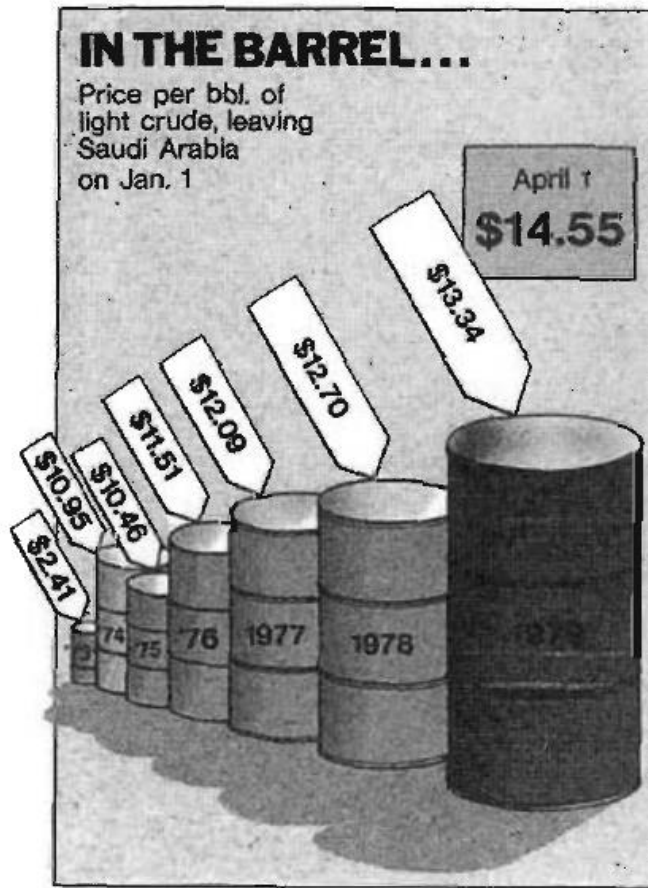
Graphical Integrity





Edward Tufte

Graphical Integrity



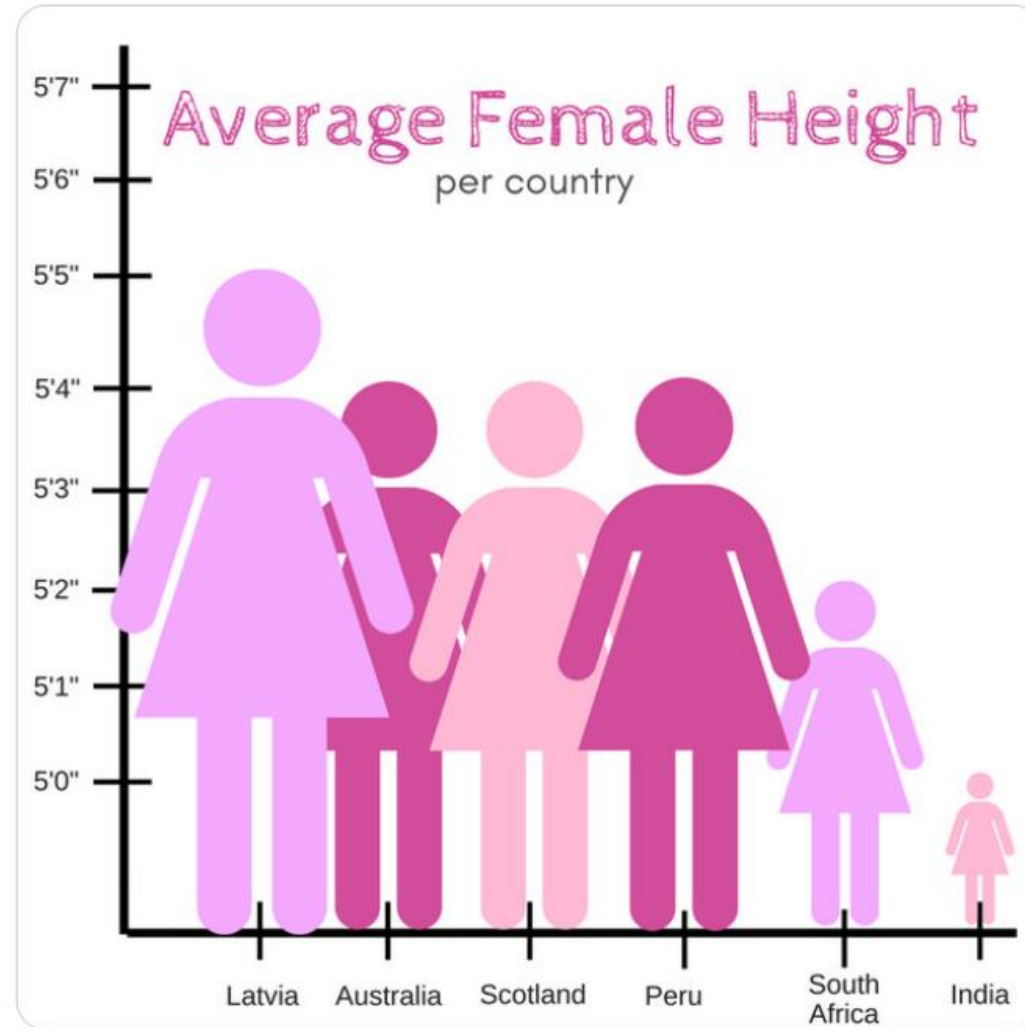
The number of information-carrying (variable) dimensions depicted should not exceed the number of dimensions in the data.

Edward Tufte

New York Times, January 27, 1981,
p. D-1.

