12

CREATING KNOWLEDGE

Statements of knowledge produced by research disciplines differ from statements of private conviction. Understanding the special character of statements of disciplinary knowledge will help you read, use, and write academic work. Claims that are likely to convince informed critical readers must go beyond the author's discoveries of personal experience to data gathered and analyzed according to a discipline's currently accepted methods and standards. Those data develop ideas and become part of the evidence for the author's conclusions. A description of data-gathering methods may in fact be a necessary part of any written research statement. The data-gathering methods and formats for arguing statements of disciplinary knowledge vary through time, from discipline to discipline, and even within disciplines. Although much of this variation comes from differences in subjects and from the historical development of techniques with each discipline, the most fundamental differences arise from the kinds of questions asked by various academic researchers. These fundamentally different questions lead to a variety of concepts, procedures, and even ways of thinking in disciplines.

Private Belief and Disciplinary Knowledge

As individuals we come to our individual conclusions. We read arguments, gather evidence, consider our experience, think the matter over, form an opinion, and make our own individual statements. Parts 1 and 2 seek to improve your skills as a writer and a reader in this process.

As citizens and members of various communities we each must come to our own opinions on issues before us and from time to time need to persuade others of our positions so that we can act together. However, even when we act together, as in electing a candidate, we act on various reasons and beliefs. The only certainty we share with fellow voters is that a number of us voted for the same candidate.

In some communities the members' need or desire for greater agreement has led to a more organized conversation over the evidence and ideas that most members can accept as community knowledge. Academic communities fostering structured statements of knowledge are called disciplines. Some examples are biology, sociology, literary studies, mathematics, and art history.

Disciplines develop research statements to answer fundamental questions, such as what causes disease, how society works, what the consequences of our number system are, or how people use written language. Basic research questions lead to other, more specific questions, such as how the AIDS virus enters a human cell and interferes with healthy cellular activity, or how the ancient Greek concept of justice changed with the advent of written language. As knowledge in a field grows, new questions proliferate and the nature of fundamental inquiries changes. Biology, for example, has over the last century shifted its fundamental question from what forms of life exist on earth to what mechanisms allow creatures to live and carry out their activities. Investigations have further generated more specific questions about organic chemical processes.

In order to develop answers that will be accepted by people working within a discipline, a discipline develops special ways of arguing and special types of evidence that members of the discipline agree are convincing and reliable for the research questions the discipline concerns itself with. Literary critics, for example, in analyzing the meaning of poetry, have developed a form of argument known as literary interpretation. Interpretation concentrates on the words of a text as major literary evidence, considers to a lesser extent the poet's statement about the work, and puts little credence in the publisher's statement. The poet's psychiatric records are usually not considered at all. These specialized types of argument and evidence are the result of a historical process, and are constantly open to change. Members of a discipline constantly argue about what the best kind of evidence is for the field, whether one experiment is more valid than another, or if one measurement procedure yields more reliable results than another. Researchers change the basic form of their argument as the issues evolve. In psychology, concern for behavior led to a shift to the use of a standardized experimental report form. More recently, the project of constructing models of mental activity has led psychology to a new form of argument.

Using whatever argumentative format and evidence are currently considered most authoritative, researchers write to convince colleagues to accept their findings as reliable knowledge. When members of a discipline accept new arguments as valid claims, researchers come to rely on those claims to carry on their own research. New research is almost always based on previous, now established claims. For example, when J. D. Watson and F. H. C. Crick first proposed the double-helix molecular structure of DNA, they had to present arguments establishing how their model fit the research data and accepted biochemical knowledge, and how several other researchers' models did not. Once the Watson-Crick model for DNA was accepted by scientists as valid scientific knowledge, researchers no longer needed to argue the Watson-Crick

model. Biochemists simply used the model to propose new research questions and projects, such as how DNA interacts with RNA, or what the exact order of certain chemicals within this structure is in the DNA of different plants and animals.

