contribute to a larger enterprise, wherein their contribution, together with that of others, leads to a product or service. For example, an engineer may use her skill to design one component of a whole airplane, or a research scientist may work with a team of other scientists each making contributions to the development of a cure for some disease.

Knowledge and skill are important parts of the efficacy of professionals, but they are not all of it, for mere possession of skill and knowledge is not enough to produce an effect. You must exercise the skill and use the knowledge, and in most professions this cannot be done in isolation. You need a business, clients, consumers, equipment, legal protection, and so on. Thus, professionals, especially computer professionals, create their own businesses or obtain employment in companies or government agencies. Creating or filling a position in one of these larger enterprises is usually what gives professionals the opportunity to use their knowledge and skill.

So, individuals acting in professional/occupational roles affect the world (they are efficacious) when they exercise their skills and knowledge in a context in which their actions have an effect. A computer professional, for example, may use his or her knowledge and skill to create software used for medical imaging or networking or record keeping. The computer professional has efficacy because he or she works in an institution organized in a certain way and supported by a broader set of social institutions (economic, legal, and political systems). This complex arrangement is what makes it possible for the skill and knowledge of the computer professional to be transformed into an effect on the world. The actions of computer professionals may directly or indirectly have powerful effects, on individuals and on the social and physical world in which we live. These effects may be good or bad and may be foreseen or unforeseen.

Because professionals have this efficacy, they bear special responsibility. That is, precisely because professionals have the ability and opportunity to affect the world in ways that others cannot, they have greater responsibility to ensure that their actions do not harm individuals or public safety and welfare. (More on this later.)

To summarize, when it comes to analyzing the ethical dilemmas of computer professionals, it is not sufficient to think of them merely as individuals acting in complex situations. To fully account for the ethical dilemmas of computer professionals, the domain of professional ethics must be recognized. This means recognizing that the moral dilemmas of computer professionals (as well as other professionals) are different from those of lay persons. It means recognizing the moral complexity of the environments in which computer professionals work as well as the special efficacy that computer professionals have in those environments. While some professionals (members of strongly differentiated professions) have special rights and responsibilities (powers and privileges) by virtue of being members of a profession, computer professionals do not. Computer professionals have special powers and privileges by virtue of their skill and knowledge and the positions they hold in organizations.

CHARACTERISTICS OF PROFESSIONS

As suggested earlier, the term *profession* is sometimes restricted to occupations that are strongly differentiated. More often than not, however, profession is used rather loosely to refer to occupational groups that for one reason or another have acquired higher social status and higher salaries. In theory we could use the term simply to refer to occupational groups such as house painters, x-ray technicians, and receptionists, as well as

doctors and lawyers. But this term is more often used to refer to a subset of occupations that, even if not strongly differentiated, have a somewhat distinct set of characteristics.

While there is no hard and fast definition, professions are often associated with the following set of characteristics:

1. Mastery of an Esoteric Body of Knowledge. Professions seem to require mastery of an esoteric body of knowledge, usually acquired through higher education. A member of the profession needs this body of knowledge in order to practice; those who do not master the knowledge cannot do the work. Because a distinct body of knowledge is so important to a profession, a related characteristic of professions is that they often embrace a division between researchers and practitioners, with the researchers devoting themselves to continuous improvement in the body of knowledge—medical researchers and clinicians, academic engineers and practicing engineers.

2. Autonomy. Members of professions typically have a good deal of autonomy in their work (as compared to other occupations in which members take orders). This autonomy is justified in part on grounds that the work of the professionals depends on esoteric knowledge; those with the esoteric knowledge should be making decisions rather than taking orders from those who don't have the knowledge, and therefore, cannot fully understand the situation.

Professions typically have autonomy both at the collective level as well as in individual practice. At the collective level, professions are often organized in a way that allows the membership to make decisions about the profession's organization and practice. Rather than being regulated by outsiders, the profession sets its own admission standards and standards of practice. Members of professions generally have more autonomy in their daily work—doctors making decisions about treatment for their patients, lawyers deciding the best strategy for defending a client, or architects deciding on the design of a building. These professionals have much more autonomy when compared to, say, sales personnel, assembly-line workers, and office clerks. In the latter occupations, members may have some say in the details of their work, but, for the most part, they are told what to do and how to do it.

3. Formal Organization. Professions generally have a single unifying, formal organization recognized by state and/or federal government, and this organization may control admission to the profession, as well as set standards for practice. The organization may also be involved in accreditation of educational institutions. In some cases, the professional organization is involved in licensing of its members. The formal organization will also generally have the power to expel individual members from the profession. In the United States, the American Medical Association and the American Bar Association are prominent examples of this type of organization.

