CHAPTER 2

DEVELOPING AND EVALUATING THEORIES OF BEHAVIOR

QUESTIONS TO PONDER

1. What is the definition of a theory?
2. How does a theory differ from a hypothesis, a law, and a model?
3. What is a computer model, and what are the advantages of designing one?
4. How do mechanistic and functional theories differ? Which type is better, and why?
5. What are the defining characteristics of quantitative and qualitative theories?
6. What is a descriptive theory?
7. What is an analogical theory?
8. What is a fundamental theory?
9. How do descriptive, analogical, and fundamental theories differ? Which is preferred and why?
10. What roles do theories play in science? Describe each role in detail.
11. What are the defining characteristics of a "good" theory? Describe each characteristic in detail.
12. What is meant by confirmation and disconfirmation of a theory?
13. How are theories tested?
14. What is the difference between a confirmational and a disconfirmational strategy? How are they used to test a theory?
15. What is strong interference, and how is it used to test a theory?
16. How do theory-driven research and data-driven research differ?
17. What are the relative advantages and disadvantages of theory-driven and data-driven research?

CHAPTER OUTLINE

What Is a Theory?
- Theory Versus Hypothesis
- Theory Versus Law
- Theory Versus Model
- Mechanistic Explanations Versus Functional Explanations

Classifying Theories
- Is the Theory Quantitative or Qualitative?
- At What Level of Description Does the Theory Operate?
- What Is the Theory's Domain?

Roles of Theory in Science
- Understanding
- Prediction
- Organizing and Interpreting Research Results
- Generating Research

Characteristics of a Good Theory

Ability to Account for Data
Explanatory Relevance
Testability
Prediction of Novel Events
Parsimony

Strategies for Testing Theories

Following a Confirmational Strategy
Following a Disconfirmational Strategy
Using Confirmational and Disconfirmational Strategies Together
Using Strong Inference

Theory-Driven Versus Data-Driven Research

Summary

Key Terms

theory
hypothesis
law
model
mechanistic explanation
functional explanation
quantitative theory
qualitative theory
descriptive theory
analogical theory
fundamental theory
domain
confirmational strategy
disconfirmational strategy
strong inference

CHAPTER GOALS

The main goals of Chapter 2 are to explain what scientific theories are, to distinguish theories from laws and from hypotheses, to describe how theories differ, and to show students how to evaluate theories of behavior.

Students should understand that the phenomena we observe represent the superficial aspects of behavior which, in turn, represent deeper processes. To adequately explain the processes that underlie behavior, we need to know what those processes are, and how they interact. This deeper level of understanding is provided by theory. In this chapter, we extensively discuss how theories fit into the research process. The student should understand what the different types of theories are, the role of theory in science, how theories are developed, what constitutes a good or bad theory, how theories are evaluated, and the relative merits of theory-driven versus data-driven research. Points to emphasize include the following:

1. Defining a theory. Students should understand what a theory is and how the scientific term differs from the more colloquial use of the term. Students should also be able to distinguish between a theory, hypothesis and model.
2. The tentative nature of theories. Students should understand that even well-established theories can be overthrown if new evidence contradictory to the theory comes to light.
3. The fact that theories can be proven false but can never be proven true. We recently heard a “creation scientist” state that creation theory had been proven

true. The statement said more about the speaker's understanding of science than it did about the theory. Students need to be shown why theories cannot be proven true, and they need to understand why this does not weaken the force of scientific theories.

4. The different types of theory and how to distinguish them. Descriptive, analogical, and what we term "fundamental" theories represent different levels of understanding. Descriptive theories merely propose a relationship without really explaining why the relationship exists; they are "surface" descriptions. Analogical theories attempt to relate the variables in the theory through analogy with known processes. Fundamental theories propose unobserved processes to explain the observed relationships. The processes themselves give rise to observable effects that, if they are in fact observed, provide indirect evidence for the existence of the proposed processes.
5. The distinction between a qualitative theory and a quantitative one.
6. What roles theories play in science.
7. The difference between following a confirmational versus disconfirmational strategy when testing a theory.
8. The role theory plays in guiding scientific research.
9. Why theories known to be inadequate often continue to be used (useful, no replacement in sight).
10. The dangers of letting theory drive research rather than the data, and vice versa, and the advantage of combining the two approaches.

IDEAS FOR CLASS ACTIVITIES

Identifying Theories, Hypotheses and Models

Have students find an example of a theory in psychology and summarize its major ideas and characteristics. Have them determine:
1. Whether the theory is quantitative or qualitative,
2. The level of description at which the theory operates,
3. The scope or domain of the theory,
4. How the theory differs from a hypothesis or model.

Some ideas for psychological theories students can user are: Terror management theory, equity theory, cognitive dissonance theory, attachment theory, cognitive-developmental theory (e.g., Piaget), Clark Hull's theory of learning, Maslow's hierarchical theory of personality, and Gibbon's scalar expectancy theory of reinforcement.

Are Theories Necessary?

Have students read B. F. Skinner's article, "Are Theories of Learning Necessary?" (the reference appears in the back of the text), and come to class prepared to debate the issue raised by the article. You can note the conditions that existed at the time the article was written (failure of Hullian theory to adequately account for all forms of learning, etc.), and use Skinner's argument to raise the question of when it is appropriate to attempt

theory construction. Was Skinner too severe in his criticism? Is a science without theory really a science? What does Skinner propose to substitute in place of theory?

Strong Inference

Discuss Platt's suggestion that all we need to make progress in any science is to follow his program of "strong inference," or systematic elimination of rival hypotheses until only one (presumably the correct one) is left. What happens to strong inference when extraneous variables cannot be as rigorously controlled as they are in molecular biology? Is the apparent lack of progress in theoretical development within many fields of psychology due to a failure to follow Platt's methods, or might the complexity of relationships and lack of adequate control over the relevant variables have more to do with it?

Platt suggests that we attempt to develop several theories to account for our data, and then rigorously pit the alternative theories against one another. Discuss the advantage of this approach over simply developing a theory and then testing its predictions.

The "competing theories" approach can be found in many studies on the "Observing Response" in the operant conditioning literature. An excellent example is:

Wilton, R. N., & Clements, R. 0. (1971). The role of information in the emission of observing responses: A test of two hypotheses. Journal of the Experimental Analysis of Behavior, 16, 1–166.

Paradigm Shift?

Kuhn (1964) suggested that scientists conduct their research under a set of implicit assumptions that constitute, in effect, a theory of the phenomena they study. This theory determines which research questions are important. When the theory is overthrown by a new view, a paradigm shift is said to occur. Under the new paradigm, new research questions become important, and many issues that were important under the old view become irrelevant.

Many now claim that American psychology is currently undergoing such a paradigm shift from the purely associationistic view that predominated under behaviorism to a view that emphasizes mental processes. Discuss this "cognitive revolution" with the class. Does it represent a true paradigm shift as Kuhn would define one? In what ways does the cognitive view change one's approach to conducting research?