Instructor Manual

Chapter 2: How Do We Find Out? The Logic, Art, and Ethics of Scientific Discovery

Chapter Summary

Chapter 2 focused on the logic, art, and ethics of discovery. We began by focusing on the *logic of discovery*. We noted that the purpose of science is to uncover fundamental **laws** of human behavior. Skeptics may believe that psychology cannot uncover laws because it is usually impossible to predict how any given person will act at any given time. We argued, however, that laws of human behavior do exist, even if we lack the ability to identify all of the causal factors that are influencing a specific person in a specific situation. Nevertheless, psychologists typically are focused less on uncovering universal laws than on developing **theories**. Theories are general statements about how the world works, but they only make predictions under well-specified conditions. Good theories can be used to help generate a wide range of testable hypotheses that apply across a wide range of different situations. Hypotheses are specific predictions that are derived from theories. Hume's **problem of induction** and Popper's response tell us that more can be gained when researchers try to generate hypotheses that will **falsify** theories, instead of hypotheses that might **validate** theories. An alternative to both falsifying and validating is to seek theoretical **qualifications**. This approach to hypothesis testing can help identify the conditions under which a theory makes accurate predictions and the conditions under which it does not. After reviewing the logic of discovery, we turned our attention to the *art of discovery*. We discussed a series of **inductive and deductive techniques** that can help researchers generate interesting and testable ideas that might change the way we think. We concluded the chapter by focusing on the *ethics of discovery*. Although no book can address all of the ethical issues a researcher will face in pursuing knowledge, we briefly reviewed the **history of ethics** in psychology and explained how **internal review boards** apply a cost–benefits analysis to ensure that research studies meet both professional and community ethical standards.

Sample Answers for the Study Questions from the Textbook

1. The goal of science is to uncover laws (universal statements of the nature of things). In contrast, psychology is a specific field of study that seeks to understand and predict how people think, feel, and behave. Unfortunately, it is difficult, if not impossible, to uncover laws that dictate how any one specific person will think, feel, or behave within any given situation. Given this fact, how can psychology be considered a scientific discipline?

Although it is nearly impossible to uncover laws that will predict a person's exact behavior in a situation, psychology can still be considered a scientific discipline. Psychologists can't make exact predictions of what a person's behavior can be, but they can predict what his or her behavior is likely to be given the situation. The research conducted by psychologists has uncovered general rules of human behavior. As with any science, the goal of psychology is to uncover laws. The fact that laws regarding human behavior have not yet been uncovered does not indicate that it will never happen.

2. What is the method of induction? What limitation to this method did David Hume identify? How was this limitation addressed by Karl Popper's analysis of the method of deduction?

The method of induction involves making many observations and arriving at a general statement about the state of things. Basically, it is reasoning from specific instances to general principles. David Hume identified a limitation of induction, known as the problem of induction. According to Hume, one can never make enough observations to come to a conclusion. It is always possible that the next observation will prove your statement wrong, no matter how many observations you have already made. Karl Popper's analysis of the method of deduction addresses the problem of induction by stating that empirical tests can never prove that a theory is correct. Deduction is reasoning from the general to the specific, and in the process, theories can be proven to be false, but can never be proven to be completely true.

3. In what way is validation (and related processes such as the positive test bias) a threat to science? How is this threat addressed when researchers seek either to falsify or qualify their own scientific theories?

Validation is a threat to science because scientists sometimes conduct experiments that will likely support their hypotheses. This bias may be conscious or unconscious, but it still exists in most cases. When researchers attempt to falsify or qualify their own psychological theories, they attempt to mitigate this bias in several ways. First, psychologists must carefully detail the methods that they use in experimentation. This allows other psychologists to repeat the experiment, leaving it open to falsification. With qualification, researchers attempt to identify the boundary conditions under which a theory is and is not true. This means that two seemingly opposite theories can explain the same thing because neither is true all of the time.

4. The ethics of a study are evaluated, in part, by applying a risk–benefit analysis. At colleges and universities in the United States, who determines what risks and what benefits apply for any given study? What formal procedures are added to most psychology studies to minimize the risks and maximize the benefits?

