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Guest Editorial

This issue contains an overview of engineering ethics education on three continents. Many of the essays discuss or provide models for engineering ethics education in specific cultural and societal contexts. The majority of articles are written by authors, both engineers and humanities scholars, who themselves have made major contributions to the development of engineering ethics education. The present editorial introduction will provide further historical background on the activities of some of the authors and their important contributions to the field of engineering ethics. The history of the field provides the woof and the cultural context provides the warp of the fabric of engineering ethics.

Stephen Unger, the author of the first essay in this issue, 'How Best to Inject Ethics into an Engineering Curriculum with a Required Course' is one of the earliest leaders in engineering ethics in the United States. He served as a faculty member with me in the National Project on Philosophical Ethics and Engineering, conducted by the Center for the Human Dimensions of Science and Technology at Rensselaer Polytechnic Institute, in the summers of 1978–1981, and authored *Controlling Technology: Ethics and the Responsible Engineer*, the first edition of which appeared in 1982. This work together with Mike Martin and Roland Schinzinger's *Ethics in Engineering,* which appeared the next year, were the first books widely used as texts for the teaching of engineering ethics in the U.S. (Mike Martin is a philosopher.)

Both Stephen Unger and the late Roland Schinzinger distinguished themselves through their contributions to electrical engineering as well as their concern for the ethical standards of engineering practice, including policy questions. Both were active in the Institute for Electrical and Electronic Engineers (IEEE) and like another author in this issue, S. Ratnajeevan H. Hoole, were elected Fellows of the IEEE and received other major honors and awards. In Professor Unger's case, this included the IEEE USAB Distinguished Contributions to Engineering Professionalism Award in 1987. Stephen Unger, Roland Schinzinger, and other engineers, often acting through engineering societies, such as the National Society for Professional Engineers or the IEEE, embody the strong presence of engineers that has been so significant in the development of engineering ethics in the U.S.

Stephen Unger was founder and later president of the IEEE Society on Social Implications of Technology and continues to be an active member of its governing body. Dr. Unger was a member of the IEEE USAB Ethics Committee and chaired that committee for two years. He played a principal role in the development of the original IEEE Ethics Code and participated in the 1990 revision of that code. In addition, he served on the IEEE Board of Directors and was a member of the IEEE Ethics Committee, 1995–8, (Chair 1997–8).

In his essay, Stephen Unger describes his approach to teaching engineering ethics to students at Columbia University. This approach broke ground in the 1970s, developed, and stood the test of time. It continues to serve as a model for ethics education in a required course taught by members of engineering faculties.

Hiroshi Iino, the author of 'Introductory and Engineering Ethics Education for Freshmen Engineering Students in Japan' has had a very distinguished career in engineering in Japan. He has been a leader in the development of engineering ethics education in his native country. Professor Iino's extensive industry experience as a chemical engineer included process and manufacturing design, engineering management, and serving as CEO of Teijin Memorex Co. Ltd., a joint venture of Teijin and Memorex Corporation, U.S.A. His breadth of industry and corporate experience has given him a broad perspective on the ethically significant problems engineers face. This is especially noteworthy in Japan, where it is less common than in the U.S. for academic engineers to have industry experience.

After retiring from Teijin in 1995, Professor Iino joined the faculty of Kanazawa Institute of Technology and began teaching his course, *Society and Engineers,* in 1996. This course has developed into a new compulsory course, *Introduction to Engineers,* which began in April 2004, for all incoming 1,700 students at Kanazawa Institute of Technology. Among his other educational innovations is the Robot Project, in which students design and build a robot. The textbook that he authored for the *Society and Engineers* course, *Becoming and Being Engineers,* was first published in 1998. Revised editions appeared in 2000, 2002, and 2004, and another is due in 2006. Last year, thirteen universities, technical institutes and technical colleges used the book either as a text or as a reference, which clearly illustrates its influence on engineering ethics education in Japan. In collaboration with Professor Jun Fudano, Professor Iino translated *Ethics in Engineering Practice and Research* by Caroline Whitbeck (New York: Cambridge University Press) into Japanese. The first half of that translation was published in 2000.

In his article, Professor Iino discusses both the introductory course in engineering and *Society and Engineers* and several case studies of accidents that he has developed for the latter course, along with barriers to the development of such case studies. His article points out interesting differences between the

U.S. and Japan, not only in engineering education, but also in ethical norms, such as the importance of the individual working harmoniously within a group. For example, in the U.S., plea bargaining is a common practice, which provides to a member of a group of guilty parties an incentive to turn over evidence that will reveal deeper patterns of corruption or negligence and convict others at fault. In Japan, however, no such practice exists because traditional cultural norms frown upon this as a form of cowardly and irresponsible behavior and a means of betraying others in order to reduce one's own punishment.

