

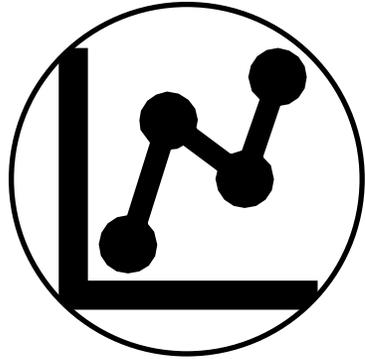


*Visualization, DD2257*  
*Prof. Dr. Tino Weinkauff*

## ***Introduction***

Requests on a Visualization  
How (Not!) to lie with visualizations

The visualization of a data set should be:



**Expressive**

*shows (only) the information in the data*



**Efficient**

*allows for quick digestion, e.g., by supporting spontaneous perception*



**Appropriate**

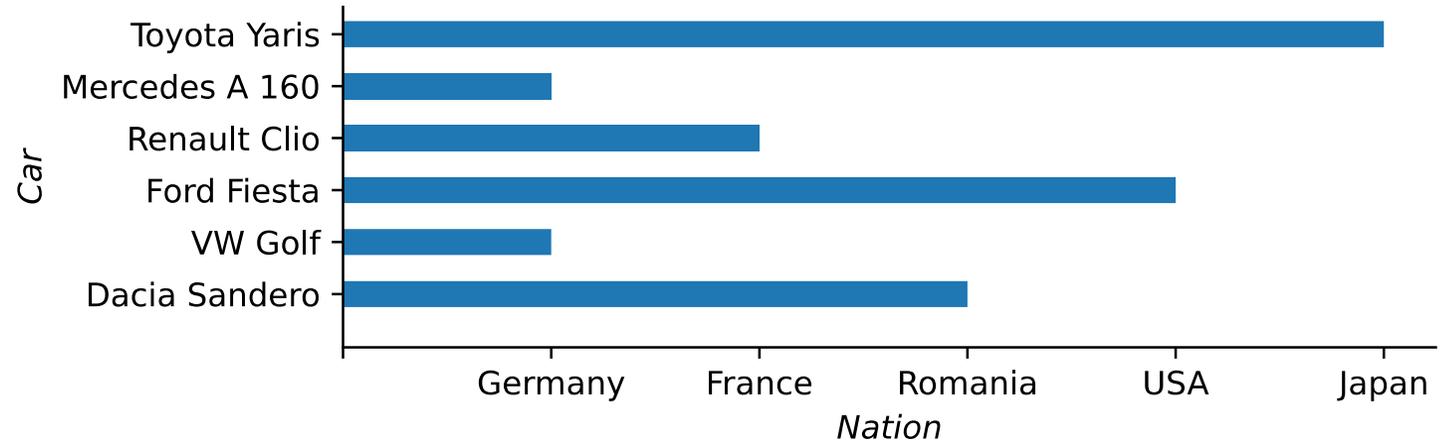
*amount of visual content is in line with the amount of data*

# Expressiveness

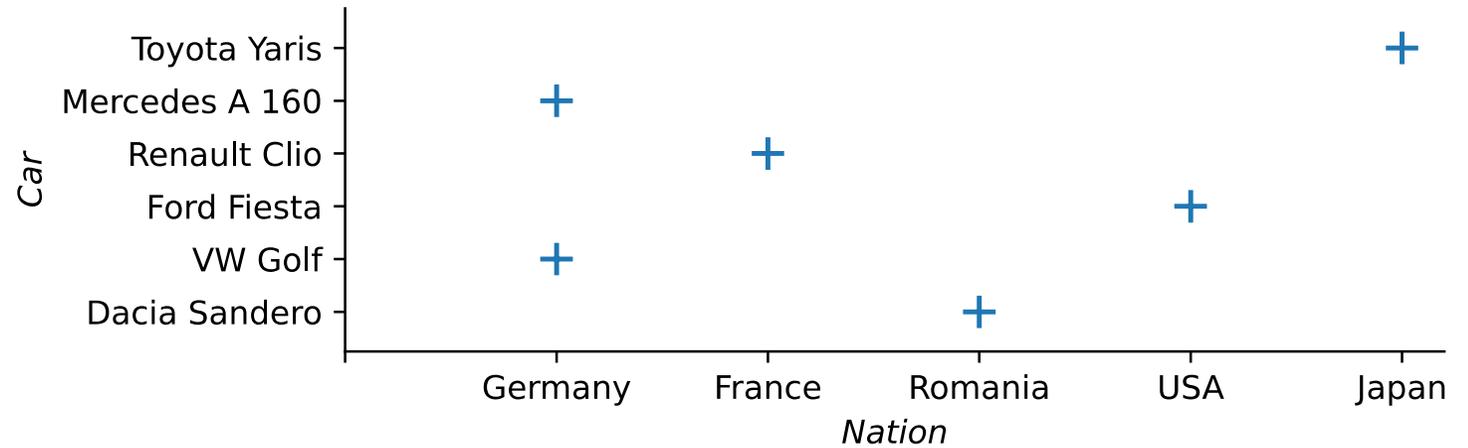
A visualization is expressive, if (only) the information is represented which is in the data.

Could also be described using the terms “Effectiveness” and “effective”.

*Requests on a Visualization*



non-expressive visualization



expressive visualization

# Efficiency

A visualization is efficient, if it can be read with minimal effort.

