

CS 147:
Computer Systems Performance Analysis
Specifics of Graphical Presentation

2015-06-15 CS147

CS 147:
Computer Systems Performance Analysis
Specifics of Graphical Presentation

Overview

Specific Things to Do

- Give Information the Reader Needs
- Limit Complexity and Confusion
- Have a Point
- Show Statistics Graphically
- Don't Always Use Graphics
- Discuss It in the Text

Principles of Esthetics

- Use Appropriate Format and Design
- Use Words, Numbers, Drawings Together
- Reflect Balance, Proportion, Relevant Scale
- Keep Detail and Complexity Accessible
- Have a Story About the Data
- Do a Professional Job of Drawing
- Avoid Decoration and Chartjunk

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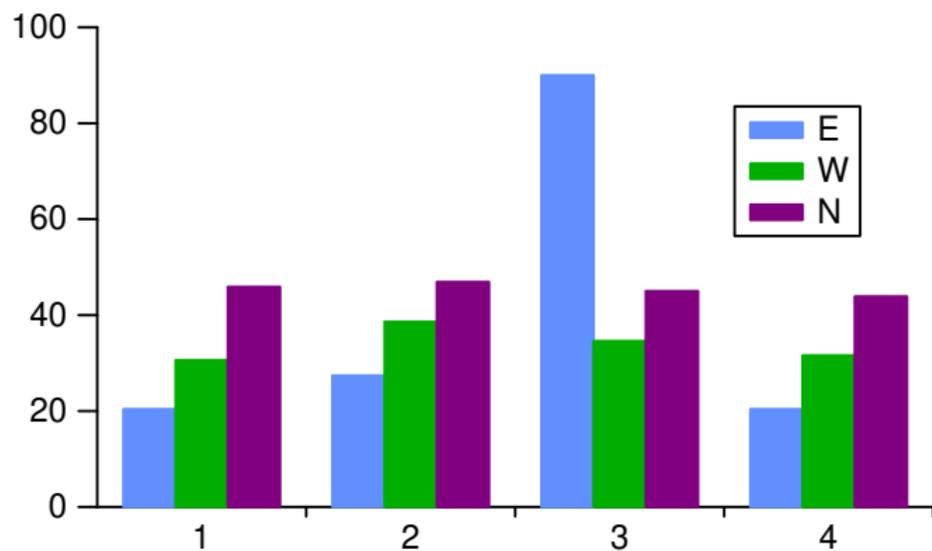
Give Information the Reader Needs

- ▶ Show informative axes
 - ▶ Use axes to indicate range
- ▶ Label things fully and intelligently
- ▶ Highlight important points on the graph

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Giving Information the Reader Needs



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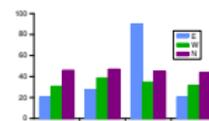
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└ Specific Things to Do

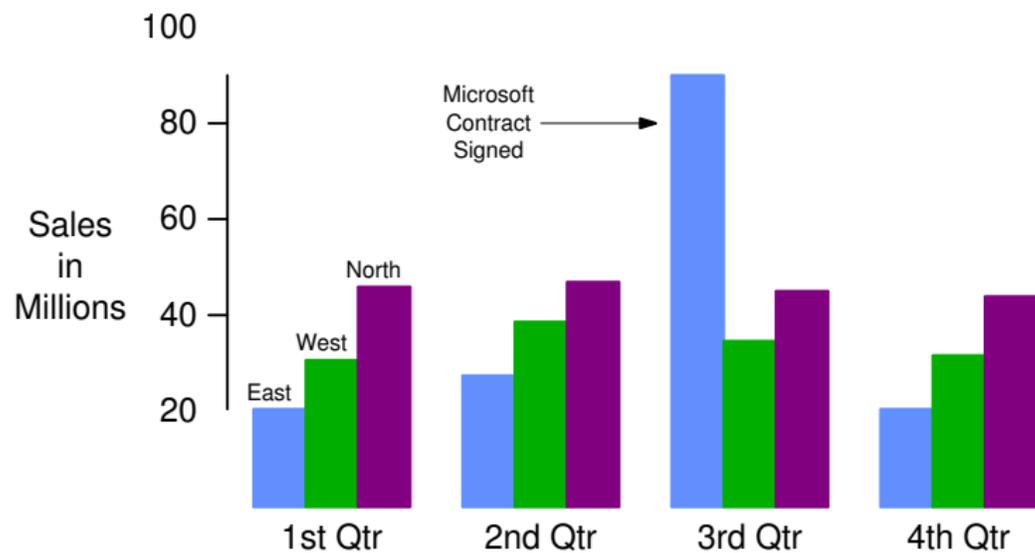
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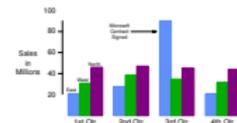


Giving Information the Reader Needs



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└ Specific Things to Do
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Giving Information the Reader Needs



Limit Complexity and Confusion

- ▶ Not too many curves
- ▶ Single scale for all curves
- ▶ No “extra” curves
- ▶ No pointless decoration (“ducks”)