Steven Nichols, the author of 'A Design Engineer's View of Liability in Engineering Practice: Negligence and Other Potential Liabilities', is both a professional engineer and a licensed attorney. He is on the faculty of the University of Texas at Austin where he serves as the Associate Vice President for Research and as the Director of the Chair of Free Enterprise in the College of Engineering. Previously, he served as the Director of the Center for Energy and Environmental Resources (formerly the Center for Energy Studies) and as Acting Director of the Center for Electromechanics at UT, Austin. For two decades, he has brought his unique combination of qualifications to bear on questions of engineering ethics, including but not limited to questions at the interface of law and ethics.

Engineering has long recognized not only the centrality of certain responsibilities in engineering practice, but also that dereliction of responsibility may take the form of negligence, and recklessness as well as deliberate wrong-doing. (With this recognition, the engineering profession has been ahead of the research community in the U.S., which until the adoption of the Federal Policy on Research Misconduct in 2000—available at http://onlineethics.org/fedresmis.html—frequently did not recognize any wrongdoing other than intentional wrongdoing.) The legal understanding of negligence is an important topic in engineering ethics, because the legal context reflects both ethical norms and establishes prudential incentives that become factors in the ethically significant problems that engineers must solve. In his article, Professor Nichols illuminates how U.S. law interprets negligence as it bears on engineering practice. He defines and distinguishes the concepts of contract liability, criminal liability, and tort liability including the notion of strict liability in torts (liability without proof of negligence), a notion peculiar to the U.S. legal system. The actual court decisions in the case of *Boatland of Houston v. Bailey et al*. discussed in his article show how some of these notions function in actual legal application.

Michiel Brumsen, the first of the philosophers writing for this issue, is a member of the philosophy department at the Delft University of Technology. His essay, 'Ethics in Engineering in the Netherlands: The Role of Professional Associations, Universities, and Law' provides a window into engineering ethics as it is developing in the Netherlands and other parts of continental Europe. He describes the current state of engineering education that exists in most of continental Europe, which he contrasts to the 'Anglo-Saxon model.' The latter is the model of engineering education taught in countries that are signatories to the Washington Accord on equivalency of accreditation of engineering education programs (The Washington Accord recognizes 'the substantial equivalency of accreditation systems of organizations holding signatory status, and the engineering education programs accredited by them'. See the Washington Accord website, which is available at http://www.washingtonaccord.org/), namely Australia, Canada, Hong Kong, Ireland, New Zealand, South Africa, United Kingdom, and the United States. Most of these countries and many (but not all) of the provisional member countries (Japan, Malaysia, Singapore, and Germany) have the same baccalaureate, masters and doctoral degree progressions for engineering education. In contrast to the 'Anglo-Saxon model,' Dr. Brumsen describes a two-track system of engineering education. The *ir* degree, which is earned at the technical universities, has a five-year curriculum and is more theory and research oriented. The *ing* degree, the more practically oriented four-year degree, is earned at Schools for Higher Professional Education (*Hoger Beroeps Onderwijs*, HBO) and includes an internship in industry. Although some students transfer from *ing* programs to *ir* programs, or pursue an *ir* degree after obtaining an *ing* degree, the educational tracks lead to different career paths. Until recently, the two groups even had separate professional societies.

Dr. Brumsen characterizes engineering societies in the Netherlands as playing a dual role, in that they have some features of trade unions (but with closer ties to industry and management) and some features of technical societies (such as informing their membership of technical advances). They have only recently adopted ethical codes or guidelines. The disciplinary sections of these societies do discuss ethically significant questions, but discuss them mainly as technical matters.

Dr. Brumsen points out legal and cultural differences between Dutch and U.S. norms and expectations regarding the practice of engineering. In particular, Dutch law does not protect whistleblowing (in the sense of reporting lapses to external authorities), although it does afford some protection to civil servants who raise concerns *within* their organizations.

