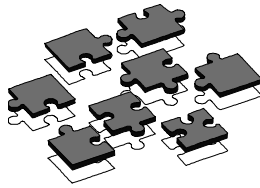


# Data Presentation

A guide to good graphics



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Marianne W. Zawitz

## 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**

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**The purpose is to show the data.**

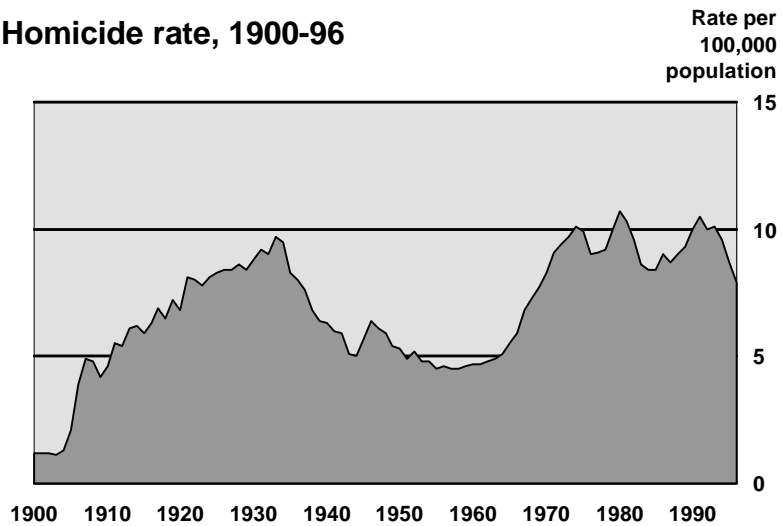
**Therefore, you should maximize:**

- **Data density**
- **Data ink**

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## Example of a graphic with high data density

Homicide rate, 1900-96



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## 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

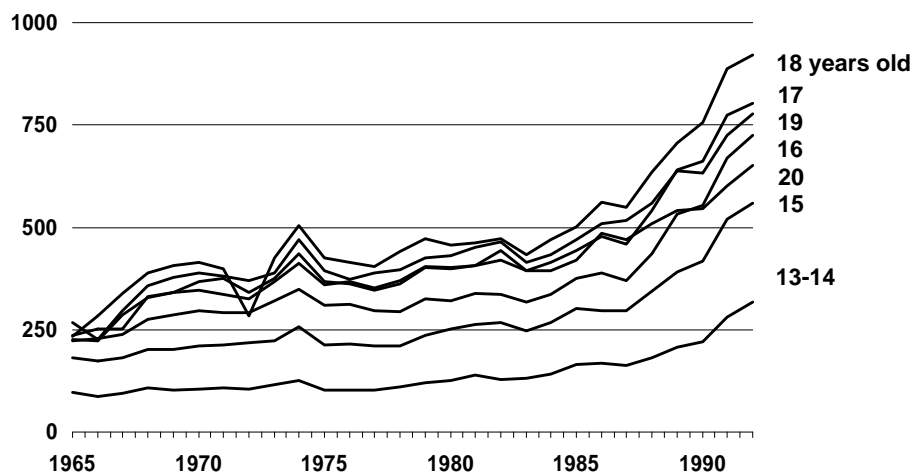
- Line graphs
- Area charts
- Scatter plots
- Maps