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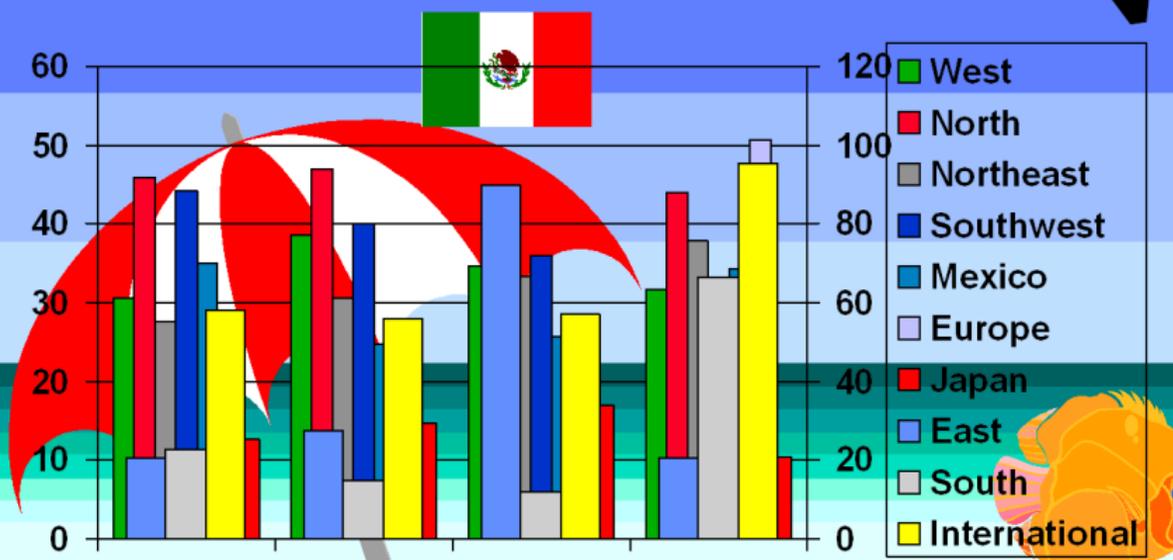
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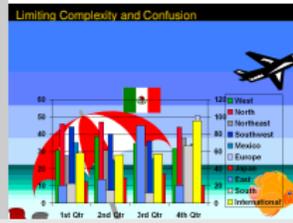
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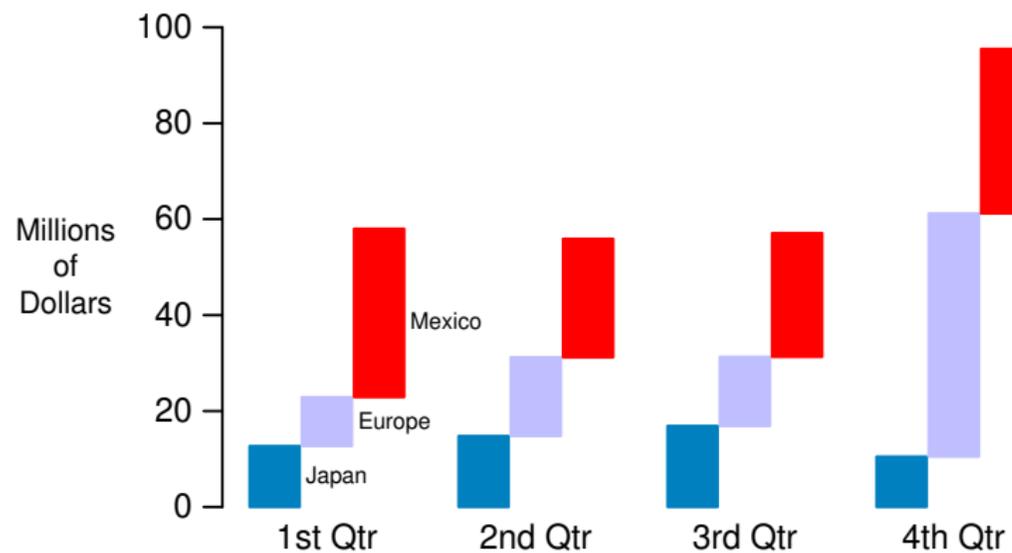


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Limiting Complexity and Confusion



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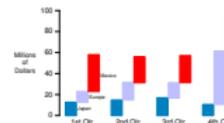
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Limiting Complexity and Confusion



Have a Point

- ▶ Graphs should add information not otherwise available to reader
- ▶ Don't plot data just because you collected it
- ▶ Know what you're trying to show, and make sure the graph shows it

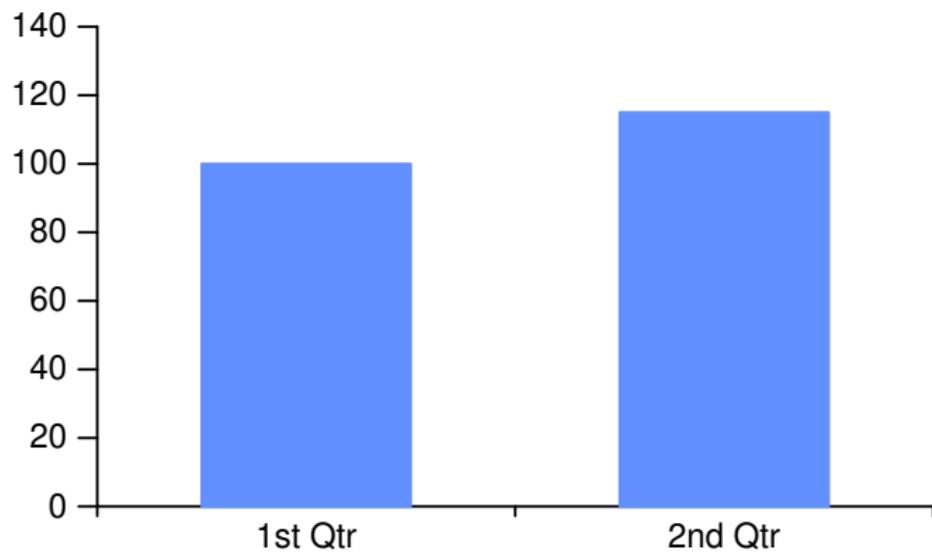
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Have a Point

