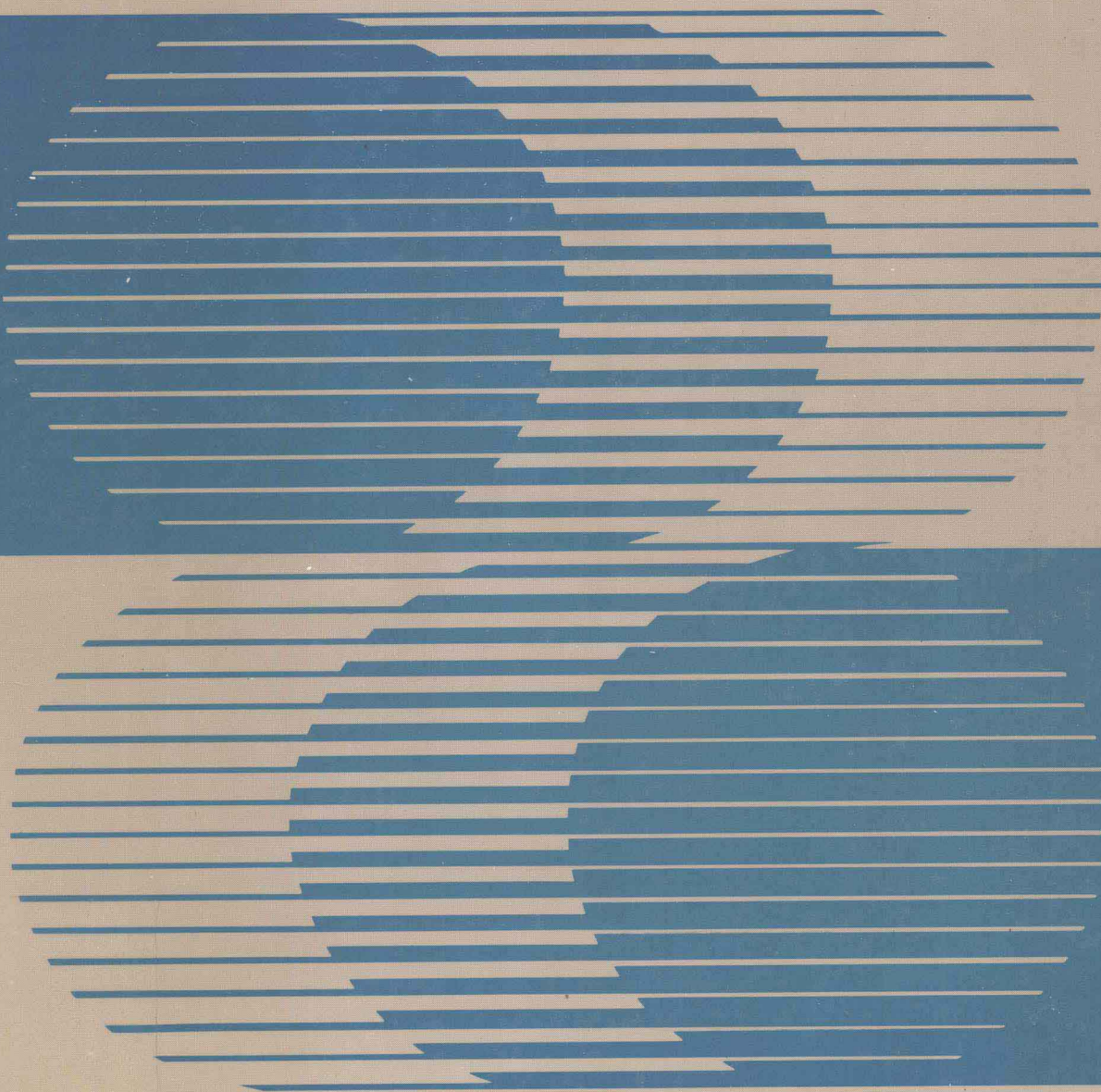


LOGICAL THINKING

AN INTEGRATED INTRODUCTION



RICHARD A. WRIGHT / KEN TOHINAKA

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An Integrated Introduction

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To the Instructor

Our goal in writing this text has been to make easier both the teaching and the learning processes of introductory logic. To help guide us towards this goal, we have adopted two principles. First, a clear connection should be established between the three standard topics of introductory logic: “informal” logic, deduction, and induction. By emphasizing the integral nature of these three areas, the material is more readily learned and hence is easier to teach. Second, the primary focus of introductory logic should be to help students develop habits of good reasoning and thinking. This requires the development of both an understanding of what constitutes a *good* argument and an understanding of the roles good reasoning and clear thinking have beyond the immediate concerns of the course. To help meet our goal, the book progresses in the following way:

1. Since presenting and recognizing good arguments depends on an ability to identify arguments, our initial focus is on useful techniques for recognizing the presence of an argument and identifying the elements of an argument. Claims are taken to be the “raw material” of arguments, and we develop procedures for accurately identifying claims through attention to language used, context of use, key assumptions made, and speaker intent. As techniques are refined, considerable attention is given to understanding problems of meaning and reference as a means for the clarification of claims.

