Elementary Statistics

Thirteenth Edition

Mario F. Triola

ELEMENTARY 13E STATISTICS

PEARSON

Chapter 2

Exploring Data with Tables and Graphs

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Exploring Data with Tables and Graphs

Key Concept

Introduce other common graphs that foster understanding of data.

Discuss some graphs that are deceptive because they create impressions about data that are somehow misleading or wrong.

Technology now provides us with powerful tools for generating a wide variety of graphs.

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- **Dotplots**
    - A graph of **quantitative** data in which each data value is plotted as a point (or dot) above a horizontal scale of values. Dots representing equal values are stacked.

Pulse Rates of Males

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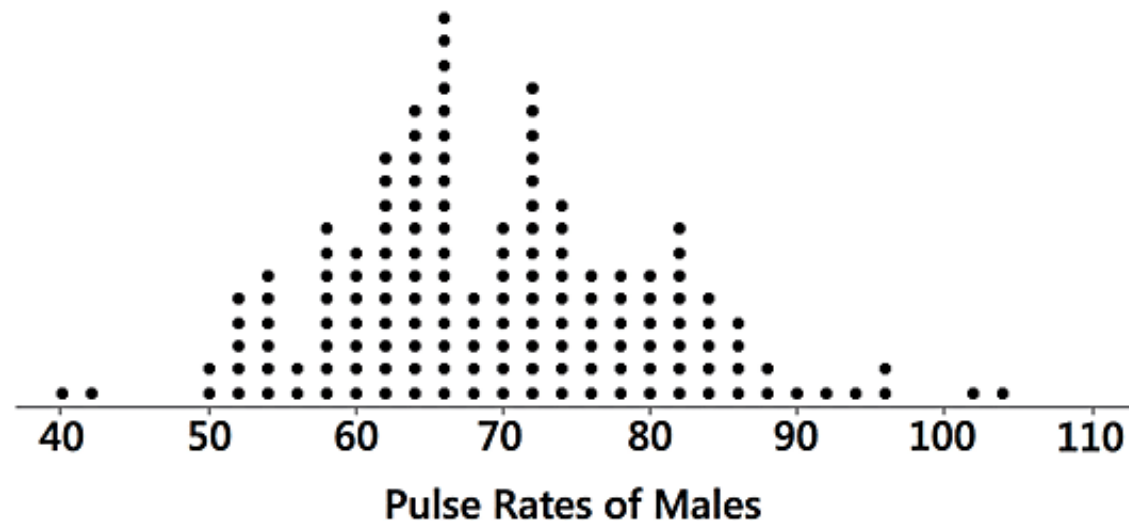
Graphs that Enlighten: Dotplots

- **Dotplots**

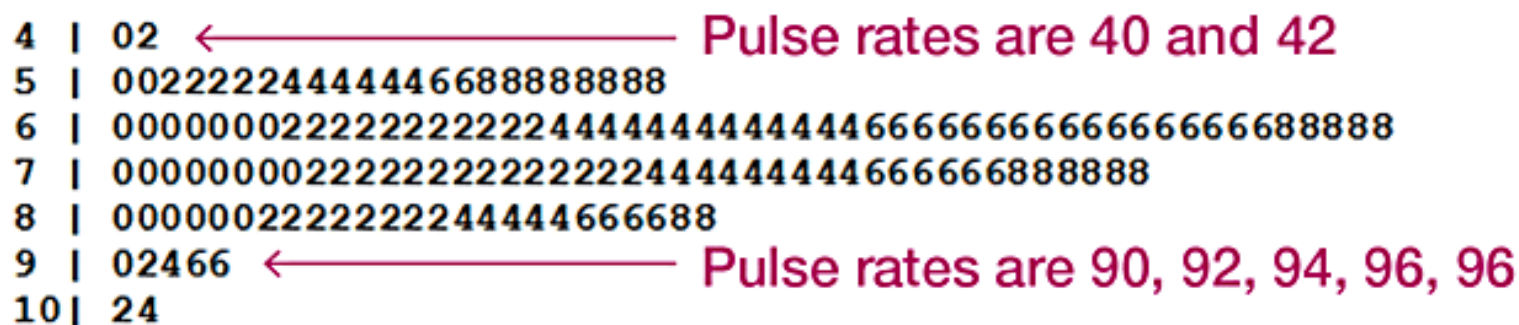 - **Features of a Dotplot**

    - Displays the shape of distribution of data.