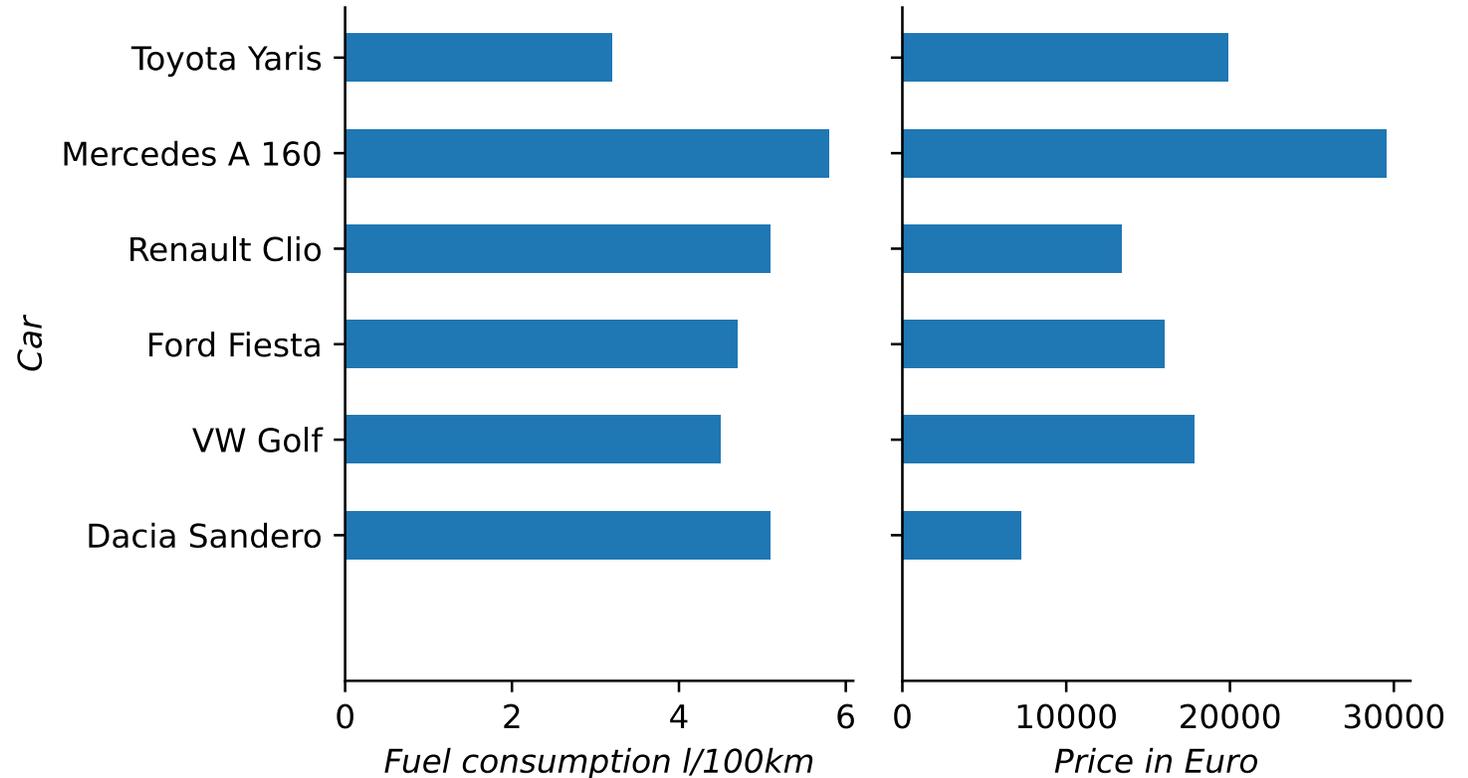
task aspects

*tailored to the task*

psychological aspects

*familiarity, intuitiveness*

supports spontaneous perception



inefficient visualization

*for task "find fuel-efficient car within budget"*

# Efficiency

A visualization is efficient, if it can be read with minimal effort.

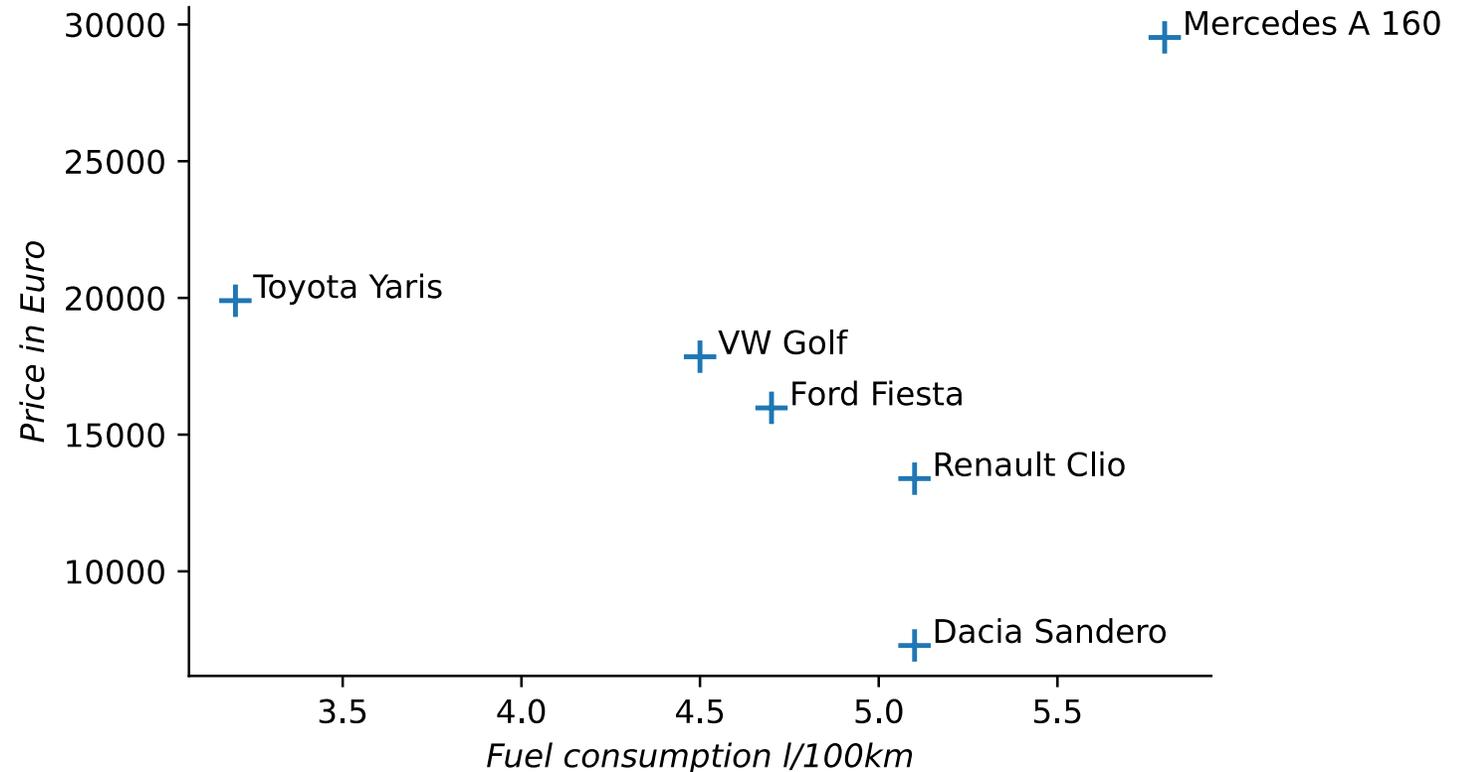
task aspects

*tailored to the task*

psychological aspects

*familiarity, intuitiveness*

supports spontaneous perception



efficient visualization

*for task "find fuel-efficient car within budget"*

## Efficiency

A visualization is efficient, if it can be read with minimal effort.

