

**A Human Rights Challenge to the Engineering Profession  
Ethical Dimensions and Leadership Opportunities in  
Professional Formation**

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**Introduction**

In the American system we have insisted on a careful positioning of engineering education. The first professional degree occurs after 4 years of college (anomalously 5 at Dartmouth) and there is widespread commitment to university-style affiliation with non-professional students, curricula, and norms of scholarly development. We as custodians of the Engineering disciplines must understand this important achievement and what it entails vis-à-vis what should and shouldn't be taught. We must perform against recognizable scholarly criteria – we must create, conserve, and convey the central animating ideas, the important facts, the useful analyses, and initiate careers that are authentically productive. And we must look to the intellectual nourishment of a whole professional cadre, which populates numerous external institutions and creates very specific demands on the time of our students and faculty. To fail on either of these dimensions is to lose our preferred place in American higher education. So there is much at stake in contemplating our roles in the large.

A few facts about engineering are familiar and useful. There are about 1.5 million American engineers; it is the most popular occupation among American males. About half or these are employed in the manufacturing industries; 12% are in government service, 3% are self-employed. About 65,000 students earn the BS yearly. 20% of these are female, 24% American minorities, and 7% foreign nationals. Most engineers are employed in corporate life; a very small percentage are officially licensed as professionals, and that percentage is concentrated away from the high-technology and high-profit areas today.

Among Engineering Colleges, the accredited curricula are overstuffed to the point of breaking. There is huge intellectual gap between home, church, and secondary school education on the one hand; and professional practice on the other. The widespread response is reliance on “Liberal Arts” or “Humanities” courses to fill this gap. Courses are typically doing multiple duty on several educational fronts: basic reading, writing, and speaking skills; familiarity with cultures

and literatures; artistic expression; philosophical and religious thought; etc. Essentially we have bundled all nontechnical topics into a rubric which is useful but dysfunctionally incomplete at developing an understanding of ethical ideas. The opportunity is there; but “Liberal Arts” and “Humanities” are not synonymous with Ethics; and the latter is not the same as Professional Ethics. In this arena we ought to distinguish several functional levels:

- Personal and interpersonal ethics: virtue, duty, utility; their theoretical support and implications
- Occupational ethics: relations among employees, employers, owners, managers, customers, and other employees
- Professional ethics: relations among the professional employee or consultant and the client, other professionals, other employees, and the employer
- Institutional ethics: relations among the profession as institution and the population at large

Perfusing all of these is an increasing complex of confusions among an individual’s role (e.g. citizen and employee)

So the work of formation of students as persons and professionals, and the formation of the profession itself, falls to us as educators. And institutions like Dartmouth need to find ways and means of professional formation that are simultaneously right for our students and for the profession at large.

### **The Industrial Revolution**

Now there is no shortage of pronouncements that the world at large is undergoing key transformations today. In technological terms, we are witnessing the maturation of the Industrial Revolution which will most likely be complete on the planet during the lifetimes of our students. It is reasonable to project a factor of 5 increase in per capita industrial metabolism, based on the existing evidence. Concurrently, reasonable projections have population stabilizing at roughly twice that of today. So on balance, the completion of the Industrial Revolution implies a factor of 10 increase (5x2) in both natural resource utilization and environmental loading.

These two common projections presume a just, stable world order with the present material inequities largely abolished, and some kind of sustainable relationship between industrial practice and nature. Implied in turn *are permanent human dependencies* on technological services and on planetary organization to supply them. The alternatives are almost universally unacceptable. But there is no technology to support 10-12 billion people at 10 times the current aggregate consumption rate. And there is no vision of a planetary ecosystem in equilibrium with this level of industry. And there is no planetary organization capable of constraining the global marketplace toward right outcomes. *What we are building will not work.*

Into this vacuum of global governance we inject the notion of *professions as global organizations*. Is engineering a profession? what is its natural scope? and what constitutes “right” engineering?

## Professions

It is asserted that engineering should be viewed as *an emergent profession*, imperfectly formed, but one that is here to stay. It is fundamentally defined by the industrial revolution and the need for development, stewardship and right deployment of industrial knowledge. As I argue above, global society is now irreversibly dependent on this — so the *need* for a profession is there.

