c. Religiosity: This variable could be measured in several ways. For example, as church attendance, the variable could be ordinal (number of times attended church in a month: every week, at least twice a month, less than two times a month, none at all).

d. Student performance: This could be measured as an interval-ratio variable as GPA or test score.

e. Social class: This variable is an ordinal variable, with categories low, working, middle, and upper.

f. Number of children: This variable could be measured in several ways. As an interval-ratio measure, the actual number of children could be reported. As an ordinal measure, the number of children could be measured in categories: 0, 1–2, 3–4, 5 or more. This could also be a nominal measurement—do you have children? Yes or No.

CHAPTER 2

1.

a. Race is a nominal variable. Class is an ordinal variable, since the categories can be ordered. Trauma is an interval variable.

b. Frequency Table for Race

Race	Frequency (f)
White	17
Nonwhite	13
Total (*N*)	30

c. White: 17/30 = .57%; Nonwhite: 13/30 = .43

3.

Number of Traumas	Frequency (f)
0	15
1	11
2	4
Total (*N*)	30

a. Trauma is an interval or ratio-level variable, since it has a real zero point and a meaningful numeric scale.

b. People in this survey are more likely to have experienced no traumas last year (50% of the group).

c. The proportion who experienced one or more traumas is calculated by first adding 36.7% and 13.3% = 50%. Then, divide that number by 100 to obtain the proportion, 0.50, or half the group.

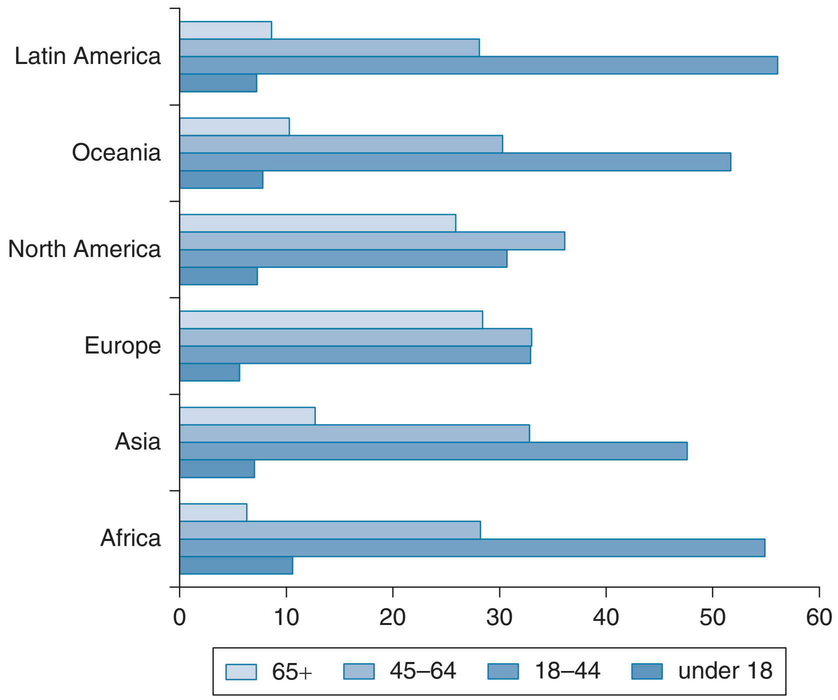
5. Support does vary by political party. The majority of strong Democrats (58.1%) and Independents (66%) agree/strongly agree with the statement. The group with the lowest percentage of agreement is Strong Republicans at 49%. The percentage disagreeing with the statement is highest among Strong Republicans (36.7%) compared with 12.3% of Strong Democrats and 11.3% of Independents.

7. The group with the largest increase in voting rates is blacks, from 53% in 1996 to 66.2% in 2012. Blacks are the only group that did not experience a decline in voting rates for the years presented. Hispanic voting rates exceeded the voting rates for Asians in 2000 and remained higher than Asians through 2012. Hispanics and Asians have the lowest voting rates for all groups. As noted in the exercise, in the 2012 presidential election, blacks had the highest voting rates for all groups, followed by non-Hispanic whites, Hispanics, and Asians. White voting rates declined by 2% from 2008 to 2012. The highest voting rate for whites was in 2004 (67.2%), in 2008 for Hispanics (49.9%) and for Asians (47.6%).

9. If we identify younger Americans as those in the 18 to 24 and 25 to 44 age-groups and older Americans in the 45–64, 65–74, and 75 and over categories—the data indicate that as age increases, so does the percentage of voting in a Presidential election. The group with the highest percentage of voting is the 65- to 74-year olds, with 73.5% voting. The percentage drops for the 75 and over age-group, but is still higher than the reported percentages for the age-groups: 18–24, 25–44, and 45–64.

11. Overall, the highest percentage of smokers are in the 12th-grade category; the lowest are students in the 8th grade. The highest percentage of daily smokers for all grades is between 1996 and 1997 with percentages declining through 2014. (There are no data for 8th and 10th graders pre-1990.) Since 2012, the percentage of students smoking daily was at 10% or below.

13.



CHAPTER 1— ANSWERS TO EXERCISES

1. Once our research question, the hypothesis, and the study variables have been selected, we move on to the next stage of the research process—measuring and collecting the data. The choice of a particular data collection method or instrument depends on our study objective. After our data have been collected, we have to find a systematic way to organize and analyze our data and set up some set of procedures to decide what we mean.

2.
   a. Democrats and Independents are more likely to support the Affordable Care Act than Republicans.
   b. Whites have greater incomes than any other race. Hispanics have incomes greater than blacks but less than whites.
   c. As the number of police in a city increases, the crime rate will decrease.
   d. Life satisfaction may vary with marital status, with satisfaction higher among married persons than those not married.
   e. Younger adults are more likely to support the legalization of marijuana than older adults.
   f. Ethnic minority families are more likely to arrange in-home care (vs. formal institutional care) for their elderly parents than nonminority families.

