

Inference to the Best Explanation

Chapter Objectives

Explanations and Inference

You will be able to

- define *inference to the best explanation* and understand how it differs from other kinds of induction.
- clarify what an explanation (including theoretical explanation) is and how it differs from an argument.
- appreciate how inference to the best explanation is used in all disciplines and in everyday life.
- demonstrate how to use inference to the best explanation in a range of different situations.

Theories and Consistency

You will be able to

- check an explanation for internal and external consistency.

Theories and Criteria

You will be able to

- explain the importance of using criteria to judge the adequacy of theories.
- list and explain the five criteria of adequacy.
- apply the criteria of adequacy to simple causal theories.
- define and explain an *ad hoc hypothesis*.

Telling Good Theories from Bad

You will be able to

- list and explain the four steps in the TEST formula.
- recognize the importance of considering alternative explanations.
- use the TEST formula to evaluate theories.

Chapter Summary

Even though an explanation is not an argument, an explanation can be part of an argument—a powerful inductive argument known as **inference to the best explanation**. In inference to the best explanation, we reason from premises about a state of affairs to an explanation for that state of affairs. Such explanations are called **theoretical explanations**, or theories.

To be worthy of consideration, a theory must meet the minimum requirement for consistency. We use the **criteria of adequacy** to judge the plausibility of a theory in relation to competing theories. The best theory is the one that meets the criteria of adequacy better than any of its competitors. The criteria of adequacy are **testability** (whether there is some way to determine if a theory is true), **fruitfulness** (the number of novel predictions made), **scope** (the amount of diverse phenomena explained), **simplicity** (the number of assumptions made), and **conservatism** (how well a theory fits with existing knowledge).

Judging the worth of a theory is a four-step process called the **TEST formula**: (1) Stating the theory and checking for consistency, (2) assessing the evidence for the theory, (3) scrutinizing alternative theories, and (4) testing the theories with the criteria of adequacy.

Answers to Select Textbook Exercises

Please note: These answers are for some of the questions that were not answered in Appendix B of *The Power of Critical Thinking*, Fifth Canadian Edition.

Exercise 9.1

2. Inference to the best explanation is a form of inductive reasoning in which we reason from premises about a state of affairs to an explanation for that state of affairs.
6. An inference to the best explanation can be deemed strong if the explanation really is the best; it is deemed cogent if the premises are also true.
10. Physicians are an obvious example (seeking explanations for symptoms). Also forensic pathologists, seeking explanations for death. Or structural engineers, seeking explanations for why a bridge fell or a building failed. Mechanics use it in figuring out what's wrong with your car.

Exercise 9.2

4. State of affairs: Nursing students loving Professor Walton's class; Explanation: Professor Walton takes dull material and makes it interesting.
9. State of affairs: Corporate CEOs make a lot of money; Explanation: the skills they have are highly in demand.

Exercise 9.3

3. Non-theoretical (interpretive)
13. Theoretical
16. Theoretical

Exercise 9.4

7. Theory 1: The four glasses of red wine resulted in the headache (a hangover).
Theory 2: Chips cause headaches.

Exercise 9.5

Answers are not provided for this exercise.

Exercise 9.6

3. In order to fully evaluate a theory, one must know and understand the competing theories. This implies that the “best theory” is the eligible theory that meets the criteria of adequacy better than any of its competitors.

Exercise 9.7

3. The simpler and more conservative theory: she hurt her leg skiing.

Exercise 9.8

1. The most plausible theory: the common cold

Exercise 9.9

Answers are not provided for this exercise.

Exercise 9.10

Answers are not provided for this exercise.

