6 The group and the individuals

In the long run, a study should help you picture how the subjects behaved or performed on each measure, either through graphic representations of the performances or through descriptive statistics that indicate the central tendency and dispersion of the scores. To begin with, then, it is useful to understand how data can be visually represented.

Frequency

If I were to ask you how frequently you brush your teeth, you would probably answer something like two times per day. Likewise, if I were to ask you how frequent a score of 67 was in Table 6.1, the obvious answer would be “three people received 67.” Frequency is just this commonsense idea. It indicates how many people did the same thing or performed a certain task in the same way. When you figured out how many people received a score of 67, you counted up, or tallied, the number of people at 67. To calculate the frequency at each score level, then, the researcher simply tallies them up and records the result, as shown in Table 6.1. But why would anyone bother to do this? Fre-

| TABLE 6.1. TALLYING FREQUENCIES |
|------------------|--------|----------|----------|
| Students         | Score  | Tally    | Frequency|
| Robert           | 65     | /        | 1        |
| Randy            | 67     | ///      | 3        |
| Henk             | 67     | /        | 1        |
| Shenan           | 67     | /        | 1        |
| Jeanne           | 69     | ///      | 4        |
| Corky            | 69     |          |          |
| Millic           | 69     | ///      | 3        |
| Archie           | 69     |          |          |
| Dean             | 70     | ///      | 2        |
| Elisabeth        | 70     | /        | 1        |
| Monique          | 72     | /        | 1        |
| Iliana           | 73     | /        | 1        |
| Bill             | 74     | /        | 1        |
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**TABLE 6.2. FREQUENCY DISTRIBUTION**

<table>
<thead>
<tr>
<th>Score value</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>1</td>
</tr>
<tr>
<td>66</td>
<td>0</td>
</tr>
<tr>
<td>67</td>
<td>3</td>
</tr>
<tr>
<td>68</td>
<td>0</td>
</tr>
<tr>
<td>69</td>
<td>4</td>
</tr>
<tr>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>71</td>
<td>0</td>
</tr>
<tr>
<td>72</td>
<td>1</td>
</tr>
<tr>
<td>73</td>
<td>1</td>
</tr>
</tbody>
</table>

**Figure 6.1 Abcissa and ordinate**

Frequencies are useful because they can be used to collapse, or summarize, information about scores received by a group, as shown in Table 6.2. This arrangement of score values from high to low and the frequency of each score value in a table is called a frequency distribution.

**Graphic representation of frequencies**

There are, however, more appealing ways to show the frequency distribution. You will generally encounter such graphic representations in one of three forms: a histogram, a bar graph, or a frequency polygon. All three are drawn on two axes: a horizontal line (also called the abscissa, or x-axis) and a vertical line (ordinate, or y-axis). These are shown in Figure 6.1.

A histogram of a frequency distribution shows a score value on the horizontal line, frequency on the vertical line, and marking an asterisk for each student who received each score, as shown in Figure 6.2a. If you used instead of asterisks to represent frequency, as shown in Figure 6.2b, looking at a bar graph, as shown in Figure 6.2c, where the top asterisk would be at the top of the bar connected by lines, you have a frequency distribution. All three types of graphs are important because they represent information that tells us how the groups performed. Another excellent reason to study these concepts is that they are sometimes used to distort information graphically (see below).

Studies in our field often omit these charts, and they usually provide some form of description of the representations of exactly how each...
A histogram of a frequency distribution is usually created by assigning score values to the horizontal line, putting potential frequency values on the vertical line, and marking an asterisk or "X" to represent each student who received each score, as shown in Figure 6.2a. If bars are used instead of asterisks to represent the same information, you are looking at a bar graph, as shown in Figure 6.2b. When dots are placed where the top asterisk would be at each score value and the dots are connected by lines, you have a frequency polygon, as shown in Figure 6.2c. All three types of graphs are important in reading statistical studies because they represent information that you should have about the way the groups performed. Another excellent reason for getting a good grip on these concepts is that they are sometimes used to misrepresent or distort information graphically (see Huff and Geis 1954).

