Appendix Preview

Appendix A introduces some basic statistical concepts used by researchers to organize and describe their data and then shows how these researchers generalize from samples of information to what is generally true.

As a first step in organizing data, researchers may display scores in a bar graph. To simplify matters, they may calculate the typical score or central tendency: the mode, the mean, or the median. Both the range and standard deviation provide measures of variation.

To determine how much two things relate, researchers calculate a correlation coefficient, a statistical measure of how strongly related two sets of scores are. The correlation coefficient tells us nothing about cause and effect.

For convenience, we often observe just a small sample and then generalize about the whole population. We can have more confidence in the generalizations we make if our samples are representative of the population, larger rather than smaller, and less rather than more variable. When interpreting experimental results, it is important that we pay attention to the methodology used, such as whether it was a cross-sectional or a longitudinal study.

Tests for statistical significance help us to determine whether differences between samples are real or whether they occurred by chance.

Appendix Guide

Describing Data

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- Exercise: Teaching Statistical Concepts Using Space and Students’ Bodies (p. 54)
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- Project: Organizing and Interpreting Data (p. 55)
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A-1. Discuss how we can describe data with measures of central tendency and variation.

The mode is the most frequently occurring score in a distribution. The mean is the arithmetic average of a distribution, obtained by adding the scores and then dividing by the number of scores. If the distribution is skewed by even a few extreme scores, the mean will be biased. The median is the middle score in a distribution; half the scores are above it and half are below it.
The range of scores—the gap between the lowest and highest score—provides only a rough estimate of variation. The more standard measure of how scores deviate from one another is the standard deviation. It better gauges whether scores are packed together or dispersed because it uses information from each score. Many types of scores are distributed along a bell-shaped curve, or a normal curve (normal distribution). Roughly 68 percent of the cases fall within one standard deviation of the mean. About 95 percent fall within two standard deviations.

A-2. Explain what it means when we say two things are correlated.

The correlation coefficient is a statistical measure of how strongly related any two sets of scores are. It can range from +1 (a perfect positive correlation) through 0.00 (the scores are unrelated) to −1 (a perfect negative correlation). Scores with a positive correlation increase and decrease together. A negative correlation coefficient indicates that one score falls as the other rises. Scatterplots reveal patterns of relationships between two sets of scores. Like other statistical measures, the correlation coefficient can help us see what the naked eye misses. However, it does not tell us about cause and effect.

A-3. Define regression toward the mean.

Illusory correlation often occurs because our belief that a relationship exists leads us to notice and recall confirming instances of our belief and to disregard disconfirming ones. Illusory correlation sometimes feeds the illusion that chance events are subject to our personal control. For example, gamblers, remembering their lucky rolls, may come to believe that they can influence the roll of the dice by again, say, throwing gently for low numbers and hard for high numbers.

Regression toward the mean can also fuel the illusion that uncontrollable events correlate with our actions. After an unusual event, things tend to return toward their average level. However, we readily attribute this normal statistical regression to something we have done.

Significant Differences

A-4. Explain how we know whether an observed difference can be generalized to other populations.

Important principles to remember in making generalizations include the following:

a. Representative samples are better than biased samples. We are particularly prone to overgeneralize from vivid cases at the extremes.

b. Less-variable observations are better than those that are more variable. Averages are more reliable when derived from scores with low variability.

c. More cases are better than fewer. Small samples provide less reliable estimates of the average than do large samples.

Psychologists use tests of statistical significance to help them determine whether differences between two groups are reliable. When the averages of the samples drawn from the groups are
reliable, and the difference between them is relatively large, we say the difference has statistical significance. This means that the difference very likely reflects a real difference and is not due to chance variation between the samples. Given large enough or homogeneous enough samples, a difference between them may be statistically significant yet have little practical significance.

A-5. Define cross-sectional studies and longitudinal studies, and discuss why it is important to know which method was used.

In cross-sectional studies, people of different ages are compared with one another over a very short period of time. In longitudinal studies, the same people are restudied and retested over a long period. Knowing which method was used helps us to know whether we should be considering the effects of cultural generation differences (in cross-sectional studies, which show a decline in intelligence) or factoring in contributors to longevity (in longitudinal studies, which show stability).