3.
   a. Interval-ratio
   b. Interval-ratio
   c. Nominal
   d. Ordinal
   e. Nominal
   f. Interval-ratio
   g. Ordinal

4.
   a. Discrete
   b. Continuous
   f. Continuous

5. There are many possible variables from which to choose. Some of the most common selections by students will probably be as follows: type of occupation or industry, work experience, and educational training or expertise. Students should first address the relationship between these variables and gender. Students may also consider measuring structural bias or discrimination.

6.

a. Unemployment records could be used to determine the actual number of unemployed; a descriptive statistic based on the population.

b. A survey is taken to estimate student opinions about the quality of food; inferential statistic.

c. National health records can be used to determine the incidence rate of breast cancer among all Asian women, so this would be a descriptive statistic.

d. The ratings will be gathered from a survey, so this is inferential.

e. A university should be able to report GPA by major, so this is a descriptive statistic based on the population.

f. In theory, the United States records all immigrants to this country. Therefore, the number of South East Asian immigrants would be a descriptive statistic. However, because of illegal immigration, surveys are also taken to estimate the total number of legal and unauthorized immigrants. In that event, the number of immigrants would be an inferential statistic.

7.

a. Annual income

b. Gender—nominal; Number of hours worked per week—interval-ratio; Years of education—interval-ratio; Job title—nominal.

c. This is an application of inferential statistics. She is using information based on her sample to predict the annual income of a larger population of young graduates.

8. At the nominal level, a simple measure of political participation is whether or not someone voted in the most recent general election. This variable would be coded either " yes" or " no."

At the ordinal level, a composite measure could be constructed of both voting and political party membership, like this:

Behavior	Code
Didn't vote, no membership	0
Voted, no membership OR Membership, didn't vote	1
Voted and membership	2

These codes are ordinal in scale because the amount of political participation can be ranked from high to low. Other possible ordinal variables can be constructed from other sets of behaviors, such as working in a candidate's campaign, signing a petition, and so forth. The key points are to create a variable whose values can be ranked and whose values are not on an interval-ratio scale.

At the interval-ratio level, political participation could be measured by the percentage of elections in which a person has voted since becoming eligible to vote or the amount of money a person donated to political candidates during some specified time period.

9.

a. Individual age: This variable could be measured as an interval-ratio variable, with actual age in years reported. As discussed in the chapter, interval-ratio variables are the highest level of measurement and can also be measured at ordinal or nominal levels.

b. Annual income: This variable could be measured as an interval-ratio variable, with actual dollar earnings reported.

c. Religiosity: This variable could be measured in several ways. For example, as church attendance, the variable could be ordinal (number of times attended church in a month: every week, at least twice a month, less than two times a month, none at all).

d. Student performance: This could be measured as an interval-ratio variable as GPA or test score.

e. Social class: This variable is an ordinal variable, with categories low, working, middle, and upper.

f. Number of children: This variable could be measured in several ways. As an interval-ratio measure, the actual number of children could be reported. As an ordinal measure, the number of children could be measured in categories: 0, 1–2, 3–4, 5 or more. This could also be a nominal measurement—do you have children? Yes or No.

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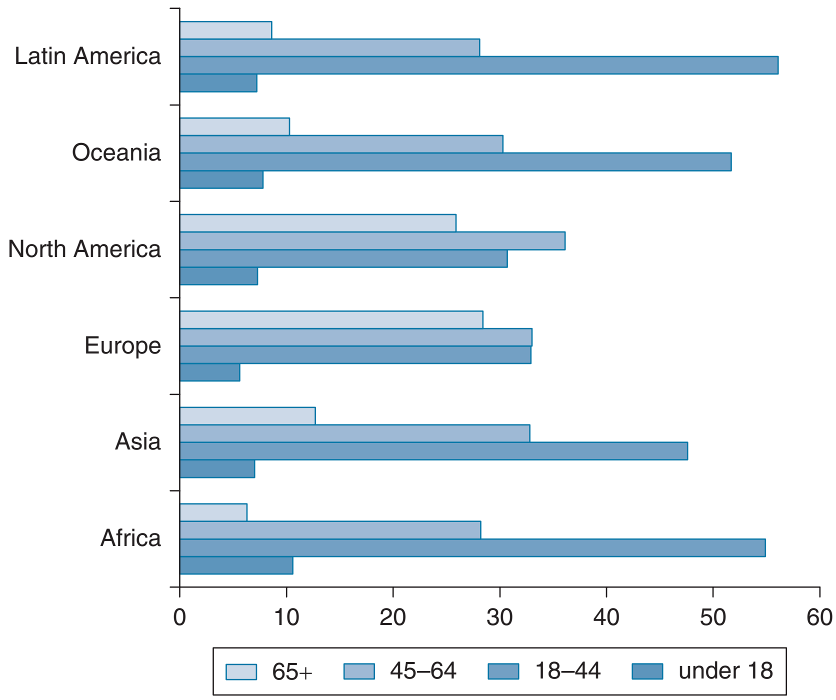


a. For Africa, Asia, Oceania, and Latin America, the largest age-group is 18 to 44 years. For Europe and North America, the age composition is slightly older; individuals aged 45 to 64 years are the largest age-group for both.

b. We display the data in a vertical bar graph. We selected a bar graph because country of origin (the basis of the percentage calculation) is nominal.

CHAPTER 3

1.

a. Mode = Routine ($f = 379$)

b. Median = Routine

c. Based on the mode and median for this variable, most respondents indicate that their lives are "routine."

d. A mean score could not be interpreted for this variable. A mean would have no meaning for a nominal measurement.

3.

a. Interval ratio. The mode can be found in two ways: by looking either for the highest frequency (14) or the highest percentage (43.8%). The mode is the category that corresponds to the value "40 hours worked last week." The median can be found in two ways: by using either the frequencies column or the cumulative percentages.

Using Frequencies	Using Cumulative Percentages
$\frac{N+1}{2} = \frac{32+1}{2} = 16.5\text{th case}$	Notice that 34.4% of the observations fall in or below the "32 hours worked last week" category; 78.1% fall in or below the "40 hours worked last week" category.
Starting with the frequency in the first category (1), add up the frequencies until you find where the 16th and 17th cases fall. Both these cases correspond to the category "40 hours worked last week," which is the median.	The 50% mark, or the median, is located somewhere within the "40 hours worked last week" category. So the median is "40 hours worked last week."

b. Since the median is merely a synonym for the 50th percentile, we already know that its value is "40 hours worked last week."

