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Social Utopias and Engineering Design

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INTRODUCTION

The juxtaposition of these two phrases – "social utopias" and "engineering design" – might seem, at least at the first sight, strange and lacking any serious warrant. The main task of this paper is to demonstrate that this impression is actually not justified. Or, to put it differently, and somewhat stronger: the analysis of the relations between these concepts is not only warranted but even – from a point of view (to be outlined below) – badly needed.

Why? – Let me commence my answer with a remark on the historical period we live in: Our times can be characterized in quite a few ways. Since the list of proposed and discussed characteristics is too long to be here presented (not to mention discussing them), I've just selected one – particularly relevant in the context of this text: We live in a period of many paradoxes (or – if you prefer – contradictions). Again: it's not possible to list even the most important of them. I'm going to focus attention on but one paradox. In its presentation and discussion I will need two concepts: globalization and "balcanization" of science. Some notes on both concepts seem to be necessary.

First: globalization. This term, though known earlier, started to gain popularity in the 1980's, and after 1989 became one of the central concepts – both of social sciences and political debates. During these three/four decades many definitions of this notion – sometime expressing in various words very similar ideas, but sometime: very different – have been proposed. The great complexity of the phenomenon of globalization accounts (though only partly) for the variety of its theoretical conceptualization. (A comprehensive discussion of these issues is to be found in the two first chapters of (Scholte, 2005).

Before I present the definition of globalization which is to be used in this text, I'd like to stress that globalization is a complex process – composed of a number of relatively autonomous but interacting sub-processes – The definition to be formulated will be a partial definition only: a definition which characterizes but one of sub-processes of which globalization is composed. The choice of this sub-process has two motivations: one more general, one more specific. The first, more general, is the following: the chosen sub-process is, in my opinion, one of the most fundamental processes making up globalization (or, perhaps

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even – just the most important one). And the second, more specific, this sub-process is particularly relevant for the analyses to be carried out in the present text.

The (partial!) definition of globalization which will be availed here goes as follows: Globalization is the process of formation of one eco-techno-social system encompassing whole our planet and whole humanity.(For stylistic reasons, and to suggest analogies with some similar notions, I will also use – regarding it as a synonym – the notion of eco-techno-socio-sphere). It should be stressed that this definition logically presupposes the factual/empirical thesis that such a process is actually going on.

The just formulated definition of globalization would demand many comments of various sort. For obvious reasons, a very limited number of them can be made here. I've decided that most useful will be comments of historical character. These comments should demonstrate that this definition is not arbitrary – formulated *ad hoc* – but refers to many important ideas formulated for the last one hundred and fifty years or so.

The term eco-techno-socio-sphere is closely related (and inspired by) the notion of ecosphere. This very term (defined in Wikipedia as "a planetary closed ecological system") was coined in 1958 by the American ecologist Lamont Cole, and popularized by (more famous) Barry Commoner. Its roots, however, reach the year 1875 when the Austrian geologist Eduard Suess coined the term "biosphere", or even somewhat earlier: to 1866 when Ernst Haeckel, one of the first spokesmen for Darwinism, introduced "ecology" as a name for a new science which was to study world of life as a system. The notion of ecosystem was introduced by the British biologist Arthur Tansley in 1935, and popularized in 1950s by Eugene Odum (the author of one of the first ecology textbooks published in1953). In this context, I'd like to mention the Gaia hypothesis proposed – around 1975 – by the British chemist James Lovelock, and by the American biologist Lynn Margulis; a hypothesis which, roughly speaking, radicalizes the idea of biosphere/ecosystem regarding whole planet as one living mega-organism.

As regards technosphere, this term was coined by the American geologist (sic!) Peter Haff (no date I found), is regarded as a synonym of anthroposhere (neither name of the inventor or the date I found). We should note that in Janusz Dietrych's book "System i konstrukcja" (Dietrych, 1975) the term "technosphere" is used, though rather incidentally. The phrase "technical system" is used in Dietrych's book amd in many other places quite often but has "local" and not "global" meaning.