via Edward Tufte

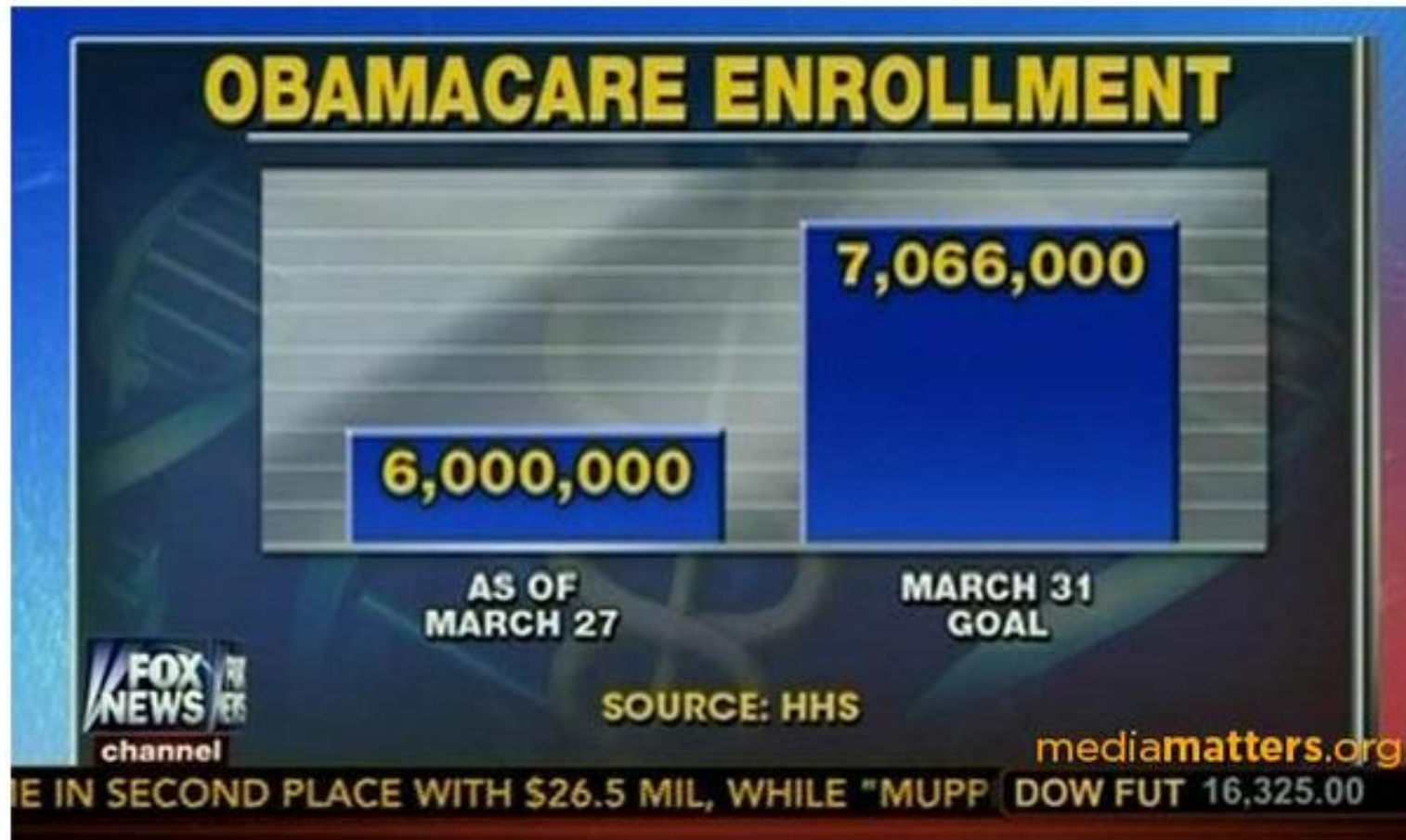
Graphical Integrity



Graphical Integrity

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Edward Tufte



Storytelling with Data

Nussbaumer Knaflic (2015)



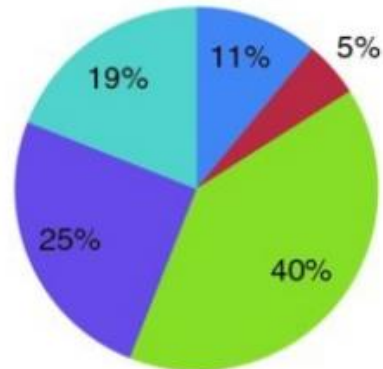
Cole Nussbaumer Knaflic

... shift from simply showing
data to storytelling with data.

Survey Results

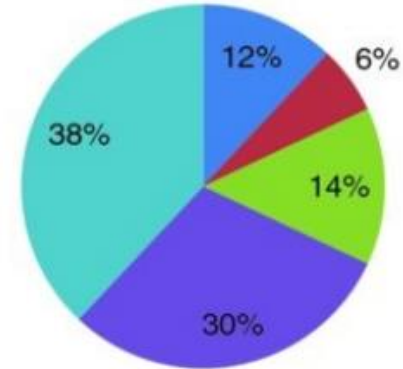
PRE: How do you feel about doing science?

■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



POST: How do you feel about doing science?

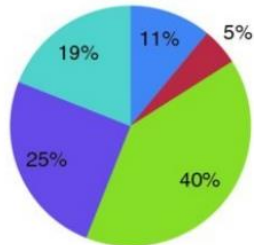
■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



Survey Results

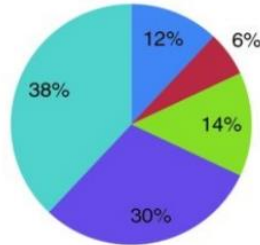
PRE: How do you feel about doing science?

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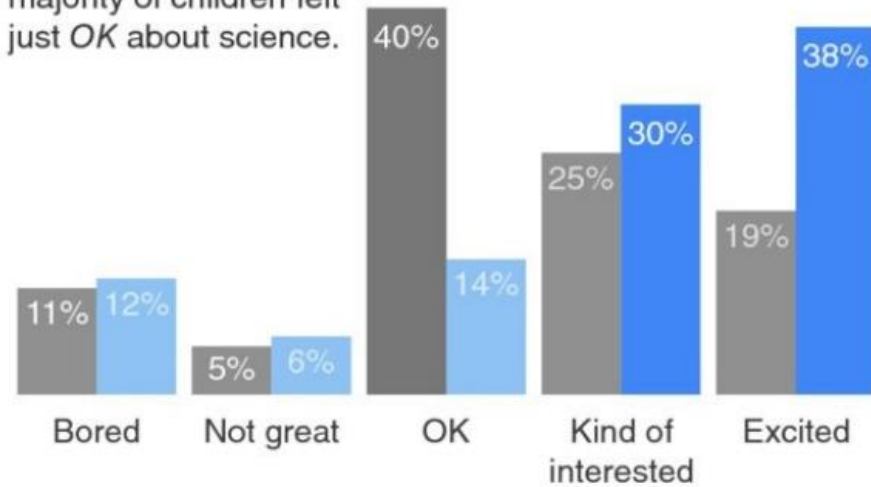
■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



Pilot program was a success

How do you feel about science?

BEFORE program, the majority of children felt just *OK* about science.



AFTER program, more children were *Kind of interested* & *Excited* about science.

Based on survey of 100 students conducted before and after pilot program (100% response rate on both surveys).

How to get there?



**understand the
context**



**choose an
effective visual**



**eliminate
clutter**



**focus
attention**



**tell a
story**

storytellingwithdata.com (2015)

Context

- Who is your audience?
 - Student, business professionals, scientists...?
- What do you want to communicate?
 - Do you want to convince them?
 - Allow them to understand something?
 - Prompt them to do something?
- What is the communication mechanism?
 - Talk, print, webpage...?
- How to communicate?
 - Which data is suitable to support your message?

How to get there?



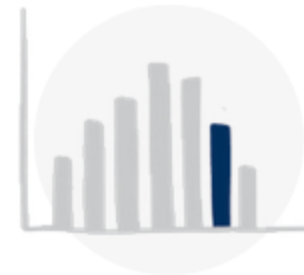
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**choose an
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**eliminate
clutter**



