Chapter 2

Working With Cases: The Importance of Concrete Learning

Chapter Objectives

Having read this chapter, answered the associated questions, and completed the included exercise, readers should be able to

- understand why studying cases is important to engineering ethics education, in general, and engineering ethics in global contexts, specifically;
- describe the process of and justifications for the steps involved in the case-study procedure;
- evidence the abilities involved in undertaking the initial steps involved in completing a case-study analysis.

2.1 CASE STUDIES

This second chapter introduces readers to the process of case-study analysis. As was indicated previously, studying cases is a useful tool for analyzing issues in applied ethics and recognizing complexities involved in making decisions with a real-world focus. This chapter further describes the benefits of and justifications for studying cases, outlines the steps involved in case-study analysis, and invites readers to practice completing this process with regard to a hypothetical case.

2.2 WHY STUDY CASES?

Chapter 1 introduced reasons for the use of cases in studying ethics. The benefits of doing so have been recognized over the last several decades, to the extent that the disciplines of engineering, professional, and applied ethics now focus on cases.[22] Studying cases helps both students and practitioners to

- learn actively, which has been demonstrated to increase understanding[23];
- determine the proper subject matter of ethical analyses;

22. For a discussion of the uses and centrality of case studies to these fields, see Beabout and Wennemann (1993), Delatte (1997), Luegenbiehl (1996), and Richards and Gorman (2004).
23. For more on this, again, see Prince (2004).

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- build an experience base regarding ethical issues before facing similar situations in the world;
- develop the ability to analyze and solve not only ethical but also engineering problems;
- recognize and understand the connection between the technical and ethical dimensions of engineering work;
- generalize by examining a variety of specific instances, thereby forming an integrated ethical perspective for oneself.

Although the study of cases is essential to an understanding of ethical issues, with an international approach to ethics, it is equally essential that engineering students and practitioners have a set of commonly agreed on set of guiding principles to which they can make reference, given their diverse backgrounds. The following discussion thus promotes the use of principles—to which the reader will be introduced shortly—in the case-study procedure.

2.3 STEPS FOR CASE ANALYSIS

2.3.1 Identifying Ethical Issues

In identifying ethical issues, it is important to keep in mind the definition of ethics from Chapter 1: *ethics concerns actions that have the potential to have a serious impact on the lives of others*. Thus, in identifying ethical issues while approaching a case, the primary concerns are those actions that have the potential to seriously impact the lives of others. These effects could be either direct or indirect, and the effects—or those affected—need not be explicit but, in many cases, should be deduced from the facts provided. In approaching a case, readers should carefully examine the facts of a situation in a general sense to see what information is provided, since, at first, there is the tendency to see only one prominent issue. In most cases, however, there will be more than one prominent issue.

Those new to ethical analysis often fail to recognize the presence of ethical issues in their lives, although doing so is one of the most crucial steps in ethical analysis.[24] When ethical issues are identified, they should be written out in question form, indicating that a conclusion should be reached, answering the question posed by the end of an analysis, for example, "should John have stolen/steal bread to feed his family?" Additionally, there are a variety of possible actors in any case—humans and nonhumans[25]—although cases may be presented from or about the perspective of only one individual:

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24. Again, as a result of innate psychological biases, one of the biggest obstacles to acting ethically is the inability to discern the ethical dimensions of situations and recognize dilemmas as ethical ones. For more on this, see Bazerman and Tenbrunsel (2013).

25. For an account of both humans and nonhumans as "actors"—and discussions of the ethical and political ramifications of these interactions—see, for example, Latour (1992, 1994, 2004).

- Identify and formulate at least five ethical issues you have encountered in either your professional life as an engineer—internship or work environments—or personal life. (Remember that ethical issues are about actions that have the potential to seriously impact the lives of others—directly or indirectly—and should be written out in the form of a question, concerning what individuals or groups should or should not, might or might not have done.)
- Additionally, refer back to the case of the Überlingen midair collision, identifying and formulating at least five ethical issues present in that case.

2.3.2 Narrowing the Focus

Given the variety of issues that can be found in even a relatively short case, a full discussion of all the issues in any case would be difficult if not impossible. Here completeness in the analysis of a few issues is preferable to superficiality in an analysis of many, since the former progressively deepens one's understanding of ethics. Analysis should thus focus on only a couple of the main issues in a case. This will often involve the revision of initial questions, changing them so as to encompass subsidiary questions that have appeared. In this way, the complexities of a case can be retained, while the topics under consideration can be arranged in a hierarchical fashion, from the most to the least important:

- Referring back to the lists of ethical issues your wrote out before—concerning those you have encountered in your professional or personal life and identified in the Überlingen case—decide which two ethical issues from each list are the most important.
- Write out a brief justification for your decisions, why you feel these are the most important ethical issues.
- If necessary, rewrite these issues to encompass any subsidiary issues you think are important.

