My Academic Engagement With Engineering Ethics

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My introduction to the subject of engineering ethics was not the result of a planned undertaking. Instead, as with so many aspects of my academic career, it was the result of chance events. Here is my story.

My Educational Background

My formal education includes a Ph.D. in philosophy from the University of Wisconsin, Madison. I began teaching courses in ethics in the late 1960's. Given my educational background at this point in time, and given what was happening in the world outside of academia, it would not have been easy for anyone (including myself) to predict that in a little more than 12 years down the road I would be developing a strong interest in ethics in engineering. The late 1960's was marked by the controversial Vietnam war, riots in major U.S. cities, the height of the civil rights movement, and a variety of fundamental social changes that were clear indicators that the "quiet years" following World War II were over. Yet, my graduate education in ethics centered around metaethical concerns about the language and logic of moral discourse. Little was said in the classroom or standard ethics texts of the time about the issues of the day outside that academic setting. Nothing was said about ethical problems in engineering.

However, my first course in teaching ethics at Eastern Michigan University in the fall of 1967 provided me with an academic "wake-up call." Armed with the most current philosophical theories about ethics I had recently learned in my graduate studies, I was greeted with vigorous objections from my students. "We don't like all this dry theoretical stuff—it's not *relevant*!" "Not relevant to what?" I asked. "Not relevant to helping us deal with the real ethical challenges all around us—racism, an unpopular war, street riots, illegal drugs, sexual liberation, and so much more. Isn't ethics supposed to be *practical*?" Yes, I agreed, it should be. And, yes, I had to agree that my graduate student preparation in metaethics had not addressed such challenges. In fact, some philosophers even insisted that metaethics had *no* normative, practical implications. My students' complaint that what I was teaching lacked practical impact launched my search for ways in which philosophical ethics could be relevant to the fundamental ethical challenges of the day.

Political philosophy was an entry point for me. But even that seemed to fall short of what I was looking for, as it tended to focus on ideal schemes of political thought without clearly addressing questions about how to connect the ideal and the real. Then I noticed that new developments in the world of medicine seemed to provide a rich context for philosophical thought. Now there were machines that could sustain functioning hearts even though patients' brains seemed

virtually inactive. Were they still alive? Would it be permissible to "pull the plug"? Now there were machines that could help diabetes patients live longer. But, if there were more patients in need than the machines could serve, which patients should be served first? Physicians, nurses, and other medical professionals had to address such questions, and they began to seek help from philosophers. At the same time the public became aware of ethically questionable medical research, such as the Tuskegee syphilis study. A national commission (the Belmont Commission) was assembled to recommend ethical guidelines for conducting research involving human subjects. Philosophers such as Tom Beauchamp and Stephen Toulmin played leading roles in formulating the influential Belmont Report, whose guidelines provided a philosophical basis for policies on research ethics at colleges and universities. Although I took an interest in these developments, it still did not occur to me to ask what engineers roles and responsibilities might (or should) have in the development of technology in medical practice and research.

At About this same time business ethics began to attract the attention of some philosophers. Economist Milton Freidman published a much discussed *New York Times* article in which he denied that corporate enterprises have any social responsibilities as such. Their responsibilities, he argued, were restricted to making money for their owners, the corporate stockholders. This article triggered a large outcry on behalf of stakeholders—those who, while lacking stock in corporations, nevertheless had a large stake in how corporations were affecting their lives. As I began exploring these issues, it still had not occurred to me to ask what responsibilities engineers have as corporate employees.

Instead, my major research interests were directed at the work of psychologists Lawrence Kohlberg and Stanley Milgram, both of whom were developing powerful theories about the moral development of children, and even adults. These theories seemed to cry out for philosophical analysis. Allegedly based on empirical work, their psychological theories seemed to borrow heavily from philosophical ideas, particularly in the case of Kohlberg, who placed Immanuel Kant at his highest stage of moral development.

In my own case, it seemed to me that paying attention to how one moves from birth to some level of moral understanding and concern was philosophically important. I was especially interested in getting clearer about the relationships between the cognitive and affective dimensions of moral development. In my doctoral dissertation I had examined the morally limiting case of sociopaths, those who seemingly lack conscience despite being quite intelligent and able to persuade others that they do have genuine moral concerns. This exploration of psychological aspects of moral life was not encouraged in my graduate studies; but, in retrospect, it was probably an indicator of my wanting some sort of integration of my philosophical studies with the empirical world outside of philosophy.

My Start in Ethics in Engineering

As it turns out, the twists and turns of my struggles to make such connections by "stepping outside the box" seems to have left me open to chance encounters that eventually would lead me to unexpected places in my academic life. In the mid 1970's I had a chance conversation with Robert Ladenson, a philosopher I knew at the Illinois Institute of Technology in Chicago. He

told me that IIT was about to launch a center for the study of ethics in the professions. Although I made a mental note of this, I recall wondering what such a center might actually do. But I had other matters to occupy my time and attention. In 1974-5 I went on my first sabbatical leave, spending a wonderful year in England, at Oxford University. There I pursued my interests in moral psychology, writing critical essays on B.F. Skinner's radical behaviorism and Lawrence Kohlberg's 6 stage theory of moral development, as well as exploring the 17th and 18th century writings of Joseph Butler, David Hume, and Thomas Reid. Excited by this work, and by the opportunity to spend extended time studying elsewhere, I applied for an NEH year-long fellowship on moral psychology held at Yale University in 1977-8. So, within a four year period, I managed somehow to spend two of them away from my own university.

