Between Theory and Practice. Scope and Interfaces of Engineering Ethics as Subject for further Research

A. Grunwald
Institute for Technology Assessment and Systems Analysis (ITAS), Research Centre Karlsruhe
P.O. box 36 40, 76021 Karlsruhe, Germany
Email: grunwald@itas.fzk.de

Abstract **– The subject area of engineering ethics is shaped rather differently, depending on the various standpoints. It reaches from descriptively analysing the behaviour of engineers with respect to moral criteria up to normative questions in what way engineers could design more "sustainable" technology. In this paper an approach is presented which allows to transparently derive the scope and relevant interfaces of engineering ethics as an attempt to structure the ongoing discussion and to allow further research.**

I. INTRODUCTION UND OVERVIEW

In many areas of society there is general agreement concerning that ethical reflection *should* be indispensable in technology development. Not only philosophers but also many managers and engineers are deeply convinced that ethical reflection plays an important role in shaping technology in a socially acceptable and environmentally sustainable way. Many engineering ethicists assume that technology development is decisively influenced by engineers and conclude that engineering ethics should be the best (and perhaps only) instrument to avoid the negative impacts of technology. This assumption leads to the demand that engineers should always perform ethical reflection parallel to their engineering work.

Many situations in engineering and business activities, however, can be classified as "business as usual" under moral aspects (cf. part II). Those situations are free from requirements to perform ethical reflections – free with respect to a surrounding normative framework which is not questioned in that context. If, however, questions concerning this framework arise then explicit ethical reflection is called for and is indispensable [1]. In this way it emerges that though ethics is – principally – indispensable for technology development, concrete ethical reflection in many cases may be replaceable by recourse to some "*morale provisoire*" governing the morals of the area affected [2]. This simplifies many processes in shaping technology by taking away the burden of reflecting each step under ethical regard but, on the other hand, emphasizes the role of ethics in cases where such "*morale provisoire*" does not cover all relevant aspects sufficiently. However, the challenge to distinguish between situations of the "business-as-usual"-type and extraordinary situation types remains. This is the most critical interface between engineers and ethics. Accordingly, to detect "entry-points" for ethical reflection is perhaps the most difficult task in this field. Given an engineer in a specific situation: how shall he or she decide whether there is an ethical problem involved in his or her work or not. What are the criteria to be applied in answering that question? What competences are required in the judgement if there might be an ethical problem or not? These questions are leading to challenges to research on engineering ethics, reflecting the scope of engineering ethics on the one hand and considering its interfaces to other disciplines on the other hand. Answering the questions mentioned above cannot be done by ethical reflection alone; research and theoretical investigations from the social sciences, especially the theory of society, have an essential impact on how to answer that questions [3]. In the present paper it will be analysed in which directions research in engineering ethics could give orientation how to improve the curriculae of teaching in this field.

II. ORIENTATIONS FOR DEFINING THE SCOPE OF ENGINEERING ETHICS

The task of ethics in general is to analyse ideas of the "good life" with respect to their justification structure, their presuppositions and premises, their normative content and their justifiability in order to compare different proposals according to their universalizability. In this way ethical reflection can be seen as a methodological endeavour dealing with the set of methods, procedures, instruments and tools to discoursively manage and solve conflicts arising from different moral assumptions in the absence of consensually accepted customs or moral systems.

In this view the term "conflict" must not be considered in a too narrow and restricted sense. It includes moral ambiguities, uncertainties and indifferences as well as new challenges, for which moral customs are yet to be established, and the doubting of established moral traditions applying them to new problems. It therefore serves as a framework for all situations where, for a given action or decision-making problem, *there is no consensually accepted moral background from which orientation for decision-making can be gained.* Categorising ethics as a reflective discipline for factual morals it can, therefore, achieve practical relevance to technology development *only if technology decisions involve moral conflicts.* Otherwise, engineering is a kind of "business-as-usual" in the sense explained below. To develop orientational knowledge about the requirement or necessity for ethical reflection in the various steps and processes of technology development by engineering the question shall be answered which types of decision-making situations can be declared as "business as usual" and which criteria for classifying them in this way may be applied. Following examples may lead to a preliminary understanding of engineering as "business as usual":

(1) Consider an engineer within a typical engineering process working in a team at a laboratory improving some technical features, for example, of an automobile, or improving the

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materials quality of some substances, for example designing a special steel to decrease the weight of some automobile components. Engineering activities of this type, so the hypothesis, does not need ethical reflection as long as some conditions are fulfilled (see below).

