CHAPTER ONE

Why Professional Ethics?

Main Ideas in this Chapter

- **This book focuses on professional ethics, not personal ethics or common morality.**
- **Engineering is a profession by some definitions of professionalism and not as clearly a profession by other definitions.**
- **Ethical commitment is central to most accounts of professionalism.**
- **Professional ethics has several characteristics that distinguish it from personal ethics and common morality.**
- **Possible conflicts between professional ethics, personal ethics, and common morality raise important moral questions.**
- **Professional engineering ethics can be divided into a negative part, which focuses on preventing disasters and professional misconduct, and a positive part, which is oriented toward producing a better life for mankind through technology.**

"WHY SHOULD I STUDY ETHICS? I am an ethical person." Engineers and engineering students often ask this question when the subject of professional ethics is raised, and the short and simple answer to it is not long in coming: "You are not being asked to study ethics in general, but your profession's ethics." We can also anticipate a response to this answer: "Well, what is the difference?" In order to answer this question, we must have an account of the nature of professionalism and then ask whether engineering is a profession according to this account. After this, we can examine more directly professional ethics as it applies to engineering.

1.1 WHAT IS A PROFESSION?

We can begin by looking at the dictionary definition of professionalism. An early meaning of the term *profession* referred to a free act of commitment to a way of life. When associated with the monastic vows of a religious order, it referred to a monk's public promise to enter a distinct way of life with allegiance to high moral ideals. One "professes" to be a certain type of person and to occupy a special social role that carries with it stringent moral requirements. By the late 17th century, the term had been secularized to refer to anyone who professed to be duly qualified.

Thus, *profession* once meant, according to the *Oxford Shorter Dictionary,* the act or fact of "professing." It has come to mean

> the occupation which one professes to be skilled in and to follow. . . . A vocation in which professed knowledge of some branch of learning is used in its application to the affairs of others, or in the practice of an art based upon it.

This brief historical account, however, is not sufficient for our purposes; this account of professionalism provides only limited insight into the nature of professionalism. We can gain deeper insight if we look at the account of professionalism given by sociologists and philosophers. We begin with a sociological account.

A Sociological Analysis of Professionalism

Among the several traditions of sociological analysis of the professions, one of the most influential has a distinctly economic orientation. These sociologists view attaining professional status as a tactic to gain power or advantage in the marketplace. Professions have considerable power in the marketplace to command high salaries, so they conclude that professional status is highly desirable. If we distinguish between an occupation, which is simply a way to make a living, and a profession, the question is how a transition from a "mere" occupation to a profession (or an occupation that has professional status) is accomplished. The answer is to be found in a series of characteristics that are marks of professional status. Although probably no profession has all of these characteristics to the highest degree possible, the more characteristics an occupation has, the more secure it is in its professional status.[1]

1. Extensive training: Entrance into a profession typically requires an extensive period of training, and this training is of an intellectual character. Many occupations require extensive apprenticeship and training, and they often require practical skills, but the training typically required of professionals focuses more on intellectual content than practical skills. Professionals' knowledge and skills are grounded in a body of theory. This theoretical base is obtained through formal education, usually in an academic institution. Today, most professionals have at least a bachelor's degree from a college or university, and many professions require more advanced degrees, which are often conferred by a professional school. Thus, the professions are usually closely allied in our society with universities, especially the larger and more prestigious ones. Although extensive training may be required for professional work, the requirement of university training serves as a barrier to limit the number of professionals and thus to provide them with an economic advantage.

2. Vital knowledge and skills: Professionals' knowledge and skills are vital to the well-being of the larger society. A society that has a sophisticated scientific and technological base is especially dependent on its professional elite. We rely on the knowledge possessed by physicians to protect us from disease and restore us to health. The lawyer has knowledge vital to our welfare if we have been sued or accused of a crime, if our business has been forced into bankruptcy, or if we want to get a divorce or buy a house. The accountant's knowledge is also important for our business successes or when we have to file our tax returns. Likewise, we are dependent on the knowledge and research of scientists and engineers for our safety in an airplane, for many of the technological advances on which our material civilization rests, and for national

defense. Since professional services are vital to the general welfare, citizens are willing to pay any price to get them.

3. Control of services: Professions usually have a monopoly on, or at least considerable control over, the provision of professional services in their area. This control is achieved in two ways. First, the profession convinces the community that only those who have graduated from a professional school should be allowed to hold the professional title. The profession usually also gains considerable control over professional schools by establishing accreditation standards that regulate the quality, curriculum content, and number of such schools. Second, a profession often attempts to persuade the community that there should be a licensing system for those who want to enter the profession. Those who practice without a license are subject to legal penalties. Although it can be argued that monopoly is necessary to protect the public from unqualified practitioners, it also increases the power of professionals in the marketplace.

4. Autonomy in the workplace: Professionals often have an unusual degree of autonomy in the workplace. This is especially true of professionals in private practice, but even professionals who work in large organizations may exercise a large degree of individual judgment and creativity in carrying out their professional responsibilities. Whether in private practice or in an organizational setting, physicians must determine the most appropriate type of medical treatment for their patients, and lawyers must decide the most successful type of defense of their clients. This is one of the most satisfying aspects of professional work. The justification for this unusual degree of autonomy is that only the professional has sufficient knowledge to determine the appropriate professional services in a given situation. Besides providing a more satisfying work environment for professionals, autonomy may also increase the ability of professionals to more easily promote their economic self-interest. For example, a physician might order more tests than necessary because they are performed by a firm in which she has a financial interest.

5. Claim to ethical regulation: Professionals claim to be regulated by ethical standards, many of which are embodied in a code of ethics. The degree of control that professions possess over the services that are vital to the well-being of the rest of the community provides an obvious temptation for abuse, so most professions attempt to limit these abuses by regulating themselves for the public benefit. Professional codes are ordinarily promulgated by professional societies and, in the United States, by state boards that regulate the professions. Sometimes professional societies attempt to punish members who violate their codes, but their powers are limited to expelling errant members. State boards have much stronger legal powers, including the ability to withdraw professional licenses and even institute criminal proceedings. These regulatory agencies are controlled by professionals themselves, and so the claim to genuine ethical regulation is sometimes seen to be suspicious. The claim to self-regulation does, however, tend to prompt the public to allow professionals to charge what they want and to allow professionals considerable autonomy.