On returning to Western Michigan University, I had another chance conversation with Robert Ladenson. This time he told me that IIT's new ethics center was hosting a two week workshop on ethics in engineering in the summer of 1979. Perhaps I might be interested in attending, he suggested. "Ethics in engineering?" I puzzled. "What could that be about?" Now captured by the travel bug, I decided it might be fun to find out. Although I had no first-hand understanding of engineering, I did have an uncle who was a successful engineer. Lacking a degree in engineering, he had nevertheless spent several years working on secret military projects in Idaho after World War II. In addition, math and science classes were my favorite subjects in high school, and for a while I thought I might want to become some sort of engineer. However, once I took my first philosophy class in college my attention shifted away from my favorite high school subjects, and I focused on philosophy and psychology. Still, I recalled reading my first serious non-fiction book at age 11. It was Harrison Brown's *Must Destruction be Our Destiny*, written just a short time after atomic weapons were used in World War II. As a young scientist, Harrison Brown had worked on the Manhattan Project and subsequently distinguished himself not only as a research chemist, but also as a scientist who wrote and spoke about the serious dangers our ways of dealing with other countries and our responses to environmental and population concerns were sorely lacking (*The Challenge of Man's Future*). Shortly after publishing his first book, he barnstormed the country, giving more than 300 lectures at colleges and universities about the need for some form of international cooperation to make certain that no further use of atomic weapons would be made. [Some 50 years later, as a member of the local Torch Club in Kalamazoo, Michigan, I joined a small group of fellow professionals having a conversation before the scheduled monthly dinner and talk. Dr. Fred Margolis, well-known in the community and also my children's physician, was fondly recalling what he had heard Harrison Brown say in one of those lectures!]

Harrison Brown was my mother's cousin. I found a copy of *Must Destruction be Our Destiny* on the shelves of my grandparents. On the jacket of this book was a strong endorsement by none other than Albert Einstein. I had already heard of Einstein, and I had also learned that we shared the same birthday (different years, of course!). With the encouragement of my grandparents, I read through this book as a 5th grader.

So, in the summer of 1979 perhaps I was ready to investigate ethics in engineering after all. In any case, I decided to join about a dozen other teachers of ethics and a similar number of engineering faculty to discuss ethical issues in engineering. We were joined by a group of guest speakers who were well known for writings related to ethical issues in engineering and

technology. (E.g., Stephen Unger, an electrical and computer engineer, author of *Controlling Technology and the Responsible Engineer*; and Loren Graham, an historian who was writing *The Ghost of an Executed Engineer.*) Many of the engineers were very reluctant to acknowledge that they knew much about ethics, and the ethics teachers were similarly reluctant to acknowledge that they knew much about engineering. The ethics teachers were more right about this than the engineers. Only one participant had advanced degrees in both areas. As it turned out, all of us had much to learn from each other, most importantly how we might acquire common ground that, despite our obvious academic differences, would enable us to learn to talk meaningfully with each other about ethical issues in engineering.

At the outset of the workshop, I learned an important lesson about what this would require. Gerald Dworkin, a very good philosopher from the University of Illinois, Chicago Circle gave what I thought was an excellent, highly understandable lecture on ethical relativism. However, the first question came from a very able engineer: "What were you talking about? I didn't understand a word of what you said." The problem was that Dworkin had failed to mention of how the theme of his talk might apply to engineers. For example, no mention was made of problems engineers might face because of differences they might find in some practices when working in another country. For example, attitudes toward bribery might be found to be strikingly different. Suddenly it was clear to me that, just as engineers would have to "translate" some of their concepts and terminology for the ethics educators, the ethics educators would have to do the same for their concepts and terminology. It could be done, but not necessarily with ease. This would turn out to be a test for all.

An Instructive Example

In our Chicago workshop, perhaps the most useful means of making headway in regard to finding ways to communicate across disciplines was to discuss case studies. Some, such as a recent series of DC-10 airline crashes, were well-known to the public. However, an equally if not more effective feature of the workshop was the discussion of cases made-up and analyzed by the small working groups of engineers and ethics teachers that Vivian Weil had us form. My group focused on a fictional case developed by Notre Dame's James Taylor, a civil engineer who specialized in traffic safety. As it turned out, our discussion of this case continued through "snailmail" for more than a year after the workshop. Seemingly simple and straightforward, this case continued to serve as a useful tool in my subsequent teaching for more than 35 years!

Here is, roughly, what James Taylor invited us to discuss:

> David Weber is a young civil engineer who specializes in improvements for roads in District 7, an eight-county district within a midwestern state. It is near the end of the fiscal year, and David's supervisor informs him that, because of a delay in the delivery of a new snow plow, the district has some uncommitted funds available to be spent within the current fiscal year. He asks David to suggest a project (or projects) that can make good use of the money before the fiscal year ends.

After careful consideration of potential projects, David narrows his choice to two possible safety improvements at intersections within his eight-county district. The expenditure would be about the same for each, and either one would virtually exhaust the available funds. Site A is the intersection of Main and Oak streets in the major city within District 7. Site B is the intersection of Grapevine and Fir roads in a rural area of District 7. Both sites, David has determined, would benefit from the installation of signal improvements.

Here is the pertinent data David is able to gather regarding the two sites:

	Site A	Site B
Main road traffic (vehicles/day)	20,000	5,000
Minor road traffic (vehicles/day)	4,000	1,000
Fatalities per year (3 yr. average)	2	1
Injuries per year (3 yr. average)	6	2
Property damage (3 yr. average)	40	12
Proposed improvement	New Signals	New Signals

A highly respected highway engineering textbook includes a table of average reductions in accidents resulting from the installation of the types of signal improvements for which David thinks the available money could be used. The tables are based on studies of intersections in urban and rural areas throughout the United States during the past 20 years.

	Urban	Rural
Percent reduction in fatalities	50	50
Percent reduction in injuries	50	60
Percent reduction in property damage	25	-25*

*Property damage-only accidents are expected to increase at the rural intersection because of an increase of rear-end accidents due to increased stopping of higher speed traffic in rural areas.

David recognizes that these reduction factors represent averages from intersections with a wide range of physical characteristics (number of approach lanes, angle of intersections, etc.), in all climates, with various mixes of trucks and passenger vehicles, various approach speeds, various driving habits, and so on. He has no special data about sites A and B that suggest that relying on these tables is likely to misrepresent the circumstances at these sites.