Studies in our field often omit these useful forms of graphs. However, they usually provide some form of descriptive statistics, that is, numerical representations of exactly how each group performed on the interval.
scale measures. It is the reader's responsibility to look at this information and try to create a mental picture of how the group or groups performed. To do so, you must keep in mind two aspects of group behavior: the center and the individuals. Both are important because you should be able to visualize the middle (or typical) behavior of the group, as well as the performance of those individuals who varied from it. In statistics, these two aspects of group behavior are called central tendency and dispersion.

Central Tendency

The first thing to look for, then, is the central tendency in a set of data. Notice that I have carefully avoided using the word average. I have done so because the common concept of average is closely related to one of three different indicators that are used to look at central tendency: the mean, the mode, and the median.

Mean

The mean is probably the single most commonly reported indicator of central tendency. It is virtually the same as the arithmetic average that you may calculate when grading classroom tests. It is symbolized in writing by \( \bar{X} \) (said "ex bar"), and the formula for this statistic is as follows:

\[
\bar{X} = \frac{\sum X}{N}
\]

where \( \bar{X} \) = mean, \( X \) = scores, \( N \) = number of scores, \( \Sigma \) = sum (or add).

For future reference, let's take a brief look at this formula. It simply says, to get the mean (\( \bar{X} \)), you add up (\( \Sigma \)) the scores (\( X \)) and divide by the number (\( N \)) of scores that you have. This formula is shown more graphically in Table 6.3. To find this mean in the example, you (1) add up the scores, (2) find the number of scores, and (3) divide the totaled scores by that number. So the mean in the example would be 70.

Even though the focus of this book is on reading and interpreting statistics, rather than doing them, it is often necessary to understand the symbols and how they work. Hence, a little exposure to this simple formula will not hurt. In addition, some of the concepts explained in this book will be easier to introduce with formulas. Of course, the concepts will always be explained in "real" language and examples will be provided. In any case, the formula for the mean was not so difficult.

<table>
<thead>
<tr>
<th>Students</th>
<th>Scores</th>
<th>Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>40</td>
<td>( \Sigma X = \text{sum of scores} )</td>
</tr>
<tr>
<td>Jakob</td>
<td>70</td>
<td>( 70 + 76 + 80 + \ldots )</td>
</tr>
<tr>
<td>Jaime</td>
<td>67</td>
<td>( 2 \times N = \text{number of scores} )</td>
</tr>
<tr>
<td>Jimmy</td>
<td>70</td>
<td>3 ( \bar{X} = \frac{\Sigma X}{N} = \frac{490}{7} )</td>
</tr>
<tr>
<td>Juanita</td>
<td>76</td>
<td>( \bar{X} = \frac{\Sigma X}{N} = \frac{490}{7} )</td>
</tr>
<tr>
<td>Jean</td>
<td>80</td>
<td>( \bar{X} = \frac{\Sigma X}{N} = \frac{490}{7} )</td>
</tr>
<tr>
<td>Jacques</td>
<td>90</td>
<td>( \bar{X} = \frac{\Sigma X}{N} = \frac{490}{7} )</td>
</tr>
</tbody>
</table>

It is just another way of saying something - much in the same way that we use syllables, we use the terms grammar and pronunciation as part of learning to understand mathematics.

Mode

The mode is the score that occurs most frequently in a set of data. In Table 6.3, what would be the mode? To keep it simple, I associate the term with its more common name: a mode (in a la mode). Thus, the mode is the score that is received by the most students. There is a straightforward idea. It should be noted, however, that there may be two or more modes in a set of scores. Such a set of scores would be termed bimodal, trimodal, etc.

Median

The median is defined as the middle point of a distribution below which 50 percent of the scores fall. In Table 6.3, you will notice that the median is 70. There are three scores below it (40, 67, and 67) and three scores above it (80, 90, and 90). So the median in this example is 70. If the scores were 10, 25, 30, and 40, it would be clear to you that it is 25.