According to this sociological analysis, the identifying characteristics of professions may have one or both of two functions: altruistic and self-interest. Arguments can certainly be made that these characteristics of professionalism are necessary in

order to protect and better serve the public. For example, professionals must be adequately trained, and they must have a certain amount of freedom to determine what is best for the patient or client. One can also view these characteristics as ways of promoting the economic self-interest of professionals. Thus, there is a certain amount of moral cynicism in this analysis, or perhaps amoralism. Even the claim to be regulated by ethical considerations may be just that—a claim. The claim may be motivated as much by economic self-interest as by genuine concern for the public good.

The next two accounts give ethical commitment a stronger place.

Professions as Social Practices

This account of professionalism begins with an analysis of a concept, not with empirical research. The concept is of a "social practice," which is, as philosopher Alasdair MacIntyre defined it,

> any coherent and complex form of socially established cooperative human activity through which goods internal to that form of activity are realized in the course of trying to achieve those standards of excellence which are appropriate to, and partially definitive of, that form of activity.[2]

A profession is an example of a social practice. Without following the ideas of MacIntyre or others completely, perhaps we can say the following about a social practice. First, every social practice has one or more aims or goods that are especially associated with it or "internal" to it. For example, medicine (along, of course, with nursing, pharmacy, osteopathy, and the like) aims at the health of patients. One of the aims of law is justice. A practice may also produce other goods, such as money, social prestige, and power, but it is these goods especially associated with the practice that interest us here and that are especially related to its moral legitimacy. Second, a social practice is inconceivable without this distinctive aim. We cannot imagine medicine apart from the aim of producing health or law without the aim of producing justice. Third, the aims of a social practice must be morally justifiable aims. Both health and justice are morally praiseworthy aims. Fourth, the distinctive aim of a social practice provides a moral criterion for evaluating the behavior of those who participate in the social practice and for resolving moral issues that might arise in the practice. Although people will differ about how the term is to be defined, if a medical practice does not promote "health," we might wonder about its moral legitimacy as a medical practice.

The advantage of this account of professionalism is that it has a distinctively moral orientation and characterizes the professions as institutions that must be not only morally permissible but also aim at some moral good. There cannot be a profession of thievery or a profession of torturing because these occupations are inconsistent with ordinary morality.

A Socratic Account of Professionalism

Philosopher Michael Davis has proposed a dialogue approach to the issue of defining "professional." Much like the Greek philosopher Socrates, Davis has engaged professionals from various countries as well as other philosophers in conversations about the meaning of "professional." In typical Socratic fashion, a definition of professionalism is not accepted uncritically but, rather, tested against counterexamples until a

definition is arrived at which seems to escape criticism. Following this program for approximately two decades, Davis has derived the following definition:

> A profession is a number of individuals in the same occupation voluntarily organized to earn a living by openly serving a moral ideal in a morally permissible way beyond what law, market, morality, and public opinion would otherwise require.[3]

This definition highlights several features that Davis believes are important in the concept of professionalism that he believes many people, including many professionals, hold:

1. A profession cannot be composed of only one person. It is always composed of a number of individuals.
2. A profession involves a public element. One must openly "profess" to be a physician or attorney, much as the dictionary accounts of the term "profession" suggest.
3. A profession is a way people earn a living and is usually something that occupies them during their working hours. A profession is still an occupation (a way of earning a living) even if the occupation enjoys professional status.
4. A profession is something that people enter into voluntarily and that they can leave voluntarily.
5. Much like advocates of the social practice approach, Davis believes that a profession must serve some morally praiseworthy goal, although this goal may not be unique to a given profession. Physicians cure the sick and comfort the dying. Lawyers help people obtain justice within the law.
6. Professionals must pursue a morally praiseworthy goal by morally permissible means. For example, medicine cannot pursue the goal of health by cruel experimentation or by deception or coercion.
7. Ethical standards in a profession should obligate professionals to act in some way that goes beyond what law, market, morality, and public opinion would otherwise require. Physicians have an obligation to help people (their patients) be healthy in a way that nonphysicians do not, and attorneys have an obligation to help people (their clients) achieve justice that the rest of us do not.

This seems like a reasonable approach to take. We believe that it is an acceptable definition of "professional," although one might ask whether Davis' definition has sufficient empirical basis. The evidence for his definition is informal and anecdotal. Although probably based on more observation than the social practice approach, some might wish for a wider body of evidence in support of it. For our purposes, however, it is enough if engineering students and engineers who read this book find that it catches the meaning of profession relevant to them and engineering ethics.

1.2 ENGINEERING AND PROFESSIONALISM

Is engineering a true profession by these criteria? Occupations are probably best viewed as forming a continuum, extending from those occupations that are unquestionably professional to those that clearly are not. The occupations that clearly are professions include medicine, law, veterinary medicine, architecture, accounting (at least certified public accountancy), and dentistry. Using these three accounts of professionalism, to what extent does engineering qualify as a profession?

Looking at the sociological or economic analysis of professionals, engineering seems to qualify only as a borderline profession. Engineers have extensive training and possess knowledge and skills that are vital to the public. However, engineers do not have anything like complete control of engineering services, at least in the United States, because a license is not required to practice many types of engineering. Because they do not have to have a license to practice, a claim by engineers to be regulated by ethical standards—at least by compulsory ethical standards—can be questioned. Only licensed engineers are governed by a compulsory code of ethics. Finally, engineers who work in large organizations and are subject to the authority of managers and employers may have limited autonomy. However, even doctors and lawyers often work in large organizations nowadays. Given that engineers are highly trained and perform services that are vital to the public, that some engineers are registered and thus work under a legally enforced ethical code, and that autonomy in the workplace may be declining for all professionals, engineering qualifies for at least quasi-professional status by the sociological account.

Some might argue that the social practice definition of professionalism also leaves engineering with a questionable professional status. Taking a cue from engineering codes, one might define the goal of engineering as holding paramount the health, safety, and welfare of the public. However, an engineer who ignores human health, safety, and welfare except insofar as these criteria are taken into account by managers who assign him or her a task should probably still be considered an engineer. On the other hand, if one takes the goal or task of engineering to be something like the production of the most sophisticated and useful technology, the ideal is not a moral one at all because technology can be used for moral or immoral ends. Still, it seems to be a useful insight to state that engineering has a goal of producing technology for the welfare of society.

In contrast to the other two accounts of professionalism, Davis' definition allows engineering full professional status. Engineering is a group activity, which openly professes special knowledge, skill, and judgment. It is the occupation by which most engineers earn their living, and it is entered into voluntarily. Engineering serves a morally good end, namely the production of technology for the benefit of mankind, and there is no reason why morally permissible means to that end cannot be used. Finally, engineers have special obligations, including protecting the health and safety of the public, as this is affected by technology.