Given this admittedly over-simplified representation of the intersections, most students quickly calculate that Site A should clearly be the preferred site for the improvement. The most glaring difference they focus on is the expected reduction in fatalities. The flow of traffic through Site A is four times greater than that through Site B. So, four times as many drivers are being served, and more lives will be saved (1 per year vs. 1 every other year). When asked to explain their

preference for Site A, utilitarian-sounding reasons like this are readily offered. Often someone will say, "It's the greatest good for the greatest number."

If the analysis were to stop here, many students might conclude that what ethics in engineering amounts to is basically "crunching the numbers" in order to determine what the highest balance of good over bad consequences is likely to be. This is one way of trying to come up with a cost-benefit analysis. Of course, quantifying things like the loss of a human life is challenging and, some would say, wrong-headed. Still, other things being equal, whatever numbers might be applied to the loss of a human life, the "cost" of losing two lives is twice that of losing one. Some might argue that saying only this is not right; the loss of some lives is more "costly" than the loss of others. Some are fathers or mothers who leave their children to the care of others. Some are prominent members of the community or the government, while others are unemployed or otherwise unproductive. But assessing the worth of a human life in these ways is quite contentious.

So, this sort of utilitarian thinking quickly gets complicated. Still, there is no reliable way of comparing and contrasting the respective populations that navigate their way through Sites A and B. However, there is another complication that at least some students bring up. As these intersections are right now, which one poses greater risks to drivers, A or B? Based on the numbers, it certainly looks like B is more risky from the standpoint of fatalities and injuries. If one had a choice of which intersection to drive through and wished to minimize personal risk, wouldn't one choose A over B, despite the greater number of fatalities associated with A? Of course, drivers might well consider other factors, as well—such as how much time it takes to travel one route as compared with the other. That is, questions of convenience might loom larger for some drivers than those of safety.

At this point it is interesting to note the extent to which David has already made some ethical decisions. His supervisor has asked him to recommend how the newly available money might be used for road improvements. David has come up with two possible recommendations—both of which focus on *safety* improvements. But improved safety is only one possible kind of improvement. Filling potholes could improve rider *comfort*, perhaps cut-down car *repair* expenses, or increase *efficiency* in travelling from one place to another. How has David come up with *safety* as the priority? Admittedly, most engineering codes of ethics say that engineers are to treat safety, health, and welfare as paramount. But to say that there is a duty to hold these values paramount is not to say that these are the *only* values that should be upheld by engineers.

Still, it seems that, as someone with special responsibilities regarding safety, David should be exploring differences in safety risks; and safety risks at these two sites may seem to him to be particularly problematic. He, like most of my students, might then focus only on the question: Which site improvement would likely result in the *greatest* improvement in safety. But suppose he also asks which safety improvement is more *fair* to those who travel within District 7? All residents of District 7 pay taxes that are used for funding the roads. Does this entitle them to at least minimal fairness regarding the road benefits to be received? This question does not assume that a more broadly utilitarian and quantitative approach will result in unfairness. But this is precisely one of the worries that critics of utilitarian approaches have. Will the minority suffer at the expense of the majority? Grounding decisions in

consideration of entitlements and fairness seems to be a different sort of grounding than a principle like "the greatest good for the greatest number"—even if, much of the time, these groundings have the same outcome.

Another matter that might come up for someone like David in a case like this is the question of whether David himself has a vested interest in which site is selected. What if David (and/or his close friends) regularly pass through Site B and hardly ever Site A? Or vice-versa. Would this affect his judgment (thus posing a conflict of interest for him)?

So, this seemingly simple case turns out to be a much more complex one—one that closer examination reveals possibly conflicting values that call for further reflection.

At this point, philosophers may be tempted to pause and talk about ethical theories (the various 'isms,' such as utilitarianism). This, it turns out, can pose several problems. First, an entire semester can easily be devoted to discussing ethical theories, without ever mentioning engineering. This is common in introductory courses in ethics that are taught in philosophy departments. Second, theoretical discussions of philosophical theories are notoriously inconclusive, with seemingly deep differences being revealed but seldom resolved. Third, in their eagerness to come up with answers to questions, rather than more questions, engineering students might understandably be dissatisfied with both of these problems. Finally, attempting to clarify big ethical theories before wrestling with particular problems may be a questionable procedure in the first place. Such a "top/down" approach may be a bad fit for the resolution of a practical problem. In fact, questions about the best way to handle questions concerning the relationship between ethical theory and practice has, to some extent, been an issue among the authors of *Engineering Ethics: Concepts and Cases*, as well as between those authors (of whom I am one) and Michael Davis (IIT, philosopher), one of the leading figures in engineering ethics today. As for me, I have consistently held the view that ethical theory needs to earn its way into the discussion of ethical issues in engineering. It is not clear, for example, that we need to discuss the large theories of ethics in order to articulate why something like falsifying data in order to be awarded a research grant is wrong. How theoretically far we need to go to get a good handle on James Taylor's case is perhaps another matter; but avoiding getting lost in a philosophical thicket may be desirable in wrestling with ethical problems in engineering.

However, questions about when, and to what extent, the ethical theories of philosophy are needed to resolve a particular case study under consideration are not the only ones that can be raised. There are also questions about whether enough details about a case are presented. For example, one might want more information about Sites A and B, let alone about other areas of possible improvement under David's purview. This is a fair criticism, but in one important respect it misses the mark if we are trying to illuminate the ethical dimensions of the sort of problem facing David. Just considering the factors presented, it seems clear that there is more than one set of ethical values that need to be brought to bear on the case. If one looks exclusively through utilitarian lens, only certain sorts of additional factors will be sought and brought forward as evidence in support of one decision or another. These factors might well be important for a good decision. But are they the only sort to consider? Those who are concerned about entitlements and rights could well say, no. In fact, those who take "the road less travelled" might say that they worry that Site B will, from a utilitarian perspective, have to get a lot worse

before Site B (and they) will be taken seriously. Suppose Site B gets worse (more dangerous) and many drivers avoid it, preferring now to go through the improved Site A. *Many*, but not *all*, may easily be able to avoid the intersection they find more objectionable. But some may not have the "luxury" of re-routing to avoid the more dangerous Site B. They might work just around the corner from that intersection. Or their children might go to the school that is near that intersection. Or—after all, that intersection was put there for a reason(s).

