Philosophy of Engineering and Artifact in the Digital Age

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Edited by

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LETTER ADDRESSED BY LUCIANO FLORIDI TO THE PHEADE 2009 PARTICIPANTS

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To the Organisers
Suceava's International Workshop
PHEADE 2009 – Philosophy of Engineering and Artifact in the Digital Era /2009

Dear Colleagues,

it is with great pleasure that I send you this message of greetings and congratulations on behalf of the International Association for Computing and Philosophy (IACAP, www.ia-cap.org).

Following Prof. Peter Boltuc's welcome suggestion, I have been following initiative in support of PHEADE 2009 and publicised within our association, as one deserving careful attention from our membership. It is a splendid and very timely idea.

We know that the world is changing dramatically and at an unprecedented speed. Never before has humanity experienced so many and such radical changes and challenges, in so many contexts, in such a short time. The transformations of our time so often depend on new technologies, which are themselves constantly evolving. It is a bubbling new reality in need of understanding and intervention. So it seems clear that our future requires a new alliance between philosophy and engineering, perhaps more in line with Francis Bacon than with Plato.

What unites us, philosophers and engineers, is our interest in understanding and building systems, whether purely conceptual or physical. We, as builders, carefully and painstakingly construct the conceptual and practical frames and tools that enable humanity to make sense of the world and to flourish in it.

It is for this very reason that IACAP has always supported a robust and fruitful dialogue between philosophy, engineering sciences, and technology. It is hard to think of a more crucial area of philosophical investigation in our society, which we define, after all, as the information society.

All this explains the very high appreciation and esteem that I would like to express, on behalf of IACAP, towards the organisers and the staff of PHEADE 2009. It is an impressive initiative, which we all hope may have a bright future.

To conclude this short message, allow me to wish to all participants a fruitful and pleasant meeting. I am sure you will enjoy the talks and take full advantage of the many opportunities for new interactions and learning offered by such a stimulating environment.

All my best regards,

Luciano Floridi

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CHAPTER ONE

EXPLORATIONS IN THE PHILOSOPHY OF ENGINEERING AND ARTEFACT

PHILOSOPHY, ENGINEERING AND TECHNOETHICS

VIOREL GULICIUC

1 Engineering Crisis and Technoethics

Most academic subjects have a meta-theory, a philosophy, as the case with the philosophy of science, the philosophy of mathematics, the philosophy of logic, the philosophy of law, the philosophy of communication, the philosophy of education, the philosophy of history and so on.

In the second half of the 20th century, in times of crisis, both for philosophy and for engineering, humankind rediscovered how the highest *techné* had a definite theoretical dimension and the highest *theoría* is also a practice. Expressions such as "practical theory" or "theoretical engineering" became common. However, this was possible only after the major crisis of philosophy itself, expressed in postmodernism, and the major crisis of engineering itself, when considering the so called emergent technologies (and especially robotic, nanotechnology and genetic engineering).

The workshops organized worldwide on the philosophy of engineering[1], *seem to suggest that the interest is not for the philosophy* in *engineering, but for the philosophy* of *engineering.*

> "Engineers are ... the unacknowledged philosophers of the postmodern world"

writes Carl Mitcham, (1998, 27).

The *ethic concerns* on the use of the emergent technologies (Joy, 2000) are waking up the interest of the philosophers too; the logic and the

[1] After the series ***Philosophy of Engineering*** workshops organized by the Royal Academy of Engineering and ***WEP 2007*** (Delft) and ***WEP 2008*** (London), we could mention ***Working Towards a Philosophy of Engineering***, a seminar organized on 25 January 2006, Loughborough University or the ***PHEADE 2009 (Philosophy of Engineering and Artefact in the Digital Age - 2009)*** workshop organized at "Stefan cel Mare" University (Romania).

philosophical methodology are more and more appealing for the engineers etc.

Day after day, *theoría* and *techné* meet in various ways, because, at its origins, the highest *theoría* has the *techné* inside and the *techné* itself is a *theoretically* designed activity.