    - It is usually possible to recreate the original list of data values.

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Stemplots (1 of 2)

- **Stemplots (or stem-and-leaf plot)**
  - Represents **quantitative** data by separating each value into two parts: the stem (such as the leftmost digit) and the leaf (such as the rightmost digit).

```
 4 | 02          ←———————————————————  Pulse rates are 40 and 42
 5 | 0022222444446688888888
 6 | 00000002222222222444444444444446666666666666666688888
 7 | 00000000222222222222244444444446666668888888
 8 | 0000002222222444444666688
 9 | 02466        ←———————————————————  Pulse rates are 90, 92, 94, 96, 96
10 | 24
```

Stemplots

- **Stemplots (or stem-and-leaf plot)**

  - **Features of a Stemplot**

    - Shows the shape of the distribution of the data.

    - Retains the original data values.

    - The sample data are sorted (arranged in order).

Time-Series Graph

- **Time-Series Graph**

  – A graph of **time-series data,** which are quantitative data that have been collected at different points in time, such as monthly or yearly
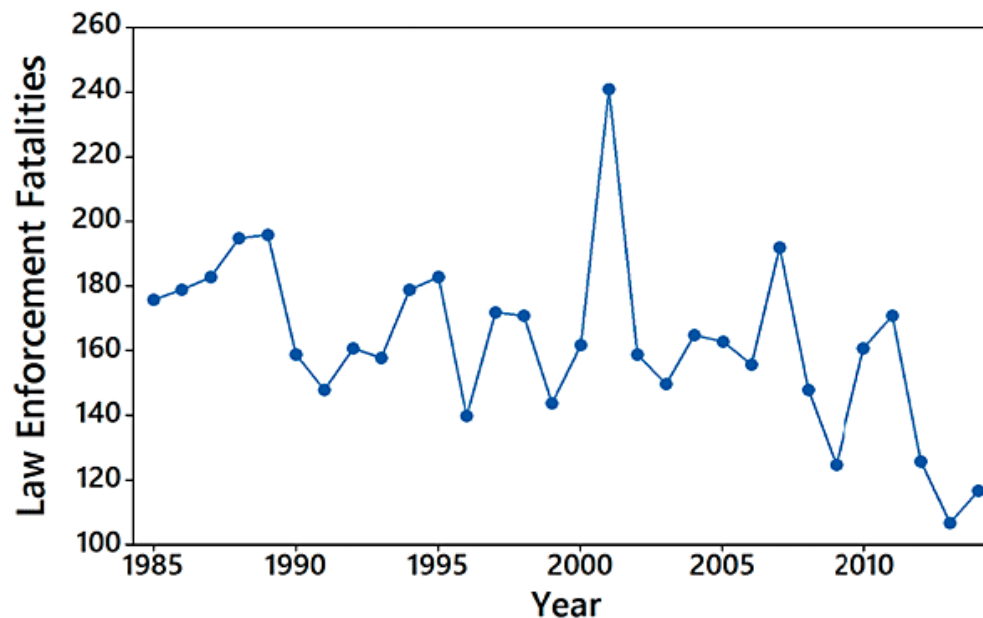
- **Time-Series Graph**

  – **Feature of a Time-Series Graph**

    ▪ Reveals information about trends over time.

Bar Graph

- **Bar Graphs**

  - A graph of bars of equal width to show frequencies of categories of **categorical** (or qualitative) data. The bars may or may not be separated by small gaps.

Bar Graph

- **Bar Graphs**

  – **Feature of a Bar Graph**
  - Shows the relative distribution of categorical data so that it is easier to compare the different categories.