25th percentile = (32×0.25) = 8th case = 30 hours worked last week.

75th percentile = (32×0.75) = 24th case = 40 hours worked last week

5.

Chapter Activities

Chapter 3: Measures of Central Tendency

Activity #1 (Group or Individual)

Have students do the following activity, individually or in small groups:

Make a list of variables pertaining to your classmates (e.g., height, eye color, and major). Develop your list so that it includes a range of nominal, ordinal, and interval/ratio level variables. Next, define your response categories. Remember, these categories must be both exhaustive and mutually exclusive. Thus, for example, eye color could be categorized according to the following: blue, brown, green, hazel, and other. Survey each person in your class and proceed to compute all appropriate measures of central tendency. Finally, write a brief report about what you observed and either present or circulate your report to the class.

Activity #2 (Group or Individual)

Have students do the following activity, individually or in small groups:

Take the data collected from Activity #1. Begin by entering the data into a new SPSS datasheet. Save your work. Next, use SPSS to compute the various measures of central tendency computed by hand in the previous group exercise. Are these answers the same as those you calculated by hand? They should be. If not, revisit your work from the previous group exercise. Find any problem spots and redo your work as needed.

Activity #3 (Group or Individual)

Have students come up with examples of variables that might be more likely to have skewed data than others (e.g., income and age). Students should come up with 3–5 examples of variables with potentially skewed data. Next, have students draw what they expect the shape of the distribution to look like and explain why. Their drawings should be labeled as positively skewed or negatively skewed. Have students present their variables and drawings to the class.

Activity #4 (Group or Individual)

Have students create one question for each level of measurement (e.g., for nominal level data you could ask, What is your favorite sports team out of the following list the Royals, Yankees, or Astros?). Then have all of the class answer the questions with their personal data. Have them calculate all of the measures of central tendency. Then have the students determine and explain which measure(s) of central tendency would best represent their dataset. Also have them discuss if any measures of central tendency would not be appropriate for their particular level of measurement. Have students bring all of this work back to the class as a whole for discussion.

Instructor Resource
Frankfort-Nachmias, *Social Statistics for a Diverse Society, 8e*
SAGE Publications, 2018

Lecture Notes

Chapter 2: Organization and Graphic Presentation of Data

Summary

- The most basic method for organizing data is to classify the observations into a frequency distribution—a table that reports the number of observations that fall into each category of the variable being analyzed.
- Constructing a frequency distribution is usually the first step in the statistical analysis of data.
- To obtain a frequency distribution for nominal and ordinal variables, count and report the number of cases that fall into each category of the variable along with the total number of cases (N).
- To construct a frequency distribution for interval-ratio variables that have a wide range of values, first combine the scores into a smaller number of groups—known as class intervals—each containing a number of scores.
- Proportions and percentages are relative frequencies.
- Percentage distributions are tables that show the percentage of observations that fall into each category of the variable.
- Cumulative frequency distributions allow us to locate the relative position of a given score in a distribution.
- Cumulative percentage distributions have wider applications than cumulative frequency distributions.
- One other method of expressing raw frequencies in relative terms is known as a rate. Rates are defined as the number of actual occurrences in a given time period divided by the number of possible occurrences.
- Rates are often multiplied by some power of 10 to eliminate decimal points and make the number easier to interpret.

Outline

- Frequency Distributions
  - The most basic method for organizing data
  - A frequency distribution is a table that reports the number of observations that fall into each category of the variable we are analyzing
  - Constructing a frequency distribution is usually the first step in the statistical analysis of data
- Proportions and Percentages
  - A proportion is a relative frequency obtained by dividing the frequency in each category by the total number of cases
  - To find a proportion (p), divide the frequency (f) in each category by the total number of cases (N)
  - To determine a frequency from a proportion, multiply the proportion by the total N
  - A percentage is a relative frequency obtained by dividing the frequency in each category by the total number of cases and multiplying by 100
- Percentage Distributions
  - A percentage distribution is a table showing the percentage of observations falling into each category of the variable
  - Percentage distributions (or proportions) should always show the base (N) on which they were computed
- The Construction of Frequency Distributions
  - Frequency distributions for nominal variables
  - Frequency distributions for ordinal-level variables
  - The major difference between frequency distributions for nominal and ordinal variables is the order in which the categories are listed
  - Frequency distributions for interval-ratio variables
  - Very often interval-ratio variables have a wide range of values, which makes simple frequency distributions very difficult to read
- Cumulative Distributions

    - A cumulative frequency distribution shows the frequencies at or below each category of the variable
    - Cumulative frequencies are appropriate only for variables that are measured at an ordinal level or higher
    - They are obtained by adding to the frequency in each category the frequencies of all the categories below it
    - A cumulative percentage distribution shows the percentage at or below each category (class interval or score) of the variable
    - A Closer Look
        - Real limits, stated limits, and midpoints of class intervals
- Rates
    - A rate is a number obtained by dividing the number of actual occurrences in a given time period by the number of possible occurrences
    - Calculating the poverty rate can be done by looking at the number of people in poverty in 2011/Total population in 2011
        - Crude rate
- Statistics in Practice: Access to Public Benefits

Graphic Presentation of Data

- The Pie Chart
    - A pie chart shows the differences in frequencies or percentages among the categories of a nominal or an ordinal variable
    - The categories are displayed as segments of a circle whose pieces add up to 100% of the total frequencies
    - This is illustrated with an overview of race and ethnicity of the elderly
- The Bar Graph
    - The bar graph provides an alternative way to present nominal or ordinal data graphically
    - This is illustrated with an overview of the marital status of the elderly