We could say, based on the advances in modern technology, that engineering has provoked dramatic changes in contemporary society; that we are living in a society of engineering. So, engineering could be of bold ethical, contextual, and cultural interest.

Let us remember the brutal loom of ethics in engineering when discussing the *Q-ring* problem, after the crash of the space shuttle Challenger, on January 28 1986. Seven lives was the price for responsibility, unjustly paid by the engineer that designed those gaskets, forever after having a life of conferences on the ethics of engineering.

Nowadays engineering is enriched by the ethical debates from IT, nanotechnology, robotics, genetic engineering, bionic systems and communication technologies. In fact, one could observe that the number of the events organized under the "umbrella" theme of ethics is almost asymptotically increasing. There is interest for topics related to the relationship between engineering and theology.

These situations seem to express some ground fears and awareness of the human condition and future in a technologic society…

Even its roots cannot be separated from the philosophy of technology (Vermaas, 2007, 25), it is only under globalization, beginning with the transmodern era, philosophy of engineering becomes an emergent domain (so, *after* the postmodern crisis of philosophy[2] and the first moments of the *crisis* of engineering itself (Goldberg, 2007)).

[2] Let's remember that in the very *Introduction to The Postmodern Condition: A Report on Knowledge* Jean-François Lyotard writes: "Simplifying to the extreme, I define postmodern as incredulity toward metanarratives. This incredulity is undoubtedly a product of progress in the sciences: but that progress in turn presupposes it. To the obsolescence of the meta-narrative apparatus of legitimation corresponds, most notably, the crisis of metaphysical philosophy and of the university institution which in the past relied on it. The narrative function is losing its functors, its great hero, its great dangers, its great voyages, its great goal. It is being dispersed in clouds of narrative language elements--narrative, but also denotative, prescriptive, descriptive, and so on [...] Where, after the metanarratives, can legitimacy reside?" At: http://www.idehist.uu.se/distans/ilmh/pm/lyotard-introd.htm

> 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 artefacts of a postmodern creative age. (Goldberg, 2007, 36).

Despite the fact that it is so new, there are already some newer branches of the philosophy of engineering itself, *largo sensu*, for example, the *applied philosophy of engineering*, or *semiotics of engineering*, or several distinct possible philosophical perspectives (Mitcham & Mackay, 2007).

Based on its ethical background, the philosophy of engineering is a transmoderne discipline. So, it is not by chance that precisely "in the age of spiritual machines", when the questions of technoethics are more and more important in our lives, the interest for "a relatively uncharted topic – the philosophy of engineering" is in a rapid *éclat* and, consequently, "the philosophy of engineering is a discipline that is just beginning to emerge" (McCarthy, 2008, 48)**.**

Attempts to explain this (commonly) unexpected association between philosophy and engineering were made starting from the association between philosophers and engineers, as it has already been made occasionally: an engineer turned into a philosopher (Wittgenstein), or a philosopher turned into an engineer (Mark Bedau). However "a formal meeting of engineering and philosophical minds is a rarity" and raises the question "why it has happened at this moment in history"? (Goldberg, 2007, 35). However, let's agree that the theme of the incorporation of engineers in philosophy and philosophers in engineering, even though it is often pointed out, is hardly exploitable.

The main questions when a new field of research is opening are focused on what is distinguishing it from other research domains. From a traditional, common perspective that means to analyze the objects *(largo sensu)* related to that research, the knowledge characterizing it, the specificity of its methods and logic, and the ethical implications of the studied domains.

In the effort (epistemographic) of positioning the philosophy of engineering, among other research fields as philosophy of technology, philosophy of science or philosophy of creation, some of the main questions we will have to consider are:

> What are the fundamental concepts in engineering that need to be defined in order to underpin a philosophy of engineering?
> What concepts from philosophy should be used to help build a philosophy of engineering?[3]

Of course, one of the best strategies would include a synopsis of all or majority of the questions on and of the philosophy of engineering. However, even in an emergent field of study, the velocity of publishing papers definitely surpasses the time needed to read and analyse their contents (and their questions). Obviously, this paradoxical situation will not stop the essay here.