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## Line chart

Weapons arrest rate, 1965-92

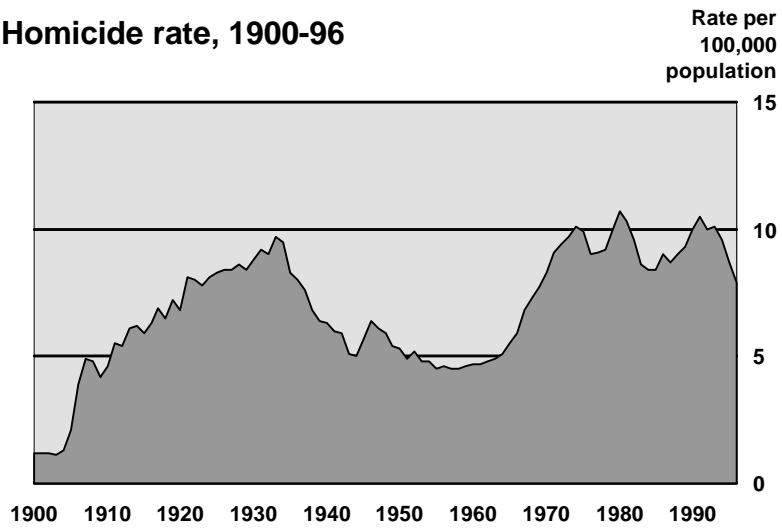
Age of offender



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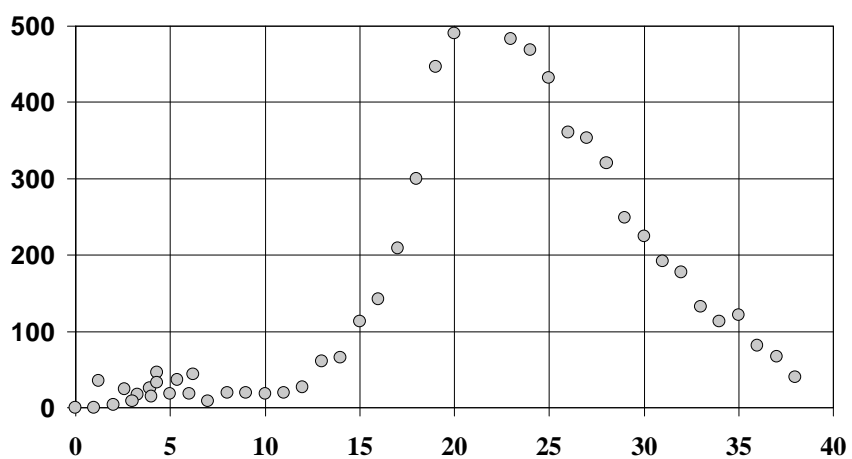
## Area chart

Homicide rate, 1900-96



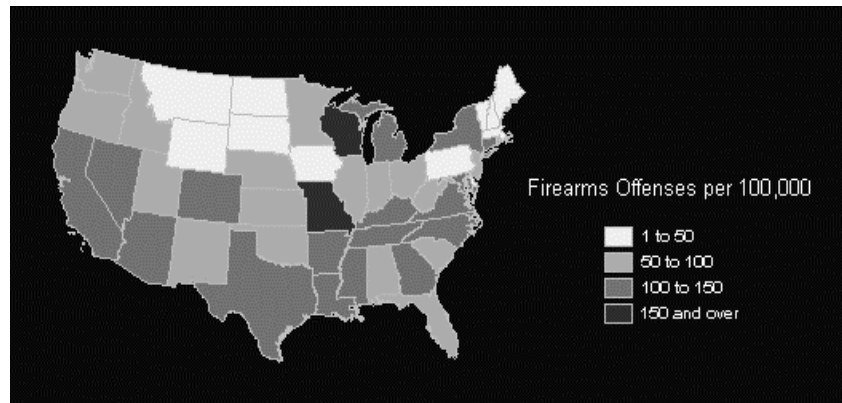
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## Scatter plot



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## Map - with scaled values



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## Graphics for categorical variables

