

**Cengage Advantage**  
Books

NINTH EDITION

# Understanding Arguments

AN INTRODUCTION TO INFORMAL LOGIC

**Walter Sinnott-Armstrong**  
**Robert Fogelin**

# UNDERSTANDING ARGUMENTS





# UNDERSTANDING ARGUMENTS

---

*An Introduction to Informal Logic*

NINTH EDITION

**WALTER SINNOTT-ARMSTRONG**

*Duke University*

**ROBERT J. FOGELIN**

*Dartmouth College*



---

Australia • Brazil • Mexico • Singapore • United Kingdom • United States

This is an electronic version of the print textbook. Due to electronic rights restrictions, some third party content may be suppressed. Editorial review has deemed that any suppressed content does not materially affect the overall learning experience. The publisher reserves the right to remove content from this title at any time if subsequent rights restrictions require it. For valuable information on pricing, previous editions, changes to current editions, and alternate formats, please visit [www.cengage.com/highered](http://www.cengage.com/highered) to search by ISBN#, author, title, or keyword for materials in your areas of interest.

**Understanding Arguments: An  
Introduction to Informal Logic,  
Ninth Edition**

**Walter Sinnott-Armstrong and  
Robert Fogelin**

Product Manager: Debra  
Matteson

Content Developer: Ian Lague

Content Coordinator: Joshua  
Duncan

Media Developer: Christian  
Biagetti

Associate Marketing Manager:  
Shanna Shelton

Rights Acquisitions Specialist:  
Shalice Shah-Caldwell

Manufacturing Planner: Sandee  
Milewski

Art and Design Direction,  
Production Management, and  
Composition: PreMediaGlobal

Cover Image: © DEA PICTURE  
LIBRARY/De Agostini Picture  
Library / Getty Images

© 2015, 2010, 2005 Cengage Learning

WCN: 02-200-203

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced, transmitted, stored, or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitizing, taping, web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher.

For product information and  
technology assistance, contact us at **Cengage Learning  
Customer & Sales Support, 1-800-354-9706**

For permission to use material from this text or product,  
submit all requests online at **www.cengage.com/permissions**.  
Further permissions questions can be emailed to  
**permissionrequest@cengage.com**.

Library of Congress Control Number: 2013952536

Student Edition:

ISBN-13: 978-1-285-19736-4

ISBN-10: 1-285-19736-4

**Cengage Learning**

200 First Stamford Place, 4th Floor  
Stamford, CT 06902  
USA

Cengage Learning is a leading provider of customized learning solutions with office locations around the globe, including Singapore, the United Kingdom, Australia, Mexico, Brazil and Japan. Locate your local office at **international.cengage.com/region**.

Cengage Learning products are represented in Canada by Nelson Education, Ltd.

For your course and learning solutions, visit **www.cengage.com**.

Purchase any of our products at your local college store or at our preferred online store **www.cengagebrain.com**.

**Instructors:** Please visit **login.cengage.com** and log in to access instructor-specific resources.

Printed in the United States of America

1 2 3 4 5 6 7 17 16 15 14 13

*To Eric, John, Lars, Miranda, and Nicholas  
and the colleges of their choice*

---





---

# CONTENTS

---

## **PREFACE XV**

## **PART I HOW TO ANALYZE ARGUMENTS 1**

---

### **CHAPTER 1**

#### **USES OF ARGUMENTS 3**

- What Arguments Are* 3
- Justifications* 4
- Explanations* 7
- Combinations: An Example* 10

### **CHAPTER 2**

#### **THE WEB OF LANGUAGE 17**

- Language and Convention* 17
- Linguistic Acts* 19
- Speech Acts* 22
  - Performatives 23
  - Kinds of Speech Acts 26
- Conversational Acts* 28
  - Conversational Rules 31
  - Conversational Implication 33
  - Rhetorical Devices 36
- Summary* 38

