Roundtable Discussion: The Place of Ethics in Science, Technology, and Engineering

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This roundtable discussion centers on the question of the place of ethics in science, technology, and engineering. Its central motif is the ways in which scientific and technological values are entangled with ethical and social values – an entanglement that calls for critical reflection. We engage in this critical reflection on the place of ethics (the habits, habitats, and inhabitants of society) in technoscientific society in terms of three situations: risk assessment, research evaluation, and engineering.

The first situation, which is discussed by two of the panel members, involves the question of attitudes we ought to take toward risk and uncertainty. Both panel members address the contrast between the precautionary and proactionary principles. The former, precaution, is familiar and has been written into science policy documents (most notably, perhaps, in the European Union). The latter, proaction, is just beginning to be discussed in the scholarly literature. We will introduce and discuss the proactionary principle with reference to William James' *The Will to Believe* and Karl Popper's "piecemeal social engineering," and then explore some of its implications for science and technology policy. This includes a discussion of the ethics of monitoring and altering technological systems when they produce unintended negative consequences that are unequally distributed.

The third panel member will then address the issue of research evaluation, drawing special attention to the ethical implications such a process entails. In particular, this paper addresses the question of the proper balance between technical and non-technical values. The argument here is that any metric for the value, quality, or excellence of research will entail normative commitments that are likely to be hidden behind a quantitative façade. It is important to critically examine these commitments both for reasons of academic autonomy and social accountability.

The final panel member will continue the theme of the proper balancing of technical and non-technical values, but from the perspective of engineering ethics and education. The goal here is to identify problematic dynamics in current engineering practices that can contribute to unethical outcomes. The paper argues there is a need for engineers to think – and communicate – ethically, and it offers strategies for accomplishing this goal. In particular, the paper recommends a two-fold strategy focused both on an individual engineer's professional obligation to communicate clearly (and blow the whistle when necessary) and on a social re-organization of engineering from hierarchies to networks.

Risk, Uncertainty, and the Will to Believe:

Thoughts on the Application of the Proactionary Principle in Science and Technology Policy

According to More (2005), the proactionary principle states:

> People's freedom to innovate technologically is highly valuable, even critical, to humanity. This implies a range of responsibilities for those considering whether and how to develop, deploy, or restrict new technologies. Assess risks and opportunities using an objective, open, and comprehensive, yet simple decision process based on science rather than collective emotional reactions. Account for the costs of restrictions and lost opportunities as fully as direct effects. Favor measures that are proportionate to the probability and magnitude of impacts, and that have the highest payoff relative to their costs. Give a high priority to people's freedom to learn, innovate, and advance.

I explore the proactionary principle in contrast to the precautionary principle with reference to William James's "The Will to Believe" (1896). Fuller (2012a) has compared proactionaries to James and precautionaries to Clifford:

> For the Jamesian voluntary believer, epistemology is about leveraging what we know now into a future we would like to see. For the Cliffordian ethical believer, epistemology is about shoring up what we know so that it remains secure as we move into an uncertain future. The former seeks risks and hence errs on the side of overestimating our knowledge, while the latter avoids risk and hence errs on the side of underestimating our knowledge.

Fuller thus portrays the proactionary as "risk-seeking" in contrast to the precautionary, who is characterized as "risk-averse."

I argue we need to distinguish carefully between risk (a known unknown) and uncertainty (an unknown unknown), especially in terms of applying the proactionary and precautionary principles in science and technology policy contexts.

References

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William James (1896). "The Will to Believe," in The Will to Believe and Other Essays in Popular Philosophy. Project Gutenberg edition (2009): http://www.gutenberg.org/files/26659/26659-h/26659-h.htm.

Max More (2005). The proactionary principle is available on More's website here: http://www.maxmore.com/proactionary.html.

Innovation and Renovation:

The Ethics of Remaking

Engineers exercise power over reality by overlooking most of its complexity. Their goal is functional adequacy, not mirroring the world in detail. To create a working internal combustion engine, one need not take account of the political economy of oil or the environmental impacts of carbon. To create a working automobile, one need not take account of the design of cities or the health impacts of smog. Nonetheless, cars driven by internal combustion engines do not just succeed in the intended function of transportation. They also create unintended consequences of urban sprawl, pollution, fatal accidents, and energy insecurities.

In this way, the process of innovation (creating and enrolling a new technology into society) calls for a compensatory process of renovation, which seeks to mitigate unintended harms by amending the technology. Catalytic converters and seatbelts are added, fuel economy is improved, urban densification is promoted, new fuels are subsidized, etc.

This paper argues that there are two basic ethical responses to renovation. The first claims that renovation signals an ethical failure. Namely, more should have been done in advance to factor wider dimensions into the design and implementation of a technology. The precautionary principle is the best known articulation of this response. It calls for reducing uncertainties prior to innovation. Carl Mitcham's argument that engineers have a *duty plus respicere* is another formulation of an ethical injunction to factor more into account.

The second response claims that renovation is, rather than a moral failure, a practical necessity. Karl Popper's notion of "piecemeal social engineering," for example, begins from the premise that we cannot predict the future. Unintended consequences are inevitable. The best course of action is to closely monitor technologies and take targeted corrective actions when problems arise. Max More's "proactionary principle" formulates a similar ethical imperative rooted in the freedom to innovate. More derides the precautionary approaches as anathema to human progress. Like Popper, he emphasizes a preferred method of act, then monitor: "Let a thousand flowers bloom! By all means, inspect the flowers for signs of infestation and weed as necessary."