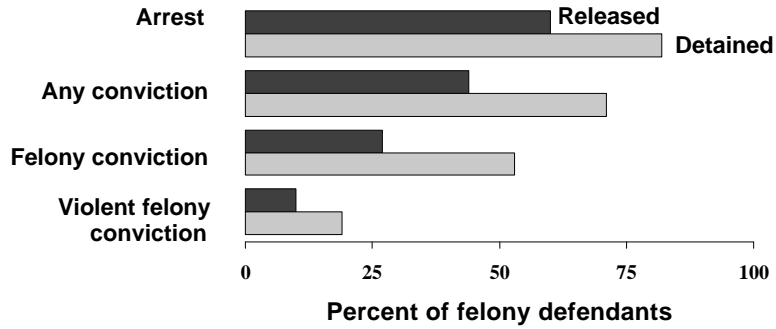
- Bar graphs
- Maps
- Diagrams

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## Bar graph

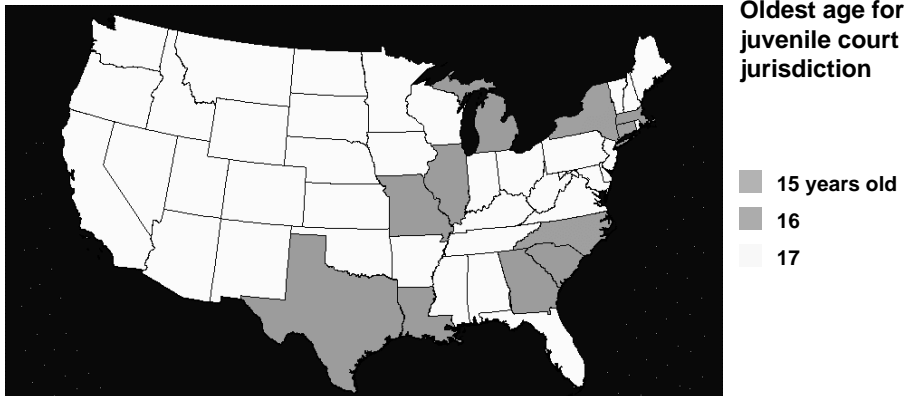
Criminal history of detained Vs. released felony defendants, 1990

Prior criminal history



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## Map - categorical data



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## Diagram

### Manhattan, New York



### Washington, D.C.



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## Cleveland's Hierarchy of graphical perception

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

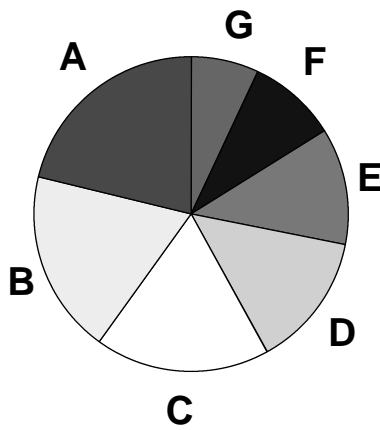
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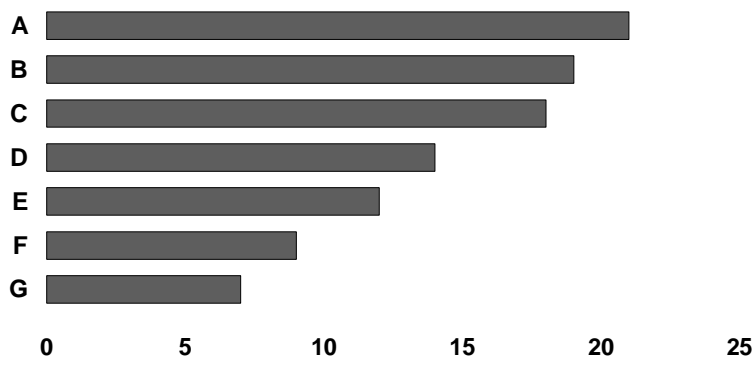
## Graphic styles to avoid

- Pie charts
- Stacked bar graphs
- Stacked line graphs

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<b>A</b>	<b>21</b>
<b>B</b>	<b>19</b>
<b>C</b>	<b>18</b>
<b>D</b>	<b>14</b>
<b>E</b>	<b>12</b>
<b>F</b>	<b>9</b>
<b>G</b>	<b>7</b>

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# **"Simplicity of design and complexity of data"**

**Edward R. Tufte**

**Bureau of Justice Statistics**

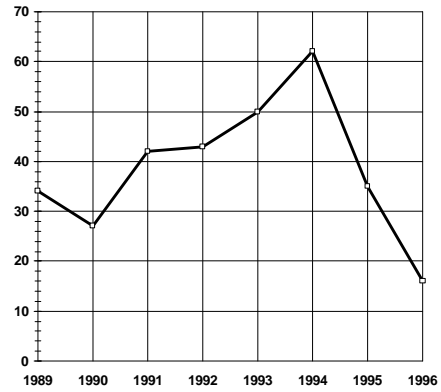
**The purpose of a chart is to show the  
data, so you need to avoid -**

- **Nondata ink**
- **Chartjunk**

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## Nondata ink

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



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## 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**