Our *thesis* is that *engineering is an activity profoundly related to philosophy, by its specific type of use of the universality and by its ethical (not simply moral) dimensions.*

2 Etymology Games

Some of the contemporary researches on *philosophy of engineering* seem to focus the discussion on (so, to reduce it to) the original relationship between *episteme* and *techné, knowledge* and *craft*. The Greek word *techné* has to be philosophically distinguished from the word *episteme* (Parry).

The question is: how could we use the lexical dimensions of philosophy and engineering? We will follow Aristotle's recommendation for the knowledge of the words' meanings. That means we will fully play with the words and their meanings, because the sense is always in the play.

The term *philosophy* is inherited from the ancient Greeks. It was gradually established, because philosophy itself gradually became distinct as a form of spiritual life (Eduard Zeller). Its uses are multiple: "1. *love of knowledge and wisdom, pursuit thereof, speculation, study"*; "2. *the systematic treatment* of a subject, *investigation*"; "3. *philosophy, the investigation* of truth and nature".

Philosophical knowledge was classified in *theoretic*, *epistemic* or *systematic*. As *theoria*, philosophy was less knowledge, in the contemporary use, than action of contemplation. The Romanian logician and historian of logic Anton Dumitriu, has proposed a distinction between the *inesse philosophy* and the *dicitur philosophy*, as based on *acategorical*, like intuitive, continuum knowledge or based on *categorical*, rational, discriminatory, common knowledge (Dumitriu, 1977).

So, philosophy was an *activity (= theoria)* and not a result/description.

[3] See: http://www.engsc.ac.uk/nef/events/philosophy0106.asp

Moreover, "love of wisdom", "love of knowledge", "investigation of truth" does not *necessarily* imply philosophy is searching for the truth, nor that it is a knowledge. From this perspective, those who claim that science is searching for the truth, that science is (*stricto sensu*) knowledge, may have some right. This is why the philosophical "truth" and "knowledge" are quite different from the scientific ones.

Engineering was defined (by the American Engineers' Council for Professional Development, in 1941) as:

> "the creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behaviour under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property".

De facto, *engineering* is derived from *engineer* (Dear, 2001, 25) one who operates an *engine*, and was "a constructor of military engines." The word *engine* itself is old enough as it is derived from the Latin word *ingenium* (that is why, maybe, engineers naturally show *genium*, but also *ingenuity*) which is deeply related to the Greek word *techné*. So, engineering itself is rooted in *techné*. That is why, exploring the etymologies of *techné*, we could discover some original characteristics of engineering itself. *techné*

The ancient uses of *techné* are:
1. *Art, skill, craft in work, cunning of hand* (of metal-working; of a shipwright; of a soothsayer).
2. *The way, manner* or *means whereby a thing is gained*, without any sense of art or craft.
3. *An art, craft, trade*, to know his *craft*; *to practise* it; to learn a thing *professionally.*
4. *An art*, i. e. *a system* or *method of making* or *doing*.[4]

As a method, *techné* (engineering) seems to be non-epistemic (because *epistéme* is not *organon*), meanwhile as knowledge (theory) it always keeps inside the teleological dimension of the making, because it is more systematic, than epistemic or theoretic.

[4] Search on *Perseus* at: http://www.perseus.tufts.edu/

However, “given that many scientific theories that seek knowledge about the world involve engineering in that endeavour, engineering should surely be of interest to philosophers”, there are pertinent questions to be asked about: “what exactly is the role of manufactured objects in finding knowledge?”, “How reliable are they?” observes Natasha McCarthy.

Engineering is delivering knowledge by a much more direct route than by aiding science. And *is obscured by the single word ‘knowledge.* When we take it into consideration it is clear that engineers seek to acquire knowledge in all of their endeavours.

