

## Section 1.7 – Misrepresentations of Data

### Bad Graphs

Some graphs are bad in the sense that they contain errors. Some are bad because they are technically correct, but misleading. It is important to develop the ability to recognize bad graphs and identify exactly how they are misleading.

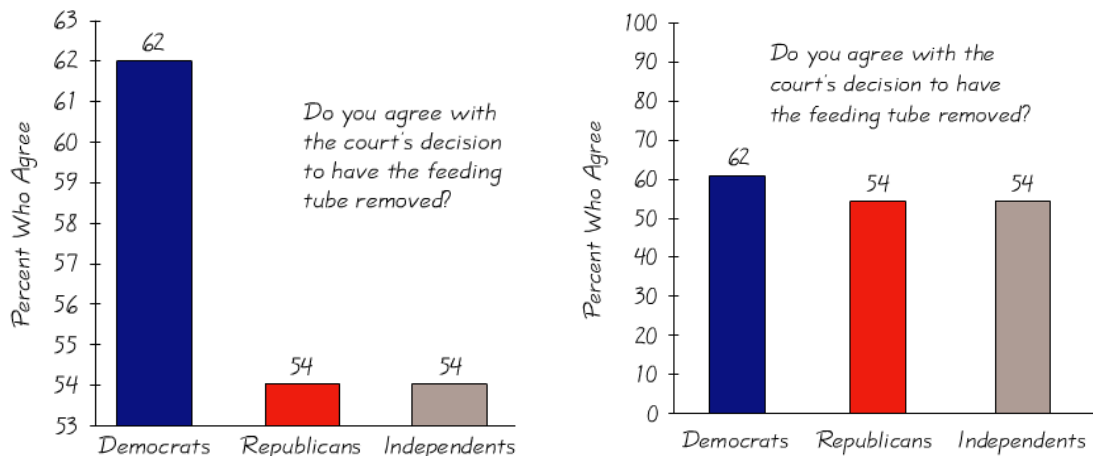
**Statistics:** The only science that enables different experts using the same figures to draw different conclusions. – **Evan Esar**

### Nonzero Axis

Some graphs are misleading because one or both of the axes begin at some value other than zero, so that differences are exaggerated.

### Example

The results of a CNN poll regarding the case of Schiavo is as shown in graph below



**Survey Results by Party**

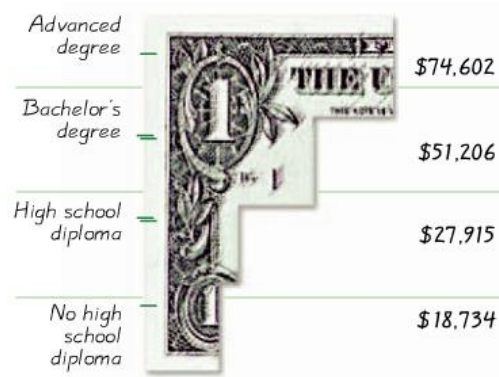
This graph (on the left) creates the incorrect impression that significantly more Democrats agreed with the court's decision than Republicans or Independents. Since graph depicts the data objectively, it creates the more correct impression that the differences are not very substantial. Many people complained that it was deceptive, so CNN posted a modified graph similar to figure on the right.

### Pictographs

Drawings of objects, called pictographs, are often misleading. Three-dimensional objects - money bags, stacks of coins, army tanks (for army expenditures), people (for population sizes), barrels (for oil production), and houses (for home construction) are commonly used to depict data. These drawings can create false impressions that distort the data.

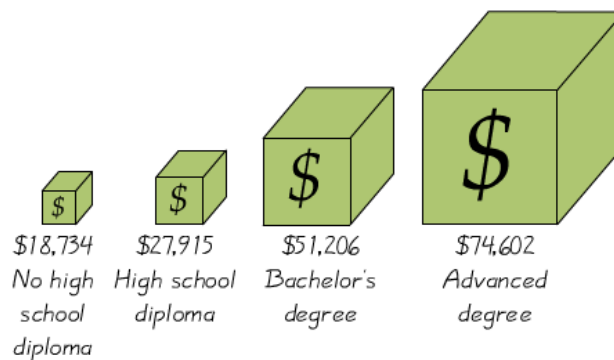
If you double each side of a square, the area does not merely double; it increases by a factor of four; if you double each side of a cube, the volume does not merely double; it increases by a factor of eight. Pictographs using areas and volumes can therefore be very misleading.

### Example



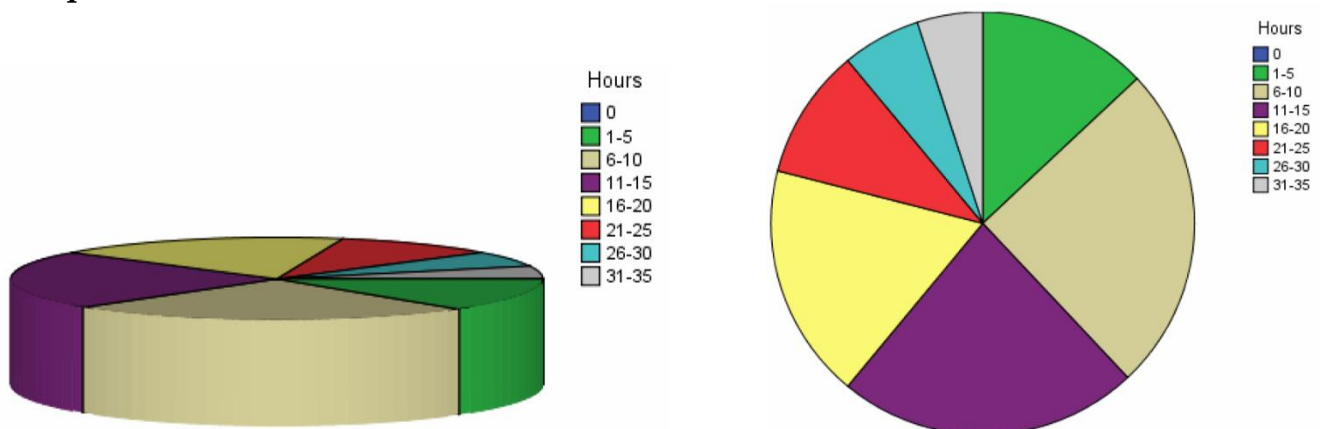
This picture is not misleading because the bars have same width, but it is somewhat too busy, and too difficult to understand.