Although engineering may not, by some definitions, be a paradigmatic profession in the same way that medicine and perhaps law are, it does have professional status by Davis' definition. From the sociological standpoint, a principal factor standing in the way of full professional status is the fact that in the United States a license is not required to practice engineering. From the standpoint of professional ethics, however, one of the crucial issues in professionalism is a genuine commitment to ethical ideals. Ethical ideals must not be merely a smoke screen for getting the public to trust professionals and impose only minimal regulation but also realized in daily practice.

1.3 TWO MODELS OF PROFESSIONALISM

Another way to understand the importance of the ethical element in professionalism is to examine two models of the professional. The contrast between the understanding of the professions as primarily motivated by economic self-interest and as

motivated by genuine ethical commitment is made especially clear by the following two models.[4]

The Business Model

According to the business model, an occupation is primarily oriented toward making a profit within the boundaries set by law. Just like any other business, a profession sells a product or service in the marketplace for a profit; the major constraint on this activity is regulation imposed by law. If people ordinarily called professionals, such as doctors, lawyers, or engineers, followed this model, their claim to professionalism would be severely limited. They might choose to adopt the trappings of professionalism, but they would do so primarily as a means to increase their income and protect themselves from governmental regulation. They would use their professional training and specialized knowledge that the layperson does not have to impress upon laypeople that they deserve a high income and preferential treatment. They would take advantage of the fact that they have knowledge that is important to ordinary citizens to gain a monopoly or virtual monopoly over certain services in order to increase profit and to persuade laypeople and governmental regulators that they should be granted a great deal of autonomy in the workplace. They would promote the ideal of self-regulation in order to avoid close governmental supervision by nonprofessionals. They would insist that governmental regulatory boards be composed primarily of other professionals in order to forestall supervision by nonprofessionals.

The major difference between the so-called professionals who adopt the business model and most other occupations, such as sales or manufacturing, is that the latter seek profit primarily by selling a physical product, such as automobiles or refrigerators, whereas professionals seek profit by selling their expertise. Nevertheless, the ultimate goal is the same in both cases: selling something in the marketplace for profit.

The Professional Model

This model offers a quite a different picture of occupations such as medicine, law, and engineering. Crucial to the professional model is the idea that engineers and other professionals have an implicit trust relationship with the larger public. The terms of this trust relationship, sometimes referred to as a ''social contract'' with the public, are that professionals agree to regulate their practice so that it promotes the public good. In the words of most engineering codes, they agree to hold paramount the safety, health, and welfare of the public. That is, they agree to regulate themselves in accordance with high standards of technical competence and ethical practice so that they do not take unfair advantage of the public. They may agree to governmental regulation, for example, by state regulatory boards, because they believe that it is the most effective and efficient way to preserve this trust relationship between themselves and the larger society. Finally, professionals may seek a monopoly or at least considerable control over the provision of the services in which they are competent, but this is in order to protect the public from incompetent providers. In return, the public confers on professionals a number of benefits. Professionals are accorded high social standing, a better than average income, and considerable autonomy in the workplace. The public also pays for a considerable percentage of professional education, at least at public universities.

It is obvious that neither the business model nor the professional model, taken by themselves, contains the whole truth about the actual practice of professionals.

Most professionals are probably not so cynical and self-interested that they think of their work wholly in terms of a pursuit of profit. However, they may not be so idealistic that they conceive of themselves as concerned primarily with public service. In terms of a description of how professionals actually operate, both models have some validity. Nevertheless, the notion of professionalism, as it is traditionally understood, requires that a professional embrace the professional model to a substantial degree, and in this model ethical commitment is paramount. Engineers can certainly adopt the professional model, and this means that the ethical component is of central importance in engineering professionalism.

1.4 THREE TYPES OF ETHICS OR MORALITY

If ethical commitment is central to professionalism, we must turn more directly to ethics and especially to professional ethics. How does professional ethics differ from other types of ethics—philosophical ethics, business ethics, personal ethics, and so on? In answering this question, it is helpful to distinguish between three types of ethics or morality.[5]

Common Morality

Common morality is the set of moral beliefs shared by almost everyone. It is the basis, or at least the reference point, for the other two types of morality that we shall discuss. When we think of ethics or morality, we usually think of such precepts as that it is wrong to murder, lie, cheat or steal, break promises, harm others physically, and so forth. It would be very difficult for us to question seriously any of these precepts.

We shall expand the notion of common morality in Chapter 3, but three characteristics of common morality must be mentioned here. First, many of the precepts of common morality are negative. According to some moralists, common morality is designed primarily to protect individuals from various types of violations or invasions of their personhood by others. I can violate your personhood by killing you, lying to you, stealing from you, and so forth.

Second, although common morality on what we might call the ''ground floor'' is primarily negative, it does contain a positive or aspirational component in such precepts as ''Prevent killing,'' ''Prevent deceit,'' ''Prevent cheating,'' and so forth. However, it might also include even more clearly positive precepts, such as ''Help the needy,'' ''Promote human happiness,'' and ''Protect the natural environment.'' This distinction between the positive and negative aspects of common morality will be important in our discussion of professional ethics.

Third, common morality makes a distinction between an evaluation of a person's actions and an evaluation of his intention. An evaluation of action is based on an application of the types of moral precepts we have been considering, but an evaluation of the person himself is based on intention. The easiest way to illustrate this distinction is to take examples from law, where this important common morality distinction also prevails. If a driver kills a pedestrian in his automobile accidentally, he may be charged with manslaughter (or nothing) but not murder. The pedestrian is just as dead as if he had been murdered, but the driver's intention was not to kill him, and the law treats the driver differently, as long as he was not reckless. The result is the same, but the intent is different. To take another example, if you convey false information to another person with the intent to deceive, you are lying.

If you convey the same false information because you do not know any better, you are not lying and not usually as morally culpable. Again, the result is the same (the person is misled), but the intent is different.

Personal Morality

Personal ethics or *personal morality* is the set of moral beliefs that a person holds. For most of us, our personal moral beliefs closely parallel the precepts of common morality. We believe that murder, lying, cheating, and stealing are wrong. However, our personal moral beliefs may differ from common morality in some areas, especially where common morality seems to be unclear or in a state of change. Thus, we may oppose stem cell research, even though common morality may not be clear on the issue. (Common morality may be unclear at least partially because the issue did not arise until scientific advancement made stem cell research possible and ordinary people have yet to identify decisive arguments.)

