‘Where did you get that made up?’ – Professions of an engineering ethics ‘trail paver’

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Bill [Dickey] is learnin’ me his experience. ~ Yogi Berra (Neyer 2008)

I began my engineering studies in 1966 at Southern Methodist University, graduating in 1970 with a Bachelor of Science degree in Electrical Engineering. Over the next three decades my career interests changed from engineering to creative writing and back to engineering, then on to doctoral studies in engineering and policy, finally settling on engineering ethics and societal implications of technology as a focus for scholarship and teaching. I’ve chosen thirty years as an initial frame for this essay because around the turn of the century my role as a “trail paver,” if not a trailblazer, in the field of engineering ethics was marked by a number of personal milestones. In 1999 I was a Bovay Lecturer in Engineering Ethics at Cornell University and an opening session plenary speaker at an international conference on engineering and computer ethics (Herkert 1999). Also, in 1999 I was co-author with several of the biggest names in the field (Taft Broome, Michael Pritchard, Vivian Weil, and Michael Davis) of a set of articles in the journal *Science and Engineering Ethics* on “exigent decision-making in engineering.” In 2000 my first book, which highlighted social, ethical and policy issues in engineering, was published and my most cited article to date, which reviewed engineering ethics education in the US, appeared in the *European Journal of Engineering Education*. Also, in 2000 I was Program Chair for the Liberal Education Division at the annual meeting of the American Society for Engineering Education (ASEE) and was granted promotion and tenure in the Science, Technology and Society (STS) Program at North Carolina State University (NC State). And in 2001 my first journal article on microethics and macroethics in the engineering profession was published in *Science and Engineering Ethics*. Apart from my personal milestones, the implementation of the “Engineering Criteria 2000” by the Accreditation Board of Engineering and Technology (ABET n.d.) heightened interest in engineering ethics education and resulted in many more engineers becoming active in the field in the 21st century. While I’ve continued to work with and learn from colleagues and students in subsequent years, the period 1971-2001 was most influential in determining my interests and involvement in engineering ethics education.

Engineer, Poet

My first exposure to ethics in science and technology occurred in an undergraduate humanities course on “Science and Society” taught by STS scholar Wade Chambers. One of the course readings was *Hiroshima* by the journalist John Hersey (1966). Years later when I was a new assistant professor at a private liberal arts college I was on a committee rethinking the first-year curriculum. One of the group’s activities was to name books every student should read. While the other faculty mentioned various of the “great books” I nominated Hersey’s poignant account of the impacts of the nuclear bomb on several survivors of Hiroshima. Even today I consider it to be one of the most influential books I have read. Other than that course I had no exposure whatsoever to science and engineering ethics as an engineering undergraduate. I did, however, begin writing, first as a journalist then as a poet, which eventually led to acceptance into a Master of Fine Arts (MFA) Program in Creative Writing.

While studying creative writing at Bowling Green State University (1971-1973), I taught first-year composition courses including courses with the theme "Science and the Future." My students were mostly liberal arts majors, with perhaps some science, technology, and business majors mixed in. In teaching these sections I gained insight into some of the ethical dilemmas posed by science and technology but also the dual nature of the typical student's response to technology – while they held technology in awe, they also had a sense of alienation from it. This duality was aptly summed up by one of the course readings, an excerpt from Norman Mailer's account of the Apollo 11 moon landing (1971) which described the poor and working-class Americans who had assembled to view the launch of the rocket:

> He has spent his life with machines [but at the launch] will see a world begin where machines are king and he does not know whether to cry from pride or the all-out ache that he does not really comprehend the new machinery (p. 60-61).

As I taught this course, the thought occurred to me that there might be a role for a "translator" between technical experts and non-experts; someone, perhaps even an engineer-poet, who might be able to help people reconcile this dual sense of awe and alienation. I was reminded of this some years later when the futurist R. Buckminster Fuller, upon learning of my background in both engineering and poetry, signed a copy of his book *Critical Path* (Fuller & Kuromiya 1981) as follows: "To Joe Herkert /Engineer, poet – /who is a poet /because he is a /truly competent /engineer and visa [sic] versa /Bucky Fuller."