2.3.3 Determining Relevant Facts

When dealing with an ethical issue in real life, huge numbers of facts about situations could be listed. Facts related to case studies on engineering ethics could be grouped into the following three categories: (1) material facts—those concerning what went wrong/right from the perspective of material conditions and circumstances, which could be associated with the specifically engineering dimensions of incidents, for example, failures of the main and backup communication systems in the Überlingen midair collision; (2) facts regarding individuals—those concerning the action or inaction of individuals, for example, Peter Nielsen's failure to realize that 757 and 154 were flying at the same altitude; and (3) facts regarding organization—those concerning the ways that persons interact with persons, persons interact with technology, etc., in terms of

business, government, etc., policies and guidelines, for example, the training of the Russian pilots to give priority to orders from air traffic control.

As facts may not always fit clearly into any one of these categories—overlapping between different ones and being connected through relations of implication and consequence to other facts—this categorization is meant to be heuristic in nature, assisting in the practice of identifying relevant facts. Additionally, although written cases restrict the reader to the facts mentioned, much of the material presented could still be superfluous in resolving the issues under consideration. Initially, one should make a list of all the facts relevant to the questions posed, grouping them in the above-described categories. This might require modification as the analysis proceeds. Next, facts that are not provided—but appear to be relevant to resolving the issues under consideration—should be listed as well:

- For each of the two most important ethical issues you identified above, list six facts that would help to answer these questions, two for each of the three categories: (1) material facts, (2) facts regarding individuals, and (3) facts regarding organizations.
- Additionally, for each question, list two missing facts that would help resolve the issues under consideration, facts concerning information missing from this case—to either you or the persons and/or organizations involved.

2.3.4 Making Reasonable Assumptions

In working with cases, students often complain they do not have enough information, using this as an excuse not to make decisions. Students might fail to recognize that this is also a common feature of real life, where reason is used as a supplement to make up for a lack of information. One needs to do the same in case-study analysis. It is possible to arrive at reasonable—although not certain—assumptions about purported facts through a process of inference. These assumptions add uncertainty in attempting to resolve ethical issues related to case study, but this uncertainty is preferable to the claim that no conclusion is possible. Making assumptions, however, is not an open-ended activity.

Assumptions should be justified, based on given data and a reasonable understanding of ordinary life. In addition, assumptions should be relevant to the particular issues under consideration. In Chapter 1, for example, the assumption was made that people tend to act for their own gain. This assumption is based on psychological studies and observations of general human behaviors. As information on the subject is limited, however, this would not be a fact regarding human motivations. Rather, the assumption is necessary as a background condition for the study of ethics:

- Referring back to the missing facts helpful to resolving the two most important ethical issues you identified above—in your professional/personal

life and the Überlingen case—what reasonable assumptions can you make? Explain your reasons for making these assumptions.
- Have there been other times in your professional or personal life when you have had to make important decisions but lacked information to make these decisions? List them. What did you do? What assumptions did you make in attempting to arrive at a decision?

2.3.5 Undertaking Definitional Clarification

One of the central tasks of philosophical analysis is gaining clarity regarding concepts. Without such clarification—which is essentially a definitional activity—communication between different persons and people can fail. This is important when dealing with issues in international contexts, where cultural connotations associated with words differ significantly.[26] In addressing an ethical issue to be resolved, it is thus important to explain the ways any central concepts are used, especially those subject to differing interpretations. This is especially true with terms that have "value connotations," implicit meanings regarding understandings of right and wrong, good and bad, etc.:

- Returning to the previous exercises, have you used terms or concepts that could be considered ambiguous or "conceptually vague"—lacking one clear definition or using terms/concepts in ways that could be confusing to others? If so, then list them.
- Imagine you're someone else and then write out how someone else might understand each of these terms/concepts.
- Provide definitional clarification regarding how you meant each term/concept to be used/how you intend others to understand them.