  - Bar graphs are often used to compare one or more categories of a variable among different groups
- The Statistical Map
  - Maps are especially useful for describing geographical variations in variables, such as population distribution, voting patterns, crime rates, or labor force composition
  - Maps can also display geographical variations on the level of cities, counties, city blocks, census tracts, and other units
- The Histogram
  - The histogram is used to show the differences in frequencies or percentages among categories of an interval-ratio variable
  - A histogram looks very similar to a bar chart except that the bars are contiguous to each other (touching) and may not be of equal width
- The Statistical Map
- The Line Graph
  - The line graph is another way to display interval-ratio distributions; it shows the differences in frequencies or percentages among categories of an interval-ratio variable
  - Points representing the frequencies of each category are placed above the midpoint of the category and are joined by a straight line
  - Both the histogram and the line graph can be used to depict distributions and trends of interval-ratio variables
  - Line graphs are generally better suited for comparing how a variable is distributed across two or more groups or across two or more time periods
- Time-Series Charts
  - A time-series chart displays changes in a variable at different points in time
  - It involves two variables
    - Time, which is labeled across the horizontal axis
    - Another variable of interest whose values (frequencies, percentages, or rates) are labeled along the vertical axis

- A Closer Look 2.2 A Cautionary Note: Distortions in Graphs
  - Always interpret the graph in the context of the numerical information the graph represents
- Statistics in Practice: Foreign Born Population 65 Years and Over

SOCIAL STATISTICS for a DIVERSE SOCIETY

Eighth Edition

Chava Frankfort-Nachmias • Anna Leon-Guerrero

Chapter 2

The Organization and Graphic Presentation of Data

Frequency distribution

- A table reporting the number of observations falling into each category of the variable

Frequency distribution

Identity	Frequency (f)
Native American	947,500
Native American of multiple ancestry	269,700
Native American of Indian descent	5,537,600
Total (N)	6,754,800

Proportions

- A relative frequency obtained by dividing the frequency in each category by the total number of cases

$$P = \frac{f}{N}$$

Percentage

- A relative frequency obtained by dividing the frequency in each category by the total number of cases and multiplying by 100

$$(\%) = P(100)$$

Proportions and percentages

Minimum Age	Proportion	Frequency	Percentage
14	1	*1/27=.037*	3.7%
15	1	.037	3.7%
16	9	.333	33.3%
17	4	.148	14.8%
18	12	.444	44.4%
Total (N)	**27**	**1.0**	**100.0%**

Percentage distributions

- A table showing the percentage of observations falling into each category of the variable

Percentage distributions

Minimum Age	Proportion	Frequency	Percentage
14	1	*1/27=.037*	3.7%
15	1	.037	3.7%
16	9	.333	33.3%
17	4	.148	14.8%
18	12	.444	44.4%
Total (N)	**27**	**1.0**	**100.0%**

Frequency distributions

- Nominal Variables

<table>
<tr><th>Gender</th><th>Tallies</th><th>Freq. f)</th><th>Percentage</th></tr>
<tr><td>Male</td><td>|||||||||||||||</td><td>15</td><td>37.5</td></tr>
<tr><td>Female</td><td>|||||||||||||||||||||||||</td><td>25</td><td>62.5</td></tr>
<tr><td>Total (N)</td><td></td><td>40</td><td>100.0</td></tr>
</table>

Frequency distributions

- Ordinal Variables

Happiness	Tallies	Freq. (f)	Percentage
Very Happy	IIIIIIIII	9	22.5
Pretty Happy	IIIIIIIIIIIIIIIIIIIIIIIII	25	62.5
Not too Happy	IIIIII	6	15.0
Total (N)		**40**	**100.0**

Cumulative distributions

- Cumulative frequency distribution
  - A distribution showing the frequency at or below each category of the variable
- Cumulative percentage distribution
  - A distribution showing the percentage at or below each category of the variable

Cumulative frequency distribution

Minimum Age	Freq. (f)	Percentage	Cumulative Frequency
14	1	3.7	1
15	1	3.7	1
16	9	33.3	2
17	4	14.8	11
18	12	44.4	27
Total (N)	**27**	**100.1***	

*Doesn't total to 100% due to rounding

Cumulative percentage distribution

Minimum Age	Freq. (f)	Percentage	Cumulative Percentage
1	1	3.7	3.7
15	1	3.7	7.4
16	9	33.3	40.7
17	4	14.8	55.5
18	12	44.4	99.9*
Total (N)	27	100.1*	

Rate

- A number obtained by dividing the number of actual occurrences in a given time period by the number of possible occurrences

Rate

- Determining the 2014 Poverty Rate
  - U.S. Census Bureau
  - Number of men and women in poverty in 2014 (actual occurrences) divided by the total population in 2014 (possible occurrences)
    - 46,247,000/308,456,000 =1.5 or 15%

Reading statistical tables

- What is the source of the table?
- How many variables are presented? What are their names?
- What is represented by the numbers presented in the first column? In the second column?

Reading statistical tables

- Selected Economic and Social Indicators for Whites, 2009

Indicators	Percentage
Family income of $200,000 or higher (in the last 12 months)	5.7
Bachelor's degree or higher	29.3
Below the poverty level (individuals)	11.7
Own a home	71