There are cases, however, when the median is not so clear-cut. For example, what is the median for these scores: 13, 14, 15, 16, and 17? There is an even number of scores, as you can see. The median would be taken to be midway between the two middle scores. The median of the two middle scores is 15 and 16, so the average makes sense. If so, what is the median for these scores: 13, 14, 15, 16, and 17?
The group and the individuals

TABLE 6.3. CALCULATING THE MEAN

<table>
<thead>
<tr>
<th>Students</th>
<th>Scores</th>
<th>Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>40</td>
<td>$\sum X = \text{sum of scores} = 40 + 67 + 67 + $</td>
</tr>
<tr>
<td>Jakob</td>
<td>67</td>
<td>$70 + 76 + 80 + 90 = 490$</td>
</tr>
<tr>
<td>Jaime</td>
<td>67</td>
<td>$2 N = \text{number of scores} = 7$</td>
</tr>
<tr>
<td>Jimmy</td>
<td>70</td>
<td>$3 \bar{X} = \frac{\sum X}{N} = \frac{490}{7} = 70$</td>
</tr>
<tr>
<td>Juanita</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Jean</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Jacques</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

It is just another way of saying something you already know how to do – much in the same way that we use syntax and phonology when others use the terms grammar and pronunciation. Try to view these simple mathematics as part of learning to understand statistics.

Mode

The mode is the score that occurs most frequently in a set of scores. In Table 6.3, what would be the mode? The mode would be 67, the only score received by two students. To keep the mode straight in my mind, I associate the term with its more common meaning of fashionable (as in à la mode). Thus, the mode is the score that is most fashionable, or is received by the most students. There is no statistical formula for this straightforward idea. It should be noted, however, that, in some cases, there may be two or more modes in a set of scores. Such a distribution of scores would be termed bimodal, trimodal, and so on.

Median

The median is defined as the middle point in a distribution, or that point below which 50 percent of the scores fall and, logically, above which 50 percent fall. In Table 6.3, you will see that Jimmy’s score of 70 has three scores below it (40, 67, and 67) and three scores above it (76, 80, and 90). So the median in this example is 70. What, then, is the median for the following set of scores: 10, 25, 30, 40, 52, 60, 76? It should be clear to you that it is 40.

There are cases, however, when the median is not so clear. For example, what is the median for these scores: 8, 10, 13, 14, 16, 25? When there is an even number of scores, as in this example, the median is taken to be midway between the two middle scores. In this example, the two middle scores are 13 and 14, so the median is 13.5. Does that make sense? If so, what is the median for these scores: 10, 25, 37, 40,
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50, 62, 71, 98? Your answer should have been 45, because that is the midpoint between the two middle scores, 40 and 50.

There are other cases in which there may be more than one score at the median, such as in the following: 45, 47, 48, 50, 50, 50, 67, 74, 87. Here, the midpoint is clearly 50, because there is an odd number of like scores at the median, separating equal numbers of scores on either side.

Still other situations arise in which fractions other than .5 occur in the median, but the important thing to remember is that the median is the point that divides the scores 50/50, much like the median in a highway divides the road into two equal parts. In statistics, however, the median may turn out to be a fraction.

To review briefly, in Table 6.3, the mean, or arithmetic average, was 70; the mode, or most-frequent score, was 67; and the median, the score that divided the scores 50/50, was 70. These are all indicators of central tendency, and each has its strengths and weaknesses. None is necessarily better than the others, although the mean is most commonly reported. The measures simply serve different purposes and are appropriate in different situations.

Dispersion

Now that you understand how to interpret the typical behavior of a group in the form of central tendency, let’s look at how the performance of individuals may vary from that typical behavior. There are two commonly reported indicators of the dispersion of a set of scores: the range and the standard deviation.

Range

You may already be familiar with the notion of range from correcting your classroom tests. Range is defined here as the number of points between the highest score on a measure and the lowest score plus one (plus one because it is viewed as including the scores at both ends). Thus, in Table 6.3, where the highest score is 90 and the lowest score is 40, the range is 51 points (90 – 40 + 1 = 51). The range provides some idea of how individuals vary from the central tendency. But it represents only the outer edges of that variation and, as a result, is strongly affected by behavior that may not be truly representative of the group as a whole. For instance, if Jan in Table 6.3 had already decided to drop the course involved and, therefore, had just guessed on the test, the range of 51 would not really represent the behavior of the group, because that behavior was strongly affected by something (Jan’s personal problem) extraneous to the students’ performances on the measure itself. Nevertheless, the range is often reported as a rule of thumb and should be interpreted as just where the high and low scores include.