### **CHAPTER 3**

#### **THE LANGUAGE OF ARGUMENT 41**

- Argument Markers* 41
  - If . . . , then . . . 43
- Arguments in Standard Form* 45
- A Problem and Some Solutions* 47
  - Assuring 48

Guarding	49
Discounting	51
<i>Evaluative Language</i>	54

**CHAPTER 4****THE ART OF CLOSE ANALYSIS 59**

<i>An Extended Example</i>	59
Clerk Hire Allowance, House of Representatives	59

**CHAPTER 5****DEEP ANALYSIS 79**

<i>Getting Down to Basics</i>	79
<i>Clarifying Crucial Terms</i>	83
<i>Dissecting the Argument</i>	83
<i>Arranging Subarguments</i>	85
<i>Some Standards for Evaluating Arguments</i>	90
Validity	91
Truth	93
Soundness	94
<i>Suppressed Premises</i>	96
Contingent Facts	97
Linguistic Principles	99
Evaluative Suppressed Premises	100
Uses and Abuses of Suppressed Premises	100
<i>The Method of Reconstruction</i>	102
<i>An Example of Reconstruction: Capital Punishment</i>	105

**PART II HOW TO EVALUATE ARGUMENTS: DEDUCTIVE STANDARDS 111****CHAPTER 6****PROPOSITIONAL LOGIC 113**

<i>The Formal Analysis of Arguments</i>	113
<i>Basic Propositional Connectives</i>	114
Conjunction	114
Disjunction	122
Negation	122
Process of Elimination	125
How Truth-Functional Connectives Work	126

Testing for Validity 128  
 Some Further Connectives 132

*Conditionals* 134

Truth Tables for Conditionals 136  
 Logical Language and Everyday Language 142  
 Other Conditionals in Ordinary Language 145

**CHAPTER 7**

**CATEGORICAL LOGIC 151**

*Beyond Propositional Logic* 151

*Categorical Propositions* 152

The Four Basic Categorical Forms 154  
 Translation into the Basic Categorical Forms 156  
 Contradictories 159  
 Existential Commitment 161

*Validity for Categorical Arguments* 162

Categorical Immediate Inferences 164  
 The Theory of the Syllogism 166

**PART III HOW TO EVALUATE ARGUMENTS: INDUCTIVE STANDARDS 177**

**CHAPTER 8**

**ARGUMENTS TO AND FROM GENERALIZATIONS 179**

*Induction versus Deduction* 179

*Statistical Generalizations* 183

Should We Accept the Premises? 184  
 Is the Sample Large Enough? 185  
 Is the Sample Biased? 186  
 Is the Sampling Procedure Biased? 187

*Statistical Applications* 189

**CHAPTER 9**

**INFERENCE TO THE BEST EXPLANATION AND FROM ANALOGY 195**

*Inferences to the Best Explanation* 195

Which Explanation Is Best? 198  
 Context Is Crucial 200

*Arguments from Analogy* 204

Are Analogies Explanations? 207

**CHAPTER 10****CAUSAL REASONING 215**

- Reasoning About Causes* 215
- Sufficient Conditions and Necessary Conditions* 217
  - The Sufficient Condition Test 220
  - The Necessary Condition Test 221
  - The Joint Test 222
  - Rigorous Testing 225
  - Reaching Positive Conclusions 226
- Applying These Methods to Find Causes* 228
  - Normality 228
  - Background Assumptions 229
  - A Detailed Example 230
- Concomitant Variation* 234

**CHAPTER 11****CHANCES 239**

- Some Fallacies of Probability* 239
  - The Gambler's Fallacy 239
  - Heuristics 241
- The Language of Probability* 243
- A Priori Probability* 244
- Some Rules of Probability* 246
  - Probabilities of Negations 246
  - Probabilities of Conjunctions 247
  - Probabilities of Disjunctions 248
  - Probabilities in a Series 249
  - Permutations and Combinations 250
- Bayes's Theorem* 253