Professional Ethics

Professional ethics is the set of standards adopted by professionals insofar as they view themselves acting as professionals. Every profession has its professional ethics: medicine, law, architecture, pharmacy, and so forth. Engineering ethics is that set of ethical standards that applies to the profession of engineering. There are several important characteristics of professional ethics.

First, unlike common morality and personal morality, professional ethics is usually stated in a formal code. In fact, there are usually several such codes, promulgated by various components of the profession. Professional societies usually have codes of ethics, referred to as ''code of professional responsibility,'' ''code of professional conduct,'' and the like. The American Medical Association has a code of ethics, as does the American Bar Association. Many engineering societies have a code of ethics, such as the American Society of Civil Engineers or the American Society of Mechanical Engineers. In addition to the professional societies, there are other sources of codes. State boards that regulate the professions have their own codes of ethics, which generally are similar to the codes of the societies. The various codes of ethics do differ in some important ways. In engineering, for example, some of the codes have begun to make reference to the environment, whereas others still do not.

Second, the professional codes of ethics of a given profession focus on the issues that are important in that profession. Professional codes in the legal profession concern themselves with such questions as perjury of clients and the unauthorized practice of law. Perjury is not an issue that is relevant to medicine or dentistry. In engineering, the code of the Association for Computing Machinery sets out regulations for privacy, intellectual property, and copyrights and patents. These are topics not covered in most of the other engineering codes.

Third, when one is in a professional relationship, professional ethics is supposed to take precedence over personal morality—at least ordinarily. This characteristic of professional ethics has an important advantage, but it can also produce complications. The advantage is that a patient or client can justifiably have certain expectations of a professional, even if the patient or client has no knowledge of the personal morality of the professional. When a patient enters a physician's examining room, she can expect the conversations there to be kept confidential, even if she does not know anything about the personal morality of the physician. When a client or

employer reveals details of a business relationship to an engineer, he can expect the engineer to keep these details in confidence, even though he knows nothing about the personal morality of the engineer. In both cases, these expectations are based on knowledge of the professional ethics of medicine and engineering, not on knowledge of the professional's personal morality.

A complication occurs when the professional's personal morality and professional ethics conflict. For example, in the past few years, some pharmacists in the United States have objected to filling prescriptions for contraceptives for unmarried women because their moral beliefs hold that sex outside of marriage is wrong. The code of the American Pharmaceutical Association makes no provision for refusing to fill a prescription on the basis of an objection from one's personal moral beliefs. In fact, the code mandates honoring the autonomy of the client. Nevertheless, some pharmacists have put their personal morality ahead of their professional obligations.

Some professions have made provisions for exceptions to professional obligations based on conscience. Physicians who believe that abortion is wrong are not required to perform an abortion, but there is still an obligation to refer the patient to a physician who will perform the abortion. Attorneys may refuse to take a client if they believe the client's cause is immoral, but they have an obligation to refer the prospective client to another attorney. Still, this compromise between personal morality and professional ethics may seem troubling to some professionals. If you believe deeply that abortion is murder, how can it be morally permissible to refer the patient to another physician who would perform the abortion? If you believe what a prospective client wants you to do is immoral, why would you refer him to another attorney who could help him do it? Nevertheless, this compromise is often seen as the best reconciliation between the rights and autonomy of the physician and the rights and autonomy of the patient, client, or employer.

Similar issues can arise in engineering, although engineering codes have not addressed them. Suppose a client asks a civil engineer to design a project that the engineer, who has strong personal environmental commitments, believes imposes unacceptable damage to a wetland. Suppose this damage is not sufficient to be clearly covered by his engineering code. In this case, the engineer probably should refer the client or employer to another engineer who might do the work.

Fourth, professional ethics sometimes differs from personal morality in its degree of restriction of personal conduct. Sometimes professional ethics is more restrictive than personal morality, and sometimes it is less restrictive. Suppose engineer Jane refuses to design military hardware because she believes war is immoral. Engineering codes do not prohibit engineers from designing military hardware, so this refusal is based on personal ethics and not on professional ethics. Here, Jane's personal ethics is more restrictive than her professional ethics. On the other hand, suppose civil engineer Mary refuses to participate in the design of a project that she believes will be contrary to the principles of sustainable development, which are set out in the code of the American Society of Civil Engineers. She may not personally believe these guidelines are correct, but she might (correctly) believe she is obligated to follow them in her professional work because they are stated in her code of ethics. Here, Mary's professional ethics is more restrictive than her personal ethics.

Similar differences in the degree of restriction between personal ethics and professional ethics can occur in other professions. Suppose a physician's personal ethics states that she should tell a woman that her future husband has a serious disease that

can be transmitted through sexual intercourse. Medical confidentiality, however, may forbid her from doing so. The physician's professional ethics in this case is more restrictive than her personal ethics. In a famous case in legal ethics, lawyers found themselves defending a decision not to tell a grieving father where his murdered daughter was buried, even though their client had told them where he had buried the bodies of his victims. They argued that this information had been conveyed to them confidentially and that, as lawyers, they could not break this confidentiality. In their defense of themselves, they emphasized that as individual human beings (following their personal ethics) they deeply sympathized with the father, but as lawyers they felt compelled to protect lawyer–client confidentiality.[6] Here, legal ethics was more restrictive than the personal ethics of the lawyers. It would not let them do something that they very much wanted to do from the standpoint of their personal morality.

In these last two cases, the professional ethics of doctors and lawyers probably also differs from common morality. Sometimes the conflicts between professional ethics, personal morality, and common morality are difficult to resolve. It is not always obvious that professional ethics should take priority, and in some cases a professional might simply conclude that her professional ethics is simply wrong and should be changed. In any case, these conflicts can provoke profound moral controversy.

The professional ethics of engineers is probably generally less likely to differ from common morality than the professional ethics of other professions. With regard to confidentiality, we shall see that confidentiality in engineering can be broken if the public interest requires it. As the previous examples show, however, professional ethics in engineering can be different from an engineer's personal ethics. In Chapter 3, we discuss more directly common morality and the ways in which it can differ from professional ethics and personal morality.

Fifth, professional ethics, like ethics generally, has a negative and a positive dimension. Being ethical has two aspects: preventing and avoiding evil and doing or promoting good. Let us call these two dimensions the two ''faces'' of ethics: the negative face and the positive face. On the one hand, we should not lie, cheat, or steal, and in certain circumstances we may have an obligation to see that others do not do so as well. On the other hand, we have some general obligation to promote human well-being. This general obligation to avoid evil and do good is intensified and made more specific when people occupy special roles and have special relationships with others.