There is another possible problem that David (or at least District 7) needs to consider. There might be popular support for road improvements that have little to do with improved safety, but much to do with convenience, or with the maintenance of vehicles, or with the "comforts" of drivers. What if the remaining money could be used to smooth out potholes and other irregularities in some of the roads in District 7. This may not reduce fatalities or accidents, but it could reduce driver complaints. How rough do the roads have to get before such complaints should be allowed to take precedence over safety issues? What ethical groundings should there be for engineering recommendations about such matters? Whatever they are, it seems clear that saying that one need only "crunch the numbers" is not an adequate answer. Even if that, in the end, is what one opts for, this calls for some sort of justification that itself is not simply a matter of number crunching.

The Importance of the NEH and NSF Workshops

With the encouragement and support of Vivian Weil, the 1979 NSF workshop spawned a number of collaborative efforts in engineering ethics. In fact, she and Robert Baum arranged for a gathering of participants from her NSF group and a similar group of engineers and ethics teachers that had participated in an NEH workshop organized by Baum in the summer of 1978. The two groups met at RPI in the summer of 1980. Baum and Al Flores (RPI, philosophy) had assembled two large volumes of papers on engineering ethics (*Ethical Problems in Engineering*, Vols. I & II), published by RPI's ethics center. Baum had just published his Hastings Center monograph, *Ethics and Engineering.* Also, Mike Martin (Philosophy) and Roland Schinzinger (Engineering), had begun collaborating on the first edition of their *Engineering Ethics*. This was an exciting project they began as participants in Baum's 1978 NEH workshop.

The 1980 workshop was also attended by Daryl Janowitz, one of my engineering colleagues at WMU with whom I had begun to have fruitful exchanges. Unfortunately, shortly after returning to the WMU campus, he suffered serious brain injury from an accident and was unable to continue teaching. However, by this time the dye was cast for my continued work in engineering ethics. Although none of the other engineering faculty at that time volunteered to join me in teaching engineering ethics, several invited me to be a guest lecturer in their classes. But before long I was encouraged to develop my own course in engineering ethics, which was listed as a general education course in my philosophy department. Most of the students were from a variety of engineering programs at WMU, and I treated them to a steady diet of famous engineering cases—for example, the Bay Area Rapid Transit (BART) whistleblowing case, the Goodrich brake scandal, the Ford Pinto tragedies, the Hyatt-Regency walkway disaster, the Three Mile Island scare, the Challenger disaster, and so on. This was an ever-growing list.

I came to view these cases as "big news, bad news" stories. Soon, however, I became concerned that my students might conclude that this was the essence of engineering ethics. In addition to possibly having a rather depressing impact on my students, this approach seemed to be a bad fit for the kinds of engineering careers they would most likely have. After all, most practicing engineers are never directly involved in a newsworthy engineering disaster. In short, they are never going to be involved in "big news" stories. So, in 1990 my colleague Jim Jaksa (WMU, communication) and I applied for a two year NSF grant to interview everyday engineers about how they see ethics in their more typical worklives. As a result, we developed more than 50 fictional case studies based on the kinds of ethical challenges faced by everyday engineers, problems of the sort that most engineering students can realistically expect to have to deal with in their careers. These cases, as well as invited commentaries by ethics teachers and engineers, were published in a 1992 volume we sent to NSF entitled *Teaching Engineering Ethics: A Case Study Approach* (NSF Grant No. DIR-8820837). Many of these cases can still be found on the Online Center for Ethics in Engineering and the Sciences. Many of them also appear in all 6 editions of *Engineering Ethics: Concepts and Cases*, which I have co-authored with C.E. Harris, Elaine E. Englehardt, Raymond Janes, and the late Michael Rabins (Cengage, 1995, 2000, 2005, 2008, 2013, and 2017).

The story of the evolution of *Engineering Ethics: Concepts and Cases* is worth telling. Rachelle Hollander, then director of NSF programs on ethics and values in science and technology, deserves credit for stimulating our collaborative work. In the early 1990s Michael Rabins (Texas A&M, engineering) was interested in developing a set of case studies for his large class on engineering ethics. Familiar with my recently completed project, Rachelle Hollander suggested that he contact me about my work. His initial thought was that we might work together on his project. However, I told him that I knew of a very good moral philosopher, Charles E. (Ed) Harris, who was teaching ethics at Mike's home institution, Texas A&M. Ed was author of *Applying Moral Theories*, and I thought he might enjoy working with Mike in developing his set of case studies. Ed said yes, and they received an NSF grant to pursue that project. I served as a consultant on their project and was invited to visit the Texas A&M campus in the spring of 1991. We agreed to meet again in the fall of 1991 in Santa Fe at the 1st International Congress on Environmentally Conscious Manufacturing. It was there that we decided to undertake the task of writing a book that could be used as a text for teaching engineering ethics.