**CHAPTER 12****CHOICES 263**

- Expected Monetary Value* 263
- Expected Overall Value* 266
- Decisions Under Ignorance* 268

**PART IV FALLACIES 273****CHAPTER 13****FALLACIES OF VAGUENESS 275**

- Uses of Unclarity* 275
- Vagueness* 276
- Heaps* 278
- Slippery Slopes* 280
  - Conceptual Slippery-Slope Arguments 280
  - Fairness Slippery-Slope Arguments 282
  - Causal Slippery-Slope Arguments 285

**CHAPTER 14****FALLACIES OF AMBIGUITY 291**

- Ambiguity* 291
- Equivocation* 295
- Definitions* 299

**CHAPTER 15****FALLACIES OF RELEVANCE 307**

- Relevance* 307
- Ad Hominem Arguments* 308
  - Inconsistency 311
  - Genetic Fallacies 311
- Appeals to Authority* 314
- More Fallacies of Relevance* 318
  - Appeals to Popular Opinion 318
  - Appeals to Emotion 319

**CHAPTER 16****FALLACIES OF VACUITY 323**

- Circularity* 323
- Begging the Question* 324
- Self-Sealers* 328

**CHAPTER 17****REFUTATION 333**

- What Is Refutation?* 333
- Counterexamples* 334
- Reductio Ad Absurdum* 337
- Straw Men and False Dichotomies* 341
- Refutation by Parallel Reasoning* 343

**PART V AREAS OF ARGUMENTATION 351****CHAPTER 18****LEGAL REASONING 353**

- Components of Legal Reasoning* 354
  - Questions of Fact 354
  - Questions of Law 355
- The Law of Discrimination* 361
  - The Equal Protection Clause 361
  - Applying the Equal Protection Clause 362
  - The Strict Scrutiny Test 363
  - The *Bakke* Case 364
  - Regents of the University of California v. *Bakke* 366
  - Legal Developments Since *Bakke* 368
  - Grutter v. Bollinger* 369
  - Gratz v. Bollinger* 375
- Burden of Proof* 381

**CHAPTER 19****MORAL REASONING 383**

- Moral Disagreements* 383
- The Problem of Abortion* 384
  - The “Pro-Life” Argument 385
  - “Pro-Choice” Responses 387
- Analogical Reasoning in Ethics* 392
- Weighing Factors* 394
  - “Abortion,” by Mary Anne Warren 397
  - “An Argument that Abortion Is Wrong,”  
by Don Marquis 409

**CHAPTER 20****SCIENTIFIC REASONING 423**

*Standard Science* 423

*Scientific Revolutions* 425

“Molecular Machines: Experimental Support for the Design  
Inference,” by Michael J. Behe 427

“Living with Darwin,” by Philip Kitcher 440

**CHAPTER 21****RELIGIOUS REASONING 449**

“Five Reasons to Believe in God,” by William Lane Craig 450

“Seven Deadly Objections to Belief in the Christian God,”  
by Edwin Curley 456

**CHAPTER 22****PHILOSOPHICAL REASONING 465**

“Sanity and the Metaphysics of Responsibility,”  
by Susan Wolf 469

“A Defence of Free Will Skepticism,”  
by Derk Pereboom 483

**INDEX 495**





---

## PREFACE

---

Traditionally, logic has been considered the most general science dealing with arguments. The task of logic is to discover the fundamental principles for distinguishing good arguments from bad ones.

For certain purposes, arguments are best studied as abstract patterns of reasoning. Logic can then focus on these general forms rather than on particular arguments, such as your attempt to prove to the bank that they, not you, made a mistake. The study of those general principles that make certain patterns of argument valid and other patterns of argument invalid is called *formal logic*. Two chapters of this work are dedicated to formal logic.