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Having a Point

- ▶ Sales were up 15% this quarter:



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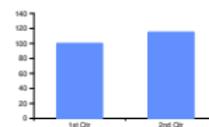
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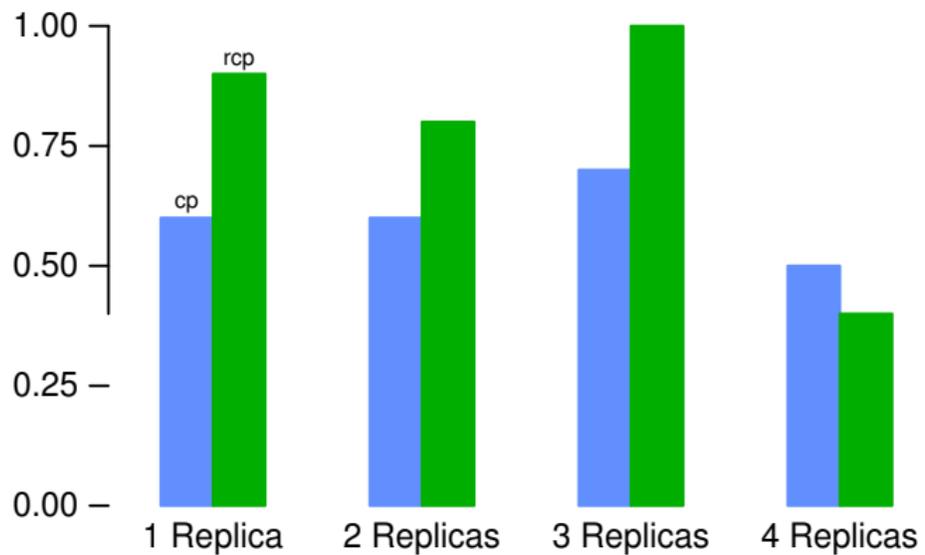
Having a Point

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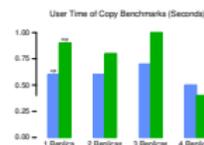
Having a Point

User Time of Copy Benchmarks (Seconds)

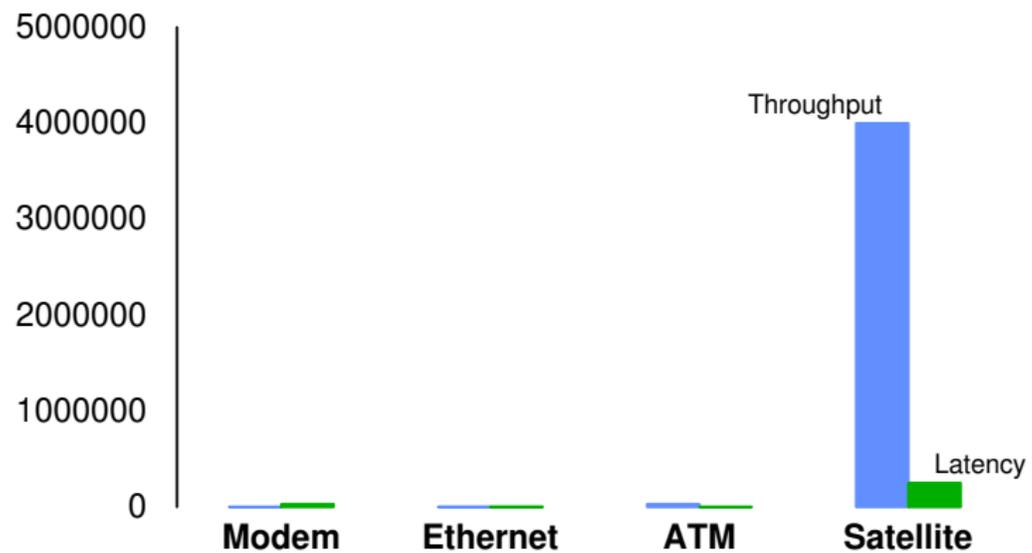


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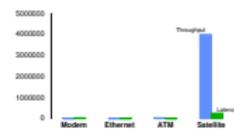