Internal review boards (IRBs) are responsible for doing a risk–benefit analysis for studies conducted at colleges and universities in the United States. IRBs are made up of a combination of university instructors/researchers, one or more staff members with expertise in the area of research, and one or more laypeople from the local community. Most psychology studies employ formal procedures to minimize risks and maximize benefits. The first procedure is informed consent. The researcher must inform the participants of any potential risks there may be in participating so that they can make an informed decision on whether or not to continue. The second procedure is freedom from coercion. Participants cannot be under any pressure to participate in a study. The third procedure is confidentiality. This requires the experimenter to identify all participants by number only and not by name. The final method discussed is debriefing. Debriefing consists of the experimenter sharing information about the research study with the participant as soon as possible. If there was any deception involved, the researcher must inform the participant of this.

5. Turn back to question 4 at the end of Chapter 1. Answer this question again, but this time consider the role of deductive theory testing and how it helps researchers make more definitive tests of theories.

Although psychologists study many unobservable phenomena, psychology is a science. The method of deduction in particular helps researchers make more definitive tests of theories. One deductive method, falsification, attempts to disprove theories so that only ones that survive careful scrutiny survive. Psychologists must allow others to attempt to disprove their theories, and science only becomes stronger when inadequate theories are discarded. The method of qualification also helps to

test theories. Since more than one psychological theory can exist under different circumstances, psychologists do not have to develop theories that explain everything regarding a certain behavior. Theories are only made stronger when they survive attempts at falsification or when a different theory is discovered that complements another already existing theory. Psychologists take advantage of deductive techniques in many instances, and this strengthens psychology as a science in general.

Multiple Choice Questions Test Bank

Student self-test questions appear first, followed by questions available only to instructors. To minimize any confusion, **student** self-test questions have an "s" appended to the question number. **Instructor** questions have an "i" appended to the question number.

Student Self-testing Questions (questions available to students online.)

1s. A(n) _____ is a universal statement that allows reliable predictions of future events.
A) theory
B) law
C) hypothesis
D) proof
Ans: B REF: The Logic of Scientific Discovery

2s. In contrast to laws, theories do not always make accurate predictions. This is partly because of _____.
A) boundary conditions
B) poor testability
C) parsimony
D) logical positivism
Ans: A REF: The Logic of Scientific Discovery

3s. The notion that there are many different causes for aggression is an example of _____.
A) a weak theory
B) parsimony
C) induction
D) equifinality
Ans: D REF: The Logic of Scientific Discovery

4s. _____ are predictions about specific events that are derived from one or more _____.
A) Hypotheses; theories
B) Proofs; hypothesis
C) Hypotheses; proofs
D) Theories; hypotheses
Ans: A REF: The Logic of Scientific Discovery

5s. _____ usually have more empirical support than _____, which usually have more empirical support than _____.
A) Laws, theories, hypotheses
B) Theories, laws, hypotheses
C) Hypotheses, laws, theories

D) Laws, hypotheses, theories
Ans: A REF: The Logic of Scientific Discovery

6s. For hypotheses to serve as good tests of specific theories, they must _____.
A) generate predictions that disagree with common sense
B) emphasize the causal relations between two or more variables
C) provide comprehensive statements about reality
D) follow in a clear and logical fashion from the theories in question
Ans: D REF: The Logic of Scientific Discovery

7s. Felix collected convincing experimental data suggesting that cigarette smoking causes lung cancer. He therefore concluded that exposure to air pollution does not cause lung cancer. Felix has failed to appreciate the principle of _____.
A) spurious variables
B) equifinality
C) induction
D) covariation
Ans: B REF: The Logic of Scientific Discovery

8s. Most people believe strongly in gravity because they have repeatedly observed that when specific objects are dropped, the objects (e.g., pins, piñatas, pianos) always fall to the earth. According to the text, this form of reasoning is referred to as _____.
A) reasoning
B) deduction
C) induction
D) validation
Ans: C REF: The Logic of Scientific Discovery

9s. Social psychologists once thought that the fundamental attribution error was a basic feature of human social judgment. Later, research showed that people in India do not make this error. This is an example of _____.
A) deduction
B) equifinality
C) a canon of science
D) the problem of induction
Ans: D REF: The Logic of Scientific Discovery

10s. Wason (1971) used the "E, K, 4, 7" task to demonstrate _____.
A) behavioral confirmation
B) the positive test bias
C) the perseverance effect
D) logical positivism
Ans: B REF: The Logic of Scientific Discovery

11s. Curtis believes that redheads are hot-tempered and aggressive. Because of this belief, Curtis frequently behaves aggressively toward redheads. Not surprisingly, Curtis's behavior often makes redheads angry at him, and it occasionally leads to aggressive confrontations. Curtis appears to be engaging in _____.
A) behavioral confirmation
B) behavioral validation
C) behavioral verification
D) behavioral confrontation
Ans: A REF: The Logic of Scientific Discovery