Until members of a discipline accept a new claim as reliable enough to serve as a basis for research, the status of any new claim remains uncertain and lacks authority. In this way true disciplinary writing differs from textbooks, popular writing in books and magazines, and encyclopedias and other reference works written for nonspecialists. Disciplinary knowledge presented for nonspecialists appears to be more authoritative and certain than that presented for specialists, because it is presented without arguments, qualifications or attention to opposing points of view.

As you advance in your chosen discipline or profession, you will read books and articles that argue new claims to knowledge. Rather than rely on the unquestioned statements of well-established knowledge reported by textbook authors, you will be obliged to share responsibility for assessing new findings within the discipline and you will be asked to argue what constitutes disciplinary knowledge in the field. Part of your professional job will be to read such arguments and to write them.

As you become involved in professional projects, you will need to consider seriously work in fields other than your own. If you enter real-estate development, for example, you will need more than a superficial knowledge of architecture to perform your job. Even if you do not design buildings yourself, you will need to judge the work that architects present to you. If you are able to read intelligently within the discipline of architecture, you may develop useful and profitable ideas. If you are a historian, being able to read serious work in economics may lend an added dimension to your historical writing. If you are an electrical engineer involved in computer design, reading in management may help you organize your project team more intelligently. In these cases, although you may not need to be able to write like an architect, economist, or management specialist, learning to read the work of architects, economists, and management specialists will offer you a decided advantage.

Part 3 will help you understand and evaluate disciplinary writing and use the knowledge you derive from each discipline's texts to think and develop your own statements in a variety of contexts. The readings in Part 3 introduce the kinds of texts you may later write as a member of your chosen discipline. This introduction to disciplinary reading and writing will guide you as an undergraduate toward the range of research methods and uses of languages in various fields as well as toward the distinctive writing styles of specific disciplines. When you commit yourself to a particular discipline, you may wish to take a more specialized course in the writing of that field.

Questions, Answers, and Evidence in Disciplines

Within disciplines, researchers ask fundamental questions about the worlds we live in: the worlds of physical objects, living beings, society and human behavior, economic activity, culture and the arts, and ideas. These questions ask for answers that can be taken as generally true-not just useful for a local practical purpose or momentarily plausible by a few people faced with a temporary choice. Within disciplines, researchers seek statements that over time will remain as descriptions of reality—how things are—statements of knowledge, therefore, must withstand the test of applicability in a wide variety of Contexts and situations. Disciplinary knowledge must be more than the ad hoc judgments we constantly make to get by isolated moments.

When building a house, for example, it may be sufficient and helpful to believe that the earth is flat or that the plot of land is not moving. However, if we wish to survey the land, a flat-earth

theory will not help us assign longitude and latitude coordinates to the site, nor will an unmoving-earth theory help relieve our fears over a solar eclipse. Astronomers and physicists across many centuries have learned much about the solar system and its movements. This knowledge is useful information for everyone to know—it describes the reality of life in the solar system—though these scientists did not specifically address daily problems faced by people building houses, surveying land, or panicking over sudden nightfall.

In order to come up with statements that reach beyond the immediate needs of a moment and that will seem true to many different people at different times and in different circumstances, disciplines put great stress on evidence—information collected about the World. The physicists' account of heavenly motions developed out of thousands of years of observations of stars, moons, and planets, as well as of moving objects on earth. Many attempts to describe heavenly motion proved inadequate to account for the evidence. Only in the sixteenth century, when Nicolaus Copernicus and Johannes Kepler began developing the notion of heliocentric planetary motion, did the argument address the evidence satisfactorily. Since the 1500s, the Copernican theory has undergone refinements, corrections, and other major adjustments to meet the changing evidence gathered about the solar system over more than four hundred years.

Evidence, or data, is the basis on which researchers in disciplines judge new findings. Evidence lends support to some claims while calling others into question. To grasp the arguments within disciplines, it is necessary to understand how evidence within various disciplines is judged as solid, how the evidence is gathered, what evidence is permissible in different arguments, and how evidence is presented in disciplinary writing.