So, “engineering is ‘know-how’”. As a consequence engineering yields

> highly successful knowledge about how to control materials and processes to bring about desired results. It is a way of getting to the nature of things – a voyage of discovery as much as science is. Hence engineering provides a useful case study for philosophers inquiring about the status of human knowledge. (McCarthy, 2006, 49)

And yet:

> Although there are revolutions in engineering, the products of engineering knowledge are not going to be overturned in the way that some scientific theories have been.” This is why “that knowledge of what works, the ‘know-how’ that engineering provides, is secure knowledge. Engineering knowledge is also genuinely cumulative – improved all the time by building on, and not re-writing, what went before. (McCarthy, 2006, 49)

Yet, even if engineering is securing knowledge, it is not also a search for the truth, but for better and better artefacts: *the artefacts produced by engineers are not “true”, but well done.*

Resuming, *when philosophy is interested in the action of searching the senses of our knowledge, engineering is interested in the action of securing it.*

For both of them, at the beginning, it was the *action.*

3 What Engineering *is*

For a philosophy of the engineering to formulate a response to this question seems to be a must.

The contemporary debates on the specificity of engineering are privileging two of the possibilities: *engineering is a distinct form of activity (practice)* and/or *engineering is a form of knowledge.*

Considering the first choice, let's agree that there are many types of human activities: thinking, building, writing poems, modelling, singing, designing, crafting etc. Focusing on engineering as an activity, the first question will be: *what type of activity is engineering?*

The answers are various, from *engineering is design*, to *engineering is making*, *engineering is logic of production*, *engineering is "construct[ing] a Bill of Materials for any complex artefact*" [McCarthy, 2006, 50], *engineering is establishing a technological chain of operations* or *engineering is securing the knowledge* necessary to produce an artefact.

The attempts to reduce engineering to one activity, confesses a strong belief in the necessity of reducing any complex human activity to a simple, unique activity. In fact, this belief is a presupposition: we are *presupposing* engineering is *an* activity.

But what if engineering is a group of activities?

Indeed, an engineer is simultaneously doing several activities: multitasking thinking, imagining, designing, planning the logistics, making etc.

Our temptation of reducing engineering activities to one single activity illustrates the belief that complexity could be (so, has to be) reduced to simplicity. Or, sometimes, the *complexity is irreducible*. Let's observe that we would not be able to imagine, design and produce complex artefacts /systems of artefacts, if we would not have, from the very beginning, the capacity to understand and manage complexity itself.

So various are the engineering activities, that it is a sign of complexity, and some authors are speaking not about engineering, but about engineering(s) and consequently not about philosophy of engineering, but about philosophies of engineering(s).

That is, we could more correctly define engineering as the complex of activities related to the artefact.

Because *artefact* is a central concept in engineering, so it is in the philosophy of engineering, too. Nowadays, the word is used with the following senses: "any object made or modified by a human being", "a kind of tangible result produced during the development of a software", "a human-made object integrating information about the culture of its creator and users", "a product of human being(s) in a social behaviour", "an object from the digital environment".

The concept of *artefact* is valued as important by Luciano Floridi (2005) (when discussing on the constructionism and knowledge in engineering), by Ibo van de Poel (when presenting the *Delft University's researchers* conceptions of the two descriptions, physical and intentional, of the artefact[5]), by Natasha McCarthy (2006) (when considering that artefacts are aims of engineering and analyzing the philosophical dimensions of the "inherent complexity of engineering artefacts") etc.

On the other hand, engineering is also considered as a specific form of design.

> The subject of 'Engineering' can be divided into two activities of analysis and synthesis. Analysis (& research) is really Science or the study of materials, actions, life etc. to better understand our world. We can call it 'Engineering Science' if the study focuses on materials, processes and material actions. However, when we start taking this knowledge and applying it to improve the quality of life we are synthesizing knowledge. We are now being creative with our knowledge. This is *design* and is *fundamental* to *engineering. Engineering* is *design*. Research & analysis is Science. Both Engineering and Science are important; but knowledge alone is of no consequence to the future of life if it does not manifest itself into material significance through *design*. (Green).