12s. Karl showed that a well-studied drug used to reduce blood pressure in men had this effect in a representative sample of men--but had no such effect in a representative sample of women. Karl's research is a good example of the approach to hypothesis testing known as _____.
A) invalidation
B) qualification
C) bifurcation
D) separation
Ans: B REF: The Logic of Scientific Discovery

13s. The concept of boundary conditions is a very close cousin of the approach to hypothesis testing known as _____.
A) validation
B) qualification
C) falsification
D) demonstration
Ans: B REF: The Logic of Scientific Discovery

14s. The experimental paradigm is grounded on the assumption that the best way to understand the true causes of behavior is to engage in _____.
A) experimentation
B) qualification
C) replication
D) verification
Ans: A REF: The Logic of Scientific Discovery

15s. Induction refers to reasoning _____.
A) from the general to the specific
B) from the specific to the general
C) by means of analogy and insight
D) by means of intuition and counterexample
Ans: B REF: The Logic of Scientific Discovery

16s. McGuire's rules for generating research hypotheses can be divided into _____.
A) inductive and deductive techniques
B) productive and counterproductive techniques
C) traditional and progressive techniques
D) intuitive and theoretical techniques
Ans: A REF: The Art of Scientific Discovery

17s. Bowlby's reliance on observations of attachment behavior in primates as a way of understanding adult romantic attachment represents an example of the use of _____ to generate new research ideas.
A) reasoning by analogy
B) a paradoxical incident
C) serendipity
D) a functional analysis
Ans: A REF: The Art of Scientific Discovery

18s. Which of the following is NOT a deductive technique for generating research hypotheses?
A) capitalizing on serendipity
B) applying a functional or adaptive analysis
C) trying to account for conflicting results

D) trying to account for exceptions to well-established principles
Ans: A REF: The Art of Scientific Discovery

19s. McGuire's research on attitude inoculation is a good example of generating a research hypothesis by taking advantage of _____.
A) a paradoxical incident
B) serendipity
C) reasoning by analogy
D) the hypothetico-deductive method
Ans: C REF: The Art of Scientific Discovery

20s. Dr. Swinkels conducted a lab experiment in which he told participants that one of their primary jobs was to make some ratings of scenes from popular movies. However, his actual reason for showing participants the movie clips was to manipulate the participants' mood. Once this experiment is done, Dr. Swinkels should make certain to _____.
A) explain the reason(s) for the deception in the study
B) explain what she expected to find in her experiment
C) put participants who saw sadness-inducing move clips back into a good mood
D) all of these (he should do all three things)
Ans: D REF: The Ethics of Scientific Discovery

Questions Reserved for Instructors (This question set is NOT available to students online.)

1i. A general statement about the relation between two or more variables is called a _____.
A) hypothesis
B) law
C) theory
D) construct
Ans: C REF: The Logic of Scientific Discovery

2i. Which of the following generally has the least amount of empirical support?
A) a law
B) a theory
C) a hypothesis
D) you cannot say without reading the literature on a specific topic
Ans: C REF: The Logic of Scientific Discovery

3i. One way to discriminate between a law and a hypothesis probably has many more _____ than a law.
A) adherents
B) boundary conditions
C) simplifying assumptions
D) derivations
Ans: B REF: The Logic of Scientific Discovery

4i. Which of the following things is LEAST precise and coherent?
A) a canon
B) a theory
C) a hypothesis
D) a law
Ans: C REF: The Logic of Scientific Discovery

5i. Theories are typically used to generate specific research _____.

A) designs
B) laws
C) hypotheses
D) conclusions
Ans: C REF: The Logic of Scientific Discovery

6i. According to the text, the principle of _____ refers to the idea that the same behavior is often produced by many different causes.
A) determinism
B) equifinality
C) pluralism
D) philosophical convergence
Ans: B REF: The Logic of Scientific Discovery

7i. Dr. Rose showed that aggression is predicted well by genetic factors. In contrast, Dr. Jones showed that aggression is predicted well by environmental factors. Which principle suggests that Dr. Rose and Dr. Jones may both be correct?
A) naive realism
B) logical positivism
C) equifinality
D) parsimony
Ans: C REF: The Logic of Scientific Discovery

8i. According to David Hume, even if all the observations scientists make are consistent with a conclusion, it is always possible that they will eventually make a new observation that violates this conclusion and proves it wrong. This is known as the problem of _____.
A) deduction
B) induction
C) reasoning
D) observational scope
Ans: B REF: The Logic of Scientific Discovery

