1.4 Uses and Abuses of Statistics

There are three kinds of lies;

lies, damned lies, and statistics.

— Disraeli

Uses of Statistics

- Manufacturers use statistics to improve efficiency.

- Conservationists can use data to show the dangers of increased pollution and population growth.

- Scientists can use statistical analyses in assessing the spread of epidemics and pandemics.

- You can become a better consumer and a more politically aware voter if you can recognize when statistics are being used to distort the picture.
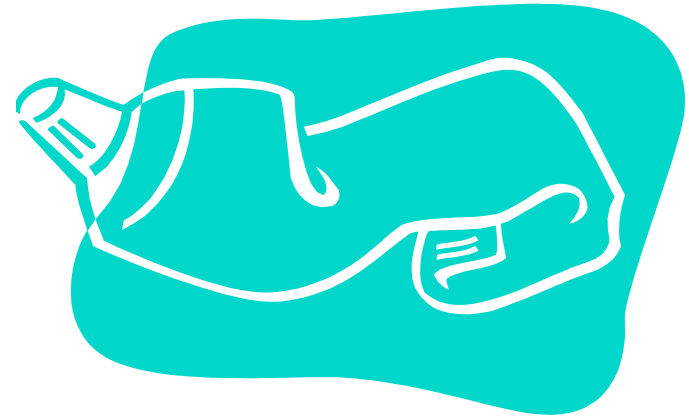
Abuses of Statistics

- **Small Samples**

Small Samples

- Small samples are extremely limited, and do not represent the population at large.

- Even if samples are relatively large, generalizations about subgroups may be based on a very small sample.

Sonis Toothpaste!

Recommended by 7 of 10 dentists for whiter teeth and stronger gums!

Abuses of Statistics

- Small Samples
- Precise Numbers

Precise Numbers

- Sometimes numbers themselves are deceptive.
  - The annual salary is $37, 735.29.
  - The annual salary is about $37,000.

- Although a precise number, with many decimal places, may instill **confidence**, it does not mean that the number is *accurate*.

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates

Guesstimates

- Estimates that are really guesses can be seriously in error.

- Consider the source of the estimate and how it was arrived at.

The Boston Times

- "According to representatives of the group protesting against the removal of candy machines in public high schools, about 50,000 protesters angered by the state's decision rallied at Government Center. Using aerial photographs, The Boston Times put the numbers at the rally at closer to 5,000."

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages

Distorted Percentages

- Misleading or unclear percentages are used.

SONIS AIRLINES

is committed to service! We've already improved on-time flights 100% in the last six months, and that is just the beginning!

Fly Sonis and soar!

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures

Partial Pictures

- Meaning that the claim does not represent the full story and while technically it may be correct, in truth it can be very inaccurate.

- "Sonis" Trucks – the world's most dependable trucks. Ninety percent of our trucks sold in this country in the last ten years are still on the road."

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures
- Deliberate Distortions

Deliberate Distortions

- This is pretty self explanatory; a claim is made based on unfounded, or unknown, data, with the specific intent to mislead and misrepresent.

- In the U.S. there is a law called the Truth in Advertising Act which is supposed to curtail companies from making unsubstantiated claims about their products.

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures
- Deliberate Distortions
- Loaded Questions

Loaded Questions

- The way a question is worded can guide responses toward a desired result.

- Sometimes questions are unintentionally loaded by such factors as the order in which items are being compared and considered.

Examples of Loaded Questions

- In the 1996 Presidential elections, candidate Ross Perot asked the question in a mail survey,

"Should the President have a line item veto to eliminate governmental waste, yes or no?"

97% of respondents said "Yes."

But, in a random survey, results were different when voters were more simply asked "Should the President have a line item veto, yes or no?"

Only 57% said "Yes."

Loaded Questions (cont.)

- A German survey asked the following two questions:
    - Would you say that traffic contributes more or less to air pollution than industry?
    - Would you say that industry contributes more or less to air pollution than traffic?