(2) In the management of a company the decision about a new production chain has to be taken. It consists of the choice between two alternatives differing in some technical features, in the cost/benefit-ratio and in some long-term strategic factors. Actors and decision-makers in this type of situation are often or even mostly, so the hypothesis, not obliged to perform ethical reflection - of course, the same as above, only if some conditions are given (see below).

The most important question behind these examples for assumed spaces free from the necessity for ethical reflection in technology development is, therefore, the question concerning the criteria defining the boundaries for such „ethics-free" spaces. If these can be given in a transparent and justified manner it can then be investigated empirically whether the conditions are fulfilled or not. In such a way defining the criteria is a task of ethical reflection itself, reflecting its own limits to practice while the investigation of the fulfilledness has to be performed empirically by means of the social sciences (this situation is a first example for relevant interfaces of engineering ethics, cf. part 1).

What conditions have to be fulfilled? The hypothesis can be, as a proposal, sharpened to the following formulation of a principle [1]: *steps, decisions and processes in technology development are free from the demand or necessity for ethical reflection if, and only if, there is a comprehensive, clear, commonly accepted and factually acknowledged normative framework, which has to be and factually is followed in technology development*. This definition, however, is to be made more operational by concretizing the following properties as indispensible for normative frameworks to allow such „ethics-free spaces" for professional activity:

(1) Comprehensiveness: The norms, principles and customs included in the normative framework must be comprehensive in the sense that they are sufficient to handle the problem under consideration. If this is not the case and if, instead, new moral questions have to be taken into account, the "business-as-usual"-type of situation does not cover these questions.

(2) Clearness: (a) There shouldn't be any ambiguity in the understanding of the normative framework between the various persons and groups affected and (b) a clear ascription and distribution of responsiblities among them has to be guaranteed. Otherwise, in the case of ambiguities with respect to the understanding of the framework or the distribution of responsibilities the "business-as-usual"-type of situation is left.

(3) Acceptance: The normative framework must be commonly accepted by the persons or groups affected. This point ensures that a technology developed according to the accepted normative framework should find acceptance, too. The framework must be accepted not as an eternal truth but as some kind of *morale provisoire,* being valid until some change occurs [2]. Severe doubting, however, leads to the necessity for ethical reflection and implies leaving the "business-as-usual"-type of situation.

(4) Acknowledgement: The normative framework must not only be established and commonly accepted but also be acknowledged. This means that laws, regulations, moral codes and customs are, in fact, followed by the participating persons or groups. The "business-as-usual"-type of situation is left if there are any violations or infringements of the normative framework. Many of the classical conflicts in engineering ethics are of this type.

These conditions for classifying decision-making and action situations in engineering as "business-as-usual"-type of situation sound, perhaps, very severe and restrictive. But they apply, in my opinion based on my knowledge about the process of technology development, to many situations. Those situations are, consequently, free from requirements to perform ethical reflections.

The *comprehensive, clear, commonly accepted and factually acknowledged* normative framework serving as an „axiological information" for the engineer is constituted by the sum of all action norms, principles or other kinds of customs, generally accepted guiding the concrete actions in technological development. In general, the normative framework consists of

- all obligations given by political regulation, such as, to acknowledge environmental or safety standards in designing new technologies and technological systems or other kinds of regulation by law relevant to technology development like waste disposal stipulations,
- all obligations below the level of regulation by law resulting from other societal regulation or quasi-regulation by generally accepted customs or traditions (here the various and presently intensively discussed professionalities' „Codes of ethics" can be mentioned as well as the "Hippocratic Oath").

It has to be taken into account very carefully that the ascription "ethics-free" to specific decision situations is valid only relative to the assumed validity of a surrounding normative framework. If, however, questions concerning this framework have to be dealt with, then explicit ethical reflection is indispensable. This is the case if there are moral ambiguities, ambiguities in the distribution of responsibilities, infringements of regulations or doubts on or insufficiencies of the normative framework. In this way an only seeming paradox emerges: namely that though ethical reflection is – principally – indispensable for "reasonable" technology development, in many situations concrete ethical reflection may be renouncable in favour of referring to a normative framework governing the morals of the problem concerned. This is taking away the burden of reflecting each step in engineering under ethical regard. On the other hand, however, it emphasizes the role of ethics in cases where such a commonly agreed and followed normative framework does not cover all relevant aspects in a sufficient manner.