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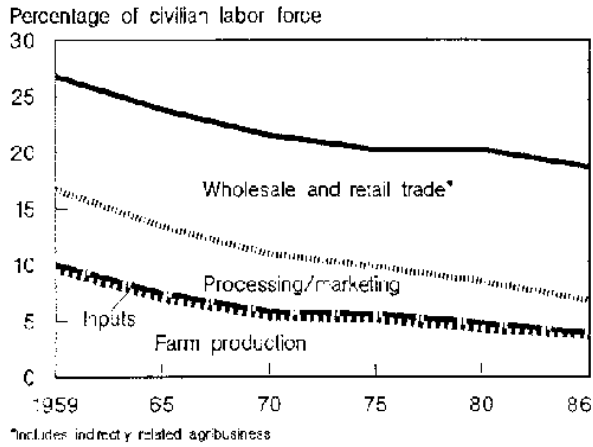
## **Use solid lines and avoid markers on lines**

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

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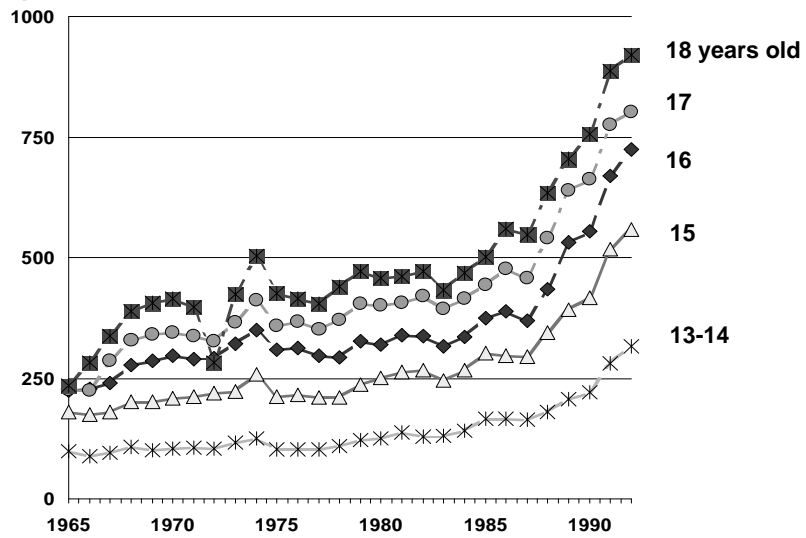
Figure 1  
**Agriculture-related employment**