Nevertheless, upon graduation with my MFA I tried for a time to live the life of a poet-bartender; while this was good for my soul it wasn't so good for my wallet, so I decided to put my BS in Electrical Engineering to use. Beginning in 1974, I worked for five and a half years as a consulting engineer in the publicly owned utility sector of the electric power industry. Over this time, I worked for two consulting firms in three different cities, eventually obtaining registration as a Professional Engineer. My activities were varied, beginning with drafting and design of electrical substations, powerlines, and small power plants. Eventually I moved into distribution system and power supply planning studies, then electric retail and wholesale rate studies, then financial feasibility studies of major power generation and transmission projects.

During my engineering career I received many reminders that engineers with backgrounds like my own were considered an anomaly. Although working as an engineer I continued writing and began working on a series of poems entitled *Danger: High Voltage*. At one point I proudly displayed above my desk at work a poster about a poetry reading I was giving. The poster announced the time and place of the reading and included a photo of me wearing a hard hat and standing in front of a "Danger: High Voltage" sign at an electrical substation. It took a while for anyone to notice, but eventually a colleague laughed and exclaimed "That's great – where did you get that made up?"

This apparent disconnect between the culture of engineering and other forms of expression would later become a cornerstone for my work on engineering ethics and the societal implications of technology (Herkert 1994, 2001). In a poem in the *Danger: High Voltage* series, "Central Switchyard," I sought to highlight this disconnect as indicated in the following excerpts

(Herkert 1975): “The constant hum of the transformer /a chant //There is no humanity here /There is no machinery here //only wires //narrow alleys /of the imagination” and “At night /the electricians return /in quiet packs /to sleep //by the switchgear.”

During the time I worked as an engineer, I witnessed several ethical dilemmas, but due to my lack of any exposure to engineering ethics was not prepared to do much about them. These included ignoring surveying errors and failing to disclose mistakes in substation construction in order to avoid costly changes, as well as fudging cost estimates in planning or financial feasibility studies in order to bring more business to the consulting firms. Practices such as these served to introduce me to what I would later call “microethics” (Herkert 2001, 2005).

About midway through my engineering career, a colleague invited me to attend a short course on nuclear power. The first five sessions of the short course focused on the science and technology of nuclear energy but the last was entitled “Public Acceptance of Nuclear Power.” The gist of the latter talk was that anyone opposed to nuclear power was a “no-growth fanatic” duped by Communists, Ralph Nader (who, the speaker was quick to point out, was an Arab) and TV journalist Walter Cronkite. A few years later the speaker’s utility company halted construction of their nuclear power plant project after spending $2.5 billion on it, which at the time was the most expensive nuclear plant abandonment (Rangel 1984). This dubious introduction to “public acceptance” was my first personal encounter with what I would later call “macroethics” (Herkert 2001, 2005).

Another outcome of the short course was that I became a member of its sponsor, the Institute of Electrical and Electronics Engineers (IEEE). I also signed up for IEEE’s Committee on Social Implications of Technology (CSIT) which later became the Society on Social Implications of Technology (SSIT) (https://technologyandsociety.org/). CSIT published a newsletter, *Technology and Society*, which upon the transition of CSIT to SSIT became *IEEE Technology & Society Magazine*. The CSIT newsletter was my first experience reading articles by engineers on such topics as technology policy and engineering ethics. A variety of policy issues were discussed in the newsletter including extensive coverage of nuclear power. Ethics cases discussed in the newsletter included the classic case of the whistle-blowing BART engineers (Unger 1973). More importantly, the newsletter demonstrated to me that there was at least a small group of engineers in my field concerned about engineering ethics and the societal implications of technology. Due in part to my work on planning and financing of publicly owned utilities and in part to the influence of the CSIT newsletter and other reading, I eventually decided to go back to graduate school and pursue a doctoral degree in engineering and policy.

Real Engineers Wear Ties

My graduate work at Washington University in St. Louis (1979-1987) focused on implementation of renewable energy technologies in the publicly owned electric utility sector (the same sector I had worked in as an engineer). In my policy research I focused on institutional barriers to renewable energy in addition to technical and economic factors, unlike many engineering studies which minimized or ignored institutional factors. For example, one study when discussing institutional constraints on power systems noted:

> These include socio-political as well as psychological requirements. Since there is no uniform trend for these constraints and their effects on power system centralization are difficult to analyze, they have been explicitly excluded in the present study (Yu 1980, p.1978).