Depending on the order the questions were asked dramatically affected the responses.
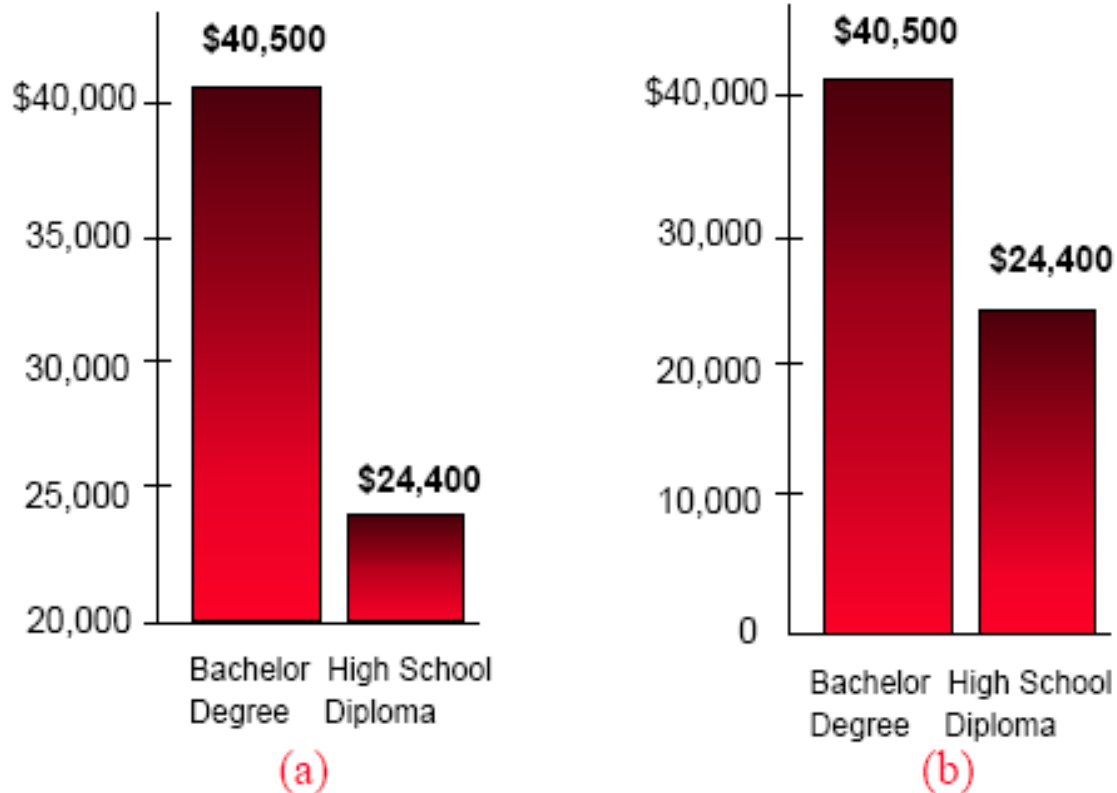
Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures
- Deliberate Distortions
- Loaded Questions
- Misleading Graphs

Misleading Graphs

- Bar graphs, pie charts, and other visual devices can be exaggerated or altered to misrepresent the information.

- We should analyze the *numerical information* given in the graph, and not be misled by the shape of the graph.

Example – Misleading Graphs

Figure 1-1 Salaries of People with Bachelor's Degrees and with High School Diplomas