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Pareto Chart

- **Pareto Charts**

  - A Pareto chart is a bar graph for categorical data, with the added stipulation that the **bars are arranged in descending order** according to frequencies, so the bars decrease in height from left to right.
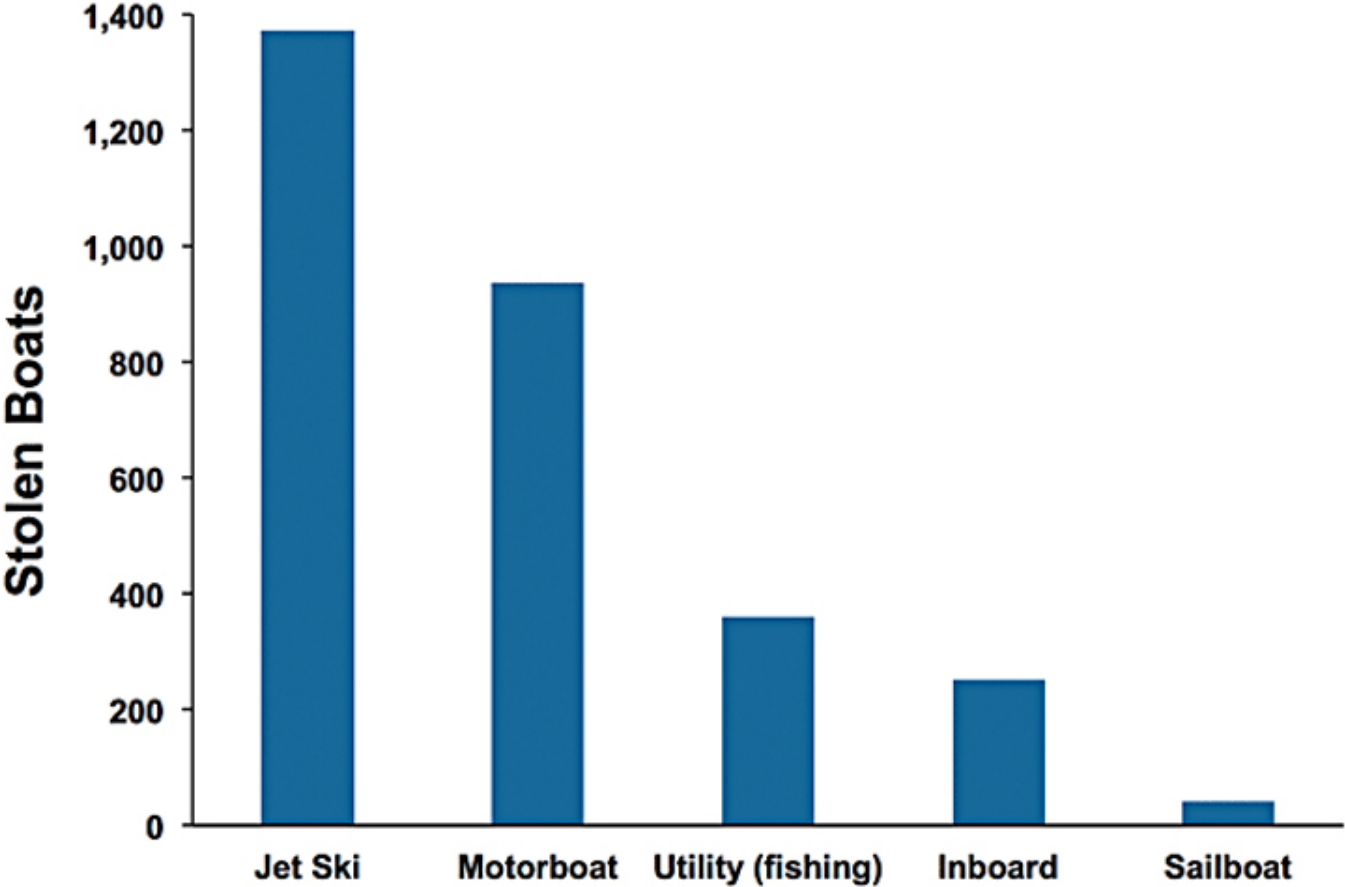
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Pareto Chart

- **Pareto Charts**

  - **Features of a Pareto Chart**
    - Shows the relative distribution of categorical data so that it is easier to compare the different categories.
    - Draws attention to the more important categories.