We published the first edition of *Engineering Ethics: Concepts and Cases* in 1995. By this time James Jaksa and I had undertaken a second NSF grant, this time to develop case studies that focused on exemplary practices of engineers. The incentive for this project came from the very last interview Jaksa and I conducted under our first NSF grant. We visited a small engineering firm in Denver that specialized in safety belts for those who wash the outside windows of high-rise buildings. This firm had been very successful in designing belts that easily satisfied the legal standards of safety that applied to belts that window washers had to wear when operating on the scaffolding that goes up and down buildings. To a person, the employees of this firm told us that, for them, high quality products were what they cared most about. The head engineer told us that he often worked overtime and weekends, at no additional pay, trying come up with a design for safety belts that would enable window washers to move the scaffolding up and down more quickly without compromising safety. Asked why, he said that when no one was looking,

the workers would often take off the legally required belts, freeing their connection with the scaffolding, but sometimes resulting in accidents. In support of his extra efforts, the engineer commented: "You just do the best you can; and even that's usually not good enough."

Reflecting on this engineer's attitude and efforts, Jaksa and realized that we had missed an important opportunity in earlier interviews. Indeed, we had managed to develop cases that were not of the "big news" variety; but only at the end of our interviewing had we come up with a case that was an alternative to "bad news." All of the previous examples had centered around pressures either to commit or avoid wrongdoing (e.g., falsifying reports, taking bribes, taking unwarranted shortcuts, getting caught in conflicts of interest, whistleblowing). Ironically, I had overlooked the fact that the case study developed by James Taylor in the 1979 IIT workshop was not of the "big news/bad news" variety. Whatever decision David would make, it would be unlikely to result in a story in the news. And the case did not focus on wrongdoing. It was, it seems, about what is the best decision, among the several that could be made.

We decided that something about how we had interviewed engineers must have encouraged them to talk about negative features of their working environment. Perhaps it was the direct invitation to talk about 'ethics' in this setting. Could this word itself have a negative connotation for them? We went back to NSF and asked for support for a project that would focus on the positive. What would the engineers interviewed regard to be good, or even exemplary, work? Much less is said about this in the media, but surely, we thought, there must be valued, successful work worth talking about. So, this is what we sought. The stories of disaster relief specialist Fred Cuny and Citicorp engineer William LeMessurier were exceptions to the predominantly negative stories featured in the news. But we found many other stories that would not be regarded as "newsworthy" in this way, but which could serve as examples of everyday engineering success and as illustrations of positive attitudes toward responsible engineering practice.

Some of this shift toward the positive made its way into the first edition of *Engineering Ethics: Concepts and Cases*. But subsequent editions have featured this even more, with the sixth edition giving more explicit attention to the virtues of highly responsible engineers. It is perhaps worth pointing out that each time we contemplated doing another edition, we asked ourselves whether we thought that another edition would enable us to make substantial changes and improvements in the previous edition. If we thought we had nothing new and significant to say, our decision would have been, no new edition would be desirable. However, we always concluded that we had room for significant changes—which we hoped would be improvements.

Sadly, prior to undertaking a fifth edition, Michael Rabins passed away. Ed Harris and I decided to go ahead anyway, inviting two new authors to join us. Raymond James (Texas A&M, engineering) had worked closely with the text in teaching the engineering ethics course at Texas A&M. Elaine Englehardt (Utah Valley University, philosophy) had extensive background in ethics and organizational communication, an area that needed further development. So, we invited them to join us in preparing the fifth (2013) and sixth (2017) editions.

Working With Others

Over my years teaching and writing about engineering ethics I have had the privilege of getting to know and work with a long list of others who have had the shared aim of developing engineering ethics as a fundamental area of academic and practical interest. The list I provide here is by no means complete, and I apologize to whomever I may have inadvertently omitted: Raja Aravamuthen, Robert Baum, Stephanie Bird, Roger Boisjoly, Taft Broome, Mark Bourgeois, Randal Curren, Jose Cruz, John Dilworth, Michael Davis, Marilyn Dyrud, Bernard Gert, Deni Elliott, Elaine Englehardt, Mark Frankel, William Frey, Jun Fudano, Theodore Goldfarb, Michael Gorman, Donald Gotterbarn, Charles E. Harris, Joseph Herkert, Rachelle Hollander, Mark Holtzapple, Chuck Huff, Samuel Florman, James Jaksa, Ray James, Deborah Johnson, Michael Loui, Matthew Keefer, Robert Ladenson, Ted Lockhart, Lee Lowry, Glen Miller, Keith Miller, Heinz Lugenbiehl, Mike Martin, Richard McCuen, Carl Mitcham, Dirk Moosmayer, Peter Parker, Sarah Pfatteicher, Michael Rabins, Kingsley Reeves, Sabine Roesser, Wade Robison, Roland Schinzinger, Brian Schrag, Grisselle Centano, Jimmy Smith, Nick Steneck, Lea Stewart, Ed Turner, Stephen Unger, Aarne Vesilind, Ibo van de Poel, Vivian Weil, Patricia Werhane, Caroline Whitbeck, Sandy Woodson, Daniel Wueste, Edmund Zhang, Qin Zhu.

Concluding Thought

What for me began as an unexpected opportunity to explore a different area of interest for two weeks in Chicago resulted in a more than 40 year commitment to helping develop engineering ethics as a fundamental area of concern to those whose interests in ethics are both practical and intellectual—with the latter earning its place in the academy and professional life because of its relation to the former.

My Most Relevant Publications, Presentations, and Awards

Books

2021 *Everyday Greed: Analysis and Appraisal*, co-edited with Elaine E. Englehardt, Springer. (Includes chapters by both editors.)

2018 *Teaching Ethics Across the Curriculum: Pedagogical Challenges*, co-edited with Elaine E. Englehardt, Springer. (Includes chapters by both editors.)

2017 *Engineering Ethics: Concepts and Cases*, with C.E. Harris, Elaine E. Englehardt, Raymond Janes, and the late Michael Rabins, Cengage. (Previous editions: 1995, 2000, 2005, 2008, 2013.)

2008 *Ethics in Engineering: Concepts and Cases*, 4th ed., with C.E. Harris and

Michael Rabins, Wadsworth. (1st ed. 1995; 2nd ed. 2000, 3rd ed. 2005.)

2006 *Professional Integrity: Thinking Ethically*, University Press of Kansas.