During this time, I also served as a Teaching Assistant in a course on "Technology and Human Affairs." Due to my professional experience, the instructor, the late Bob Morgan, asked me to teach the course unit on engineering ethics. Bob also advised me that I would have more credibility with engineering students if I wore a tie (advice I didn't follow). Later, when Morgan was on leave, I taught the entire course. This course was my first experience teaching engineering ethics content. Materials were scarce in those days – for engineering ethics material we relied primarily on the two-volume anthology of readings and cases edited by Baum and Flores (1978) and articles from the CSIT newsletter. When I taught the entire course, I also used the book *Powerline: The First Battle of America's Energy War* (Casper & Wellstone 1981) which was co-authored by the late Senator Paul Wellstone of Minnesota. The book chronicles the struggle of farmers to prevent a high-voltage DC powerline from being built across their prime farmland. It does a remarkable job of showing how even conservative farmers can become radicalized by a technology being shoved down their throat. It also shows the insensitivity of some engineers to the plight of the farmers. The powerline's route, for example, was determined by a numerical method that assigned zero "avoidance" value to farmland (pp. 63-65). This book and my research on renewable energy technologies in the electric utility industry gave me insight into the relationship between engineering ethics and public policy, a topic I have returned to throughout my career (Herkert 2004a).

My first full-time academic position was at Lafayette College (1986-1993). Lafayette is one of a few liberal arts colleges with accredited engineering programs. The position I was hired for was based in the engineering division but was designated "Technology Studies." I was charged with creating a Technology Studies Minor and working with the Bachelor of Arts in Engineering Program (since renamed Engineering Studies). I developed and taught a course on Technology, Values and Society and with two colleagues in the Chemistry Department developed a senior seminar on Technological Catastrophes which included major case studies of the Space Shuttle Challenger accident, the Chernobyl nuclear accident, the Bhopal chemical leak, and the Exxon Valdez oil spill, the latter of which occurred during the first course offering. I was also a key player in developing and teaching a new required course in Engineering Professionalism and Ethics. At the urging of a group of students in my Technology, Values and Society class I began to incorporate collaborative learning strategies in my teaching. One of those students, James Winebrake, is currently Provost and Vice Chancellor for Academic Affairs at University of North Carolina at Wilmington, and formerly served as Dean of the College of Liberal Arts at Rochester Institute of Technology (RIT). Winebrake helped establish the Grand Challenge Scholars Program at RIT and has written (2015) on the need for overcoming obstacles to more effective integration of STEM education and the liberal arts. During my time at Lafayette, I also attended my first ASEE meeting, eventually finding homes in the Liberal Education Division, now Liberal Education/Engineering and Society (LEES) Division (https://sites.asee.org/lees/), and the Engineering Ethics Division (https://sites.asee.org/ethicsdivision/).

A major factor in my development as a teacher and scholar in engineering ethics was my participation in the Ethics Project at Lafayette. The project, directed by philosopher George Panichas and funded by a small gift to the college, brought together faculty from philosophy, religion, engineering, science, business, and social sciences in a workshop designed to give us a background in moral philosophy, but also to share and refine strategies for teaching applied ethics within our disciplines. The Ethics Project also presented the opportunity for me to meet a number of prominent figures in the field of engineering ethics, including the engineer Steve Unger and philosophers Patricia Werhane, Deborah Johnson, and Vivian Weil. For example, I was a commentator on a talk Werhane gave at Lafayette on the Space Shuttle Challenger case; this commentary became my first publication on engineering ethics (Herkert 1991).

Johnson's visit to Lafayette was my first opportunity to observe an expert in engineering ethics lead discussions of ethics cases. I also gained a friend and mentor who has guided me throughout my career. Johnson's textbook *Ethical Issues in Engineering* (1991) was an early influence on my scholarship. Two articles in the anthology in particular made a lasting impression: John Ladd's (1991) essay criticizing codes of ethics which first introduced me to the terms "microethics" and "macroethics" and Langdon Winner's article "Engineering Ethics and Political Imagination" (1991) which argues that engineers have an ethical responsibility to become engaged in questions of public policy relating to technology (i.e. "macroethics"). Johnson has also been influential in that, like mine (Herkert 2006), her interests have been at the intersection of engineering ethics and STS. In her own words, her "…analysis emphasizes: the contingency of technology and the many actors involved in its development; a conception of technology as sociotechnical systems; and, the values infused (in a variety of ways) in technology" (Johnson 2007, p. 21). This contextual approach to engineering ethics fits well with my interests in examining collective moral responsibility of the engineering profession as well the role of professional engineering societies in promoting and supporting ethical behavior (Herkert 2001, 2003; Herkert & Borenstein 2020).