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Pareto Chart

Pareto Chart of Stolen Boats

Pie Chart

- **Pie Charts**
  - A very common graph that depicts categorical data as slices of a circle, in which the size of each slice is proportional to the frequency count for the category
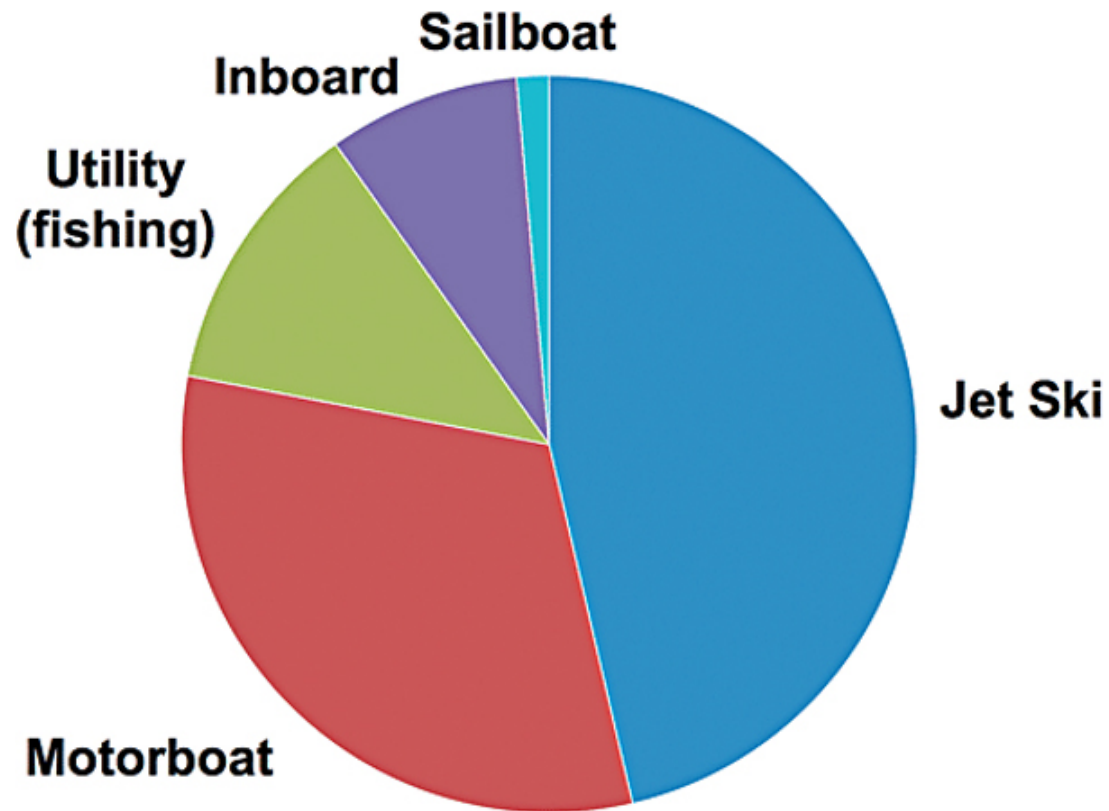
Pie Chart

- **Pie Charts**

  - **Feature of a Pie Chart**

    - Shows the distribution of categorical data in a commonly used format.

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Pie Chart of Stolen Boats

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Frequency Polygon (1 of 3)

- **Frequency Polygon**

  - A graph using line segments connected to points located directly above class midpoint values