1997 *Practicing Engineering Ethics* (IEEE Engineers Guide to Business Series), with C.E. Harris and Michael Rabins.

1996 *Responsible Communication: Ethical Issues in Business, Industry, and the Professions*, co-edited with James Jaksa, Hampton Press. [Also author of "Computer Ethics: The Responsible Professional," and co-author with James Jaksa, "Introduction," and "Chernobyl Revisited."]

1992 *Teaching Engineering Ethics: A Case Study Approach*, ed. with James Jaksa, Western Michigan University Center for the Study of Ethics, NSF Grant No. DIR-8820837.

Articles

2015 "Ethical Theory and Teaching Engineering Ethics," with Elaine E. Englehardt, in Satya Sundar Sethy, ed., *Contemporary Ethical Issues in Engineering*, Hershey, PA: IGI Global Publishing.

2014 "Engineering Ethics: An Overview," with C.E. Harris, in J. Britt and Carl Mitcham, eds., *Ethics, Science, Technology, and Engineering: A Global Resource*, 2nd ed., 4 vols. Farmington Hills, MI: MacMillan.

2013 "Engineering Ethics," in *The International Encyclopedia of Ethics*, 1st ed., edited by Hugh LaFollette, Blackwell Publishing Ltd.

2009 "Professional Standards for Engineers," in Anthonie Meijers, Editor-in-Chief, Handbook Philosophy of Technology and Engineering Sciences: Part V: Normativity and Values in Technology, Ibo van de Poel, Associate Editor, Elsevier.

2002 "Conflict of Interest: The Very Idea," *Research Integrity*, Vol. 5, No. 2, Spring.

2001 "Response to 'Ordinary Reasonable Care is not the Minimum for Engineers' (M. Davis)," *Science & Engineering Ethics*, Vol. 7, Issue 2.

2001 "Responsible Engineering: The Importance of Character and Imagination," *Science & Engineering Ethics*, Vol. 7, No. 3.

2000 Review of Rosa Lynn B. Pinkus, et.al., *Engineering Ethics: Balancing Cost, Schedule, and Risk* (Cambridge, 1997), in *Technology and Culture*, Vol. 41.

2000 “Service-Learning and Engineering Ethics,” *Science and Engineering Ethics*, Vol. 6, Issue 3.

1999 “Introduction,” “‘The Concrete Sumo’--Exigent Decision-Making in Engineering” and “Commentary: Broome’s ‘Concrete Sumo’”, *Science and Engineering Ethics*, Vol. 5, Issue 4.

1998 “Professional Responsibility: Focusing on the Exemplary,” *Science and Engineering Ethics*, Vol 4, Issue 2.

1998 “Bribery: The Concept,” *Science and Engineering Ethics*, Vol. 4, Issue 3.

1997 “Responsible Engineering: *Gilbane Gold* Revisited,” with Mark Holtzapple, *Science and Engineering Ethics*, Vol. 3, Issue 2, 1997, pp. 217-230.

1997 Commentary on Michael Davis, “Better Communication Between Engineers and Managers,” *Science and Engineering Ethics*, Vol. 3, Issue 2.

1996 "Teaching Engineering Ethics: Why? What? Where? When?," with Michael Davis, C.E. Harris, and Michael Rabins, *Journal of Engineering Education* (American Society of Engineering Educators), Vol. 85, No. 2.

1996 “Communication in High Risk Technologies,” with James Jaksa, in Josina Makau and Ronald Arnett, eds., *Communication Ethics in an Age of Diversity* (University of Illinois Press).

1996 “Conflicts of Interest: Conceptual and Normative Issues,” *Academic Medicine*, December.

1993 Review: Deborah Johnson, ed., *Ethical Issues in Engineering, in Research in Philosophy and Technology*.

1992 "Good Works," *Professional Ethics*, Vol. I, Nos. 1 & 2, Spring/Summer.

1992 "Preparing Professionals for Ethical Responsibilities: The Role of Universities," with Michael Rabins (Mechanical Engineering, Texas A&M), in Mo Ramshidi, Mo Shahinpoor, and Joe Mullins, eds., *Proceedings of the 1st International Congress on Environmentally Conscious Manufacturing* (Albuquerque, NM: ECM Press).

1990 "Beyond Disaster Ethics," *Centennial Review*, Vol. XXXIV, No. 2.

1990 "Teaching Engineering Ethics: A Case Study Approach," *Michigan Professional Engineer*, Nov./Dec.

1987 "Ethics, Engineering, and the Examined Life: Educational Goals for Technical Schools," *Michigan Professional Engineer*, December.

Relevant Presentations

2013 Fall semester, Visiting Scholar at Hitotsubashi University, Tokyo, Japan. Seminar "Ethics and Life", with Elaine E. Englehardt, 25 students from 9 countries (7 three hour sessions).

2013 Series of presentations, in Japan with Elaine E. Englehardt: Sept. 11, "Building an Ethics Across the Curriculum Program; Sept. 12, "Contemporary Legal and Judicial Ethics"; Oct. 6, "Research Integrity in Academic Institutions"; Oct. 17, "Roundtable on Research Integrity for Shiseido Cosmetics, Global," with Shiseido executive representatives; Oct. 31-Nov. 2, "Ethical Analysis of Exome Developments in the Human Genome Project," "Moral Education and Blind Spots," and Pritchard *Keynote Address*, "Professional Integrity", 8th International Applied Ethics Conference, Hakkaido University, in Sapporo, Japan; Nov. 3-4, "Engineering Ethics and Moral Theory," and "Roundtable on the Future of Global Engineering Ethics," with Michael Davis and Jun Fudano, held at Kanazawa University; Nov. 11, "Research Integrity in Industry and Science, Research Center of Shiseido Cosmetics; Nov. 17, "Business Ethics and Corporate Social Responsibility," at Graduate School of Business, Chuo University, Tokyo; Nov. 21-3, "Building the Ideal Curriculum in Engineering Ethics," Tokyo University (workshop for 8 colleges and universities in Japan); Nov. 26, "Building Research Integrity into Japan's Curricula," at invitation of President of Hitotsubashi University.