### Example



It depicts one-dimensional data with three-dimensional boxes. Last box is 64 times as large as first box, but income is only 4 times as large.

### Example

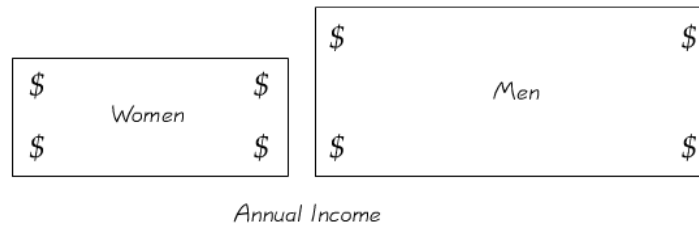


## **Guidelines for Constructing Good Graphics**

- ✓ Title and label the graphic axes clearly, providing explanations, if needed. Include units of measurement and a data source when appropriate.
- ✓ Avoid distortion. Never lie about the data.
- ✓ Minimize the amount of white space in the graph. Use the available space to let the data stand out. If scales are truncated, be sure to clearly indicate this to the reader.
- ✓ Avoid clutter, such as excessive gridlines and unnecessary backgrounds or pictures. Don't distract the reader.
- ✓ Avoid three dimensions. Three-dimensional charts may look nice, but they distract the reader and often lead to misinterpretation of the graphic.
- ✓ Do not use more than one design in the same graphic. Sometimes graphs use a different design in one portion of the graph to draw attention to that area. Don't try to force the reader to any specific part of the graph. Let the data speak for themselves.
- ✓ Avoid relative graphs that are devoid of data or scales.

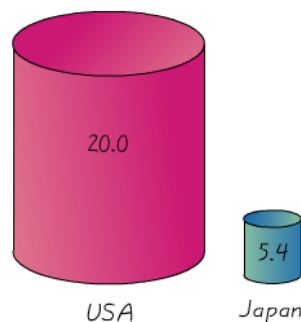
## Exercise    Section 1.7 – Misrepresentations of Data

1. Assume that, as a newspaper reporter, you must graph data showing that increased smoking causes an increased risk of lung cancer. Given that people might be helped and lives might be saved by creating a graph that exaggerates the risk of lung cancer, is it ethical to construct such a graph?
2. The accompanying graph depicts average full-time incomes of women and men aged 18 and over. For a recent year, those incomes were \$37,197 for women and \$53,059 for men (based on data from the U.S. Census Bureau). Does the graph make a fair comparison of the data? Why or why not? If the graph distorts the data, construct a fair graph.

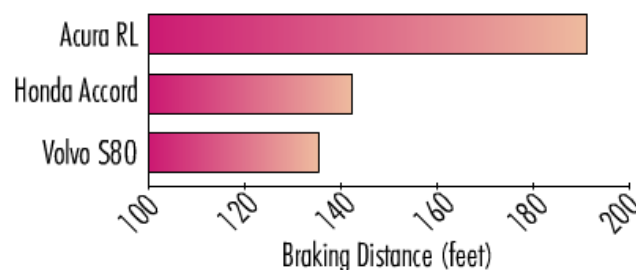


3. The accompanying graph uses cylinders to represent barrels of oil consumed by the U.S. and Japan. Does the graph distort the data or does it depict the data fairly? Why or why not? If the graph distorts the data, construct a graph that depicts the data fairly.

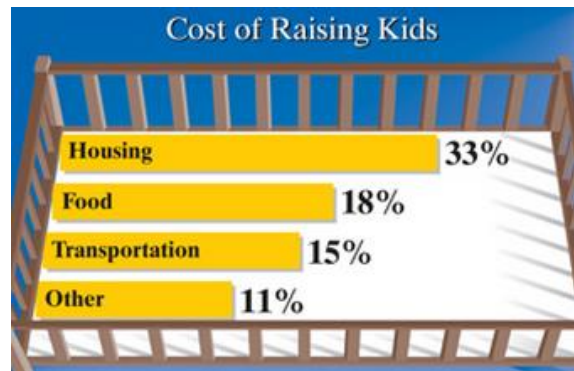
Daily Oil Consumption  
(millions of barrels)



4. The accompanying graph shows the braking distances for different cars measured under the same conditions. Describe the ways in which this graph might be deceptive. How much greater is the braking distance of the Acura RL than the braking distance of the Volvo S80? Draw the graph in a way that depicts the data more fairly.



5. The graph represents the percentage of income a middle-income family will spend on their children



- How is the graphic misleading?
- What could be done to improve the graphics?