4. Code of Ethics. Professions generally have a code of ethics (or a code of professional conduct). The code of ethics is both a way of setting standards in the field and a mechanism for maintaining autonomy. Members of professions with a code of conduct must adhere to the code no matter what their employment context; an employer—be it in a small or large business or government or a nonprofit—cannot require a professional to do anything that goes against the professional code. In many cases, professions require their members to take an oath to a code when they become members. A code of ethics also serves as a statement from the profession to the public as to what to expect from its members. In this way, codes of ethics promote public trust.

5. Social Function. Professions are generally understood to fulfill an important social function. Medicine, for example, is committed to promoting health, and while

lawyers are not alone responsible for justice, they play a vital role in the system of legal institutions aimed at achieving justice. Engineering is more difficult to describe because engineering is not committed to a single social good; rather engineering is devoted to developing technologies that facilitate a variety of social endeavors (transportation, communication, commerce, etc.). Nevertheless, as stated in several codes of conduct, engineers are committed to protecting safety and welfare in any projects they pursue.

These five characteristics are associated with a subset of occupational groups that have typically been labeled professions—doctors, lawyers, engineers, architects, accountants, and clergy. However, as already suggested, the concept of profession or professional is not hard and fixed. Moreover, it would be a mistake to think of this as a simple dichotomy; that is, it would be a mistake to think that any occupational group can be classified either as a profession or not a profession. These five characteristics are better seen as describing a model or paradigm against which various occupational groups can be measured. Occupational groups (such as computer professionals) can be examined in terms of these characteristics, some of which they exhibit and some they do not. Think of a continuum of professions/nonprofessions: Several occupations can be placed at one end of the continuum because they possess all of the characteristics mentioned and possess them to a high degree. At the other end of the continuum are occupations that exhibit none of these characteristics. There are many other occupational groups falling in between and closer or farther from each end of the continuum.

THE SYSTEM OF PROFESSIONS

Another way of thinking about professions that may be particularly helpful in understanding the field of computing is to think of the five characteristics listed as implicitly describing a process of professionalization. Many occupational groups want the power of self-regulation and the status and high salaries that go with it. To achieve this status and power, they must acquire and maintain a monopoly of control over a particular domain of activity. The characteristics listed implicitly describe how this is typically achieved.

An occupational group must organize itself into a formal unit. It must demonstrate that in a certain domain of activity (e.g., distributing therapeutic drugs, building bridges, auditing financial records, producing software), it is dangerous for just anyone to be doing the job. The activity will be safer, more effective, and, therefore, better for all who are affected, if that domain of activity is restricted to persons who have mastered a particular body of knowledge and have undergone special training. Moreover, the occupational group must convince the public that lay people cannot judge who is appropriately trained and qualified. Only those who have mastered the relevant body of knowledge can truly judge whether someone is qualified. In this way, the group convinces the public and government that for the good of society, a monopoly of control should be given to that group. The group is then given a monopoly of control in a certain domain of activity. The monopoly means that only members of that profession can

by the work of the profession). In other words, the occupational group must contin
ously demonstrate that it is worthy of the monopoly and this means controlling wh
becomes a member and how they practice, as well as expelling those who don't live up
to the standards.

The system of professions makes clear the role of each of the characteristi
mentioned above. To obtain a monopoly of control and self-regulation, an occupation
group must organize itself and convince the public that there is *special knowledge* in it
domain of activity and only those who have that knowledge should engage in the acti
ity. It must also convince the public that only members of the profession are qualified t
evaluate/determine who should be allowed to practice. The group must make clear tha
an important *social function* is at stake and can best be achieved by granting the know
edgeable group control of the particular domain of activity. In order to convince th
public to trust the group, the group adopts a *code of ethics* committing itself to certai
standards of conduct. If the group succeeds, the public (through state or federa
government) recognizes the *formal organization* of the occupational group, gives it a
monopoly of control in its domain, and prohibits nonmembers from engaging in the
activity. The monopoly of control gives the group *collective autonomy* and recognition o
the profession as such may justify *individual autonomy* in the practice of the profession.

It is useful to think of this process as establishing a social contract between a profe
sion and society. "Society" here refers to the public though the contract is negotiated, so
to speak, through state and/or federal government. Each side takes on responsibilities
in exchange for something it perceives to be valuable. Members of a profession organize
themselves and promise to pursue or protect a social good in exchange for recognition
by the state. The state grants the profession a monopoly of control of certain activities in
exchange for the commitment by the profession that it will self-regulate in ways that
serve the public interest. So, the profession gets the power of self-regulation in
exchange for the commitment to protect and pursue a social good. Society gets better
quality of services in a particular domain of activity in exchange for the commitment to
support and enforce the profession's monopoly.

The social contract idea makes clear that there is always the possibility that the
contract may be broken. If the occupational group violates its part of the contract, by
failing to do a good job of setting standards and controlling admission, then the state could
take away its monopoly and begin to regulate the domain of activity from the outside. On
the other hand, a professional group can go to the state and complain that it is not being
given the support it has been promised. For example, doctors would justifiably complain if
courts began to demand that doctors reveal confidential information about their patients.