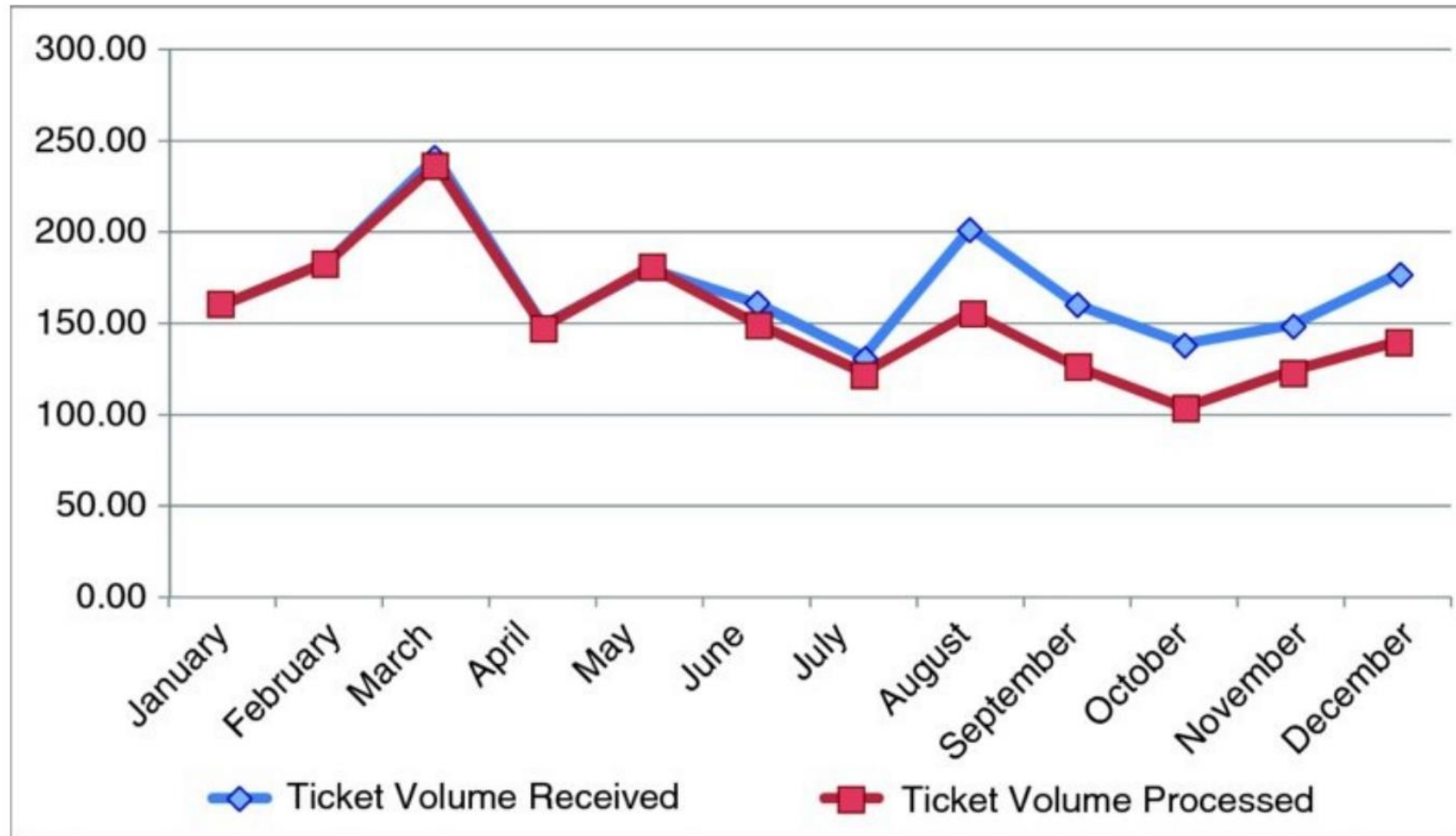
**focus
attention**



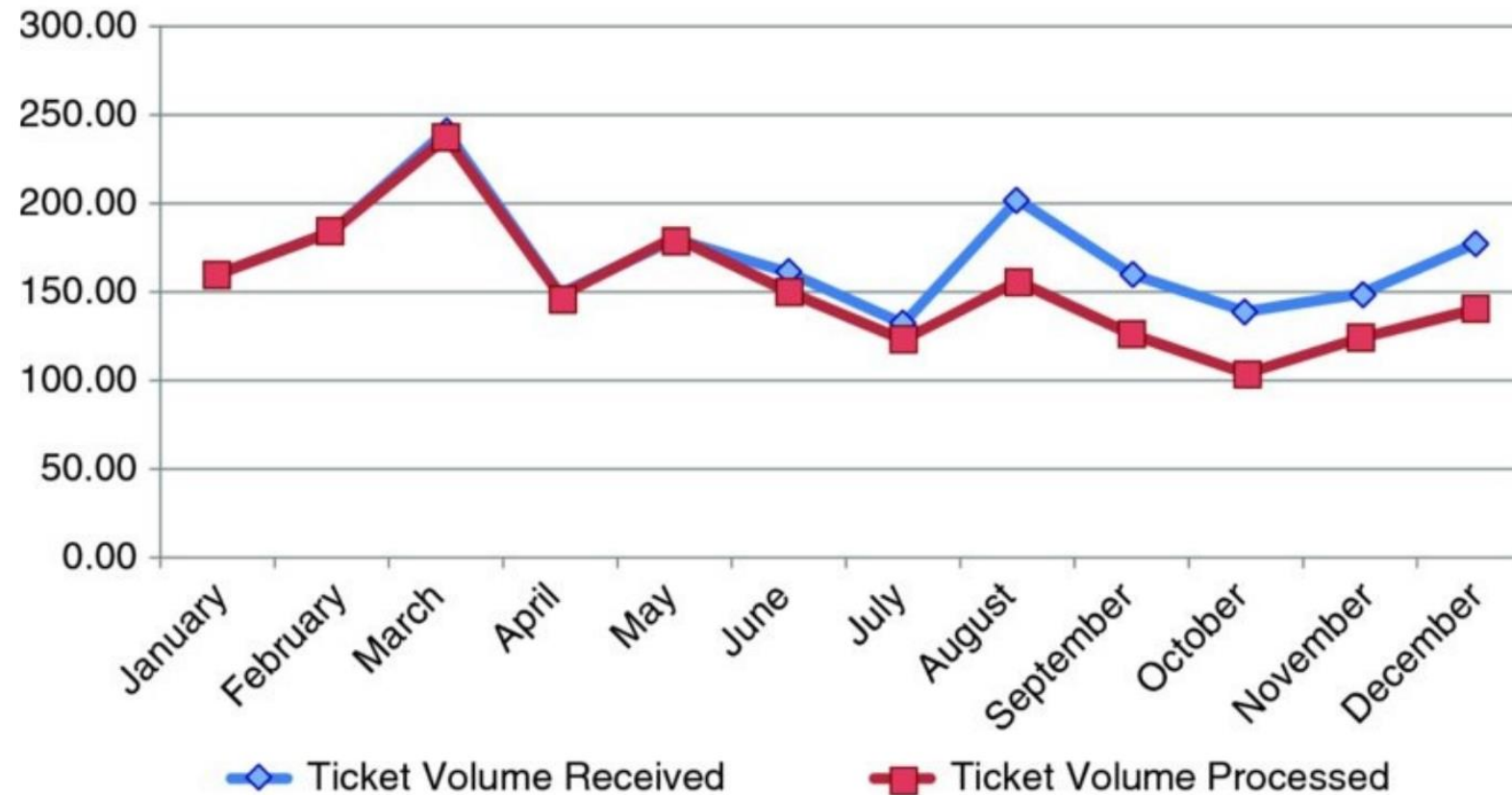
**tell a
story**

storytellingwithdata.com (2015)

