Edward Tufte

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Overview

- Who is he?
- Why should we listen to him?
- Tufte's Big Ideas

  :: Enforce Visual Comparisons
  :: Show Causality
  :: Show Multivariate Data
  :: Integrate all visual elements (words, numbers, images)
  :: Content-Driven Design

Who is he?

Edward Tufte :: www.edwardtufte.com/
Professor at Yale, Statistical Evidence

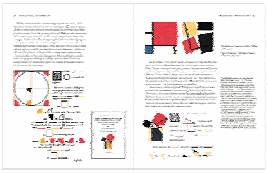
Author

Why should we listen to him?

His work speaks volumes about his talent

He is a domain specialist

There aren't many alternatives



Tufte's Big Ideas

Central, general issues with displaying data:

:: Flatland (two dimensional world), and how to escape it
:: The really interesting data is almost always "multivariate"
:: Whitespace is a good thing

"Available resolution for displays of information isn't adequate for quantity and richness of information"

What does this mean?

Tufte's Big Ideas : "5 grand principles"

1. Enforce Visual Comparisons
2. Show Causality
3. Show Multivariate Data
4. Integrate all visual elements (words, numbers, images)
5. Content-Driven Design

Tufte's Big Ideas : "5 grand principles"

1. Enforce Visual Comparisons

We can draw conclusions easier by comparing data

Visual comparison is faster and easier than mathematical or conceptual comparison

Use thickness, color, weight to emphasize visual comparisons

When possible, show comparisons adjacent in space rather than over time

Tufte's Big Ideas : "5 grand principles"

2. Show Causality

Causality: one thing makes another thing occur

Causality in a graph enhances and reinforces the meaning of the content

Graphs without causality often leave us wondering what the point is

Tufte's Big Ideas : "5 grand principles"

3. Show Multivariate Data

Try to show data on more than two dimensions, enhancing the meaning and point of the graph

Data with multiple variables enhances the viewing experience, drawing the user in

Don't bring your work to the level of the user – bring the user to the level of the work

How does this oppose basic HCI principles?

Tufte's Big Ideas : "5 grand principles"

4. Integrate all visual elements (words, numbers, images)

Try to include images, text and numbers where visually appropriate, instead of pushing all contextual information to the "legend"

Don't make the user learn your "system"

Tufte's Big Ideas : "5 grand principles"

5. Content-Driven Design

Good information design will never save poor content!

:: **Quality**. If the data is wrong to begin with, the designer is already dead in the water.

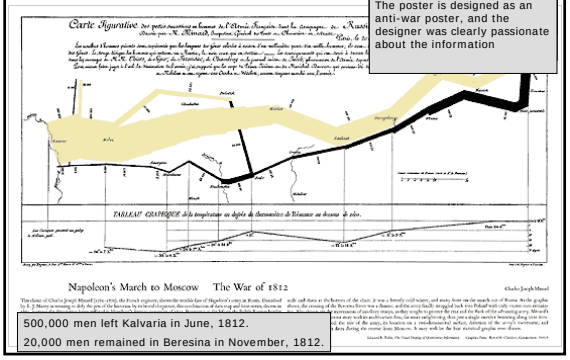
:: **Relevance**. Why are you presenting the information, and for whom? If you are passionate about the topic, your interest will be clear to your audience.

:: **Integrity**. Don't use your graphs to lie, push an agenda, or otherwise manipulate the viewer.

Tufte's Big Ideas, illustrated

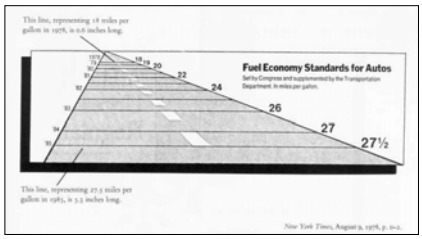
Design should be Content Driven

The poster is designed as an anti-war poster, and the designer was clearly passionate about the information



Tufte : Using Graphs to Lie

:: A "lie-factor" (visual % / actual %) exaggerates differences or similarities



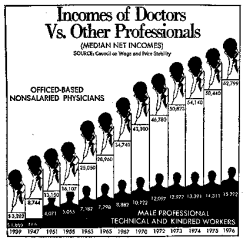
Actual increase in mileage: 53%
Visual increase in mileage: 783%
Lie Factor: **14.8**

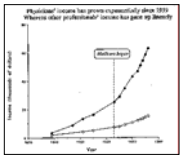
Tufte : Using Graphs to Lie

:: Use area of volume instead of linear scales to exaggerate differences

Tufte : Using Graphs to Lie

:: Exaggerate or changing the scale in mid-graph





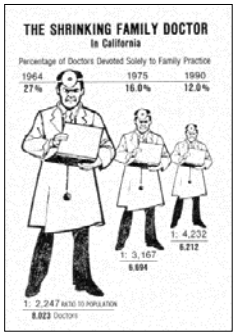
Looks like a linear salary increase …
… Actually an exponential increase!