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

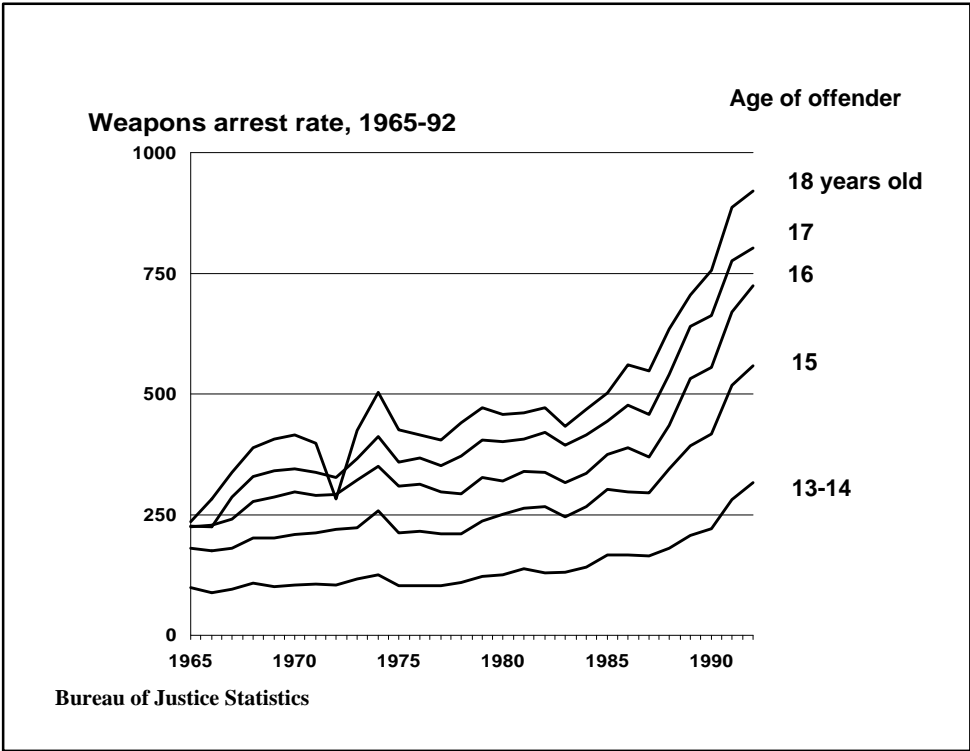
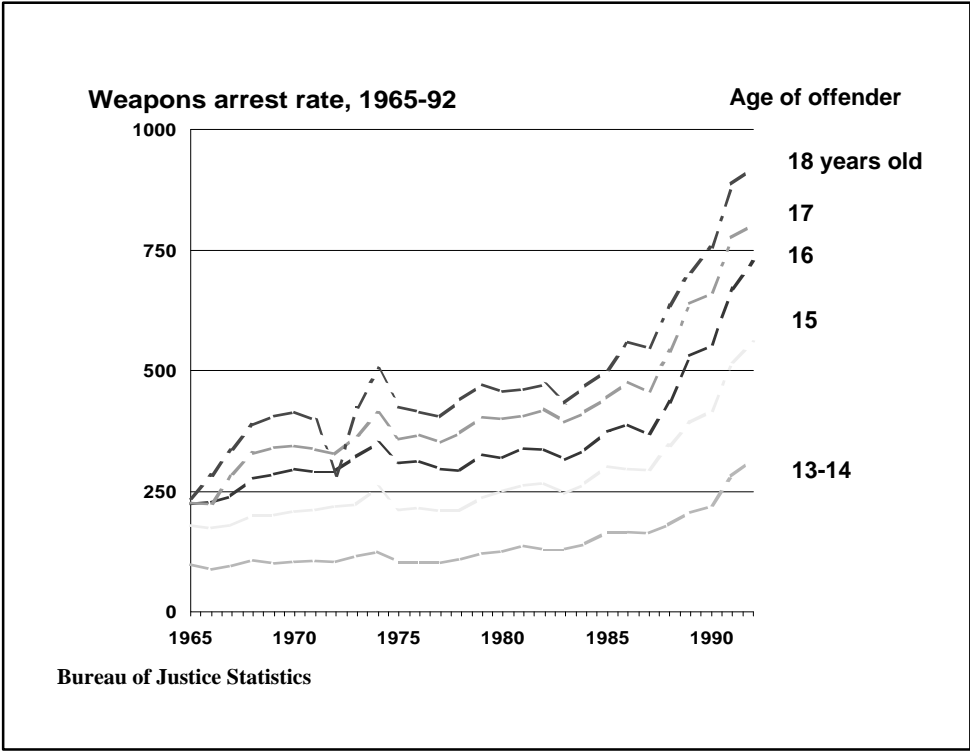


**Weapons arrest rate, 1965-92**

**Age of offender**



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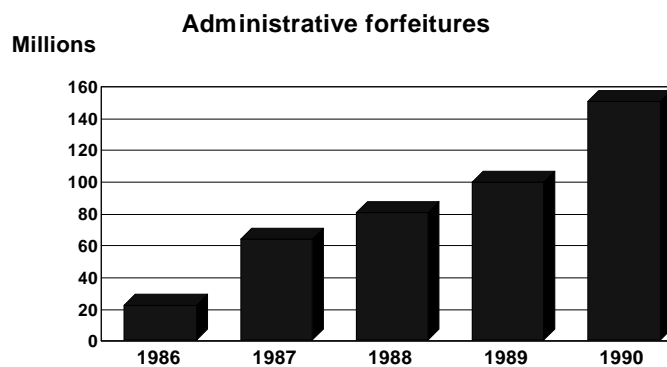


## Use solid fill patterns

- 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

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## Example of cross hatching problems