Chapter 1. Section 1-3. Triola, Elementary Statistics, Eighth Edition. Copyright 2001. Addison Wesley Longman
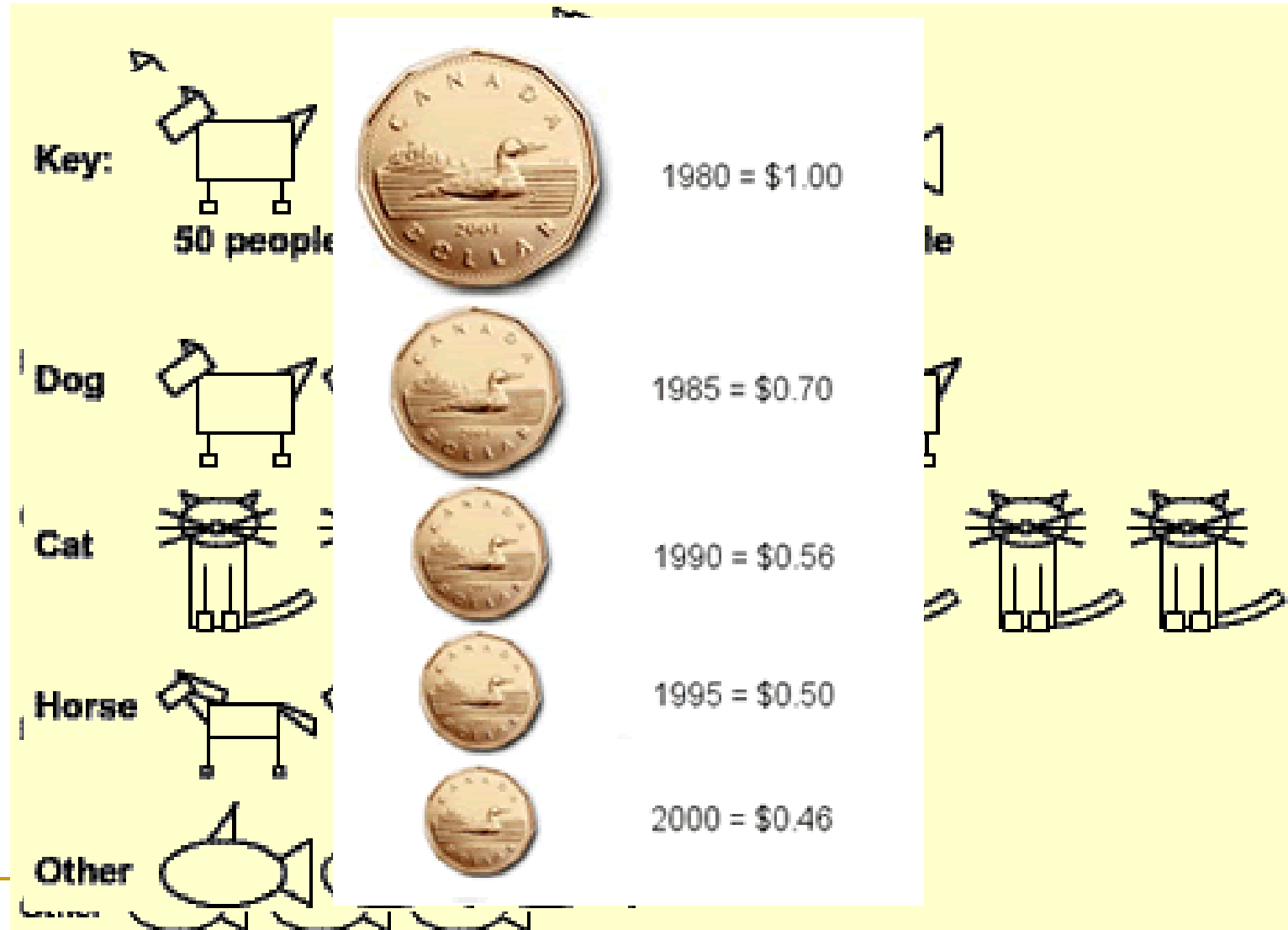
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Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures
- Deliberate Distortions
- Loaded Questions
- Misleading Graphs
- Pictographs

Pictographs

- A pictograph is a drawing of an object meant to represent and depict data.

- Examples – money bags can represent savings or spending; barrels can represent oil use, and so on.

- Distorting the drawings of pictographs can also distort the underlying information.

Pictographs

Key:

50 people

Dog

Cat

Horse

Other

1980 = $1.00
1985 = $0.70
1990 = $0.56
1995 = $0.50
2000 = $0.46

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures
- Deliberate Distortions
- Loaded Questions
- Misleading Graphs
- Pictographs
- Pollster Pressure

Pollster Pressure

- Survey subjects often provide responses that are favorable to their self-image.

- "In a telephone survey, 94% of respondents said that they washed their hands after using a bathroom. Contrary to this figure, observations at public restrooms at Penn Station in New York City and at Golden Gate Park in San Francisco show that the actual rate is closer to 68%."

Abuses of Statistics

- Small Samples
- Precise Numbers
- Guesstimates
- Distorted Percentages
- Partial Pictures
- Deliberate Distortions
- Loaded Questions
- Misleading Graphs
- Pictographs
- Pollster Pressure
- Bad Samples (self-selected survey)

Bad Samples

- Using inappropriate means to gather data.

- Poor data collection.

- Self-selected surveys.

Example of Bad Samples

- The ABC news program "Nightline" conducted a poll where viewers could call a "900" number (a toll call that cost 50 cents) and answer the following question,

"Should the United Nations remain located in the United States?"

There was a total of 186,000 responses, with 67% or two thirds of respondents in favor of moving the UN out of the United States.

Example continued.

- Program host Ted Koppel also reported that in a separate study of 500 randomly selected people, 72% of the respondents wanted the United Nations to stay in the United States.

- Which of these represents poor sampling?