IS COMPUTING A PROFESSION? ARE COMPUTER PROFESSIONALS "PROFESSIONALS"?

Where does computing fit in this scheme of things? What does the field of computing
look like when described in terms of the five characteristics mentioned above? Where is
computing in the process of professionalization?

To fully answer these questions would take us too far afield, not because they are
difficult questions, but because the field of computing is so diverse and complex. The
field of computing as an occupation (or set of occupations) is still young and evolving.
The range of those who are called computer professionals is extremely broad, including

those who design, sell, and maintain software and hardware; those who write documentation; those who advise on the security of information systems; those who design, monitor, and maintain Web sites; those who work for Internet service providers; those who work as academic computer scientists; and on and on. It is difficult to figure out what these jobs have in common except that, in one way or another, they involve the use of computer and information technology. This is in sharp contrast with older professions that are organized around a domain of life (law enforcement, medicine, religion, accounting) rather than a technology.

I will not try to sort out all the subfields and emerging divisions within computing. Instead, I will mention two trends in the organization of computing that seem worth watching, and then I will examine, in very broad terms, where the field of computing seems to fit on the continuum of professions/nonprofessions. I will also briefly discuss the emergence of software engineering as a distinct field within computing.

One trend to watch in the evolving organization of computing is the specification of occupations in ways that push computing out of sight or into the background. Remember that a distinct feature of computer technology is its malleability. Because of this malleability, computer technology is used in a wide variety of domains and fields. As computing becomes more and more a routine part of particular domains, it may well be that individuals will come to identify with the domain rather than computing. Computing may become an assumed part of many jobs, just as reading and writing are essential skills for doing many jobs. Where this happens, a worker will not be considered a computer professional per se, but simply a manager, a librarian, a graphic artist, an engineer, a security expert, a teacher, and these occupations require having and using knowledge of computers and information technology. Being able to use word processors, e-mail, and Web browsers is now standard for many occupations. As computer technology becomes more and more user friendly, this trend is likely to continue.

A trend that might be watched for clues as to how the organization of computing is evolving is the new curriculums being developed on college campuses and other educational institutions. There are computer engineering degrees as well as computer science degrees, but there are also new degree programs in business, for example, information management or MIS (management of information systems), and in communication, information studies, and so on. The curriculums that evolve are likely to be connected to categories of future professions and subfields.

With this as a backdrop, we can now discuss the field of computing in terms of the five characteristics of professions. At first glance, it would seem that computing possesses all of these characteristics, though it possesses them in complex and, perhaps, diffused ways.

Most computer professionals must master an esoteric body of knowledge to do what they do. Many people who work in the field have acquired their knowledge of computing through higher education.[1] Moreover, it appears that computing has a division between researchers and practitioners with knowledge of computing being continuously improved upon by those who do research and innovate.

Nevertheless, there are many points of controversy with regard to the esoteric body of knowledge on which computing is based. First, because the field is new and because of the huge demand for computing expertise, there are many people working in the field

[1] This is more true now than in the early days of computing when there were no educational programs in computing.

who do not have college degrees and many people who have college degrees but not in the field of computing.

Whether or not computing is actually based on mastery of an esoteric body of knowledge is a matter of contention. Some argue that computer science does not yet have its own body of knowledge; it relies on other fields (e.g., mathematics, engineering, physics). Others argue that computing does not really rely on a *systematic* or *abstract* body of knowledge and in this sense the body of knowledge on which it draws is not *esoteric;* rather computing relies on knowing how to do things. It is more application than science.

This is an important issue because, as mentioned earlier, identifying a special body of knowledge is part of the process of becoming recognized as a distinct occupational group. Indeed, the importance of identifying a distinct body of knowledge can be seen in recent events surrounding the licensing of software engineers (to be further discussed in the next section of this chapter). The Association for Computer Machinery (ACM), one of the largest organizations of computer professionals in the United States, recently took a position opposing the licensing of software engineers *at this time.* ACM took this position on the grounds that there is not yet an identifiable body of knowledge in software engineering. The ACM committee appointed to explore the issue of licensing of software engineers found that: "There is no widely accepted body of knowledge defining competency in software engineering."

When it comes to autonomy, the situation is again complex. As mentioned earlier, computing is not a strongly differentiated profession. That is, computer professionals are not allowed to do or required to do anything that an ordinary person (non-computer professional) cannot do. Strong differentiation aside, computer professionals have varying degrees of autonomy depending on where they work and what their positions are in an organizational hierarchy. Yes, those who work in private practice, by owning their own companies or consulting firms, and those who have worked their way up the ladder in corporate or government agencies, have greater decision making authority. They have greater autonomy than those who are newly employed in companies and lower in the organizational hierarchy.