  - A frequency polygon is very similar to a histogram, but a frequency polygon uses line segments instead of bars.
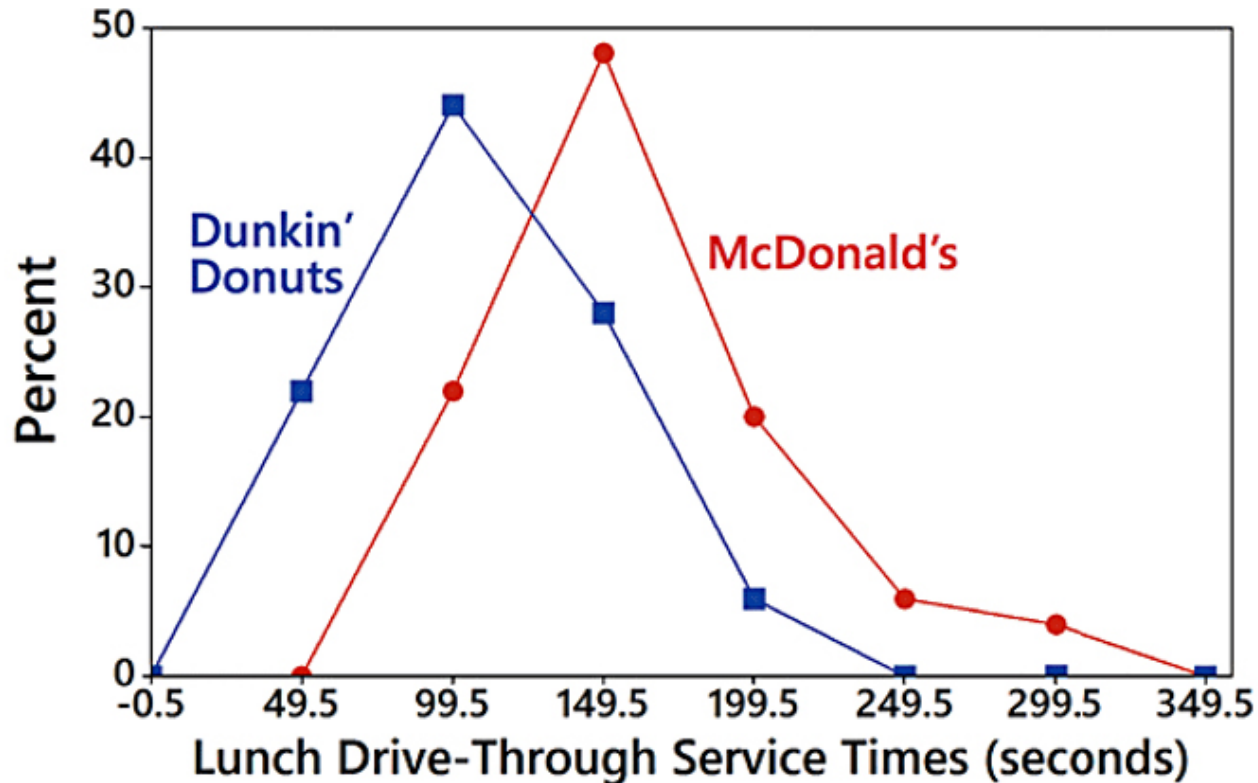
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- **Frequency Polygon**

  – A variation of the basic frequency polygon is the relative frequency polygon, which uses relative frequencies (proportions or percentages) for the vertical scale.

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Frequency Polygon (3 of 3)

Frequency Polygon of McDonald's Lunch Service Times

Relative Frequency Polygon

Relative Frequency Polygons for McDonald's and Dunkin' Donuts

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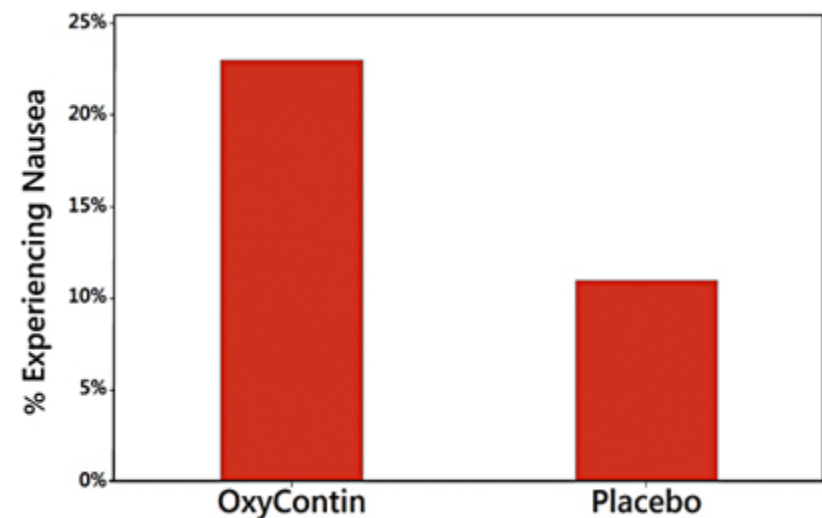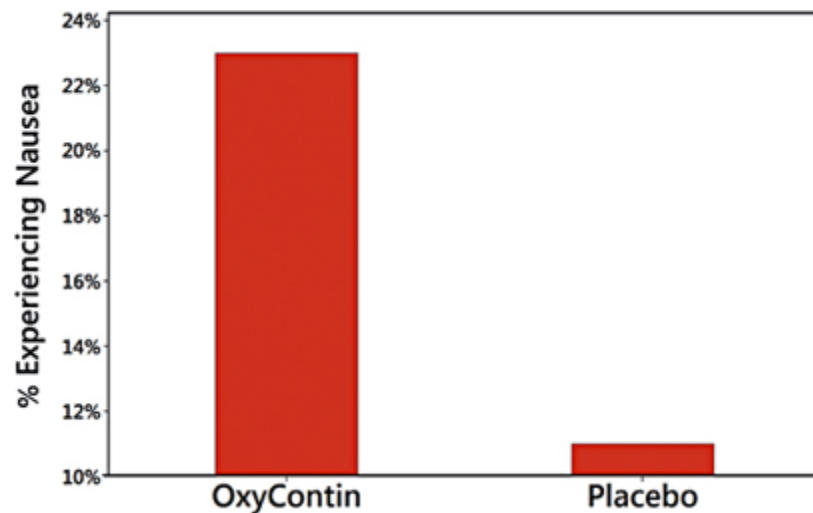# Graphs That Deceive