Disciplined Evidence Gathering

Gathering convincing evidence is not easy. Almost every way of gathering information about reality presents problems. Consider interviews: does twenty people making the same statement make it any truer than one person stating it? Or are the twenty people even reporting the same thing? If each uses a slightly different phrasing, do they all mean the same thing? Or if they are using the same words, might they still intend slightly different meanings? And have the questions you asked in the twenty interviews influenced the kinds of answers you got? On the other hand, if you only observe individuals, you do not know what they are feeling. Nor do you learn what happened earlier that might affect or explain your observations. Moreover, in both interviews and observations, the variables may be so complex, with so much happening at once, that you really cannot legitimately come to any clear-cut answers. If you try to design experiments, you get into whole new sets of problems.

Since academic disciplines set themselves the task of establishing knowledge, that is, of formulating and arguing for statements that reasoning people will accept as descriptions of reality, the disciplines have developed standards and procedures for identifying and reporting acceptable evidence as well as for arguing for new ideas. The methodology—that is, the standards and procedures for gathering and presenting information about the world—helps ensure that the evidence gathered and the conclusions drawn by one researcher will seem valid to another researcher. Moreover, the use of accepted methods in most cases allows researchers to verify one another's results independently. They can examine the same documents, gather similar data, or run the identical experiment to see whether the new results coincide with the old. Thus a number of researchers may come to agree on whether the conclusions are supported by consistent evidence. The creation of knowledge is a group venture, requiring the work of many people. Mutual criticism helps develop reliable knowledge.

Method thus is part of the process that produces the final piece of writing. The quality, character, content, and function of the final statement of knowledge depend on the method that produces the evidence and ideas that appear in the paper. Different methods will produce different evidence, ideas, and arguments. Divergent methods among authors may produce disagreement. Unacceptable methods may produce unacceptable knowledge claims. Innovative methods may open up new ideas of investigation and whole new kinds of statements to be made. Method is so central to the understanding and evaluation of the final written statement that in many disciplines a writer is obliged to describe as part of the statement the method used to produce and analyze the data. In this way, many articles contain stories of how they were made.

Methods Vary

As important as method is, no single, fixed method serves for all kinds of statements. As the following pages indicate, methods vary through time, from discipline to discipline, and even within disciplines. As you take courses in different subject areas or even in two branches of the same field, you may in fact become rather confused about the many ways people go about gathering and presenting knowledge. The differences among the branches of knowledge seem so great that at times you may wonder how people with different approaches to knowledge communicate. And even if they do communicate, you may wonder what they have to say that would be mutually useful or acceptable.

One strategy for dealing with this confusion of methods and knowledge is to commit oneself to one method, declaring all others illegitimate. This strategy has been adopted with some success by many people. Adherents of a single method may call it the scientific method or the humanistic method or the method of faith. Such a strategy, however, leads one to overlook the many significant contributions of the other methods; moreover, one overlooks the similarities and interplay among these methods. One may even overlook the fact that great variety exists even within a given method. Philosophers of science have had great difficulty coming up with one definition of scientific method that consistently holds true even for a single science such as physics, let alone ail the natural sciences. Once the Social sciences are brought into the picture, the concept of one scientific method becomes even more troublesome.

A more fruitful strategy is to look at the methods used in each circumstance, try to understand why they are used, and then evaluate how appropriate they seem to the situation. That is the strategy pursued in this book. Not only will this strategy allow you to appreciate a greater variety of statements gathered by a variety of methods, it will also give you the intellectual flexibility to consider many options in how best to develop statements about questions you wish to pursue. At the very least you will understand why you are doing what you are doing, and thus you will do it better.

Methods Change with Time

As a field grows and changes, new methodological possibilities appear and ideas change. The invention of the telescope at the beginning of the seventeenth century made possible a new way of gathering evidence about the heavens, as did the invention of the radio telescope in this century. Each of these inventions opened up new kinds of data about the planets and the Stars, but each also required the development of new standards and procedures to guarantee that the results would meet the approval of other practitioners in the field. One cannot simply look through a telescope and claim to see something. Rather, one can, but then one's word is not likely to be taken seriously. To be taken seriously, one must use a certain quality instrument in an atmosphere sufficiently clear of interfering contamination. Then one must record findings in

such a way that other researchers can interpret them precisely and agree with the conclusions. Thus, members of the field must negotiate the appropriate methodology and the appropriate form of presentation.