2.3.6 Conducting Ethical Analysis

"Ethical analysis" here means the application of principles further explained and justified throughout this text.[27] In making ethical judgments, alternatives to this approach also exist, some of which will also be discussed. At present, it is sufficient to note that this process of applying principles is crucial to making ethical judgments and that, at times, principles may be insufficient. This means that in the process of application, a simultaneous process of refining and justifying the prior foundations for making ethical judgments should also occur.[28] In many ways, this

26. For a discussion of the ways this interferes with accurately assessing cross-cultural values, see Kulich and Zhang (2010).
27. Chapters 3–11 list and justify these principles. For a full list of these principles, see Appendix I.
28. This process is similar in nature to "reflective equilibrium" in Rawls (1999), "principlism" in the field of biomedical ethics by Beauchamp and Childress (2008), and the "ethical cycle" as proposed by engineering ethicists Van de Poehl and Royakkers (2007, 2011). Regarding the nature of "reflective principlism," a modification of principlism appropriate to teaching engineering ethics, see Kisselburgh, Zoltowski, Beever, Hess, and Iliadis (2014).

process should be similar in nature to the one that occurs in the common-law tradition, in the interplay between laws and their interpretations in courts.

It is important to remember that no externally provided set of principles can ever serve as a final authority. Individuals must exercise their reason in making judgments, for they are the ones ultimately accountable for their decisions.

The first step in analysis consists in reviewing the set of available principles and deciding which of them applies to the issues under consideration. For example, if someone takes bread without paying, then this action could be considered ethically wrong according to the principle "one should not steal." In applying principles to specific cases, however, conflicts may well arise between principles. The next step then is to decide whether such conflicts exist. If only one principle applies, then no conflict will exist, although this is seldom the case. If conflicts exist, then it must be determined whether one principle should override another. This may lead to a general prioritization of one principle over another, but the established hierarchy might also only apply to the case at hand. For example, if someone takes bread to feed his or her starving family, then according to the principle "one should feed his or her family," a conflict of principles arises.

Deciding which principles should take precedence—either in general or with reference to a specific case—is based on the ability to reason in relation to the given set of facts. The final step in analysis consists in deciding whether the set of principles available is sufficient to reach decisions regarding the case—to resolve the ethical issues—or whether additional principles for action are needed. Principles concerning general and personal ethics might be especially relevant in resolving ethical issues:

- Which ethical principles—rules for behavior regarding right and wrong—are important in your personal and working, professional life? List them.
- Are these principles the same in your personal and working, professional life? Why or why not?
- Which of these principles apply to the ethical issues you previously raised concerning your professional/personal life and the Überlingen case—in other words, which of these principles helped/would help you resolve the ethical issues/answer the questions you posed above?
- Do any of the principles conflict in the two situations? If so, then how would you "hierarchize"—rank in priority—these principles? Is this hierarchy generally applicable or specific to the case under consideration? Why?
- Are there any other ethical principles that might be applicable to these issues—rules for how people should conduct themselves regarding right and wrong that would help resolve the ethical issues/answer the questions you posed before?

2.3.7 Reviewing the Process

A complete case analysis is an "iterative process," which means that as case study proceeds, new issues might be recognized, additional facts may be needed, or confused concepts could require clarification. Going back and revising materials from earlier stages of analysis causes no harm. Aiming at completeness is more important than aiming at linearity and straightforwardness. If this step is included, a written analysis will more closely mirror real-life approaches to dealing with ethical problems.

The other aspect of process review is determining whether mistakes have been made throughout the analysis. Here it is important to make sure that consistency and objectivity have been maintained in the process. Just as in solving engineering problems, the ability to use reason is the key instrument in ethical analysis.[29] Reason can, of course, be influenced by subjective biases and subconscious elements. It is important that one be aware of and guard against such biases and elements, so as to reach a conclusion that has the potential to convince others of its reasonableness:

- Complete the process review on the work you've done so far concerning the ethical issues you raised about your professional/personal life and the Überlingen case—review the first 6 steps of the case-study procedure one more time. Have you missed any important facts? Do any of the concepts you have used require further clarification? Have you maintained consistency and objectivity throughout? Have your own unconscious or subjective biases influenced your analyses?
- When dealing with an ethical situation, do you think it is acceptable that your reasoning be influenced by biases? Why or why not? Explain a situation when biases might and might not be tolerable.

2.3.8 Resolving the Issue

After the process review, answers to the initially posed questions can be stated with some certainty. In real life, decisions have to be made. Even a failure to act typically results in consequences. In an analysis of the type conducted here, however, some claim they are unable to arrive at a conclusion, either because they do not have sufficient information or because they are unable to decide on the appropriate application of principles. Because of the nature of real-life consequences, however, such avoidance is acceptable only in very rare instances.