At the collective level, it would seem that computer professionals do not have a great deal of autonomy, though they do have some. There is no single professional organization comparable to the AMA or the ABA; no single organization to which all members of the profession must belong. There is no formal process of admission that you must go through to become a computer professional. Nevertheless, computing has several large formal organizations. ACM and IEEE-CS (Institute for Electronics and Electrical Engineering Computer Society) are probably the largest and most visible. In recent years, these organizations have worked together to come up with curriculum requirements for accreditation of degree programs in computing and computer engineering. While these organizations have little in the way of enforcement power, attention is paid to their recommendations, and this effectively gives them some degree of self-regulation.

While there is no single code of ethics binding all computer professionals, ACM and IEEE, as well as other more specialized computer professional organizations have codes, and they are relatively similar in what they specify as the responsibilities of computer professionals.

Finally, as for fulfilling a social function, it seems clear that computing is now a crucial part of our society and will continue to be important. I hesitate to say that computing fulfills an important social function for computing is not a good in itself,

in the way that health and justice are. Computing is closer to engineering in this respect. Engineering and computing are activities that help us to achieve other social goods such as health, safety, efficiency, communication, and transportation. Computing supports a variety of social functions but is not itself a social function.

So, computing has several of the features associated with professions though it exhibits these characteristics in complex ways. It seems fair to say that computing is not at the far end of either side of the continuum of professions/nonprofessions, though it also seems fair to say that it is much closer to the profession side of the continuum than many other occupations.

SOFTWARE ENGINEERING

Software engineering appears to be one area of computing that is emerging as a distinct profession within the field of computing. This trend seems to have been created by the initiative of individuals in the field who are concerned about the quality and safety of the software currently being produced and sold. Developing software engineering as a distinct field involves several of the activities that have already been discussed. For example, it means identifying a unique body of knowledge that a person must possess to be a competent software engineer. It means developing educational requirements (curriculum components) such that the person who meets the requirements is much more likely to produce high quality, safe software than someone without the training. It means developing mechanisms for licensing of members. This will include identifying or creating the proper organization for issuing licenses and identifying requirements for obtaining a license, such as passing an exam or acquiring a certain number of years of experience.

The state of Texas has boldly taken the first steps in this process and has established software engineering licensing in its state. Texas has developed a set of requirements and an exam that candidates must pass in order to receive a license.

Another requirement for professionalization is a code of ethics. While the Texas licensing initiative is not explicitly associated with a code of ethics, in its early stages of development Texas asked for assistance from the ACM and IEEE and these two organizations established a joint task force to design a code of ethics and professional conduct specifically for software engineering. Even though the ACM subsequently decided not to support efforts at licensing of software engineers, the code of ethics was developed jointly by ACM and IEEE-CS.

The Texas licensing process, at this point, does not make software engineering a strongly differentiated profession; that is, it does not give those with licenses the power to do anything that nonlicensed engineers cannot do. Rather, Texas licensing seems aimed at helping those who contract for creation of software in identifying competent qualified professionals, that is, those who have obtained licenses. Though it is difficult to predict what will follow, the Texas initiative could be the first step in a sequence that will lead to granting licensed software engineers the power to determine whether software is released for sale (or not).

The Texas initiative is important for many reasons. Among them is that Texas defined software engineering as *engineering*. In doing this, Texas was able to make use of the apparatus (agencies, procedures, and practices) already in place for the licensing of other kinds of engineers. This will not be possible for all areas of computing, but it helps to give shape to the field of software development. Classifying software engineers as

engineers provides a context and framework for thinking about the work of software designers. It helps the public to understand how to think about the products and services being provided by software engineers.

The Texas initiative is a serious attempt at setting standards in a field in which, in many contexts, there are none. Moreover, it looks like the first steps in a process of negotiating the social contract between computer professionals and those who are affected by their work. While the process is far from over, other groups of computer professionals can learn a great from observing how the process proceeds.

PROFESSIONAL RELATIONSHIPS

The work-life of computer professionals is, as already suggested, far from simple morally. When computer professionals take on jobs, depending on the details, they may enter into relationships with any one or several of the following: (1) an employer, (2) a client, (3) coprofessionals, and (4) the public. Each of these relationships have ethical parameters.

Employer-Employee

When a person accepts a job in an organization, he or she enters into a relationship with an employer. While many conditions of this relationship will be made explicit when the employee is hired—responsibilities, salary, hours of work—many conditions will not be mentioned. Some conditions are not mentioned because they are specified by law (for example, an employee may not be required to do anything illegal); they are assumed by both parties. Some aspects of the relationship may be negotiated through a union (for example, employees with more seniority cannot be laid off before employees with less seniority). Yet many other conditions of the relationship will not be mentioned because neither party has an interest in them at the moment, because no one can anticipate all the situations which may arise, and probably because it is better not to press the uncertainties of some aspects of employer-employee relations. For example, when you accept a job, do you, thereby, agree to work overtime whenever your supervisor requests it? If you work for a local government and it gets into financial trouble, will you accept your salary in script? Do you agree never to speak out publicly on political issues that may affect your employer? Do you agree to a dress code?