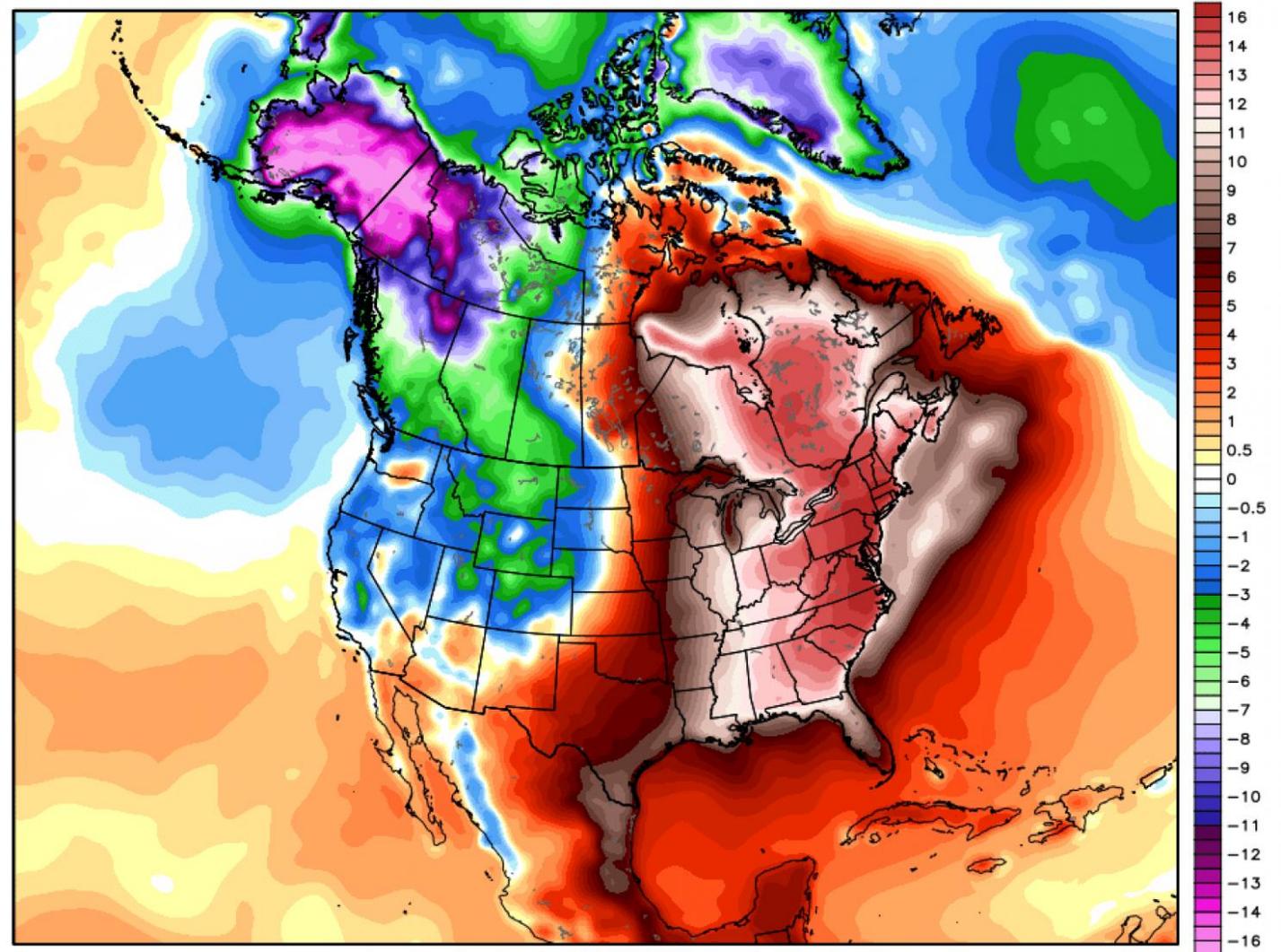
task aspects

*tailored to the task*

psychological aspects

*familiarity, intuitiveness*

supports spontaneous perception



(potentially) inefficient visualization  
*due to repeating and unintuitive colors*

# Efficiency

A visualization is efficient, if it can be read with minimal effort.

task aspects

*tailored to the task*

psychological aspects

*familiarity, intuitiveness*

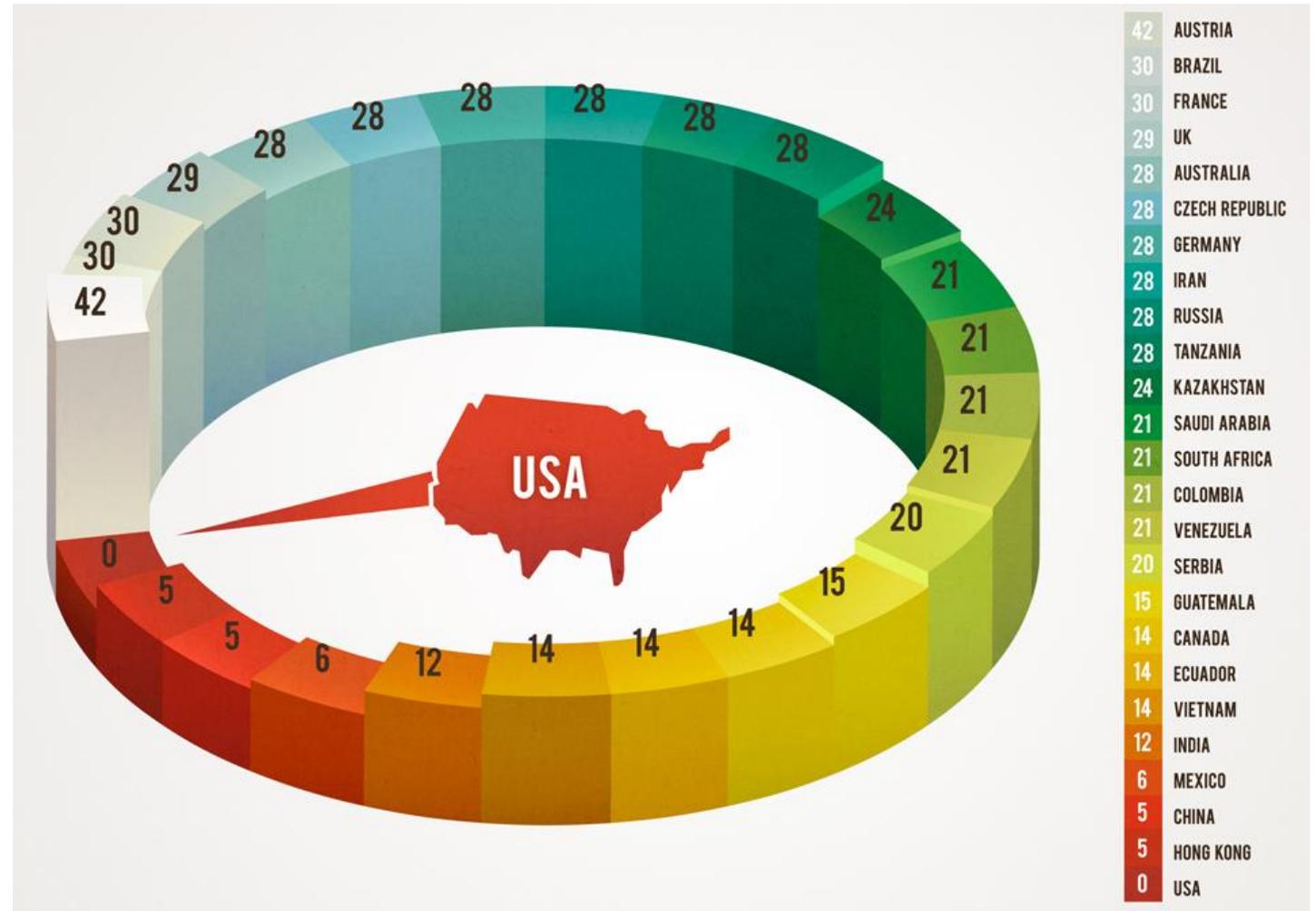
supports spontaneous perception



# Appropriateness

A visualization is appropriate, if the amount of visual content is in line with the amount of data.

Consider the cost – benefit ratio of creating versus reading the visualization.



