[Extended Abstract]

Why Philosophy? Why Now?

Engineering Responds to the Crisis of a Creative Era

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1. INTRODUCTION

At this first *Workshop on Philosophy and Engineering* (WPE-2007), it seems useful to reflect on what may have caused such a gathering to come to pass and why it may have happened now. After all, philosophers and engineers haven't had much use for each other over the years. Certainly philosophers have been reflecting seriously on technology for some time [1], and engineers have occasionally waxed philosophical [1]. Indeed there has been the occasional individual engineer turned philosopher (most notably, Wittgenstein), and the occasional philosopher turned engineer (for example, Mark Bedau), but a formal meeting of engineering and philosophical minds is a rarity, and the occasion begs us to ask why this event has happened and to question why it has happened at this moment in history.

The purpose of this talk is to consider these questions from the standpoint of an engineering educator and researcher in the opening moments of the 21st century. I start by considering some of the ways in which philosophers and engineers are odd companions. I continue by examining the unsettling creative imperative of our times, how it has been shaped by certain technological and economic forces, and how these forces may be spurring a reexamination of the nature and practice of engineering. . This leads to the consideration of *philosophy as crisis response tool* and to a call for the injection of at least three elements of philosophical thought into the education of today's engineers.

2. STRANGE BEDFELLOWS

That a meeting of philosophers and engineers should take place at all is particularly strange if we recount some of the differences between them. On the one hand, philosophers are humanists and engineers are technologists. Philosophers are contemplative and engineers are action oriented. Philosophers are articulate and engineers are sometimes linguistically naïve. Philosophers delight in the ambiguity of contradictory positions and engineers eschew ambiguity with a vengeance. Philosophers pursue reflection in itself, and engineers use reflection as a tool.

With such a load of differences, it seems odd that those gathered at the workshop might have anything to talk about at all, but I hasten to add that generally philosophers and engineers do share a passion for *logic*. Moreover, it is probably safe to assume that the philosophers and engineers gathered at this workshop share a greater interest in technology and philosophy, respectively, than we might find in corresponding populations at large. Nonetheless, the coming together of almost polar opposites deserves a better explanation than can be obtained by citing a single common interest or a fortuitously biased sample of individuals.

3. THEN AND NOW?

The Hegelian habit of seeking developmental explanations in countervailing forces in history may be useful in this regard. In particular, I see engineering as practiced today as a particular *paradigm* developed in response to the technological, governmental, and economic conditions following World War II. I then argue, as many others have, that our current times demand increased *creativity* and *inventiveness* particularly in the advanced economies in ways that recommend change in engineering patterns of thought.

3.1 World War II and Engineering Today

Engineering as taught today can be understood as largely a response to the technological and economic forces in place after World War II. At that time, economies of scale were dominant, large hierarchical organizations were the rule, and engineers became increasingly scientific in response to perceptions of the status of science after the war. Whether this status was deserved and whether the reaction should have been as strong as it was can be debated [2]; however there is little doubt that these tendencies were reinforced by governmental actions [3] that funded basic scientific research in post-war government labs and universities, thereby encouraging academic engineers to join what was then a new money chase.

3.2 Friedman, Florida, Pink & All That

A number of current authors [4-6] have looked at the globalizing technological and economic changes around the world and concluded that returns to routine analytical work, including engineering, are diminishing, and returns to *creativity* are increasing. Friedman's *The World is Flat* has become a shorthand symbol for these thoughts, and flat worlds are almost everywhere remarked. *Pink's* analysis in *A Whole New Mind* [6] has a number of useful clues for actionable change in curriculum, but a key distinction can be made between the *category enhancers*, workers who merely improve upon existing category of products, and *category creators*, those who are sufficiently creative to develop and market successful new products and services.

The point here is not to follow these analyses in detail, but rather to understand that the world of engineering has changed in a way that demands attention, and to observe that those who teach engineering continue their allegiance to a paradigm developed in earlier times.

4. KUHN & THE RESPONSE TO CRISIS

The use of the term "paradigm" in the previous paragraph was, of course, an allusion to the book that made that term famous. Kuhn's *The Structure of Scientific Revolutions* shook up both the philosophy and history of science in important ways, but here we are concerned with Kuhn's observations with respect to scientists, their response to crisis, and the role of philosophy [7]:

> …I think, particularly in periods of acknowledged crisis that scientists have turned to philosophical analysis as a device for unlocking the riddles of their fields. Some have not generally needed or wanted to be philosophers. Indeed, normal science usually holds creative philosophy at arm's length, and probably for good reason…But that is not to say that the search for assumptions cannot be an effective way to weaken the grip of a tradition upon the mind and to suggest the basis for a new one. (p. 88)

Kuhn is suggesting that scientists rarely turn to philosophy explicitly except in cases where old scientific paradigms are ripe for overthrow because of an accumulation of anomalies that resist "puzzle solving" within the rules of the paradigm.

Here I argue that a key reason we are now meeting in Delft, at least from the perspective of engineers and engineering educators among us, is that, like physics at the turn of the 20th century, engineering is in considerable crisis because the engineering paradigm of WW2 and the cold war is unable to effectively design artifacts of a postmodern creative age.

5. CENTRIPETAL FORCES OF THE O'S

The reliance on science-push engineering unleashed at the end of WW2 continues unabated. Engineering deans like to talk about the O's of 21st century technology: nan**o**technology, bi**o**technology, and inf**o**rmation technology, and without a doubt nano and bio are members of the science-push club. For nano- and biotechnology, the paradigm of the WW2 and the cold war work pretty well, except that the *pace of change* and the relentless push of new products and services into unfamiliar territory *does* up the ante along lines suggested by creative age theorists.

Having said this, information technology responds to both technological opportunity and human concerns in unprecedented ways. Where in the cold war, humans were error to be eliminated from the loop, today humans, in some sense, *are* the loop. Cursory reflection about Google, Ebay, Facebook, and other examples of information technology of our age reveals the integral nature of humans as part and parcel of the systems engineers must design today. Although the push for new categories is as fast and furious as in the other O's, the need to understand another O, *homo sapiens,* and to develop better soci**o**technology pushes engineering into areas where it has only made limited forays. Thus, the challenges of category creation and the challenge of *homo sapiens* in the loop help push engineers to reflect on the nature of their education, training, and occupation.

6. THREE LESSONS

The remainder of the talk considers three lessons of ancient and modern philosophy for the creation of new categories of product and service. These lessons have been explored in a one-hour course (14 lectures) entitled *Creative Modeling for Technology Visionaries* taught online (here) at the University of Illinois at Urbana-Champaign.

To develop effective methods of modeling novel product/service situations, the course considers three elements: (1) *Socratic dialectic,* (2) *Aristotelian data mining,* and (3) *construction of engineering reality.* The empirical success of the first two items in bootstrapping the Western project of knowledge argues for their injections in other situations where systematic creative understanding must be obtained. The third element carries *The Construction of Social Reality* [8] into the realm of engineering with examples drawn from Web2.0 systems design.

7. REFERENCES

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