We already find in engineering many of the conventional hallmarks of professions, including

- a clearly conceived distinctive competence,
- educational standards and accreditation,
- provision for licensing and continuing education,
- codes of conduct and judicial processes.

But we find also an *ambiguous social contract*. Are engineers professionals, or employees? Do their loyalties lie in making profit for their employers, or to the service population at large? Who is the client? Is there in fact an independent institutional response to a basic human problem? Is there something in education or certification which requires adherence to the professional version of these ideas? Behind all these questions is the nagging fact that most engineers are not in fact licensed as such – their “professional” status stems from their university preparation and their corporate employment. As a result, the “profession” is largely captive today to financial priorities, which are *de facto* laissez-faire globally and which are the primary and imperfect determinants global industrialization.

A negative conclusion to the professional question is of course possible and common. Where does that leave us? Without any hope of a profession devoted to technological stewardship, at a time when the technical genie appears to be out of the bottle, driving many imperfect globalization processes, and at a time when people everywhere are looking for ways to channel their individual energies toward right industrial ends. So we assert, yes, engineering is a profession, albeit imperfect and emergent, and we must perfect it as one of many instruments of right global governance.

That affirmation has profound consequences.

## Engineering and Human Rights

It is commonly asserted in various ways that “Engineers serve basic human needs”. What are those needs? Certainly, engineering addresses material needs and above we assert that a material dependence on technology is essential to any realistic view of the planet. But a workable definition of those needs is sorely needed. It is easy to use up the whole industrial product and still have an unacceptable material condition – unacceptable from almost any viewpoint. And materialism itself cannot be allowed free reign here. That is certainly a message to take home from any exposure to the Humanities!

So I suggest we return to an irrefutable, secular reference point here: the United Nations' Universal Declaration of Human Rights. Significantly the UDHR preamble cites a principle familiar to students of the Humanities:

“Whereas recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world ..... Now, therefore, The General Assembly, Proclaims this Universal Declaration of Human Rights as a common standard of achievement for all peoples and all nations....”

Article 25 is especially relevant:

“Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control. “

These and other contemporary statements elevate the material human condition to the position of authoritative *right*. And while scholars will debate the distinctions among positive (economic) and negative rights, entitlements, necessities, wants, needs, etc., there is broad consensus for a certain baseline. It is asserted that the Object of Professional Engineering be the provision of this baseline of material well being, perhaps in a Rawlsian sense focusing on the least-well-provided for.

### **Social Thought**

There is at least a century of structured thinking about very-large scale human organizations. Some of the important poles of this discussion are illustrated in the accompanying figure: Corporations, Governments, Professions, and Persons. Human social interactions are modulated by an increasingly complex and overlapping network of these institutions. Each has authority in some aspect of human affairs. The good of Persons trumps all in this rendering. A good *Society* is one where it is easy for *Persons* to be good<sup>1</sup>.

Professions are characterized by the confluence of two essential ingredients:

1. The cultivation of specialized, theoretical knowledge; and,
2. The direction of that knowledge toward the common good.

This dual character distinguishes groups of occupational specialists from professions. The former lack the second characteristic; the latter profess it.

Today there is remarkable convergence among scholars ( e.g Krause, May, Abbot, Friedson, Perkin) that we are losing sight of the professional ideal; that our professionals are increasingly are increasingly functioning as specialized corporate employees; and that we lack professional institutional structures to rectify this. At the same time, non-progress toward elementary human rights in the sense of the UN's UDHR is easy to discern. The traditional reliance on “good