Although other articles discuss cultural issues as they affect ethical evaluations of kinds of actions and policies, Drs. S. Ratnajeevan H. Hoole and Dushyanthi Hoole's contribution considers the broadest range of factors that influence the understanding of and approaches to education in engineering ethics. In doing so, they expand consideration to include the effect of political as well as cultural factors that influence how effectively ethics can be taught, especially in countries marked by civil conflict such as their home country of Sri Lanka. These two authors are, respectively educated in electrical engineering and in analytical and organic chemistry. However, Dushyanthi Hoole has increasingly become involved in educational policy,

pioneering web-based teaching for distance learning in Sri Lanka, and now is addressing equity issues in education as Education Specialist for Save the Children in Sri Lanka. Currently, S. Ratnajeevan H. Hoole is a professor in Electrical Engineering and Computer Sciences at University of Peradeniya and was elected Fellow of the IEEE for his 'contributions to computational methods for design optimization of electrical devices.'

Their article, 'Asian Values and the Human Rights Basis of Professional Ethics,' considers cultural differences regarding values that have been touched on in earlier essays but also describe special problems of teaching ethics in a civil war situation. In particular, they argue that two values widely espoused in western culture are at odds with what have been widely termed as 'Asian values.' The values of Western Liberalism are, first, the exclusion of religion from public life, and second, the ideal of impartiality that overrides consideration of loyalty to family and clan interests in making professional and administrative decisions. The authors argue that these values, which have been widely discussed for cultures in Southeast Asia, apply equally well to the South Asian culture of Sri Lanka. They prominently include religious symbolism in public life. As a result, the operative ideal is not secular public life, but a multicultural approach in the form of inclusion of the predominant religious traditions, especially Hinduism and Buddhism, in public ceremonies.

Because of the historical influence of British culture on Sri Lanka, the Hooles contrast and compare current British and Sri Lankan norms, and therefore provide information about both cultures.

Despite its western origins, a human rights approach to ethics provides the Drs. Hoole with a useful framework for teaching ethics, including engineering ethics, to engineering students in Sri Lanka. The human rights approach has the advantage in being neutral with respect to the religious and cultural conflicts that have been central in the civil war in Sri Lanka. By adopting human rights as the foundational ethical concept they seek to simultaneously acknowledge the importance of family and clan loyalty that is also widely recognized in Asian cultures without allowing such considerations of loyalty to obscure other ethical considerations.

An additional challenge that the Hooles discuss and must address in their teaching is the recent history of neglect of verbal learning (in any language) in the engineering course of study in Sri Lanka. In their teaching, they seek to remediate the students writing and communication skills as well as teaching ethics specifically.

Professor Michael Pritchard, the author of 'Perception & Imagination in Engineering Ethics' is a professor in philosophy at Western Michigan University, where he co-directs the Center for the Study of Ethics in Society. He has significantly influenced several areas of practical and professional ethics, including engineering ethics and such disparate subfields as ethical behavior in children and communication ethics. With Charles Harris and Michael Rabins, he is co-author of *Engineering Ethics*: *Concepts and Cases*, (Belmont, California: Wadsworth/Thomson Learning) one of the most widely used engineering ethics texts in the U.S. It was first published in 1995 and the third edition will appear sometime in 2004.

Professor Pritchard's essay addresses the topics of character and constructive or synthetic reasoning that has characterized much of the recent literature in engineering ethics in the U.S. It has supplemented previous discussions that focused exclusively on analytic skills, such as subsumption of instances under moral principles, ethical criticism and justification. The particular synthetic skills he considers here are those involved in perception and imagination.

Professor Pritchard begins with Lawrence Blum's notion of *moral perception* to discuss the ethical importance of what is not merely known, but noticed. His definition of perception includes both awareness of needs and anticipation of possible consequences. He discusses many examples of design familiar in daily life to show what consequences were and were not considered by the designers, and the unforeseen negative consequences that sometimes resulted. For example, after traffic light timing was designed with a time delay between the moment at which the light in one direction turned red and the light at right angles to it turned green, many drivers developed the habit of continuing to go through intersections after the traffic lights had turned red. Professor Pritchard illustrates how analogous behavior and neglect of other practices, such as consulting the literature on a subject, or learning from previous accidents, have led to a variety of negative outcomes in the work of engineers and scientists, and argues that these represent a failure of responsibility on the part of engineers. He also takes up another theme that has received much attention in late twentieth century moral theory–the theme of luck–but presents a very different perspective on it, stressing how the responsible individual is prepared to be lucky.

The purpose of this issue is to provide an overview of engineering ethics from an international perspective. The diversity as well as the similarities in the considerations and approaches offered here provide important lessons for those who seek to further advance research and teaching in this field in a range of settings and cultural contexts.

Caroline Whitbeck
Elmer G. Beamer-Hubert H. Schneider
Professor in Ethics at Case Western Reserve University