Even without the invention of new means of observation or the refinement of old ones, methodological ideas may change just because the interests of a field change. For example, in the last twenty years, many historians have shifted their interests from the large public events—the histories of queens, kings, and wars—to the lives of ordinary people—the histories of families, sexuality, childhood, even eating. This has led to many methodological changes. Not only have certain kinds of documents become more valuable to scrutinize—such as the records of farm production or the birth and death registers of small villages—but statistical methods have been introduced to deal with trends involving many common people. The introduction of statistical material has also changed the form of the traditional historical narrative, so that now historians are arguing over how statistics should be presented, what kind of meaning they should be given, and how they should be discussed within a historical argument.

Changes in basic thinking in a field can even change whether a particular method is thought to give valuable or reliable results. As some clinical psychologists have come to believe that psychological behavior is influenced by the individual's social situation, they have come to distrust evidence from experiments that strip away realistic social situations. They prefer methods that preserve naturalistic settings in order to view the individual in the actual situation of his or her own life. Other experimental psychologists, however, still believe that such naturalistic methods contain so many variables that it is impossible to know what is really going on. Thus professionals may disagree not only on the ideas and the facts but on the very ways in which one can determine facts and present them to support ideas.

As disciplines evolve, modes of argument change in corresponding ways. The invention of the scientific journal in the seventeenth century, for example, necessitated the invention of a form for scientific articles. The form evolved over the years, so that an experimental report published in 1665 bears little resemblance to one published today. In the deepest sense, the way anyone chooses to argue about knowledge reveals that person's fundamental concept of what knowledge is and how people can know it. If one believes that people's behavior follows regular patterns and that one can observe these patterns through statistical regularities in some quantifiable aspects of behavior, one will argue by presenting general patterns supported by statistical tables. If one believes that people's behavior results from complex individual choices that take into account many levels of human experience, one is likely not to argue for general patterns but rather to layout an individual's situation, options, and choices in one particular case.

Methods Vary with Disciplines

Some of the largest fundamental differences in what counts as evidence and how to obtain it stem from the character of disciplines producing organized knowledge. Experimental psychologists go about producing knowledge in ways different from literary critics, historians, economists, or experimental physicists. To some degree the differences of the disciplines arise simply because disciplines look at separate areas of reality. Biologists look at living organisms, physicists look at the behavior of physical matter, sociologists look at group behavior, and art historians look at objects of art and the artists that produced them.

Because paintings are not electrons, they must be described in different ways, and evidence about them must be gathered and organized in different ways. Because electrons are small and move fast, scientists need special detectors to find them and measure their energy. Paintings are large enough to be seen and usually stay still; they can frequently be found easily. Electrons are

all pretty much like one another, differing only in their energies and relations to other particles, so a researcher looks for the patterns of their behavior. Paintings are different from one another, so art critics look for what makes a particular artist's work specia1. Electrons operate on the basis of laws of nature, so researchers relate their behavior to general equations. Paintings arise from the skill and imagination of an individual and they appeal to human observers, so art critics and historians try to analyze the skill and imagination of the painter and the appeal of the artwork. Electrons in Japan and America and on the moon all seem to be the same, but art varies from year to year and from culture to culture. Through such comparisons, one may be able to explain a number of differences in the procedures and knowledge of disciplines. The objects of investigation are different, requiring different kinds of data, different modes of description, and different methods of gathering data. Different special problems as well must be overcome.

Even more fundamental than the differences in objects of investigation, however, are the kinds of questions the disciplines are trying to answer. Chemists ask how elements combine to make more complex substances. Sociologists ask how social institutions and other groupings are developed and maintained, how they function and affect the lives of their members. Psychologists try to find out why people behave or think the way they do; clinical psychologists concern themselves with how people might be helped to feel better mentally and lead more successful lives. Literary critics explain what happens in a literary work; historical literary scholars want to know what the correct text is and how the text relates to events and other texts at the time of its writing.