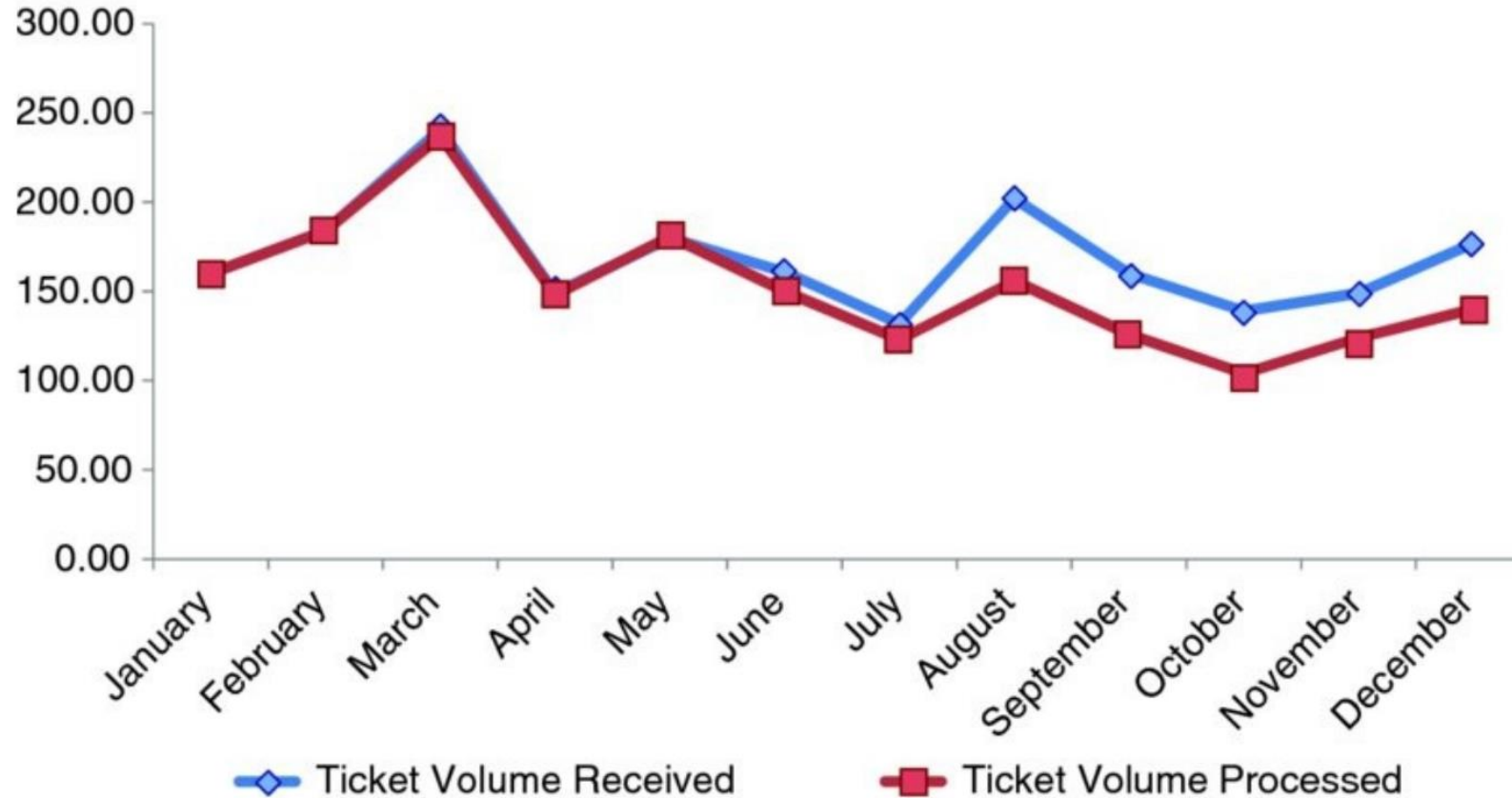
Clutter is your Enemy



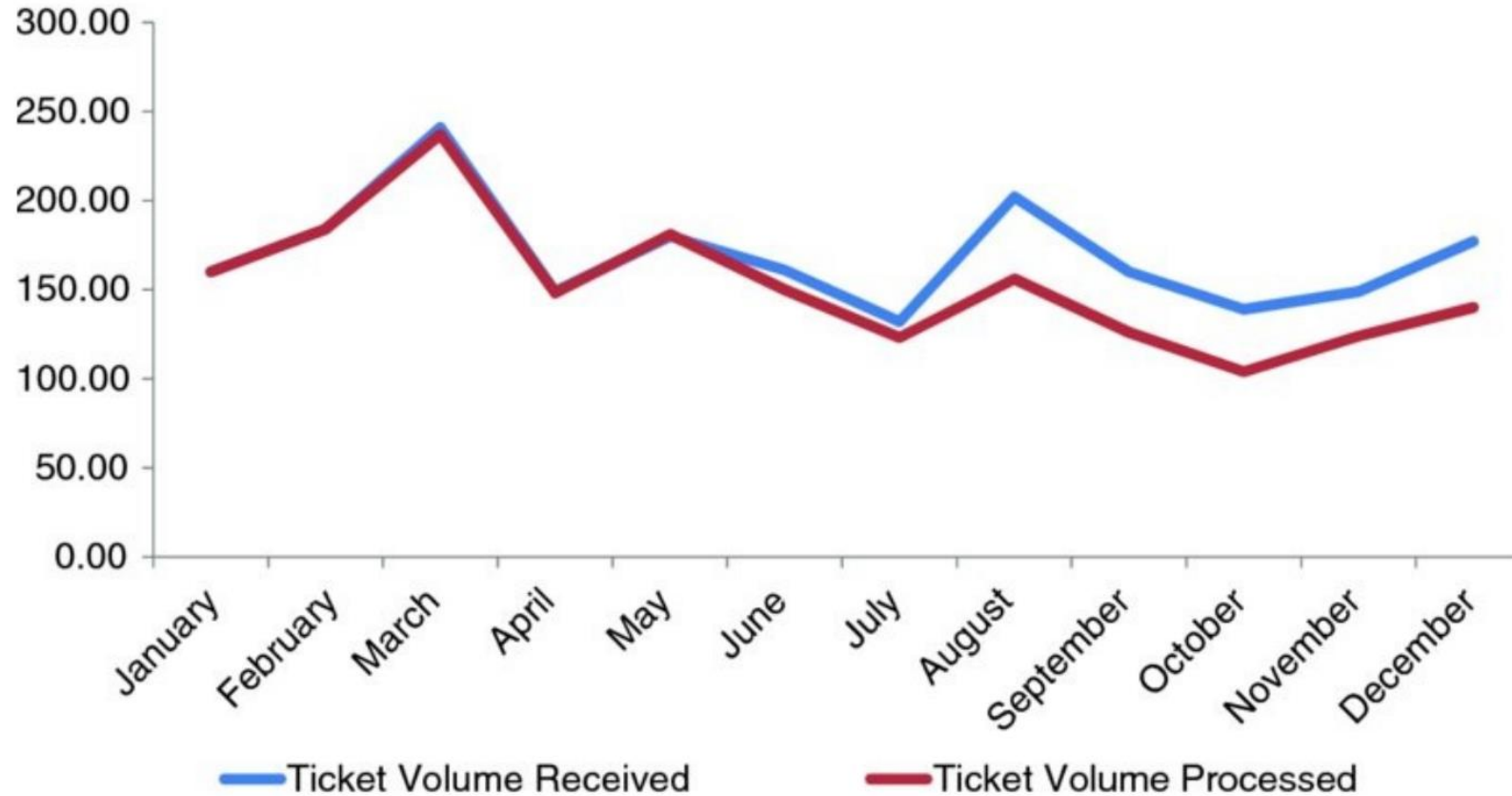
Clutter is your Enemy



Clutter is your Enemy



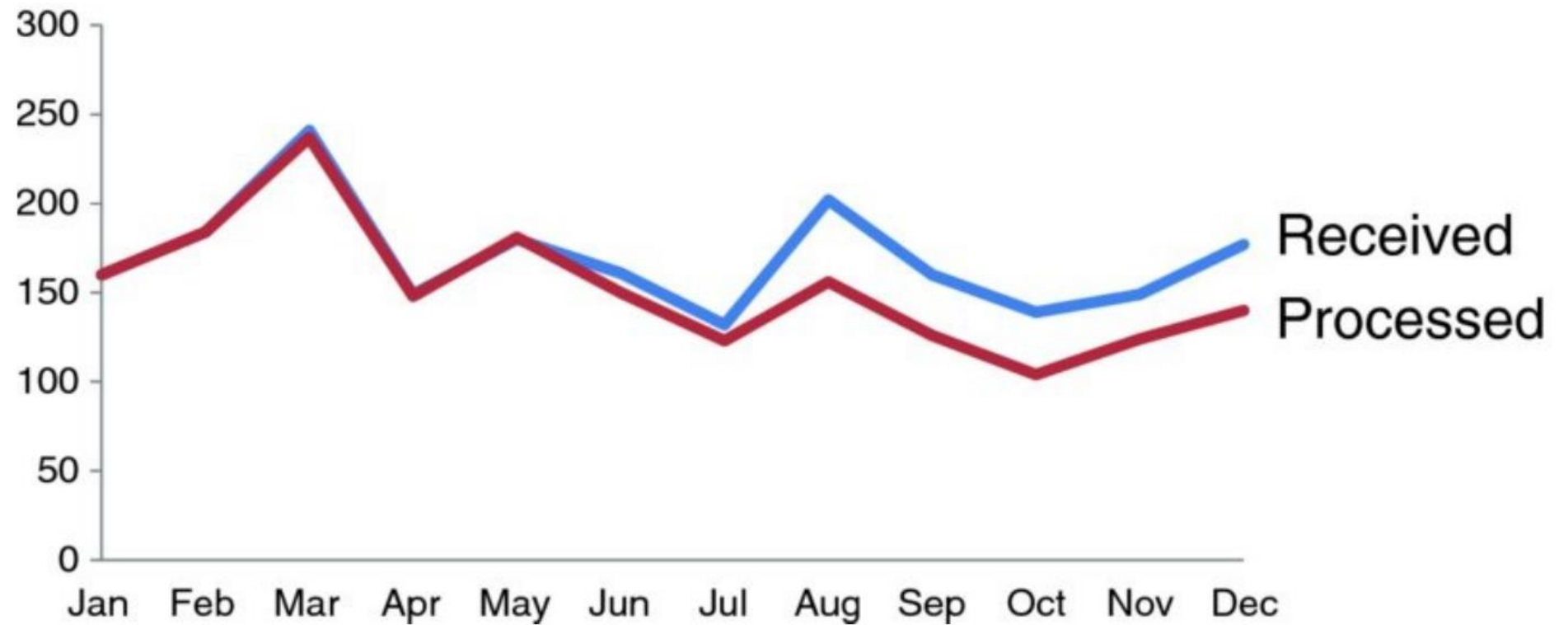
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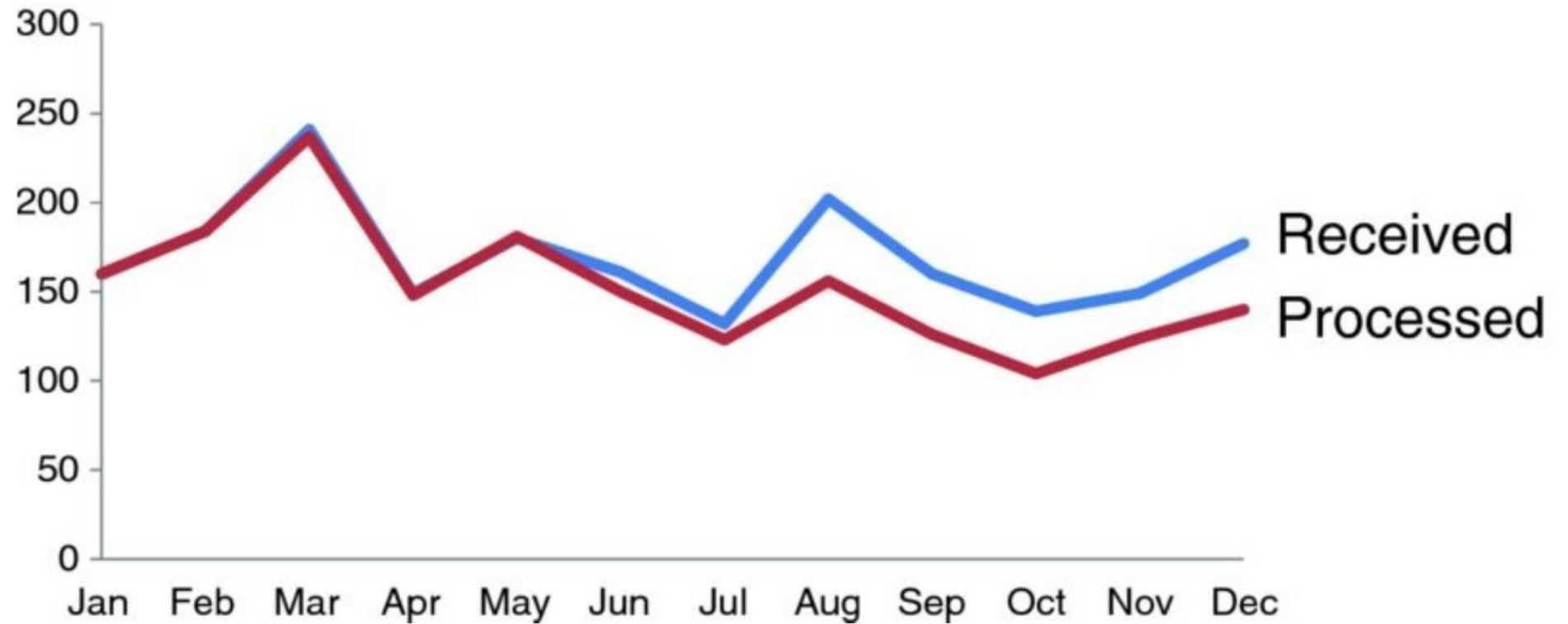