This poses a crucial question: When is weeding (i.e., renovation) necessary? The question has two components: a) what shall count as sufficient evidence of harm to warrant a renovation (and which renovation should be implemented)? b) who shall decide when a renovation is necessary?

These questions are fraught, because innovations in capitalist systems create vested interests. Those who profit from the innovation often stand to lose from any renovation. They will use their power (augmented by the wealth generated from their innovation) to cast doubt on and stifle evidence of harm and to marginalize opponents from decision making authority.

This systemic bias against renovation is an ethical shortcoming that must be remedied if proactionary or piecemeal social engineering is to live up to ideals of fairness and objectivity. There must be thorough and impartial monitoring and those most vulnerable to the harms of innovation must be empowered to initiate and design renovations.

The Politics of Measurement: Negotiating the Is-Ought of Research Impact Assessment

The contemporary academy is in a period of rapid change. Intensified budgetary restrictions, increasingly diverse student bodies, and demands to cater education to current market conditions all exert varying degrees of pressure on the traditional organization and institutional strategies of colleges and universities. In particular, challenges to the perceived irrelevance of much academic research to problems faced outside of the academy – environmental crises, issues of public health, and the general negotiation of democratic political involvement, to name a few – call into question traditional notions regarding the proper relationship between the academy and society. Rather, policymakers are now demanding to see the public returns on federal investment in academic research; in other words, the demand is for a demonstration of the impact of scholarship beyond the academy. In this presentation, I will summarize both critiques of the assumption that more scholarship equals greater societal progress and the demand for research impact assessment as a platform for critically analyzing a dominant response to this situation: the amalgamation of a host of numbers designed to demonstrate societal impact.

In a 2005 *Science* editorial, the late John Marburger III, then-director of the White House's Office of Science and Technology Policy, acknowledged a significant gap between the academy and society. He argued that the need for robust metrics, for example, to track the economic effects of specific (innovation) policies required not just episodic federal investment, but no less than a community of social scientists devoted to the task. A new National Science Foundation funding program, called the Science of Science and Innovation Policy (SciSIP), was introduced that same year, presumably to provide resources for the development of precisely that scholarly community. Marburger's recommendation seems an intuitive political response to the situation: in a knowledge economy, it is wise to consult those who produce knowledge (academics) when one encounters an issue pointing to a fundamental knowledge deficit. However, the assumption that only a specialized community of empirical scientists is best equipped to tackle the scope and depth of an inherently political (and, therefore, *philosophical*) situation reflects a questionable traditional deference not just toward academic knowledge and its producers in general, but toward specific kinds of academic knowledge (special sciences) and their specific producers (scientific disciplines). Even more troubling is that metrics and indices purporting to capture the impact of research upon society in general, economic and other, have proliferated to an extent that their applicability to assessing research impact is assumed. Additionally, attempts to point out flaws inherent in measures such as citation analyses and econometric models are typically met with the simple defense that what is needed are more and more sophisticated metrics.

On the contrary, I argue that approaching research impact assessment as a purely scientific or technical problem will fail to capture the actual policy implications of such assessments – the social and political governance of the academy – and will miss the point of demonstrating the impact of research in general. I will argue that the rationale for impact is political, not simply empirical; that is, impact raises questions of ethics, values, and tacit philosophical commitments to traditional presuppositions regarding the relation between academic research and the broader public in a democratic state. And it does so in a way that implicates a broader array of issues than pointing to direct, causal connections between academic and non-academic work.

Engineers' Ethical Thinking within Hierarchy：Problems and a Proposed Solution

In engineering today, two phenomena occasionally arise: (1) engineers only obey and execute the decisions made by managers, like soldiers obey orders from their superiors, and they don't ponder engineering projects ethically; and (2) even if engineers have ethical thoughts on their engineering activities, there is often a failure to communicate these thoughts effectively to managers. Both of these phenomena are harmful to carrying out engineering projects safely and effectively.

The first situation is a typification of "The banality of evil," and the second one I call "Deciding everything by one man's say". These two are very closely related to the modern hierarchical enterprise organization structure featuring a strong "command-to obey". "The banality of evil" in modern hierarchical enterprise results from the engineers' "inability to think". As inferiors, engineers feel they must simply obey their superior manager's decision and implement it with their professional knowledge and skills. "Deciding everything by one man's say" exactly means deciding everything by the manager's say. In other words, there is "enlightened despotism" in modern hierarchical enterprise.

Moreover, in a wider sense, the reason why engineers sometimes don't considerate their conduct ethically, or they don't argue their ethical standpoints with their manger, includes the whole social ethical environment: there is a misunderstanding of the nature of modern enterprise (it is only regarded as an economic organization rather than a social constituent), and engineers lack the ethical dimension of self-discipline and instead experience heteronomy.

To encourage engineers' ethical thinking and communication, I propose the following strategies: cultivating engineers' "hard consciousness" of professional ethics to make them insist on their ethical views and communicate with manger positively; and reorganizing and transforming the hierarchical enterprise organization structure into a networked enterprise organization structure.