Role morality is the name given to moral obligations based on special roles and relationships. One example of role morality is the set of special obligations of parents to their children. Parents have an obligation not only not to harm their children but also to care for them and promote their flourishing. Another example of role morality is the obligation of political leaders to promote the well-being of citizens.

Professional ethics is another example of role morality. Professionals have both an obligation not to harm their clients, patients, and employers, and an obligation to contribute to their well-being. The negative aspect of professional ethics is oriented toward the prevention of professional malpractice and harm to the public. Let us call this dimension of professional ethics *preventive ethics* because of its focus on preventing professional misconduct and harm to the public. Professionals also have an obligation to use their knowledge and expertise to promote the public good. Let us call this more positive dimension of professional ethics

aspirational ethics because it encourages aspirations or ideals in professionals to promote the welfare of the public.

The aspirational component has generally received less emphasis in professional ethics than the preventive component. This is true in engineering ethics as well, so it should not be surprising that the aspirational component of professional ethics has received less emphasis in earlier editions of this textbook. In this edition, we have attempted to redress this imbalance to some extent. At least we shall attempt to give more emphasis to the aspirational component of engineering ethics. Next, we discuss in more detail these two faces of professional ethics as they apply to engineering.

1.5 THE NEGATIVE FACE OF ENGINEERING ETHICS: PREVENTIVE ETHICS

During the past few decades, professional ethics for engineers has, as we have said, focused on its negative face, or what we have called preventive ethics. Preventive ethics is commonly formulated in rules, and these rules are usually stated in codes of ethics. A look at engineering codes of ethics will show not only that they are primarily sets of rules but also that these rules are for the most part negative in character. The rules are often in the form of prohibitions, or statements that probably should be understood primarily as prohibitions. For example, by one way of counting, 80 percent of the code of the National Society of Professional Engineers (NSPE) consists of provisions that are, either explicitly or implicitly, negative and prohibitive in character. Many of the provisions are explicitly negative in that they use terms such as "not" or "only." For example, section 1,c under "Rules of Practice" states that "engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized by law or this Code." Section 1,b under "Rules of Practice" states that "engineers shall approve only those engineering documents that are in conformity with applicable standards." This is another way of saying that engineers shall not approve engineering documents that are not in conformity with applicable standards.

Many provisions that are not stated in a negative form nevertheless have an essentially negative force. The rule having to do with undisclosed conflicts of interest is stated in the following way: "Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services." This could also be stated as follows: "Engineers shall not engage in known or potential undisclosed conflicts of interest that could influence or appear to influence their judgment or the quality of their services." Many other provisions of the code, such as the requirement that engineers notify the appropriate professional bodies or public authorities of code violations (II,1,f) are "policing" provisions and thus essentially negative in character. Even the requirement that engineers be "objective and truthful" (II,3,a) is another way of stating that engineers shall not be biased and deceitful in their professional judgments. Similarly, the provision that engineers continue their professional development (III,9,e) is another way of stating that engineers shall not neglect their professional development.

This negative character of the codes is probably entirely appropriate, and it is easy to think of several reasons for this negative orientation. First, as previously discussed, common sense and common morality support the idea that the first duty of moral agents, including professionals, is not to harm others—not to murder, lie, cheat, or steal, for example. Before engineers have an obligation to do good, they have

an obligation to do no harm. Second, the codes are formulated in terms of rules that can be enforced, and it is easier to enforce negative rules than positive rules. A rule that states "avoid undisclosed conflicts of interest" is relatively easy to enforce, at least in comparison to a rule that states "hold paramount the welfare of the public."

Another reason for the negative orientation of engineering ethics is the influence of what are often called "disaster cases," which are incidents that resulted, or could have resulted, in loss of life or harm due to technology. The following are examples of disaster cases that have been important in the development of engineering ethics.

The Bay Area Rapid Transit (BART) Case. BART went into service in 1972. Holger Hjortsvang, a systems engineer, and Max Blankenzee, a programmer analyst, became concerned that there was no systems engineering group to oversee the development of the control and propulsion systems. When they communicated these concerns to management, both orally and in writing, they were told not to make trouble. At approximately the same time, an electrical engineer, Robert Bruder, reported inadequate work on the installation and testing of control and communications equipment. In November of 1971, the three engineers presented their concerns in a confidential way to Daniel Helix, a member of the BART board of directors. When BART managers identified the three engineers, they were fired.

On October 2, 1972, 3 weeks after BART began carrying passengers, one of the BART trains crashed at the Fremont station due to a short circuit in a transistor. Fortunately, there were no deaths and only a few injuries. The three engineers finally won out-of-court settlements, although their careers were disrupted for almost 2 years. The case generated legal precedents that have been used in subsequent cases, and it had a major impact on the development of engineering ethics.[7]

Goodrich A-7 Brake Case. In 1968, the B. F. Goodrich Corporation won a contract for the design of the brakes for the Navy A-7 aircraft with an innovative four-rotor brake design. Testing showed, however, that the four-rotor system would not function in accordance with government specifications. Managers attempted to show that the brakes did meet government test standards by directing that the brakes should be allowed to coast longer between applications than allowed by military specifications, be cooled by fans between and during test runs, and be remachined between test runs. Upon learning about these gross violations of governmental standards, Searle Lawson, a young, recently graduated engineer, and Kermit Vandivier, a technical writer, informed the FBI, which in turn alerted the Government Accounting Office. Vandivier was fired by Goodrich, and Lawson resigned and went to work for another company.[8]

The DC-10 Case. The DC-10, a wide-bodied aircraft, was introduced into commercial service in 1972, during a time of intense competition in the aviation industry in the United States. Since the cargo area is pressurized as well as the cabin, it must be able to withstand pressures up to 38 pounds per square inch. During the first year of service, a rear cargo door that was improperly closed blew open over Windsor, Ontario. Luckily, a skilled pilot was able to land the plane successfully. Two weeks after the accident, Convair engineer Dan Applegate expressed doubts about the "Band-Aid" fixes proposed for the cargo door lock and latch system. Managers rejected his expression of concerns because they believed Convair would have to pay for any

fixes they proposed, so the prime contractor, McDonnell Douglas, was not notified of Applegate's concerns. On March 3, 1974, soon after takeoff on a flight from Paris to London, the cargo door of a plane broke off, resulting in a crash that killed 346 passengers. At that time, it was the worst aircraft accident in history.[9]

There are common themes in these cases, as well as in the better known *Challenger* and *Columbia* cases that are discussed later: engineers trying to prevent disasters and being thwarted by managers in their attempts, engineers finding that they have to go public or in some way enlist the support of others, and disasters occurring when engineers do not continue to protest (as in the DC-10 case). These are certainly stories that need to be told, and there are lessons to be learned about the importance of, and the risks involved in, protecting the health and safety of the public. We believe that preventive ethics should always be an important part of engineering ethics. However, there is more to being a good professional than avoiding misconduct and preventing harm to the public. We now discuss this more positive and aspirational aspect of engineering.