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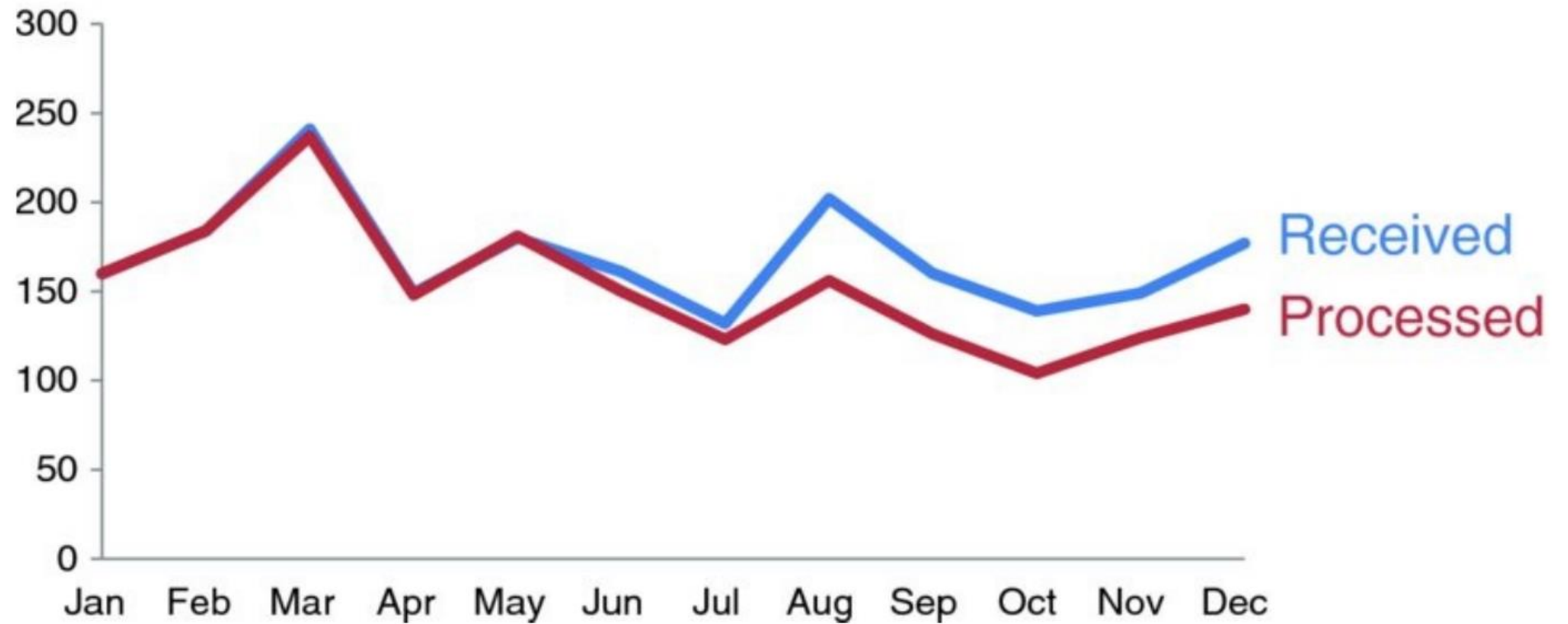
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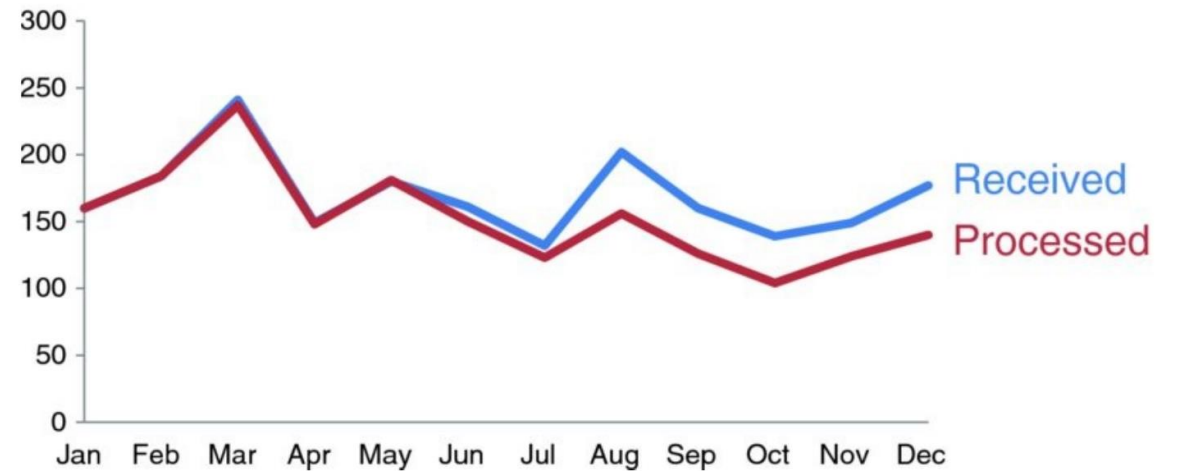
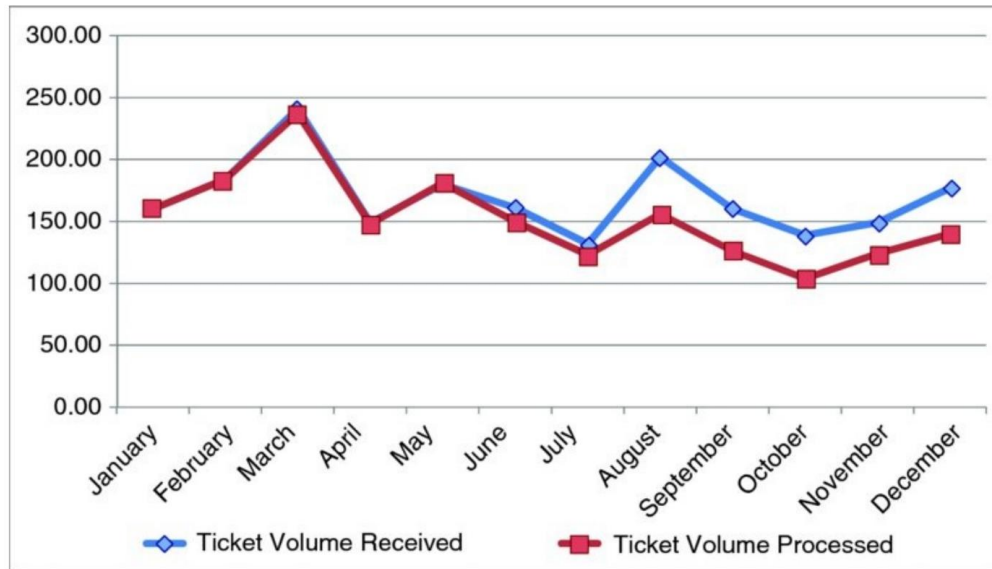
Clutter is your Enemy