Study Questions

1. What is inference to the best explanation? What is the logical pattern of inference to the best explanation?
2. Under what circumstances can an inference to the best explanation be deemed strong? Cogent?
3. What is the minimum requirement of consistency?
4. What does it mean for a theory to be internally and externally consistent?
5. What are the criteria of adequacy?
6. What does it mean for a theory to be the best?
7. What is the criterion of testability? What does it mean for a theory to be testable?
8. What is the criterion of fruitfulness?
9. What is the criterion of scope? In what way did Albert Einstein’s theory have more scope than Isaac Newton’s?
10. What is the criterion of simplicity?
11. What is an ad hoc hypothesis?

12. What is the criterion of conservatism?
13. What is the TEST formula? What four steps does it comprise?
14. How do theoretical explanations differ from interpretive explanations? Procedural explanations? Teleological explanations?
15. Why are most conspiracy theories implausible? Which criterion of adequacy is problematic for conspiracy theories, and why? Use an example to illustrate.

Self-Assessment Quiz

Scroll down for answers.

Explanation Identification

For each of the following, determine whether there is an explanation present. If there is, say what state of affairs is being explained and what the explanation is.

1. Canadians are more prone to vitamin D deficiency than residents of Florida because in much of Canada people don't get enough sunlight, especially during the dark winter months.
2. You should study hard for your Critical Thinking test if you want to get a good mark.
3. Penelope did well on her Critical Thinking test because she studied long and hard.
4. The Falcon Heavy launch vehicle put Elon Musk's Tesla Roadster into outer space.
5. Elon Musk put a Tesla Roadster into space because he wanted to prove that Falcon Heavy could deliver a payload into planetary orbit.
6. The Edmonton Oilers missed the playoffs because Connor McDavid was injured.

Theoretical versus Non-Theoretical Explanations

For each of the following, determine whether the type of explanation offered is theoretical (i.e., the kind used in inference to the best explanation) or non-theoretical (e.g., teleological, interpretive, procedural).

1. The Speaker of the House has the responsibility to interpret Parliamentary rules and traditions and to ensure that those rules and traditions are upheld in the Parliament.
2. My computer failed because my sister downloaded a file that was infected by a virus.
3. The Liberal Party won re-election even though they were spectacularly unpopular because they were less unpopular than the main alternative.

4. Ophthalmology is the branch of medicine concerned with health of the eye.
5. God gave us thumbs so that we can grip objects, like bananas and telephones.
6. Metaphysics is one of the five main sub-disciplines of philosophy. It is concerned with the nature of ultimate reality.
7. Arrive at the airport two hours before your flight. Check your bags at the baggage drop, then go through the security screening before proceeding to your gate for boarding.
8. Douglas is late for the meeting because he has a flat tire.
9. Auston Matthews is not in the lineup because he has a concussion.

Testability

For each set of phenomena and accompanying theories listed below, determine which theory is *testable*.

1. Phenomenon: You have a serious injury when you get struck by a car after you fail to notice that the traffic light had changed.
Theory 1: You were distracted by a telephone call from your girlfriend.
Theory 2: You are experiencing bad karma due to wrong actions in a previous life.
Theory 3: Your mind was being controlled by extraterrestrials.
2. Phenomenon: You develop an extreme fever, accompanied by loss of appetite and chills, while travelling in East Africa.
Theory 1: A sorcerer has put a spell on you.
Theory 2: You have contracted malaria from a mosquito bite.
Theory 3: Negative energy, caused by your pessimism about the trip, has caused the illness.
3. Phenomenon: Your watch stopped working.
Theory 1: An invisible goblin lives inside your watch and stops the parts from moving.
Theory 2: The battery is dead.
Theory 3: Super-intelligent, extradimensional beings suspended the passage of space-time within your watch.

Simplicity

For each set of phenomenon and accompanying theories listed below, determine which theory is *simplest*.

1. Phenomenon: The diversity of plant and animal species in the world today.
Theory 1: The existence of a benevolent spirit that created the various species.
Theory 2: Natural selection and genetic adaptation to the varied environmental conditions in the world.

2. Phenomenon: The New England Patriots win Super Bowl LIII.
Theory 1: The Patriots trade for a great running back and get a strong linebacker and a strong kicker in the draft.
Theory 2: A corrupt billionaire fan bribes all the other teams to lose to the Patriots.