In brief: the concept word "technosphere" exists but is rather rarely used. Much more popular are words in which "techno- "is connected with other lexical part ("sphere"/"system" is not taken into account here). For instance, in 1976 the term "technoecosystem" was introduced by the American economist Kenneth. E. Boulding. The idea which seems to have given rise to this notion is similar to that which inspired the concept of Anthopocen – a geological period (its

beginning is dated to the mid-20th century) marked by the great, noticeable influence of humanity on the state of the Earth – the notion widely popularized (at the beginning of our century) by the Dutch chemist, Nobel-prize winner, Paul J. Crutzen.

The concept of sociotechnical system is also known. It was developed in mid-1950s in Tavistock Institute (UK). But, similarly to the concept of technical system, it has been more or less 'local" (referred most often to factories or other production units) and never "global". (More on sociotechnical systems in (Bauer and Herder, 2009).) Interestingly, in sociology situation was for a long time similar: the word "system" has been used since mid-20th century but in very general and wide sense: not only (national) societies, but also local communities, or even – families were regarded as systems. Only in the early 1970's the American sociologist Immanuel Wallerstein introduced the concept of world-system which, according to his theory, encompasses today whole humanity. It is thus analogous to the concept of biosphere (global ecosystem).

I'd like to end this historical overview mentioning three very different interesting ideas. First. I'd like to invoke the notion of noosphere. Very interestingly, this notion was introduced by the Russian mineralogist and geochemist Vladimir Vernadsky in the beginning of 20th century but widely popularized by the French Jesuit, priest, paleontologist and philosopher, Pierre Teilhard de Chardin, This concept can be regarded as anticipating the notion of global information society or of collective mind. In the Teilhard's philosophy the rise of noosphere has a moral and religious dimension.

Interpreting globalization as the rise of eco-techno-sociosphere we should not forget the role which played Club of Rome and its first report "Limits to Growth" (1972), The question of correctness (or lack of it) of predictions it contains – though interesting and important – is here to be set aside. I am convinced that just this report for the first time introduced (though rather implicitly than explicitly) the concept of eco-techno-sociosphere and presented its dynamical model. We should not also forget that it was one of the first instances of computer modelling of great processes – based on system dynamics created by the American engineer Jay W. Forrester – It is a good moment to stress that the definition of globalization – to be more precise – should be based on an exact (mathematical) definition of system, But the choice of such a definition is rather a difficult ask. It could not have been accomplished here.

Finally, a few words on a theoretical idea (developed, in particular, in the Santa Fe Institute) of complex adaptive system. M. Gell-Mann, the great American physicist and one of the main proponents of this idea, expresses his hope that in the coming future "humanity as a whole – and other organisms dwelling our planet – will be functioning, to a much greater degree than today, as one very rich complex adaptive system" (Gell-Mann, 1996).

So much about globalization. And now – some comments on "balkanization" of science, This term, taken from political theory, was popularized by the German philosopher Georg Picht it describes processes which have going on for the last

ca. seventy five years (since the end of 2nd World War and which accelerated after 1968 – processes of multiplication of scientific disciplines. subdisciplines etc. In some disciplines (mainly in social sciences and humanities) it was strengthened by multiplication of – more or less closed – orientations, schools etc. Somewhat paradoxically, some efforts to counteract these processes which resulted in the rise of various inter/multi/trans-disciplines or disciplines attempting at universalism (such as system theory of Bertalanffy or cybernetics of Wiener) seem to intensify. The genesis of this processes would deserve a separate analysis. Without trying to present even a brief sketch of such an analysis, let me formulate two brief remarks. First, I'd like to mention published in 1963 book "Little Science, Big Science" (Solla Price, 1967). The concept of big science can be best instantiated by the American "Manhattan Project". And second. Already in the mid-1960s S. Lem introduced the concept of "megabits bomb", or "information barrier" (Lem, 1974) – It is a good moment to signalize two analogies between Solla Price's and Lem's observations and the two fundamental ideas of the first report to the Club of Rome. First, the idea of exponential growth and of its various consequences (in the case of scince; exponential growth of scientist, of scientific books and journals…) Second: the idea of limits to growth.