Standard deviation

The standard deviation provides a sort of average of all scores from the mean. To understand this, let’s review the formula again at the formula. Recall that $\bar{X}$ was the best estimate of a population score, that $\Sigma$ indicated the total, and that $N$ was the number of scores or subjects.

The standard deviation ($SD$) is:

$$\sqrt{\frac{\Sigma (X - \bar{X})^2}{N}}$$

Starting from the inside and working outwards, the formula first requires you to subtract the mean from each score ($X - \bar{X}$); square each of these differences ($\Sigma (X - \bar{X})^2$); add them up ($\Sigma (X - \bar{X})^2$); This sum is then divided ($\Sigma (X - \bar{X})^2/N$, and the square root of this is the standard deviation. Table 6.4 makes this clearer.

Remember that the mean in Table 6.4 and the mean for Table 6.4, you must line up each score with the “differences” from the mean and add them. Then you insert all this information into the formula, and for this example is 14.41. Let’s now review this step by step. I claimed that the standard deviation is a measure of the squaring and the square root, notice that the formula is a sum of the “differences” from the mean and adding up and then dividing by $N$ (similar to the mean) of the differences of all scores from the mean. Thus, the standard deviation measures how far the deviations of all scores from the mean. It is often better than the range because it takes into account the effects of any extreme scores.
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Nevertheless, the range is often reported as one indicator of the dispersion
and should be interpreted as just what it is—the number of points
between the high and low scores, including both of them.

Standard deviation

The standard deviation provides a sort of average of the differences of
all scores from the mean. To understand what this means, let's look
again at the formula. Recall that \( X \) was the symbol for the mean, that
\( X \) symbolized the scores, that \( \Sigma \) indicated that something should be
added up, and that \( N \) was the number of subjects. The formula for the
standard deviation (SD) is

\[
\sqrt{\frac{\Sigma (X - \bar{X})^2}{N}}
\]

Starting from the inside and working outward, you can see that the
formula first requires you to subtract the mean, already calculated, from
each score \( (X - \bar{X}) \); square each of these values \( (X - \bar{X})^2 \); and add
them up \( \Sigma (X - \bar{X})^2 \). This sum is then divided by the number of scores
\( \Sigma (X - \bar{X})^2/N \), and the square root of the result

\[
\sqrt{\frac{\Sigma (X - \bar{X})^2}{N}}
\]

is the standard deviation. Table 6.4 makes this formula clearer.
Remember that the mean in Table 6.3 was 70. Using the same scores
and mean for Table 6.4, you must line up each score with the mean and
then subtract the mean from each score. Next, you must square each of
the “differences” from the mean and add up the squared values. When
you insert all this information into the formula, you find that the result
for this example is 14.41. Let’s now return to the definition.
I claimed that the standard deviation is a sort of average (ignoring
the squaring and the square root, notice that you are adding something
up and then dividing by \( N \) — similar to what you did to calculate the
mean of the differences of all scores from the mean (so it turns out that
what you are averaging is the difference of each student’s score from
the mean). Thus, the standard deviation is a sort of average of the
differences of all scores from the mean. These differences are also called
their deviations from the mean — hence the name standard deviation.
What this sort of average tells you will be explained more fully in the
next chapter. Just keep in mind that it is a good indicator of dispersion.
It is often better than the range because it is an averaging process. By
averaging, the effects of any extreme scores that are not attributable to
TABLE 6.4. THE STANDARD DEVIATION

<table>
<thead>
<tr>
<th>Students (Group J)</th>
<th>Score (X)</th>
<th>Mean (X̄)</th>
<th>Difference (X - X̄)</th>
<th>Difference squared (X - X̄)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>40</td>
<td>-70</td>
<td>-30</td>
<td>900</td>
</tr>
<tr>
<td>Jakob</td>
<td>67</td>
<td>-70</td>
<td>-3</td>
<td>9</td>
</tr>
<tr>
<td>Jaime</td>
<td>67</td>
<td>-70</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Jimmy</td>
<td>70</td>
<td>-70</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Juanita</td>
<td>76</td>
<td>-70</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>Jean</td>
<td>80</td>
<td>-70</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Jacques</td>
<td>90</td>
<td>-70</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

Σ (X - X̄)² = 1454

\[ SD = \sqrt{\frac{\sum (X - X̄)²}{N}} = \sqrt{\frac{1454}{7}} \]

= 207.71 = 14.41

performance on the test (e.g., Jan’s personal problem) are generally minimized.