Considering the second choice, there also are various forms of knowledge. The *relationship with knowledge distinguishes philosophy, science and engineering.* Engineering is commonly considered as a specific form of knowledge. However, it cannot be reduced to either scientific knowledge or to the empirical one: if in philosophy we are in the pursuit of questions like: *Have we a genuine knowledge about the world?, How are we acquiring that knowledge?, Can we ever be fully confident it is genuine?*; in science, the aim is to find truth and to acquire genuine knowledge (McCarthy, 2006), and to observe that engineering is an important part in acquiring our knowledge, because theoretical science's search for knowledge, "supported by experimental data", would not be attainable without it. So, engineering is not "in the truth business", as we are considering science is. It is not a form of scientific knowledge, but a form of securing (scientific) knowledge.

It seems that a reductionist mechanism prevails in the existing responses on what is engineering, when reduced to a distinct form of practice (activity), or to a form of knowledge.

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[5] During the seminar organized on March 27, in 2007, on *Philosophy of Engineering* at the Royal Academy of Engineering.

This situation is multi-philosophically highly significant. Let's explain. Mircea Eliade observed that the Human Being has several types of insertion into reality, into being. A modern researcher would say that our consciousness is already structured when being-toward.

As scientists, we are searching for the truth; as artists, we are sensible to the beauty; as religious men, we are looking for the sacred; as philosophers, we are hunting the sense; as moral people, we are hoping for the right. They could all be considered as *interfaces* with the being.

Because engineering could not be reduced to science, neither to art, or any other human activity, we will not speak about the philosophy of engineering as about the philosophy of art, of science etc

Maybe it is time to consider engineering as the sixth human mode of insertion into reality.

4 Speculations

Reducing philosophy to an exclusive theoretical activity and engineering to an exclusive practical one is not respecting the original meanings of those two types of human activity.

Or, in the original use of a word, we always will find its future uses, because "any provenance is already a future" - "ein Herkunft aber bleibt stehts Zukunft", as observes Jean Beaufret when bolding common themes and ideas of the philosophies of Husserl and Heidegger.).

Let us remember that, in the very introduction of the first book of his famous work ***The lives and Opinions of Eminent Philosophers***, Diogenes Laërtius, notes that "if we may believe the Egyptians, Hephaestus was the son of the Nile, and with him philosophy began, priests and prophets being its chief exponents. Hephaestus lived 48,863 years before Alexander of Macedon ....." (*Laërtius*) [6].

Ignoring for good reasons "if we may believe", from the above quotation (it is not suggested by the Greek text), *Diogenes Laërtius's statement is bolding the common roots of philosophy and engineering.*

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[6] However, the Greek text, accessible at:
http://www.mikrosapoplous.gr/dl/dl01.html#thales would be preferable, for multiple reasons. For example, in the online text of R. D. Hicks translation (1925, Harvard University Press), Hephaestus is replaced by Vulcan. Or Hephaestus was only *grosso modo* the Greek equivalent of Roman god Vulcan and the Egyptian god Ptah (from Memphis). He was the god of *technology, craft, metallurgy, fire, volcanoes a.o.* That is why, the use, in the online version, of the term "Vulcan" instead of "Hephaestus" confuses, because primarily, the Roman god was the god of fire. Their different primary meanings create different philosophical uses.

Those common roots could be found in some of their ancient etymologies. For illustration, let's remember that David, the Armenian, in his ***Introduction to Philosophy***, was reviewing six different definitions of philosophy. Two are particularly interesting for us: one consideration, with Aristotle, is that philosophy is the *study of the being qua being*; other, considering it as *purification for death*. It is about *theoria*, the non-demonstrative, the direct knowledge, and not about the *episteme*, the demonstrative knowledge, the mediated knowledge here.