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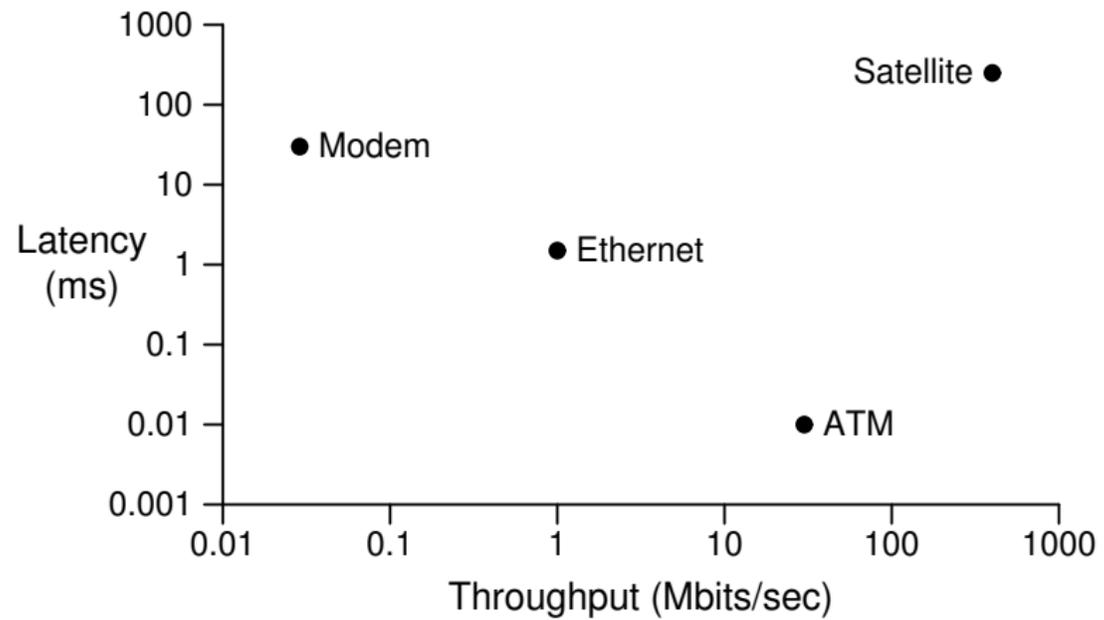


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Having a Point



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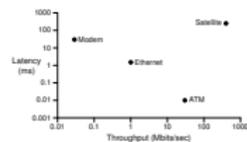
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└ Specific Things to Do

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Having a Point



Show Statistics Graphically

- ▶ Put bars in a reasonable order
 - ▶ Geographical
 - ▶ Best to worst
 - ▶ Even alphabetic
- ▶ Make bar widths reflect interval widths
 - ▶ Hard to do with most graphing software
- ▶ Show confidence intervals on the graph
 - ▶ Examples will be shown later

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Don't Always Use Graphics

- ▶ Tables are best for small sets of numbers
 - ▶ Tufte says 20 or fewer
- ▶ Also best for certain arrangements of data
 - ▶ E.g., 10 graphs of 3 points each
- ▶ Sometimes a simple sentence will do
- ▶ Always ask whether the chart is the best way to present the information
 - ▶ And whether it brings out your message

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└ Specific Things to Do

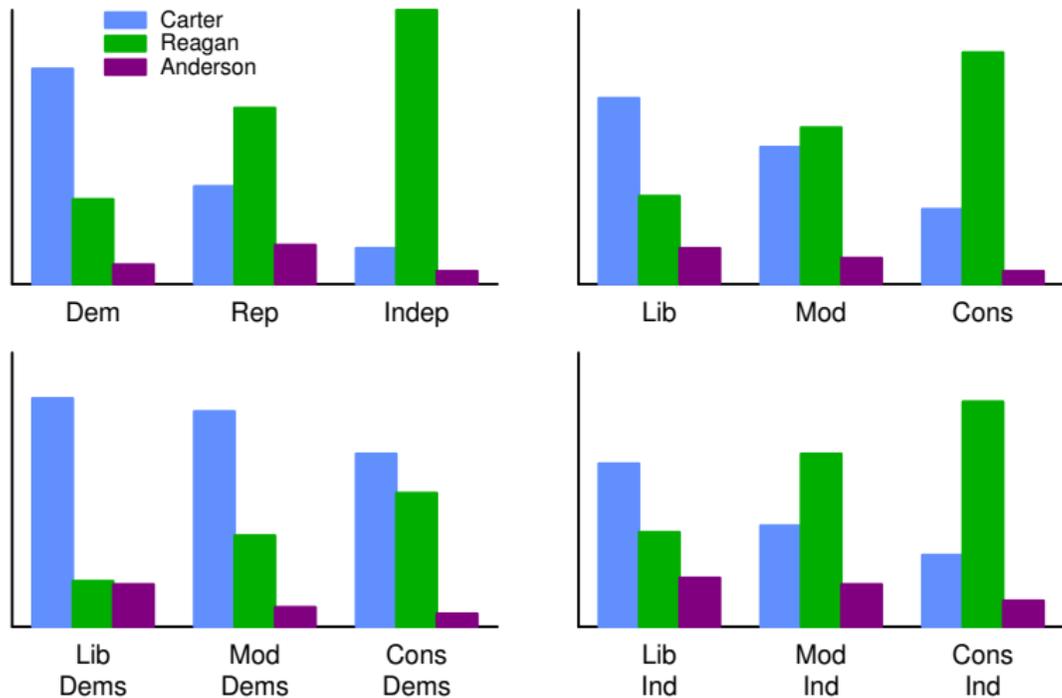
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Text Would Have Been Better



