

# Improve How You Visualize Data

With  
annotations  
from author

Marshall Meier

Project Manager- Rosemount

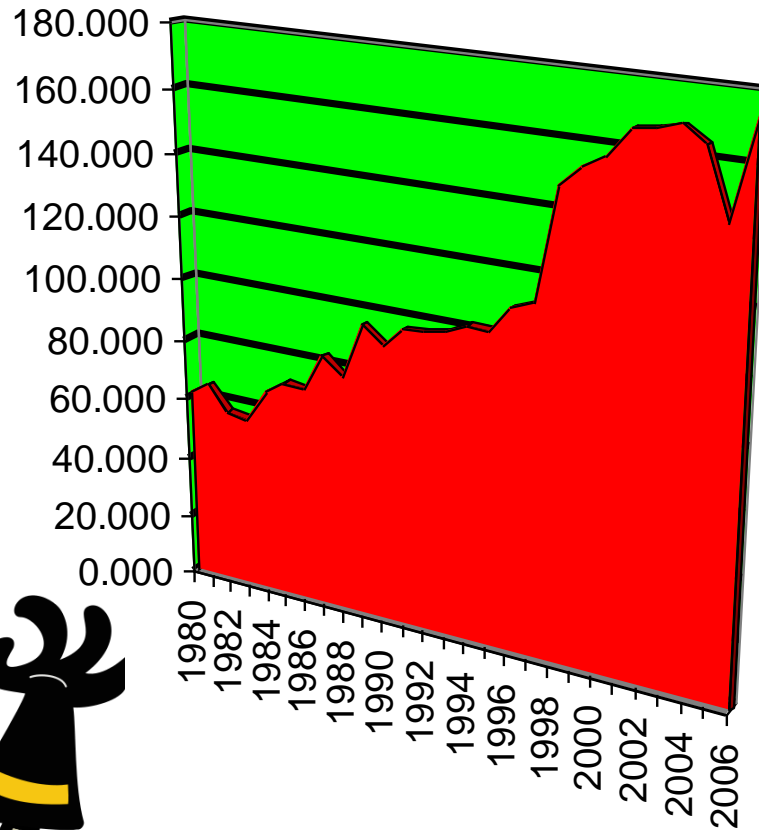
Where **ideas** become **solutions**.



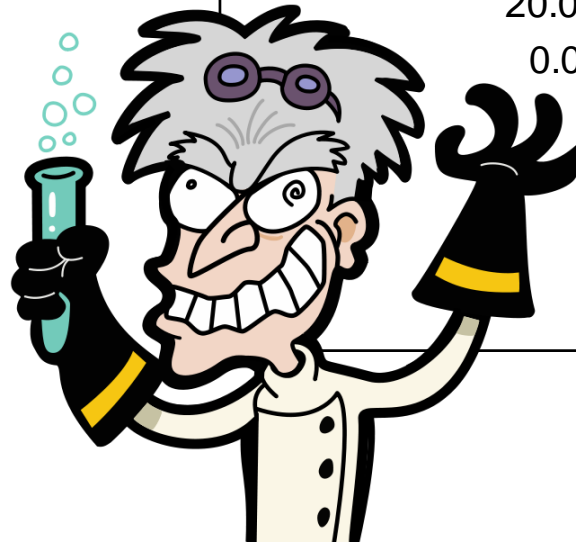
Why are we here?

Because we've all created, and more often been forced to view, graphics such as this

## Invention Patents Issued - U.S.



■ Thousand/Year



Source: US Statistical Abstract, 2008

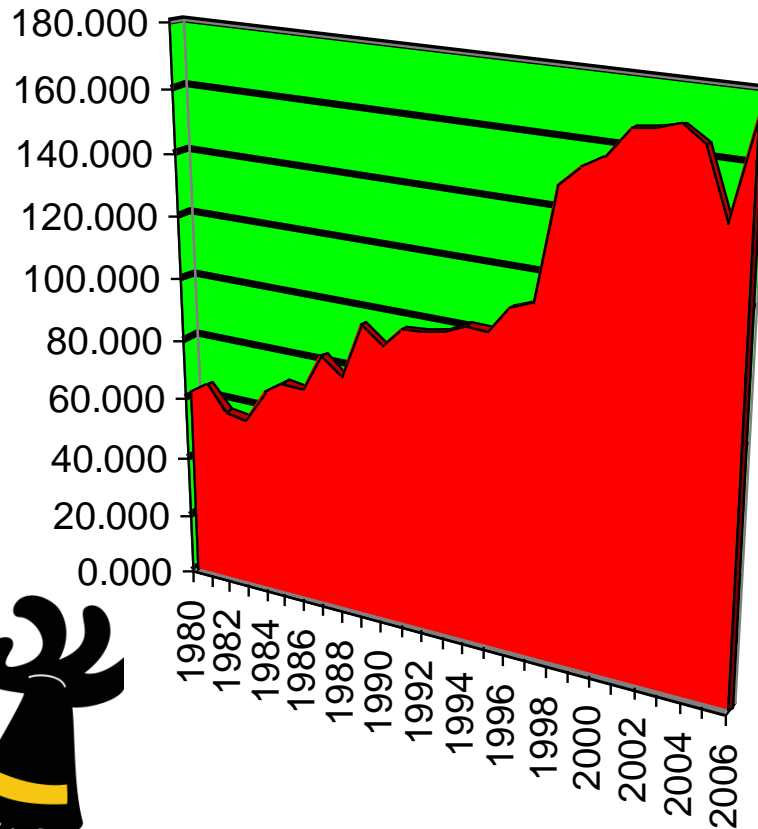
But what we really need to do is help "unlock your data"



Unlock  
your data

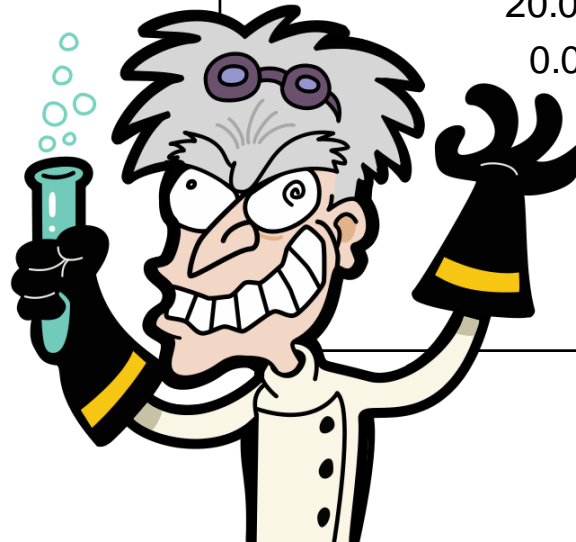
So instead of looking at something like this

## Invention Patents Issued - U.S.



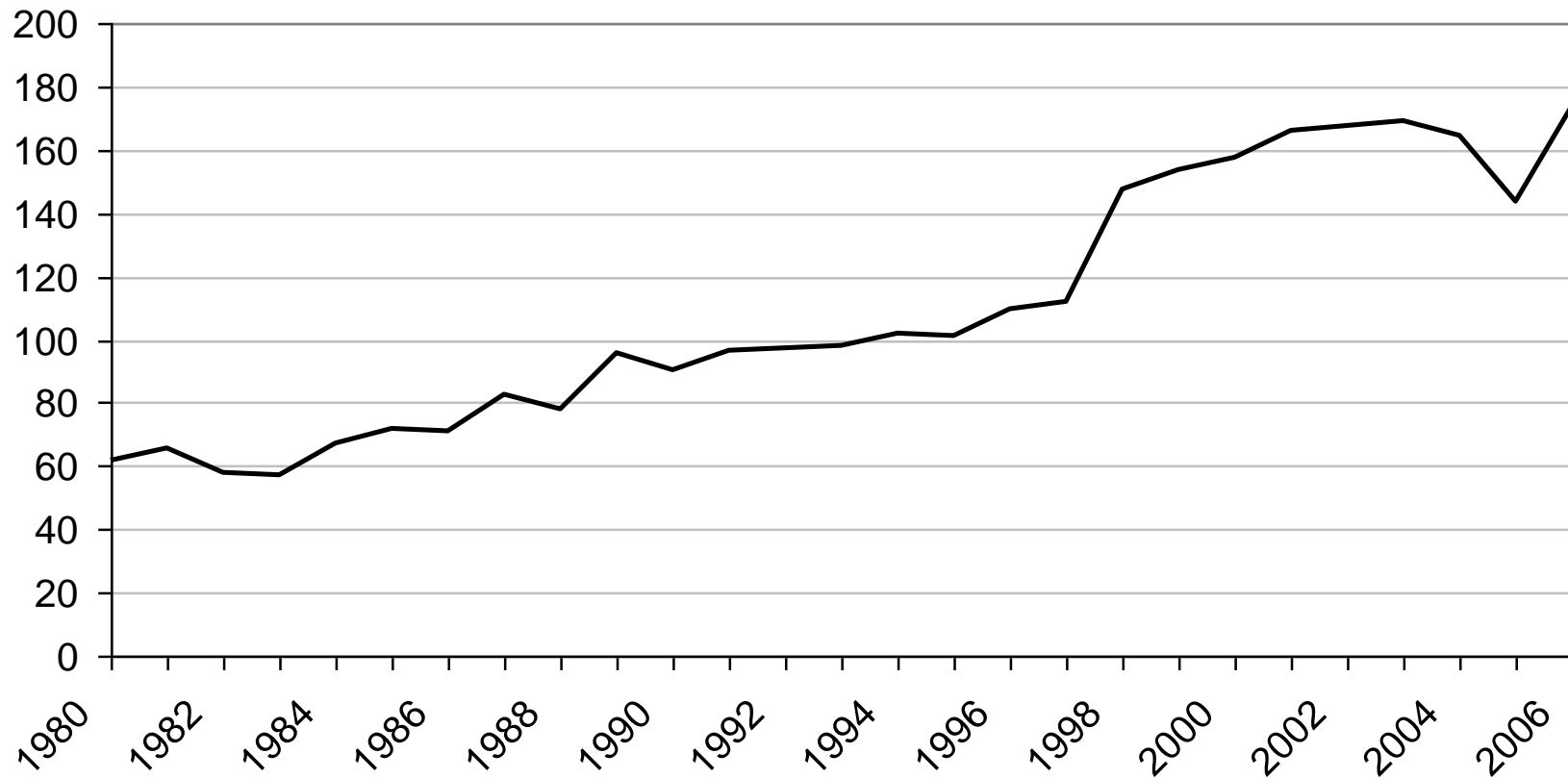
■ Thousand/Year

Source: US Statistical Abstract, 2008



We look at something like this

## Invention Patents Issued - U.S (Thousand/Year)



A close-up, cinematic shot of the character Yoda. He is shown from the chest up, looking directly at the camera with a thoughtful expression. His large, wrinkled green head is the central focus, with his large, pointed ears visible on either side. His hands are clasped together in front of him, resting on his lap. He is wearing his characteristic brown, textured robes. The lighting is dramatic, highlighting the texture of his skin and the folds of his clothing against a dark, out-of-focus background.

Why does it matter?

Your data is important. It helps you understand problems and make decisions



Understand  
problems and  
make  
decisions



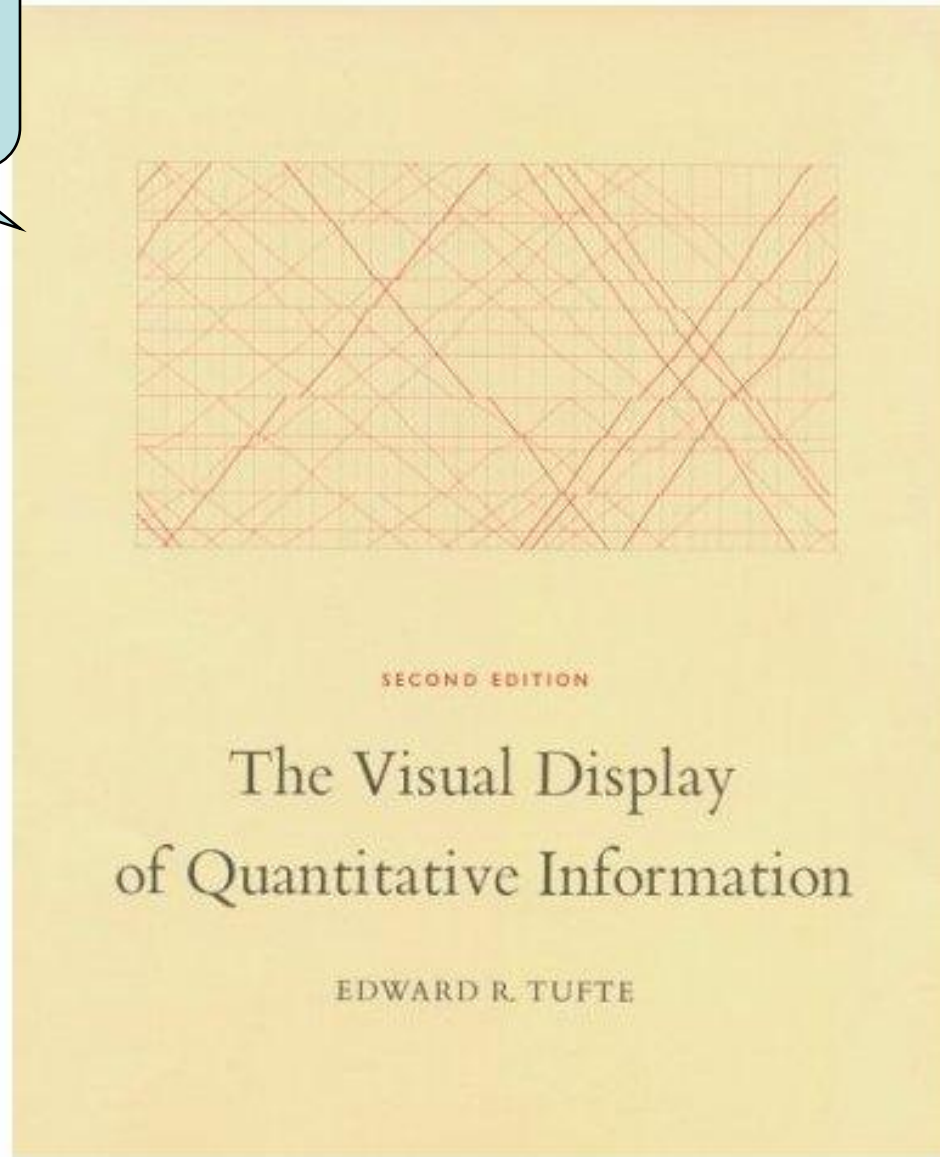


None of what I'm talking about here is new. Many of the principles come directly from Edward Tufte, who is the preeminent thought leader in the field

# Edward Tufte

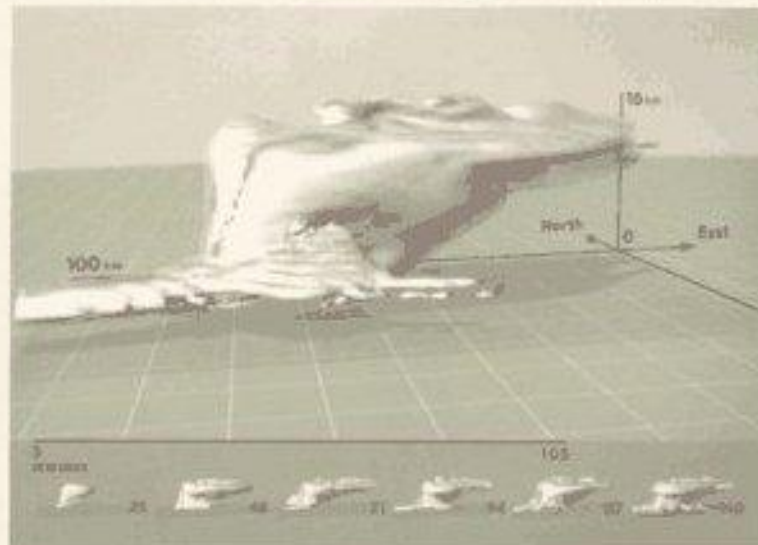


This is Tufte's seminal work. His first of four books.