The moral foundation of the employer-employee relationship is contractual. Each party agrees to do certain things in exchange for certain things. Generally, the employee agrees to perform certain tasks and the employer agrees to pay compensation and provide the work environment. Since the relationship is contractual in character, we may think of it as fulfilling the requirements of the categorical imperative. Each party exercises his or her autonomy in consenting to the terms of the contract since each party is free to refuse to enter into the contract.

According to the categorical imperative, each individual should be treated with respect and never used merely as a means. Thus, it is wrong for either the employer or the employee to take advantage of the other. This means, among other things, that each party must be honest. An employee must be honest with her employer about her qualifications for the job and must do the work promised. Otherwise, she is simply using the employer to get what she wants without respecting the employer's interests.

Trade secrecy is one area where the line is particularly difficult to draw. While employers have a legal right to expect their employees to keep trade secrets, it is unclear how far employers should be allowed to go to protect their trade secrets. (Trade secrecy law will be discussed more in Chapter 6.) For example, an employer may try to prevent an employee from taking a job at another company for fear that the employee will, intentionally or unintentionally, reveal their secrets to the new employer. Typically employers have employees sign agreements promising not to reveal secrets and they sometimes require employees to agree not to work in the same industry for a certain period of time after they leave the company.

Needless to say, employees often want to move on to another job and their best opportunities are likely to be, if not in the same industry, at least, doing the same kind of work. Employees learn a great deal of what might be called "generic" knowledge while working at a company. It is not considered wrong for employees to take this knowledge with them to their next job. It is this knowledge and experience that makes an employee attractive to another company. So, the employer's legitimate concern about a trade secret has to be balanced against the right of an employee to work where he or she wants.

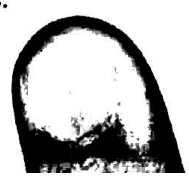
The employer-employee relationship is more complicated and less well-defined than you might expect. Employees do incur special responsibilities to their employers, but there are limits to this. The Carl Babbage scenario, at the beginning of this chapter, illustrates the point clearly enough. We cannot say that Babbage has no responsibilities to Acme. If he were to blow the whistle, a great deal of damage could be done to the company. And, the damage would be done even if his concerns turned out to be wrong. On the other hand, it is hard to say that out of loyalty to the company he should do nothing. What he owes the company and when he should "break ranks" is not easy to figure out.

Client-Professional

The Carl Babbage scenario can also be understood to involve a conflict between an employee's responsibilities to an employer and to a client. The client in this case is the Defense Department, and technically it is Acme's client, only indirectly Babbage's. The Defense Department has entrusted its project to Acme, and it would seem that to be true to this trust, Acme should inform its client of the unanticipated problems. The problem here, of course, is that Acme does not appear to be behaving well. This creates the problem for Babbage. He is expected by Acme to use the channels of authority in the organization. One can think of Acme's organizational structure as a mechanism for managing its responsibilities. Babbage has tried to work through this structure but it has not been effective.

In both the Leikessa Jones scenario and the Juan Roriguez scenario, the layers of bureaucracy are removed so that there is a more direct client-professional relationship. These are, perhaps, the better cases to use when first thinking through the character of client-professional relationships.

As with the employer-employee relationship, the client-professional relationship can be thought of as essentially a contractual relationship. Each party provides something the other wants, and both parties agree to the terms of the relationship. They agree about what will be done, how long it will take, how much the client will pay, where the work will be done, and so on. The important thing to keep in mind about client-professional relationships is the disparity in knowledge or expertise of the parties.



The client seeks the professional's special knowledge and expertise, but because the client does not possess that knowledge, the client must depend on the professional. "Trust" is the operative term here. The client needs the professional to make or help make decisions that may be crucial to the client's business, and must *trust* that the professional will use his or her knowledge competently, effectively, and efficiently. This is true of doctor-patient, lawyer-client, architect-client, and teacher-student relationships, as well as in relationships between computer professionals and clients.

Different models have been proposed for understanding how this disparity in knowledge in professional-client relationships should be handled. Perhaps the most important models are: (1) agency, (2) paternalism, and (3) fiduciary (Bayles, 1981).

Briefly, on the agency model, the professional is to act as the agent of the professional and simply implement what the client requests. Here the implication is that the client retains all decision-making authority. The professional may make decisions but they are minor, that is, they are simply implications of the client's choice. I call a stock broker, tell her what stocks I want to buy, how many, what price, and she executes the transaction. She is my agent.

Some client-professional relationships are like this, but the problem with this model is that it does not come to grips with the special knowledge or expertise of the professional. Often the professional has knowledge that reflects back on what the client ought to be deciding. Professional advice is needed not just to implement decisions but to help make the decisions.