2009 "Engineering Ethics in the United States," Conference on International Engineering Ethics, Kanasawa Institute of Technology, Tokyo, Japan, March.

2008 "What Should a Professional do When No One is Looking?" Lincoln Ethics Program Fall Lecture, Lincoln Center for Applied Ethics, Arizona State University, Polytechnic Campus (Sept. 18), and "Workshop on Teaching Ethics Across the Curriculum" (Sept. 18).

2002 St. Louis, "Teaching Ethics in Engineering and the Sciences: Accentuating the Positive," Conference on Ethics in the Education of Scientists, Clinicians, and Engineers, held at St. Louis University, sponsored by Sigma Xi, the Scientific Research Society, Feb. 8.

2002 SUNY-Stony Brook, "From Engineering to Ethics,...and Back Again", Conference on Ethics in Engineering, April 20.

2001 "Responsible Engineering: The Importance of Virtue and Imagination," University of Detroit, April 2.

2001 "Teaching Engineering Ethics," Visiting Scholar on Ethics in Engineering, University of West Virginia, April 12.

2001 "Responsible Engineering," Visiting Scholar on Ethics in Engineering, University of West Virginia, April 12.

2000 Respondent, Panel on "Doing the Minimum as an Alternative to Exercising Reasonable Care in a Professional Role," with Michael Davis and Patricia Werhane, Annual Meeting of the Association for Practical and Professional Ethics, Washington, D.C., February 26.

2000 "Teaching Engineering Ethics," workshop for faculty at Southern Illinois University, Edwardsville, April 14.

2000 "Professional Responsibility: Character and Imagination in Engineering," NSF "Green Processing" Institute (for undergraduate engineering students from across the country), North Carolina State University, June 16.

2000 "Service Learning: A Positive Approach to Teaching Engineering Ethics and Social Impact of Engineering," co-authored with, and presented by, Edmund Tsang (U. South Alabama), American Association of Engineering Educators Annual Conference, June 21.

2000 "Research Ethics at WMU," Michigan Council of Graduate Deans, Northern Michigan University, Sept. 29.

2000 "An Institutional Change Model for Teaching Research Ethics," Society for Ethics Across the Curriculum, Salt Lake City, Utah, Oct. 20. (Contents prepared with Sylvia Culp, Wayne Fuqua, David Hartmann, and Thomas VanValey, all of WMU. I made the presentation.)

2000 "Virtue and Imagination: On Being Ready to be Lucky," Society for Ethics Across the Curriculum, Salt Lake City, Utah, Oct. 21.

2000 Panelist, "An Evaluation of the NSF funded Online Center for Ethics in Science and Engineering," Albuquerque, New Mexico, November 8-10.

1999 "Engineering Responsibility: The Role of Character and Imagination," U.S. Naval Academy, February 24.

1999 "Service Learning and Engineering Ethics," International Conference on Engineering Ethics, Case Western Reserve, Cleveland, March 23.

1999 Seminar on Engineering Ethics, Annual Conference of the Michigan Society for Professional Engineers, Boyne Highlands, MI, May 15.

1998 "Imagination and Engineering Responsibility," Program in Science, Technology and Human Values, Duke University, February 19. Also presented to Michigan Society for Professional Engineers, East Lansing MI, Sept. 22.

1998 "Exemplary Professional Practice," Association for Practical and Professional Summer Institute on *Ethics in the Professions and Practice*, University of Montana, Missoula MT, August 4.

1997 "Liability and Ethical Issues for Engineers," American Association for the Advancement of Science Meetings, Seattle, WA, February 18.

1997 "On Being Professionally Responsible," Phi Kappa Phi Honor Society, University of Idaho, April 19.

1997 "Engineering Ethics," Lafayette College, Lafayette, PA, April 30.

1997 "Professional Responsibility," Ohio Northern University, Ada, OH, May 12.

1997 "Conflicts of Interest" and "Teaching Research Ethics," National Science Foundation Institute on Graduate Student Research Ethics, Association for Practical & Professional Ethics, Indiana University, June 7-8.

1997 "Good Works, A Case for Exemplary Engineering," public lecture, Princeton University, July 9.

1997 "Engineering Ethics," 3 hour lecture workshop for engineering faculty at Indiana Institute of Technology, Ft. Wayne, August 19.

1997 "Bribery," International Conference on Engineering Ethics, Duke University, September 15.

1997 "Responsible Engineering," Keynote Address, Midwest Association of Engineering Educators, University of Iowa, October 10.

1997 "Professional Responsibility in Science and Engineering," Ford Motor Company Chapter of Sigma Xi, The Scientific Research Society, Dearborn, Michigan, December 4.

1996 "Casuistry and Engineering Codes of Ethics," Association for Practical & Professional Ethics, St. Louis, Missouri, March 1.

1996 "Professionalism and Ethics," Michigan Society for Professional Engineers,

50th Annual Meeting, Boyne Highlands, Michigan, May 18.

1996 "What Do Professionals Do When No One is Watching?", Commencement Address for graduate students at Pacific University, Forest Grove, Oregon, May 20.

1996 "Codes of Ethics," Association for Practical & Professional Ethics Summer Institute on Ethics, University of Montana, July 23.

1996 "Conflicts of Interest," Association for Practical & Professional Ethics Summer Institute on Ethics, University of Montana, July 25.

1995 "Education for Responsibility: A Challenge to Engineers and Other Professionals," 3rd Annual Lecture in Ethics and Engineering, Center for Academic Ethics, Wayne State University, April 19.

1995 "Engineering Ethics and Professional Responsibility," Purdue University at Kokomo and Delco Corporation, October 19.