The distinction of "ethics-free" situations and situations obliged to ethical reflection allows to raise two types of research questions for engineering ethics. At first, it seems sensible to investigate this normative framework in more detail. This challenge opens interfaces of engineering ethics and law, the political sciences and value research. Secondly, the border between both areas has to be analysed very carefully because this border is not an eternal or ontological one but is "constructed" by society and, therefore, is varying through time and culture cf. part III).

III. SCOPE AND INTERFACES OF ENGINEERING ETHICS

The main distinction introduced in part 2 shall be used as an analytical framework for arriving at orientations for further research on the scope and interfaces of engineering ethics. The scope of engineering ethics is societally defined (constructed). This "construction" does not happen explicitly but is implicitly created in the practices of society (and, for example, influenced by technology development, cf. the thesis of the co-evolution of technology and society [4]). Therefore, empirical research as well as hermeneutical interpretation are required to make this normative framework and its changes over time explicit and accessible for reflection. The scope depends on several factors including:

- the "state of the art" of the normative framework of society (see part 2 for a tentative description of the elements involved); the task of explicating the normative framework and its borders or its "grey zones" is an important point of a future research agenda of engineering ethics;
- the diagnosis whether a specific question is covered by the normative framework (defined by the criteria given above) or not; this ascription requires a normative background in form of criteria ruling the judgment if the criteria defining a "business-as-usual" situation are fulfilled or not. This leads to reflection requirements in normative ethics;
- the assessment which role engineers have in the overall process of technology development and which kinds of decisions to be made by engineers are possibly subject to ethical reflction and what engineers should do in such cases. These questions can be answered by social science of technology.

The following interfaces of engineering ethics are important in looking for answers to these questions:

- normative ethics;
- philosophy of technology;
- law and its influence of technology (including the limits of law);
- theory of society, especially the theory of the normative elements of society [5];
- sociological modelling of technology development in order to learn more about the role of engineers in technology development.

IV. LEARNING AND PROGRESS

The next question arises regarding the range of validity of ascribing the predicate „ethics-free" to a special situation. Such frameworks can only be understood as elements of a *morale provisoire* [2] because they are based upon a pre-deliberative agreement, which itself may change due to the cultural evolution or is intendedly changed by explicit reflection upon it. Accordingly, the designation „ethics-free" always shows this provisional character. It has to be taken as an ascription relative to the actual state of the relation between culture, society and technology, relative to the moral convictions of society and to the knowledge about consequences and impact of technology. The ascription, therefore, is valid, quite analogously to a *morale provisoire*, as long as there is no need for modifying it or adding something to it – it is valid so long as it works well.

Its validity may be destroyed or decreased by several mechanisms. Such mechanisms can be identified by analysing the cases for which the criteria mentioned in part II are not fulfilled. There might be, for example, inherent crises of the normative framework caused by detected inconsistencies, externally drawing into doubt some essentials of the framework, severe factual infringements or technical inventions which imply, as a consequence, that the normative framework no longer covers the moral questions involved in that technology.

This argumentation highlights that technology development can not simply be oriented to factually accepted norms or values, as is often presupposed in approaches of participatory technology assessment. This is hindered by the inherent innovative mechanism of science and technology: the moral background does not consist of a fixed framework into which the new technologies must fit (or otherwise be rejected). Instead, the moral framework has to be developed hand in hand with technology development – it is exactly the task of ethics to reflect and support this moral development. This mechanism of a co-evolution of technology and morals leads, as a consequence, to the point that the normative framework governing technology development in certain situations as well as the ascriptions of „ethics-free" spaces for technology development *are both provisional in their validity*: metaphorically speaking, some levels of morals agreed upon within the stream of evolution.

This situation opens further question for engineering ethics. If there is a co-evolution of technology and values how can this evolution be made subject to intentional shaping instead of leaving it to quasi-natural and blind evolution? This can be done, so the thesis which has still to be elaborated in more detail, by designing ethical reflection on technology as part of an overall process of reflective learning. The subject of this learning process is the normative framework of society and its challenges by technological innovations. This shows that engineering ethics has two functions:

1) Orienting the engineer's behaviour as is mostly see as the main task of engineering ethics [6];
2) Contributing to social progress by learning processes and developing further the societal normative framework guiding the development and enculturation of technology.

In this way, engineering ethics is confronted also with the question of intentional malleability of technology at the different levels of engineers and businesspersons. Normative conflicts at these levels arise and force society to develop new normative elements to handle resulting conflicts. Engineering ethics, therefore, cannot be separated from a general ethics of technology [4].

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