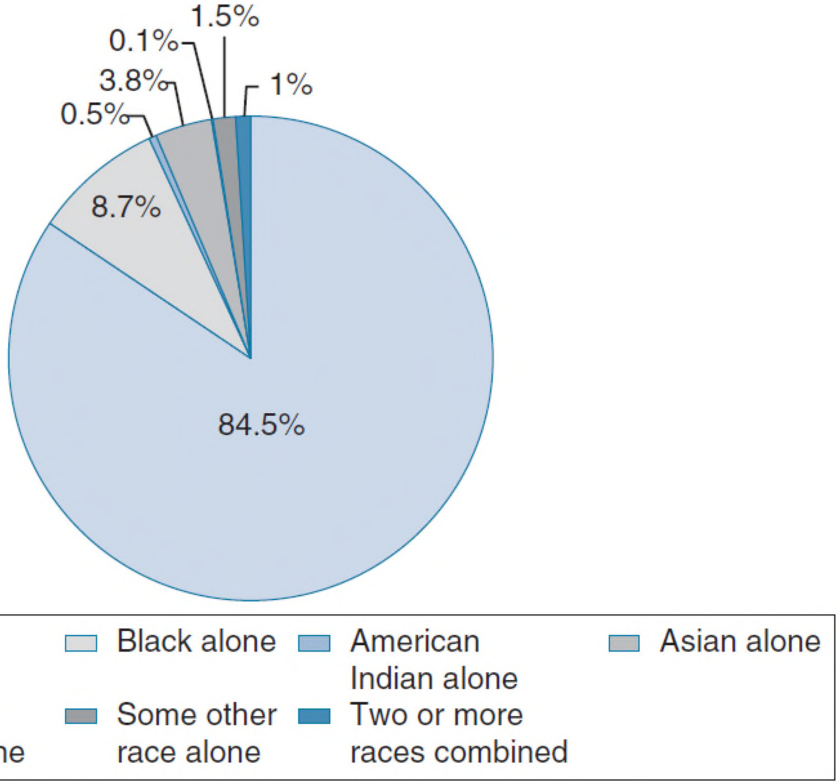
Source: U.S. Census Bureau, 2012 Statistical Abstract of the United States, Table 36

Graphic presentation of data

- The pie chart
  - A graph showing the differences in frequencies or percentages among categories of a nominal or an ordinal variable
  - The categories are displayed as segments of a circle whose pieces add up to 100 % of the total frequencies

The pie chart

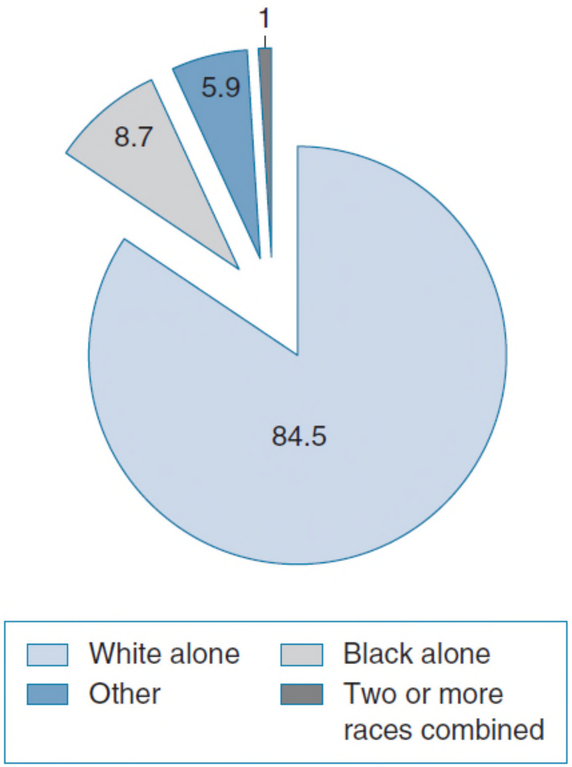
Figure 2.1 Five-Year Estimates of the U.S. Population 65 Years and Over by Race, 2010–2014



Source: U.S. Census Bureau, *American Fact Finder*, Table S0103, 2015.

The pie chart

Figure 2.2 Five-Year Estimates of U.S. Population 65 Years and Over by Race, 2010–2014



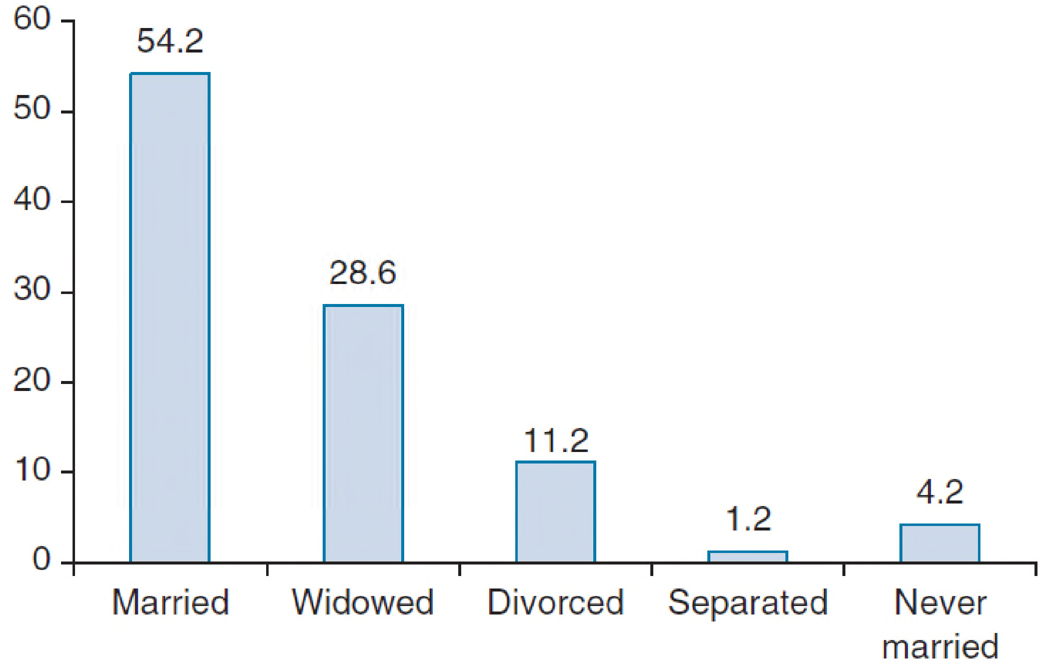
Source: U.S. Census Bureau, *American Fact Finder*, Table S01013, 2015.