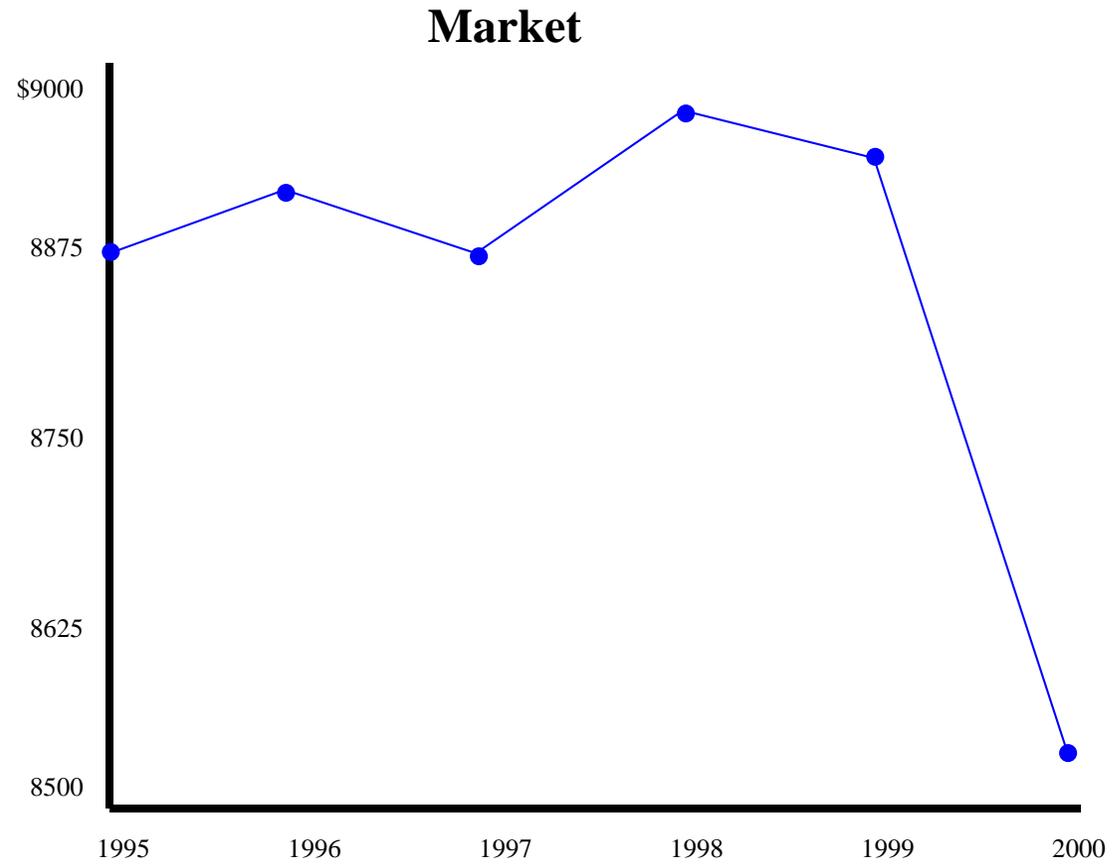
inappropriate visualization

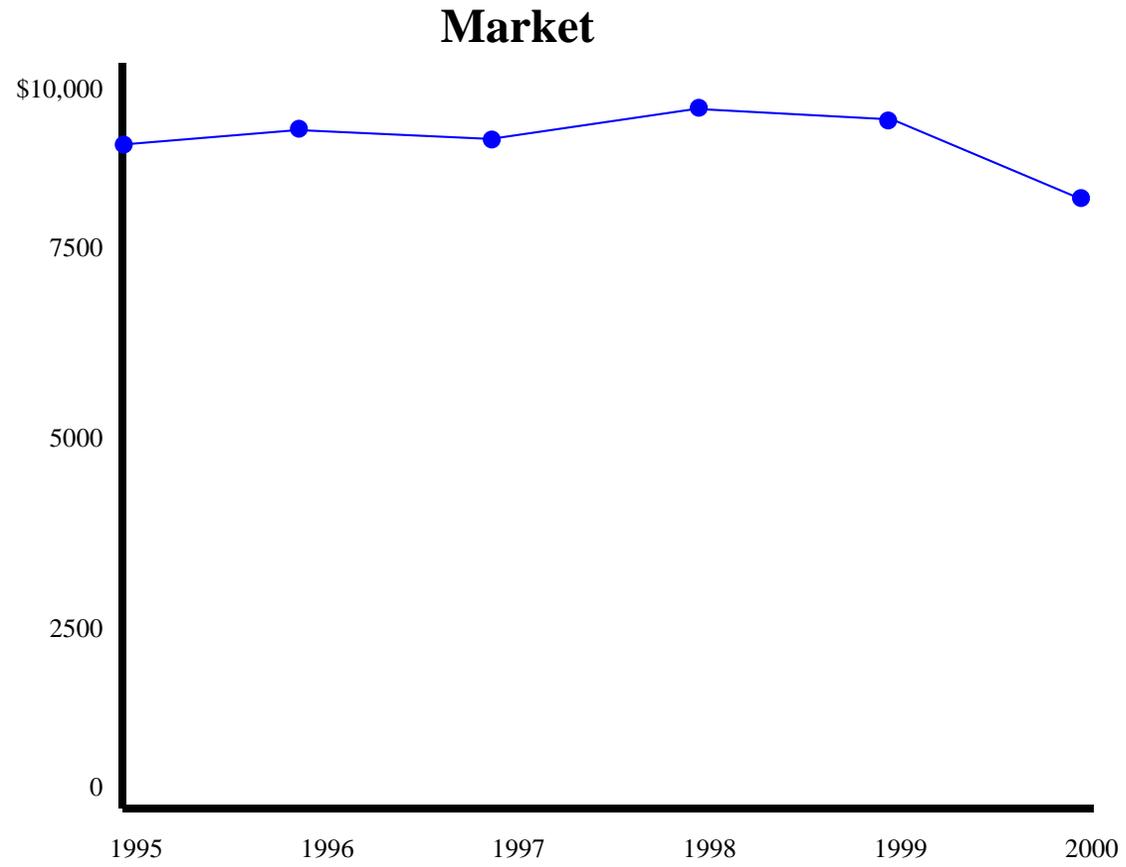


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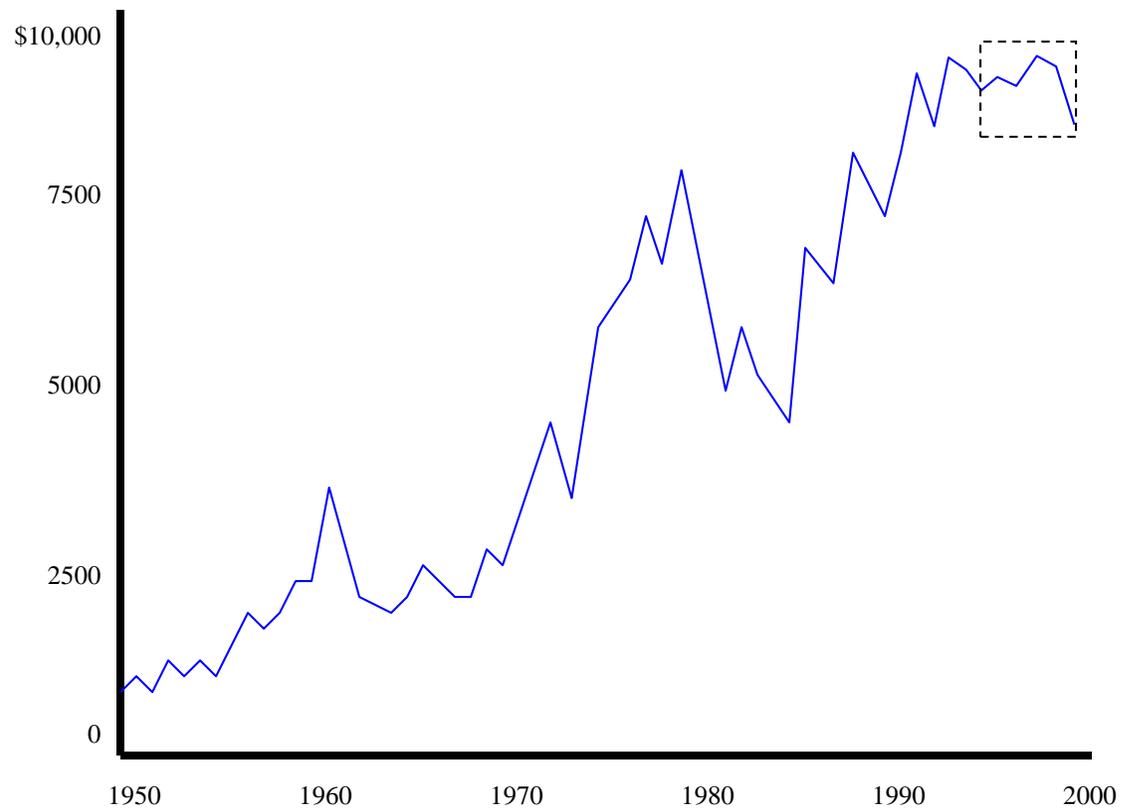
## ***Introduction***