I was among a small group of Ethics Project participants to visit the late philosopher Vivian Weil (Hollander et al. 2017) at the Center for the Study of Ethics in the Professions (CSEP) at Illinois Institute of Technology. I returned from the visit with an armful of CSEP publications, a notepad full of ideas for my teaching and research, and another longtime friend and mentor. Vivian always checked in with me at conferences and meetings, and often by email, equally concerned about my professional and personal well-being. She never missed an opportunity to introduce me to colleagues and make me feel welcome in the growing engineering ethics community. Once when we were at a conference I introduced Vivian to an engineering colleague who then asked if Vivian was my spouse. Vivian and I had a laugh about this, but I later told her that I should have said that she was my mother since she was, indeed, the mother of engineering ethics!

Also, as part of the Ethics Project, I invited the late Steve Unger (Herkert & Andrews 2023), one of the founders of CSIT/SSIT, to speak at Lafayette. When he found out that I was an SSIT member, Steve invited me to a meeting of the group's Administrative Committee. At that meeting I was appointed Publications Chair and for the next 25 years served SSIT as an officer, board member, committee chair, and/or Editor of the society's journal *IEEE Technology and Society Magazine*. Unger's work in engineering ethics was to a great extent based upon his experience working on ethics within IEEE. Largely due to his influence, as well as my own

experiences after joining the leadership of SSIT, one major aspect of my scholarly work has been connecting ethics-related activities within the profession with scholarly work on engineering ethics (Herkert 2001). Unger also influenced my teaching; I used his textbook *Controlling Technology* (1994) for many years in my engineering ethics classes. I served as SSIT President in 1995-1996 and throughout the nineties and beyond benefited from interaction with Unger and other SSIT leaders including the historian of technology, Ron Kline, whose work on integrating engineering ethics and STS (Kline 2001) was, like Johnson's, influential in my teaching and scholarship. In addition, Kline's award-winning editorial in *IEEE Technology and Society Magazine,* "'Engineer of Death' or 'Winning with Technology'?" (1991) which took to task an ad that was run by the US branch of IEEE following the 1990-1991 Gulf War, was an impressive example for me in "speaking truth to power." As Kline concluded his editorial: "… 'Winning with Technology' means taking into account the social implications for *everyone* concerned – a fitting goal for a professional society aspiring to be transnational."

While at Lafayette, I was also reminded of the suspicion engineers had for a person of my background when an engineering colleague commented that I wasn't a "real engineer." Ironically, at the time this comment was made I was the only member of my department who was a registered Professional Engineer! Following a talk I gave on risk assessment and the culture of engineering which highlighted the findings of social scientists on the value of non-expert risk perceptions (Herkert 1994), word spread in the engineering building that I was "anti-technology." The fact that I wasn't perceived as a "real engineer" by some colleagues may have played a role in my not receiving tenure at Lafayette. The College President was rumored to have said to my tenure committee something to the effect that engineering faculty should be in their declining years before they become engaged in topics like engineering ethics and societal implications of technology.

Although I was denied tenure at Lafayette it is gratifying to know that the Engineering Studies Program, for which I helped lay some early groundwork, has become well-established. Now after more than 50 years, the program, "recognizing the increasingly complex challenges of sociotechnical systems," continues to give students a strong interdisciplinary background in engineering and the liberal arts despite continuing to encounter resource and other challenges such as program identity (Bernhardt & Rossmann 2019; Rossmann, Sanford & Cohen 2021).