What is the result of these processes? I would characterize it as follows The more we know about "our world" (our planet, ourselves etc.; all the rest of the Universe let's put here aside) the less we understand it. If it would be only a problem of our cognitive aspirations, we could accept such a situation, remaining intellectually unsatisfied. But the problem is much more serious Even if we do not believe in the most alarming warnings (and even some very prominent scientists – such as F. von Weizsacker or M. Rees – declare that self-destruction of humanity, though of little probability, is not excluded), we surely acknowledge the great challenges humanity faces today. And if we agree that we live in and are part of one single system (eco-techno-social), we should also agree that understanding this system is necessary if accept our responsibility.

What is to be done? A systematic answer would require a large historical-sociological study of post-war science. To my knowledge, such a study does not exist and it is doubtful whether it will rise in the foreseeable future. But if a problem is serious and urgent, and we have not scientifically-based answers, we should follow intuition/common-sense based answers. I would propose two answers. First, drawing upon a slogan of environmental movements "Think globally, act locally". In other words; do what you can and what contributes, even very little, to the globally desirable changes. Second: An idea presented by the great physicist Murray Gell-Mann. He stresses that "explosion of information is to a considerable degree explosion of disinformation". He suggests some reforms in the academic prize-system: "We should try that such very creative actions like writing a serious review paper would enjoy a greater prestige". He stresses that "humanity will tremendously gain, if the prize-system will change

in such a way that selection pressure will favor both gaining information and its sorting" (Gell-Mann, 1996).

ON SOCIAL UTOPIAS

As it is well known, the word "utopia" was invented by an English thinker and politician Thomas Morus (regarded as one of utopian socialists; also Roman Catholic Saint (1935), in 2000 declared by John Paul II the patron-saint of statesmen and politicians). The word derives from Greek words "*topos*" (place) and "*ou*" (not). Jerzy Szacki suggests that also "*eu"* (good) should be taken into account (Szacki, 2000). But his book "Utopia" (1516) – though it gave the name is not the first instance of the literary genre to which it gave the name. The first utopia was created by Plato and presented in his "Republic". On the other hand, it is an undisputable fact that utopias are generally characteristic for modern times: The development of utopias is a part and parcel of the civilizational and cultural processes which started in the 15th century – the epoch of Humanism and Renaissance – and comprise such processes as the rise of the natural empirical sciences (from Copernicus to Newton), – of modern political thought (Machiavelli), – of modern philosophy (Descartes), of modern art (Leonardo da Vinci). New impetus to the development of utopias was given in 18th century by the Enlightenment. The particularly important role was played here by one of the fundamental ideas of this epoch – the idea of progress.

In 19th century a new literary genre – Science Fiction – was developed (the beginning of this genre is a matter of dispute; some regard Johannes Kepler's novel "Somnium" (1608/1634) as the first SF work). Let's mention here but three names: Mary Shelly – the author of "Frankenstein" (1818), Jules Verne (in spite of the older tradition of this genre, called sometime "the Father of science fiction") – the author of "Twenty Thousands Leagues Under the Sea" (1869) and of many other SF novels, and – Adam Mickiewicz. Not only for the Polish reader, it should be interesting that a great Romantic poet was writing "History of the Future" in which demonstrated great prognostic intuition, concerning in particular technological development (unfortunately only small parts of this work remained, most knowledge about it is based on his family and friends information) – The development of the SF literature can be regarded as one of the side effects of the first industrial revolution.

SF literature should be mentioned here for a few reasons. First: Utopian and SF literature are both similar and different: They depict worlds different from the world in which their authors live. They are most often future-oriented. Their creation demands great imagination. But, on the other hand, utopias describe rather social relations, SF literature – machines, tools and other technical instruments. (Of course this is schematic picture: many works can be counted to both genres; for instance many novels of Stanislaw Lem.) Second: SF literature has inspired some inventors and thus played a role (which, of course, should not be overestimated) in the development of technology. Third: SF, due to its relations with utopian thought and also with actual technology, can be

regarded as a link connecting these two – at the first sight: rather distant – areas of human activity. Fourth: the historical fate of both genres has been rather different: SF has flourished after 2nd World War, utopias – have declined (though it could not be said that it completely disappeared).