How (Not!) to lie with visualization





# Market



- Edward Rolf Tufte
- born 1942
- Professor emeritus of political science, statistics, and computer science at Yale University
- authored and self-published many award-winning books on data visualization design
  - The Visual Display of Quantitative Information
  - Envisioning Information
  - Visual Explanations

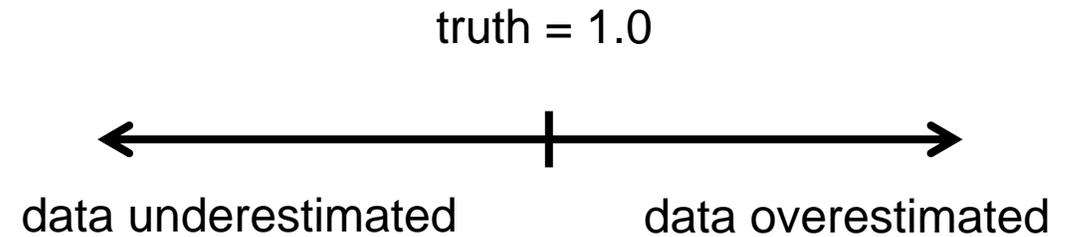


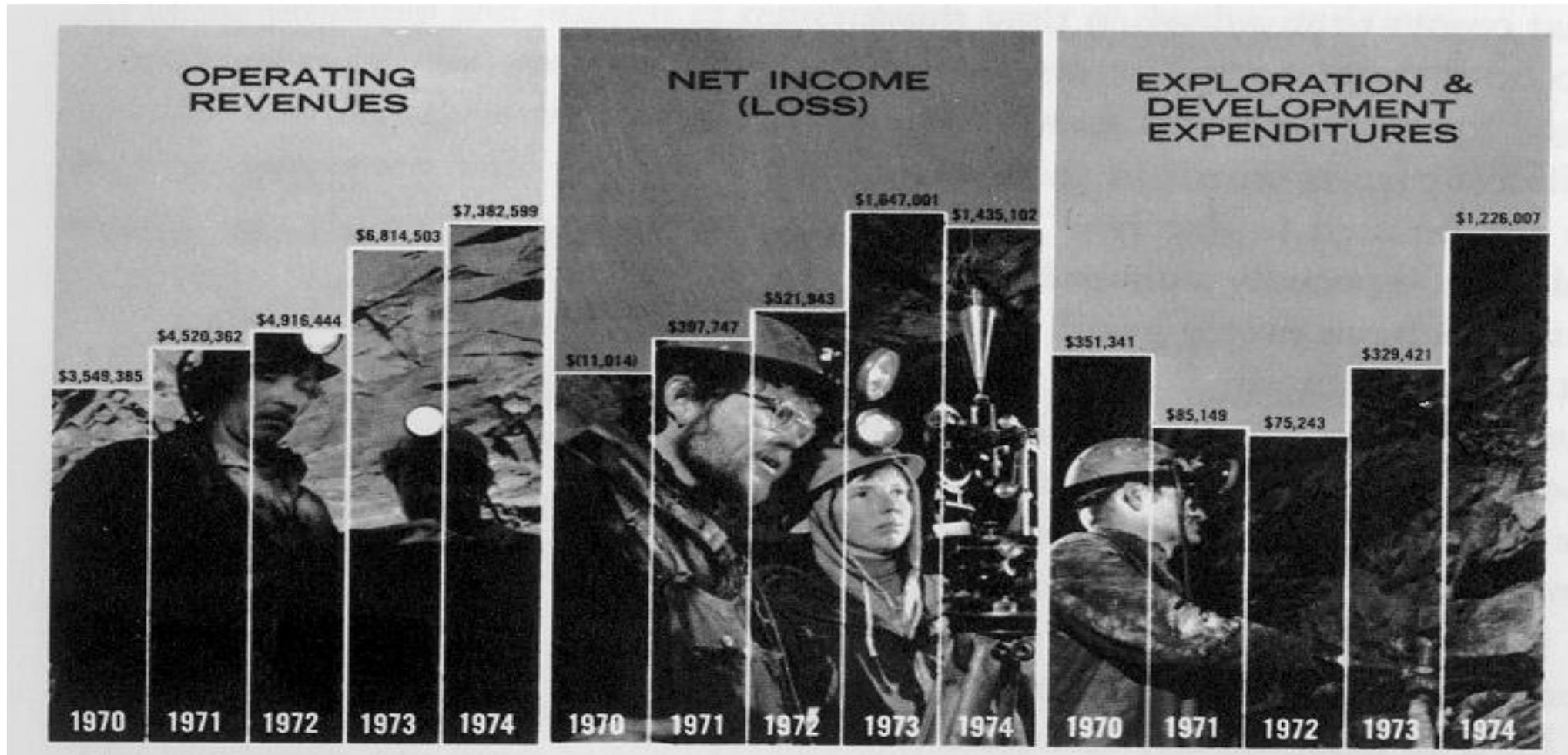
Edward Tufte presenting in Dallas, Texas, May 2015.  
Photo by Keegan Peterzell, [Wikimedia Commons](#), CC BY-SA 4.0.

One of Tufte's Rules:

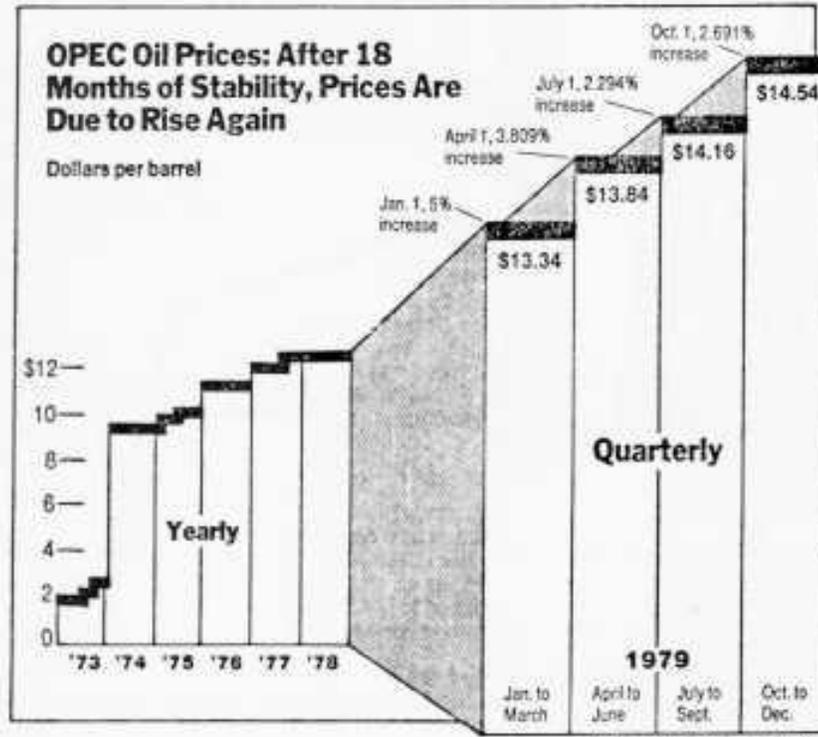
Visual attribute value should be directly proportional to data attribute value

$$\text{Lie factor} = \frac{\text{visual effect}}{\text{data effect}}$$





Design variation corrupts this display:



0.5?

13

*New York Times*, December 19, 1978, p. D-7.