2. Once the basic elements of an argument have been introduced and the language of arguments discussed, a formal deductive system (propositional logic) is presented. The system is introduced through an initial focus on tech-

niques for translating from English to the formal notation so that the logical structures of propositions may be better understood. A complete deductive system, including truth table analysis, conditional proof, and indirect proof, is then presented in order to clarify both the nature of deduction and certain fundamental relationships between the premises and conclusion of an argument.

3. Using as background the previous accounts of arguments in general, and deduction in particular, the distinction between deduction and induction is described in terms of speaker intent. Inductive arguments are introduced through consideration of analogies and then discussed in detail. Following that discussion, general criteria are presented for evaluating inductive arguments.

4. Discussion of fallacies, both formal and informal, is delayed until work with both deductive and inductive arguments has been completed. In this way, the nature of a *good* argument is used as a basis for explicating bad arguments. This approach allows discussion of common fallacies in light of the previous material. A brief summary of the text is then given in terms of a checklist of procedures to be followed when evaluating a particular piece of reasoning.

Throughout the text ample exercises are provided, many of which have a “real life” focus. In addition, each chapter ends with a self-quiz on the chapter. Answers to all the quizzes and to over half of the exercises are provided at the back of the book. (The remainder of the answers, along with some strategies we have found helpful in teaching introductory logic, are given in a teacher’s manual.) The appendix presents an abbreviated but complete system of predicate logic that uses only two rules of inference (both instantiation rules) in conjunction with indirect proof. Its precursors may be found in Quine, *Elementary Logic*, rev. ed. (Harper and Row, 1965); Barker, *The Elements of Logic* (McGraw-Hill, 1965); and Tapscott, *Elementary Applied Symbolic Logic* (Prentice-Hall, 1976).

We have consciously attempted to anticipate the usual sorts of difficulties encountered in teaching introductory logic courses and resolve them effectively, even if that means occasional departure from traditional practice. In any event, both the content and the structure of the text have been guided by our conviction that the material of an introductory logic course can be presented in a manner that forms a natural progression, develops useful skills, and is relatively easy to use.

Although the contents are arranged in the order we prefer, differing emphases are possible. Instructors who wish to concentrate on the formal aspects of logic may skip either chapter 3 or chapters 8 and 9, focusing on chapters 4 through 7 and the appendix. Those who wish to deal with the formal system in less detail have a number of options: the appendix may be ignored while concentrating on the rest of the formal system; the appendix as well as the material on conditional and indirect proofs may be omitted; all of chapter 7 may be skipped (although the system would then be incomplete);

and some may wish to use only the material on translation and truth table analysis in association with the non-formal chapters. There are other useful possibilities as well. For example, the truth tables may be presented before the rules of inference, which would allow giving both formal and intuitive justifications for the rules when they are introduced. It is also possible to use the material on the deduction/induction distinction prior to working with the formal system.

While we recognize that good judgment cannot be codified, much less taught, we do believe that introductory logic courses can help to develop and refine native abilities. We hope this text will help ease that process. Users of the text are invited to contribute suggestions for its improvement.

ACKNOWLEDGMENTS

Because this project evolved over a number of years, there are many people to whom we owe our thanks. First and foremost are the thousands of students at the University of Toledo and Talledega College, whose use of manuscript versions of this text helped to shape and sharpen the present book. Without their help this project could never have been completed, let alone begun. A colleague, Professor Ramakrishna Puligandla, deserves special thanks for his encouragement, his willingness to discuss technical problems, and his valuable advice. Dr. T. R. Girill's careful and detailed critiques of the manuscript were invaluable in making both substantive and stylistic changes. A large debt is also owed Professor Bangs Tapscott, particularly for his help with the appendix. We appreciate also the suggestions of the anonymous reviewers and the many friends who helped to identify difficulties in early drafts and enabled us to rectify our mistakes. Any remaining errors are, of course, our own.

Materials for the formal system first appeared in Richard Wright's *Elementary Logic: A programmed modular introduction to symbolic logic*, published by the University Press of America, and are used here with the permission of the publisher.

Public thanks are also due to our brigade of typists: Jackie Hakius, Leonore Johnson, Kay Locke, Marie Warrington, and Barbara Wiemer; to Teresa Fausey and Anne Lakofsky, who proofed the answers; and to Sandra Wright who typed the Teacher's Manual. We are grateful to college editor Bud Therien of Prentice-Hall, whose faith in us never waived even when it should have; to Frank Hubert, production editor, for an excellent job; and especially to Hilda Tauber, our copy editor, who deserves all possible credit for bringing coherence and clarity to often turgid prose. Each of these people made significant contributions to the book for which we are grateful. Again, our thanks to you all.

