Data Presentation

A guide to good graphics

Bureau of Justice Statistics
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Quality presentations of data -

■ Take advantage of how we already process information

■ Reduce the number of processes required to understand the data

■ Tear down some fundamental obstacles to understanding

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Statistical Graphics --

- show the big picture
- are paragraphs of data
- are best when constructed to convey one finding or concept

The purpose is to show the data.

Therefore, you should maximize:

- Data density
- Data ink
Homicide rate, 1900-96

Rate per 100,000 population


Example of a graphic with high data density

Use graphics, when you have -

- More than 10 data points
- To show big picture
  not fine data

Use tables, when you need -

- Exact numeric values
- Localized comparisons

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Graphics for continuous variables

- Line graphs
- Area charts
- Scatter plots
- Maps

Line chart

Weapons arrest rate, 1965-92

Age of offender

18 years old
17
19
16
20
15
13-14

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Area chart

Homicide rate, 1900-96

Rate per 100,000 population

Scatter plot
Map - with scaled values

Graphics for categorical variables

- Bar graphs
- Maps
- Diagrams
Bar graph

Criminal history of detained Vs. released felony defendants, 1990

Prior criminal history

- Arrest
- Any conviction
- Felony conviction
- Violent felony conviction

Map - categorical data

Oldest age for juvenile court jurisdiction

- 15 years old
- 16
- 17

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Diagram

Manhattan, New York

2 rejected
100 drug arrests → 98 accepted → 40 dismissed → 3 to trial → 55 guilty plea

Washington, D.C.

16 rejected
100 drug arrests → 84 accepted → 30 dismissed → 5 to trial → 49 guilty plea

Cleveland’s Hierarchy of graphical perception

- Position along a common scale
- Position along identical nonaligned scales
- Length
- Angle - Slope
- Area
- Volume
- Color - Hue
Graphic styles to avoid

- Pie charts
- Stacked bar graphs
- Stacked line graphs
"Simplicity of design and complexity of data"
Edward R. Tufte

The purpose of a chart is to show the data, so you need to avoid -

- Nondata ink
- Chartjunk

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Nondata ink

- Grids
- Ticks
- Frames
- Anything that does not convey data

Example of chart junk

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Avoid optical illusions

- Broken lines, markers, and hatching fill patterns obscure the data and are hard to look at
- Improper aspect ratios can distort the slope of a line
- Perspective can distort values

Use solid lines and avoid markers on lines

- Patterned lines can mislead the user
- Broken lines and markers require the brain to consolidate all of the pieces (continuation effect)
Agriculture-related employment

The food and fiber sector still accounts for nearly 19 percent of the jobs in America today.

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Weapons arrest rate, 1965-92

Age of offender

- 18 years old
- 17
- 16
- 15
- 13-14

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Use solid fill patterns

- Hatched fill patterns cause a moiré effect which is hard to look at
- Keep the space between bars to a minimum to avoid the moiré effect

Example of cross hatching problems
Criminal history of detained Vs. released felony defendants, 1990

Prior criminal history

- Arrest
- Any conviction
- Felony conviction
- Violent felony conviction

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Use an aspect ratio that is appropriate to the data and our visual system

- The aspect ratio of a chart is the comparison of the width to the height

- An improper aspect ratio can distort the slope of a line or make differences disappear

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The proper aspect ratio of a chart is about 1 tall to 1.3 wide
Never use 3 dimensional designs for 2 dimensional data

- Designs done in perspective make accurate comparisons impossible
- Data can easily be hidden

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Hidden data is a common problem with 3D presentations of 2D data

A simple line chart in 2 dimensions avoids hiding data

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Avoid graphical puzzles

- Start the scale at zero
- Use only one unit of measurement per graphic

How to lie with statistics

U.S. Homicide Rate and Percent of Population 18-24

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Not a lie, but a puzzle

U.S. Homicide Rate and Percent of Population 18-24

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Understandable truth

U.S. Homicide Rate and Percent of Population 18-24

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Scale selections should --

■ include all of the data

■ result in ticks, grids, or labels that are easy to understand like 10s, 100s, 1,000s

■ use as few labels as required to convey the message

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How to display many lines on a line chart

■ Use small multiples
■ Use different colors for different lines
■ Use different weights or shades in black and white
■ Break lines to show one on top
■ Reduce the number of lines shown to those of interest

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Make all verbal tasks easy to understand

- Do not use abbreviations
- Avoid acronyms
- Write all labels left to right
- Use proper grammar
- Do not use legends unless using maps
**Difficult verbal tasks**

Criminal history of detained Vs. released felony defendants, 1990

- Arrest
- Any conviction
- Felony conviction
- Violent felony conviction

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**Easy to perform verbal tasks**

Criminal history of detained Vs. released felony defendants, 1990

- Prior criminal history
  - Arrest
  - Any conviction
  - Felony conviction
  - Violent felony conviction

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