The success of SF literature seems to be easily explainable: the great technological and civilizational progress after 1945 – whatever are its negative side effects – is undisputable. And the fate of utopias? On the one hand, the function of utopias has been overtaken by futurology (the term introduced by a German historian Ossip Flechtheim in 1945) or other types of future studies. On the other, utopias have been – to a great degree – discredited. The reason can be easily guessed if you look at the title of a history of the Soviet Union, written by M. Heller and A. Niekrisz (both – Soviet dissidents!): "Utopia in Power". From this point of view (shared by a significant number of social scientists and philosophers), utopia is not an innocent, childish phantasy, but – a very dangerous phantasy.

If I accepted this point of view, I would not be able to maintain that we need utopias. But I do not accept it. Since the issue is very serious, I should present my stance in a possibly precise way and possibly well-justified. First: I am skeptical as to the supposed role of utopias in revolutions and other great social/political transformations. In my opinion, neither the course of the French 1789 Revolution nor the course of the Bolshevik 1917 Revolution can be explained by a reference to any utopia. Unfortunately, I have to limit myself to this declaration; any discussion of the mechanisms of these revolutions is at this place impossible. Second: I think that if utopias are – to a degree – dangerous then they are not directly dangerous but only – indirectly. To put it in somewhat different way: not utopias are dangerous but: utopianism – fanatical faith in a utopia. But all types of fanaticism, (nationalist, religious or any other) are dangerous. Third: utopias can be constructed in various ways. Some of them are more risky, some others are less risky: some can more easily generate utopianism, some others – not so easily, if at all.

Up to this moment, I have availed of the word "utopia" in an intuitive way. To go further, introducing a definition of utopia is necessary. Before I formulate this definition, I'd like to stress that it is not so-called regulating definition (making the intuitive meaning of a word more precise), but rather an definition arbitrarily using a word to give a name to a (theoretical) concept.

Since now, the word "utopia" will be used as a name for any model of a possible social world. This decision needs some comments. They will be divided into two groups. The first group will contain comments on the meaning of the phrase "possible social world". The second group will contain comments on the choice of the word "utopia".

The first group: Let's start then with "possible social world". This concept is an application (concretization) of the more general term "possible world". This term was introduced by Leibniz in a metaphysical-theological concept. Only centuries later – in the 1960's – the concept of possible world started to gain popularity.

At the beginning as a technical term in the so-called modal logic, a time later – in other domains of philosophy. Interestingly enough, similar ideas appeared in physical sciences. In 1957 Hugh Everett proposed so-called many-worlds interpretation of quantum mechanics. The analogous notion of multiverse (a a set of Universes) is used today in cosmological discussions. (A popular presentation of all these ideas can be found in the already cited book (Gell-Mann, 1996). The idea of possible worlds (many worlds, parallel worlds) is complex and gives rise to great many difficult questions. This idea (having different variants) seems, however, to express widely accepted intuition: many events which actually happened might have not happened, and some of those which did not happen might have happened. In other words: the life of each of us might have been different from that we have experienced, the history of our nation might have had other course that it has actually had, the evolution of life on the Earth might have been different from that which has been ongoing; finally: also the evolution of the Universe might have been different – Let me add that the word "world" could be replaced by the word "history", thus we could be speaking about "possible histories".

The notion of "possible social world" is to refer to all worlds (all histories) having some common elements such as the Earth (plants, animals etc. including) and its location in the Universe, and "biological nature" of *Homo sapiens*.

Let me make now two remarks on the notion of model (of a possible social world) As in any other case, model of a possible social world can be better or worse. The characteristics of the given world can be more or less vague, more or less complete etc. Thus uopias can be better or worse in the strictly "technical" (methodological) sense. And second remark. For some fundamental epistemological reasons, it is not possible to construct a model depicting one and only one possible (social) world. Thus, if we would like to be very precise, we should be speaking about a model of a set of "sufficiently similar" worlds. However, at present moment such precision does not seem necessary – So much for the intended meaning of the notion of utopia.