- **Nonzero Vertical Axis**

  - A common deceptive graph involves using a vertical scale that starts at some value greater than zero to exaggerate differences between groups.

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Graphs That Deceive

- **Nonzero Vertical Axis**

Always examine a graph carefully to see whether a vertical axis begins at some point other than zero so that differences are exaggerated.

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Graphs That Deceive

- **Pictographs**

  - Drawings of objects, called **pictographs**, are often misleading. Data that are one-dimensional in nature (such as budget amounts) are often depicted with two-dimensional objects (such as dollar bills) or three-dimensional objects (such as stacks of coins, homes, or barrels).

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Graphs That Deceive

- **Pictographs**
  - By using pictographs, artists can create false impressions that grossly distort differences by using these simple principles of basic geometry:
    - When you double each side of a square, its area doesn't merely double; it increases by a factor of **four**.
    - When you double each side of a cube, its volume doesn't merely double; it increases by a factor of **eight.**

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Pictographs
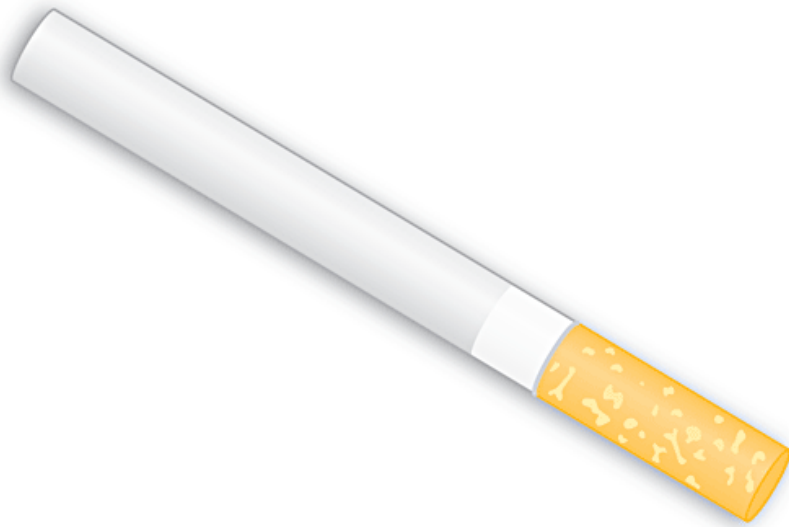
1970: 37% of U.S. adults smoked.

2013: 18% of U.S. adults smoked.

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Concluding Thoughts (1 of 2)

In addition to the graphs we have discussed in this section, there are many other useful graphs - some of which have not yet been created. The world needs more people who can create original graphs that enlighten us about the nature of data.

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Concluding Thoughts

In **The Visual Display of Quantitative Information,** Edward Tufte offers these principles:

- For small data sets of 20 values or fewer, use a table instead of a graph.

- A graph of data should make us focus on the true nature of the data, not on other elements, such as eye-catching but distracting design features.

- Do not distort data; construct a graph to reveal the true nature of the data.

- Almost all of the ink in a graph should be used for the data, not for other design elements.

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