R.W.
K.T.

To the Student

You are embarking on studies that may be quite unlike anything you have yet undertaken. In this course you will be considering the language you use, and the thought processes reflected in the language you use, with the aim of achieving these general objectives:

1. Develop and improve your ability to think clearly, reason well, and communicate more effectively.
2. Develop and improve specific skills for presenting and evaluating arguments as encountered in everyday reading, talking, and writing.
3. Develop and improve your critical judgment—that ability to deal with situations by thinking, rather than by just “reacting.”

Achieving these objectives will not come about automatically; still it won't be impossibly difficult since we intend to rely on those reasoning skills you already have, and help you to develop them further.

How can the study of logic lead to these goals? There are several ways. First, studying logic helps you to become aware of those aspects of language which will improve your ability to think clearly. Thinking clearly involves using language clearly, so if you understand how the language works you can use it more effectively and efficiently. Second, the study of logic will help you develop a systematic thinking strategy so that your thinking will be more clearly directed and less random or haphazard. Thinking clearly is not simply tak-

ing the word of someone you believe to be “smarter” than you; it is not just following your emotions or “gut reactions”; nor is it acting like sheep, just going along with everyone else. Logical thinking is the careful working out of the best response, or deriving the conclusion that is *justified*—i.e., supported by good reasons and certified by the best reasoning techniques at your command. Third, studying logic will help to improve your abstract reasoning skills, which are so important to *any* intellectual activity and are crucial to *understanding* the world around you.

Obviously, one book cannot cover everything on this subject. *Logical Thinking* is designed to help you learn the fundamentals so that, in future applications, you will be able to continue developing your basic skills to a high level of proficiency. To accomplish that, the primary focus of this text is on the presentation and critical assessment of arguments. Although all uses of language relevant to clear thinking do not necessarily involve arguments, if you learn to deal with arguments you will at the same time learn to deal with the other uses as well. Moreover, arguments are extremely valuable in two primary language activities—persuading and problem solving. By learning to formulate, understand, and critically assess these language activities through the study of arguments, you will develop the basic skills of clear thinking.

Learning the techniques of logical thinking is not too difficult, but it will require careful, painstaking, and precise work on your part. At first it may seem as if nothing is going right, that your thinking has slowed down and become more cumbersome. This is natural when learning to do something in a new way, so don't get discouraged. Just keep plugging away and you will be surprised at how quickly you catch on. Although you may not be accustomed to the level of intellectual precision that will be demanded of you, practice and patience will help you sharpen your ability to think clearly and precisely.

In this course, each student has a special role to fulfill. Thinking is necessarily an individual activity. No one can actually think for you (although by uncritically accepting what someone says, you are, in a sense, letting that person think for you). Learning to think clearly is thus an activity in which *you* must be the primary moving force. Your instructor cannot treat you like an empty container to be filled with knowledge from his supply. With your instructor's guidance and this text as your tools, *you will teach yourself how to think clearly*. The course your instructor has designed will direct your work around this text so that the topics will be covered and specific skills will be learned at specific times, in an appropriate order. It is important for you to regard the course as an integrated whole which is divided up, merely for convenience, into chapters, lesson assignments, etc. An integrated approach to logic requires that *you* pay attention to the way different basic aspects of clear thinking relate to each other, and that *you* work diligently on your own.

Because learning to think clearly is a cumulative process, at each new step you must make use of what you have previously learned, developing new skills by relying on those you have already mastered. It is therefore important

that you work carefully. This means not just doing the exercises but also checking the answers *after* you have done your work and then making sure you understand why your answer was wrong or why it was right. If you find you have not mastered basic skills and concepts, it is important that you get help before you proceed, so that you are able to develop new skills.

The concentration of effort in this text is upon *applied* logic, not theoretical logic. Since theoretical points are sometimes important to help you understand what you are doing, however, they will appear on occasion. The thing to keep in mind is that the goal of this book is understanding, not memorization. Work on understanding the theoretical points *as they fit into the overall picture*. For if you truly understand the materials, you will be able to use them with profit not only in this course but in your other pursuits as well.

Your instructor and this text can guide you in your learning of logic, but in the final analysis we can take you only as far as you are willing to go. As you embark on this challenging expedition, bear this in mind: Your instructor can chart the course and this textbook can supply the “navigational” equipment, but only your efforts can determine how far you will travel. We hope you go far and enjoy the trip.