Now, let's pass to the second group of comments. These comments concern the choice of the word: Being interested in introducing (analyzing and applying) the notion of possible social world I could have chosen another word to label this notion. Eventually, I could have decided to remain this notion without and label (though it would be a bit inconvenient). But I decided for the word "utopia". I did it so for a number of reasons. First: I think that Plato, Morus and many others presented models of some possible social worlds. We may not find them attractive, we can criticize them for lack of theoretical analysis of these world, for the stability of their worlds or for the lack any ideas about how to construct these worlds. But they started activity which is, I am deeply convinced, a manifestation of a fundamental trait of human nature: We are not satisfied with the material world around us but we change it and adapt to our needs. We are not satisfied with the "natural instincts" of our children but we educate them. Finally, we are not always satisfied with ourselves; we learn new skills,

sometime we try to form our characters. Why the social order should be regarded as “given” and as one which should not be changed? Some criticists of utopias indicate to the possibility of errors or of unintended negative consequence – Rightly so. But our influencing on the Nature has not been full of errors and negative consequences? Very often the same people who criticize social utopias defend uncontrolled interventions into our environment. Should we believe that interventions into social order are always more dangerous than interventions into the natural world? – I doubt.

The word “utopia” happens to be used as stigmatization of these reforms-plans which, according to the criticist, are “too radical” and/or “too universal” (“all encompassing”). But no known utopia proposed to change “everything totally”. (Is even doubtful whether such utopia is at all conceivable). Other critiques avail of “utopia” to stigmatize some social designs as “impossible to be realized”. However, most often, such declarations manifest – at best – limitations of criticist’s imagination, and at worst – unfair strategy of criticism/polemic.

And still a remark. This time – on dystopias I think that we should completely reject this term. Why? Consider this question: Is Plato’s vision of the state. Is it a utopia or – dystopia? For Plato it was an image of perfect social world, but for many (all?) of us – it surely is not. We should not distinguish utopias and dystopias. Instead, we should be speaking that – from the given axiological point of view – this utopia depicts a desirable/acceptable social world, and that one – not desirable/unacceptable.

The exploration of the space of possible social worlds is surely very difficult task. But, due to the challenges humanity faces today, this task should be undertaken. Fortunately, there are some symptoms of changes. The very recent instance of such activities is the Japan idea of Society 5.0. (The industrial society has the number 3.0, the existing information society – the number 4.0) This society is defined as “People-centric super smart society” (A systematic presentation in (Degutchi et al, 2020).

SOME PHILOSOPHICAL REMARKS ON TECHNOLOGY

Stanisław Lem, one of the best known in the world Polish writers, was also an interesting philosopher. He contributed to ethics and philosophy of literature/culture but also – to the philosophy of technology. His main work in this domain – “Summa Technologiae” (1964) – still today deserves, I think, attention. One of the main ideas this book contains is the idea of technoevolution. The last word happens to be occasionally used but rather in an intuitive and descriptive way. Lem’s idea is much more profound. He claims for similarities but also for differences between biological evolution (as theoretically described by Darwin and his followers) and evolution of technology (Lem,1974). Unfortunately, neither Lem himself nor – to my knowledge – no other person developed further this idea – It’s too bad. Not only from the theoretical point of view, but also – practical.

To justify this opinion let me say some words on the notion of technological determinism. Wikipedia starts its text devoted to this notion with brief and decided formulation: “Technological determinism is a reductionist theory that assumes that a society’s technology determines the development of its social structure and cultural values”. In spite of its apparent simplicity, this thesis can be interpreted in different ways. For various reasons, out of which I want to mention but one: The meaning of the thesis depends on the way in which we interpret the word “determines”. After decades of debates (inspired mainly, though not exclusively, by the rise of quantum mechanics) on determinism, it is generally accepted that determination (of a factor, of a process etc.) can be “strong” or “weak”, can be probabilistic or not-probabilistic etc. Therefore, without going into details, we can speak about stronger and weaker forms of technological determinism. And even accepting only a weak form of it, we agree that technology exerts some influence on the way in which we live and that this influence can have not only positive but also negative consequences (negative – from a point of view, sometime accepted by the majority of humans). And if we think that some negative consequences are possible (and that they might overweight the positive ones) we are getting prone to consider how to eliminate the negative consequences. Perhaps by changing a given technology, by replacing it by an alternative one. And if situations of this sort are becoming more and more often, the idea of regulating technology appears, Sometime, most often at the beginning, it takes the form of simple destruction (Luddite movements of various types). Today we are looking for more sophisticated forms of regulating technology. And looking for these forms, we could/should refer just to technology itself, or – to be precise – to its scientific foundations. I mean here the control theory. At this moment I’d like to stress the role of knowledge about determinisms characteristic for the controlled system.(It is not incidental that controlling mechanical systems is generally more effective than controlling biological systems; it is connected with the epistemological differences between mechanics and biology.) And just at this moment we return to the Lem’s idea of techoevolution, and – of its theory. Such a theory should address many questions. In the context of present paper as the most important might be regarded the question of deterministic character of technoevolution. In particular the question of unilineal vs. multilineal character of this evolution. To precise this question, a lot of theoretical (conceptual) work should be done. But even at the present moment we can say that it is most likely that technoevolution has multileal character. Two arguments support this conviction. On one hand – a comparison-based argument: In the contemporary theory of biological evolution definitely dominates multilineal view; similarly – in the sociological/anthropological theories of social evolution. On the other hand – an argument based on the history of technology. It seems to me that, for instance, the history of transport offers some interesting instances: The domination of combustions-engines automobiles, and the marginal role of electric cars was determined rather by the external (economic or even cultural) factors and not by