A different but complementary way of viewing an argument is to treat it as a particular use of language: Presenting arguments is one of the important things we do with words. This approach stresses that arguing is a linguistic activity. Instead of studying arguments as abstract patterns, it examines them as they occur in concrete settings. It raises questions of the following kind:

What is the place of argument within language as a whole?

What words or phrases are characteristic of arguments?

How do these words function?

What task or tasks are arguments supposed to perform?

When an approach to argument has this emphasis, the study is called *informal logic*. Though it contains a substantial treatment of formal logic, *Understanding Arguments*, as its subtitle indicates, is primarily a textbook in informal logic.

The ninth edition of *Understanding Arguments* differs from the eighth edition in a number of ways. The most important change is simplification. Many chapters have been shortened and streamlined. Our goal was to remove tangents and complexities that confuse students so that the main points could be understood more easily. In addition, the different kinds of inductive arguments have been reordered to provide a better flow between topics. Several sections have been split up and reorganized for clarity. Some of the more difficult and confusing topics have been dropped. This edition also contains new readings on moral and philosophical reasoning in Chapters 19 and 22. These new readings make the text more accessible and relevant to popular debates. Finally, we updated many examples, exercises, and discussion questions throughout the text.

Another major innovation that begins with this Ninth Edition is that readers of *Understanding Arguments* will also have free access to detailed lectures, exercises, and quizzes on all of the material in Chapters 1–17. There are over 100 mini-lectures keyed to almost 1000 corresponding questions. These supplementary materials are available for free on the Coursera website (<https://www.coursera.org/>) in a MOOC titled Think Again: How to Reason and Argue. We hope that these lectures and exercises help readers get the most out of this book.

This new edition has been influenced by our teaching of this material with various colleagues. In this regard, we would especially like to thank Ram Neta, who co-taught with Walter Sinnott-Armstrong on the Coursera website, as well as to many people at Coursera and in the Office of Instructional Technology at Duke University, who taught us to make these topics more accessible and lively. We received invaluable help from two student assistants—Joe Metz and Jason Bowers—in addition to the many others who helped us on previous editions. We are also indebted to the following reviewers: Dan Berger, Simpson University; William Brunson, University of Nevada–Las Vegas; Aaron Cobb, Auburn University–Montgomery; Nathaniel Goldberg, Washington and Lee University; Deke Gould, Augustana College; Robert Bruce Kelsey, Thomas College; Jung Kwon, Long Beach City College; Judith Little, SUNY–Potsdam; Diane Michelfelder, Macalester College; Rachel Mohr, University of Nebraska–Lincoln; Dennis Montgomery, Norfolk State University; Patrice Nango, Mesa Community College; Kurt Nutting, San Francisco State University; Michael Patton, University of Montevallo; Marc Pugliese, Saint Leo University; Eric Rovie, Georgia Perimeter College–Newton; and Catherine Womack, Bridgewater State University. At Cengage Learning and PreMediaGlobal, we received expert advice and assistance from Joann Kozyrev–Senior Sponsoring Editor, Debra Matteson–Product Manager, Prashanth Kamavarapu–Project Manager, Ian Lague–Development Editor, Kristina Mose-Libon–Art Director, and Joshua Duncan–Assistant Editor. Without all of these people, this book would contain many more mistakes than it undoubtedly still does.

Walter Sinnott-Armstrong  
Robert J. Fogelin

# HOW TO ANALYZE ARGUMENTS

*Arguments are all around us. They bombard us constantly in advertisements; in courtrooms; in political, moral, and religious debates; in academic courses on mathematics, science, history, literature, and philosophy; and in our personal lives when we make decisions about our careers, finances, and families. These crucial aspects of our lives cannot be understood fully without understanding arguments. The goal of this book, then, is to help us understand arguments and, thereby, to understand our lives.*

*We will view arguments as tools. To understand a tool, we need to know the purposes for which it is used, the material out of which it is made, and the forms that it takes. For example, hammers are normally used to drive nails or to pound malleable substances. Hammers are usually made out of a metal head and a handle of wood, plastic, or metal. A typical hammer's handle is long and thin, and its head is perpendicular to its handle. Similarly, in order to understand arguments, we need to investigate their purposes, materials, and forms.*