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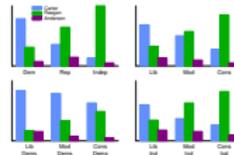
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└ Specific Things to Do

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Text Would Have Been Better



Discuss It in the Text

- ▶ Figures should be self-explanatory
 - ▶ Many people scan papers, just look at graphs
 - ▶ Good graphs build interest, “hook” readers
 - ▶ Caption should help that process
- ▶ But text should highlight and aid figures
 - ▶ Tell readers when to look at figures
 - ▶ Point out what figure is telling them
 - ▶ Expand on what figure has to say
 - ▶ Put figures near text so it’s easy to find

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Esthetics

- ▶ Not everyone is an artist
 - ▶ But figures should be visually pleasing
- ▶ Elegance is found in
 - ▶ Simplicity of design
 - ▶ Complexity of data

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└ Principles of Esthetics
└ Esthetics

Esthetics

- Not everyone is an artist
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Use Appropriate Format and Design

- ▶ Don't automatically draw a graph
 - ▶ Mentioned before
- ▶ Choose graphical format carefully
- ▶ Sometimes "text graphic" works best
 - ▶ Use text placement to communicate numbers
 - ▶ Very close to being a table

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Use Appropriate Format and Design

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Using Text as a Graphic

CEA: +4.7	About a year ago, eight forecasters were asked for their predictions on some key economic indicators. Here's how the forecasts stack up against the probable 1978 results (shown in the black panel).			WEF: 6.8
DR: +4.5				CB: 6.7
NABE: +4.5				NABE: 6.7
WEF: +4.5				IBM: 6.6
CBO: +4.4				DR: 6.5
CB: +4.2				CBO: 6.3
IBM: +4.1	NABE: +6.2	IBM: +5.9	WEF: +21	CEA: 6.3
GNP: +3.8	IPG: +5.8	CPI: +7.7	Profits: +13.3	Unempl: 6.0
CE: +2.9	CB: +5.5	IBM: +6.6	DR: +10.5	<i>(New York Times, Jan. 2, 1979)</i>
	DR: +5.2	NABE: +6.5	IBM: +10.4	
	WEF: +4.8	CB: +6.2	CE: +6.5	

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Using Text as a Graphic

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<small>About a year ago, eight forecasters were asked for their predictions on some key economic indicators. Here's how the forecasts stack up against the probable 1978 results (shown in the black panel).</small>																				

The Stem-and-Leaf Plot

From Tukey, via Tufte, heights of some volcanos:

0|9 = 900 feet

```

0|98766562
1|97719630
2|99987766544422211009850
3|876655412099551426
4|9998844331929433361107
5|97666666554422210097731
6|898665441077761065
7|98855431100652108073
8|653322122937
9|377655421000493
10|0984433165212
11|4963201631
12|45421164
13|47830
14|00
15|676
16|52
17|92
18|5
19|39730
  
```

Stem-and-leaf displays:
heights of 218 volcanos, unit 100 feet

19|3 = 19,300 feet

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- └ Principles of Esthetics
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The Stem-and-Leaf Plot