Putting the picture together

To review briefly, then, two aspects of group behavior normally are described: the central tendency and dispersion. Central tendency indicates what the middle, or typical, behavior is on a given measure in the form of the mean (arithmetic average), mode (the most-often-received score), and the median (the score that splits the group 50/50). Which of these indicators is presented in a particular study will depend on the type of data and analyses in that study. But, in most cases, you will find at least one of them.

Likewise, you should look for an indication of the dispersion of scores, or the way individuals varied from the typical behavior of the group. This variation may be presented as the range (the difference between the highest and lowest scores, including both) or the standard deviation (a sort of average of how far individuals varied from the mean). Again, this information, in one form or another, is usually presented, and you should look for it so you can picture how the group or groups performed.

Such information is particularly useful in comparing the behavior of several groups on a particular measure. In Table 6.5, for instance, two groups — J and K — are clearly involved, and fairly complete information is presented on the typical behavior within each group and on how the individuals varied from that typical behavior. You should now be able to answer the following questions about these groups:

1. Which group did generally better on the test?
2. Which group had the single lowest score?
3. Which group had the widest spread of scores?
4. Which group was the most homogeneous?
5. Which group was the most intelligent?

To answer Question 1, you should have looked at the central tendency. Clearly, Group J and, therefore, performed better as a group. Question 2, you should have looked at the range, noticing that they are probably single score of the lowest score (40). For Question 3, you should have looked at the standard deviation for Group J was considerably higher than for Group K. Question 4 will be found by looking at the range for Group K is considerably lower, which indicates the group was more tightly grouped than Group J. Thus Group K is considerably better. Question 5 is look at the standard deviations rather than extreme scores can occur for reasons other than group on the measure. Since the standard deviation process, such aberrations affect it less. To look at the relative homogeneity of a group.

You should have seen that is the idea what the test in this example is illustrating whether it is measuring intelligence at all, or is more intelligent than Group K? This is not should not be misinterpreted by you or numbers are just numbers, and it is you to determine what they mean. This is just to do. But it should become even easier because you will see more precisely how to relate, how they can go away, and how to test, and reader of language studies.
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TABLE 6.5. GROUPS J AND K ON MY EXAM

<table>
<thead>
<tr>
<th>Group</th>
<th>( \bar{X} )</th>
<th>Mode</th>
<th>Median</th>
<th>Low</th>
<th>High</th>
<th>Range</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>70</td>
<td>67</td>
<td>70</td>
<td>40</td>
<td>90</td>
<td>51</td>
<td>14</td>
</tr>
<tr>
<td>K</td>
<td>60</td>
<td>55</td>
<td>62</td>
<td>55</td>
<td>68</td>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>

To answer the following questions about the behavior of these two groups:

1. Which group did generally better on the exam?
2. Which group had the single lowest score?
3. Which group had the widest spread of scores?
4. Which group was the most homogeneous on the test?
5. Which group was the most intelligent?

To answer Question 1, you should have looked at all three indicators of the central tendency. Clearly, Group J is higher on all three indicators and, therefore, performed better as a group on the examination. In Question 2, you should have looked at the low–high figures (remembering that they are probably single scores in this case) and the lowest score (40). For Question 3, you should have noted that the range for Group J was considerably higher than that for Group K. This would tell you that Group J had the widest spread of scores. The answer to Question 4 will be found by looking at the standard deviations. The one for Group K is considerably lower, which indicates that the scores of the group were more tightly grouped around the mean than those of Group J. Thus Group K is considerably more homogeneous. But why look at the standard deviations rather than the ranges? Remember that extreme scores can occur for reasons other than the performance of the group on the measure. Since the standard deviation is a sort of averaging process, such aberrations affect it less. Therefore, it is the better indicator of the relative homogeneity of a group.

