Chapter 25

Ethics

INTRODUCTION

The primary responsibility of an engineering professional is to protect public health and safety. However, engineering professionals also have a responsibility to their employers or clients, to their families and themselves, and to the environment. Meeting these responsibilities will challenge the practicing engineer to draw upon a system of ethical values.

Well, what about ethics? Ethics means "doing the right thing" as opposed to "what you have the right to do." But doing the right thing is not always obvious or easy. In fact, ethical decisions are often difficult and may involve a certain amount of self-sacrifice. Doing the right thing for a practicing engineer can be especially challenging. Furthermore, the corporate and government world has confused this concept by developing ethics programs that emphasize only what you have the right to do. An organization, for example, may have a list—often called a Code of Ethics or Code of Conduct—of what an employee can and cannot get away with. Employees are required to sign an acknowledgement that they have read and understood the list. The company unfortunately calls this "ethics training."[(1)]

One difficulty in some situations is recognizing when a question of ethics is involved. Frequently, in the area of environmental management, a breach of ethics involves a practice that endangers public health and safety or covers up a violation of a rule or regulation. Occasionally, however, a breach may involve a case of the exact opposite. This might seem an unlikely scenario. How can someone be too honest, too caring or too professional?

Regarding the above, one example is lying to save a life. Suppose you are standing on a street and a woman runs past you chased by two men. She screams, "They are trying to attack me!" as she dashes into the entry of a building around a corner. The men ask you, "Which way did she go?" What do you tell them? Clearly, the right thing is to lie. In this case, the value of caring overrides the value of honesty. This situation is exaggerated to illustrate that sometimes it is appropriate to violate certain values to protect public health and safety. In doing the right thing, ideally one should not have to make snap decisions and should take the time to investigate all of the facts (e.g., whether or not the woman was a thief and the men were police).

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Sometimes, one must decide how much to sacrifice to ensure public health and safety. In establishing environmental regulations, the regulating agency must decide how safe and how stringent to make the regulations. For example, in the case of air toxic regulations, one standard may result in 10 cancer cases per one million people. But why isn't it for or one or none? Who should decide?[2]

TEACHING ETHICS

Professionals are often skeptical about the value or practicality of discussing ethics in the workplace. When students hear that they are required to take an ethics course or if they opt for one as an elective in their schedules, they frequently wonder whether ethics can be taught. They share the skepticism of the practitioners about such discussion. Of course, both groups are usually thinking of ethics as instruction in "goodness", and they are rightly skeptical, given their own wealth of experience with or knowledge of moral problems. They have seen enough already to know that you cannot change a person's way of doing things simply by teaching about correct behavior.

The teaching of ethics is not a challenge if ethics is understood *only* as a philosophical system. Parks notes that teaching ethics is important, but "if we are concerned with the teaching of ethics is understood as the practice of accountability to a profession vital to the common good, the underlying and more profound challenge before all professional schools (and other organizations) is located in the question: How do we foster the formation of leadership characterized, in part, by practice of moral courage?"[3]

Moral courage requires knowing *and* acting. College and university educators, as well as those charged with ethics training in the private sector, develop a sense of uneasiness when topics such as "fostering leadership formation," "moral courage," or "knowing *and* acting on that knowledge" are mentioned. Such terms resurrect images of theological indoctrination, Sunday school recitations, or pulpit sermonizing. These images contrast sharply with what the present-day professor envisions as the groves of academic freedom and dispassionate analysis. Perhaps out of fear of disrespecting the dignity of students and devaluing their critical reasoning powers or their ability to understand where the truth lies, faculty take a dim view of academic goals that go beyond those strictly cognitive. The consequence of such values among the professoriate is the further erosion of a moral commons where an agreed-upon set of values and beliefs allows for discourse on ethics. Of course, the erosion has continued steadily from the inception of the Enlightenment Project in the seventeenth century until the present day wherever industrialized and postindustrialized societies have been subject to rapid cultural, economic, political, and technological change. It is not simply an erosion in the realm of higher education. Practitioners in the engineering and scientific communities experience the same erosion of the moral commons taking place in society as a whole.

The author is certainly in agreement with other colleagues in higher education and those who do ethics training in the private sector, that individuals are not to be

manipulated or indoctrinated. However, the author is also convinced that not only should students and other participants in ethics analysis have a body of knowledge but also that they have a responsibility for the civic life of society. Such responsibility requires leadership, moral courage, and action. Of course, none of these characteristics can be demanded or forced, only elicited. That is the great, yet delicate challenge facing the professoriate and all those charged with ethics training in other sectors. Eliciting a sense of civic responsibility as a goal of ethics analysis can be realized only as a derivative of cognitive processes and not as a direct goal. In sum, the formation of personal character and the practice of virtue are not to be subject to external control and the diminution of individual freedom through manipulation or indoctrination.