Tufte : Data-Ink Ratio

$$\frac{\text{"Data" Ink}}{\text{Total Ink}} = \text{Data Ink Ratio}$$

Increase data-ink ratio by:

:: Avoid heavy grids
:: Use whitespace to indicate gridlines
:: Erase non-data ink
:: Remove dropshadows, boxes, pointers, redundant legends, and other extraneous crap

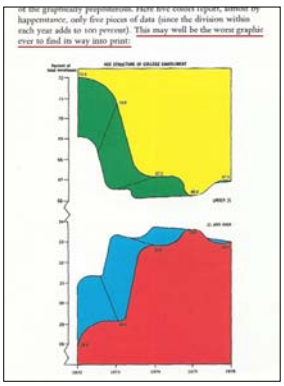


Tufte : Data Density

$$\frac{\text{\# of data points}}{\text{Area of image}} = \text{Data Density}$$

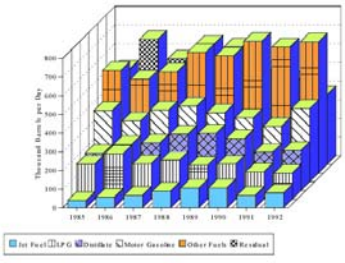
Increase data-density ratio by:

:: Increasing data-ink ratio
:: Including more data points (use small multiples)
:: Including more variables

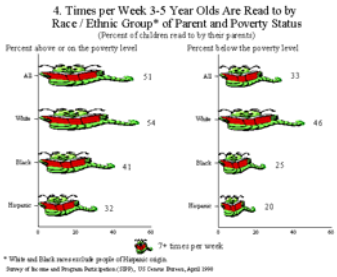


Tufte : Chartjunk

Decorative elements that provide no data and cause confusion



Tufte : Chartjunk



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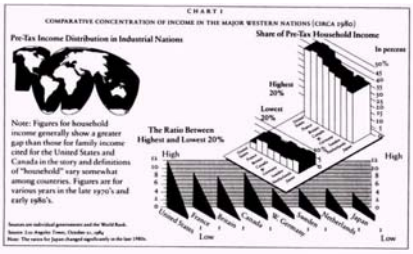


When Charts Fail

1986.

When Charts Fail : The Challenger

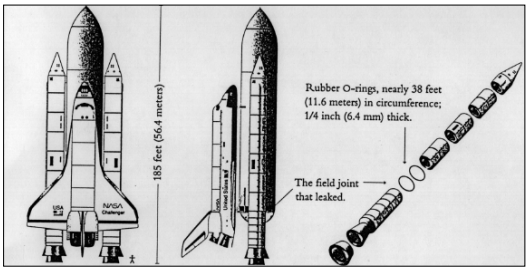
On Jan 28, 1986, at 11.38 am EST, the space shuttle Challenger was launched from Cape Canaveral, Florida.

The mission ended 73 seconds later when the Challenger exploded.

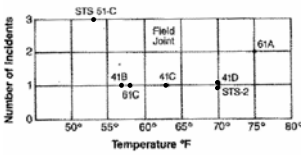
All 7 crew members were killed.

How could this happen?

When Charts Fail : The Challenger



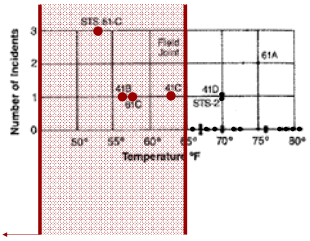
When Charts Fail : The Challenger



This is one of several graphs reviewed before deciding to launch the shuttle.

Do you see any correlation between temperature and previous incidents?

When Charts Fail : The Challenger



This is the same chart, but with every launch added to the graph instead of just the problematic launches.

Now do you see any correlation between temperature and previous incidents?

It was 36 degrees on the day of the launch!

When Charts Fail : The Challenger

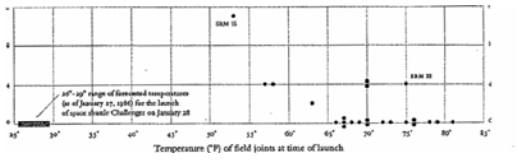
Things we now know, after the fact:

:: O-ring resiliency is directly related to its temperature.

:: A warm O-ring that has been compressed will return to its original shape much quicker than will a cold O-ring when compression is relieved. Thus, a warm O-ring will follow the opening of the tang-to-clevis gap. A cold O-ring may not.

:: A compressed O-ring at 75 degrees Fahrenheit is five times more responsive in returning to its uncompressed shape than a cold O-ring at 30 degrees Fahrenheit.

When Charts Fail : The Challenger



What if this was the chart shown to decision makers before the launch?

Summary

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