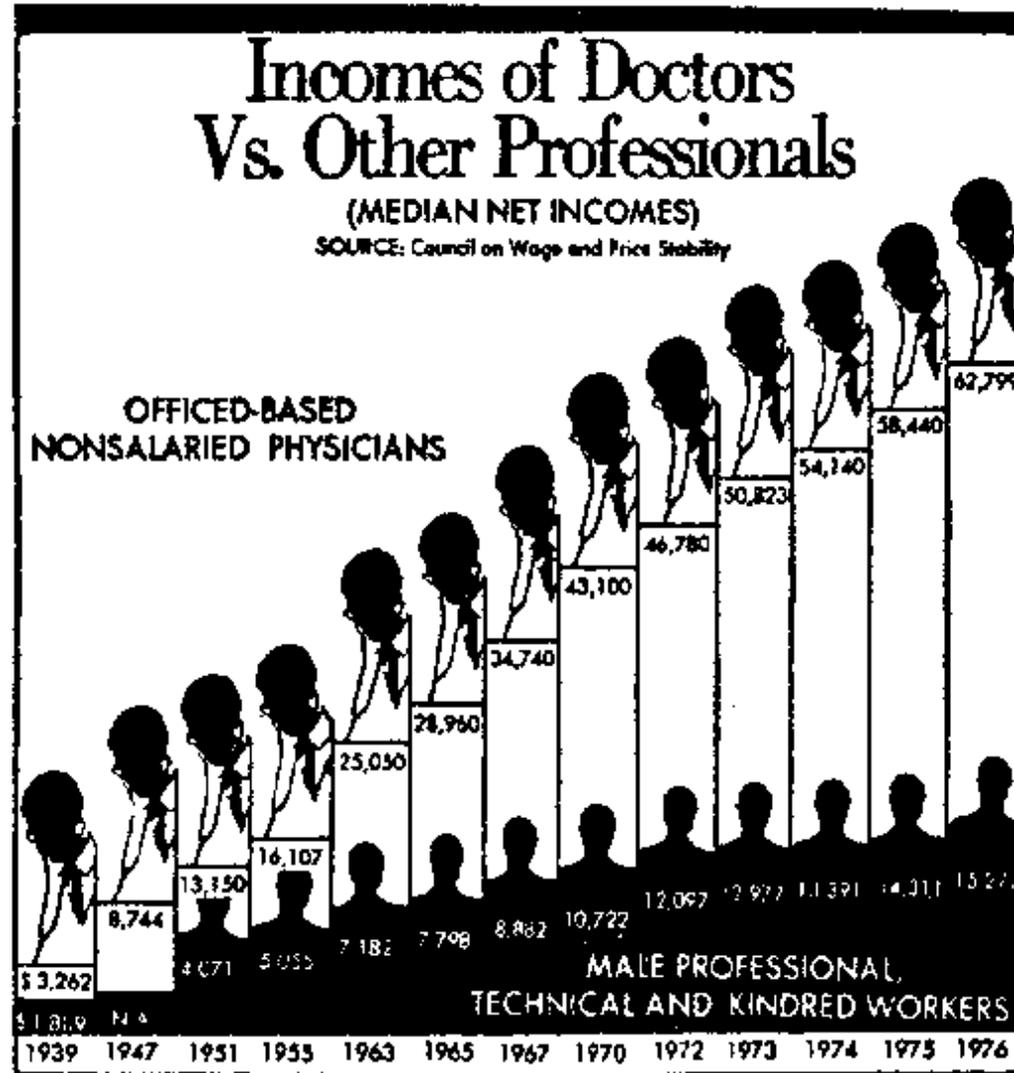
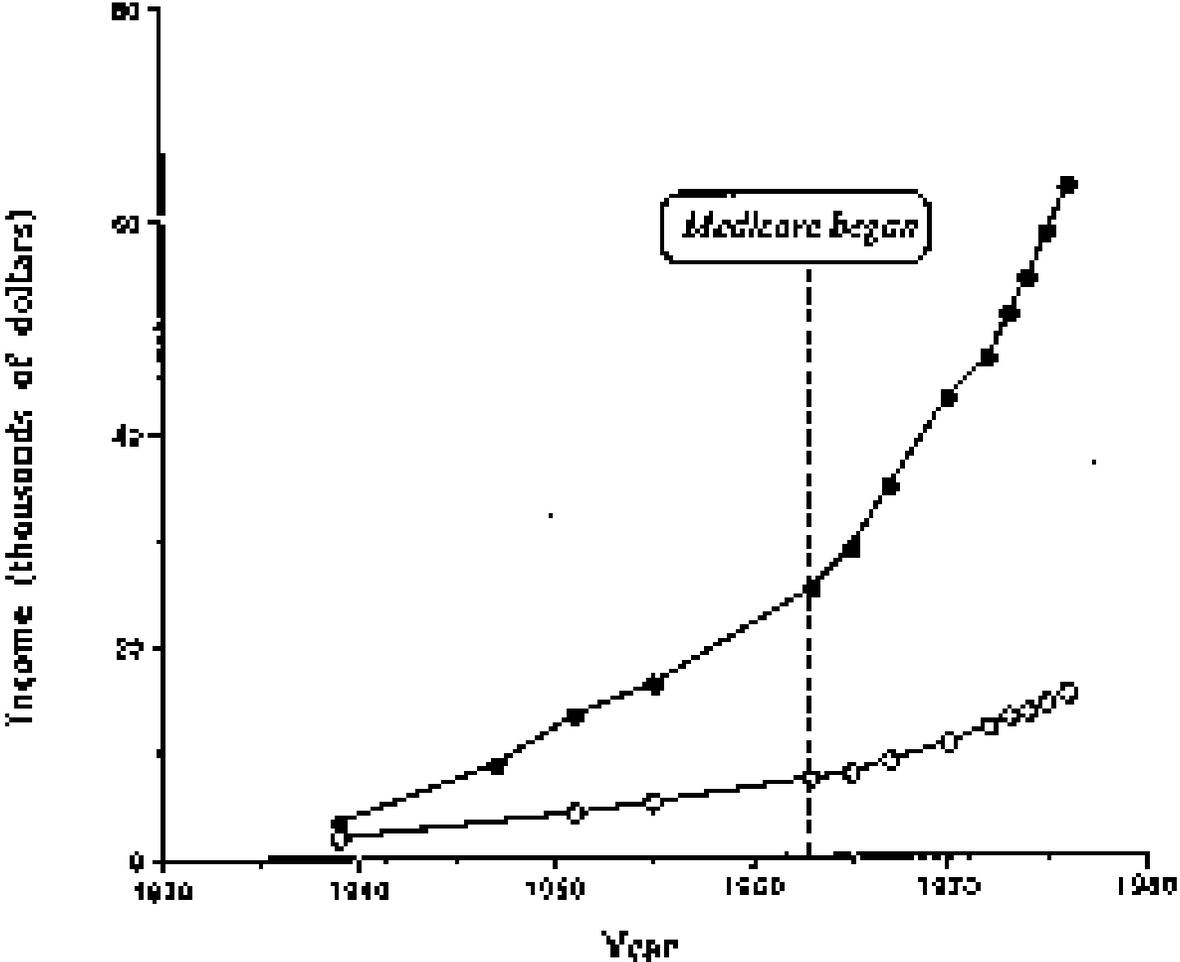


Figure 13. Changing scale in mid-axis to make exponential growth linear (© The Washington Post).

Physicians' income has grown exponentially since 1939  
Whereas other professionals' income has gone up linearly



# THE SHRINKING FAMILY DOCTOR In California

Percentage of Doctors Devoted Solely to Family Practice

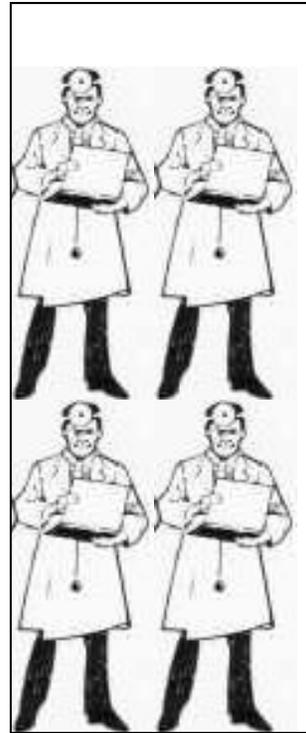
1964                      1975                      1990



*Los Angeles Times*, August 5, 1979, p. 3.



