Marco, Micro, Structure, Agency: Analysing Approaches to Engineering Ethics

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Marco, Micro, Structure, Agency: Analysing Approaches to Engineering Ethics[1]

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[1] For the purpose of brevity referencing has been kept to a minimum. This is based on a paper given at the 2011 Annual SEFI Conference: http://www.sefi.be/wp-content/papers2011/T6/187.pdf. See also Conlon and Zandvoort (2011).

There have been many calls for the reform of Engineering Ethics education. The dominant approach, which uses case studies to teach students to solve ethical dilemmas, is being rejected. Various alternatives to a narrow focus on case studies have been suggested including a demand to focus on macro issues (Herkert 2006) or to use an approach based on aspirational ethics (Bowen 2009). Others call for a fuller engagement with the philosophy of Technology (Son2008) or Science, Technology and Society Studies (Lynch and Kline (2000). Others (Mitcham 2009) have identified a "policy turn". This is seen as particularly important in light of increasing demands that engineers practice the principles of sustainable development (SD) (Donnelly and Boyle 2006).

All of this presents a challenge to those attempting to integrate Engineering Ethics into higher education engineering programmes . Given the divergence in approaches, it is necessary to develop tools to understand these approaches and how they might relate to each other. Such consideration may allow us to explore the possibilities for developing an integrated approach to teaching Engineering Ethics . The various approaches can be analysed using a useful framework developed by Ritzer (2001) to map out different paradigms in social analysis. The framework is based on four levels of analysis which emerge from the interaction of two social continua: the *macro/micro* (the magnitude of phenomena) and the *subjective/objective* (whether a phenomenon has a material existence, or exists simply in the realm of ideas and knowledge).

Given the emeregence of a variety of approaches to Engineering Ethics and the demand for a greater focus on macro issues, Ritzer's framework provides a useful tool for analysing current approaches (Fig 1). It highlights the importance of both micro and macro levels of analysis, and their integration. Crucially, it allows us to see that a macro-focus involves interrogating both the *goals* of the profession and the *social context* in which engineers work. This may allow us to avoid a moralism that may burden engineers with responsibilities that they cannot meet, while allowing us t better identify those circumstances which would facilitate the attainment of broad goals such as enhancing human welfare.

In using Ritzer's framework, my focus is on capturing the fundamental image of the subject as presented by each paradigm.

Macroscopic			
Objective	**Macro-Objective:** Focus on social, economic and political structures and public policy	**Macro-subjective:** Focus on goals and values of the profession	**Subjective**
	Micro-objective: Focu on organisational culture and processes.	**Micro-subjective:** Focus on consciousness of individual engineers: their ability to identify and solve ethical dilemmas.	
Microscopic			

Fig. 1 Levels of analysis in engineering ethics

Micro-Subjective Approach

The main focus of this approach is the *consciousness* and *commitment* of individual engineers, along with their ability to *identify* and *resolve* ethical dilemmas. This approach considers the ethical commitments of individuals and uses simplified case studies to "train" students to resolve ethical dilemmas which often involve challenges to managerial wrongdoing (see Conlon and Zandvoort, 2011).

Key problems with this approach include the assumption that win-win solutions exist for ethical problems; further, it assumes that individual engineers can actually implement their proposed solutions. The case studies used in training typically do not adequately reflect real-world engineering practice. In focusing solely on an individual engineer's possible courses of action, these case studies tend to be uninformative about the social, organisational and political complexities of engineering practice. Further, the focus on clashes of interest between management and engineers means that engineers' own practices are not subject to critical examination - the assumption tends to be that engineers need to be emboldened to resist amoral managers. Despite this limitation, however, this approach does highlight the manner in which strictly commercial-focused needs can clash with the requirements of good engineering.

Micro-Objective Approach

In order to address the context of engineering practice , some have argued that Engineering Ethics should be informed by Science, Technology and Society studies.

The focus in this approach is on *why* accidents happen in engineering projects. The explanation is usually sought within the prevailing organisational culture and processes with exemplary work being Vaughan's (1996) analysis of the Challenger space shuttle disaster. In explain the disaster she emphasises *institutional logics* and the manner in which patterns of behaviour developed and became institutionalised within the organisations supportinthe Shuttle programme. Vaughan discusses how risk came to be redefined, leading to a number of   launches with a flawed design. This led to what Vaughan calls the "normalisation of deviance".

Lynch and Kline (2000) draw on Vaughan's analysis to argue for a focus on the *detail* of engineering practice and the *role* of organisational culture and processes. Their aim is to explore how engineers can learn to identify features of their practice that potentially contribute to ethically problematic outcomes *before* clear-cut dilemmas emerge. They propose that engineers should exercise imagination to prevent these problematic characteristics from developing in their practice. While this approach can be welcomed as it moves us away from simplified case descriptions lacking their organisational and social context it is not without problems.