The bar graph

- A graph showing the differences in frequencies or percentages among categories of a nominal or an ordinal variable
  – The categories are displayed as rectangles of equal width with their height proportional to the frequency or percentage of the category

The bar graph

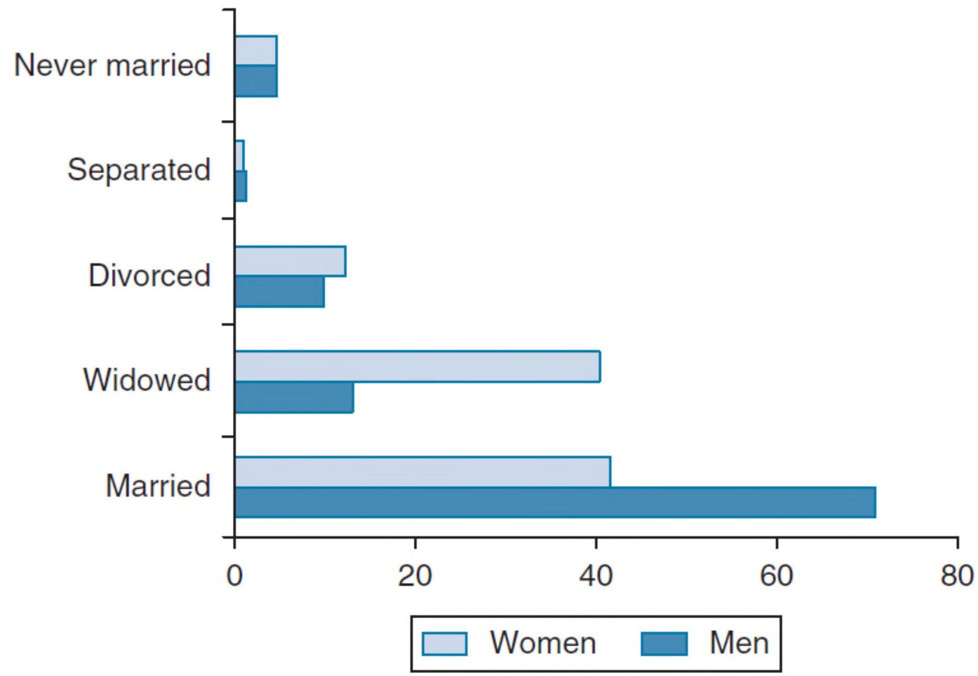
Figure 2.3 Marital Status of U.S. Elderly (65 Years and Older), Percentages, 2010



Source: Loraine West, Samantha Cole, Daniel Goodkind, and Wan He, 65+ *in the United States: 2010,* Current Population Report, P23-212, 2014.

The bar graph

Figure 2.4 Marital Status of U.S. Elderly (65 Years and Older) by Gender (Percentages), 2010



Source: Loraine West, Samantha Cole, Daniel Goodkind, and Wan He, 65+ *in the United States: 2010*, Current Population Report, P23-212, 2014.

The statistical map

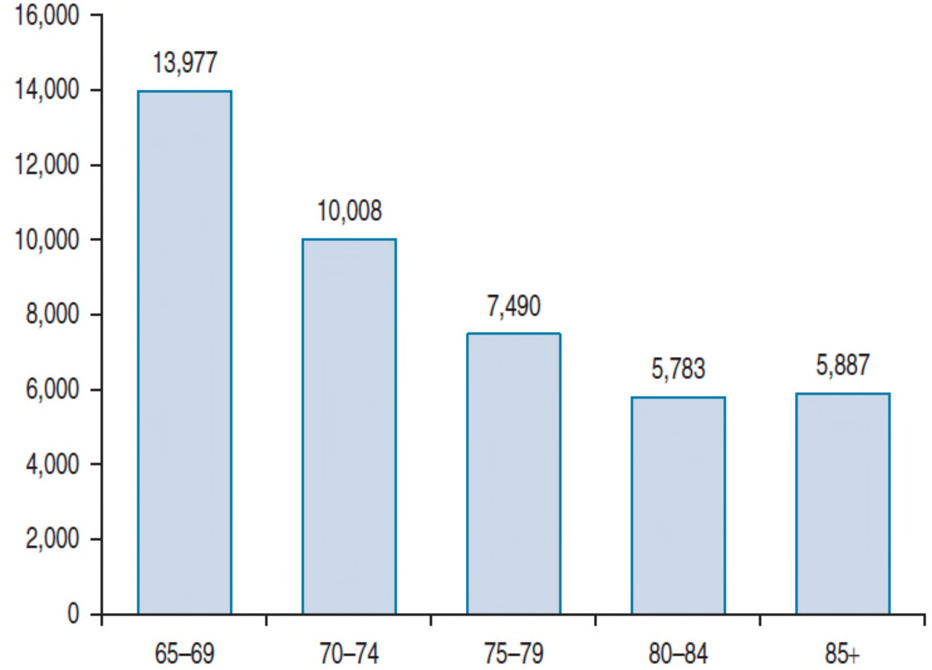
- We can display dramatic geographical changes in American society by using a statistical map
  - Especially useful for describing geographical variations in variables
    - Population distribution
    - Voting patterns
    - Crimes rates

The histogram

- A graph showing the differences in frequencies or percentages among categories of an interval-ratio variable
  - The categories are displayed as contiguous bars, with width proportional to the width of the category and height proportional to the frequency or percentage of that category

The histogram

Figure 2.5 Age Distribution of U.S. Population 65 Years and Over, 2012 (Numbers in Thousands)