*Chapter 1 discusses the main purposes or uses of arguments. The material from which arguments are made is language, so Chapters 2 and 3 explore language in general and then the language of argument in particular. Chapters 4 and 5 use the lessons learned by then to analyze concrete examples of arguments in detail. The following chapters turn to the forms of arguments, including deductive forms in Part II (Chapters 6 and 7) and inductive forms in Part III (Chapters 8–12). Each form of argument comes with its own standards of adequacy. Part IV (Chapters 13–17) will then consider the main ways in which arguments can go astray, including fallacies of clarity, relevance, and vacuity. By the end of this journey, we should understand arguments much better.*



## USES OF ARGUMENTS

*What are arguments? In our view, arguments are tools, so the first step toward understanding arguments is to ask what they are used for—what people are trying to accomplish when they give arguments. This brief chapter will propose a definition of arguments and then explore two main purposes of arguments: justification and explanation. Both justifications and explanations try to provide reasons, but reasons of different kinds. Justifications are supposed to give reasons to believe their conclusions, whereas explanations are supposed to give reasons why their conclusions are true. Each of these purposes is more complicated and fascinating than is usually assumed.*

### WHAT ARGUMENTS ARE

---

The word “argument” may suggest quarrels or squabbles. That is what a child means when she reports that her parents are having an argument. Arguments of that sort often include abuse, name-calling, and yelling. That is not what this book is about. The goal here is not to teach you to yell louder, to be more abusive, or to beat your opponents into submission.

Our topic is the kind of argument defined by Monty Python in their justly famous “Argument Clinic.” In this skit, a client enters a clinic and pays for an argument. In the first room, however, all he gets is abuse, which is not argument. When he finally finds the right room to get an argument, the person who is supposed to give him an argument simply denies whatever the client says, so the client complains that mere denial is different from argument, because “an argument is a connected series of statements to establish a definite proposition.” This definition is almost correct. As we will see, the purpose of an argument need not always be to “establish” its conclusion, both because some conclusions were established in advance and because many reasons are inconclusive. Nonetheless, Monty Python’s definition needs to be modified only a little in order to arrive at an adequate definition:

An argument is a connected series of sentences, statements, or propositions (called “premises”) that are intended to give a reason of some kind for a sentence, statement, or proposition (called the “conclusion”).

This definition does not pretend to be precise, but it does tell us what arguments are made of (sentences, statements, or propositions) and what their purpose is (to give reasons).

Another virtue of this definition is that it is flexible enough to cover the wide variety of arguments that people actually give. Different arguments are intended to give reasons of very different sorts. These reasons might be justificatory reasons to believe or to disbelieve some claim. They might, instead, be explanatory reasons why something happened. They might even be practical reasons to do some act. Because reasons come in so many kinds, arguments are useful in a great variety of situations in daily life. Trying to determine why your computer crashed, why your friend acted the way she did, and whether it will rain tomorrow as well as trying to decide which political candidate to vote for, which play to use at a crucial point in a football game, where to go to college, and whether to support or oppose capital punishment—all involve weighing and evaluating reasons.

It is inaccurate, therefore, to think of arguments as serving only one single, simple purpose. People often assume that you always use every argument to make other people believe what you believe and what they did not believe before hearing or reading the argument. Actually, however, some arguments are used for that purpose, but others are not. To fully understand arguments in all their glory, then, we need to distinguish different uses of argument. In particular, we will focus on two exemplary purposes: justification and explanation.