This step then involves clearly stating a conclusion. In addition, a short justification should be provided as to why the conclusion is appropriate. After working

29. Again, for more on this analogy, see Whitbeck (2011), and for a fuller discussion of this position, see Van de Poehl and Royakkers (2011).

on a case, a certain conclusion might appear to follow so obviously that no further explanation is required. However, the reasons for stated conclusions might not be as obvious to those unfamiliar with the case under consideration:

- Resolve the ethical issues you identified as the most important with regard to your professional/personal life and the Überlingen case, answering the questions you posed above.
- Provide brief justifications for these responses.

2.3.9 Identifying Practical Constraints

From a traditional ethical perspective, the previous step would complete an analysis. As indicated before, however, the approach taken here aims at recognizing and coming to terms with the realities of life in case-study analysis. For this reason, it is important to examine whether any practical constraints exist that would make an ethically acceptable action too difficult to expect from someone in the set of circumstances under consideration. This could include, for instance, deeply ingrained cultural norms. In the literature, these kinds of reasons for not acting ethically are called "excusing" or "mitigating conditions," and they would absolve someone for a part or all of the responsibility for not acting ethically. Rather than conceiving this inaction as simply a failure to adhere to ethical standards, it is more appropriate to think of these excusing conditions as part of a fuller and more complete ethical analysis. Practical constraints are a fact of life and should be acknowledged as such. Recognizing such constraints can allow one to avoid ethical problems in the first place:

- In your personal and/or professional life, have you acted in an unethical manner? List the practical constraints that prevented you from acting in an ethical fashion, explaining the nature of these constraints.
- Referring to the answers you gave to the ethical issues in your professional/personal life and the Überlingen case, do practical constraints exist that would prevent a resolution in the way you described? If so, then list and explain the nature of these constraints in relation to the issues.
- Give an example of how deeply ingrained cultural norms can create mitigating conditions in relation to the resolution of ethical issues.

2.3.10 Avoiding Ethical Problems

In addition to addressing the ethical issues with which one will be confronted, case-study analysis helps one to think ahead and avoid serious ethical quandaries in the first place. The most successful individuals are those who think ahead and plan for potential consequences of their actions. The best chess and basketball players, for example, are those who anticipate their opponents' moves ahead of time, perhaps even before the opponents themselves. This requires an

understanding of one's opponents specifically and human psychology in general.[30] The same principles apply in dealing with ethical issues.

Although circumstances sometimes require having to face and make difficult decisions with regard to ethical problems, at other times such problems can be avoided in the first place.[31] While this is easier to determine in retrospect than at the time—the saying in English, "Hindsight is 20-20," refers to this phenomenon—even hypothetical discussions can help processes of decision-making. However, this step should come at the end of case-study analysis rather than at the beginning, so as not to preclude the possibility of making hard choices:

- With regard to difficult ethical decisions you have made in your own life, might you have avoided making such decisions had you acted differently earlier? In other words, had you made different decisions previously, might you have avoided being in a position where you were confronted with a difficult ethical decision?
- Referring again to the questions you raised regarding your professional/personal life and the Überlingen case, could these issues have been avoided if different decisions had been made earlier? Explain your answer.

CASE STUDY—A HYPOTHETICAL CASE FOR STUDENT ANALYSIS: A HEATING UNIT DEFECT

The following is a hypothetical case included for readers to conduct their own sample analysis, either individually or in small groups. Begin by reading the case included below and, after having done so, write out the following:

1. Five ethical issues that appear in the case, stated as questions regarding what should or should not—might or might not—have been done.
2. State what you consider to be the main ethical issue, briefly giving reasons for why you consider it to be the most important ethical issue.
3. List facts provided in the case that are relevant to resolving the main ethical issue/answering this question, categorizing these in terms of material-/engineering-related facts, facts concerning individuals, and facts regarding organizations. Additionally, list any missing facts—information that is absent but would be relevant to resolving this issue.
4. List reasonable assumptions you can make regarding the missing facts/absent information needed to resolve the main ethical issue you identified above.

30. Regarding the benefits involved in empathizing with others and visualizing one's intended conduct, see Lu, Dane, and Gellman (2005).

31. The philosopher John Doris claims this is a major takeaway from findings related to situationist psychology: since small environmental factors make big differences in the ways persons and people behave—especially unconsciously—rather than "character," to avoid acting unethically, persons and people should avoid certain types of environments in the first place (Doris, 2005).

5. Review your work thus far, undertaking any necessary conceptual clarification.
6. Identify ethical principles relevant to the issue under consideration, determining a hierarchy and thereby resolving possible conflicts between them. (As readers have not yet been introduced to the full list of and justifications for principles of global engineering ethics—outlined in Chapters 3–11—they should refer to principles of right action that seem intuitive or with which they are already familiar, for example, "don't hurt others" or "do onto others as you would have others do onto you."[32])
7. Review your work thus far, determining the need for adjustments to any of the prior steps.
8. Resolve the ethical issue under consideration, reaching a final answer to the main question you identified previously. Briefly justify your decision.
9. Identify any practical constraints that might influence a purely ethical judgment.
10. Discuss ways the main ethical issue could have been avoided had different actions been taken earlier. Identify at least three.