Clutter is your Enemy



Clutter is your Enemy



How to get there?



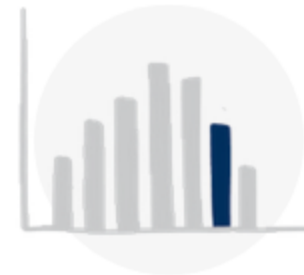
**understand the
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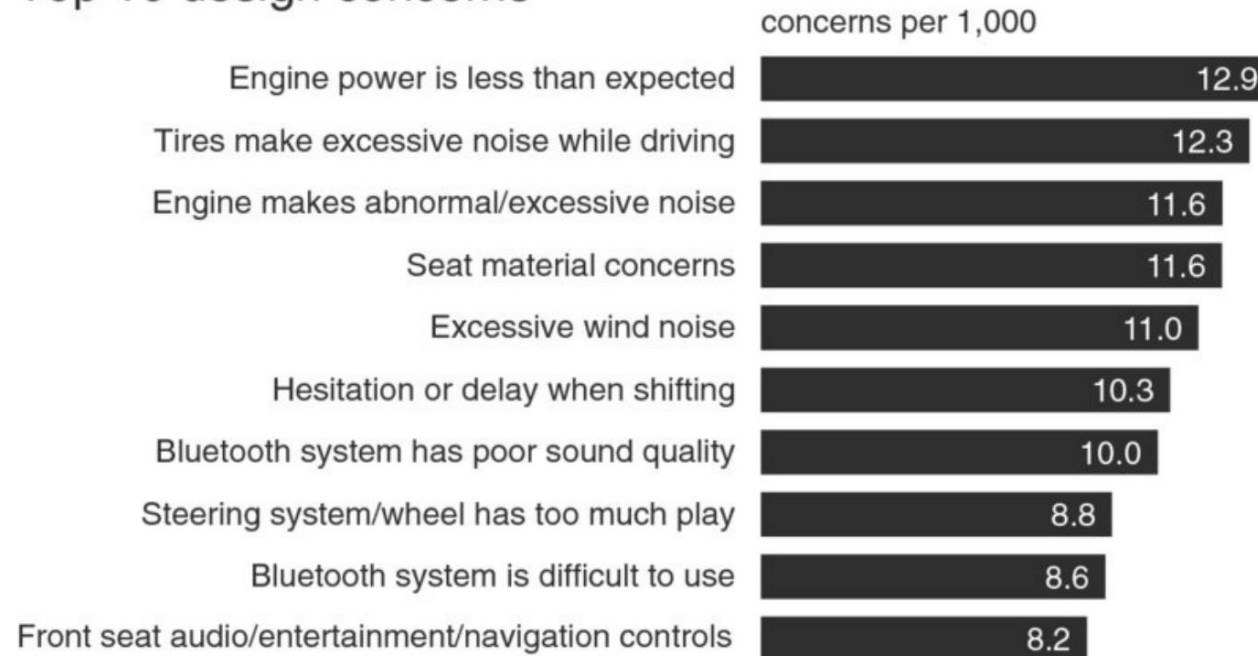