=



?

# THE SHRINKING FAMILY DOCTOR In California

Percentage of Doctors Devoted Solely to Family Practice

1964	1975	1990
27%	16.0%	12.0%



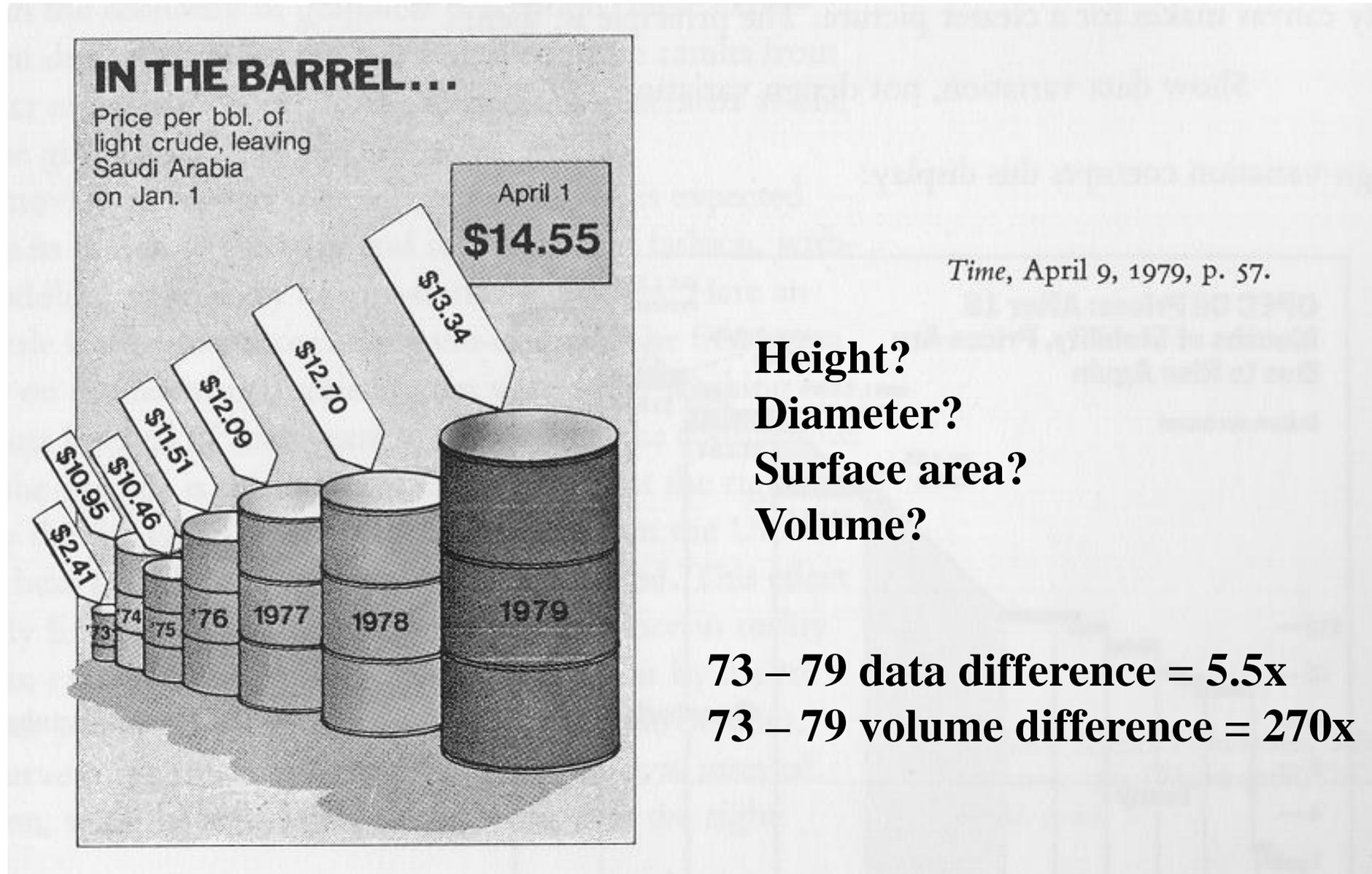
*Los Angeles Times*, August 5, 1979, p. 3-

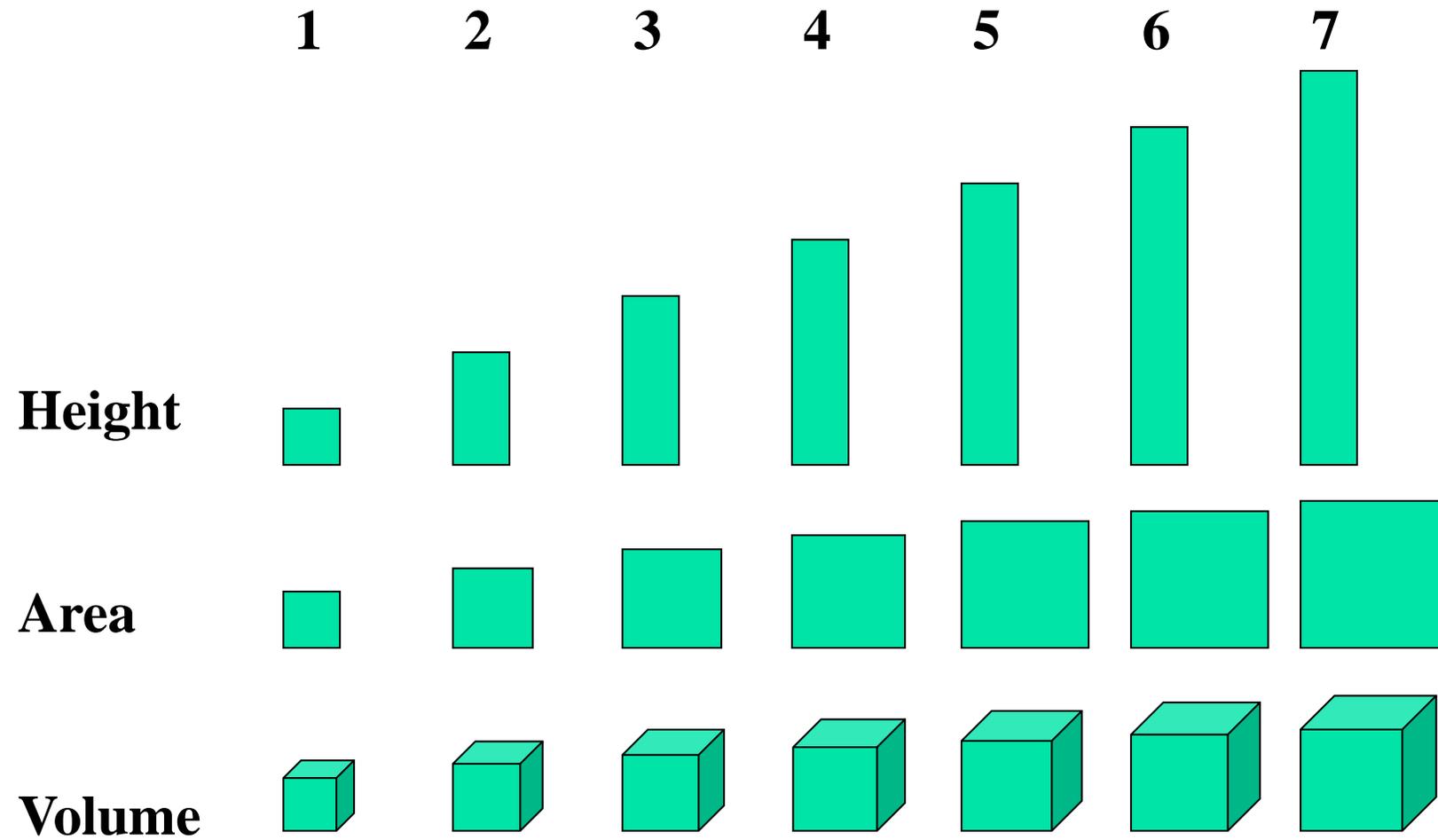
- Height = value  
Width = value  
Area = value<sup>2</sup>