Real Ethicists Don't Wear Fluff

My next academic stop was NC State (1994-2007) where I was hired into the Division of Multidisciplinary Studies (now known as Interdisciplinary Studies) in the College of Humanities and Social Sciences. The job description specified an STS scholar with science or engineering credentials. One of my main responsibilities was working with the Benjamin Franklin Scholars (BFS) Program, a dual degree program in engineering and humanities/social sciences (Herkert & Lavelle 2005). I ultimately became the Director of the BFS Program reporting through the Dean's offices in both colleges. I also worked with the STS Program, eventually becoming program Director. My teaching duties included an inherited engineering ethics course, an introductory STS course, and the Technological Catastrophes course I had co-developed at Lafayette College (Herkert 2004b). In addition, I taught STS seminars in the Master of Liberal

Studies Program for which I won two Outstanding Instructor of the Year awards. I also taught online for the first time, developing an online version of the engineering ethics course.

Now that I was based in a humanities/social sciences college I encountered skepticism from "real" philosophers and social scientists. One philosopher commented at a college curriculum committee meeting that courses such as engineering ethics and biomedical ethics weren't ethics at all but only so much "fluff." At a meeting of a different committee a historian commented that the "history of technology" was not a legitimate "field" of history.

Shortly after I arrived at NC State my senior colleague, Pat Hamlett, suggested that I focus my scholarship on engineering ethics. One step in this direction was to attend an ethics workshop at the University of Montana sponsored by the Association for Practical and Professional Ethics (APPE) (https://www.appe-ethics.org/) and convened by Deni Elliot. At the workshop I attended a seminar on engineering ethics taught by philosopher Michael Pritchard who would become a good friend and major influence on my career. Pritchard is particularly gifted at working with engineers; his example has been of great help to me as I've tried to bridge the gap between my own interdisciplinary background and that of "real engineers." Pritchard (2001) was also a pioneer in emphasizing the personal characteristics that lead to admirable ethical behavior in engineering, as opposed to dwelling on engineering failures, a concept that I have found useful in connecting with engineering students.

Through APPE's annual meetings I was able to reconnect with folks I had met earlier, including Weil and Johnson, as well as make new connections in the field of engineering ethics. At my first APPE meeting I made a presentation on collaborative learning at a mini-conference on engineering and computing ethics; my contribution (Herkert 1997a) and other mini-conference presentations were published in a special issue of *Science and Engineering Ethics* guest-edited by Michael Loui. Loui was not only a skilled and supportive editor but, like Unger, he was an exemplar for me on how an engineer could make their mark in the field of engineering ethics. Soon thereafter Loui and I were part of an *IEEE Spectrum* roundtable on engineering and computing ethics that I helped organize (Sweet 1998). We later worked together within SSIT and the National Institute for Engineering Ethics (NIEE) (discussed below). Through APPE and other ethics conferences, including one sponsored by the Engineering Foundation, I also met and learned of the contributions to the field of engineering ethics of other engineers including Roger Boisjoly as well as other philosophers including Caroline Whitbeck, Ed Harris, and Michael Davis.

The late Roger Boisjoly (1991), the Morton-Thiokol engineer who disclosed the flaws in the Challenger's solid rocket boosters, was generous with his time and insights. I was especially interested in the Challenger case due to its relevance to my teaching both in my engineering ethics course and in my technological catastrophes course. One year I invited Boisjoly to speak at NC State; despite being in poor health, he worked harder in his two-day visit, including a public lecture, a dinner talk, and guest lecturing in two classes, than all but a few guest speakers I have known. In addition to giving me a deeper understanding of the Challenger case, Boisjoly, who worked as a forensic engineer after he left Morton-Thiokol, shared with me videos related to product liability lawsuits which I found useful in my teaching and in my scholarship on the relationship between engineering ethics and product liability (Herkert 2003).

Following publication of a paper of mine in the first electronic supplement of the *IEEE Transactions on Education* that discussed online engineering ethics resources (Herkert 1997b), the late Caroline Whitbeck invited me to join the Advisory Group of the Online Center for Engineering Ethics she maintained at Case-Western University. I subsequently was a subcontractor on one of Whitbeck's National Science Foundation (NSF) renewal grants, charged with developing materials on engineering, environment, and sustainable development. In addition to encouraging my interest and involvement in online engineering ethics education, Whitbeck's (1996) concept of "ethics as design" made a great impression on me. By showing how ethicists could learn from engineering designers, she helped me better understand the interdisciplinary give and take of engineering ethics as well as how my "dual identity" as both engineer and ethicist was a strength rather than an anomaly.