9i. The method of deduction can be described as _____.
A) reasoning from the general to the specific
B) reasoning from the specific to the general
C) reasoning from the practical to the symbolic
D) reasoning from the symbolic to the practical
Ans: A REF: The Logic of Scientific Discovery

10i. Which approach to scientific hypothesis testing is similar to the bias demonstrated in Wason's (1971) "E, K, 4, 7" experiment?
A) validation
B) qualification
C) falsification
D) demonstration
Ans: A REF: The Logic of Scientific Discovery

11i. Which approach to scientific hypothesis testing would a logical positivist such as Karl Popper be **most** likely to support?
A) validation
B) qualification
C) falsification

D) demonstration
Ans: C REF: The Logic of Scientific Discovery

12i. A critic of a popular theory who believes that the theory is seriously flawed would probably test the theory by trying to engage in what proponents of the theory consider _____.
A) validation
B) qualification
C) falsification
D) demonstration
Ans: C REF: The Logic of Scientific Discovery

13i. Bill McGuire has argued that almost every theory in psychology is correct under some conditions and incorrect under others. In light of this fact, which approach to hypothesis testing would McGuire be most likely to support?
A) validation
B) qualification
C) falsification
D) demonstration
Ans: B REF: The Logic of Scientific Discovery

14i. Which approach to hypothesis testing can resolve the conflict between two opposing theories by specifying the conditions under which each of the theories is correct?
A) qualification
B) integration
C) validation
D) falsification
Ans: A REF: The Logic of Scientific Discovery

15i. Persuasive messages generally have the most impact shortly after they are delivered, but in some cases, the impact grows stronger over a period of time. Which deductive strategy for hypothesis generation does this represent?
A) validation
B) hypothetico-deductive method
C) falsification
D) accounting for exceptions
Ans: D REF: The Art of Scientific Discovery

16i. Which of the following is NOT an inductive technique for generating research hypotheses?
A) using case studies
B) trying to account for paradoxical incidents
C) analyzing the practitioner's rule of thumb
D) reasoning by analogy
Ans: D REF: The Art of Scientific Discovery

17i. Paying careful attention to what highly skilled experts do as a way of generating a new research hypothesis is what McGuire calls _____.
A) applying a functional or adaptive analysis
B) trying to account for conflicting results
C) the expertise heuristic
D) analyzing the practitioner's rules of thumb
Ans: D REF: The Art of Scientific Discovery

18i. B. F. Skinner appears to have discovered the partial reinforcement effect when he was running a simple conditioning experiment, ran low on food pellets, and began reinforcing only a percentage of responses he otherwise would have reinforced 100% of the time. This is an example of _____.
A) capitalizing on a paradoxical incident
B) serendipity
C) reasoning by analogy
D) the hypothetico-deductive method
Ans: B REF: The Art of Scientific Discovery

19i. The goal of IRBs (internal review boards) is to ensure that all studies conducted at a specific university or research site _____.
A) adhere to consensually agreed upon community standards of ethical behavior
B) are scientifically rigorous and cost-effective
C) directly benefit the people who serve as research participants
D) lead to treatments of, or cures for, major mental health problems
Ans: A REF: The Ethics of Scientific Discovery

20i. To decide whether a specific research proposal is ethical, internal review boards (IRBs) always consider both "risks" and "benefits." What general rule regarding risks and benefits do IRBs apply?
A) The risk to benefit ratio in research must be at least 1:2, meaning that the benefits must be at least twice as great as the risks.
B) All risks and benefits likely to arise as a result of participation in a study must be fully explained to participants prior to their participation.
C) Any benefits that are likely to arise as a result of participation in a study must outweigh all of the risks.
D) The benefits of education in an experiment must outweigh any risks of coercion.
Ans: C REF: The Ethics of Scientific Discovery

21i. Derek's proposed research study involves him engaging in casual conversations with his classmates regarding their alcohol use and then writing down their responses after he has returned home from class. His university's IRB is likely to reject his proposal on the grounds that it violates which ethical principle?
A) freedom from coercion
B) informed consent
C) protection from physical and psychological harm
D) qualification
Ans: B REF: The Ethics of Scientific Discovery

22i. Destroying a list of names that can be linked to participant identification numbers is an example of upholding _____.
A) informed consent
B) confidentiality
C) inter-rater reliability
D) deception
Ans: B REF: The Ethics of Scientific Discovery