EDWARD R. TUFTE

VISUAL EXPLANATIONS

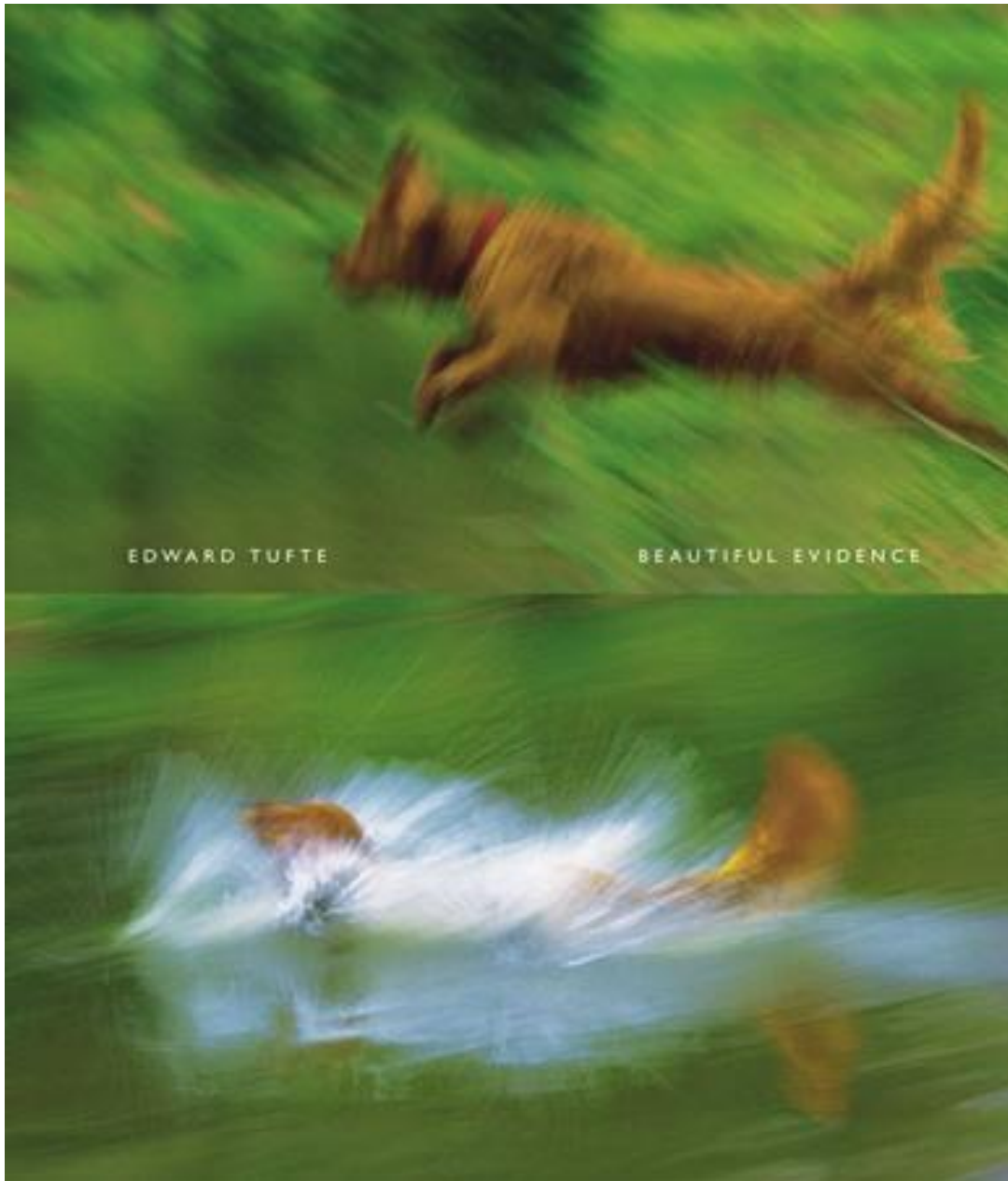


IMAGES AND QUANTITIES, EVIDENCE AND NARRATIVE

*Edward R. Tufte*

# Envisioning Information



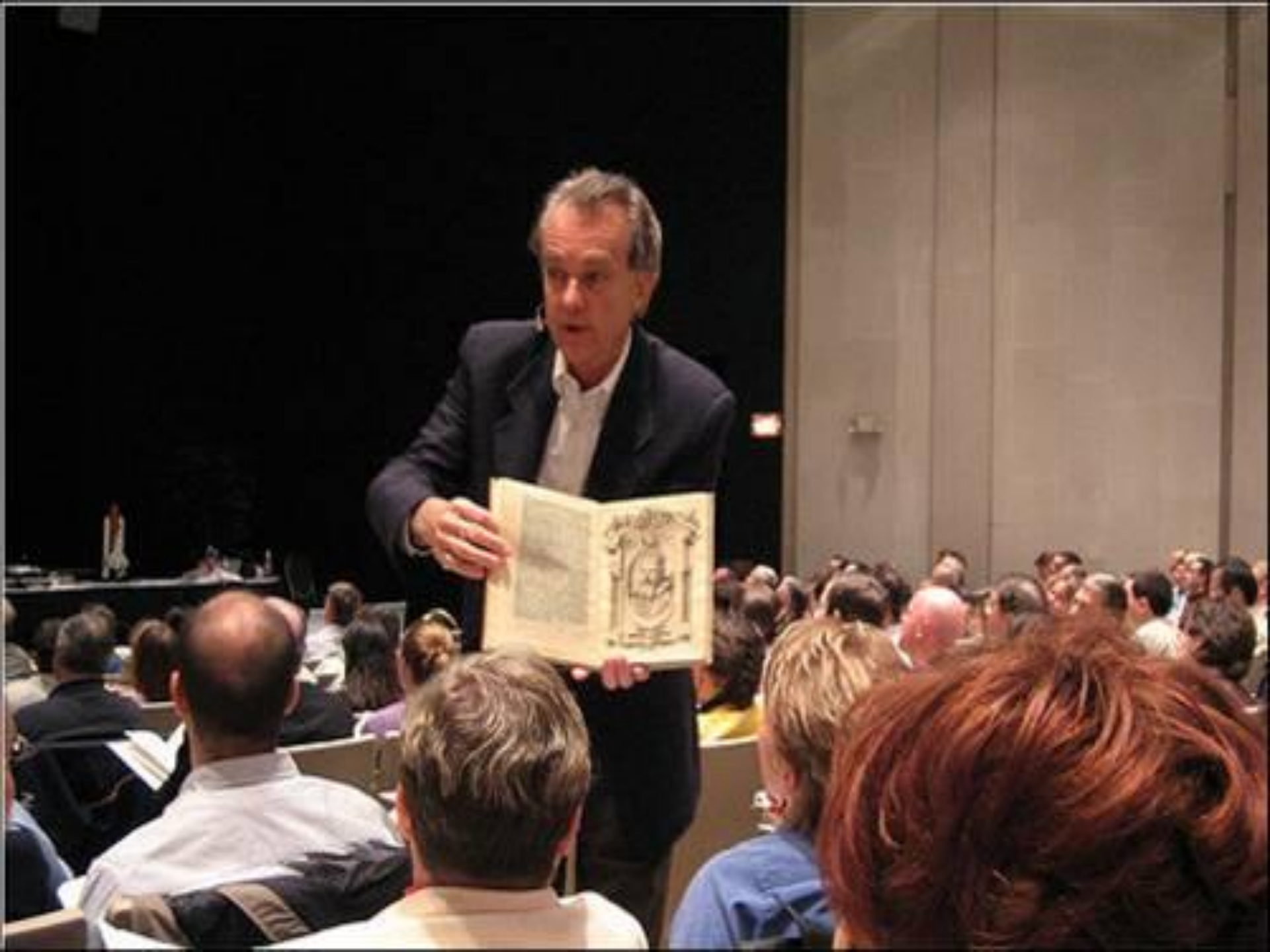


EDWARD TUFTE

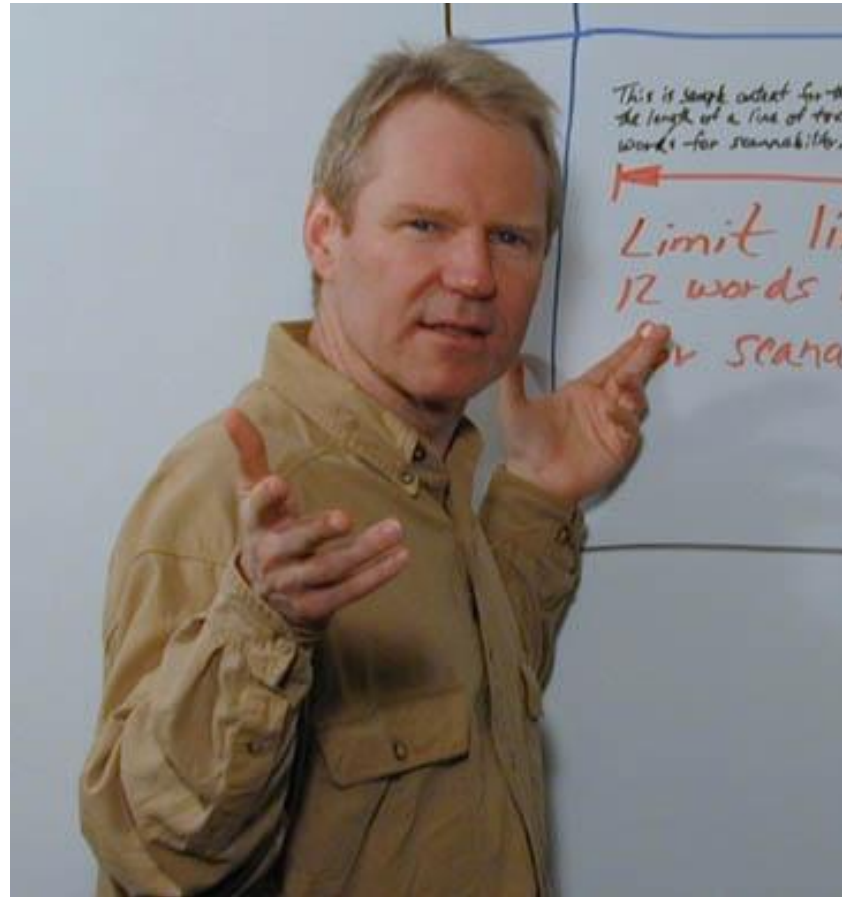
BEAUTIFUL EVIDENCE

Tufte presents sold-out, 1 day seminars around the country





Another thought-leader is Stephen Few, who wrote a couple of books on the topic of data presentation



# Stephen Few



# INFORMATION DASHBOARD DESIGN

The Effective Visual Communication of Data



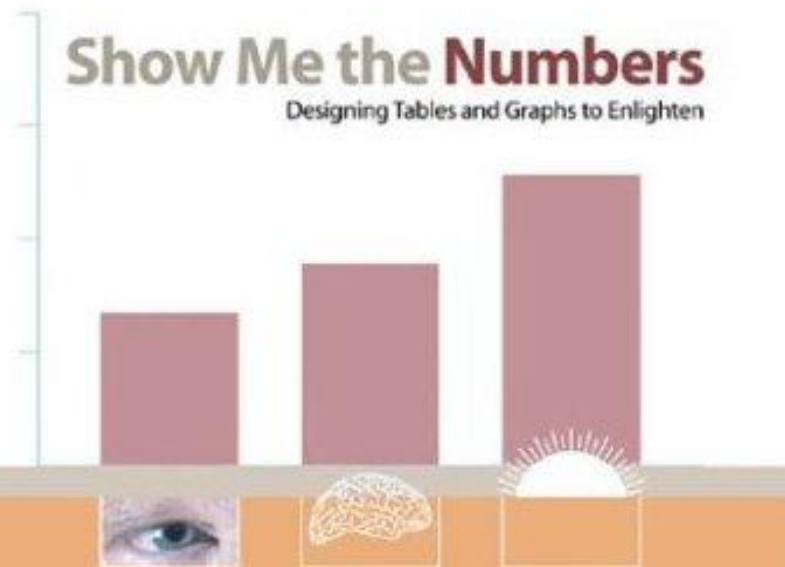
Stephen Few

O'REILLY®



# Show Me the Numbers

Designing Tables and Graphs to Enlighten



Stephen Few

What are the goals for an excellent chart/graph?

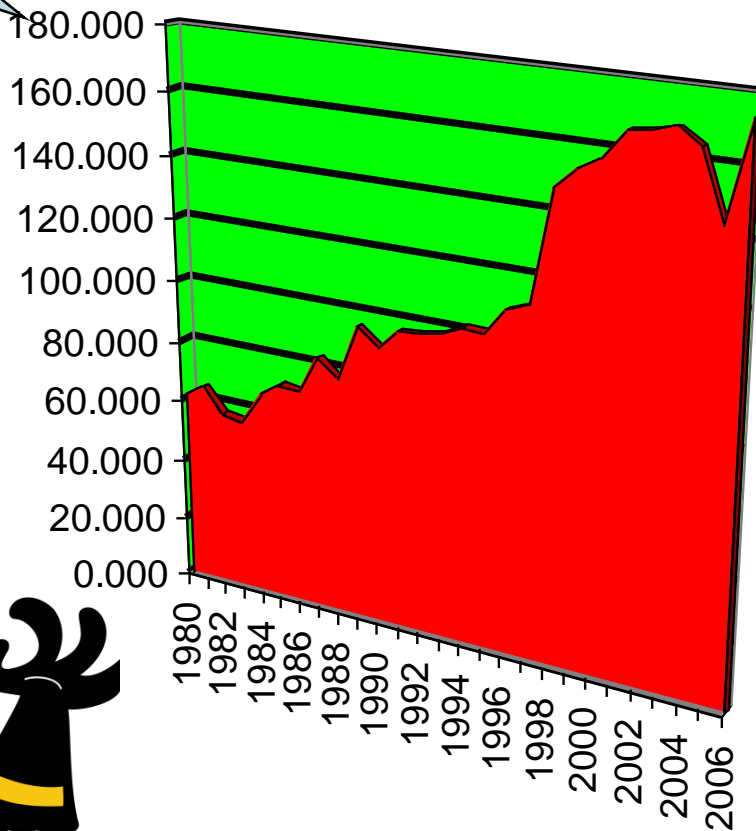
Show the data

Get the viewers to ask questions

This graphic shows a lot of things, many of which aren't the actual data.