Ed Harris, whose textbook with Pritchard and the engineer Michael Rabins (Harris, Pritchard & Rabins 1994) was a cornerstone of engineering ethics education especially with respect to promulgating the use of case studies, was among the most collegial philosophers I encountered. I often used Harris' work in my engineering ethics course (Harris 1995, 2004) and enjoyed learning from his presentations and published work. More than anyone else I met during this period Harris expressed an interest in learning from my work especially with respect to the connection between engineering ethics and STS.

Perhaps the person I have cited most in my work has been the philosopher Michael Davis. I was particularly influenced by his focus on the importance of engineering codes of ethics (1991), his concept that thinking ethically is part of "thinking like an engineer" (1991, 1998), and his clear delineation of the goals of engineering ethics education (1999). Davis has been a friend as well as one of my harshest critics, taking to task in his article "Engineers and Sustainability" (2010) my notion of microethics and macroethics (Herkert 2001, 2005) and my analysis of the treatment of sustainable development in engineering ethics (Herkert 1998). In fact, I finally realized that I had "made it" in engineering ethics when Davis, who was critical of others in the field (2001), deemed my work worthy of criticism!

I met many other contributors to the field during this period, three of whom I would eventually work with: Jimmy Smith, Rachelle Hollander, and Keith Miller (see below). Other authors who shaped my early thinking on engineering ethics education included philosopher Mike Martin and engineer Roland Schinzinger (1996), historian of technology Edwin Layton, Jr. (1986), and engineer Larry Shuman and his colleagues at the University of Pittsburgh (Pinkus et al. 1997).

And so, around the turn of the century, just a half dozen years or so after Hamlett encouraged me to focus my scholarly work on engineering ethics, I found myself more or less established in the field (and subsequently invited to participate in this collection on trailblazers). While at the time not all of my career choices over the prior three decades seemed connected, in retrospect my final choice to pursue scholarship and teaching on engineering ethics and societal implications of technology was a logical outcome of these earlier choices. The most significant of these experiences included my brief exposure to STS as an undergraduate engineering student; experience of different ways of knowing and expressing through creative writing and teaching English composition; work as an engineer that schooled me in both technical and non-technical

aspects of engineering and the "microethical" dilemmas that sometimes arise; graduate research and teaching in engineering, policy, and ethics that laid the groundwork for my interest in "macroethics;" interdisciplinary faculty appointments that provided me the opportunity to teach and publish in engineering ethics, engineering ethics education, and STS; the opportunity to work with academic programs at two institutions that sought to integrate engineering and the liberal arts; and the chance to meet and collaborate with colleagues through such organizations as IEEE, ASEE, and APPE. I think that some of my success has been due to being in the right place at the right time – there just weren't many engineers, particularly early career engineers, engaged in engineering ethics scholarship at the time I became involved. Mostly, though, I owe my success to the mentoring and encouragement of the trailblazers who went before me, including personal interaction with most of those represented in this collection and others who unfortunately passed on before this project was conceived.

More Learnin' and Experience

While this essay has focused on the formative years of my career I would be remiss not to mention the colleagues and institutions I have been associated with and learned from since then.

I was elected to the Executive Board of the NIEE in 2005 and served for six years, after which I was elected a Distinguished Life Member. NIEE, which was led for many years by the late engineer Jimmy Smith, has been a leader in integrating the efforts of academic and practicing engineers in the promotion of engineering ethics education through seminars, courses, books, and videos. As noted earlier, connecting the academic and practitioner experiences of engineering ethics has been a major thrust of my work and my association with NIEE introduced me to many practicing engineers I would otherwise not have had the opportunity to meet and work with. It also gave me the opportunity to make and renew friendships with other academics working on engineering ethics, many of whom are mentioned in this essay. In 2020 NIEE moved to Purdue University (https://www.niee.org/), under the leadership of Director Brent Jesiek and Deputy Director Justin Hess, and I have continued to participate on the Board.