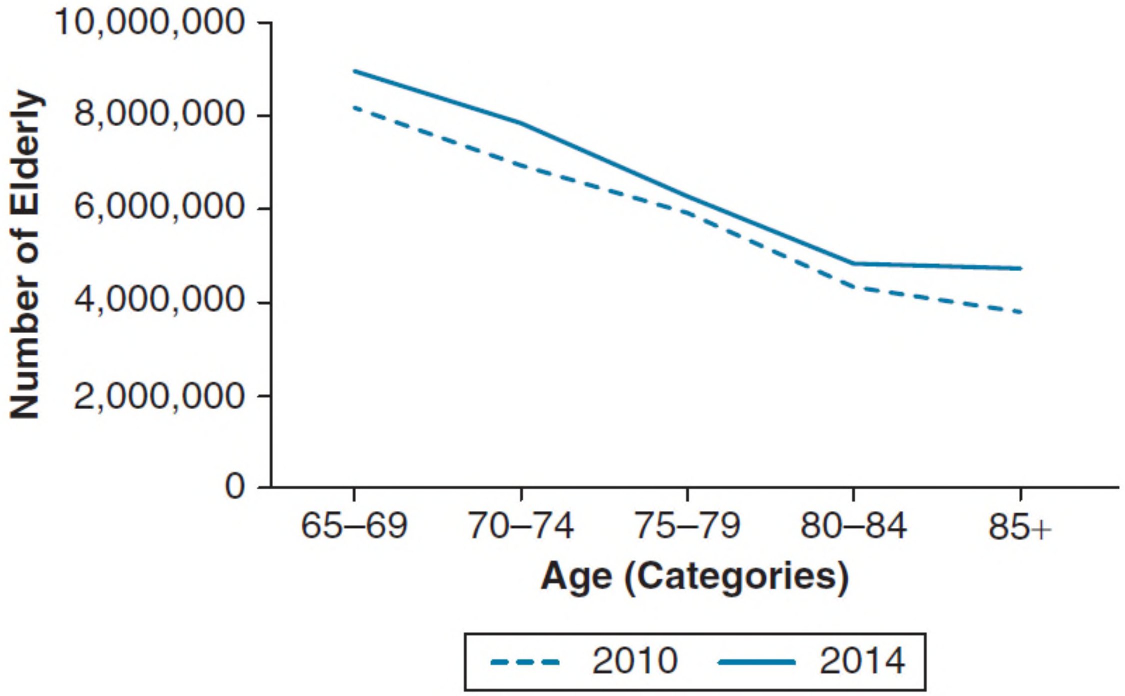
Source: Jennifer Ortman, Victoria Velkoff, and Howard Hogan, *An Aging Nation: The Older Population of the United States*, Current Population Reports, P25-1140, 2014.

The line graph

- A graph showing the differences in frequencies or percentages among categories of an interval-ratio variable
- Points representing the frequencies of each category are placed above the midpoint of the category and are joined by a straight line

The line graph

Figure 2.7 Population of Japan, Age 65 and Above, 2010 and 2014



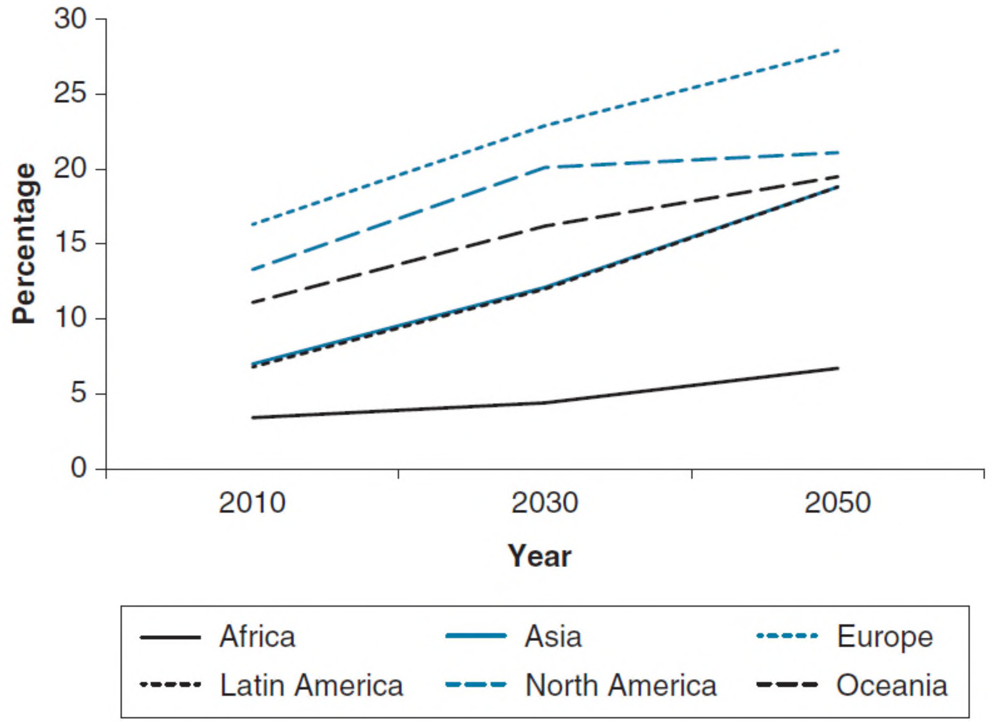
Source: United Nations Statistics Division, *Population by Age, Sex, and Urban/Rural Residence*, 2015. Retrieved from http://data.un.org/Data.aspx?d=POP&f=tableCode%3A22

Time series charts

- A graph displaying changes in a variables at different points in time
  - It shows time (measured in units such as years or months) on the horizontal axis and the frequencies (percentages or rates) of another variable on the vertical axis

Time series charts

Figure 2.8 Percentage of Total Population 65 Years and Above for Selected World Regions, 2010, 2030, and 2050



Source: Loraine West, Samantha Cole, Daniel Goodkind, and Wan He, 65+ *in the United States:* 2010, Current Population Report, P23-212, 2014.

Distortions in graphs

- Graphs not only quickly inform us, they can quickly deceive us
- Because we are often more interested in general impressions than in detailed analyses of the numbers, we are more vulnerable to being swayed by distorted graphs