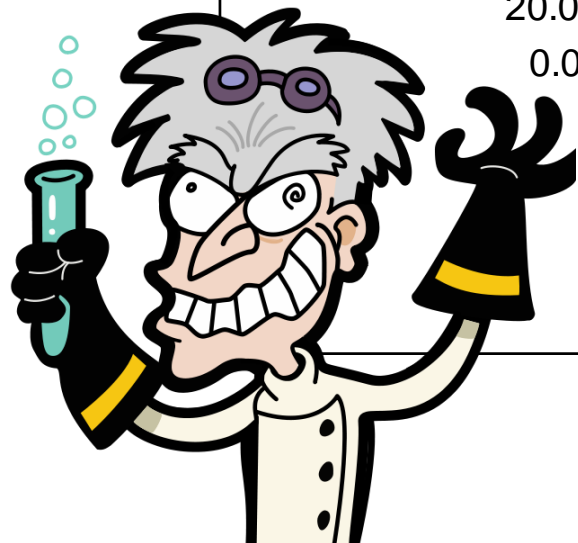
It may get you asking questions, but you'll have to get through the noise first

## Invention Patents Issued - U.S.



Thousand/Year

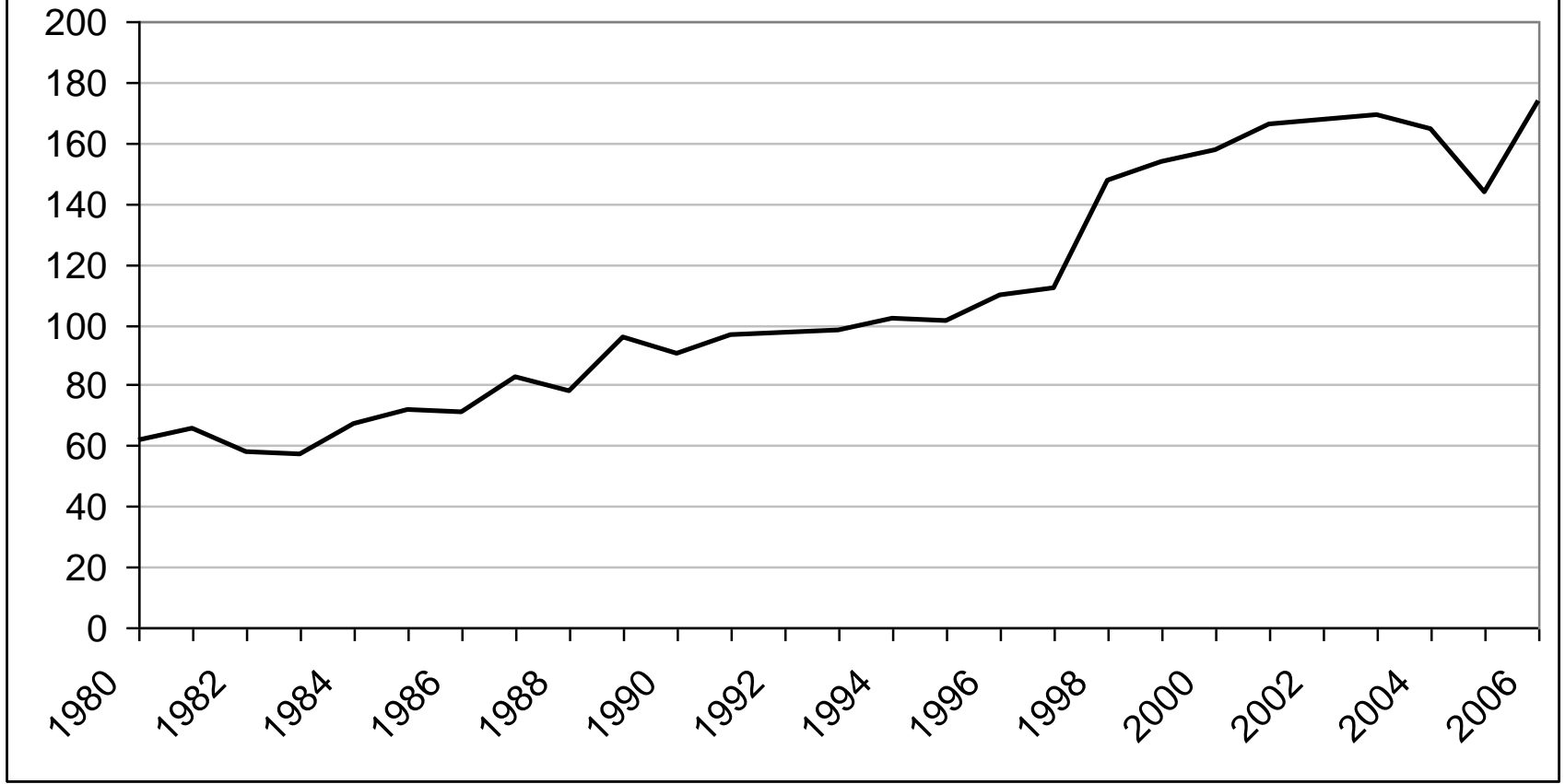
Source: US Statistical Abstract, 2008



In the cleaned-up version, only the data is shown.

Now that I can focus on the data, I can start asking questions about it. Why the sharp rise in the late 90's? Why the one year dip in 2005?

## Invention Patents Issued - U.S (Thousand/Year)



Source: US Statistical Abstract, 2008

A blue waveform graphic, resembling a signal or sound wave, is centered on a white background. The waveform has several peaks and troughs of varying heights. Overlaid in the center of the waveform is the text "Data/Ink Ratio" in a white, sans-serif font.

Data/Ink Ratio

Data-ink ratio =

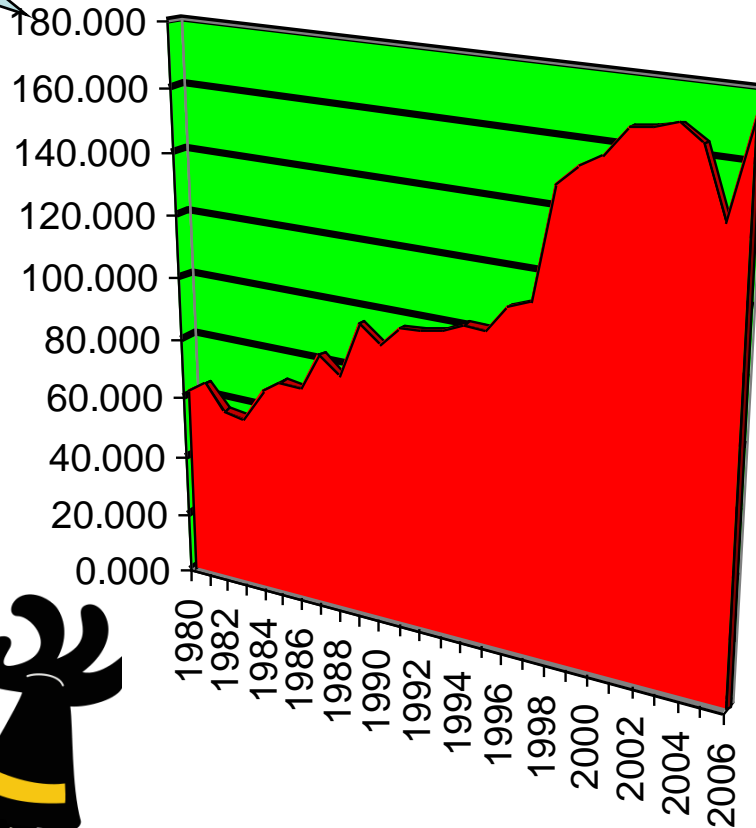
$$\frac{\text{data ink}}{\text{total ink used in graphic}}$$



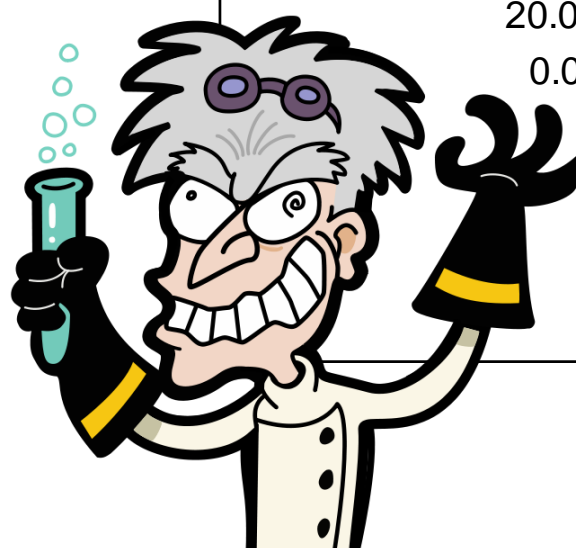
The data-ink ratio in this graphic is very poor. Look how much ink (or pixels) is dedicated to non-data.

This includes the clipart, as well as the green and red in the graph.

## Invention Patents Issued - U.S.



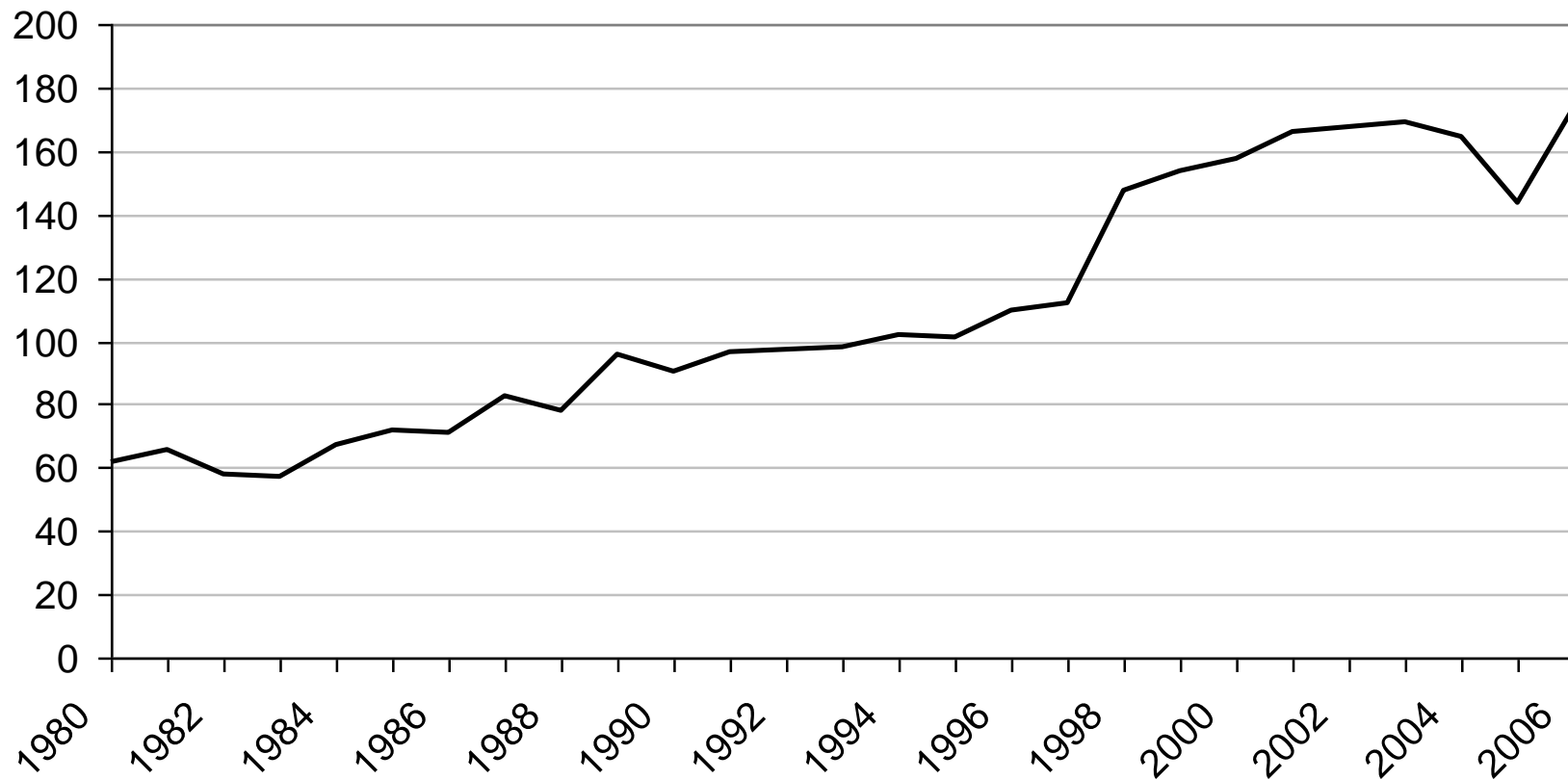
■ Thousand/Year



Source: US Statistical Abstract, 2008

Much better data-ink ratio.

## Invention Patents Issued - U.S (Thousand/Year)



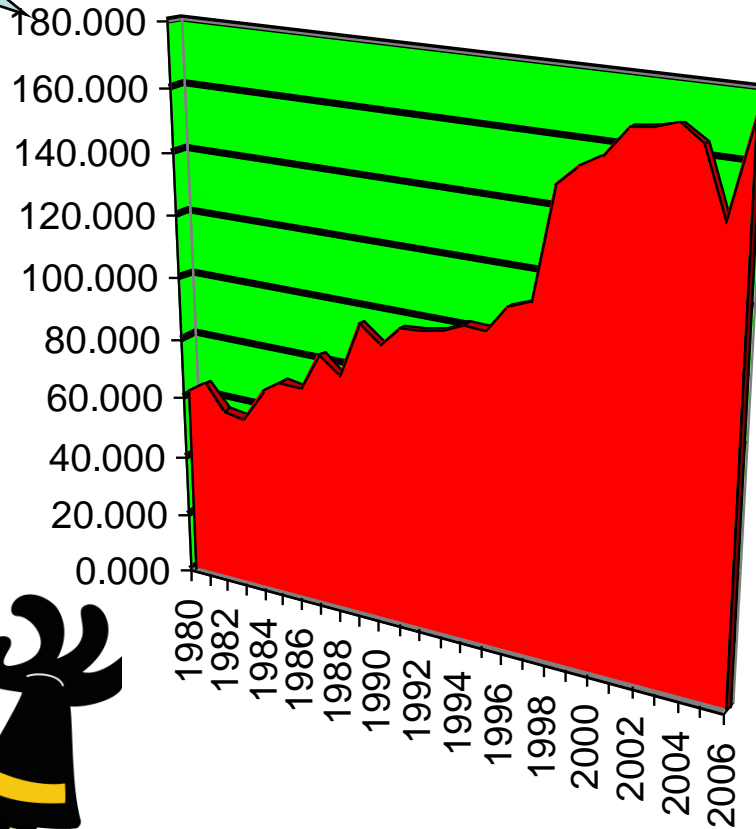


Chartjunk

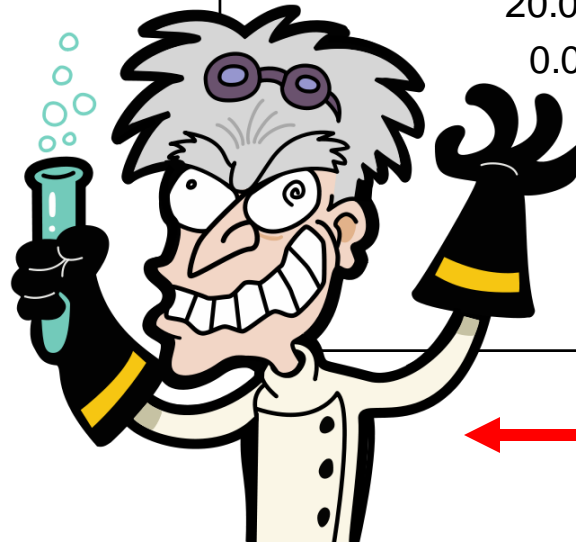
Chartjunk exists solely to make the graphic more "aesthetically pleasing", or in this case to distract you from the data.

If you think your graph is boring, you have the wrong data.

## Invention Patents Issued - U.S.

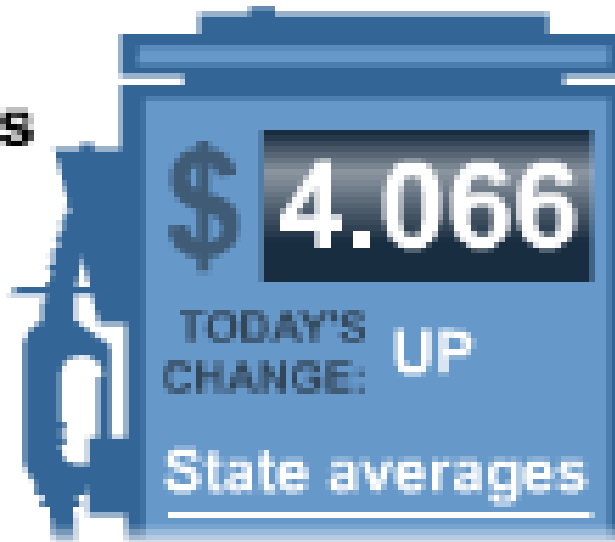


■ Thousand/Year



Here's a graph from USA today. It has two points of data. That gas is \$4.066, and that it is up. That's it. But it wasted a lot of pixels making the data more "approachable".