"logic of technology development". Similarly, in the aviation the triumph of airplanes and the elimination of airships may be accounted for by social factors rather than by the technological ones. These historical instances, however helpful, have – if seen in the perspective of further analysis – one weak point: Both demonstrate a sort of "struggle for survival" between various – actually (and not only in the minds or on the drawing boards of engineers) existing – "technological species".

To grasp better the problem which is to be discussed in a moment, it will be helpful to say some words about a mechanism of technoevolution. At the basis of thechoevolution is the process of generating new inventions. If viewed in a very long perspective, this process is itself of evolutionary character. Almost for sure, it started with "incidental inventions" consisting in noticing that incidentally produced/modified objects are better than the older ones. Later on, for a very long time inventions were generated consciously/intentionally but individually, in an not organized way (Archimedes and all his followers during the next twenty centuries). The situation changed in 19th century. The nature of this change was characterized aptly and compactly by the British philosopher and mathematician Alfred N. Whitehead. According to him, "the greatest invention of 19th century was the invention of the method of invention" (Whitehead, 1988), If you think about one of the greatest inventors of all times – Thomas A. Edison. He held 1.093 US patents, but for one of his most important inventions he could not receive a patent since for organizational (institutional/social) inventions patens were not granted. But, if to follow Whitehead, the first industrial research laboratory he established (1876) in Menlo Park – can be rightly so characterized.

I would like to draw attention to two issues. First: For a few decades a new domain of knowledge – known as heuristics – has been developed. It is knowledge (some prefer the word "art") of creative thinking. It is being developed in various directions: sometime is oriented at formulating very general (to be applied in many very different domains) rules, sometime it tries to formulate more specific prescriptions for a particular area of human activity. As regards the first type of heuristics, it is may be still today best represented by the the book "How to Solve It" written by a prominent Hungarian-American mathematician George Polya. And as regards technological creativity, I would like the ideas of G.S. Altszuller. He interprets inventing as problem-solving (Altszuller,1983). Even if the basic idea is rather simple, despite this it is very important: Formulating problems is by no means a simple, trivial task. Especially if the problems are formulated in the context of advanced complex systems. Let me give a difficult, controversial instance; We can ask how to develop new weapons, including offensive ones, or how to construct a purely defensive system. Or even how to design a technology – safe for all states – of gradual elimination of various types of weapons. Two points are evident: Firstly, it almost sure that each of these formulation will result in different technological solutions. Secondly, formulation of each of these question presupposes a set of opinions about the international relations, the role of armies in politics etc.

I'd like to mention the idea (and practice) of technology assessment (A systematic presentation is to be found in (Grunwald, 2009).) This idea can be regarded as a manifestation of an attitude towards technology which deserves to be baptized as "rational" – in opposition to both: naïve pro-technological optimism and equally naïve anti-technological pessimism.
To sum up: the evolution of the system of production of the technologies has not ended. Many interesting changes can be expected.