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098766562
197719630
299987766544422211009850
3876655412099551426
49998844331929433361107
59766666554422210097731
6898665441077761065
798855431100652108073
8653322122937
9377655421000493
100984433165212
114963201631
1245421164
1347830
1400
15676
1652
1792
185
1939730
193 = 19,300 feet
  
```

Choosing a Graphical Format

- ▶ Many options, more being invented all the time
 - ▶ Examples will be given later
 - ▶ See Jain for some commonly useful ones
 - ▶ Tufte shows ways to get creative
- ▶ Choose a format that reflects your data
 - ▶ Or that helps you analyze it yourself

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Use Words, Numbers, Drawings Together

- ▶ Put graphics near or in text that discusses them
 - ▶ Even if you have to murder your word processor
- ▶ Integrate text into graphics
- ▶ Tufte: “Data graphics are paragraphs about data and should be treated as such”

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└ Principles of Esthetics

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Reflect Balance, Proportion, Relevant Scale

- ▶ Much of this boils down to “artistic sense”
- ▶ Make sure things are big enough to read
 - ▶ Tiny type is OK only for young people!
- ▶ Keep lines thin
 - ▶ But use heavier lines to indicate important information
- ▶ Keep horizontal larger than vertical
 - ▶ About 50% larger works well

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└ Principles of Esthetics

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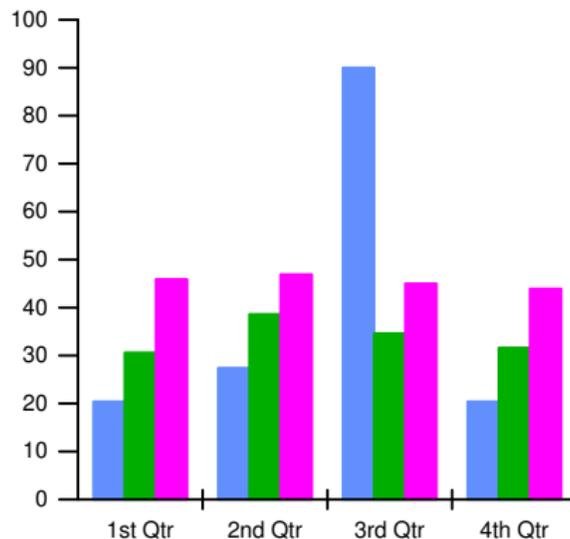
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Poor Balance and Proportion

- ▶ Sales in the North and West districts were steady through all quarters