**Track  
today's  
gas  
price**



The idea of chartjunk can apply to websites too., Look at all of the eye-catching graphics that distract you.



Yahoo! **HotJobs**: Lucrative Work-a

Web | Images | Video | Local | Shopping | more

Search:

Web Search

Yahoo! Home

My Yahoo!

Jun 14, 2008 | Pe

Answers

Autos

Calendar

Finance

Games

Groups

HotJobs

Maps

Mobile Web

Movies

Music

News

OMG

Personals

Real Estate

Shopping UPDATED!

Featured

Entertainment

Sports

Video



### First Hulk not green

The original Hulk wasn't green, and Arnold Schwarzenegger wanted to play him on the TV show. [» Fun facts](#)

- Report: Norton mad over final edit
- Users like new remake of 'The Hulk'



Fun 'Hulk' facts: He wasn't originally green



WNBA star called 'traitor' for her Olympic choice



Winehouse's racist video comes under fire



The ways airports deal with problem passengers

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World

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As of 3:49 p.m. CDT

- Cedar Rapids flood recedes; Des Moines levee fails [Photos](#)
- Black conservatives conflicted on Obama campaign ['08 Race](#)
- Bush recalls Russert as 'thorough, decent man' [Photos](#)

Hi, Marshall



Mail



Messenger



Weather  
77°F



Local



Want a New Car?  
**Why Pay Stick**  
Get Started Now!  
Get Internet Price

Done

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Done

Here's a screenshot from GM's 2007 annual report. There's some interesting data in there amount world area sales, but there's a lot of chartjunk (picture of a car and world map) that don't add any value.



▼ 2007 ANNUAL REPORT HOME

▼ FEATURE SECTION

▼ PUTTING THE WORLD ON WHEELS

A Great Start in the Russian Market

One Million Strong

A Spark in India

Rugged Around the World

European Success Story

Twin Wins in 2007

The Future of Chevy

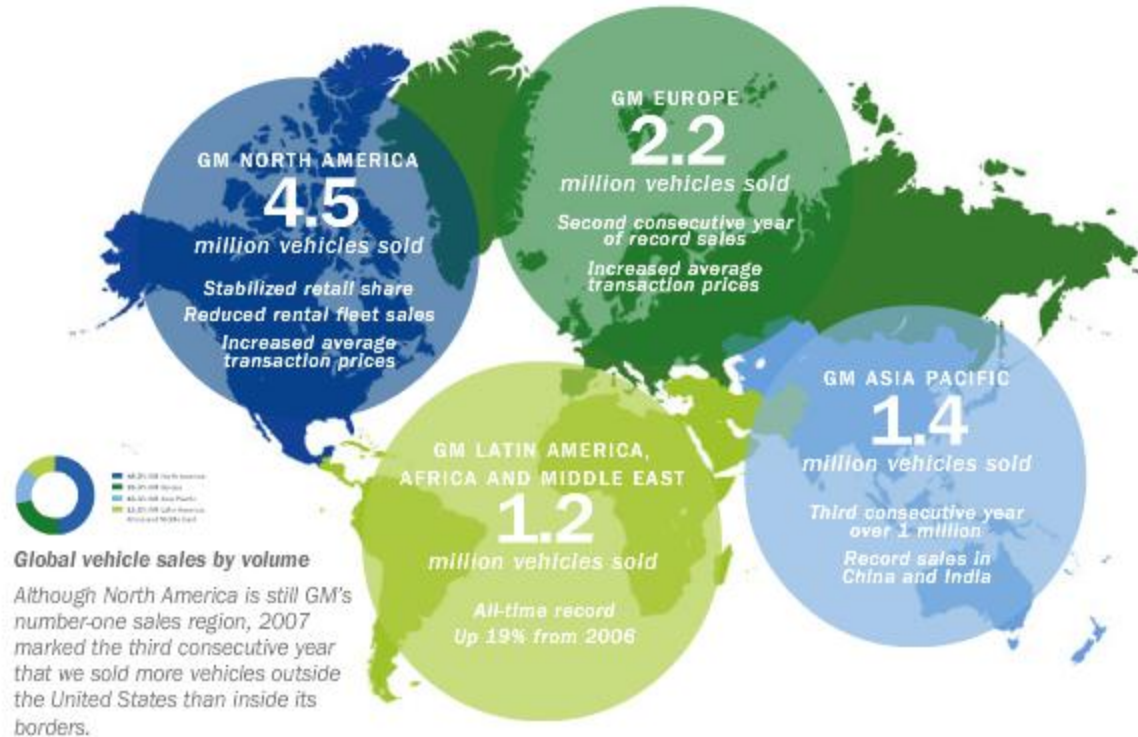
▼ DRIVING THE FUTURE

▼ A WORLD OF POSSIBILITY

▼ EXTERNAL

## PUTTING THE WORLD ON WHEELS.

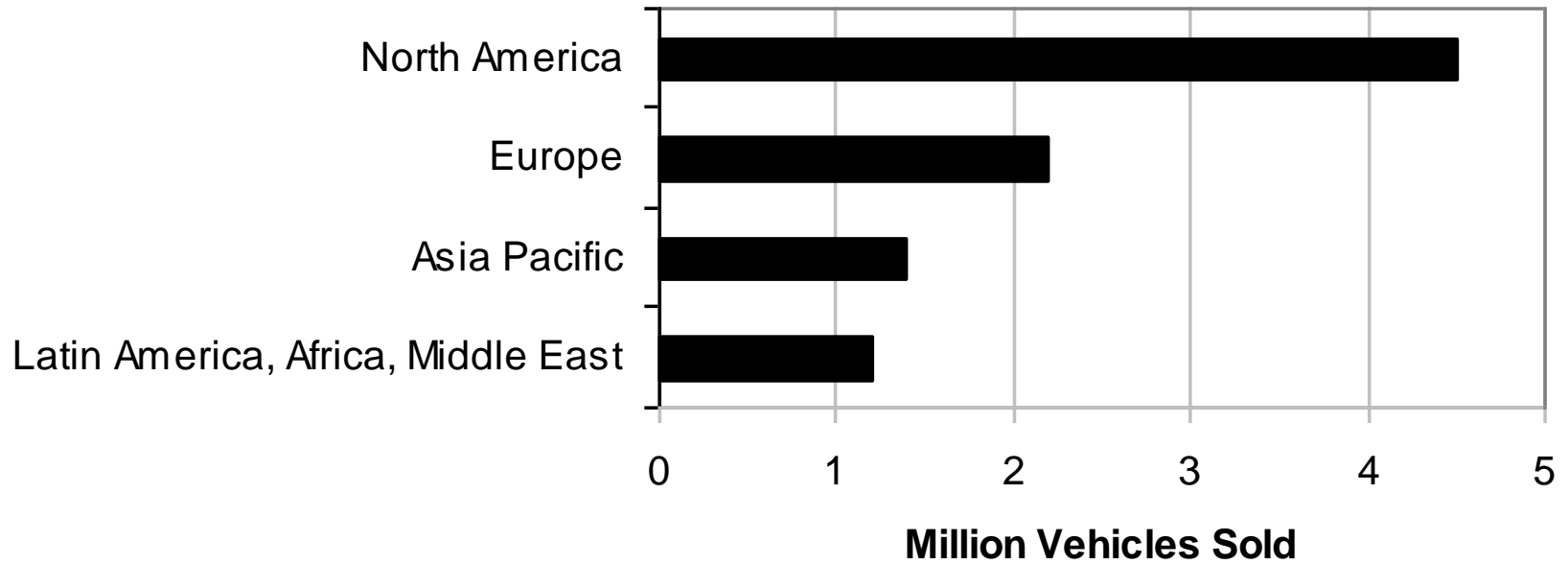
In 2007, we sold more than 9 million vehicles for the third consecutive year and the fourth time in our 100-year history. We're growing where the growth is, in emerging markets, where our share and sales continue to increase.

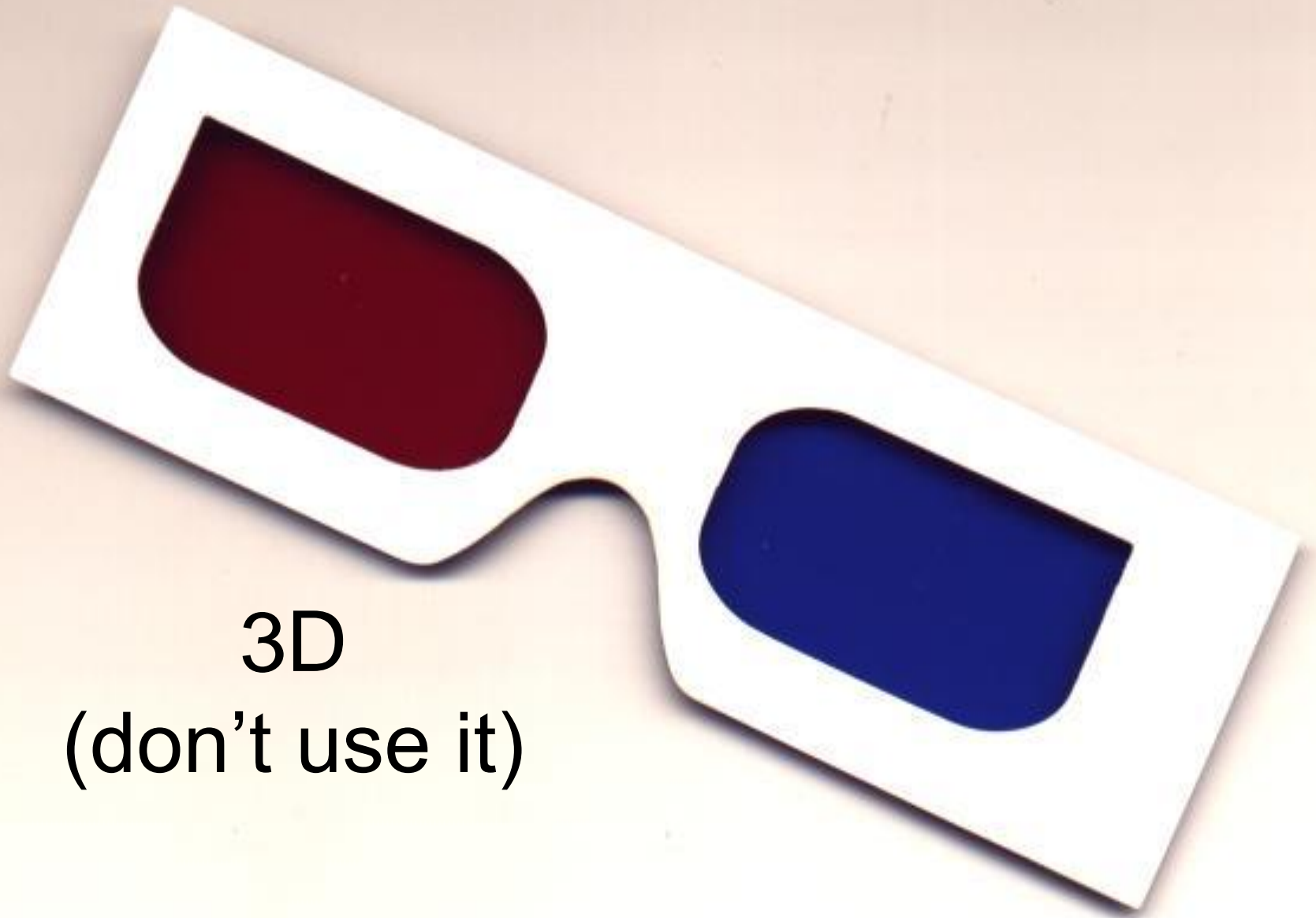




Better to just show the data. Here I can clearly see which world areas have the most sales