The reader should note that the bulk of the material to follow has been drawn from the work of Wilcox and Theodore.[4]

THE CASE STUDY APPROACH

The author believes that the case study method is a valuable way to take seriously Parks's response to the question "Can ethics be taught?" He also considers the method to be an important tool in investigating the relationship between assumptions, values, and moral life, as well as an ethical reflection on those three aspects of life. The author is also convinced that the case study method is one of the most useful ways of teaching ethics and of achieving the goals of ethics education outlined below by the Hastings Center.[5]

1. *Stimulating the Moral Imagination*. The concreteness of the case study appeals very much to the learning style of most people. While a certain amount of ambiguity is essential to evoke interest and discussion, it is also a stimulus for enlivening knowledge. Hopefully, the participant will begin to appreciate the moral complexity of a situation, which in the past might have been thought of only as a technical or managerial problem. Practice in the art of case discussion has the larger intent of leading the individual to bring an ethical frame of reference to bear on the variety of problems faced in the discipline studied. Stimulating the moral imagination is similar to putting on a pair of glasses that are tinted. The result is that the whole world is seen through that tint. As a consequence of the case study method, the authors of the cases to follow hope that each individual will see his or her field of study through the interpretive glasses of engineering and environmental ethics. He or she would then routinely ask: "What is the moral issue here?"
2. *Recognizing Ethical Issues*. The case analyst should not be content with a good "imagination." The further challenge is the recognition of specific moral problems and how they differ from one another in terms of immediacy or urgency. Concreteness is an important asset of the case study and clearly assists in achieving this second goal. Comparing and contrasting a variety of cases through discussion is essential to recognition and leads to achievement of the next goal.

3. *Developing Analytical Skills*. Differentiation, comparison, contrasts—all of these must be related to an enhanced ability to solve the problem. To achieve this goal, the student of ethics is taught to bring the skills developed in his or her major field of study to bear on the ambiguous situation, the moral dilemma, or the competing values that must be addressed. Analytic skills are best honed through the use of examples or cases. The technical ability to analyze all dimensions of an environmental spill will have an impact on how the moral aspect of the problem is understood in terms of resolving the problem. Of course, ethical systems that emphasize the importance of consequences, the obligations inherent in a duty-based ethic, as well as theories of justice or virtue, will enhance the ability to use technical or discipline-based analytic skills in resolving the problem. Knowing, however, is related to acting. This leads to the fourth goal.
4. *Eliciting a Sense of Moral Obligation and Personal Responsibility*. Much has already been said about the importance of this goal. However, it should be clear that a sense of moral obligation does not mean that there is one set of absolute answers. Dictating a solution is quite different from an internalization process whereby the individual commits himself or herself to be a "seeker"—one who takes personal responsibility for addressing and resolving the moral problems facing engineers or scientists. Both professions constitute the "guardians of the system" in the technical community. They are the first line of response to the problems and dilemmas facing the professions as such. To point to the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the Federal Bureau of Investigation (FBI), congressional formulators of public policy, or other sovereign countries as the parties responsible for resolving acute problems is to abnegate one's moral responsibility as a professional. To say this is not to dictate solutions, but to alert individuals to their personal responsibility for the integrity of their respective field. Eliciting a sense of responsibility depends on an assessment of the assumptions or "images at the core of one's heart." Assessment of ethical systems or normative frames of reference must be connected to the actual assumptions or images that constitute a person's worldview. Challenging the individual to examine that worldview in relation to a case and ethical system(s) is the first step in joining doing to knowing. Closely related to the achievement of this goal is the following one.
5. *Tolerating and Resisting—Disagreement and Ambiguity*. An essential component of case discussion is the willingness to listen carefully to the points-of-view held by others. Cases, by their nature, are ambiguous. They are bare-boned affairs meant more to be provocative than to lead to a clear-cut jury decision. The purpose of the case is to stimulate discussion and learning among individuals. As a result, there will be much disagreement surrounding the ethical issues in the case and the best option for resolving it. Toleration does not mean "putting up with people with whom I disagree." Respect for the inherent dignity of the person and a willingness to understand not only

another position but also a person's reasons for or interest in that point-of-view, should be part of the case discussion. Toleration does not mean all opinions must be of equal value and worth. It is true that respect for and listening to another person's argument may lead one to change a position. However, a careful description and discussion of the other person's position may also lead to a greater conviction that one's own position is correct. What is clearly of central concern is the belief that the free flow of ideas and carefully wrought arguments, presented from all sides without fear of control, manipulation, threat, or disdain, is at the core of human understanding and development. This hallowed concept of academic freedom is the catalyst that allows human communities to be committed to the search for truth, without at the same time declaring absolute possession of the truth.