- ▶ East sales varied widely, significantly outperforming the other districts in the third quarter



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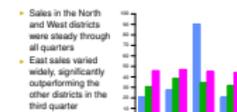
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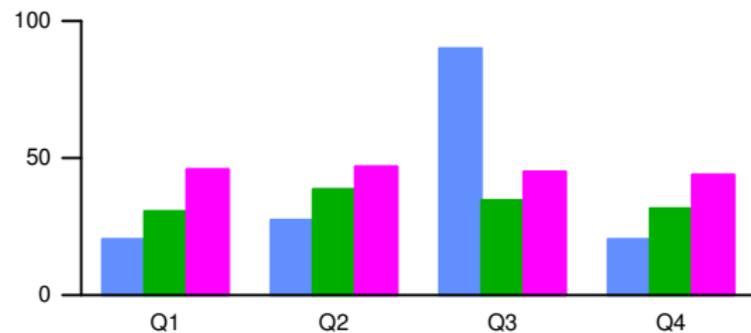
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Better Proportion

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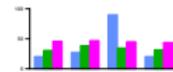
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Better Proportion

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Keep Detail and Complexity Accessible

- ▶ Make your graphics friendly:
 - ▶ Avoid abbreviations and encodings
 - ▶ Run words left-to-right
 - ▶ Explain data with little messages
 - ▶ Label graphics, don't use elaborate shadings and a complex legend
 - ▶ Avoid red/green distinctions
 - ▶ Use clean, serif fonts in mixed case

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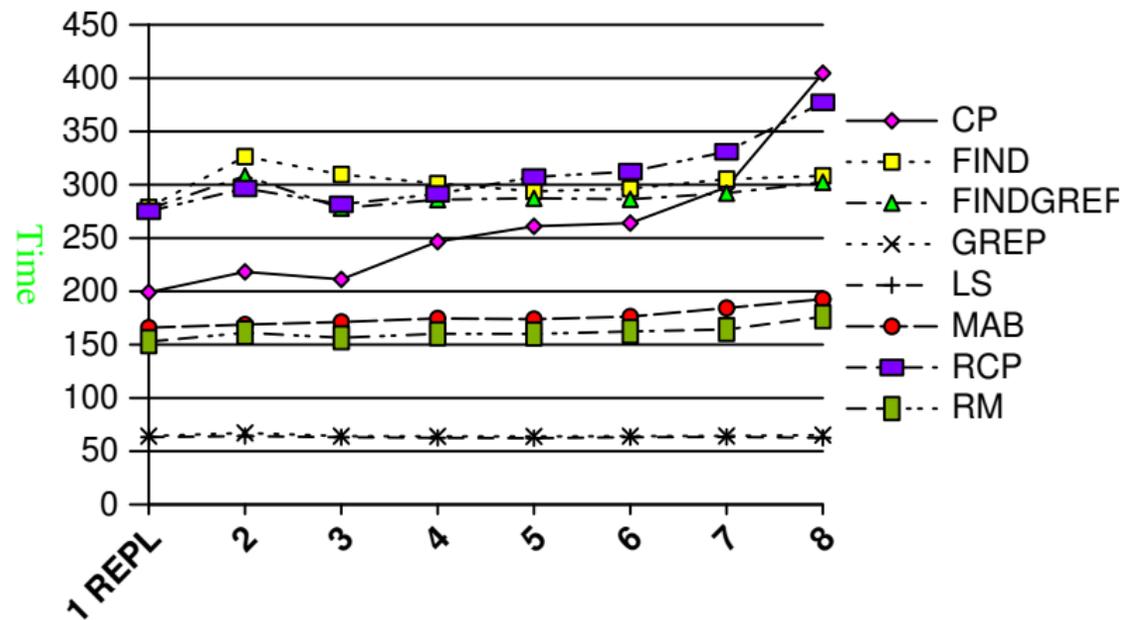
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An Unfriendly Graph



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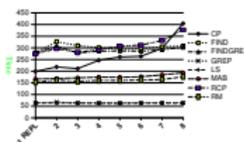
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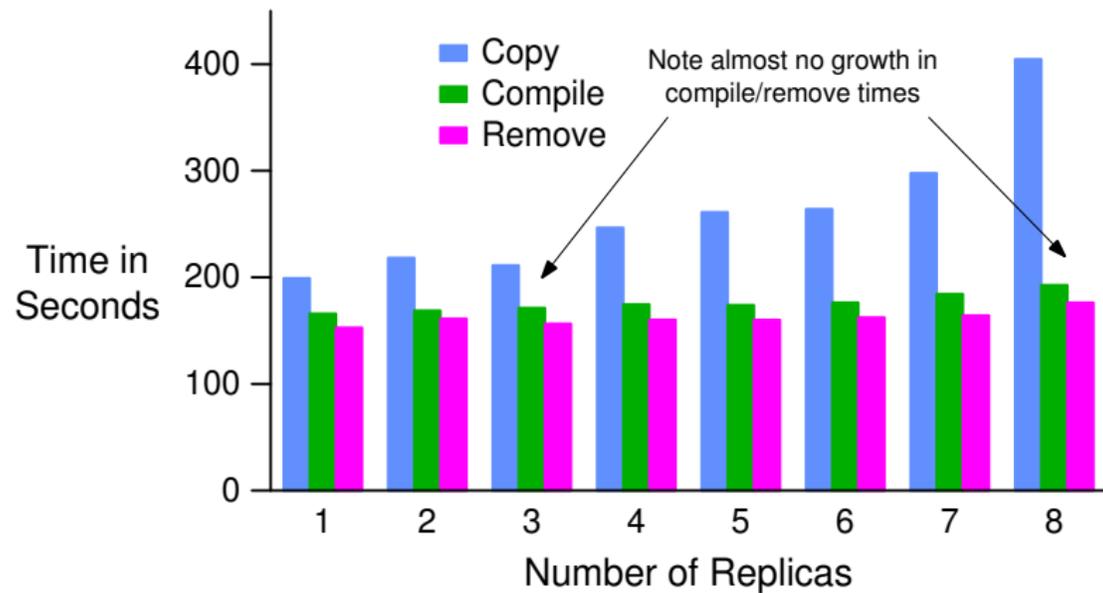
└ Keep Detail and Complexity Accessible

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An Unfriendly Graph



A Friendly Version



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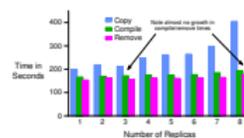
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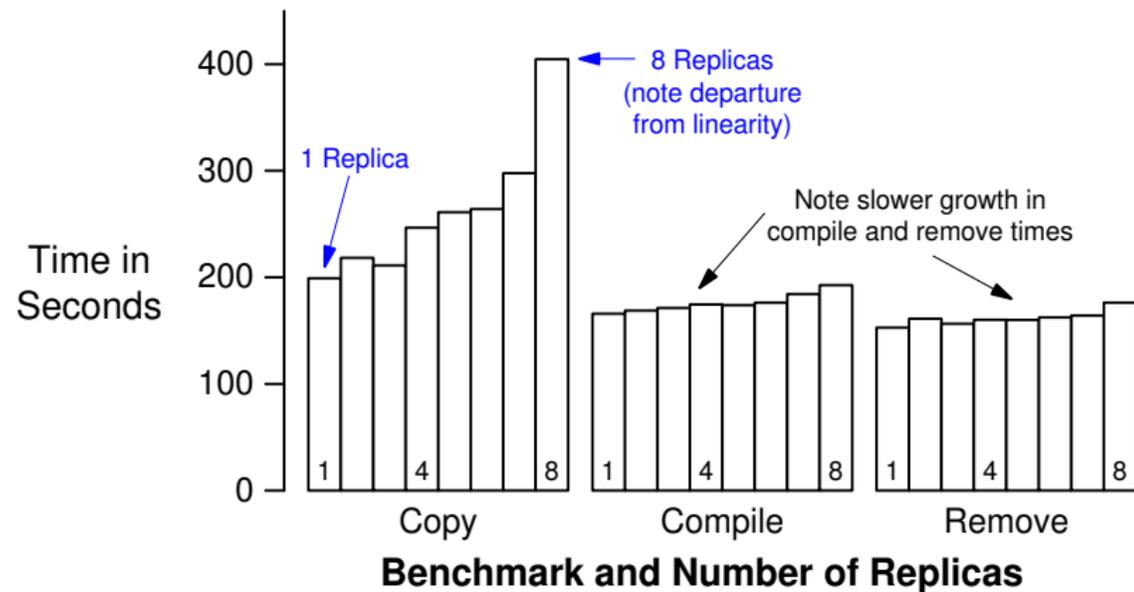
└ Keep Detail and Complexity Accessible

└ A Friendly Version

A Friendly Version



Even Friendlier



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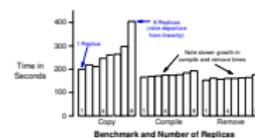