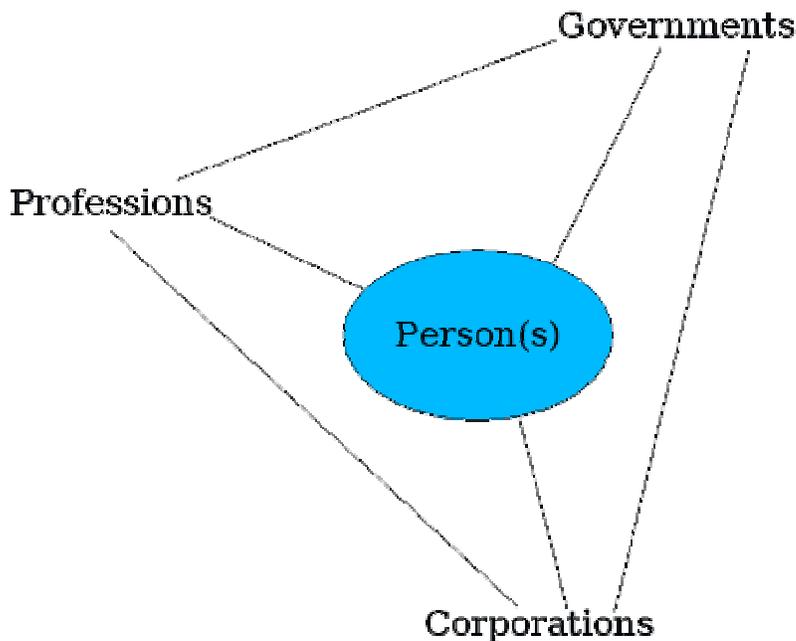
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<sup>1</sup> Statement attributed to Peter Maurin by Kreeft (1991).

government” as the representative of the common good is not adequate in itself to rectify this on a global basis.

The resulting vacuum in authority calls for a renewed commitment by professions to their distinguishing feature, devotion to the common good, and for independent action on their parts. Educational institutions above all profess engineering education infused with human values. A central outcome should be the formation of institutions which deliver the common good to people, and which take responsibility when that does not happen.

**Critical questions arise:** a) how is the common good represented in professional education, and realized in subsequent practice? And b) can one identify a universal form of professionalism, i.e. one that can rest on a Public Theology or a Common Morality? There are growing calls for some compass to guide large, pluralistic social organizations; a metaphysical Referent for Public Virtue. This would add transcendent depth to our social constructions; “virtue” to our institutions. As our secular professions embrace their global nature, extending beyond their cultural heritages, they will inevitably hit this fundamental vacuum in purpose. There is a growing scholarly interest in identifying universal aspects of the common good which will support this critical aspect of professionalism, in a secular context (e.g. McElroy, Hollenbach, Stackhouse, Kung).



**Figure 1. Network of Social Institutions.**

### **Professional Responsibilities**

We arrive at the point of affirming Engineering as a Profession, and the task of fixing the imperfections. The first job is announcing the *central concern*: we advocate this be the *attainment of human rights in technology*, as implied in the UDHR.

There are three aspects. The first is the right to the *material baseline* of life. Included are housing, water supply and sanitation, freedom from threat of aggression, access to information, and the like. These we name necessary “technological services”. The second is the right to proper *stewardship of natural resources* (the ultimate industrial input). While newer in its conception, we assert that all people have the right to sustained and productive use of the natural resources of the planet. No individual property right or national sovereignty right can be allowed to supersede this elementary right of people – a controversial position today, but necessary. The third right is to the proper *use, cultivation, and application of technological knowledge*. Knowledge is the ultimate (economic) substitute for depletable natural resources. Its proper development must accompany natural resource use.

These responsibilities devolve from Engineering as we already know it. Dealing with the details is within the defined competence of today’s engineers. And outcomes in terms of these rights are directly attributable to the actions of engineers. We need to see to it that engineers and their professional organizations take responsibility for those outcomes.

It is important to grasp what is at stake here. Today many organizations claim allegiance to some of these rights. But we are asserting that Professional Engineers adopt *responsibility* for their *achievement*. Not exclusive responsibility – that would be foolish and autocratic. But responsibility nevertheless, in the sense that non-achievement represents a failure before the Creator, and that those so endowed are obliged to find leadership paths.