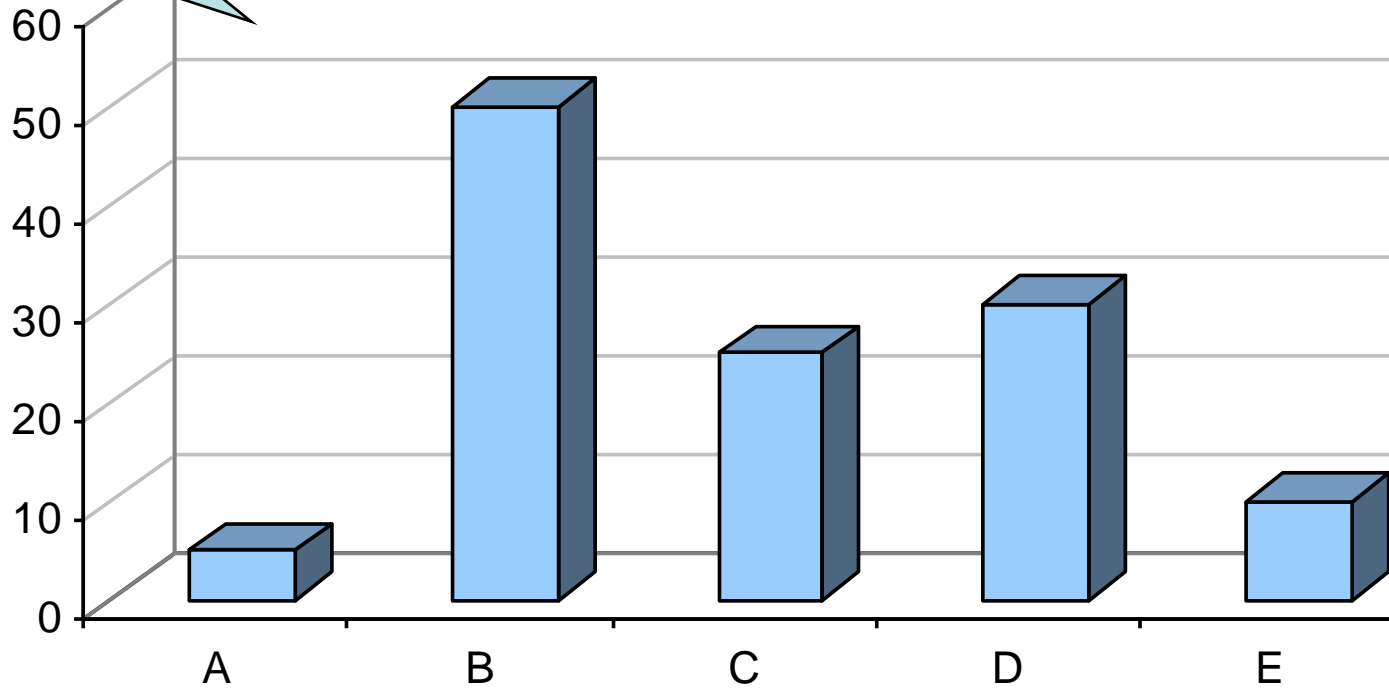
## GM Global Vehicle Sales - 2007



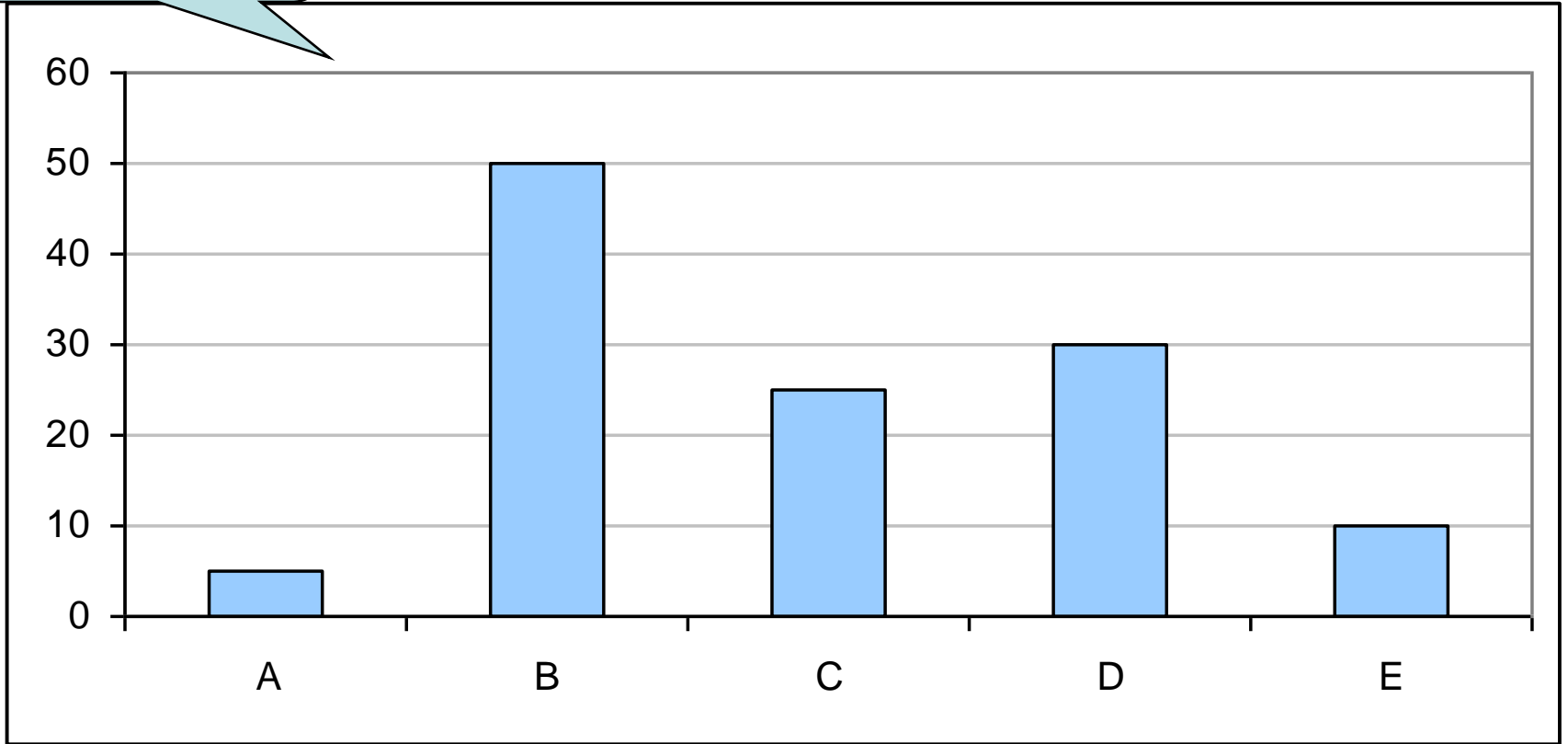


3D  
(don't use it)

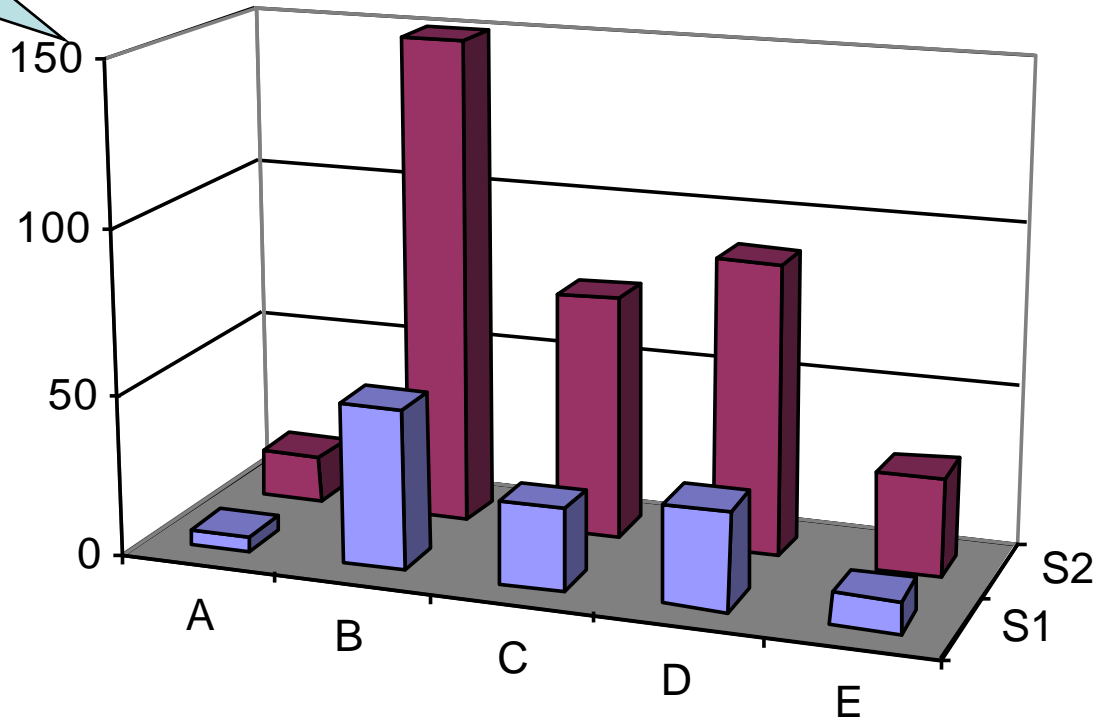
3D graphs are often used because they "look cool". But the third dimension doesn't add anything.



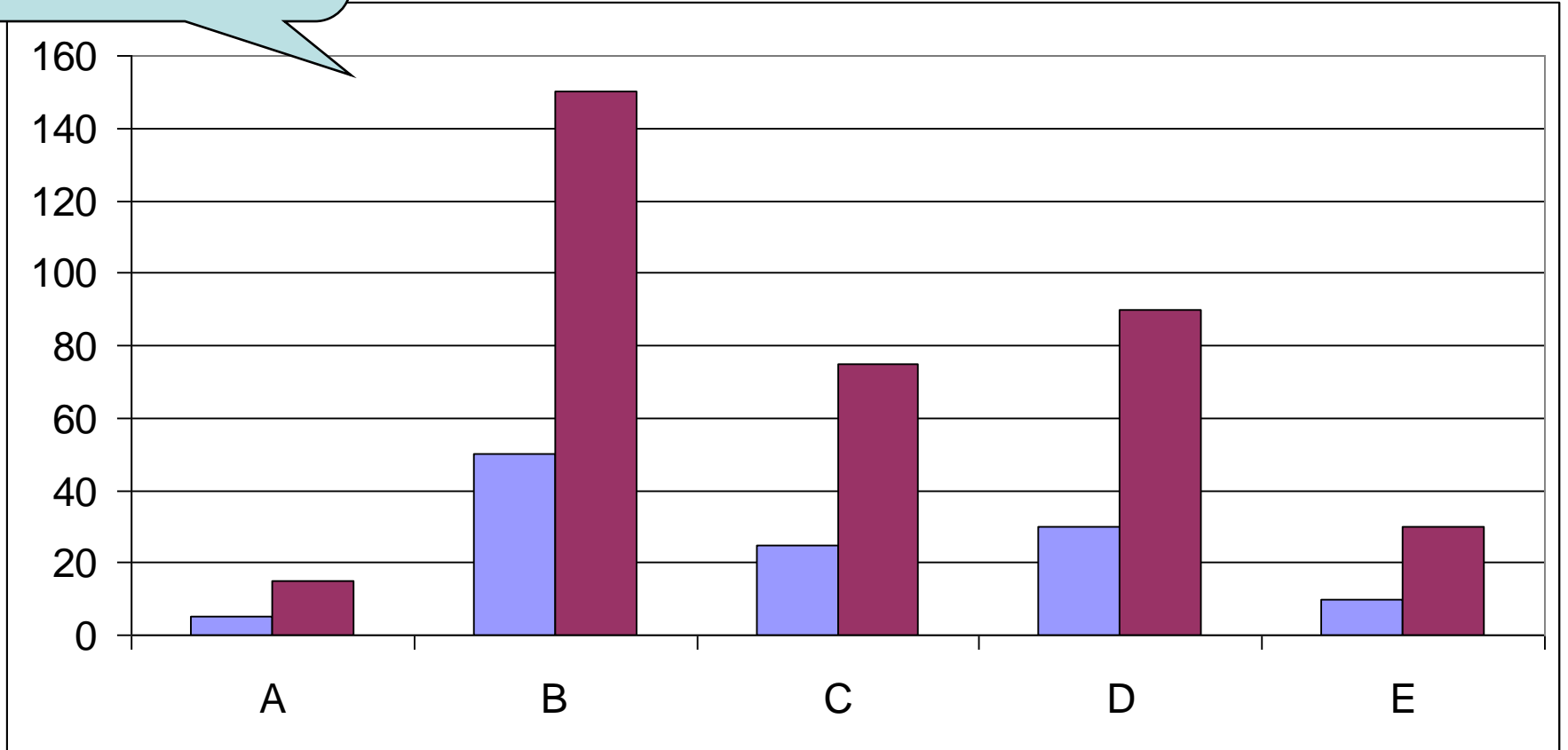
Better to just stick with two dimensions



Even worse is when the graph has multiple data series, and is even tilted! It's difficult to make comparisons between two data points.



Much better. Now I can make comparisons.



# Distortions

# Lie Factor

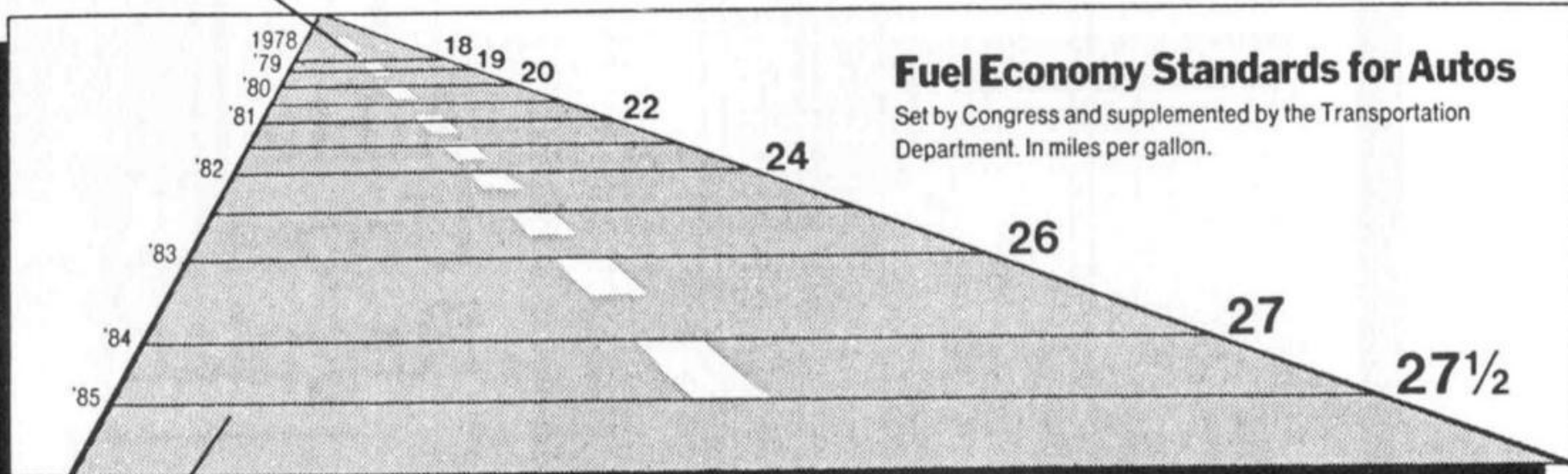


Lie Factor =

$$\frac{\text{Size of effect shown in graphic}}{\text{Size of effect in data}}$$

In 1978, a line 0.6 inches long is used to represent 18mpg, but a line 5.3 inches long (nearly 10 times longer) is used to represent 27.5 mpg (which is only 50% greater)

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



## Fuel Economy Standards for Autos

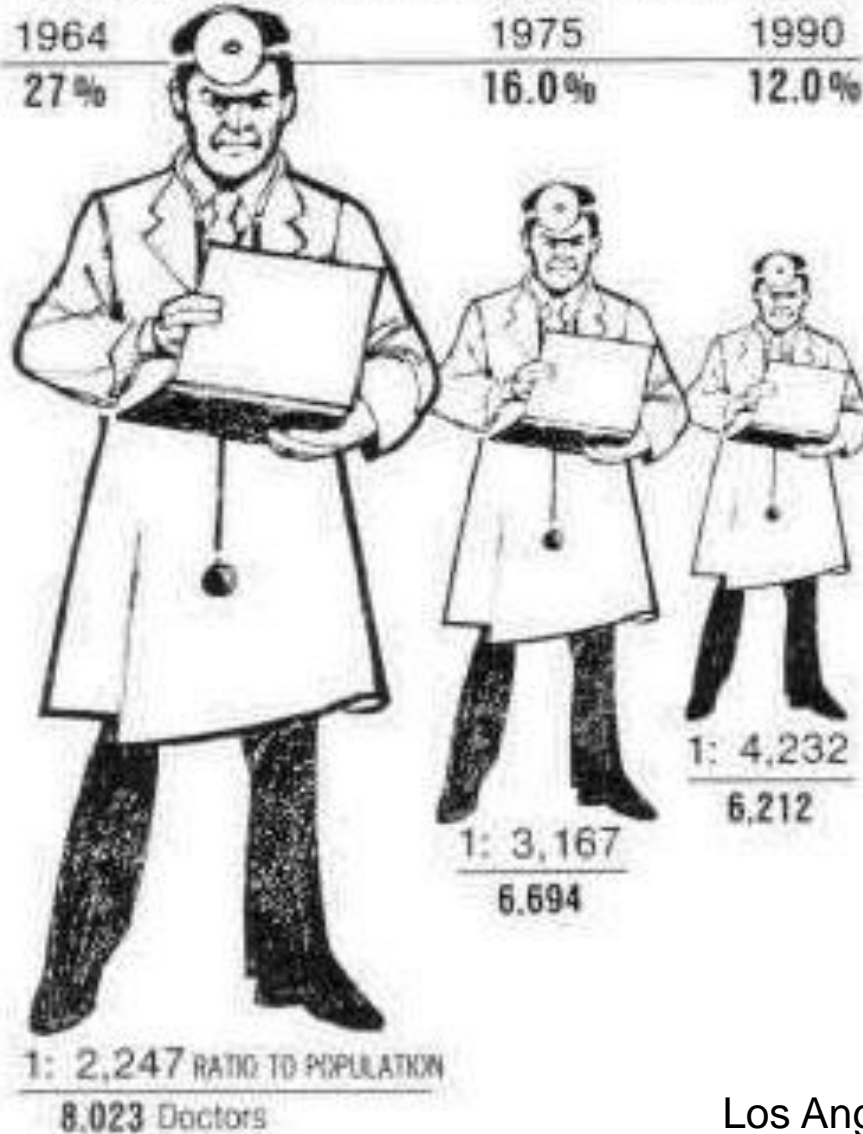
Set by Congress and supplemented by the Transportation Department. In miles per gallon.