## JUSTIFICATIONS

---

One of the most prominent uses of arguments is to justify a disputed claim. For example, if I claim that September 11, 2001, was a Tuesday, and you deny this or simply express some doubt, then we might look for a calendar. But suppose we don't have a calendar for 2001. Luckily, we do find a calendar for 2002. Now I can justify my claim to you by presenting this argument: The calendar shows that September 11 was on Wednesday in 2002; 2002 was not a leap year, since 2002 is not divisible by 4; nonleap years have 365 days, which is 1 more day than 52 weeks; so September 11 must have been on Tuesday in 2001. You should now be convinced.

What have I done? My utterance of this argument has the *effect* of changing your mind by getting you to believe a conclusion that you did not believe before. Of course, I might also be able to change your mind by hypnotizing you. But normally I do not want to use hypnosis. I also do not want to change your mind by manufacturing a fake calendar for 2002 with the wrong dates or by fooling you with a bad argument. Such tricks would not satisfy my goals fully. This shows that changing your mind is not all that I am trying to accomplish. I want more than simply to *persuade* you or *convince*

you. What else do I want? My additional aim is to show you that you *should* change your mind, and why. I want my argument to be *good* and to give you a *good reason* to change your mind. I want my argument not only to persuade you but also to make you *justified* in believing my conclusion.

The above example is typical of one kind of justification, but there are other patterns. Suppose that I share your doubts about which day of the week it was on September 11, 2001. Then I might use the same argument to justify my belief as well as yours. Indeed, you don't even need to be present. If I am all alone, and I just want to figure out which day of the week it was on September 11, 2001, then I might think in terms of this same argument. Here the goal is not to convince anybody else, but the argument is still used to find a good reason to believe the conclusion.

In cases like these, we can say that the argument is used for *impersonal normative justification*. The justification is normative because the goal is to find a reason that is a good reason. It is impersonal because what is sought is a reason that is or should be accepted as a good reason by everyone capable of grasping this argument, regardless of who they are. The purpose is to show that there *is* a reason to believe the conclusion, regardless of who *has* a reason to believe it. Other arguments, in contrast, are aimed at specific people, and the goal is to show that those particular people are committed to the conclusion or have a reason to believe the conclusion. Such individualized uses of arguments seek what can be called *personal justification*.

There should be nothing surprising about different people having different reasons. I might climb a mountain to appreciate the view at the top, whereas you climb it to get exercise, and your friend climbs it to be able to talk to you while you climb it. Different people can have different reasons for the same action. Similarly, different people can have different reasons to believe the same conclusion. Suppose that someone is murdered in the ballroom with a revolver. I might have good reason to believe that Miss Peacock did not commit the murder, because I saw her in the library at the time the murder was committed. You might not trust me when I tell you that I saw her, but you still might have good reason to believe that she is innocent, because you believe that Colonel Mustard did it alone. Even if I doubt that Colonel Mustard did it, we still each have our own reasons to agree that Miss Peacock is innocent.

When different people with different beliefs are involved, we need to ask who is supposed to accept the reason that is given in an argument. A speaker might give an argument to show a listener that the speaker has a reason to believe something, even though the speaker knows that the audience does not and need not accept that reason. Suppose that you are an atheist, but I am an evangelical Christian, and you ask me why I believe that Jesus rose from the dead. I might respond that the Bible says that Jesus rose from the dead, and what the Bible says must be true, so Jesus rose from the dead. This argument tells you what *my* reasons are for believing what I believe, even if *you* do not accept those reasons. My argument can be used to show you that

I have reasons and what my reasons are, regardless of whether you believe that my reasons are good ones and also regardless of whether my reasons really are good ones.

The reverse can also happen. A speaker might give an argument to show a listener that the listener has a reason to believe something, even though the speaker does not accept that reason. Suppose that you often throw loud parties late into the night close to my bedroom. I want to convince you to stop or at least quiet down. Fortunately, you think that every citizen ought to obey the law. I disagree, for I am an anarchist bent on undermining all governments and laws. Still, I want to get a good night's sleep before the protest tomorrow, so I might argue that it is illegal to make that much noise so late, and you ought to obey the law, so you ought to stop throwing such loud parties. This argument can show you that *you* are committed to its conclusion, even if *I* believe that its premises are false.