1.6 THE POSITIVE FACE OF ENGINEERING ETHICS: ASPIRATIONAL ETHICS

It is easy to see the limitations of a professional ethics that is confined to the negative dimension. One of the limitations is the relative absence of the motivational dimension. Engineers do not choose engineering as a career in order to prevent disasters and avoid professional misconduct. To be sure, many engineering students desire the financial rewards and social position that an engineering career promises, and this is legitimate. We have found, however, that engineering students are also attracted by the prospect of making a difference in the world, and doing so in a positive way. They are excited by projects that alleviate human drudgery through labor-saving devices, eliminate disease by providing clean water and sanitation, develop new medical devices that save lives, create automobiles that run on less fuel and are less polluting, and preserve the environment with recyclable products. Most of us probably believe that these activities—and many others—improve the quality of human life.

This more positive aspect of engineering is recognized to some extent in engineering codes of ethics. The first Fundamental Canon of the NSPE code of ethics requires engineers to promote the "welfare" of the public, as well as prevent violations of safety and health. Virtually all of the major engineering codes begin with similar statements. Nevertheless, the positive face of engineering ethics has taken second place to the negative face in most engineering ethics textbooks, including our own. In this edition, we include this more positive or aspirational aspect of engineering ethics.

In addition to us, several other writers on engineering ethics have come to advocate an increased emphasis on the more positive and welfare-promoting aspect of engineering. Mike Martin, author of an important textbook in engineering ethics, opened a recent monograph with the following statement:

> Personal commitments motivate, guide, and give meaning to the work of professionals. Yet these commitments have yet to receive the attention they deserve in thinking about professional ethics. . . . I seek to widen professional ethics to include personal commitment, especially commitments to ideals not mandatory for all members of a profession.[10]

Personal commitments to ideals, Martin believes, can add an important new and positive dimension to engineering ethics.

P. Aarne Veslilind, engineer and writer on engineering ethics, edited the book, *Peace Engineering; When Personal Values and Engineering Careers Converge*. In one of the essays, written by Robert Textor, the following account of "peace" is given:

- Global environmental management
- Sustainable development, especially in the less developed countries
- Tangible, visible steps toward greater economic justice
- Efforts to control and reduce the production and use of weapons, from landmines and small arms to nuclear and other weapons of mass destruction
- Awareness of cultural differences and skill in finding common ethical ground[11]

Although all engineers might not want to subscribe to some elements of the political agenda suggested here, Textor's statement again highlights the positive aspect of engineering—enhancing human welfare. The book title also makes reference to personal values.

Promoting the welfare of the public can be done in many different ways, ranging from designing a new energy-saving device in the course of one's ordinary employment to using one's vacation time to design and help install a water purification system in an underdeveloped country. Aspirational ethics, then, involves a spectrum of engineering activities. Let us call the more extreme and altruistic examples of aspirational ethics "good works" and the more ordinary and mundane examples "ordinary positive engineering." Although the division between these two categories is not always sharp, we believe the distinction is useful. Let us begin with the category of good works.

Good Works

Good works refers to the more outstanding and altruistic examples of aspirational ethics—those that often involve an element of self-sacrifice. Good works are exemplary actions that may go beyond what is professionally required. A good work is commendable conduct that goes beyond the basic requirements associated with a particular social role, such as the role of a professional. Good works can include outstanding examples of preventive ethics, such as the attempt of engineer Roger Boisjoly to stop the fatal launch of the *Challenger,* but here we are interested in illustrations of good works that fall into the aspirational ethics category. The following are examples.

The Sealed-Beam Headlight. A group of General Electric engineers on their own time in the late 1930s developed the sealed beam headlight, which greatly reduced the number of accidents caused by night driving. There was considerable doubt as to whether the headlight could be developed, but the engineers persisted and finally achieved success.[12]

Air Bags. Carl Clark helped to develop air bags. Even though he was a scientist and not a degreed engineer, his work might well have been done by an engineer. He is now advocating air bags on bumpers, and he has even invented wearable air bags for the elderly to prevent broken hips. He does not get paid for all of his time, and the bumper air bags were even patented by someone else.[13]

Disaster Relief. Fredrick C. Cuny attended engineering school, but he never received his degree in engineering due to poor grades. In his early twenties, however, he learned how to conduct disaster relief in such a way that the victims could recover enough to help themselves. At age 27, he founded the Interact Relief and Reconstruction Corporation. He was soon working in Biafra helping to organize an airlift to rescue Biafrans after a war. Later, he organized relief efforts, involving engineering work, in Bosnia after the war and in Iraq after Operation Desert Storm. When his work in Iraq was completed, the Kurds held a farewell celebration. Cuny was the only civilian in a parade with the Marines with whom he had worked.[14]

Engineers Without Borders. Engineers Without Borders is an international organization for engineering professionals and engineering students who want to use their professional expertise to promote human welfare. Engineering students from the University of Arizona chapter are working on a water supply and purification project in the village of Mafi Zongo, Ghana, West Africa. The project will supply 30 or more villages, with approximately 10,000 people, with safe drinking water. In another project, engineering students from the University of Colorado installed a water system in Muramka, a Rwandan village. The system provides villagers with up to 7000 liters of safe water for everyday use. The system consists of a gravity-fed settling tank, rapid sand filters, and a solar-powered sanitation light.[15]

Ordinary Positive Engineering

Most examples of aspirational ethics do not readily fall into the category of good works. They are done in the course of one's job, and they do not involve any heroism or self-sacrifice. One might even say that most of the things an engineer does are examples of ordinary positive engineering, as long as a good argument can be made that they contribute in some way to human welfare. Although this may be true, we are thinking here of actions that usually involve a more conscious and creative attempt to do something that contributes to human welfare. The following are examples, some fictional and some actual.

An Experimental Automobile. Daniel is a young engineer who is excited about being put on a project to develop an experimental automobile that has as many recyclable parts as possible, is lightweight but safe, and gets at least 60 miles per gallon.