These differences in underlying interests lead the disciplines to approach in different ways the objects they investigate, even when they are looking at the same object. Disciplines, for example, look at murder in rather different ways. The biochemist wants to find out whether homicidal behavior can be linked to a chemical structure, perhaps within the genetic material. Legal scholars want to know how the crime should be defined-and what constitutes adequate proof for conviction or acquittal. Psychologists are interested in finding out what thinking, feelings, or childhood events lead to antisocial behavior. Sociologists want to know if certain classes of society or certain social situations produce more murderers. Literary critics are interested in seeing how a character who murders acts within a literary work and perhaps serves a larger literary meaning. Last, but certainly not least, criminologists want to know how to catch suspects, and penologists want to know how to deal with them once they are in prison.

Criminologists and penologists reveal strikingly that the problems and questions a discipline addresses frequently derive from the social and political institutions they serve. Without legal and police systems as well as a criminal system, criminologists would not have a subject. Without prisons, penology would make no sense. This relationship to institutions of power appears not just in applied fields. Socialist economics differs from capitalist economics. Health and economic interests drive molecular biology to focus on certain problems at the expense of others. Even such aesthetic, non-worldly subjects as art criticism often can be seen as the product of larger social issues; different countries and different ages, after all, produce different art.

In order to solve the problems they are interested in, disciplines develop specific ways of thinking. In order to predict how elements combine and to describe the properties of combined elements, chemists try to understand and measure the binding forces in atoms and molecules. They try to determine models of how molecules fit together, and thus you may see them actually playing with oversize models that look like Tinkertoys, figuring out just how a particular molecule might fit together. Psychologists, treating the human mind and behavior as complex phenomena molded by learning, try to understand the different parts of individual perception and behavior and how they change through learning. Literary critics, concerned with how a literary text fits together, will consider how the separate parts of a story, such as character, setting, plot, imagery,

and style, fit together into a consistent design. People in more applied fields, such as social work, criminology, or even medicine, will borrow ways of thinking and results from other fields, but only in relation to solving the practical problems that motivate their fields, such as making people healthy. Modern medicine, for example, borrows techniques and theory from engineering, physics, chemistry, biology, psychology, and even sociology, but only in the context of the practical task at hand.

These different ways of thinking, in turn, lead investigators in various fields to look at different aspects of phenomena and to gather specific sorts of data. The medical doctor looking at a gunshot wound will measure the extent of blood loss and physical damage and the patient's pulse and blood pressure in order to determine treatment. The criminologist will look at the angle of entry, powder bums, caliber of the bullet, and even the extracted slug, in order to re-create the crime and identify the culprit. The sociologist will find out about the victim's class, income, and family structure, and perhaps inquire into how the victim was treated by the police and the hospital in order to see how these institutions relate to the condition of being a victim. The clinical psychologist will inquire into the victim's feelings and perceptions of the event, to help the victim cope with the trauma.

Methods Vary Within Disciplines

The same kind of variety that exists in the methods of disciplines often exists within a single discipline, often for similar reasons. Separate research groups may have various underlying assumptions about their subject, may be interested in separate problems and questions, and may look at different aspects of the same general subject that defines the discipline.

In political science or government departments at your college, you may, for example, find many approaches to the subject of government. Political philosophers, interested in such problems as the nature of political institutions, how political institutions affect human life, and what the best or most justifiable form of government might be, approach their subject in a general philosophic way. They often begin with such questions as, what is the nature of human existence? and why do people form governments? They may refer to historical examples, but they proceed largely through reasoning about a sequence of ideas (see Chapter 16). Historical scholars in political science are interested in how particular political decisions were made in history and how political institutions developed through a historical process. Their studies, based on detailed examination of evidence from the past (see Chapter 13), reveal the actual historical institutions and decisions that developed through the complex forces in history rather than the general principles sought by the political philosophers. Sometimes, in a subfield like the study of the development of constitutional governments, the philosophic and historical issues come together, for that subfield tries to understand the development of different governments as a combination of philosophic and historical goals of people who shape constitutions and of the intellectual and political forces that surround them.