APPLICATIONS

The three Illustrative Examples below have been drawn from the work of Wilcox and Theodore,[4] keying primarily on heat transfer issues. Each example is presented in case-study format, containing both a fact pattern and finally, questions for discussion. These questions are by no means definitive. While they will help individuals focus on the case, the issues raised will make the most sense if they lead to a wide-ranging discussion among all readers. As noted, analysis of ethics cases comes alive in group work. Answering the questions individually is a helpful first step, but one's understanding of ethical problems and dilemmas generally improves dramatically in group discussion.

ILLUSTRATIVE EXAMPLE 25.1

Fact Pattern A chemical plant on the West Coast recently experienced a serious reactor explosion that resulted in several injuries and a fatality. There is an ongoing investigation to find out what caused the explosion. Injured workers and their families are angry and anxious to blame someone for this unfortunate accident.

Stan, one of the head executives at this chemical plant, is trying to get to the bottom of the situation with Terry, a plant manager.

Stan asks, "So, did you find out anything new?"

Terry responds, "Well, the reactor that exploded was recently upgraded to increase production. Everything was supposedly checked out, but someone overlooked a minor factor. The reactor eventually overloaded and exploded."

Stan asks, "Well, who's responsible for that mistake?"

Terry disappointingly says, "Well, remember Laura? She was one of the chemical engineers working on that production line. She quit about a month ago. Everyone seems to be pointing fingers at her, saying that she was in charge of upgrading that reactor."

"I have all of these angry people ready to seek revenge for this explosion. Terry, the reputation of this company is at stake. Not only have we caused injuries, but we have polluted the

environment. Now you tell me the person at fault isn't even here anymore. How is that supposed to help anything?" shouts Stan.

Reluctantly, Terry suggests, "Well, we could always blame someone who is dispensable. For example, Rob, one of the janitors that works here, has been acting up lately. His supervisors have warned him about slacking off. He has quite a temper and tends to scream threats at people. We could try to blame him."

Stan asks, "But how would we do that? Wouldn't people know that it's not his fault? Can we get away with that?"

"Well, most people wouldn't be surprised Rob got mad about something and decided to mess up one of the reactors. He was working the night the explosion occurred. In fact, the explosion happened during one of his shifts. Maybe he was at the other side of the plant when it occurred, which is probably why he was not hurt," says Terry.

"But isn't this blatantly wrong? We cannot blame an innocent man for this," Stan comments.

"Stan, we are in a serious mess here. Our company's reputation is on the line. You said so yourself. We may all lose our jobs. No one will care if we blame a rowdy janitor for this. He was bound to be fired anyway. His attitude was not going to be tolerated much longer. I think that this is the best solution for everyone," says Terry.

After pondering the situation for a few minutes, Stan agrees. "After weighing all of the pros and cons, I think you're right, Terry. Our blaming Rob for the explosion may not be the moral thing to do, but we have to try to solve this problem by hurting as few people as possible. If we do it this way, we might be able to recover from this disaster."

Questions for Discussion

1. What are the facts in this case?
2. What other options do Terry and Stan have to remedy the situation?
3. Was the decision to blame Rob justified?
4. Do you think Terry and Stan can get away with blaming Rob for the explosion?
5. If the truth was revealed, what do you think would happen to Stan, Terry, Rob, and the rest of the company? ■

ILLUSTRATIVE EXAMPLE 25.2

Fact Pattern Curts Inc. is a company specializing in applications involving power plants. Recently, their business has taken a jump forward, and the company has started obtaining contracts faster than they can hire and train individuals.

John is a mechanical engineer for Curts Inc. Because of the recent lack of employees, he has been juggling two or more projects at the same time. One project that he neglected for a while is a contract with the local utility company to modify an existing burner to use a more economical fuel and still produce the same amount of energy.