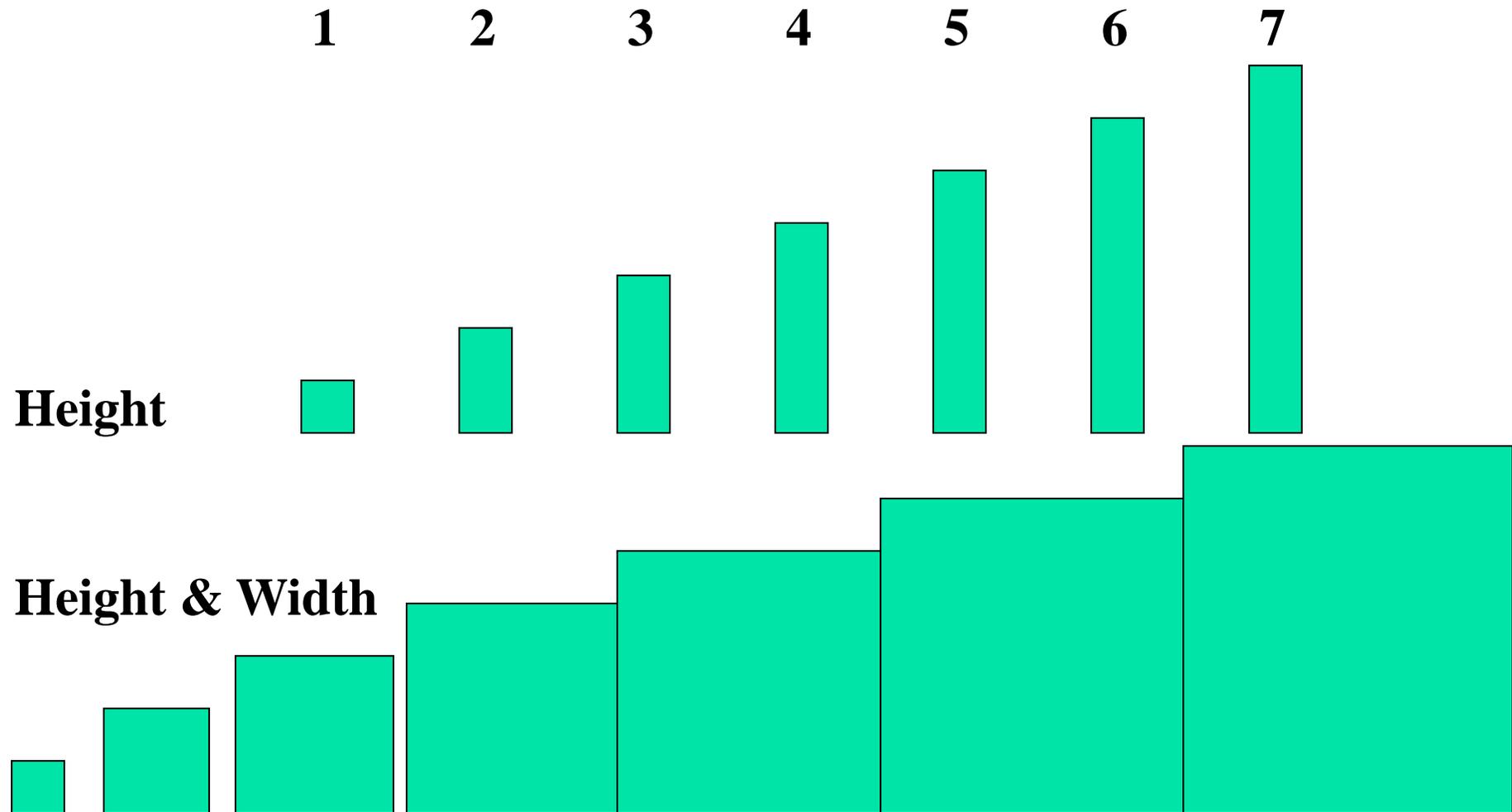
or

- Area = value  
height\*width = value  
height = width = value<sup>0.5</sup>

**Problem:  
Using 2 visual dimensions to  
represent 1 data dimension.**



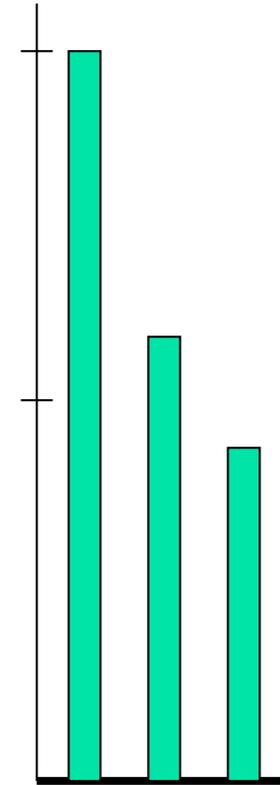
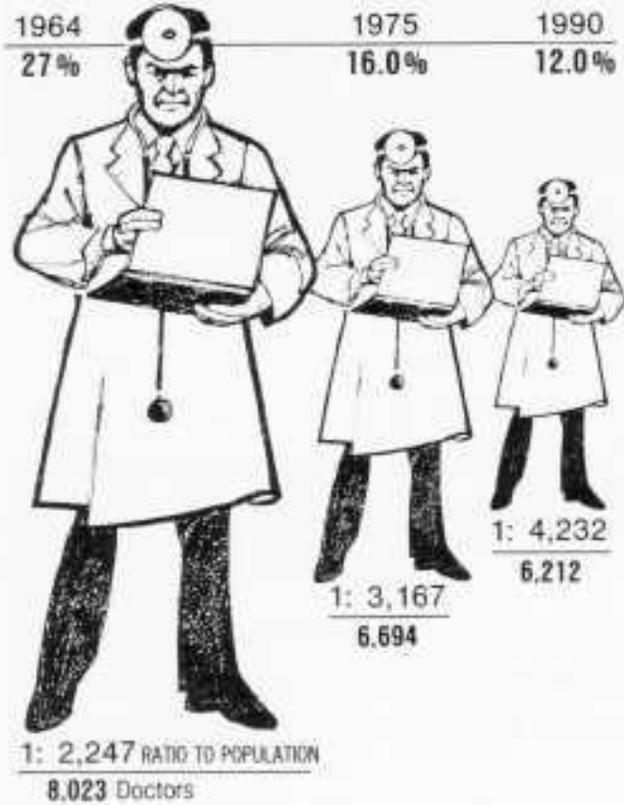




## THE SHRINKING FAMILY DOCTOR In California

Percentage of Doctors Devoted Solely to Family Practice

1964	1975	1990
27%	16.0%	12.0%



- Show entire scale
- Show data in context
- Consistent, linear scale
  - Log scale for log data
- Up vs. down: indicate direction of improvement
- Avoid size encoding
  - Use height OR width
  - Don't use both for same data attribute
  - Avoid area, volume encoding

**SUPERMARKETS HAVE MORE GROSS REVENUE THAN MANY LARGE CORPORATIONS.**



For more, see <http://wtfviz.net/>