3. Phenomenon: The linesman mistakenly calls Connor McDavid off-side.
Theory 1: The referee misperceived the play.
Theory 2: Gary Bettman recently noticed that the Edmonton Oilers are creeping up in the NHL standings and might make the playoffs if they win a few more games. He's concerned that if a small market team like the Oilers make the playoffs, fewer viewers in the larger, American television markets will tune into the games, hurting the NHL's ratings and deterring sponsors from buying ads during the games. He took deputy commissioner Bill Daly aside in private, and instructed him to call the linesman before the game, to inform him that "Gary likes his eggs over-hard," which is pre-established code meaning that the linesman is to do what he can, within the bounds of plausible deniability, to impede McDavid's progress into the offensive zone.

Conservatism

For each set of phenomenon and accompanying theories listed below, determine which theory is most *conservative*.

1. Phenomenon: Relief of hay fever symptoms in thirty people after they took a homeopathic remedy.
Theory 1: Homeopathy relieved the symptoms.
Theory 2: The placebo effect was behind the relief of symptoms.
Theory 3: The full moon caused the relief of symptoms.

2. Phenomenon: Famed psychic Uri Geller appearing to bend spoons with his mind.
Theory 1: He has psychic powers.
Theory 2: He has tapped into a kind of energy unknown to science.
Theory 3: He uses simple conjuring tricks that magicians regularly employ.

3. Phenomenon: Your honest friend, who usually does poorly on tests, unexpectedly does very well on a hard logic test.
Theory 1: She prayed extensively before the test.
Theory 2: She worked very hard preparing for the test.
Theory 3: During the exam, she read the minds of the other students.

4. Phenomenon: Radiometric techniques indicate that trilobite fossils found in the Burgess shale, located high in the Canadian Rockies, are over 500 million years old.
Theory 1: God created the world five minutes ago, complete with fossils which appear to be over 500 million years old, and test results which appear to indicate that they are.
Theory 2: Radiometric dating techniques work and the fossils really are over 500 million years old.
Theory 3: Noah carved thousands of rock fragments, to make it appear as if they contained fossils. He deposited them in the Burgess Shale, high in the Rocky Mountains, before the flood waters subsided and sea levels drastically dropped.

Adequacy

On the basis of what you already know and the criteria of adequacy, determine which theory in each group is most plausible.

1. Phenomenon: A sudden rush to enroll in nursing programs throughout the province.
Theory 1: A heart-throb pop singer's most recent hit is about falling in love with a nurse.
Theory 2: Many young people suddenly have an interest in healthcare work.
Theory 3: The province has just announced strong incentives to study nursing, accompanied by lucrative pay increases to practising nurses.
2. Phenomenon: Four people sitting together in the fourth row got unusually high scores on a difficult linear algebra test.
Theory 1: The students were cheating by passing answers to one another during the test.
Theory 2: Students in the fourth row tend to do better than other students on math tests.
Theory 3: The test was multiple choice and these students all just got very lucky.
3. Phenomenon: You notice a smell of rotten eggs in your home.
Theory 1: Pranksters have set off a "stink bomb" in your home.
Theory 2: There is a natural gas leak.
Theory 3: It is just your imagination.

Applying TEST

Evaluate the following theory by using the TEST formula. As part of your evaluation:

- a) state the claim to be evaluated;
- b) indicate what phenomenon is being explained;
- c) specify at least one alternative theory; and
- d) use the criteria of adequacy to assess the two theories and determine which one is more plausible.

You are talking with a fellow student about the upcoming organic chemistry midterm and suddenly develop the strange feeling that you have experienced this exact situation before, although you cannot quite recall when. Reflecting on the situation, you infer that the cause of your experience is the fact that you have lived your current life before, experiencing exactly the same experiences in exactly the same way.