I was associated with the Center for Engineering, Ethics and Society (CEES) at the National Academy of Engineering from 2008-2020 including as a member of the Center's Advisory Group and as a member of the Editorial Board of the Online Ethics Center (OEC) for Engineering and Science that was gifted to CEES when Caroline Whitbeck retired. During that time, I worked closely with former CEES Director and philosopher Rachelle Hollander and program officer and historian of science Frazier Benya. Vivian Weil introduced me to Hollander at a conference in 1995 but I didn't have the chance to interact much with Rachelle until a 2004 conference in Paris where we encountered daunting technological challenges including French ATM machines and shoelaces (mine) that wouldn't stay tied. Since then Hollander has been a friend, mentor, and collaborator (Herkert, Hollander, et al. 2015), helping to fine tune my approach to teaching ethics, deepening my appreciation of the need for quality online ethics resources, demonstrating how to bring seemingly irreconcilable stakeholders together for dialogue, and helping me up when I fall (both metaphorically and physically).

I have continued my participation in the ASEE, serving for a second time as Program Chair for LEES in 2010 and as LEES Division Chair in 2011-2012. I also served as a Board Member of

the Engineering Ethics Constituent Committee from 2003 to 2006 and of its successor the Engineering Ethics Division from 2012 to 2015. I was on a committee to draft the first ASEE Code of Ethics (ASEE n.d.), and as a member of the ASEE Committee on Ethics and Member Conduct since 2020 I have been involved in efforts to revise the code and evaluate ethics-related organizational policies and procedures. In ASEE I have worked with many colleagues from various disciplines throughout the years, far too many to mention here. In many ways these colleagues have been more supportive of my work than even my home institutions. In 2005 I received the Sterling Olmsted Award, the highest honor bestowed by LEES, for "making significant contributions in the teaching and administering of liberal education in engineering education." I was elected an ASEE Fellow in 2019.

I have continued to work within IEEE, of which I am a Life Senior Member, serving as Editor of *IEEE Technology and Society Magazine* from 2003 to 2007, on the IEEE Ethics and Member Conduct Committee from 2008 to 2010, and as Co-Program Chair with computer scientist/ethicist Keith Miller of the first IEEE Ethics Symposium in 2014 which was co-sponsored by SSIT. At the end of 2015, after 25 years of service to SSIT in various capacities, I announced my intention to "retire." A few weeks later, then SSIT President Greg Adamson asked me to remain engaged with IEEE in connection with an uptick in IEEE ethics activities that Greg was involved in instigating. Feeling a bit like Don Michael Corleone in *The Godfather – Part III* ("just when I thought I was out…they pull me back in") I agreed to be Adamson's "Consigliere." I served with Greg on ethics committees of the IEEE Technical Activities Board and the IEEE Board of Governors and had significant involvement in the successful effort in 2017 to revise the IEEE Code of Ethics (IEEE n.d.) to incorporate the notions of "ethical design," "sustainable development," "societal implications of technology" and "intelligent systems". The first and last of these concepts were the initial focus of the revision process, due primarily to the growing interest in ethics and artificial intelligence within the IEEE and broader technology communities. Sustainable development was added for consistency with other engineering codes and in recognition of the United Nations' Sustainable Development Goals. Societal implications of technology recognized IEEE's historic and contemporary commitments in this area, and the need for technologists to recognize their ethical responsibilities to society (Adamson & Herkert 2022).

In 2019 I was again elected to serve on the SSIT Board of Governors and re-elected in 2022. I currently serve as Chair of the SSIT Technical Committee on Ethics and Human Values. In 2021 SSIT assumed complete responsibility for the IEEE ETHICS conference series and I served as Program Chair of ETHICS-2021 (https://attend.ieee.org/ethics-2021/) and Program Co-Chair of ETHICS-2023 (https://attend.ieee.org/ethics-2023/) which was hosted at Purdue by NIEE. I have worked with and learned from many colleagues in SSIT and IEEE over the years including my dear friend Brian O'Connell who died prematurely from cancer in 2008. My scholarly collaboration with O'Connell, a specialist in computer law and ethics, resulted in work on the relationship between engineering ethics and computer ethics (O'Connell & Herkert 2004).

Among my other professional activities, I served for five years (2008-2012) as a founding associate editor of the journal *Engineering Studies* and was co-conference chair of the 2014 annual meeting of the Society for Ethics Across the Curriculum with Karin Ellison, Associate

Director of the Center for Biology and Society Program at Arizona State University (ASU), and philosopher Kelly Smith.