An Auditory Visual Tracker. Students in a senior design course at Texas A & M decided to build an auditory visual tracker for use in evaluating the training of visual skills in children with disabilities. The engineering students met the children for whom the equipment was being designed, and this encounter so motivated the students that they worked overtime to complete the project. At the end of the project, they got to see the children use the tracker.

Reducing Emissions. Jane has just been assigned to a project to reduce the emissions of toxic chemicals below the standards set by governmental regulation. Her managers believe that the emission standards will soon be made more restrictive anyway, and that by beginning early the plant will be ''ahead of the game.'' In fact, however, both Jane and her manager are genuinely committed to reducing environmental pollution.

A Solution to "Gilbane Gold." In a well-known videotape in engineering ethics, a young engineer, David Jackson, believes that his plant's emissions should be reduced to comply with a new and more accurate test that has not yet been enacted into law. His manager refuses to cooperate until the standards are legally changed. David's resolution of the problem is to inform the press, an action that will probably cost him his job. Michael Pritchard and chemical engineer Mark Holtzapple suggest an engineering solution that would both further reduce toxic waste and be less costly than the system David's plant is currently using. The solution would probably have helped the environment, changed the manager's position, and saved David's job.[16]

Aspirational Ethics and Professional Character: The Good Engineer

Two features of aspirational ethics are of special importance. First, as Mike Martin noted, the more positive aspect of engineering ethics has a motivational element that is not present in the same way in preventive ethics. Second, as Martin also suggested, there is a discretionary element in aspirational ethics: An engineer has a considerable degree of freedom in how he or she promotes public welfare. Neither of these two features can be conveyed well in rules. Rules are not very effective motivational instruments, especially motivation to positive action. Rules are also inadequate to handle situations in which there is a great deal of discretion. "Hold paramount public welfare" gives little direction for conduct. It does not tell an engineer whether she should devote her time to Engineers Without Borders or to some special project on which she is willing to work overtime, or to simply designing a product that is more energy efficient. These decisions should be left to the individual engineer, given her interest, abilities, and what is possible in her own situation.

For these reasons, we believe that the more appropriate vocabulary for expressing aspirational ethics is that of professional character rather than the vocabulary of rules, which are more appropriate for preventive ethics. Rules do a good job of expressing prohibitions: "Don't violate confidentiality," "Don't have undisclosed conflicts of interest." Rules are less appropriate for capturing and stimulating motivation to do good. Here, the most relevant question is not "What kinds of rules are important in directing the more positive and aspirational elements of engineering work?" Rather, the question is "What type of person, professionally speaking, will be most likely to promote the welfare of the public through his or her engineering work?"

Let us use the term *professional character* to refer to those character traits that serve to define the kind of person one is, professionally speaking. The "good engineer" is the engineer who has those traits of professional character that make him or her the best or ideal engineer. To be sure, the vocabulary of professional character can also be used to describe the engineer who would be a good exponent of preventive ethics. Considering the examples of preventive ethics discussed previously, it is easy to see that the BART engineers displayed courage in attempting to alert management to the problems they found in the BART system. Vandivier also displayed courage in reporting the problems with the four-rotor brake to outside sources. One can think of other character traits that the engineers in the examples of preventive ethics displayed, such as technical expertise and concern for public safety and health. Nevertheless, preventive ethics can be expressed—and has traditionally been expressed—in terms of negative rules.

We can use the term *professional character portrait* to refer to the set of character traits that would make an engineer a good engineer, and especially an effective

practitioner of aspirational ethics. We suggest three character traits that might be a part of such a professional character portrait.

The first professional character trait is professional pride, particularly pride in technical excellence. If an engineer wants her work as a professional to contribute to public welfare, the first thing she must do is be sure that her professional expertise is at the highest possible level. Professional expertise in engineering includes not only the obvious proficiencies in mathematics, physics, and engineering science but also those capacities and sensitivities that only come with a certain level of experience.

The second professional character trait is social awareness, which is an awareness of the way in which technology both affects and is affected by the larger social environment. In other words, engineers need an awareness of what we call in Chapter 5 the "social embeddedness" of technology. Engineers as well as the rest of us are sometimes tempted to view technology as isolated from the larger social context. In the extreme version of this view, technology is governed by considerations internal to technology itself and neither influences nor is influenced by social forces and institutions. In a less extreme view, technology powerfully influences social institutions and forces, but there is little, if any, causal effect in the other direction. However, the engineer who is sufficiently aware of the social dimension of technology understands that technology both influences and is influenced by the larger social context. On the one hand, technology can be an instrument of the power elite and can be used for such things as the deskilling of labor. On the other hand, technology can be utilized by grassroots movements, as protesters did in China and bloggers do in the United States. In any case, engineers are often called on to make design decisions that are not socially neutral. This often requires sensitivities and commitments that cannot be incorporated into rules. We believe that such social awareness is an important aspect of a professional character that will take seriously the obligation to promote public welfare through professional work.

A third professional character trait that can support aspirational ethics is an environmental consciousness. Later in this book, we explore this issue more thoroughly, but here it need only be said that the authors believe that environmental issues will increasingly play a crucial role in almost all aspects of engineering. Increasingly, human welfare will be seen as integral to preserving the integrity of the natural environment that supports human and all other forms of life. Eventually, we believe, being environmentally conscious will be recognized as an important element in professional engineering character.

1.7 CASES, CASES, CASES!

In this chapter, we have frequently referred to cases in engineering ethics. Their importance cannot be overemphasized, and they serve several important functions. First, it is through the study of cases that we learn to recognize the presence of ethical problems, even in situations in which we might have thought there are only technical issues. Second, it is by studying cases that we can most easily develop the abilities necessary to engage in constructive ethical analysis. Cases stimulate the moral imagination by challenging us to anticipate the possible alternatives for resolving them and to think about the consequences of those alternatives. Third, a study of cases is the most effective way to understand that the codes cannot provide ready-made answers to

many moral questions that professional engineering practice generates and that individual engineers must become responsible agents in moral deliberation. They must both interpret the codes they have and (occasionally) consider how the codes should be revised. Fourth, the study of cases shows us that there may be some irresolvable uncertainties in ethical analysis and that in some situations rational and responsible professionals may disagree about what is right.

Cases appear throughout the text. Each chapter is introduced with a case, which is usually referred to in the chapter. In many chapters, we present our own attempts to resolve ethical problems. We often use brief cases to illustrate various points in our argument.