**tell a
story**

storytellingwithdata.com (2015)

Guiding Attention

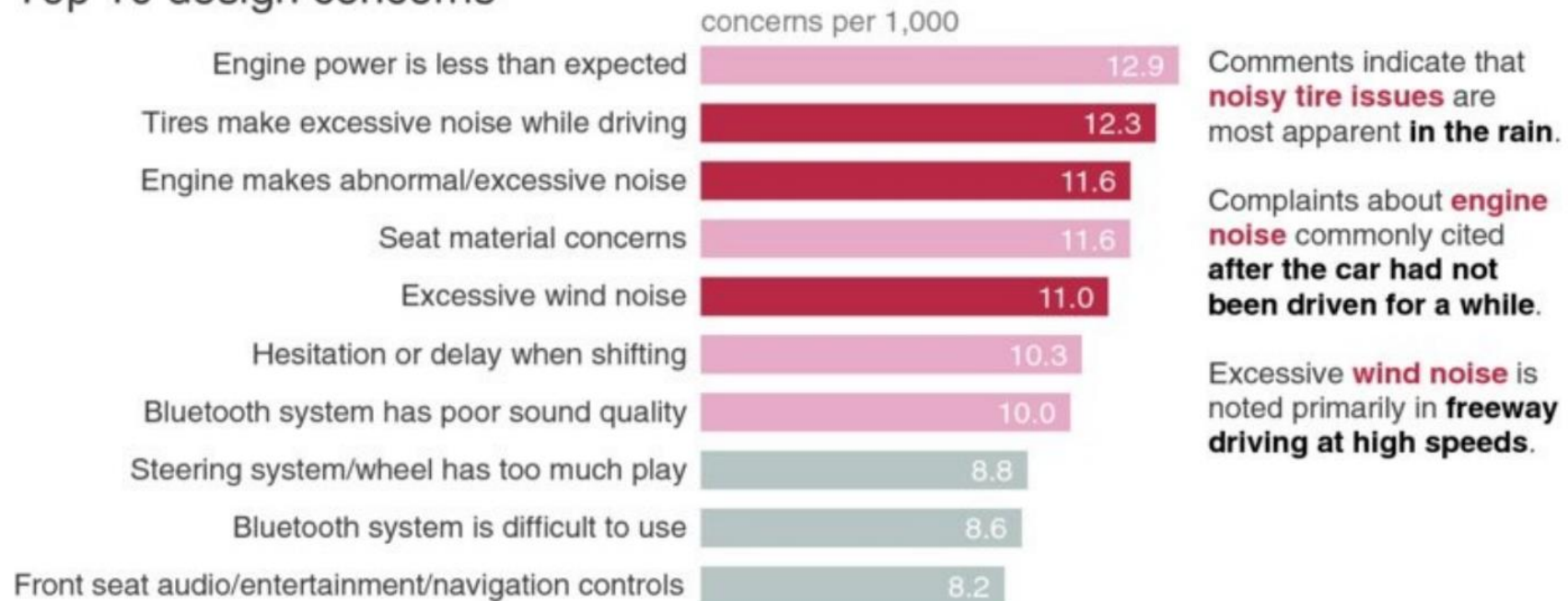
Top 10 design concerns



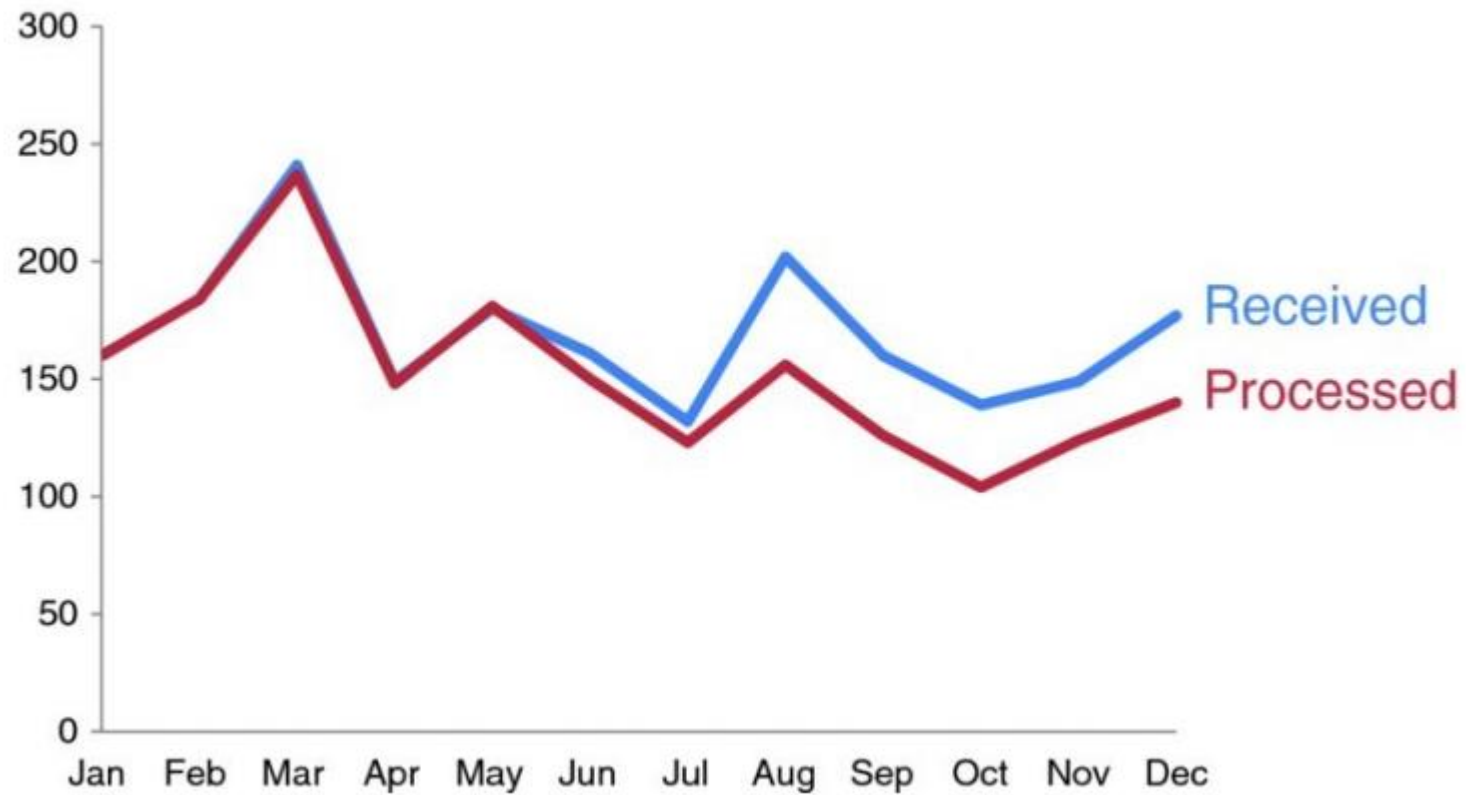
Guiding Attention

Of the top design concerns, three are noise-related.