Of course, whether I succeed in showing my audience that they have a reason to believe my conclusion depends on who my audience is. My argument won't work against loud neighbors who don't care about the law. Consequently, we need to know who the audience is and what they believe in order to be able to show them what reason they have to believe a conclusion.

In all of these cases, arguments are used to show that someone has a reason to believe the conclusion of the argument. That is why all of these uses can be seen as providing different kinds of justification. The differences become crucial when we try to evaluate such arguments. If my goal is to show you that you have a reason to believe something, then I can be criticized for using a premise that you reject. Your beliefs are no basis for criticism, however, if all I want is to show my own reasons for believing the conclusion. Thus, to evaluate an argument properly, we often need to determine not only whether the argument is being used to justify a belief but also which kind of justification is sought and who the audience is.

### EXERCISE I

Write the best brief argument you can to justify each of the following claims to someone who does not believe them.

1. Nine is not a prime number.
2. Seven is a prime number.
3. A molecule of water has three atoms in it.
4. Water is not made up of carbon.
5. The U.S. president lives in Washington, D.C.
6. The Earth is not flat.
7. Humans have walked on the moon.
8. Most bicycles have two wheels.



## DISCUSSION QUESTION

When, if ever, is it legitimate to try to convince someone else to believe something on the basis of a premise that you yourself reject? Consider a variety of cases.

## EXPLANATIONS

A different but equally important use of arguments is to provide explanations. Explanations answer questions about how or why something happened. We explain how a mongoose got out of his cage by pointing to a hole he dug under the fence. We explain why Smith was acquitted by saying that he got off on a technicality. The purpose of explanations is not to prove that something happened, but to make sense of things.

An example will bring out the difference between justification and explanation. One person claims that a school's flagpole is thirty-five feet tall, and someone else asks her to justify this claim. In response, she might produce a receipt from the Allegiance Flagpole Company acknowledging payment for a flagpole thirty-five feet in height. Alternatively, she may put a stick straight up into the ground, measure the stick's length and its shadow's length, then measure the length of the flagpole's shadow, and calculate the length of the flagpole. Neither of these justifications, however, will answer a different question: *Why* is the flagpole thirty-five feet tall? This new question could be answered in all sorts of ways, depending on context: The school could not afford a taller one. It struck the committee as about the right height for the location. That was the only size flagpole in stock. There is a state law limiting flagpoles to thirty-five feet. And so on. These answers help us understand why the flagpole is thirty-five feet tall. They explain its height.

Sometimes simply filling in the details of a story provides an explanation. For example, we can explain how a two-year-old girl foiled a bank robbery by saying that the robber tripped over her while fleeing from the bank. Here we have made sense out of an unusual event by putting it in the context of a plausible *narrative*. It is unusual for a two-year-old girl to foil a bank robbery, but there is nothing unusual about a person tripping over a child when running recklessly at full speed in a crowded area.

Although the narrative is probably the most common form of explanation in everyday life, we also often use arguments to give explanations. We can explain a certain event by deriving it from established principles and accepted facts. This argument then has the following form:

- (1) General principles or laws
- (2) A statement of initial conditions
- ∴ (3) A statement of the phenomenon to be explained

The symbol “∴” is pronounced “therefore” and indicates that the premises above the line are supposed to give a reason for the conclusion below the

line. By “initial conditions” we mean those facts in the context that, together with appropriate general principles and laws, allow us to derive the result that the event to be explained occurs.