FROM SOCIAL UTOPIAS TO TECHNOLOGICAL DESIGN AND BACK

Let me start this chapter with an additional remark on the notion of utopias. According to assumed here definitions, social utopias are model of possible social worlds. But, accordingly to modal logic, what is real is also possible (incidentally: to construct an object is the most convincing way to demonstrate that such an object is possible). Therefore, models of the real social word are also – *ex definitione* – utopias. This convention may be somewhat inconvenient but it should remind us that the sphere of "the possible" is larger than the sphere of what is (perhaps incidentally) real. Additionally, this convention should suggest that some worlds are "almost real" (are getting real). It should also suggest one of the simplest ways of constructing models of non-real possible worlds: Worlds depicted by such models differ but "minimally" from the real world. In other words, some trends noticed in the real world are extrapolated (some parameters are either – more or less – strengthened or – more or less – weakened) and in this ways new utopias are obtained.
This strategy I want to apply to the problem of technology development. I am going to start from – on one hand – a very interesting (though, at the present moment, rather marginal) social phenomenon known as Free Software Movement (or more generally Free-culture movement), and – on the other hand – a very differentiated group of phenomena commonly labelled as "volunteering". A systematic analysis of this phenomena would be a subject for a rather large book. Of whatever type will be the dynamics of these phenomena (increasing, oscillating etc.) they demonstrated that some people, if they do not have to struggle for biological or economic survival, are ready to spent a part of their free time, for various forms of productive (in the broadest sense, encompassing non-material goods) unpaid activity. One can speculate (I purposively use this term to stress that intellectual "speculation" is an important phase, but – on the other hand – only a phase, of creative thinking) that the important diminishing of the average time of formal (paid) work – a possibility of considerable probability – could contribute to popularization of various types of serious but free activity. But is the shortening the working time probable? I tend to answer in an indirect way: It is not only probable but – simply necessary, of course if the process of automation and robotization of material production and (some) material services will be advancing. And you could connect these two ideas (of unpaid work and of radical shortening the time of paid work) with the idea (tested recently in Finland) of basic – some add: unconditional – income,

Taken together they make up quite viable, in my opinion, project. Surely not during the next decade or two. But during the next five decades? Let's assume that the answer is positive. What about technology development in such a world? I risk the hypothesis that it could be in a sense more dynamic than today, but in another sense – less dynamic. More dynamic – in the sense of generating new technological ideas (of various scales: from small improvements in everyday objects to global technical systems) – generated in the global, collaborative free work. Less dynamic – in the sense of more profound analyses of the positive and negative consequences of introducing into our global system new technical objects (systems, processes etc.); genuinely democratic technological assessment needs time. If technological innovations are produced by large profit-oriented institutions the tendency toward minimization of this time should be expected. So, this combination – of great, freely created technological ideas, and of cautious decisions about their materialization – would be, in my opinion, socially and ecologically optimal. (It should be added here that in Holland some experiments inspired b the idea of so-called "constructive technology assessments" have been conducted).

Let's take now another road: from technological design to social utopias. The bad reputation of many (all?) traditional utopias is determined by various factors. Although, in my opinion, not all weaknesses ascribed to utopias are real but some critical opinions are surely justified. However, as I've already declared, we badly need utopias. (Interestingly, ending his book on complexity, Gell-Mann states that "it is worth to construct models of the future…in order to stimulate imagination" (Gell-Mann, 1996). Yet just utopias, and not one utopia; we need many and possibly variegated utopias. And – no less important – we need well-constructed utopias. To outline a characteristic of this, badly demanded, trait of utopias, it might be convenient to discuss the concept of a good technological design. A systematic discussion is impossible here. But at least some elements of such a discussion can and should be presented here. First point: No technological object (be a telephone, be a a chemical plant or whatever else) is to be "perfect". It should satisfy precisely defined criteria. Second: the relations between these criteria should be carefully analyzed, and if turns out that a not all can be at the same time fully satisfied, a hierarchy of criteria should be defined. Third: the possibility of the project, as viewed from the best available scientific theories, should be analyzed. Fourth: possibly great and differentiated set of tests (computer, laboratory, "real world") should be carried out. Of course, due to the specificity of human/social reality, realization of all these conditions is more difficult than in the case of physical/technical objects. Notwithstanding, utopias constructors should be aware of these conditions and try to be satisfy them to the greatest possible degree.