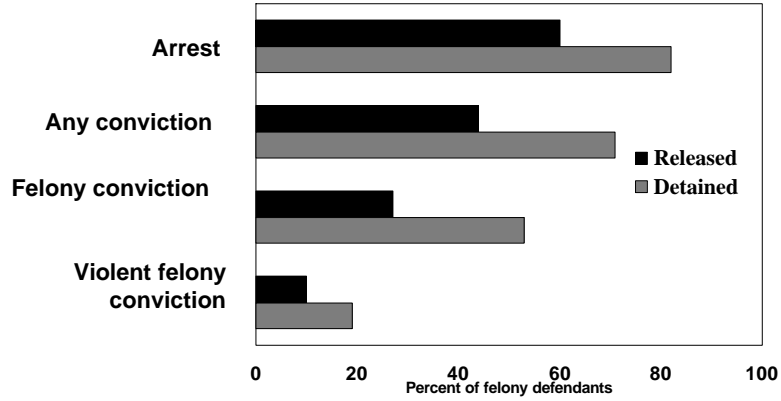


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### Criminal history of detained Vs. released felony defendants, 1990

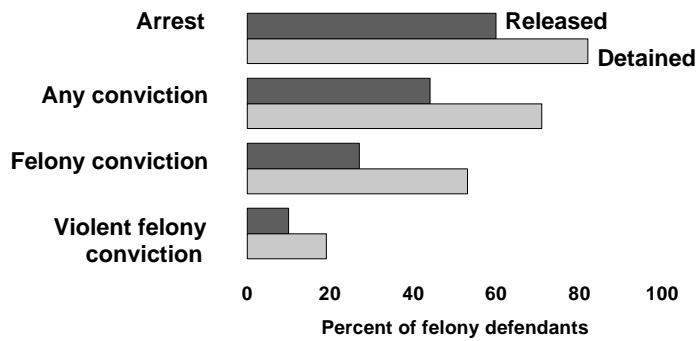
Prior criminal history



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### Criminal history of detained Vs. released felony defendants, 1990

Prior criminal history



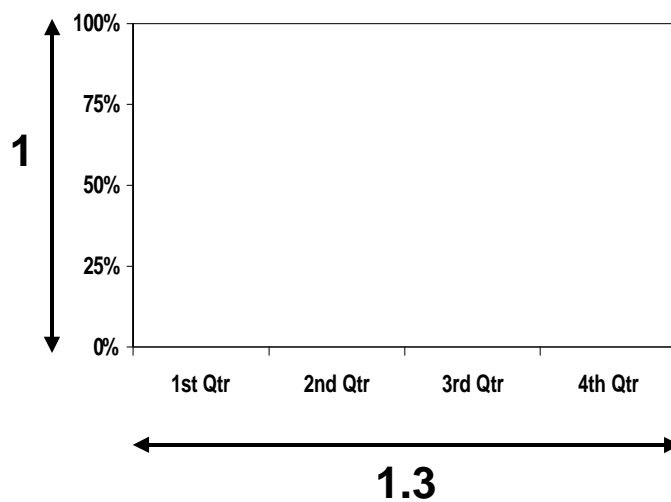
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**Use an aspect ratio that is appropriate to the data and our visual system**

- **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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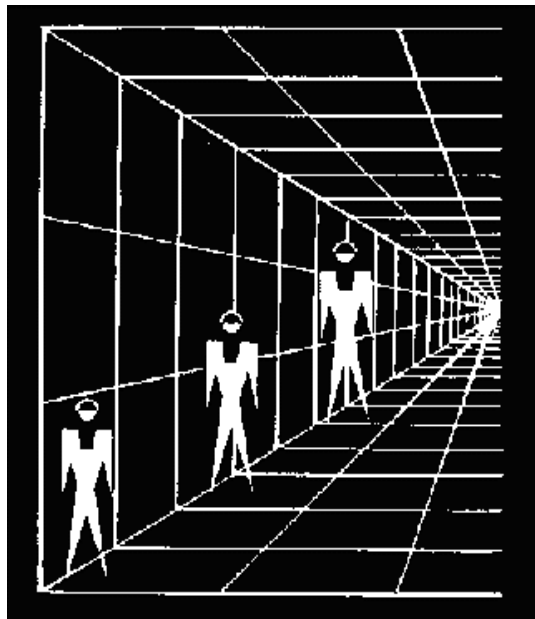
**The proper aspect ratio of a chart is about 1 tall to 1.3 wide**