At the opposite extreme is the paternalistic model. Here the client transfers all decision-making authority to the professional. The professional acts in the interests of the client making decisions that he or she believes will benefit the client. This model clearly recognizes the special expertise of the professional, so much so that the client has little "say." We used to think that the doctor-patient relationship followed this model. I go to a doctor, report my symptoms, and the rest is up to the doctor. He or she decides what I need and prescribes the treatment. I am simply expected to accept what the doctor prescribes. How can I question the doctor's authority when I don't have the expert knowledge?

The problem with the paternalistic model of client-professional relationships is that it expects the client to turn over all autonomy to the professional and cease to be a decision maker. The client must place him or herself at the complete mercy of the professional.

The third model attempts to understand client-professional relationships as relationships in which both parties have a role and are working together. Clients retain decision-making authority but make decisions on the basis of information provided by the professional. This is called the "fiduciary" model. "Fiduciary" implies trust. On this model, both parties must trust one another. The client must trust the professional to use his or her expert knowledge and to think in terms of the interest of the client, but the professional must also trust that the client will give the professional relevant information, will listen to what the professional says, and so on. On this model, decision making is shared.

Using the fiduciary model, computer professionals serving clients have the responsibility to be honest with clients about what they can and can't do, to inform them about what is possible, give them realistic estimates of time and costs for their services, and much more. They also have the responsibility to give clients the opportunity to make decisions about various features of the software or hardware being developed. Leikessa Jones seems to be working on the assumption of this sort of relationship in that she has informed her client of the possibilities and has made a recommendation. The problem now is that she doesn't think her client is making the right decision. The fiduciary

model would seem to call upon her to go back to her client and try to explain. It is h to say what she should do if she is unsuccessful at convincing them. What is clear is t she owes her clients the benefits of her judgment.

In the Juan Rodriguez scenario, we see a computer professional doing someth that threatens to undermine the trust that is so important to client-professional relatio ships. Juan has allowed himself to enter into a conflict of interest situation. His client—t hospital—expects him to exercise professional judgment on behalf of (in the interest o the hospital. While Juan may think he will be able to evaluate the offers made by each so ware company objectively, he has an interest in one of those companies that could affect h judgment. If representatives of the hospital find out about this, they might well conclud that Juan has not acted in the hospital's best interest. Even if Juan recommends that the hos pital buy software from another company (not Tri-Star), there is the possibility that Juan' judgment has been distorted by his "bending over backwards" to treat the other companies fairly. In that case, the hospital would not have gotten the best system either.

Society-Professional

When professionals exercise their skill and act in their professional roles, their activities may affect others who are neither employers nor clients. For example, you may design a computer system that will be used in a dangerous manufacturing process. Use of the system may put workers at risk or it may put residents in the neighborhood of the plant at risk. Or, you might simply design a database management system for a company, where the security of the system has implications for those who are in the database. Because the work of computer professionals has these potential effects, computer professionals have a relationship with those who may be affected.

This relationship is, to a certain extent, shaped by law. That is, regulatory laws setting safety standards for products and construction are made in order to protect the public interest. But the law does not and cannot possibly anticipate all the effects that the work of professionals may have. At the same time, professionals, including computer professionals, are often in the best position to see what effects their work will have or to evaluate the risks involved. Carl Babbage, for example, because of his expertise and familiarity with the system being designed, is in a better position than anyone outside of Acme to know whether or not the missile detecting system needs further evaluation.

The relationship between professionals and the individuals indirectly affected by their work can also be understood in terms of a social contract (as suggested earlier). In this framework, society grants the members of a profession (or the profession as a whole) the right to practice their profession in exchange for their promise to practice the profession in ways that serve society, or, at least in ways that do no harm to society. This means maintaining professional standards and looking out for the public good. On this model, both parties give something and receive something in the exchange. Society gives professionals the right to practice and other forms of support, and receives the benefits of having such professionals. Professionals receive the right to practice and other forms of societal support (protection of law, access to educational systems, and so on), and in exchange take on the burden of responsibility for managing themselves so as to serve the public interest. If a profession were not committed to public good, it would be foolish for society to allow members to practice.

Another way to understand the relationship between professionals and the public is by returning to the idea of professions possessing special knowledge and skill, and the

power of positions. What distinguishes computer professionals from others is their knowledge of how computers work, what computers can and cannot do, and how to get computers to do things. This knowledge, one might insist, carries with it, some responsibility. When a person has knowledge—special knowledge—he has a responsibility to use it for the benefit of humanity, or, at least, not to the detriment of humanity. Special knowledge coupled with the power of position gives computer professionals efficacy; they can do things in the world which others cannot. Thus, they have greater responsibility than others.

The only problem with this account is that it seems to simply assert a correlation between knowledge and responsibility without showing the connection. The connection is left as a primitive without explanation. Thus, we cannot help but ask: Why does responsibility come with knowledge? Why does it have to be so?