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1

THE LOGICAL POINT OF VIEW

1.1 PRELIMINARIES

Logical thinking consists primarily in the formulation or evaluation of arguments. Learning to understand and analyze arguments is thus the heart of logical thinking. But what is an argument? In ordinary usage, the word ‘argument’ usually means ‘disagreement’, ‘dispute’, ‘fight’, or the like. For logic, however, the term has a more specialized meaning. An argument in logic is a use of language in which reasons are given as to why what someone says is true (some specific claim, statement, or assertion) should be accepted as true. For example, if your sister says

“Today was not a good day for me.”

she is only presenting a claim; that is, saying something she expects you to accept as true simply because she said it. There is no argument involved in such cases. Suppose, however, that your sister says

“Today was not a good day for me—since there was no hot water for my shower, I ran out of coffee, my car wouldn’t start, and I was late for my appointment.”

In this case she has given a specific set of reasons which she expects will *show* you that the claim—“Today was not a good day for me”—is true. This sort of presenting reasons to back up some claim is an argument in the logical sense. Accordingly, each of the following is also an argument:

- (1) “Since the area of a rectangle is determined by multiplying its length and width, there must be 800 square meters of floor space in this loft.”
- (2) “My car engine is misfiring, so it probably needs a tune-up.”
- (3) “We should postpone the picnic, given the weather forecast.”

For the purposes of logic a use of language, to count as an argument, must present both a claim and at least one *reason* for accepting that particular claim; that is, every argument will have *premises** (the reasons) and a *conclusion* (the claim based on the reasons). Further, when someone presents an argument sincerely, that person is saying or implying that he thinks the premises and the conclusion are logically connected, and the way they are connected is that the premises of the argument show that the conclusion is true. Determining whether an argument is a good one means determining whether the premises do in fact logically show the truth of the conclusion. In this text you will learn various techniques, guides, and rules to assist you in making such a determination. Before we start, however, it will be helpful to get a general idea of what is involved in evaluating an argument.

To evaluate an argument, of whatever form or type, you have to examine the relationship that the speaker has claimed there exists between the premises and the conclusion. If in fact there is no connection at all between the premises and the conclusion, the argument cannot be acceptable even if the premises are true. Premises that are unrelated to a conclusion simply cannot support the truth of that conclusion, and such an argument cannot be a good argument. Even if there is some sort of connection between the premises and the conclusion of an argument, however, a good argument is not guaranteed; for the premises may not be sufficient to support the conclusion in the way that a good argument requires.

These brief preliminary observations suggest two general principles that should be applied when evaluating arguments. One, which we will call the *Principle of Rationality*, can be described as follows:

THE PRINCIPLE OF RATIONALITY

Any argument, to be a good one, must contain premises that are both relevant to the conclusion and sufficient for the support of the conclusion.

*‘Premise’ is sometimes spelled ‘premiss’.

Since sufficient premises, whatever else they amount to, surely must be true, there will be a corollary principle:

THE PRINCIPLE OF TRUTH

Any argument, to be a good one, must have true premises.

It is one thing to identify general principles that good arguments must satisfy, but quite another to acquire enough understanding of such principles to apply them properly. In particular, it is necessary to know how to tell when premises are relevant and sufficient, because only then can an argument be properly evaluated. The rest of this text is devoted to developing and refining your understanding of these principles and to helping you develop the tools and skills necessary for successfully identifying arguments that meet their terms.

Implicit in the adoption of these principles is the assumption that it is far better to be persuaded by good reasons than to be persuaded by any other means. For example, a loaded gun held to your head may persuade you to go along as a robber's hostage. Similarly, you could be persuaded by bribery, blackmail, trickery, and so on. To be persuaded by a good argument is to be persuaded by good reasons. The principles of rationality and truth, then, impose requirements on reasons and, in effect, identify what is to count as a good reason. Further, since persuasion by good reasons is nothing more than persuasion by good arguments, the point of a good argument is to persuade someone *rationally* that the conclusion of the argument is true and therefore that it ought to be accepted. Whenever good reasons cannot be found to support a conclusion, there is justification for withholding judgment until there *are* good reasons for accepting the claim.

Logic is thus the study of arguments and the standards (i.e., the criteria) by which they are judged to be good or bad; so learning to reason well (to think logically) means learning to identify arguments and to evaluate them accurately. This process requires reflecting upon the various elements of good reasoning, identifying the features common to all good arguments, learning how to produce good arguments and how to recognize bad ones. In its practical applications, logic teaches how to persuade others through good reasons, and how to avoid being persuaded by trickery and deception or by well-intentioned, though nevertheless bad, arguments.

1.2 IDENTIFYING ARGUMENTS

Although there are an indefinite number of situations in which claims can be made, not all of them are or contain an argument. Arguments tend to involve special uses of language and occur when the speaker asserts that one proposition, the conclusion, is true because each of a different set of propositions, the