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

# THE SHRINKING FAMILY DOCTOR In California

Percentage of Doctors Devoted Solely to Family Practice

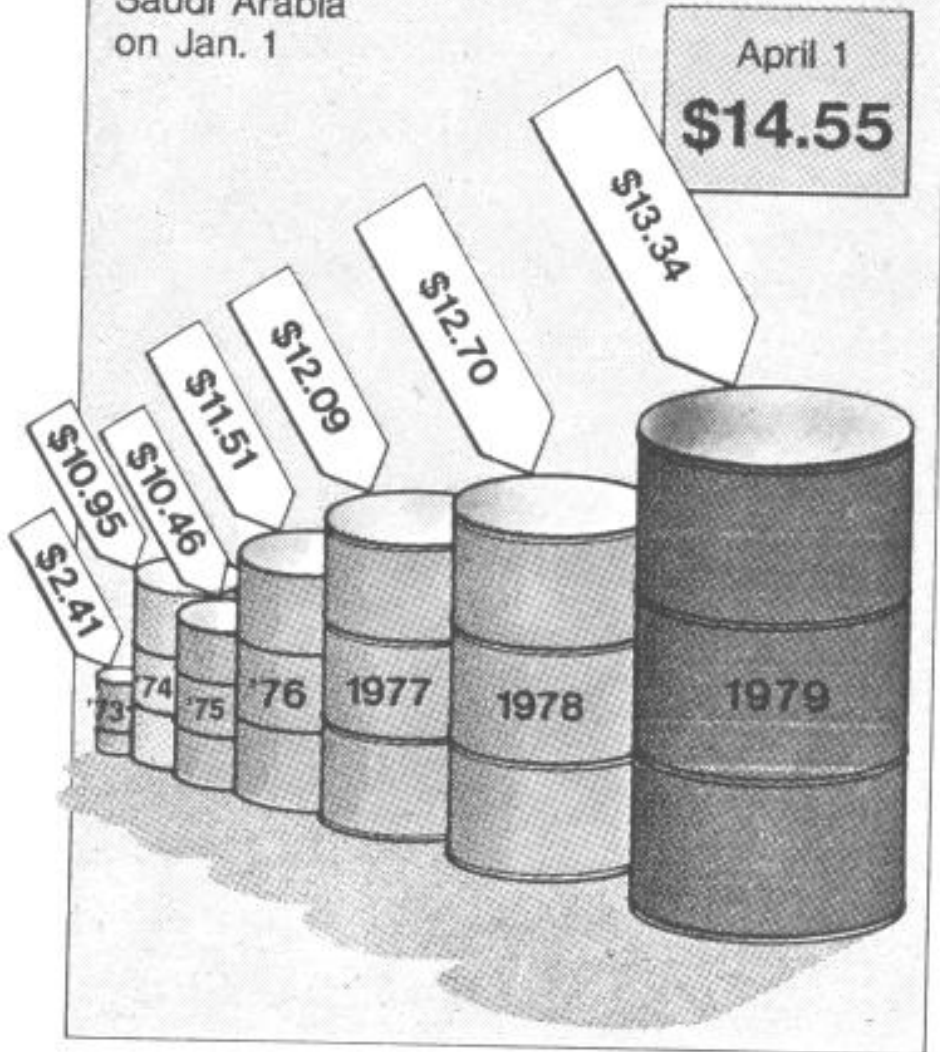
1964	1975	1990
27%	16.0%	12.0%



Another example. The 1964 percentage is a little more than twice the 1990 percentage, but the 1964 doctor is huge compared to the 1990 doctor

# IN THE BARREL...

Price per bbl. of  
light crude, leaving  
Saudi Arabia  
on Jan. 1



Same thing for comparing the  
1973 and 1979 price of oil

A round pie with a lattice crust is centered on a dark, reflective surface. The pie is made of golden-brown, flaky dough strips woven into a grid pattern. The filling is visible through the lattice, appearing to be a fruit-based mixture. The lighting is soft, highlighting the texture of the crust. The background is a dark, slightly textured surface, possibly a countertop or table.

# Pie Charts

The GM annual report also contained a pie chart on how sales are distributed across the world.



## PUTTING THE WORLD ON WHEELS.

In 2007, we sold more than 9 million vehicles for the third consecutive year and the fourth time in our 100-year history. We're growing where the growth is, in emerging markets, where our share and sales continue to increase.

✓ 2007 ANNUAL REPORT HOME

✓ FEATURE SECTION

### ✓ PUTTING THE WORLD ON WHEELS

A Great Start in the Russian Market

One Million Strong

A Spark in India

Rugged Around the World

European Success Story

Twin Wins in 2007

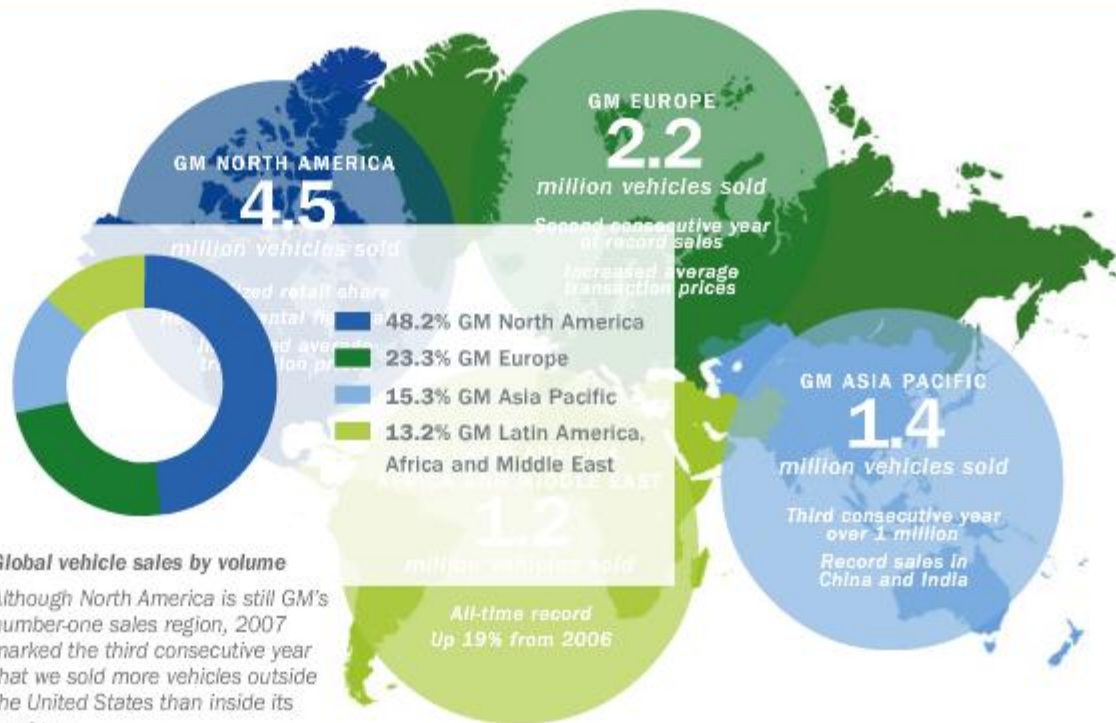
The Future of Chevy

### ✓ DRIVING THE FUTURE

### ✓ A WORLD OF POSSIBILITY

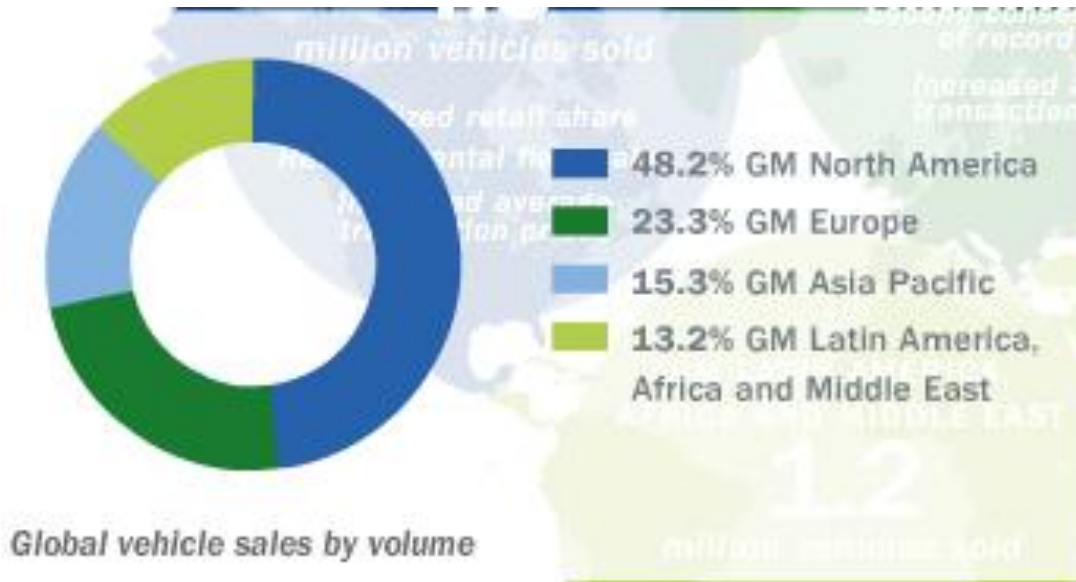
✓ EXTERNAL

Download 2007 AR PDF  
Annual Report Archive

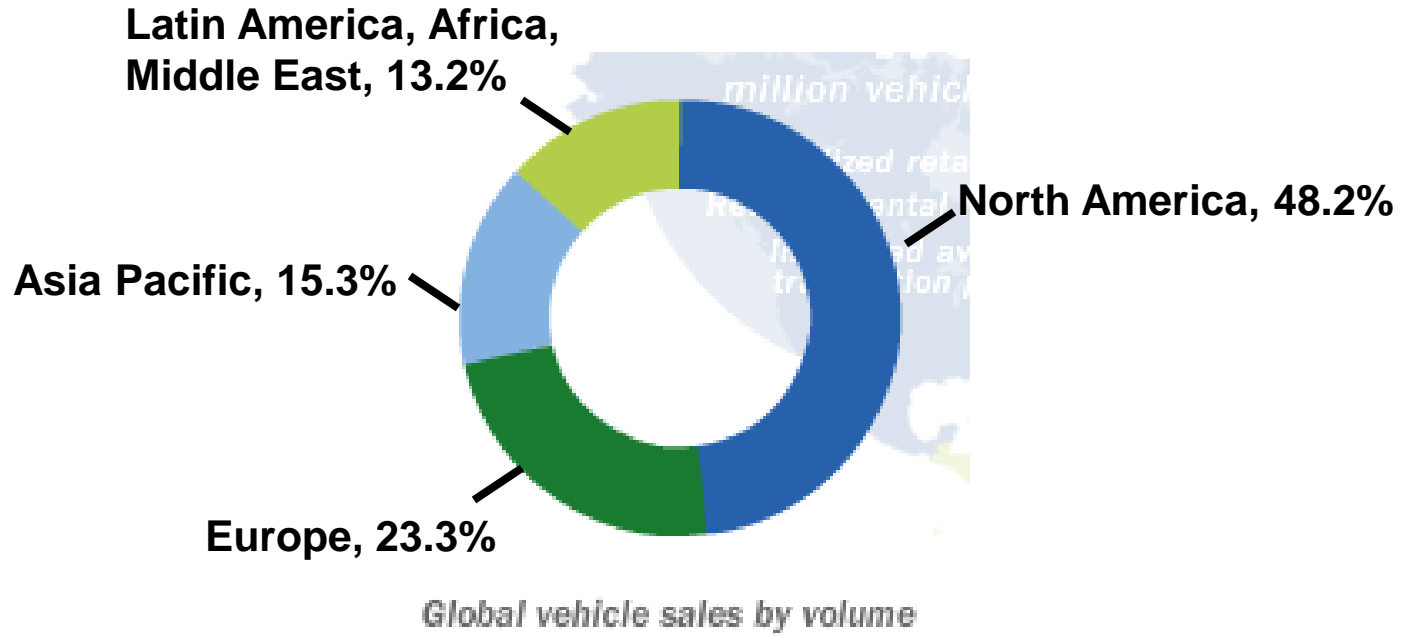


Here's a zoomed in version.

The problem with this pie chart is that I have to continually go back and forth from the chart to the legend when reading it.



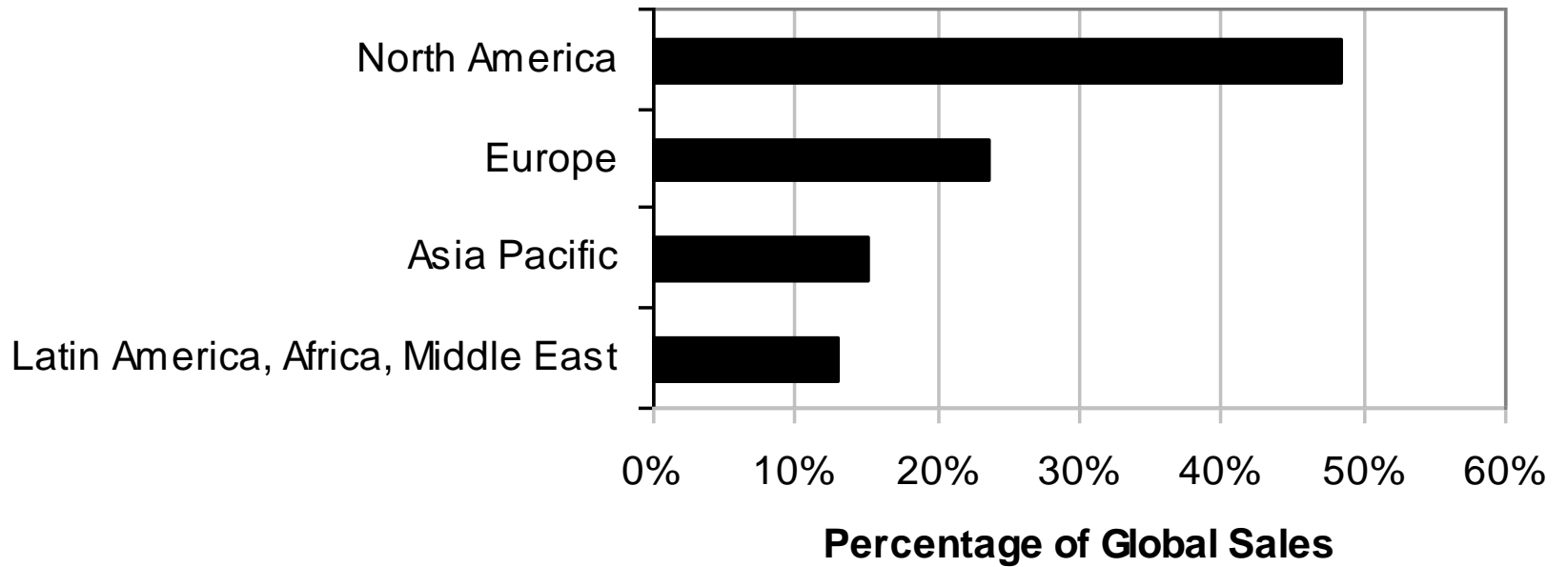
This is a little better. At least the numbers are tied to the area on the graph





Better yet, just give me a simple bar graph. It's much easier to make comparisons this way.

## GM Global Vehicle Sales - 2007

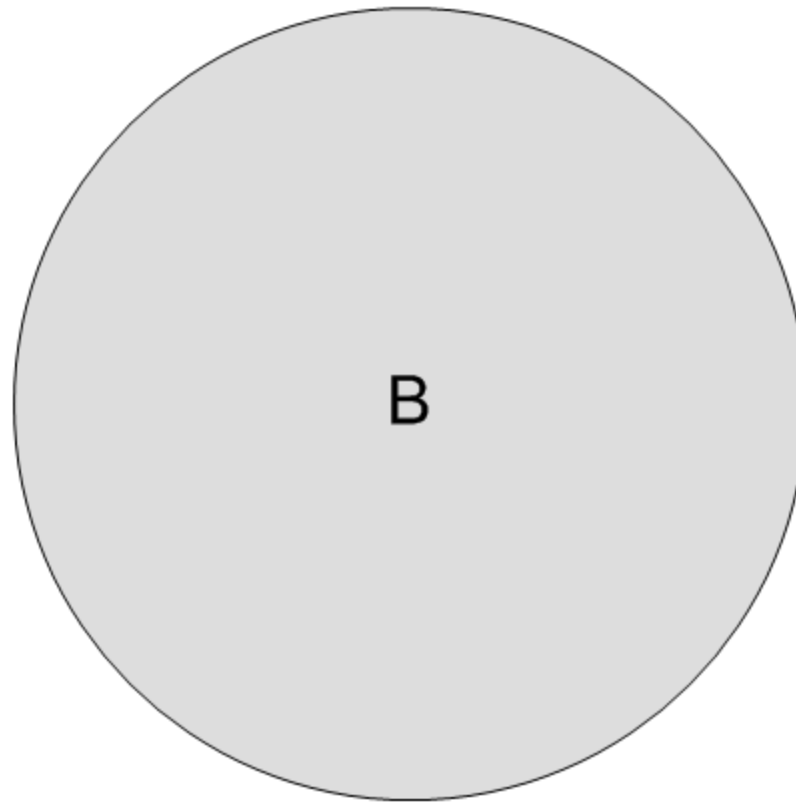
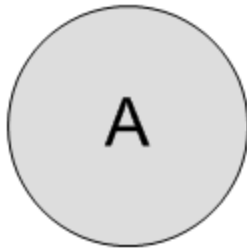




Area comparisons

One of the problems with pie charts is that to compare pie slices, we need to compare the size of the slices. Unfortunately the human eye isn't good at comparing area.