So, when *philosophy was the wisdom of the study of being qua being*, *techné* was not only making, but *wise* making, as activity of the master craftsman, as the same Aristotle is bolding in ***Metaphysics***:

> […] what is called Wisdom is concerned with the primary causes and principles, so that, as has been already stated, the man of experience is held to be wiser than the mere possessors of any power of sensation, the artist than the man of experience, the master craftsman than the artisan; and the speculative sciences to be more learned than the productive (1.981b)

Maybe a research of the specificity of the philosophy of engineering should focus on the dynamic perspective and not on the static one: *what philosophy and engineering are doing* and lesser *what they are / are considered to be.*

This is why *any research in the emerging philosophy of engineering should not forget that both philosophy and engineering are deeply rooted in their common nature of human activities.*

5 Dimensions in the Philosophy of Engineering

As William Grimson observed, there is a huge need now for a systematic approach to the philosophy of engineering. In the mean time, let's also observe that a *study in the philosophy of engineering is not like an epistemographic one* (Dear, 2001)[7], *but like an epistemological one.*

We need, *an inventory of the integration of the philosophy in engineering subjects, into the themes of the philosophy of engineering*, but without limiting their number "through the 'lens' of the five classical branches of philosophy which are taken here to be epistemology, logic,

[7] *Epistemography* as "an enterprise centrally concerned with developing an empirical understanding of scientific knowledge, in contrast to *epistemology*, which is a prescriptive study of how knowledge can or should be made." (Dear, 2001)

metaphysics, ethics and aesthetics", that could be considered, *dimensions in the philosophy of engineering.*

Philosophy of engineering has a metaphysic (ontological) dimension, because it is investigating the nature of the artefact as being, the mereology of artefact components etc. and concepts like *part/whole, structure, function, life-cycle, emergence, process and product, needs and requirements, success and failure, design and planning*.

Here we could formulate the question of whether "there is a common sets of ontological presuppositions and assumptions for all the diversity of activities we call 'engineering'" (Chang). We could agree that among the concepts and objects fundamental to engineering one could find: design, emergence, part/whole, structure, function, process & product, life-cycle, needs and requirements, success and failure etc. essential in managing complexity, as Giancarlo Guizzardi (2005) is founding in the works of Peter Simons.

Philosophy of engineering has a gnoseological (epistemological) dimension because, even it is not a truth business, it is concerned with the nature and scope of knowledge in engineering, and whether knowledge is possible in engineering.

In the search for an answer on the nature of engineering knowledge, a series of questions have to be asked:

> What are the intellectual foundations of engineering? What is engineering knowledge, and what is it to have engineering knowledge? What can philosophers learn from engineering about knowledge? Do engineering and science share a common goal in the quest for knowledge, and do they make equal contributions to our knowledge of the natural world? (Floridi, 2005)

For Luciano Floridi, *constructionism* is the form of knowledge in engineering:

> the constructionist approach of knowledge is based on the presupposition that knowledge itself could and should be reduced to the actions of an epistemic agent. (2005)

Ultimately, the specific condition of human knowledge in engineering is sending us toward the question: *do we have to redefine epistemology and gnoseology or do we change them?*

Philosophy of engineering has an axiological dimension, because the artefacts designing, producing and using are value based activities.

The need for a coherent debate in the rational understanding of engineering design already has a philosophical dimension. From this

perspective, engineering is primarily a social rather that a technological discipline. It is informing and influencing societal attitudes and values.

In the *Transcript of Discussions* during the seminar philosophy of engineering (27 March 2007), Ibo van de Poel is speaking about the "value sensitive design". He states:

> this is the idea of building values into the design of products, to make them better, from a moral point of view. It is not only a question of avoiding what is bad with technology but also to do good with technology.

Philosophy of engineering has an ethic dimension, because it is concerned with questions of meta-ethics and ethics applied to all the very different activities we are calling *engineering*.

