RESEARCH HYPOTHESES AND QUESTIONS

A research hypothesis is a prediction of the outcome of a study. The prediction may be based on an educated guess or a formal theory. Example 1 is a hypothesis for a nonexperimental study.

Example 1
It is hypothesized that first grade girls will show better reading comprehension than first grade boys.

In Example 1, the author is predicting that he or she will find higher comprehension among girls than boys. To test it, a nonexperimental study would be appropriate because nothing in the hypothesis suggests that treatments will be given.

A simple research hypothesis predicts a relationship between two variables. From your study of variables, it should be clear that the two variables in Example 1 are (1) gender and (2) reading comprehension. The hypothesis states that reading comprehension is related to gender.

Example 2 is a hypothesis for an experimental study.

Example 2
It is hypothesized that children who are shown a video with mild violence will be more aggressive on the playground than those who are shown a similar video without the violence.

In Example 2, the independent variable is violence (mild vs. none), and the dependent variable is aggressiveness on the playground.

The hypotheses in Examples 1 and 2 are examples of directional hypotheses. In a directional hypothesis, we predict which group will be higher or have more of something.

Sometimes we have a nondirectional hypothesis. Consider Example 3.

Example 3
It is hypothesized that the child-rearing practices of Tribe A are different from those of Tribe B.

The author of Example 3 is saying that there will be a difference but does not predict the direction of the difference. This is perfectly acceptable when there is no basis for making an educated guess.

Instead of a nondirectional hypothesis, we might state a research purpose. Example 4
shows a research purpose that corresponds to the nondirectional hypothesis in Example 3.

Example 4
The purpose is to explore the differences in childrearing practices between Tribe A and Tribe B.

A research question may also be substituted for a nondirectional hypothesis. Example 5 shows a research question that corresponds to the nondirectional hypothesis in Example 3.

Example 5
The research question is “How do the childrearing practices in Tribe A and Tribe B differ?”

When using a research question as the basis for research, we usually should be careful not to state it as a question that can be answered with a simple “yes” or “no,” as is done in Example 6.

Example 6
The question is, “Do the child-rearing practices in Tribe A and Tribe B differ?”

Example 6 merely asks “do they differ?” This is not a very interesting research question. Example 5 is superior because it asks “how do they differ?”

The choice between a nondirectional hypothesis, a research purpose, and a research question, is purely a matter of personal taste—all are acceptable in the scientific community. Of course, when we are willing to predict the outcome of a study, we should state a directional hypothesis.

If you’ve read research reports, you may have encountered references to another type of hypothesis—the null hypothesis. This is a statistical hypothesis, which will be explored next.
EXERCISE

1. Which type of statement (hypothesis, purpose, or question) predicts the outcome of a study?

2. “It is hypothesized that college students who have firm career goals achieve higher GPAs than those who do not have firm career goals.” Is this a directional or nondirectional hypothesis?

3. Would an experimental or nonexperimental study be better for testing the hypothesis in question 2?

4. “It is hypothesized that children of immigrants and children of native born citizens will differ in their attitudes toward school.” Is this a directional or nondirectional hypothesis?

5. “The goal of this study is to examine college students’ attitudes toward religion.” Is this statement a hypothesis or purpose?

6. “Are children of alcoholics different in their social adjustment than children of non-alcoholics?” Is this research question stated appropriately? Why? Why not?

7. When we are willing to predict the outcome of a study, should we state a directional or nondirectional hypothesis?

Questions for Discussion

8. Restate this hypothesis as a research purpose: “It is hypothesized that there is a difference in job satisfaction between those who receive regular feedback on their job performance and those who receive irregular feedback.”

9. Is the hypothesis in question 9 directional or nondirectional? Explain.

10. Could an experiment be conducted to test the hypothesis in question 8? Explain.

11. Restate this hypothesis as a research question: “It is hypothesized that those who exercise regularly and those who do not exercise regularly will differ in other behaviors that affect health.”
ANSWERS

1. hypothesis
2. directional
3. nonexperimental
4. nondirectional
5. purpose
6. no, because it is stated in a way that can be answered yes or no
7. directional
8. Sample answer: The purpose is to explore differences in job satisfaction between those who receive regular feedback on their job performance and those who receive irregular feedback.
9. nondirectional because it does not predict which group will have greater job satisfaction
10. Sample answer: yes, because we could physically manipulate the regularity of feedback
11. Sample answer: How do those who exercise regularly and those who do not differ in other behaviors that affect health?
INTRODUCTION TO THE NULL HYPOTHESIS