## **Never use 3 dimensional designs for 2 dimensional data**

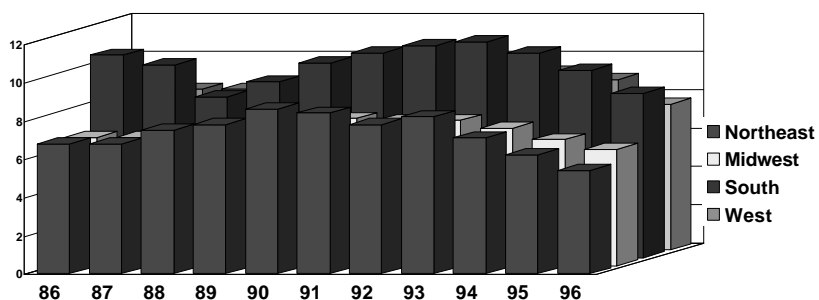
- **Designs done in perspective make accurate comparisons impossible**
- **Data can easily be hidden**

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

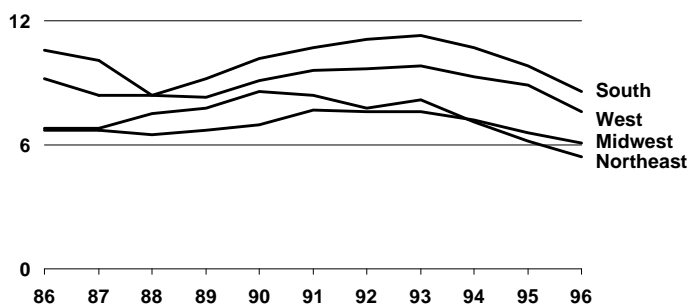
Homicide Victimization Rates by Region



Bureau of Justice Statistics

## A simple line chart in 2 dimensions avoids hiding data

Homicide Victimization Rates by Region



Bureau of Justice Statistics

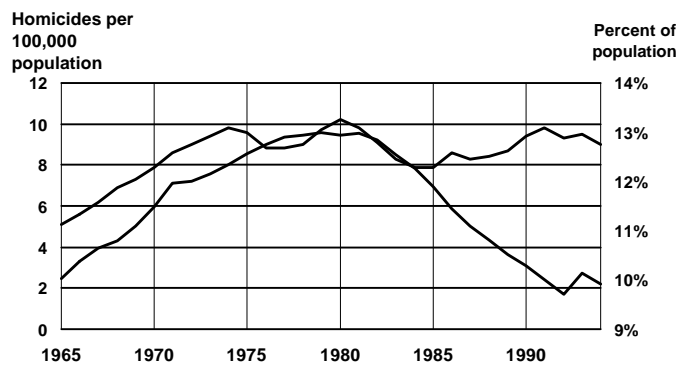
## Avoid graphical puzzles

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

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## How to lie with statistics

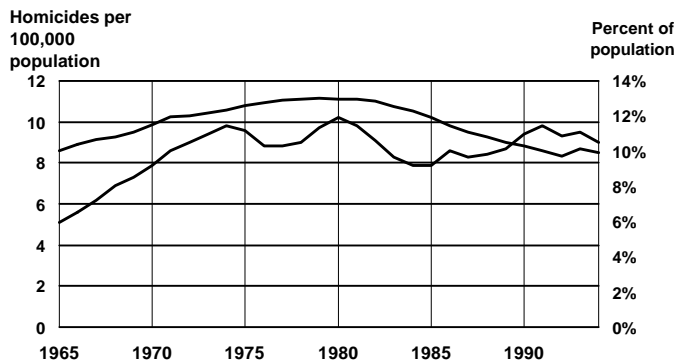
U.S. Homicide Rate and Percent of Population 18-24