Now, the project is near the end, and he just got started on his assignment of giving a detailed report about the fuel to be used. Initial information was gathered by a team of engineers who concluded the fuel will be easy to obtain if imported from South America and that it will produce the same amount of energy. John finds out that the fuel, which is a very crude (tarlike) oil, is suspected of being carcinogenic when burned, according to a study done on this type of fuel.

When he brings this to the attention of his peers, they accuse him of trying to destroy all of their work at the last minute.

John takes a moment to think over his options: Should he destroy the whole team's work, or forget about that *one* study and finish the project?

Questions for Discussion

1. What are the facts in this case?
2. What is the ethical problem John faces?
3. Does John have more than two options?
4. Which course of action would you recommend to John? ■

ILLUSTRATIVE EXAMPLE 25.3

Fact Pattern Ricardo is beginning his fourth year as an engineering student at a university in Boston and is now in charge of a team of students who are determined to build the school's first solar-electric car. In order to gain corporate donations and university funding, the car must gain a great deal of exposure. It is decided by the team that the car will race in the Tour de Sol in May 2010. This gives the students a goal and provides ample justification for investment.

The time frame from the team's inception of the idea to the date of the race is less than a year; this fact poses the obvious problem of feasibility. To overcome this difficulty, the group presents the solar car project to all of the senior design classes in every discipline of engineering. The idea is to split the car into many smaller projects; teams would finish their concentrated assignments and present them as senior projects. The idea is also pitched to marketing, business, and communications seniors, who can design investment solicitation plans and help the team gain access to local and national media.

Within the next few weeks, teams are set up for all known aspects of the project, and Ricardo is to coordinate everything—creating communication links between teams, setting goals, and negotiating timelines for the integration of all the projects. Key to all aspects of the project are safety considerations. In addition to all government safety regulations, the car has to abide by several safety guidelines set by the Tour de Sol. In order to obtain money and materials, the team has to convince every sponsor that all Tour de Sol requirements will be met on time.

Over the following few weeks, car body designs are submitted, altered, and reworked until a final design is agreed upon. At that point a massive effort is made to obtain the materials and components necessary to construct it. With those in hand and a procedure plan laid out, groups of five to twenty people work in rotation twenty-four hours a day for the next month to complete the monocoque of the car (the shell made of all advanced composite materials). At this point, every team has the huge task of integrating the final design of its product to meet the actual specifications of the monocoque and the preliminary specs of other product groups. During this process the interior design group discovers that miscommunication between their group and the body team has led to a monocoque design that is not tall enough at certain critical points. There is a specific regulation regarding the height from the bottom of the lowest part of the seat to the ceiling of the car. The height of the car at this point is about an inch too short, and the seat configuration also takes an additional, unexpected inch of height. This causes a two-inch disparity between the actual and the designed configuration, and a breach of

regulation by about an inch. More important, this change also directly reduces the distance between the top of the driver's helmet and the ceiling, which means that, in the event of even a minor crash, the driver's chances of serious injury to the neck are increased. The interior group analyzes the situation and determines that the seat angle cannot be changed to reduce the height because they have designed the seat based on the largest ergonomically feasible angle to minimize the height in the first place.

A meeting is held including Ricardo and all of the team members involved in the process. It is determined that there is nothing that can be done in the interior of the car without breaking several safety regulations directly related to the driver. The only possible way to bring the car within these regulations is to increase the height of the monocoque, which will require the reconstruction of the entire monocoque and is impossible from both time and resources standpoints. Ricardo is faced directly with either enforcing a redesign that would effectively scrap the project or keeping a design that breaks the height regulation. He decides to postpone the decision by allowing everyone to work as scheduled and assigning a person from each of the two relevant teams to try to find an alternative solution. Weeks pass, and the deadline is approaching. The two team members report that there is no way, outside of a new monocoque, to change the height without causing more severe problems. They do report, however, that this regulation was never actually checked by a third party in past races and is used more as a guideline than as a hard-and-fast rule. Since there seems no alternative and apparently no punishment is rendered for breaking the rule, all of the group members agree to allow the "violation" to go unchanged. Ricardo despises the predicament and the decision, but does not want to let his entire project go down the tubes for a technicality. The decision holds and the car is finished barely in time, yet Ricardo is still uneasy in the final days before the race.

Questions for Discussion

1. What are the facts in this case?
2. What is the ethical problem facing Ricardo?
3. How could Ricardo have anticipated the problem before it was too late?
4. What are Ricardo's options in handling the situation?
5. What do you think should be done?
6. What do you think Ricardo's actions should have been upon learning of the situation? ■

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