Firstly, although Vaughan pays considerable attention to the wider economic and political environment in which NASA operated and the way it reinforced the normalisation of deviance Lynch and Kline's focus is mainly on the organisational culture. Secondly, in focusing on the issue of organisational culture itself, there is a danger of seeing organisational actors as "social dopes who are merely following the script. This can lead to a neglect of the capacity of organisation members to challenge dominant cultural scripts. Lynch and Kline also fail to specify how engineers who become aware of the normalisation of deviance are to change the problematic aspects of organisational practices Some (Swierstra and Jelsma 2006) have argued that the picture painted by Lynch and Kline is too rosy and call for “an institutional ethics”: a focus on the relationship between individual moral agency and the individual’s enabling and constraining environment

Macro-SubjectiveApproach

Bearing in mind these criticisms, we can widen our focus and examine the role of *macro* issues in Engineering Ethics. The shift of focus to the macro level requires, in the first instance, a focus on the *goals* of engineering. This approach requires that engineers reflect on *what kind of society* is desirable.

Bowen (2009) calls for an “aspirational ethics”. He makes a distinction between ethics and morality. He states that ethics may be seen as *aims* of a life that can be regarded as good, and morality as *norms* that provide articulation of these aims. He argues that Engineering Ethics has focused, to date, on *morality* and suggests that engineers have, to a significant extent, forgotten that their primary objective is the promotion of human well-being. He suggests that engineers have mistaken wealth and engineered artefacts for the real end of the practice, which is actually human well-being. What is needed, he argues, is the development of a genuinely aspirational ethical ethos within engineering which prioritises human flourishing through contributing to human well-being.

Bowen argues that engineers have not engaged sufficiently in any ethical analysis of their activities; he suggests that engineers themselves need to adopt a positive way of life and take responsibility for the outcomes of their activities. A person who “genuinely possesses a virtue would be expected to manifest it through the range of his or her activities” (p. 79)

Bowen’s approach is useful in reminding engineers of the importance of prioritising people’s needs. But it is not clear that he offers a clear path to address the failure to do so. He neither provides criteria by which human well-being can be judged, nor adequately takes account of the specifically corporate context in which much engineering takes place.

The main emphasis, for Bowen, is on the *culture* of engineering and the development of an aspirational ethos. There is a danger here of moralism. While engineers *may* be committed to ethical practices it is not always *possible* to behave ethically. To exercise moral agency, commitment to particular outcomes *is* necessary, but so is the power to achieve these outcomes. Bowen provides no discussion of power and no engagement with what has been called the “captivity of engineering” (Holt 2001).

Raising the level of analysis to address the broader goals of engineering is therefore not enough, unless we address the capacity of engineers to practice engineering in a way that promotes human flourishing.

Macro-Objective Approach

At the heart of this approach is the demand of Zandvoort et al. (2000) that engineers need to accept that they must play an active role in helping to reshape the context from which ethical problems arise “whenever that may be necessary”. Such an attitude will help engineers to meet their ethical responsibilities and facilitate the attainment of the goals of engineering.

It is possible to identify two broad and overlapping approaches to facilitating change in the environment in which engineers work. The first would seem to accept that the current organisation of production and consumption *can* be reformed through regulation to give support to engineers. The second questions whether the goals of sustainability and social justice *can* be met within the confines of current relations of production and consumption. Some have argued that reform is not enough, that we need a wider focus and that there are contradictions between the goals of engineering, such as sustainability, and current political and economic priorities (Petrella 2001). Some call for opposition to market based problem solving (Nieusma 2004).

Within this broad approach we can also see a demand for for a fuller engagement between Science and Technology Studies and Engineering Ethics (Johnson and Wetmore, 2007). STS offers “thick” descriptions (complex and context-driven) of the manner in which technology and society are co-determined. It is argued that engineers do not just produce technology, but socio-technical systems which shape human activity (Johnson and Wetmore 2007). Thus engineers’ ethical responsibilities are wider than traditionally understood; further, they must engage with other actors who are responsible for the development of socio-technical systems. The problem here is that some STS scholars lack a general perspective on the social and technical patterns under study and shy away from normative analysis and proposals for changes in public policy (see Herkert 2006).

Agency, Structure, or Macro-Micro

This brief review of different approaches to Engineering Ethics suggests there are a number of factors to be considered when examining the capacity of engineers to practice engineering in a socially responsible manner. An integrated approach would not merely add the macro approach to the micro approach, but incorporate the four levels of analysis and their interaction into the *analysis of engineering practice*. Some issues arise from this.