This sounds quite abstract, but an example should clarify the basic idea. Suppose we put an ice cube into a glass and then fill the glass with water to the brim. The ice will stick out above the surface of the water. What will happen when the ice cube melts? Will the water overflow? Will it remain at the same level? Will it go down? Here we are asking for a *prediction*, and it will, of course, make sense to ask a person to *justify* whatever prediction he or she makes. Stumped by this question, we let the ice cube melt to see what happens. We observe that the water level remains unchanged. After a few experiments, we convince ourselves that this result always occurs. We now have a new question: *Why* does this occur? Now we want an explanation of this phenomenon. The explanation turns upon the law of buoyancy, which says that an object in water is buoyed up by a force equal to the weight of the water it displaces. This law implies that, if we put an object in water, it will continue to sink until it displaces a volume of water whose weight is equal to its own weight (or else the object hits the bottom of the container). With this in mind, go back to the original problem. An ice cube is itself simply water in a solid state. Thus, when it melts, it will exactly fill in the volume of water it displaced, so the water level will remain unchanged.

We can now see how this explanation conforms to the argumentative pattern mentioned above:

- (1) General principles or laws (Primarily the law of buoyancy)
- (2) Initial conditions (An ice cube in a glass of water filled to the brim)
- ∴(3) Phenomenon explained (The level of the water remaining unchanged after the ice cube melts)

This explanation is fairly good. People with only a slight understanding of science can follow it and see why the water level remains unchanged. We should also notice that it is not a *complete* explanation, because certain things are simply taken for granted—for example, that things do not change weight when they pass from a solid to a liquid state. To put the explanation into perfect argumentative form, this assumption and many others would have to be stated explicitly. This is never done in everyday life and is only rarely done in the most exact sciences.

Is this explanation any good? Explanations are satisfactory if they remove bewilderment or surprise by telling us *how* or *why* something happened in a way that is relevant to the concerns of a particular context. Our example does seem to accomplish that much. However, it might seem that even the best explanations are not very useful because they take so much for granted. In explaining why the water level remains the same when the ice cube melts, we cited the law of buoyancy. Now, why should that law be true? What explains *it*? To explain the law of buoyancy, we would have to derive it from other laws that are more general and, perhaps, more intelligible. In fact, this

has been done. Archimedes simultaneously proved and explained the law of buoyancy by deriving it from the laws of the lever. How about the laws of the lever? Can they be proved and explained by deriving them from still higher and more comprehensive laws? Perhaps. Yet reasons give out, and sooner or later explanation (like justification) comes to an end. It is the task of science and all rational inquiry to move that boundary further and further back. But even when there is more to explain, that does not show that a partial explanation is totally useless. As we have seen, explanations can be useful even when they are incomplete, and even though they are not used to justify any disputed claim. Explanation is, thus, a separate use of arguments.

### EXERCISE II

Houses in Indonesia sometimes have their electrical outlets in the middle of the wall rather than at floor level. Why? A beginning of an explanation is that flooding is a danger in the Netherlands. Citing this fact does not help much, however, unless one remembers that Indonesia was formerly a Dutch colony. We can understand why the Dutch might put their electrical outlets above floor level in the Netherlands. It is safer in a country where flooding is a danger. Is flooding, then, a similar danger in Indonesia? Apparently not; so why did the Dutch continue this practice in Indonesia? The answer is that colonial settlers tend to preserve their home customs, practices, and styles. The Dutch continued to build Dutch-style houses with the electrical outlets where (for them) they are normally placed—that is, in the middle of the wall rather than at floor level. Restate this explanation in the form of an argument (that is, specify its premises and conclusion).

### EXERCISE III

Write a brief argument to explain each of the following. Indicate what facts and what general principles are employed in your explanations. (Do not forget those principles that may seem too obvious to mention.)

1. Why a lighter-than-air balloon rises.
2. Why there is an international date line.
3. Why average temperatures tend to be higher closer to the equator.
4. Why there are usually more college freshmen who plan to go to medical school than there are seniors who still plan to go to medical school.
5. Why almost no textbooks are more than eighteen inches high.
6. Why most cars have four tires (instead of more or fewer).
7. Why paintings by Van Gogh cost so much.
8. Why wages go up when unemployment goes down.