One way to establish the correlation between knowledge and responsibility is to base it on a principle of ordinary morality. Alpern (1983) argues that the edict "do no harm" is a fundamental principle of ordinary morality that no one should or will question. He has to qualify the principle somewhat so that it reads, "other things being equal, one should exercise due care to avoid contributing to significantly harming others." He then adds a corollary, the corollary of proportionate care: "whenever one is in a position to contribute to greater harm or when one is in a position to play a more critical part in producing harm than is another person, one must exercise greater care to avoid so doing."

Focusing on engineers, Alpern argues that while engineers are no different from anybody else in having the responsibility to avoid contributing to significant harm, they are different in that they are in positions (because of their work) in which they can do more harm than others. Thus, they have a responsibility to do more, to take greater care.

All of this would seem to apply to computer professionals—at least, to many of them. Computer professionals often hold positions in which they can use their expertise to contribute to projects which have the potential to harm others, as in the case of Carl Babbage. Since they act in ways that have the potential to do more harm, they have greater responsibility.

Alpern's account does seem to apply to computer professionals, though it is worth noting that according to this account it is not just computer professionals that bear responsibility but all those who contribute to projects with the potential to harm. Employed computer professionals can argue that they do not have nearly as much power as corporate managers, CEOs, or anyone above them in an organizational hierarchy. Alpern's proportionality thesis implies that the greater a person's power, the greater his or her responsibility. Of course, this need not be an either/or matter. Everyone, by Alpern's account, bears some responsibility, and so computer professionals bear their share of the responsibility along with managers and executives (Johnson, 1992).

Professional-Professional

Many professionals believe that they have obligations to other members of their profession. For example, professionals are often reluctant to criticize each other publicly and they often help each other in getting jobs or in testifying at hearings when one of them is being sued. However, whether or not such behavior can be justified as a moral obligation is controversial.

It seems that the special treatment one professional gives to another may at times be good and other times not. The earlier discussion of loyalty is relevant here. If one of your coprofessionals is an alcoholic and, as a result, not doing a competent job, it is good that you try to help the person. On the other hand, if you keep your coprofessionals' problem a secret, not wanting to jeopardize his or her career, this may result in injury to the person's employer or client. Similarly, when professionals get together to fix prices, this may be good for the professionals in that they can demand higher and higher prices, but it is not good for consumers who might benefit from a more competitive market.

We can take the cynical view that professionals only unite with one another to serve their shared self-interest but even this line of thinking, when extended to the long-term interests, justifies professionals treating clients and the public well. Every professional has an interest in the reputation of the profession because it affects how individual members are perceived and treated. Hence, each member of a profession may further his or her self-interest by forming alliances with other coprofessionals and agreeing to refrain from certain types of behavior. For example, even though some might benefit from lying about their qualifications, or taking bribes, or fudging test results, in the long run such practices hurt the reputation of the profession and, therefore, individual practitioners. The trust that clients and society must place in professionals is undermined and eroded when members of a profession behave badly. All members of the profession are hurt. Clients become more reluctant to use computer systems and to rely on computer experts.

One way to think about what professionals owe to one another is to think of what they owe each other in the way of adherence to certain standards of conduct. This is different from thinking only of what they might do to help and protect one another in the short term. Rules about being honest, avoiding conflicts of interest, giving credit where credit is due, and so on can be understood to be obligations of one member of a profession to other members (Davis, 1992).

CONFLICTING RESPONSIBILITIES

The complexity of managing responsibilities in the relationships just discussed should not be underestimated. Indeed, your work environment is not always structured so as to make it easy to keep your responsibilities in harmony. Issues of professional ethics often arise from conflicts between responsibilities to different parties.

Possibly the most common—at least, the most publicized—conflict is that between responsibilities to an employer and responsibility to society. The Carl Babbage case illustrates the typical situation. The employed professional is working on a project and has serious reservations about the safety or reliability of the product. For the good of those who will be affected by the project, the professional believes the project should not go forward yet. On the other hand, the employer (or supervisor) believes that it is in the interest of the company for the project to go forward. The professional has to decide whether to keep quiet or do something that will "rock the boat."

To see why this conflict arises, we can return to our discussion of the characteristics of the work life of professionals and compare the situation of a typical employed computer professional with that of a stereotypical doctor. Perhaps the most striking difference is that the typical computer professional employed in a large private corporation has much less autonomy than a doctor working in private practice. Computer professionals often work as employees of very large corporations or government agencies and have little autonomy.

Another characteristic of the work of computer professionals in contrast with that of doctors, is its relatively fragmented nature. Computer professionals often work on small parts of much larger, highly complex projects. Whatever authority they have is limited to the small segment, with someone else having the designated responsibility for the whole project. As well, computer professionals are often quite distant from the ultimate effects of their activities. They may work on a project at certain stages of its development and then never see the product until it appears in the market place, having no involvement in how it is used, distributed, or advertised. Doctors, on the other hand, see in their patients the direct results of their decisions, and lawyers know whether they have won or lost cases, furthered or impeded the interests of their clients, and so on.