CONCLUSIONS

There are many arguments supporting the thesis that the Earth, together with whole humanity and with all material objects humans have created, is getting

one system. According to many various opinions – based on otherwise different philosophical (religious, ideological…) fundamentals – we, all humans, are responsible for the future of this system. This responsibility demands knowledge of this system. Since the system is, beyond any reasonable doubt, non-linear (in the strict sense of the word) its study has to be "circular": from models of its subsystems to a model of the whole system, and from a model of the whole system to models of its subsystems. Additionally, responsibility for the future implies that we are interested in the long-term dynamics of the system.

Whether we are researchers studying this or that element of the system, or we are designers (engineers, "social designers"…) who design new elements (be material, be organizational/structural) of this system, or also we are decision-makers (active citizens, politicians, managers…) who decide which elements should be introduced and what elements should be designed – we all need, if we are to perform our tasks In responsible way, an amount of knowledge about the whole system – It leads us to the following conclusions. First: General knowledge can be regarded also as an element of comprehensive development of personality. But the main role this knowledge is to play is much more practical and close to the professional knowledge. Second, the decision what "general knowledge" – as a part of education – should contain should be made on the basis of a theoretical model of the global system. Third: "general knowledge" for students of social sciences should contain important elements of technological and ecological knowledge, for studying natural sciences – elements of social and technological knowledge, and for engineers – elements of ecological and social knowledge. Fourth: the notion of knowledge should be understood in a broad way: it should be knowledge not only about "the real" but also about "the possible" – about possible chances and threats in the close and distant future. To design such a curriculum would be an important contribution to the creation better, more sustainable, world.

REFERENCES

Altszuller, G. S. (1982). Elementy teorii twórczości inżynierskiej. Warszawa: Wydawnictwa Naukowo-Techniczne.

Bauer, J. M., Herder (2013). Designing Socio-Technical Systems. In: Meijers, A., ed. Philosophy of Technology and Engineering Sciences, Amsterdam: Elsevier, pp. 601-629.

Deguchi, A., Hirari, C. , Matsuoka, H., Nakano, T. Oshima, K., Tai, M., Tani, S. (2020). What is Society 5.0?. In: Hitachi-UTokyo Laboratory, ed. Society 5.0. A People-centric Super-smart Society. Singapore: Springer Open, pp. 1-24.

Dietrych, J. (1985). System i konstrukcja. Warszawa: Wydawnictwa Naukowo-Techniczne.

Gell-Man, M. (1996). Kwark i jaguar. Przygody z prostotą i złożonością. Warszawa: Wydawnictwo CIS.

Grunwald, A. (2009). Technology Assessment; Concepts and Methods. In: Meijers, A., ed. Philosophy of Technology and Engineering Sciences, Amsterdam: Elsevier, pp. 1103-1146.

Lem, S. (1974). Summa technologiae. Kraków: Wydawnictwo Literackie.

Scholte, J. A. (2005). Globalization. A Critical Introduction. 2nd Edition. Revided and Updated. New York: Palgrave.
Solla Price, D. (1967). Mała nauka, wielka nauka. Warszawa: Wiedza Powszechna.
Szacki, J. (2000). Spotkania z utopią. Warszawa: Wydawnictwo Sic!.
Whitehead, A.N. (1988). Nauka i świat współczesny. Warszawa: Instytut Wydawniczy Pax.

Abstract: A paradox of our time is identified: on the one hand – the development of one global system (ecological, technological and social), on the other hand – the still increasing "balkanization" of science. The dynamics of this systems is a source of well-known numerous global problems. Its possibly effective solution needs adequate knowledge about the system. For this reason, counteraction to "balkanization" of science is of great practical importance. And this counteraction should comprise not only development of "transboundary" sciences (such as biochemistry or social psychology) but also establishing and developing links between very distant disciplines. This text is intended as a contribution to linking social and engineering sciences. The notion of design plays the central role in this text. Its meaning in the engineering sciences. The notion of utopia has been chosen as a partial counterpart to the term of engineering design. This notion was defined using a concept of possible world – taken from modal logic. It encompasses two ideas: this of design and that of prediction, It is claimed that we need many utopias and that their plurality is of fundamental importance for protecting us against the threats of utopianism. The paper suggests that social utopias can play a heuristic role in engineering design (particularly in the initial phase of defining technological problems), and – on the other hand – that the theory of engineering design can be supportive for, badly needed, development of methodology of utopias creation.

Keywords: globalization, design, possible social world, utopia, technoevolution