Firstly, rather than trying to neatly demarcate what is or is not a macro or micro issue, it might be better to use the sociological distinction between *structure* and *agency* as a basis for integrating macro issues into the analysis. It is not always clear that macro and micro issues can be distinguished. A focus on macro issues does not mean that micro issues disappear but rather highlights the need to widen the analysis to look at how the broader environment enables or constrains the capacity of engineers to, for example, design safe products.

Secondly, agency can sometime be misunderstood as the absence of structural constraints, suggesting that that all structural forces are negative. This, to some extent, arises from a traditional focus on professional autonomy in Engineering Ethics (Davis, 1996) and the conflation of agency and autonomy. But we know from social theory (see for example Archer 2000) that structures can either *enable* or *constrain* social actors. So, for example, building regulations can improve energy efficiency, thus providing gains for the public, while also enabling engineers, committed to sustainability, to implement their designs. Thus, the agency of engineers is increased through regulation. What is at stake here is the character of regulation. It is the case that regulations have not always addressed the need to promote sustainability. But as values have changed in society and social struggles by environmental activists have taken effect, change has occurred. The question, then, is one of engineers developing alliances *across* society with the aim of promoting the kinds of change that will enable them to attain goals such as sustainability in their practice. Such arguments may force engineers to consider their relationships with other actors in society. In this context, a focus on professional autonomy within the profession may not be helpful.

Finally, it is clear that there are diverse views on what is involved in attaining the goals of safety, welfare and sustainability in engineering. For example, there is a need for the profession to clarify what it actually means by *sustainability*. In the interim, those teaching Engineering Ethics have a responsibility to provide students with the recognition that change is *necessary* and *possible* and that there *are* alternatives to the market-based systems which constrain the activities of engineers. Without a sense that alternatives exist, agency fails to have any real meaning, as outcomes are seen as predetermined. Thus it becomes necessary to consider *what* alternative models of engineering practice are available, other than those located within profit-driven and hierarchically-organised corporations.

References

Archer, M. (2000) *Being Human,* Cambridge University Press.

Bowen, W.R. (2009) *Engineering Ethics: Outline of an Aspirational Approach*. London: Springer.

Conlon, E. and Zandvoort, H. (2011) Broadening Ethics Teaching in Engineering: Beyond the Individualistic Approach, *Science and Engineering Ethics*, 17 (2), 217-32.

Davis, M. (1998) *Thinking Like an Engineer,* Oxford University Press.

Donnelly, R. and Boyle, C.(2006) The Catch-22 of engineering sustainable development. *Journal of Environmental Engineering,* (February 2006), 149-155.

Herkert, J.R. (2005) Ways of thinking about and teaching ethical problem solving: Microethics and macroethics in engineering. *Science and Engineering Ethics*, 11(3), 373-385.

Herket, J.R. (2006) Confession of a shoveler. *Bulletin of Science, Technology and Society*, *26* (5) 410-8.

Holt, J.E. (2001) The status of engineering in the age of technology, *International Journal of Engineering Education*, 17 (6), 496-501.

Johnson, D.G Wetmore, J.M. (2007) STS and ethics: Implications for engineering ethics. *The Handbook of Science and Technology Studies*. MIT Press.

Lynch, W.T. and Kline, R. (2000) Engineering practice and engineering ethics. *Science, Technology and Human Values*, 25 (2) 195–225.

Mitcham, C. (2009) A historico-ethical perspective on engineering education: from use and convenience to policy engagement, *Engineering Studies*, 1(1), 35-55.

Nieusma, D. (2004) Alternative design scholarship: Working toward appropriate design, *Design Issues*, 20(3), 13-24.

Petrella, R (2001) Globalisation and ethical commitment. In P. Goujan and B.H. Dubreuil, Technology and Ethics, Peeters: Leuven.

Ritzer,G. (2001) *Explorations In Social Theory: From Metatheorizing To Rationalization*. London: Sage.

Son, W.C. (2008) Philosophy of technology and micro-ethics in engineering. *Science and Engineering Ethics*, 14,(3), 405-415.

Swierstra, T. and Jelsma, J. (2006) Responsibility without moralism in technoscientific design practice. *Science, Technology and Human Values,* 31(3), 309-332.

Vaughan, D. (1996) *The Challenger Launch Decision.* University of Chicago Press.

Zandvoort, H., Van de Poel, I. and Brumsen, M. (2000) Ethics in the engineering curricula: topics, trends and challenges for the future, *European Journal of Engineering Education*, *25*, (4) 291–302.