John Smith is a young, single engineer who graduated from college about 2 years ago. Since that time, he has worked for the Kastor Manufacturing Company. His most recent assignment, which began 4 months ago, consists in developing a part to be integrated into a new electric heating unit the company is planning to market, mainly to young people living in small apartments. Smith is happy in his work since he likes and respects his coworkers. Smith's home life is a bit more troublesome: he lives with his elderly parents who largely depend on him to take care of them, since his father is unable to work due to a debilitating disease, and his mother is depressed all the time because of this.

Smith's work on the project goes according to schedule, although he is under some pressure to complete his part of the project. One day, however, his tests show that the part on which he is working will fail within the first 2000 h of service in approximately one out of every one thousand units in which it will be installed. Failure of the part could potentially result in the unit's overheating and a fire. Further testing reveals to Smith that in order to correct this defect, he will basically need to start his work over again. Naturally upset by this finding, Smith reports this problem to his supervisor, John Brady.

As usual, Brady is sympathetic to Smith's concerns, but when Smith asks for extra time to complete his portion of the project, Brady tells him in no uncertain terms that the part must be ready on time. Management has told Brady that the heater must be available on time, since Kastor's primary competitor will release a rival heating unit approximately a month after Kastor is

32. Again, a full list of the principles of global engineering ethics can be found in Appendix I and an analysis of the hypothetical "Case of Curious George" in Appendix II.

scheduled to release its own. Brady also tells Smith, confidentially, that Kastor is facing financial difficulties; at present, this information should be kept from the employees.

When Smith continues to express his concerns, Brady assures him that he will personally see to it that corrective actions are taken later. Brady will insist to management—at the possible expense of his job—that the part for which Smith is responsible be redesigned and any units that have already been sold be recalled. He tells Smith that in terms of the big picture, this is the most cost-effective way to handle the situation. Plus, Brady tells Smith, it is likely that most of the units will be recalled before any problems occur, since the units are likely to be used less than 2000 h during an entire heating season, and the recall should occur within 6 months.

EXERCISE—ANALYZE ENGINEERING A BETTER GLOBAL FUTURE

The case of the Überlingen midair collision involves the actual loss of life, and that of a heating unit defect concerns potential breaches in public safety. To ensure public safety, the case-study procedure can be used on incidences such as these to determine better courses of action, ones that keep people safe. By contrast, the case of Engineering a Better Global Future: Fusion Power Across Borders involves neither the actual loss of life nor potential breaches in public safety. Rather, it could be considered a case of "aspirational ethics," one where individuals and organizations have behaved in more exemplary manners and from which lessons can be learned. To ensure better outcomes, the case-study procedure can be used on situations such as these, not only keeping people safe but also improving their lives:

- Returning to Engineering a Better Global Future in Chapter 1, complete the same 10 steps of the case-study procedure you carried out on a situation related to your professional/personal life and the Überlingen case.
- Other than case studies, what do you think are ways engineers in global contexts can better understand ethical issues? Explain your answer. Have you participated in these activities? Why or why not?

2.4 SUMMARY

In combination with the use of reason and role responsibilities of engineers, case-study analysis is an essential aspect of a global approach to engineering ethics. The case-study procedure is part of a "ground-up," reciprocal approach to ethics—examining individual instances following the case-study procedure, generalizing an ethical framework on this basis, bringing this framework to bear on further instances, and so on and so forth. This approach is important as general disagreement exists regarding ethical theories, especially in global and cross-cultural contexts, and because the fields of engineering and technology

are constantly and quickly changing, such that a malleable and adaptive approach to ethics is necessary. As the hypothetical case of A Heating Unit Defect makes clear, in many instances, it is difficult to determine a clear and correct course of ethical action. Rather, one has to make reasonable assumptions when information is unavailable, determining and employing relevant principles to the best of one's ability.

REVIEW QUESTIONS

1. List three skills utilized by students and practitioners during case-study analysis. Explain two situations in which these abilities would be essential for a global engineer.
2. Explain "value connotations."
3. What makes definitional clarification especially important in relation to the global context of engineering ethics?
4. What steps should one take if conflicts arise between available principles during ethical analysis?
5. Why is "iteration" important to the case-study procedure?

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