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## Not a lie, but a puzzle

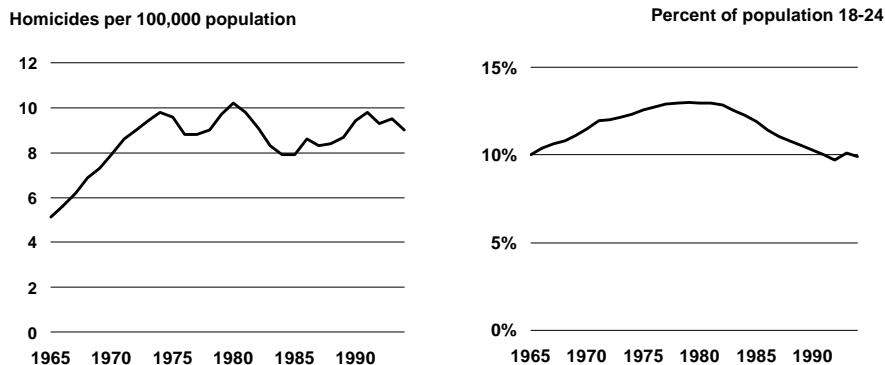
U.S. Homicide Rate and Percent of Population 18-24



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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**

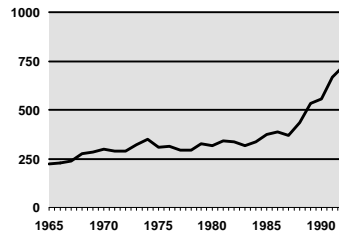
- **Use small multiples**
- **Use different colors for different lines**
- **Use different weights or shades in black and white**
- **Break lines to show one on top**
- **Reduce the number of lines shown to those of interest**

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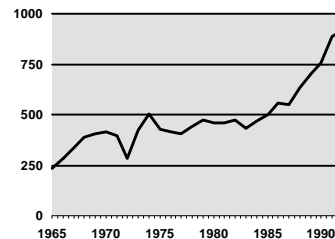
## Small multiples

### Weapons arrest rate, 1965-92

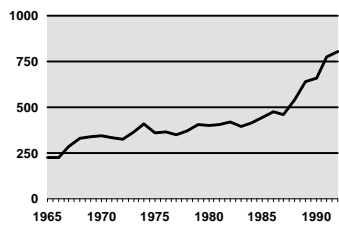
16 years old



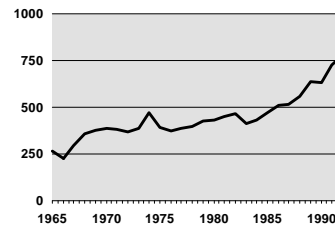
18 years old



17 years old



19 years old



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## Make all verbal tasks easy to understand

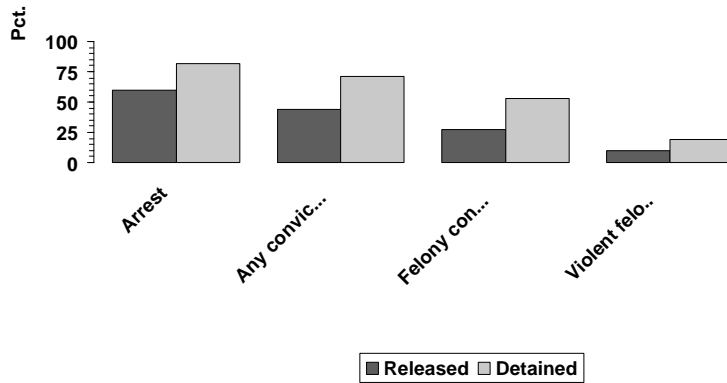
- Do not use abbreviations
- Avoid acronyms
- Write all labels left to right
- Use proper grammar
- Do not use legends unless using maps

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## Difficult verbal tasks

Criminal history of detained Vs. released felony defendants, 1990

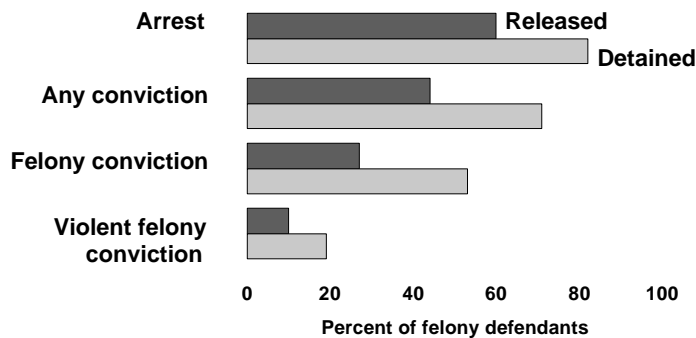


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## Easy to perform verbal tasks

Criminal history of detained Vs. released felony defendants, 1990

Prior criminal history



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