Answers to Self-Assessment Quiz

Explanation Identification

1. This is an explanation of why Canadians are more prone to vitamin D deficiency than residents of Florida. The explanation is that in much of Canada people don't get enough sunlight, especially during the dark winter months.
2. This is not an explanation. (It is a bit of good advice put in the form of a conditional.)
3. This is an explanation of why Penelope did well on her Critical Thinking test. The explanation is that she studied long and hard.
4. This is not an explanation. (It is a report about a SpaceX test flight.)
5. This is an explanation of why Elon Musk put a Tesla Roadster into space. The explanation is that he wanted to prove that the Falcon Heavy launch vehicle could put a payload into planetary orbit.
6. This is an explanation of why the Edmonton Oilers missed the playoffs. The explanation is that Connor McDavid was injured.

Theoretical versus Non-Theoretical Explanations

1. This is non-theoretical; it clarifies the function of the Speaker.
2. Theoretical.
3. Theoretical.
4. This is non-theoretical; a meaning of the term "ophthalmology" is offered.
5. This is non-theoretical; offers a teleological explanation for the existence of human thumbs.
6. This explanation is non-theoretical; it is an interpretive explanation of the sub-discipline of philosophy known as "metaphysics."
7. This explanation is non-theoretical; it is a procedural explanation of what to do when you arrive at the airport to take a flight.
8. Theoretical
9. Theoretical

Testability

1. Theory 1 is testable. Both bad karma and extraterrestrials are untestable "hypotheses," but it is possible to confirm that one was distracted by a telephone call.
2. Theory 2 is testable. Sorcery and negative energy are untestable, but there are simple blood tests to confirm malaria.
3. Theory 2 is testable, by replacing the battery. Both 1 and 3 explain the phenomenon in question by reference to unobservable entities.

Simplicity

1. Theory 2 is simpler. The alternative requires the existence of a benevolent spirit in addition to known biological entities and processes.
2. Theory 1 is simpler. Teams ordinarily trade and draft in order to strengthen weaknesses; while the theory of the corrupt billionaire is plausible, it requires more suppositions than the alternative.
3. Theory 1 is simpler. Theory 2 requires the existence of a complicated conspiracy involving Bettman, Daly, the linesman, and a mysterious code.

Conservatism

1. Theory 2 is most conservative because the placebo effect is well established. Neither homeopathy nor the effects of the full moon are well established.
2. Theory 3 is most conservative. The alternatives are not established, but it is obvious that magicians employ conjuring tricks.
3. Theory 2 is most conservative. Mind reading and the effects of prayer on test writing are not well established. However, the effects of studying are established.
4. Theory 2 is the most conservative. Both Theory 1 and 2 are, by contrast, inconsistent with a vast body of well-established scientific background beliefs from a variety of distinct scientific disciplines, including geology, paleontology, astronomy, physics, and chemistry.

Adequacy

1. Theory 3 best satisfies the criteria of adequacy. It is simple, conservative, has greater scope, and is fruitful. Theories 1 and 2 are not simple, appearing to make ad hoc hypotheses. They also are not fruitful and have limited scope.
2. Theory 1 best satisfies the criteria of adequacy. The luck hypothesis is not conservative in explaining why four people scored very highly on a test. Theory 2 fails in not being simple or conservative. Both 2 and 3 lack fruitfulness.
3. Theory 2 is best. Theories 1 and 2 are both simpler than theory 3. Theories 1 and 2 are both possible, but if there is no reason to believe that there are pranksters about, then you ought to get out of the house and call emergency services (assuming the house uses natural gas).

Applying TEST

- a) The cause of your feeling is the fact that you have lived your current life before.
- b) Your “déjà vu” feelings.
- c) Something in your current situation reminds you of a past event, but that event is not clear to your consciousness.

The “prior life” hypothesis fails the simplicity and conservatism criteria. It is also untestable and not fruitful. The “feeling” hypothesis is simpler, more conservative, and perhaps even fruitful.