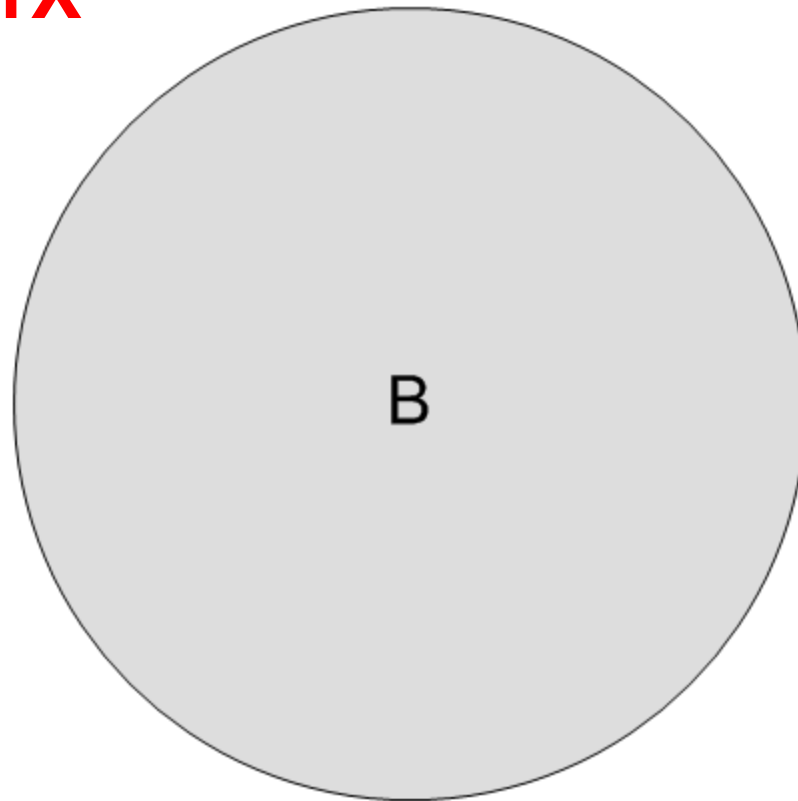
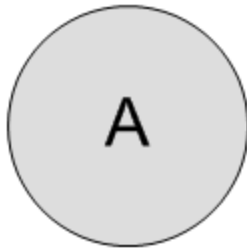
# How much bigger is Circle B?



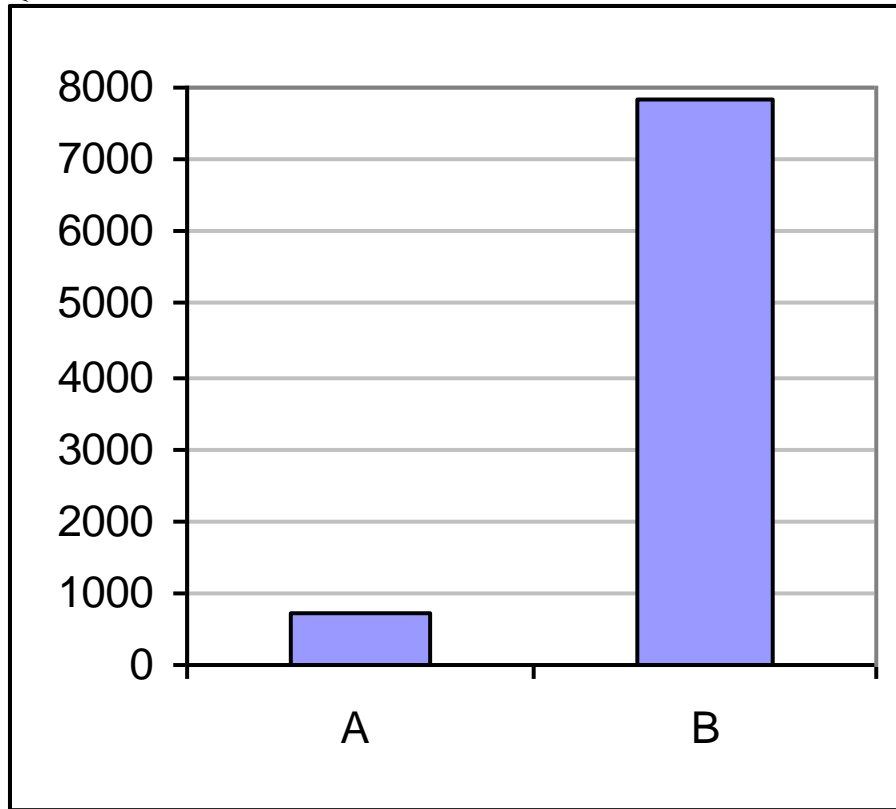
In the presentation at Exchange,  
the audience guessed 5x bigger or  
10x bigger.

# How much bigger is Circle B?

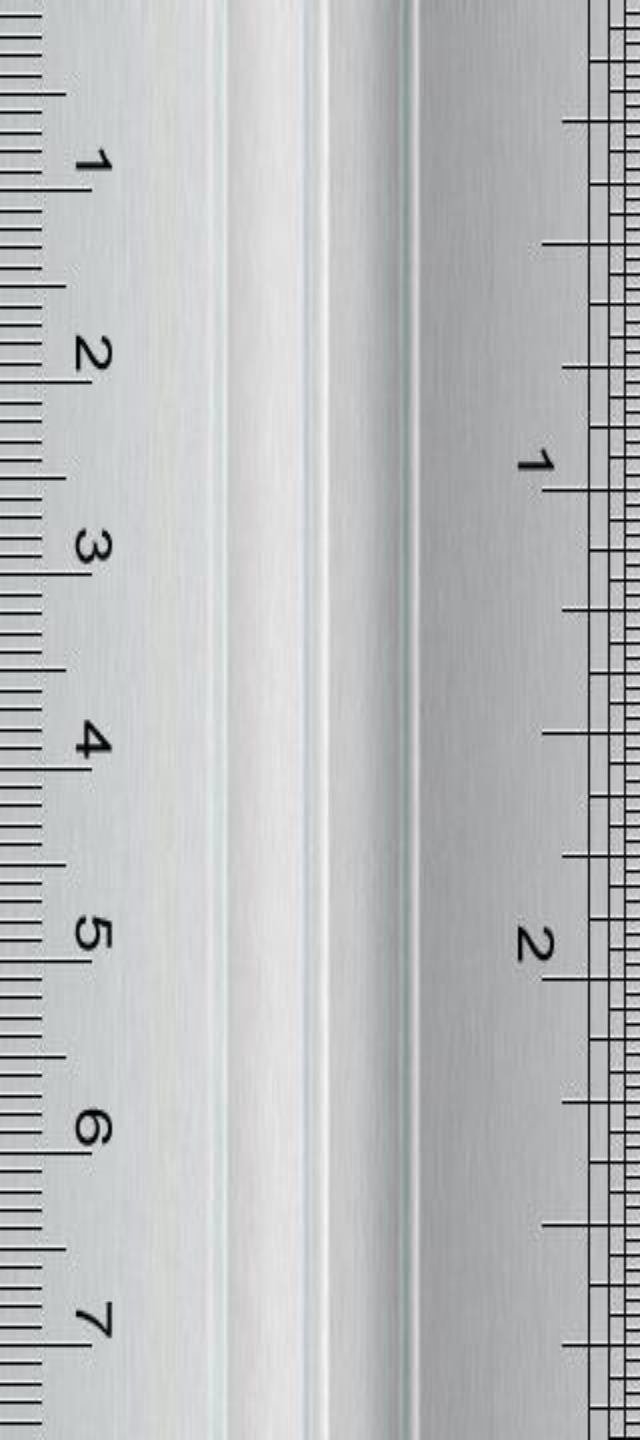
**Over 11X**



Much more effective to just put it in a bar graph.



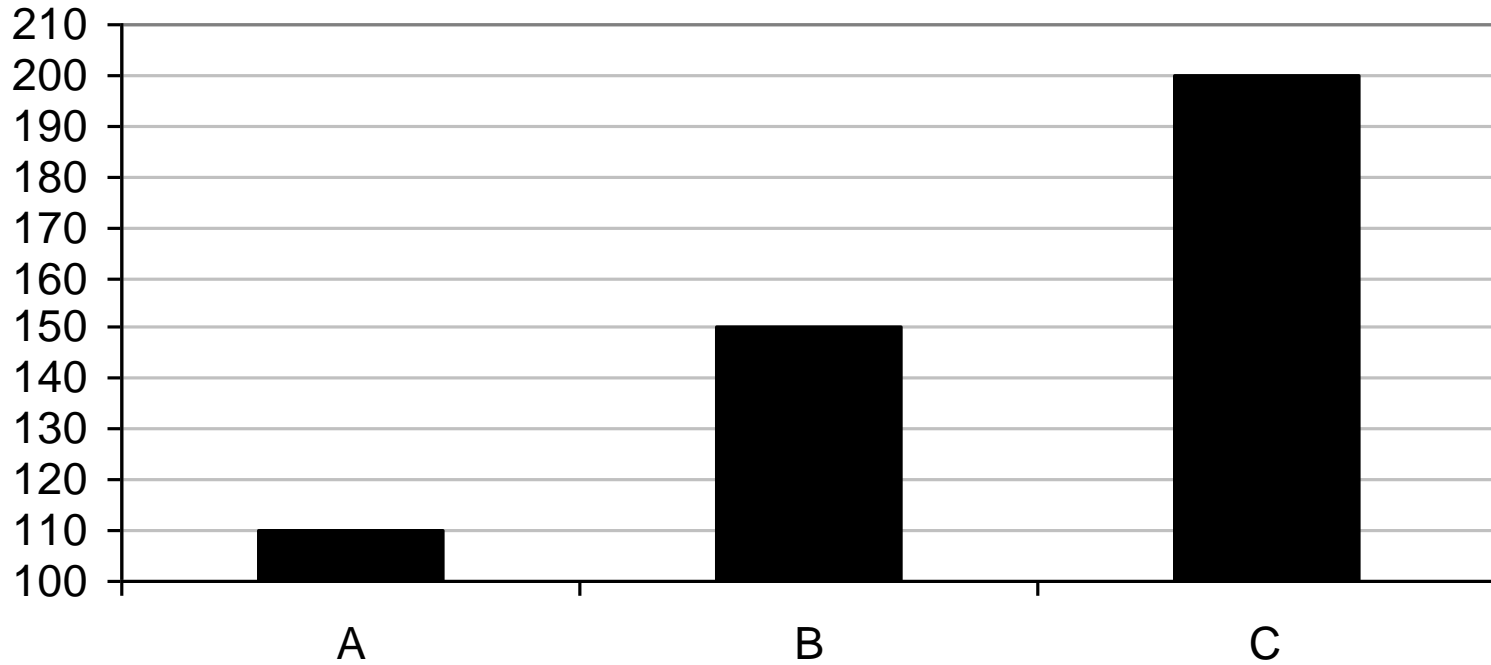
# Scales



When the scale doesn't start at zero, it can be misleading.

In the graph below, the value of C is nearly twice as large as A. But the C's bar is nearly 10 times larger than A's bar.

**What's wrong with the scale on the left?**



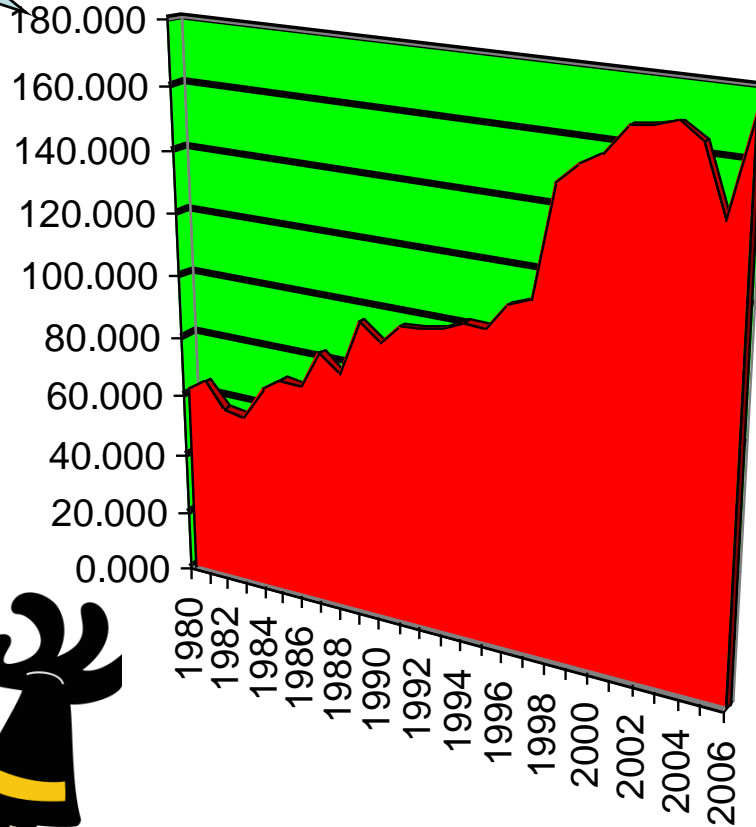
# Grid Muting



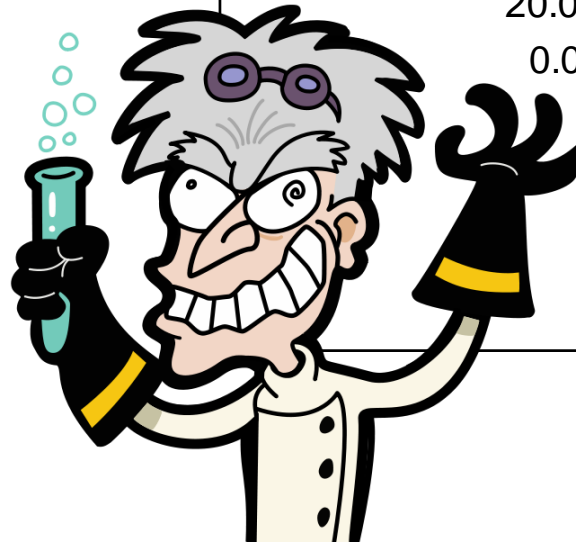
Here's a really easy way to improve your graph.

Why is the gridline on the graphs so dark?