1995 "Why be Honest?", invited lecture in Alabama Humanities Program, "Making Responsible & Ethical Decisions," Mobile, Alabama, October 23.

1995 "What Do You Do When No One Is Watching? A Question of Responsibility," invited lecture in Alabama Humanities Program, "Making Responsible & Ethical Decisions," Mobile, Alabama, October 24.

1995 "Conflicts of Interest: Conceptual and Normative Issues," presented at conference on "Conflicts of Interest in University/Industry Relations," Case Western Reserve, Cleveland, October 30-1.

1994 "Teaching Engineering Ethics: Attitudes Toward Responsibility," Rochester Insitute of Technology, and guest lecturer in Engineering Ethics class, January 13-4.

1994 "Why Teach Engineering Ethics?", part of mini-plenary session on Teaching Engineering Ethics, American Association of Engineering Educators, Edmonton, Alberta, Canada, June 28.

1993 "Alternative Conceptions of Responsible Engineering," and "Methods of Presenting Ethics: Classroom Applications and Case Studies," Texas A&M Engineering Faculty Workshop on Ethics and Professionalism, Jan. 15-16.

1993 "The Use of Computers in Presenting Case Studies on Engineering Ethics," as part of special AAAS seminar, Teaching Ethics in Science and Engineering, Boston, February 11.

1991 "Ethics in Engineering," presenter and consultant at Texas A&M University, April 4-6.

1991 "Preparing Professionals for Ethical Responsibilities: The Role of Universities," with Michael Rabins (Mechanical Engineering, Texas A&M), 1st International Congress on Environmentally Conscious Manufacturing, Santa

1992 "The Responsible Professional," lst speaker in GTE Lecture Series on Ethics and Computing, University of Vermont, Sept. 24, 1992.

1991 "Ethics in Engineering," Keynote Address, Order of the Engineer, Student Society of Professional Engineers, University of Michigan, February l8.

1991 "Ethics in Engineering," presenter and consultant at Texas A&M University, April 4-6.

1991 "Preparing Professionals for Ethical Responsibilities: The Role of Universities," with Michael Rabins (Mechanical Engineering, Texas A&M), 1st International Congress on Environmentally Conscious Manufacturing, Santa Fe, NM, Sept. 18, 1991.

1990 "Engineering Ethics: A Case Study Approach," NSF Conference on Engineering Ethics, Chicago, June 12.

1988 "Ethics, Engineering and Technical Writers," Technical Writing Forum, Wayne State University, November 2.

1983 "Engineering, Ethics, and the Examined Life," invited speaker, National Meetings of the American Society of Engineering Educators, Rochester Institute of Technology, June 3.

1980 "Moral Reasoning and Engineering," 1st National Conference on Ethics and Engineering, RPI, June 22.

I also have made many presentations to various groups on topics such as business and professional ethics, engineering ethics, research ethics, and philosophy for children.

Grants and Awards

Principal Investigator, “Teaching Research Ethics: An Institutional Change Model,” WMU project funded by the National Science Foundation, 2001-3. Total funding for 2 year program: $225,000. No cost extension for a 3rd year (2003-4).

Co-Principal Investigator, “Ethics in the Science Classroom,” Summer Institutes for High School Science Teachers (conducted with Theodore Goldfarb, Chemist at SUNY at Stony Brook), National Science Foundation, June 21-4 (Orlando, Florida), July 21-4, 2000 (Seattle, Washington). $17,433 subcontract through SUNY at Stony Brook.

Final Review Panel, EVIST Program, National Science Foundation, 1996-9.
Consultant and Presenter, NSF supported Faculty Workshop on Teaching Ethics in Engineering and Business, University of Puerto Rico at Mayaguez, December 14-19, 1998.

Principal Investigator, “Ethics and Values in High School Science Classes,” National Science Foundation, Sept. 1, 1997-Aug. 31, 1998, $55,000. [Matching NSF grant to collaborator Theodore Goldfarb (Chemistry, SUNY at Stony Brook).]

WMU Sabbatical Leave, “Ethics in Science and Engineering,” 1997-8 Academic Year.

Consultant and Presenter, National Science Foundation program for junior and senior high school teachers, "Ethics and Values in Science and Technology," State University of New York--Stony Brook, Summer 1994--Spring 1997.

Co-Principal Investigator, National Science Foundation sponsored “Research Ethics: Workshop for Graduate Students in the Sciences,” held at Indiana University, 1996, 1997, 1998, 1999, 2000.

Consultant and External Evaluator, FIPSE grant, “Development and Pilot Testing of a Graduate Degree Program With a Specialization in the Teaching of Applied and Professional Ethics,” University of Montana, 1996-9.

Principal Investigator, "Ethics in Engineering: Good Works," National Science Foundation/Ethics and Values Studies, Sept. 1, 1994-Aug. 31, 1995, $48,000.

Consultant and Presenter, NSF sponsored “Planning and Scoping Workshop on Ethics,” University of Puerto Rico--Mayaguez, April 25-7, 1995.

Consultant and Presenter, NSF/Bovary Endowment “Workshop to Develop Numerical Problems Associated With Ethics Cases for Use in Required Undergraduate Engineering Courses,” Texas A&M University, August 14-18, 1995

Principal Investigator, "Teaching Ethics in Engineering: A Case Study Approach," National Science Foundation/Ethics and Values in Science Program, $125,000 grant, 1989-9.

Reviewer for IIT Center for the Study of Ethics in the Professions Module Series on

Engineering Ethics [Conflicts of Interest in Engineering], 1985.

Reviewer for Presentations at 2nd National Conference on Ethics and Engineering, March 4-6, 1982.

Invited Participant, NSF Chautauqua Program on Ethics & Engineering, University of Hartford, October 14-16, 1979 and March 3-5, 1980.

NSF Fellow, Workshop on Ethics & Engineering, Illinois Institute of Technology, July 16-27, 1979; July 16-22, 1980.