You should have seen through Question 5 immediately. You have no idea what the test in this example is like. How, then, can you decide whether it is measuring intelligence at all, much less whether Group J is more intelligent than Group K? This is an example of how the numbers should not be misinterpreted by you or by the authors you read. The numbers are just numbers, and it is your responsibility to look at them and determine what they mean. This is a task you should now be able to do. But it should become even easier and clearer in the next chapter because you will see more precisely how central tendency and dispersion relate, how they can go awry, and how they can help you – the teacher, tester, and reader of language studies.
Terms and symbols

abscissa  mean ($\bar{X}$)
bar graph  median
bimodal distribution, trimodal  mode
  distribution, and so forth  N
central tendency  ordinate
descriptive statistics  range
  deviations  standard deviation ($SD$)
dispersion  X
frequency  x-axis
frequency distribution  y-axis
frequency polygon  $\Sigma$
histogram

Review questions

1. What is central tendency? What are three indexes of central tendency?
   Which index is the best indicator?
2. What is dispersion? What two indexes are usually used to estimate
dispersion? Which index is the best indicator?
3. Why should group behavior on a measure usually be described in
terms of both the central tendency and dispersion?
4. What is a frequency distribution? And what is the advantage of a
frequency distribution?
5. Can you label the abscissa and ordinate on the axes below?

6. Which of the three graphic representations at the top of page 73 is
   a histogram? A bar graph? A frequency polygon?

Application

The table on page 74 is adapted from ...
language learning

mean ($\bar{X}$)
median
mode
$N$
ordinate
range
standard deviation (SD)
$x$
$x$-axis
$y$
$y$-axis
$\Sigma$

What are three indexes of central tendency?

or?

indexes are usually used to estimate what is the best indicator?

which a measure usually be described in frequency and dispersion?

on? And what is the advantage of a coordinate on the axes below?

Application

The table on page 74 is adapted from Figure 5.7 in Chapter 5. Look it over, then answer the questions that follow.
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DESCRIPTIVE STATISTICS FOR FALL 1977 SAMPLE

<table>
<thead>
<tr>
<th>Group</th>
<th>Measure</th>
<th>( \bar{X} )</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placed Students (n = 133)</td>
<td>Course grade</td>
<td>2.99</td>
<td>.62</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
<td>67.83</td>
<td>9.89</td>
</tr>
<tr>
<td></td>
<td>Cloze test</td>
<td>22.97</td>
<td>4.56</td>
</tr>
<tr>
<td>Continuing Students (n = 31)</td>
<td>Course grade</td>
<td>2.04</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
<td>55.31</td>
<td>9.66</td>
</tr>
<tr>
<td></td>
<td>Cloze test</td>
<td>15.87</td>
<td>4.57</td>
</tr>
</tbody>
</table>

1. Which group was larger?
2. Which group typically had higher grades?
3. Which measure probably had more possible points on it? What additional piece of information would have helped to answer this question?
4. Which group performed better on the cloze test? How do you know that?
5. Which group performed more heterogeneously on the final exam? How do you know that?
6. What additional information would you have liked to see in this table to help you interpret the groups’ behaviors?

7 Patterns in human life

Whether you believe that events are perfectly random, you will probably notice certain patterns that occur in your life. Descriptive statistics, in addition to helping us describe these patterns and how individuals relate to them, also help us get a grip on how these patterns work, I will discuss concepts and how they interrelate: probability, distribution, and standardized scores.

Probability

Short of taking you on a group trip to Russia, the best way to demonstrate probability is to make a coin and start flipping it. What did you get? Does this recognize that there was a 50 percent chance of heads or tails? You probably observed a fairly predictable pattern to events like this.

In more formal terms, the probability of a coin flip is 1 in 2, or 50 percent. This probability is the number of expected outcomes by the total number of possibilities (heads or tails). Thus, one expected outcome of the two possibilities (of heads or tails) is 50 percent probability of getting heads.

What, then, is the probability of getting a six-sided die? Again, you need only divide the number of possible outcomes (one) by the total number of possible outcomes. One divided by six is .166, or a 17 percent probability of getting a five.

Why go through all this arithmetic? There are three good reasons. First, it is important to estimate the probability of a given event is the ratio of the expected number of possible outcomes. This ratio, which can be stated in percentages. Second, and perhaps most importantly, this knowledge will help if you ever asked...