Top 10 design concerns



Guiding Attention



Guiding Attention



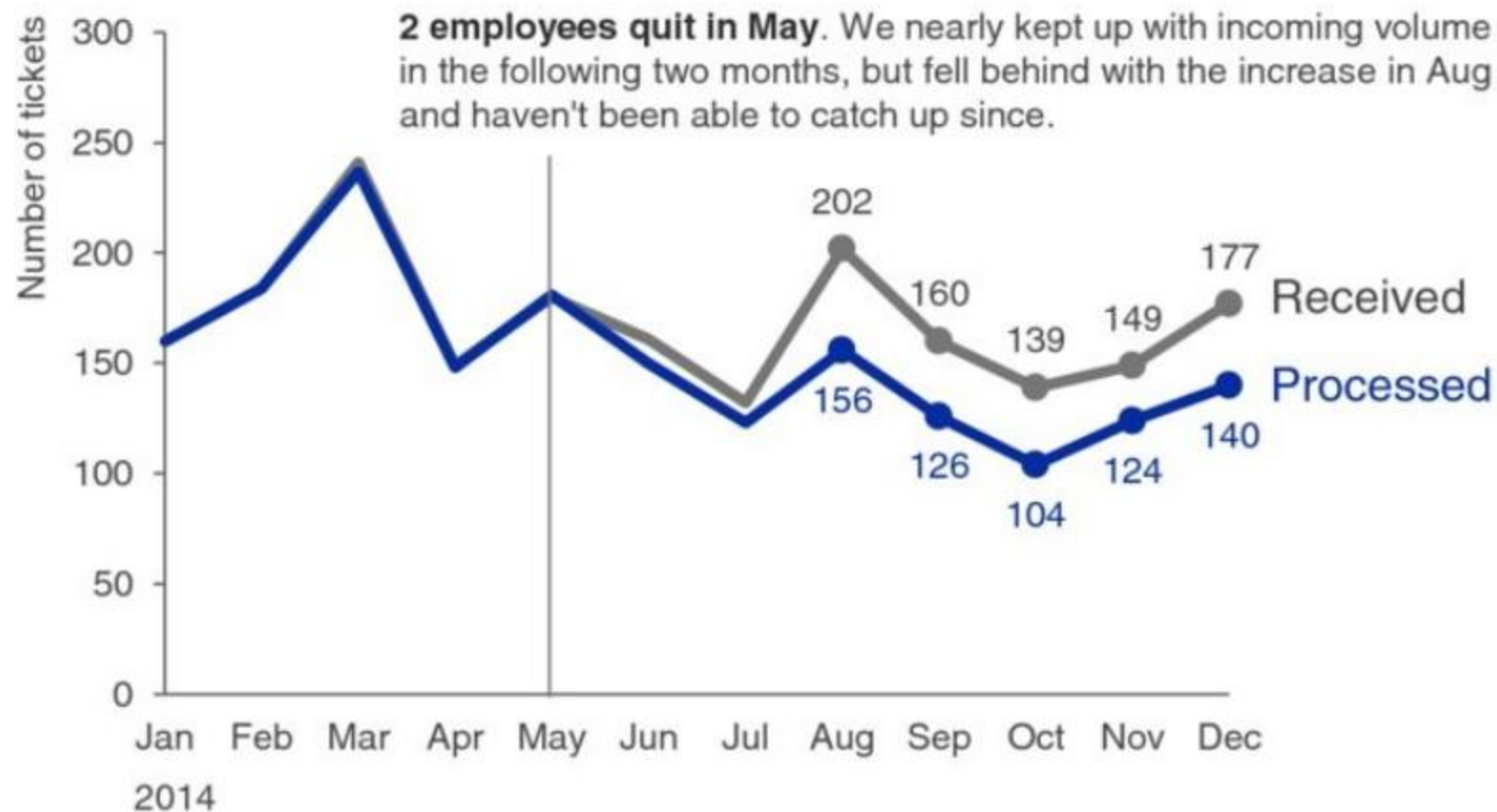
Guiding Attention



Please approve the hire of 2 FTEs

to backfill those who quit in the past year

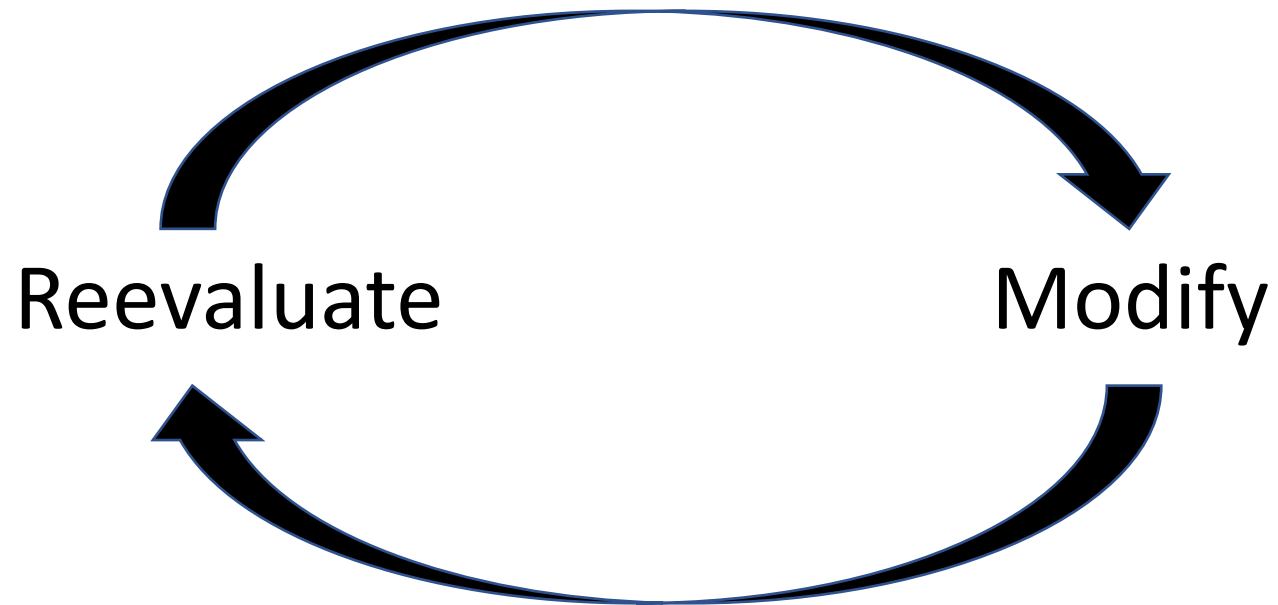
Ticket volume over time



My Practical Summary

- Know your context and what you want to say
 - Message, audience, means of communication
- Keep it simple
 - Remove useless chart junk
 - Maximize data-ink ratio (within reason)
 - Design should be simple so data can be complex
 - If possible, avoid legends directly include labels in plot
- Guide attention
 - to whatever is important for your message

The Process



 seaborn
 matplotlib

+


INKSCAPE 1.0
Draw Freely.


Illustrator

Design is choice. The theory of the visual display of quantitative information consists of principles that generate design options and that guide choices among options. The principles should not be applied rigidly or in a peevish spirit; they are not logically or mathematically certain; and it is better to violate any principle than to place graceless or inelegant marks on paper.

Edward Tufte