I have continued to benefit from many collaborations in my scholarship on engineering ethics and engineering ethics education, including several NSF-funded projects. From 2007-2015 I was Lincoln Associate Professor of Ethics and Technology at ASU. In addition to the Lincoln Center for Applied Ethics, I was affiliated with the Consortium for Science, Policy & Outcomes. During this time, I engaged in research with several colleagues on science and engineering ethics education (Canary et al. 2012; 2014), energy ethics (Herkert, Hollander, et al. 2015), and emerging technologies (Marchant, Allenby & Herkert 2011; Herkert & Kostyk 2015). I also began teaching half of my course load online and developed a greater appreciation for both the opportunities and obstacles for online learning in ethics and STS education. For example, the learning style and/or lifestyle (e.g., work or family commitments) of certain students may be better suited to online learning than to face-to-face learning; course discussion formats and participation windows need to be sensitive to such differences. For two years I led an ethics-across-the curriculum faculty development seminar at ASU's Polytechnic Campus which included colleagues from the disciplines of communication, engineering, history, international politics, psychology, nutrition, biology, and English, several of whom contributed to a 2011 special issue of the journal *Teaching Ethics* (Herkert 2011). The journal Co-Editors, Michael Pritchard and Elaine Englehardt, had also contributed directly to the ASU Polytechnic program as guest speakers. In 2013 I was elected a Fellow of the American Association for the Advancement of Science "for distinguished scholarship, teaching, and interdisciplinary research in the ethics of engineering and technology and in the relationships among science, technology, and society.

Upon my retirement from ASU, I returned to the Raleigh area and re-engaged with NC State including teaching part-time in the STS Program and working as a visiting scholar in the Genetic Engineering and Society (GES) Center. My major activity at GES involved an NSF-funded study on ethics and responsible innovation in biotechnology communities (Herkert, Kuzma, et al. 2017; Roberts, Herkert & Kuzma 2020).

I have also continued to work with Ellison on developing new environmental and life sciences materials for the OEC and on an ethics-across-the curriculum program for the ASU School of Life Sciences (Ellison, Facemire & Herkert 2018). Civil engineering educator Brock Barry and I have written on research in engineering ethics education (Barry & Herkert 2015a) and U.S. perspectives on teaching engineering ethics in an international context (Barry & Herkert 2015b). My close friends Keith Miller and the philosopher Jason Borenstein and I have an ongoing collaboration on engineering ethics and autonomous vehicles (AVs). While the ethics literature has focused primarily on the programming of decision-making software for AVs, in particular the "trolley" problem, more fundamental safety issues will first need to be addressed including software and vehicle testing, reliability of sensors and other system hardware and software, complexity and tight coupling of system components, and behavior of drivers and passengers (Borenstein, Herkert & Miller 2017). When AVs are viewed as part of a complex socio-technical system that includes vehicles with various levels of automation, as well as motorcycles, scooters, bicycles, pedestrians, and animals, addressing these safety concerns becomes even more complex and important (Borenstein, Herkert & Miller 2019). These issues become all the more daunting

when the scope of AVs is expanded beyond personal automobiles to include trucks, buses, trains, ships, and "flying taxis." (Herkert, Borenstein & Miller 2022). The three of us have also written on lessons for engineering ethics of the Boeing 737 MAX crashes (Herkert, Borenstein & Miller 2020).

As I hope this essay has made clear, my work in engineering ethics education has been highly interdisciplinary, involving many collaborations and building on the work of numerous pioneers in the field. Throughout my career I've been blessed with the support of colleagues, friends, and students in following and sometimes "paving" the path these trailblazers have set forth. My advice to other academic engineers looking to contribute to the field would be to: 1) engage in faculty development activities to the fullest extent possible; 2) explore ethics-related activities within the professional societies in your engineering field; 3) attend and network at both engineering and ethics conferences and meetings; 4) embrace interdisciplinary collaborations; and 5) especially for early-career faculty, be prepared for skepticism about your work from engineers, philosophers and others indisposed to engaging in interdisciplinary inquiry. Though the trail can be frustrating at times, it is well worth the journey!

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