Cases are of several types. We have already discussed examples of cases that illustrate both preventive and the more positive aspects of professional ethics. Another way to categorize cases is to state that some focus on micro-level issues about the practice of individual engineers, whereas others have to do with questions of social policy regarding technology.[17] Some cases are fictional but realistic, whereas others are actual cases. Sometimes cases are simplified in order to focus on a particular point, but simplification risks distortion. Ideally, most cases would be given a ''thick'' (i.e., extended) description instead of a ''thin'' (i.e., abbreviated) description, but this is not possible here. Many thick descriptions of individual cases require a book-length account. Of course, instructors are free to add details as necessary.

Two final points are important with regard to the use of cases. First, the use of cases is especially appropriate in a text on professional ethics. A medical school dean known to one of the authors once said, ''Physicians are tied to the post of use.'' By this he presumably meant that physicians do not have the luxury of thinking indefinitely about moral problems. They must make decisions about what treatment to administer or what advice to give in a specific case.

Engineers, like other professionals, are also tied to the post of use. They must make decisions about particular designs that will affect the lives and financial well-being of many people, give professional advice to individual managers and clients, make decisions about particular purchases, decide whether to protest a decision by a manager, and take other specific actions that have important consequences for themselves and others. Engineers, like other professionals, are case-oriented. They do not work in generalities, and they must make decisions. The study of cases helps students understand that professional ethics is not simply an irrelevant addition to professional education but, rather, is intimately related to the practice of engineering.

Second, the study of cases is especially valuable for engineers who aspire to management positions. Cases have long been at the center of management education. Many, if not most, of the issues faced by managers have ethical dimensions. Some of the methods for resolving ethical problems discussed in Chapter 3—especially finding what we call a ''creative middle way'' solution—have much in common with the methods employed by managers. Like engineers, managers must make decisions within constraints, and they usually try to make decisions that satisfy as many of those constraints as possible. The kind of creative problem solving necessary to make such decisions is very similar to the deliberation that is helpful in resolving many ethical problems.

1.8 CHAPTER SUMMARY

This book focuses on professional ethics, not one's personal ethics or what is often called common morality. Sociologists and philosophers have come up with several different accounts of professionalism. By some of them, engineering in the United States does not enjoy full professional status, primarily because in the United States an engineer does not have to be licensed to practice engineering. By Michael Davis' Socratic definition of professionalism, however, engineers do have full professional status.

Running through all of the accounts of professionalism is the idea that ethical commitment, or at least a claim to it, is crucial to a claim to be a professional. This means that professional ethics is central to the idea of professionalism. Professional ethics has a number of distinct characteristics, many of which serve to differentiate it from personal ethics and common morality. Professional ethics is usually stated (in part) in a code of ethics, focuses on issues that are important in a given profession, often takes precedence over personal morality when a professional is in his professional capacity, and sometimes differs from personal morality in its degree of restriction of personal conduct. Finally, professional ethics can usefully be divided into those precepts that aim at preventing professional misconduct and engineering disasters (preventive ethics) and those positive ideals oriented toward producing a better life for humankind through technology (aspirational ethics). In elaborating on aspirational ethics, one can think of those professional qualities that enable one to be more effective in promoting human welfare. Cases are a valuable tool in developing the skills necessary for ethical practice.

NOTES

1. These five characteristics are described in Ernest Greenwood, "Attributes of a Profession," *Social Work,* July 1957, pp. 45–55. (For two more extensive sociological accounts that take this economic approach, see Magali Sarfatti Larson, *The Rise of Professionalism* (Berkeley: University of California Press, 1977) and Andrew Abbott, *The System of Professions* (Chicago: University of Chicago Press, 1988). For this entire discussion, we have profited from e-mail comments and two papers by Michael Davis: "Is There a Profession of Engineering?" *Science and Engineering Ethics,* 3, no. 4, 1997, pp. 407–428, and an unpublished paper, used with permission, "Is Engineering in Japan a Profession?"
2. Alasdair MacIntyre, *After Virtue* (Notre Dame, IN: University of Notre Dame Press, 1984), p. 187. For an elaboration of the concept of social practice and another application to professionalism, see Timo Airaksinen, "Service and Science in Professional Life," in Ruth F. Chadwick, ed., *Ethics and the Professions* (Aldershot, UK: Averbury, 1994).
3. Michael Davis, "Is There a Profession of Engineering?" *Science and Engineering Ethics,* 3, no. 4, 1997, p. 417.
4. We are indebted for some aspects of the elaboration of these two models to Professor Ray James, Department of Civil Engineering, Texas A & M University.
5. Often, we use the terms ethics and morality interchangeably because the terms are usually used interchangeably in philosophical ethics. However, there is some difference in usage, in that the term ethics is sometimes used with a more formalized statement of moral precepts, especially as these precepts are stated in ethical codes. Thus, it is more common to refer to "professional ethics" than "professional morality."
6. Reported in several sources, including *The New York Times,* June 20, 1974.
7. *Encyclopedia of Science and Technology Ethics* (Detroit: Thomson, 2005), vol. 1, pp. 170–172.

8. Kermit Vandivier, "Why Should My Conscience Bother Me?" in Robert Heilbroner, ed., *In the Name of Profit* (Garden City, NY: Doubleday, 1972), p. 29.
9. *Encyclopedia of Science and Technology Ethics* (Detroit: Thomson, 2005), vol. 2, pp. 472–473.
10. Mike W. Martin, *Meaningful Work* (New York: Oxford University Press, 2000), p. vii.
11. P. Aarne Vesilind, *Peace Engineering: When Personal Values and Engineering Careers Converge* (Woodsville, NH: Lakeshore Press, 2005), p. 15.
12. This account is based on G. P. E. Meese, "The Sealed Beam Case," *Business & Professional Ethics,* 1, no. 3, Spring 1982, pp. 1–20.
13. See Michael S. Pritchard, "Professional Responsibility: Focusing on the Exemplary," *Science and Engineering Ethics,* 4, 1998, p. 222. This article contains a discussion of good works, which is a concept first introduced by Pritchard.
14. Ibid., pp. 230–233.
15. See the Engineers Without Borders website at http://www.ewb-usa.org.
16. Michael S. Pritchard and Mark Holtzapple, "Responsible Engineering: *Gilbane Gold* Revisited," *Science and Engineering Ethics,* 3, 1997, pp. 217–230.
17. For a discussion of the distinction between micro- and macro-level issues, see Joseph Herkert, "Future Directions in Engineering Ethics Research: Microethics, Macroethics and the Role of Professional Societies," *Science and Engineering Ethics,* 7, no. 3, 2001, pp. 403–414.