One could observe that the ethic problems are omnipresent nowadays in the events under the philosophy of engineering, as, for example: "How many people could ecologically live on our planet?" "What are the philosophical implications of this approach?"[8]

When the problems of ethics arise under the larger frame of the philosophy of technology, then the ethic issues debated are multiplying in an explosive way and concepts like risk, uncertainty are more and more important. Moreover, philosophy of engineering is a duty, like knowledge itself is a duty in a technological world (Lorenzo Magnani, 2007).

Philosophy of engineering has an aesthetic dimension, because some of the subject of industrial design deals with beauty, art, enjoyment, emotions, etc.

There is a whole discussion about the need of aesthetic (as it is with logic or ethics) education in the culture of engineering, or the presence of aesthetic values in engineers' artefacts.

> "Engineering is the display of culture. In the engineering practice processes, different times, different places, different ethnic groups, different knowledge and skills background and different aesthetics will all influence the design, construction of the specific projects and even the maintenance of the project results." (Bao, 2007, 76).

Philosophy of engineering has a philosophy of mind dimension, because it deals with the problems of the engineering as making vs.

[8] The best example is the book *Abstracts of the Workshop* Philosophy & Engineering 2007, Delft University of Technology, October 29-31, 2007, http://www.illigal.uiuc.edu/web/wpe/files/2007/10/wpe2007abstracts.pdf

engineering as design nature, an extension of the problems of the mind and its relationship to the body.

During the philosophy of engineering seminar of the Royal Academy of Engineering, on the AI and IT, on 11th July 2007, the questions debated were:

> *What can engineering tell us about consciousness? Who decides when we have built a conscious machine - the philosopher or the engineer? What can philosophers and engineers contribute together to the study of, and research into, AI? What issues does the Web, especially the Semantic Web, create for philosophy?*

Philosophy of engineering even has a dimension related to the philosophy of language, because engineers are using language in a particular way.

Maybe that is why Carl Mitcham and Robert Mackay are interested in a linguistic approach as one of the possible sub-fields of research in the philosophy of engineering (Mitcham & Mackay, 2007, 29-30).

Moreover, the use of language could be considered as a technological subject, when accepting that a word has many similarities with an artefact (Monk, 2005).

From such a perspective, it is the time to fully *accept that a word is an artefact.*

Philosophy of engineering has a political philosophy dimension, when studying the government policies toward technology, there are implications for individuals and communities, intellectual property, rights and obligations of the engineer.

Just to take an example, we could mention an increasing interest in the researches of the global catastrophic risks etc (2008).

Philosophy of engineering has a logic (methodological) dimension, too, because engineering is deeply related to methodology and requires discussions on various methodological problems, because each type of engineering has its logical particularities.

Philosophy of engineering has even a hermeneutic dimension if accepting that engineers are not as "linguistically naïve" as they are considered sometimes.

6 Horizons in the Philosophy of Engineering

A philosophy of engineering could be deployed starting from the main currents in contemporary philosophy, as observed by Carl Mitcham and Robert Mackay (2007):

> in beginning to think about possibilities for the philosophy of engineering it is useful to consider how this new regionalization of philosophy might take shape within different approaches to philosophy.

Based on the identification of six main currents in contemporary philosophy (phenomenological philosophy, postmodernist philosophy, analytic philosophy, linguistic philosophy, pragmatist philosophy and thomist philosophy), they are exploring the corresponding number of different approaches in the philosophy of engineering having each its own bibliographical references. (Mitcham & Mackay, 2007, 29).

As Mitcham and Mackay consider, those authors are: for the *phenomenological philosophy*, Don Ihde; for the *postmodernist philosophy*, Michel Foucault, Jean-François Lyotard, Jacques Derrida and Billy Vaugh Koen; for the *analytic philosophy,* Mario Bunge; for the *linguistic philosophy*, Ludwig Wittgenstein; for the *pragmatist philosophy*, John Dewey, Paul Durbin and Larry Hickman. For the *thomist philosophy* we could name Jason T. Eberl. (Mitcham & Mackay, 2007, 30)

Those currents could be considered as horizons in the philosophy of engineering, because they are not simple limits, but *limits that cannot be passed over* (the horizons exploration is not very cumulative).