Suppose we drew random samples of engineers and psychologists, administered a self-report measure of sociability, and computed the mean (the most commonly used average) for each group. Furthermore, suppose the mean for engineers is 65.00 and the mean for psychologists is 70.00. Where did the five point difference come from? There are three possible explanations:

1. Perhaps the population of psychologists is truly more sociable than the population of engineers, and our samples correctly identified the difference. (In fact, our research hypothesis may have been that psychologists are more sociable than engineers — which now appears to be supported by the data)

2. Perhaps there was a bias in procedures. By using random sampling, we have ruled out sampling bias, but other procedures such as measurement may be biased. For example, maybe the psychologists were contacted during December, when many social events take place and the engineers were contacted during a gloomy February. The only way to rule out bias as an explanation is to take physical steps to prevent it. In this case, we would want to make sure that the sociability of both groups was measured in the same way at the same time.

3. Perhaps the populations of psychologists and engineers are the same but the samples are unrepresentative of their populations because of random sampling errors. For instance, the random draw may have given us a sample of psychologists who are more sociable, on the average, than their population.

The third explanation has a name — it is the null hypothesis. The general form in which it is stated varies from researcher to researcher. Here are three versions, all of which are consistent with each other:

Version A of the null hypothesis:
The observed difference was created by sampling error. (Note that the term sampling error refers only to random errors—not errors created by a bias.)

Version B of the null hypothesis:
There is no true difference between the two groups. (The term true difference refers to the difference we would find in a census of the populations, that is, the difference we would find if there were no sampling errors.)

Version C of the null hypothesis:
The true difference between the two groups is zero.

Significance tests determine the probability that the null hypothesis is true. (We will be
considering the use of specific significance tests in future weeks.) Suppose for our example, we use a significance test and find that the probability that the null hypothesis is true is less than 5 in 100; this would be stated as \( p < .05 \), where \( p \) obviously stands for probability. Of course, if the chances that something is true are less than 5 in 100, it’s a good bet that it’s not true. If it’s probably not true, we reject the null hypothesis, leaving us with only the first two explanations that we started with as viable explanations for the difference.

There is no rule of nature that dictates at what probability level the null hypothesis should be rejected. However, conventional wisdom suggests that .05 or less (such as .01 or .001) is reasonable. Of course, researchers should state in their reports the probability level they used to determine whether to reject the null hypothesis.

Note that when we fail to reject the null hypothesis because the probability is greater than .05, we do just that: we “fail to reject” the null hypothesis and it stays on our list of possible explanations; we never “accept” the null hypothesis as the only explanation — remember, there are three possible explanations and failing to reject one of them does not mean that you are accepting it as the only explanation.

An alternative way to say that we have rejected the null hypothesis is to state that the difference is statistically significant. Thus, if we state that a difference is statistically significant at the .05 level (meaning .05 or less), it is equivalent to stating that the null hypothesis has been rejected at that level.

When you read research reported in academic journals, you will find that the null hypothesis is seldom stated by researchers, who assume that you know that the sole purpose of a significance test is to test a null hypothesis. Instead, researchers tell you which differences were tested for significance, which significance test they used, and which differences were found to be statistically significant. It is more common to find null hypotheses stated in theses and dissertations since committee members may wish to make sure that the students they are supervising understand the reason they have conducted a significance test. As we consider specific significance tests in other chapters of the text, we’ll examine the null hypothesis in more detail.

**EXERCISE**

1. How many explanations were there for the difference in sociability between psychologists and engineers in the example in this topic?

2. What does the null hypothesis say about sampling error?

3. Does the term *sampling error* refer to *random errors* or to bias?
4. The null hypothesis says that the true difference equals what value?

5. What is used to determine the probabilities that null hypotheses are true?

6. For what does \( p < .05 \) stand?

7. Do we reject the null hypothesis when the probability of its truth is high or when it is low?

8. What do we do if the probability is greater than .05?

9. What is an alternative way of saying that we have rejected the null hypothesis?

10. Are you more likely to find a null hypothesis stated in a journal article or in a thesis?

**ANSWERS**

1. three
2. the observed difference was created by sampling error
3. random errors
4. zero
5. significance tests
6. probability that the null hypothesis is true less than 5 in 100
7. when it is low
8. fail to reject the null hypothesis
9. a difference is statistically significant
10. thesis