Often computer professionals find themselves in a tension between their need for autonomy and the demands for organizational loyalty made by their employers (Layton, 1971/1986). On the one hand, they need autonomy because they have special knowledge. If they are to use that knowledge in a responsible manner and for the good of society, they must have the power to do so. However, insofar as they work for corporations with complex, highly bureaucratized organizational structures, and insofar as such large organizations need coordination of their various parts, there must be a division of labor, and they must often simply do what they are told. Carl Babbage's dilemma arises from this tension.

Acts of whistle-blowing arise out of precisely this sort of situation. Whistle-blowers opt against loyalty to their employer in favor of protecting society. Whistle-blowing is, perhaps, the most dramatic form of the problem. Other issues that come up for computer professionals are more subtle aspects of this same tension—between loyalty to employer and social responsibility or professional responsibility. Should I work on military projects or other projects I believe are likely to have bad effects? What am I to do when I know that a certain kind of system can never be built safely or securely enough, but I need the money or my company needs the contract? What do I do when a client is willing to settle for much less safety or security than is possible?

In the case of computer professionals, because the profession is relatively new and not well organized, the commitment to public safety and welfare is neither well entrenched in everyday practice nor well articulated in professional codes or literature. Nevertheless, the tension exists between protecting public good or adhering to professional standards *and* staying loyal to a higher organizational authority. It comes into clear focus now and then when cases involving public safety come to public attention. One of the first cases of whistle-blowing to be written about extensively involved three computer specialists working on the Bay Area Rapid Transit (BART) system (Anderson et al., 1980). The computer professionals in this case were concerned about the safety of the system controlling train speeds. They feared that under certain circumstances trains might be speeded up when they should be slowed. When their concerns were dismissed by their supervisors and then by the board monitoring the project, they went to newspaper reporters. In another case drawing public attention, David Parnas, a well-recognized computer scientist, spoke out against funding for the Strategic Defense Initiatives (Parnas, 1987).

CODES OF ETHICS AND PROFESSIONAL CONDUCT

The role of a code of ethics and professional conduct was discussed earlier in this chapter in relation to the process of professionalization. However, codes of ethics serve a variety of functions, so they are worthy of further discussion. It is important to keep in

mind that a code of ethics may, at one and the same time, be directed to members of the profession, the public, and employers and clients of members of the profession.

Perhaps the most important function of a code of ethics is as a statement embodying the collective wisdom of members of the profession. You can read a code of ethics as a statement of what members of the profession, with many years of experience, have found to be the most important things to think about and do when working as a computer professional. The code expresses both the experience of many members and the consensus of many members.

Currently, there are several codes of ethics in computing. Perhaps the most visible codes are those produced by the ACM and the IEEE. These codes as well as the newly developed Software Engineering Code of Ethics and Professional Practice are available on the Web. The addresses are provided at the end of this chapter. I mentioned earlier that the latter code was developed by a joint ACM-IEEE taskforce with an eye to the licensing of software engineers.

While these codes are somewhat different in their emphasis, they are remarkably similar in what they identify as important for computer professionals. As you review these codes, you should keep in mind that codes of ethics serve multiple functions. Earlier in this chapter, I discussed the role of codes of ethics in establishing public trust. Even if a profession does not win a monopoly of control, the code helps to fend off external regulation. In effect, the code says to the public that this profession will serve the interests of the public and will adhere to certain standards of behavior as well as aspire to certain ideals. In making this statement, the profession wants to show that it is worthy of trust as well as special status. In this way, the code also sets expectations; it informs employers and clients as well as the public of what to expect in their dealings with members of the profession.

Insofar as codes of ethics are aimed at the public, they may appear to be a public relations tool; they make the profession look good. So it is important to remember that regardless of the motive for its creation, if the code contains rules that protect the public, and promote worthy practices, then their self-serving character is not problematic.

Codes of ethics are not just statements to the public; they are also statements to and for members of the profession. They can serve several functions here. First, a code may be understood to be a statement of the shared commitments of the members. As such we might think of a code as the embodiment of agreed upon values and concerns. Second, a code may be a statement of agreed upon rules or standards. In creating a code, members of a profession may be understood to be saying to each other, "these are the standards we all agree to follow." A third function of a code in relation to its members is to sensitize members to issues that they might not be aware of. As new members read the code for the first time (or experienced members re-read the code), they may become aware of issues surrounding computing that they had not fully recognized before.

Related to the standard setting function, a code of professional conduct might be designed to provide guidance to professionals who find themselves in tough ethical situations. In other words, a professional who finds herself in a tight spot might look to the code to help figure out what to do. This is a particularly difficult goal to achieve with a code since the situations that computer professionals find themselves in are so diverse and the details can make all the difference. Codes of ethics must be general enough to apply to most, if not all, computer professionals, and in order to do this, they must stay very general. In the 1992 ACM Code of Ethics, the taskforce developing the Code recognized the tension between generalities and specifics and between ideals and