Some scholars now see the political process as not just a matter of institutions and obvious political decision makers (such as heads-of state or members of legislative bodies) but one of public attitudes and indirect public action. Some of these scholars study literary texts as a reflection of political attitudes, as a demonstration of how politics affects the whole of life as represented in literature, and as historical facts of political action and public opinion making. Much contemporary writing in Eastern Europe, for example, reveals both the political tensions and the difficulties of life within the former Soviet satellites; the authors of this literature can as well be seen as a crucial part of the political opposition. These political scientists employ a kind of literary interpretation (see page 241).

Other branches of political science, such as comparative international government, are more descriptive; they assume that we must understand how governments work before we can deal with them.

Today the most common branch of political science in the United States attempts to copy what it considers the scientific method and limits itself to issues that can be studied in mathematical or statistical ways. Data often come from survey research, and findings are usually reported in standard research-report format (see Chapter 14). Although the subject does not easily lend itself to experimental work, sometimes experiments (see Chapter 15) are used to help elucidate political behavior. In this approach, researchers, who consider themselves behavioral scientists, typically ask questions about the relationship between voting patterns and economic, social, geographic, or other defining characteristics of voters. Similarly, they study the way elected officials represent the interests of their constituencies and the means by which the constituents express their interests. These political scientists treat governments (or at least the governments of modern democracies, particularly the United States) as mass phenomena. Such studies do seem to fit in well with the realities of contemporary American politics and are of much practical use to political figures trying to gain and maintain the support of large numbers of voters.

We can see then, even within one field, that one object of study can be approached from many angles with different assumptions and motivating questions. Sometimes communication may break down among these various approaches within a single discipline, for adherents of one approach may see adherents of another as totally misguided. But with proper appreciation for the assumptions, problems, and methods of different research groups, the chances for fruitful interchange increase.

Learning the Methods of Your Discipline

These differences at all levels present a daunting array of methods and forms of presentations to become acquainted with. In order to test, support, and argue for statements in a particular field, you must use the kind of data or evidence currently accepted in that field, gathered and presented in the currently accepted ways.-Fortunately, as you start to identify the disciplines you wish to work with and the kinds of underlying questions that interest you, the methodological range will narrow and you will begin to be trained in the methods and formats currently considered appropriate. Part of your methodological training in your chosen field will come indirectly through examples and through the standards you have to meet for your assignments, but part will be presented directly in laboratory and methodology classes.

Part 3 looks at some of the methods of data gathering and data presentation in various fields. This introduction to data gathering and presentation, however, barely suggests the range of methods available to different fields; moreover, it cannot live up to the standards of any field in either rigor or comprehensiveness. You do not need to master all the possibilities of method, however; at this point you need only be aware that many variations exist and that each has its reasons, assumptions, and consequences. The discussion, examples, and exercises in the following chapters will offer you a broad sense of how the statements you and others make may be grounded in forms of disciplinary methods and argument, so that as you enter into your chosen field of study and encounter readings from other fields, you will have a better understanding of what you and others are doing. By seeing how ideas are developed, tested, and presented in a variety of fields, you may gain a better sense of the meaning of what you read and

write in the contexts of disciplines. You will see that the writing of knowledge is a dynamic process filled with choices.

Basically, most disciplines work with only three kinds of data: (1) accounts, artifacts, and remains of objects and of events that have already happened; (2) observations about current situations and events as they happen; and (3) observations of new, specialized situations created through experiments. The special problems, interests, and points of view of different disciplines lead them to collect and handle these kinds of data differently, but the basic categories are shared. Chapters 13, 14, and 15 present these three kinds of data. Chapter 16 considers theoretical forms of inquiry, which attempt to address issues in the most general form, abstracted from any concrete data.