From this perspective and resuming the ideas of Mitcham and Mackay, one could use topics such as:

1. "engineering and/or some of its diverse manifestations as phenomena call for more careful description and attention" in the phenomenological approach to the philosophy of engineering.
2. "question whether there even really is such a thing as engineering" in the postmodernist approach to the philosophy of engineering.
3. "conceptual distinctions between science and engineering, for the recognition of special forms of logic and knowledge in engineering, and for the engineering of ethics", "rethink[ing] engineering in terms broader than those of engineering itself while applying engineering methods to the rethinking of many other aspects of human experience" in the analytic philosophy of engineering.
4. describing "engineering as a particular language game" in the linguistic philosophy.
5. an epistemological and a social philosophical approach in the pragmatist philosophy of engineering.
6. an "attempt to understand engineering in relation to the standard branches of philosophy: metaphysics, epistemology, and ethics" in the thomist philosophy of engineering.

7 The Non-Generic Universality of Philosophy, Engineering and Being

For generic universality, non-generic universality is similar to what negentropy is for entropy.

Both the philosophy and the engineering are highly negentropic human endeavours, as they are interested in understanding, preserving and enriching the irreducible complexity of being.

More than twenty five years ago, starting from and continuing some philosophical developments of the Romanian philosophy, I have realized that, in order to understand *what-it-is/being* and to secure our knowledge, we are assuming a type of universality dependent on the quantitative identity (in which all x could, so have to be reduced to y).

By this we are reducing the richness of being, because we are *presupposing* that this is the only possible type of universality and that being itself exists universal only in this quantitative way.

Various philosophical traditions have understood the naïvety and the dangerous implications of such a static, frozen, inanimate perspective on what-it-is/being and reacted against it.

Non-generic universality is not the absence of generality, but the presence of a partial, insular, localized generality. It is the universality suggested by Ludwig Wittgenstein by the metaphors of rope and of the plan of a city, that one searched by Mircea Eliade beyond the *coincidentia oppositorum*, one in which beings, whatever they are or could be, are "islands in the stream" etc. (Guliciuc, 2009)

After the crashes of the belief in *Weltanschauung* and then in the *metanarratives*, philosophers have difficulties in their positioning concerning the reports with regard to universality. It is highly significant that, even though we are continuing, inertial and in a disguised way, to search for the generic universality everywhere, we understand more and more clearly that we do not have any idea about how the being really is, without the possibility to build a theory of the extended relativity of our knowledge.

Because it is focused on the study of being qua being and because the human being is a vectorial being (has a forward inside), philosophy is extracting order to build islands of sense.

Engineering has not and seems not to have these kinds of difficulties in its relationship with universality. Whether a philosopher or a scientist, an engineer is not searching for the generic universality of his (engineering) knowledge, but for the well made artefact – as a design, as a technological

chain, as a product etc. - the type of universality he is working with is a non-generic one.

Because engineers do not dream to build the Universal Machine, but the best machine from their time, engineering is extracting order to build islands of order; of secure knowledge.

Philosophy needs engineering in order to secure its senses.

Engineering needs philosophy to find the sense of its secured knowledge.

8. Conclusions

The philosophy of engineering could have unexpected continuation from the pedagogy of the digital natives / digital immigrants of Marc Presnky (2009), when discussing wisdom in an engineering [technologized] world (Guliciuc, 2009b), when debating on concepts like "the cultured engineer", "the New renaissance Engineer" of the 21st century and his new skills.

Some philosophers are not very happy *nowadays, when engineers want to use philosophy as a tool* (Goldberg, 2007). *From the perspective here assumed – in which both philosophy and engineering are human activities with common roots in the practice, focused on the extraction and building of islands of order (complexity) – there is no problem here, because philosophy, so focused on those artefacts named* words *is a tool* (how unexpected would that be).

Finally, philosophy could be considered as the engineering of concepts, meanwhile *engineering could be considered as the search for wisdom in the making.*