## **The University Role**

Why do we have professional schools in universities? On the one hand we legitimize professional education and the intellectual disciplines underpinning it. In this sense we entrust the formation of new professionals to the university, in exchange for professional constraints on the outcome (necessary skills, etc.) But perhaps most importantly, we implicitly entrust the formation and re-formation of the *profession* to the university. Educators cannot shrink from these responsibilities: the formation of persons, the formation of professionals, and the (re)formation of the profession itself. The latter point is of ultimate importance for professional engineering today. Are we providing the right compass for individual professionals in terms of professional obligations? are we providing the institutional means to facilitate professional achievement? and relative to general education, are we developing the right expectations for professional responsibility for industrial outcomes?

The ideas above lead to many suggestions for reform. First and foremost, we need the profession's acceptance and articulation of the animating ideas grounded in Human Rights, and of professional responsibilities stemming from them. This is a critical step which needs to be taken by leadership organizations.

Along these lines, we note a pervasive error in the confusion of ends and means. The standard organizational lines of engineering education emphasize means, not ends: mechanical engineering, aerospace engineering, computer engineering, chemical engineering, etc. Where

are the ends served? A proper organization of the profession would emphasize the human purposes served. An example organizational structure might be:

- Productivity, organization and management
- Infrastructure (including communications and information, e.g. education)
- Natural resources and environment
- Health
- Security

These represent fundamental human concerns and spheres in which we can address human rights. The standing group of categories are means-oriented, dealing with natural phenomena but not human problems. Trade groups deal with means; professions deal with ends. The end does not justify the means; but the means alone are not enough.

Recently I began “polling” department chairs and deans about what informs their priorities in hiring, research, etc. Almost universally I found the following responses:

- Follow the money
- Follow curiosity
- Follow the prestige (beat Harvard)

Each of these is a distortion. The price system is obviously imperfect; while we need money in academe, it is not a goal but a constraint. Human curiosity is a good guide, and uninquisitive professors are not good ones. But it has no intrinsic value – it is simply a trait. And who needs another Harvard? We have one and it cannot teach most students. Certainly we need competitive faculty but the standard is empty beyond that. What is obviously missing here is the overarching, principled objective of professional education! That vacuum is easy to explain in terms of the newness of the profession and its confusion on this point. But it cannot be allowed to persist. I have offered some suggestions for moving forward.

An overwhelming need is for the profession to get outside of the imperfect price system as its sole method of prioritization; and to construct an independent sense of the balance of market and non-market priorities.<sup>2</sup> Essentially, all economic activity is not equal and good. Singular in this category is the lack of any organized ProBono engineering activity wherein prioritized extra-market activities are pursued with full-strength engineering talent. This must be corrected. The professional’s economy of human activity is not the same as that of the accountant or the utility theorist.

## **Conclusion**

Engineering is permeated with 2 distinct visions of the ‘good engineer’. One concentrates on the innate satisfaction which attends making something work and understanding it – perhaps the vision of Florman. One could characterize this as a vision of “integrity of the human artifact”, sustained by human skill and nerve. That is good; we certainly need to encourage this kind of satisfaction with integrity in specialized work; it is primal and human. But it characterizes both

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<sup>2</sup> All of this of course presumes the continued large imperfections in the price system, which is likely to be a feature of the global situation for at least 1 or 2 professional generations.

good and bad sides of technology, its productive and destructive sides. I saw this as an undergraduate and as an early-career professional.

As a graduate student I began to love the deep foundational theory we preserve as engineering science – it addresses natural phenomena as diverse as atmospheric motions, microelectronics, and navigation, with explanatory power. This is the world of Gauss, Helmholtz, Markov, Kalman. We certainly need to instill in our students a love of theory which works and a disciplined commitment to it. But this too is neutral, a construction of the mind which can work both ways for us.

These two images of engineering are displayed centrally in the icons of one of our great institutes – *mens et manus*, a blacksmith and a scholar. They are not a bad guide to the nature of our profession. But Professors need more, the “third rail” of engineering, the central animating idea of the Profession – the responsibility before the Creator for securing human rights in a technological world. And this view should always accompany the other two, prominently before students and onlookers alike. It is the only thing which can distinguish engineering-as-profession, from engineering-as-occupation; and the only thing which can properly guide us in right paths.

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