## Invention Patents Issued - U.S.

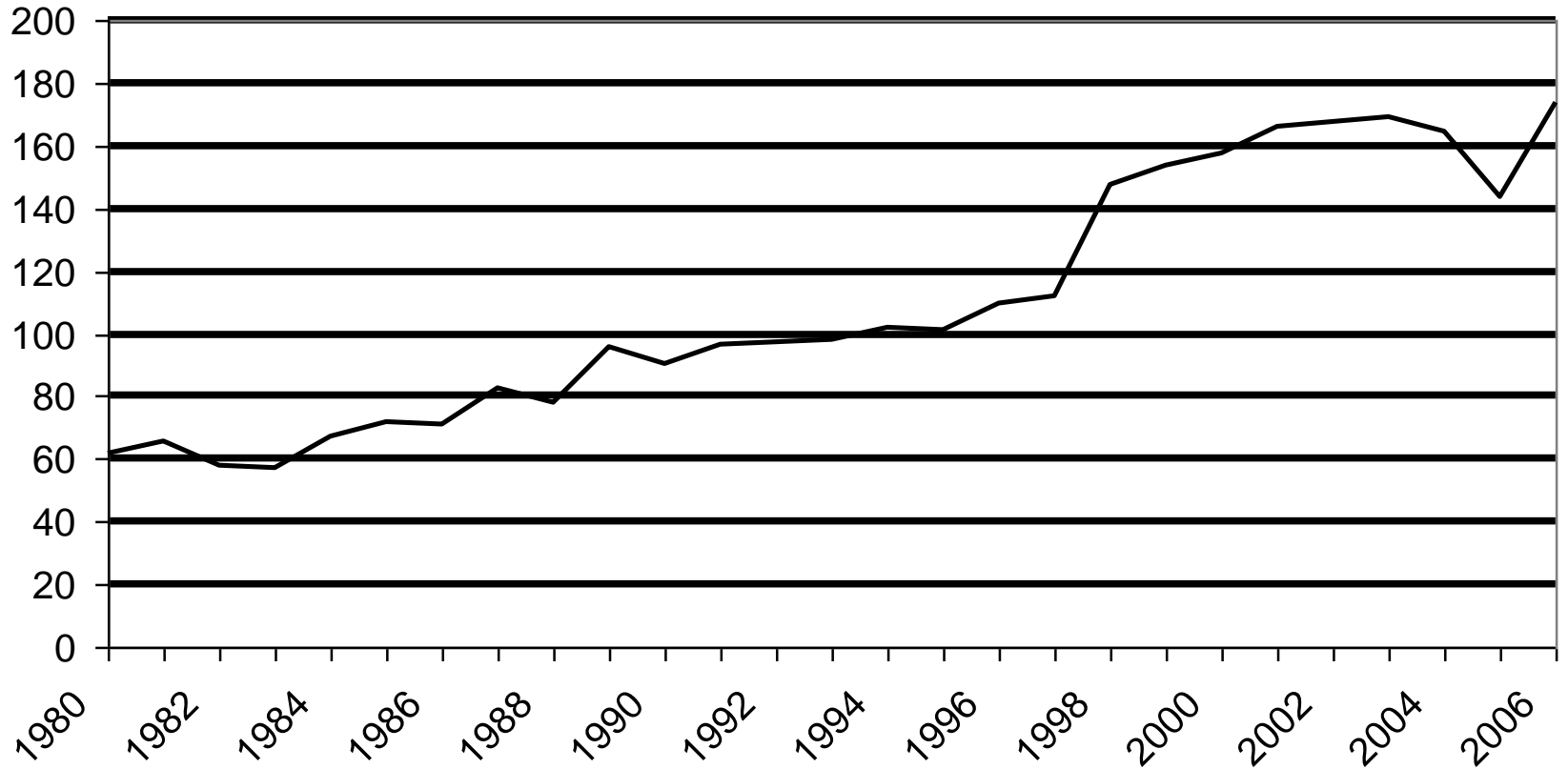


■ Thousand/Year



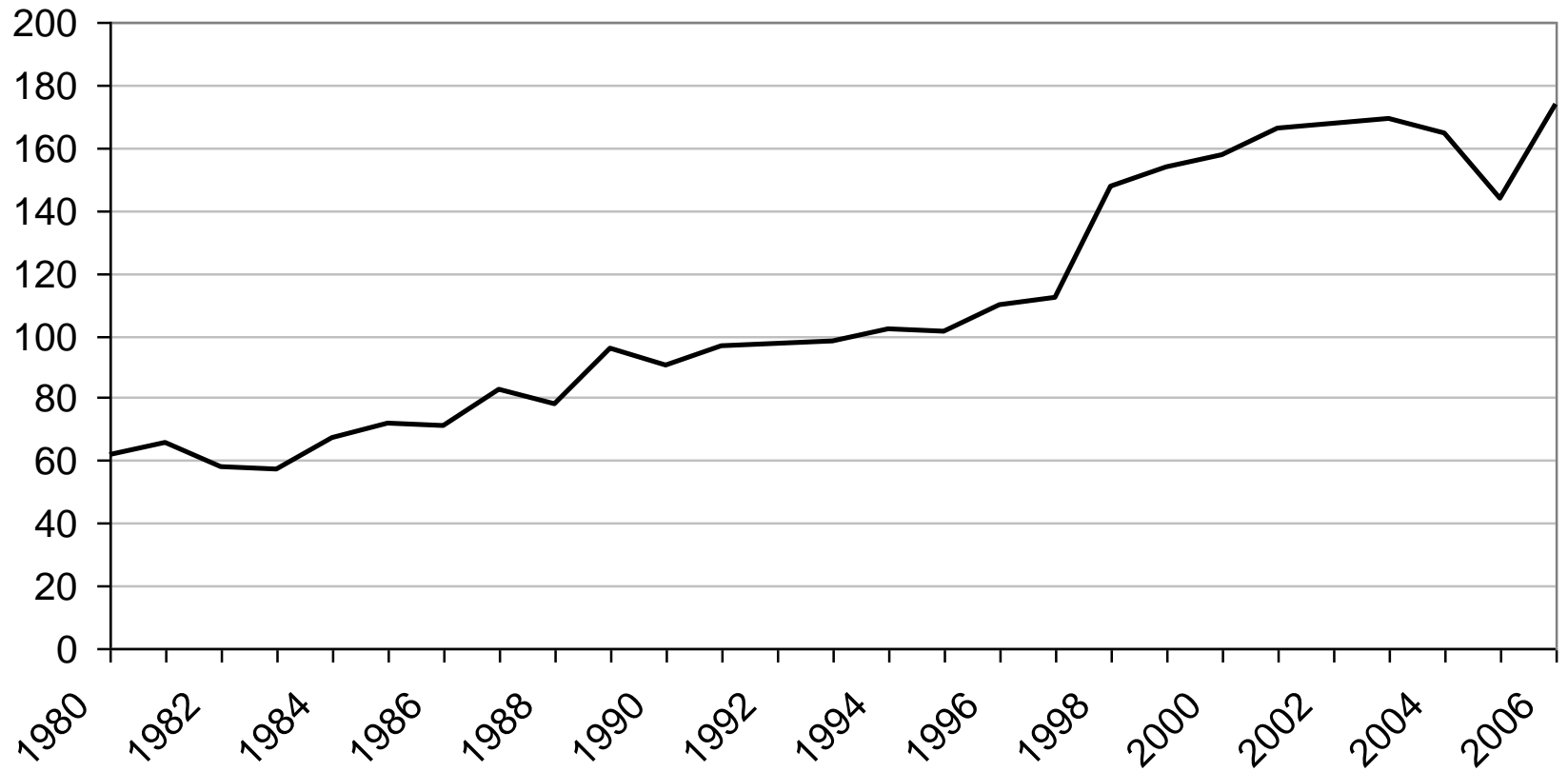
Here the lines are dark on the simplified graph. Why?

## Invention Patents Issued - U.S (Thousand/Year)



Much better. Just change the color of the line to grey, and they are muted and get out of your way.

## Invention Patents Issued - U.S (Thousand/Year)

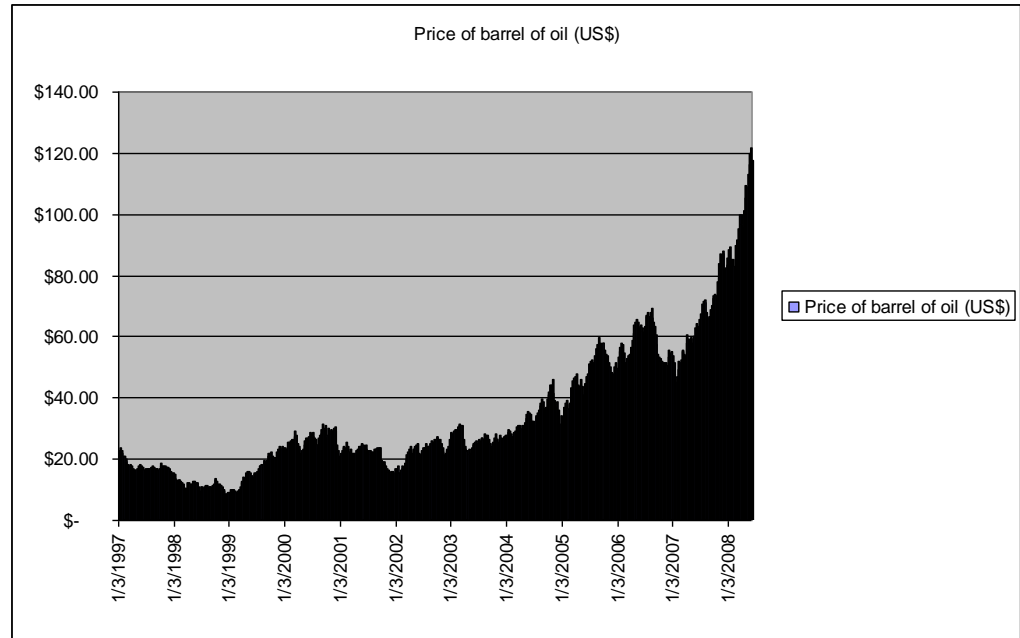


Demo

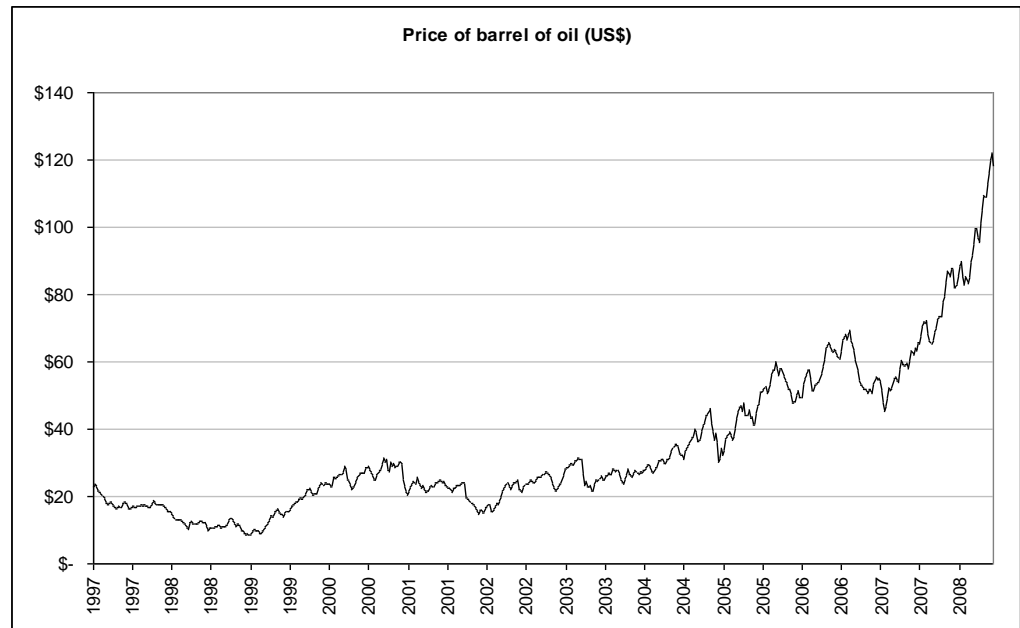


In the presentation I showed several techniques in Excel for taking the default chart from Excel and improving it

Before



After

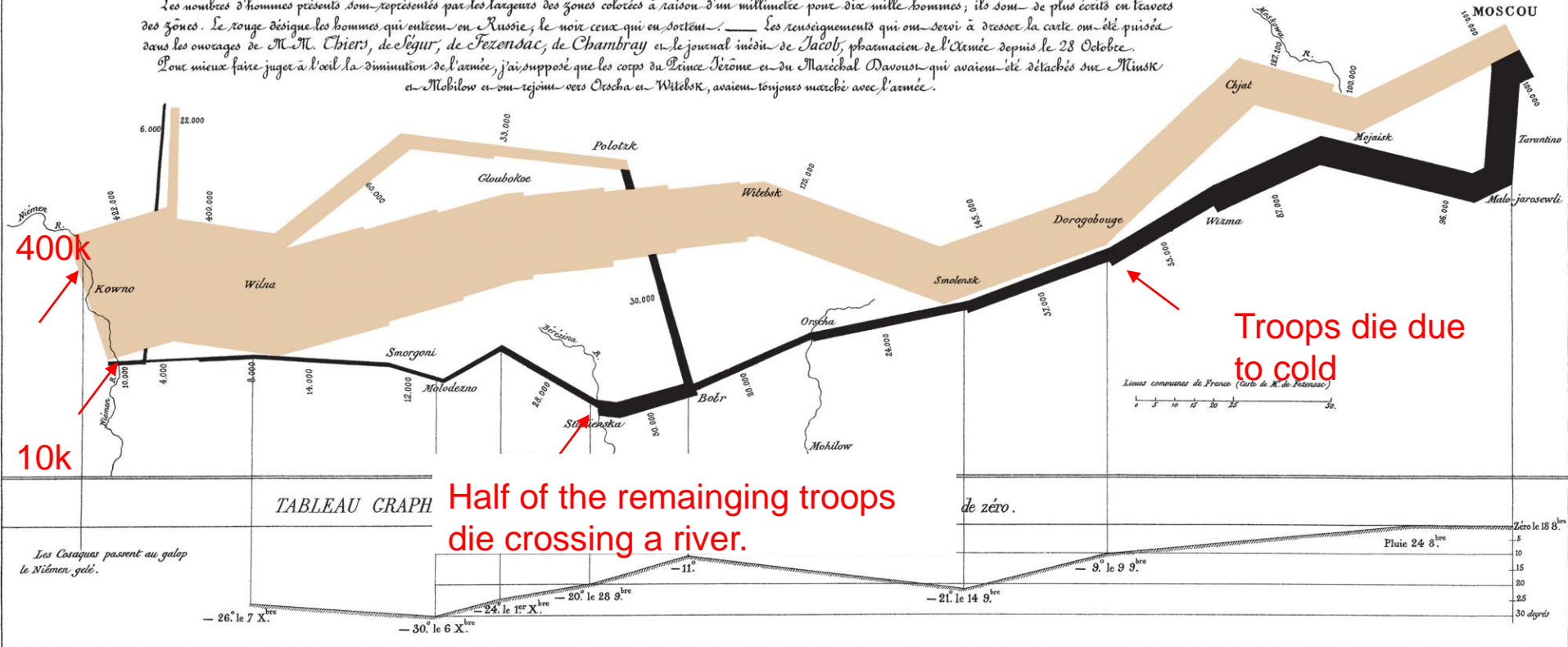


An example of an excellent graphic

# Napoleon's march into Russia

*Carte Figurative* des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.  
Dressée par M. Mimarid, 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 Fézensac, 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 Davoust qui avaient été détachés sur Minsk et Mabilow n'en rejoignent vers Orscha et Witebsk, avaient toujours marché avec l'armée.



This is an amazing graphic. It was drawn by a French designer in the 1880s.

- The width of the line represents the size of Napoleon's army. It was 400,000 at the beginning
- The tan line represents the march into Russia, the black line represents the retreat from Russia
- Look how Napoleon's army is losing troops!

- What started out as an army 400,000 strong, limps back from Russia only 10,000 left.

When done right, charts and graphs bring your data to life, and can make a powerful argument.

In this case, the devastating effect of war is shown.

# Questions



Marshall Meier

Emerson Process Management – Rosemount

[marshall.meier@emerson.com](mailto:marshall.meier@emerson.com)



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Process Management

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