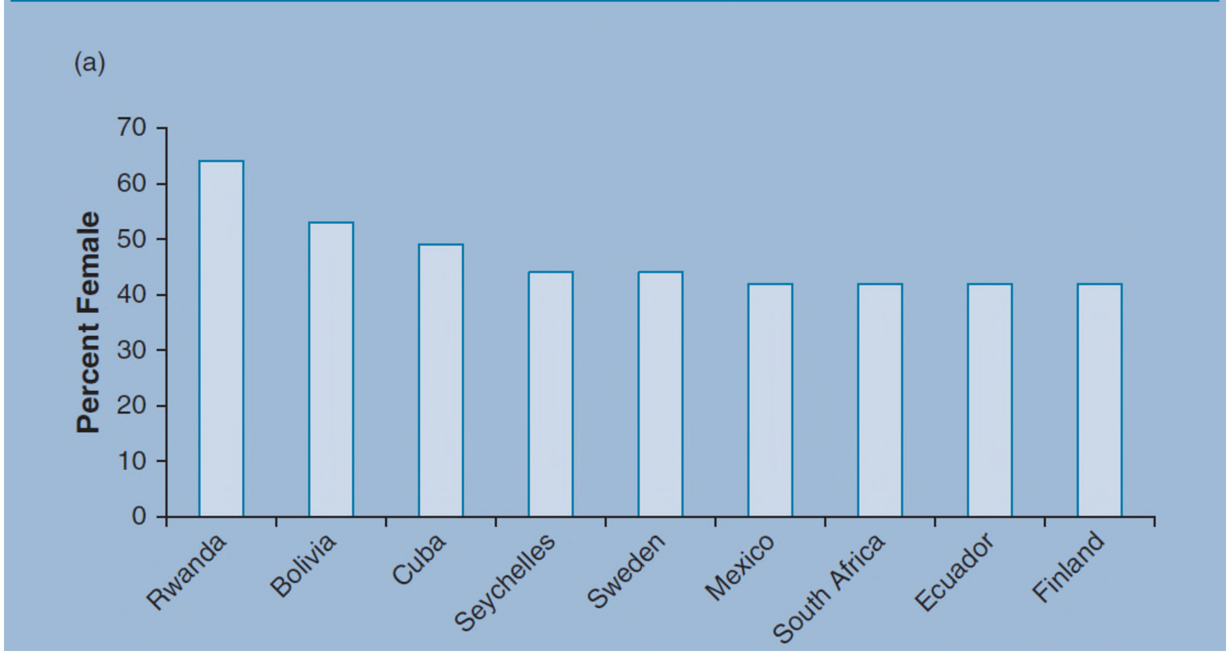
Distortions in graphs

- What are graphical distortions?
- How can we recognize them?

Graphical distortions

- Axes can be stretched or shrunk to create any desired result

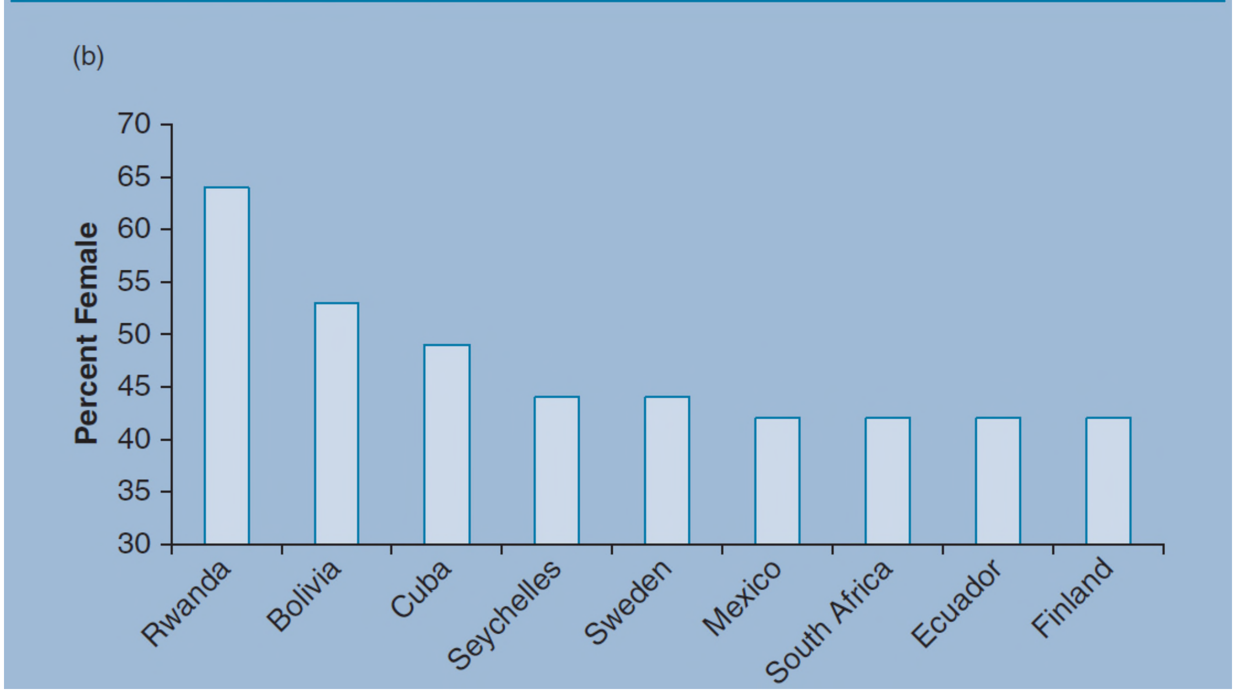
Figure 2.9 **Female Representation in National Parliaments, 2015: (a) Using 0 as the Baseline and (b) Using 30 as the Baseline**



Graphical distortions

- Axes can be stretched or shrunk to create any desired result

Figure 2.9 (Continued)



Statistics in practice

- The following graphs are particularly suitable for making comparisons among groups:
  - Bar chart
  - Line graph
  - Time series chart

Why use charts and graphs?

- What do you lose?
  - Ability to examine numeric detail offered by a table
  - Ability to see additional relationships within data
  - Potentially time
    - We can get caught up in selecting colors and formatting charts when a simply formatted table is sufficient

Why use charts and graphs?

- What do you gain?
  - Ability to direct readers' attention to one aspect of the evidence
  - Ability to reach readers who might otherwise be intimidated by the same data in a tabular format
  - Ability to focus on bigger picture rather than perhaps minor technical details

Key terms

- Cumulative Frequency Distribution
- Cumulative Percentage Distribution
- Frequency Distribution
- Percentage
- Percentage Distribution
- Proportion
- Rate
- Bar Graph
- Histogram
- Line Graph
- Pie Chart
- Time-Series Chart