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└ Principles of Esthetics

└ Keep Detail and Complexity Accessible

└ Even Friendlier

Even Friendlier



Have a Story About the Data (Narrative Quality)

- ▶ May be difficult in technical papers
- ▶ But think about why you are drawing graph
- ▶ Example:
 - ▶ Performance is controlled by network speed
 - ▶ But it tops out at high end
 - ▶ And that's because we hit a CPU bottleneck

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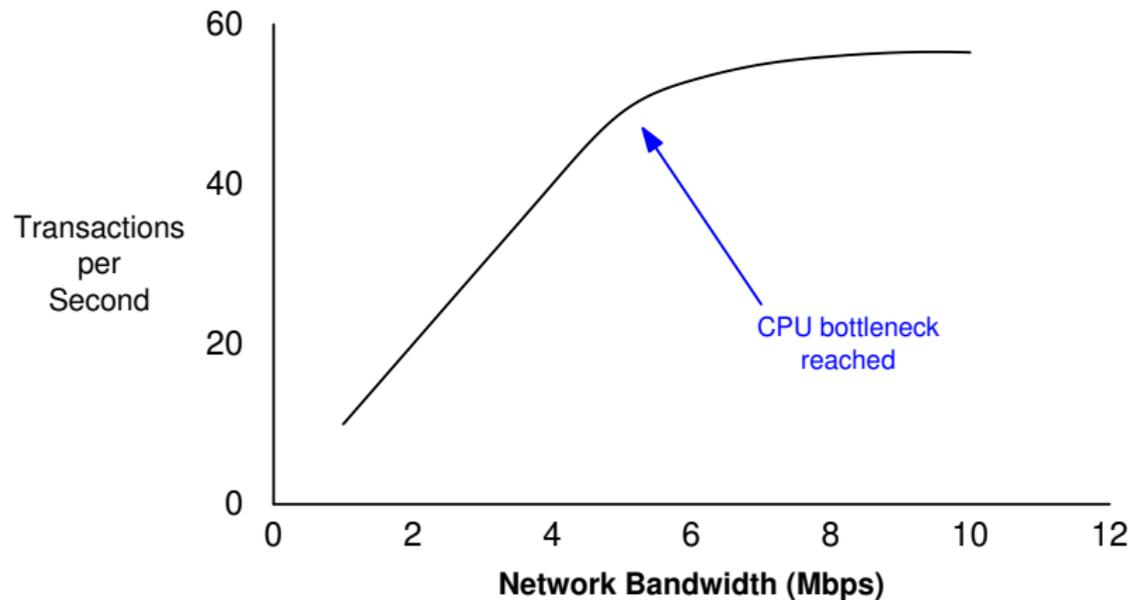
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Showing a Story About the Data

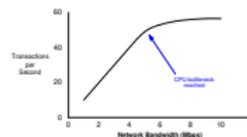


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- └ Principles of Esthetics
- └ Have a Story About the Data
- └ Showing a Story About the Data

Showing a Story About the Data



Do a Professional Job of Drawing

- ▶ This is easy with modern tools
 - ▶ But take the time to do it right
- ▶ Align things carefully
- ▶ Check final version **in format you will use**
 - ▶ I.e., print Postscript one last time before submission
 - ▶ Or look at your slides on projection screen
 - ▶ Preferably in presentation room
 - ▶ Color balance varies by projector

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Avoid Decoration and Chartjunk

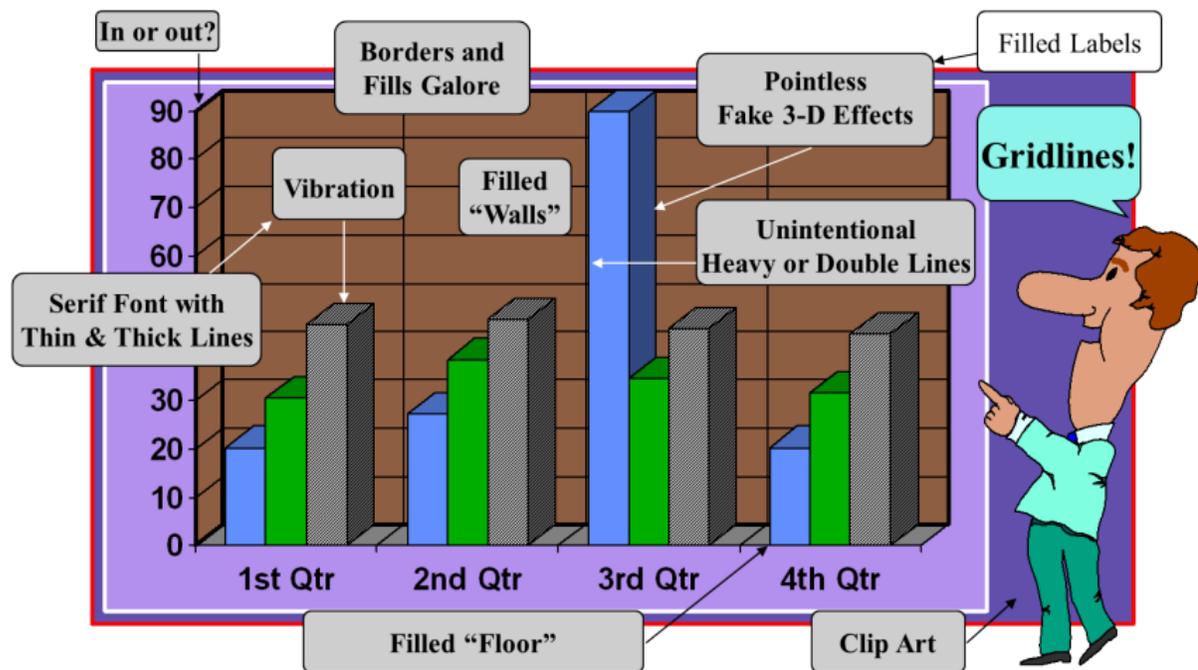
- ▶ Powerpoint, etc. make chartjunk easy
- ▶ Avoid clip art, automatic backgrounds, etc.
- ▶ Remember: *data* is the story
 - ▶ Statistics aren't boring
 - ▶ Uninterested readers aren't drawn by cartoons
 - ▶ Interested readers are distracted
- ▶ Does removing it change message?
 - ▶ If not, leave it out

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Examples of Chartjunk



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