A CRITICAL ASSESSMENT OF TRANSHUMANISM

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Summary: *1. The Problem at Stake. 2. Transplantation and Integration. 3. Geneticism and Computationalism. 4. The Transhumanist Strategy. 5. Culture and Self-canalization. 6. Ecological Implications. 7. Drawing some theological conclusions.*

1. The Problem at Stake

Humanity has always taken advantage of technology for assisting its control on the environment by both counterbalancing physical impairments and empowering human natural resources. From this general point of view, by analyzing our last-generation technological tools and devices, we think that the present situation is not *substantially* different from that of any past epoch. Indeed, the introduction of the wheel, scripture, printing, airplanes, and electricity, for mentioning some examples, have not less transformed the relations among humans and the human culture itself. All those technological means, with their countless applications, turned out to be essential not only in enhancing the biological human capabilities but also in opening new channels for human expression, communication and social organization. However, any true technological advance raised a wide range of problems, involving scientific and cognitive matters, environmental and social factors as well as ethical, philosophical and even religious or theological concerns. Therefore, the first steps in introducing some revolutionary pieces of technology are very delicate and need to be carefully and critically assessed case by case. In such transitory situations, new ethical and juridical standards must be established. As a consequence, new technologies may give raise to reject reactions and even fuel irrational fears. For instance, we may recall how public opinion reacted in a very alarmed way against the introduction of trains and cars: some journalists arrived to assume that overcoming 20 mph would have seriously damaged the human body. In such situations a critical assessment of the new pos-

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sibilities opened by the most advanced technologies, as well as of the dangers and difficulties that such changes represent, may be very useful. Indeed, even when those technologies should turn out to be fully positive, the problem of their cultural and social assimilation still remains. This critical assessment should be done at very different levels, but it should always imply a serious scientific analysis, since we cannot deal with these kinds of problems without resorting to the general scientific knowledge about the physical constitution of our world, the biological domain as well as the human intelligence and consciousness.

Although there are some communalities between recent developments and previous ones, in present times there is a feature of technological evolution that marks a point of discontinuity: while until recent times technological evolution mainly consisted in the production of external tools designed to more and more efficiently perform a number of tasks (like observing celestial bodies by means of telescopes or small entities with microscopes) some of the most recent developments go into the direction of implementing computer-engineered devices into the human body so to improve or even radically change the fulfillment of some biological functions. Such a goal has become one of the core themes of a recently arisen movement called *"transhumanism"*.[1] Starting from the question of whether the current status of humankind represents an end or just an early stage of evolution such that human nature is still a "work-in-progress", transhumanists wish a pervasive use of technological means in order to overcome human limitations and enhance physical, psychological and intellectual capabilities.

It is a matter of fact that, in the last few decades, significant scientific-technological achievements have been reached that opened previously unimaginable possibilities in this direction. In particular, we mention that recent experiments revealed the monkey's capability to control movements of artificial devices by coupling them with the electrical activity of neuronal groups of the primary motor cortex.[2] These developments may allow designing neuroprosthetic devices. Scientists regard such achievements as promising perspectives for rehabilitation procedures.[3] However, transhumanists wish to promote sophisticated technologies able not only to alleviate suffering or healing injuries and (congenital or acquired) handicaps but also to enhance the current human biological capabilities overcoming some of its limitations. Neuroprosthesis are a crucial part of this program. Building and implanting artificial tissues and organs, using drugs and pharmacological findings, as well as molecular and genetic engineering are all welcome means to enhance the pres-

[1] See BOSTROM 2003, especially SECS. 5 and 7, for some history of the movement.
[2] WESSBERG *ET AL.* 2000; NICOLESIS 2001; CINCOTTI *ET AL.* 2003.
[3] See, for example SERRUYA *ET AL.* 2002; JEANNEROD 2006, pp. 43-44.

ent human condition. The last frontier (the dream) for many transhumanists is the so-called *mind uploading*, i.e. «the process of transferring one intellect from a biological brain to a computer».[4] Mind uploading would bring many advantages according to the transhumanist program: avoiding biological senescence, radical cognitive enhancement, the possibility to have back-up copies of oneself and, last but not least, living forever. Alluring as it may appear to many, the transhumanist dream raises several serious questions. Some of them are scientific and cognitive. Let us start by these ones.

2. Transplantation and Integration

The first crucial question is about the extent to which we can substitute organic tissues or whole organs with artificial devices, as well as assist the body with implanted chips, without undermining basic functionalities or even the unity of the organism. Already Aristotle[5] discussed the so-called Theseus-ship paradox: up to which point can we assume that a ship remains the same after having progressively substituted all of its parts? We think that this question is at the very core of transhumanism, and has deep biological, medical, and ethical consequences.

As a matter of fact, organisms cyclically substitute the whole of their biological matter. However, as again Aristotle remarked and more recently Varela[6] recalled, a living organism is characterized by *autopoiesis*, i.e. the ability to transform external matter and energy into an internal cycle of self-production and -reproduction. This means that the organism demolishes and rebuilds its own structures by self-maintaining a formal and structural unity. It is possible to consider the unity of an organism as a dynamical process, yet organisms capability to preserve some key properties and functions should be recognized along the whole process. In other words, the general lesson that can be drawn here is that the organism is able to assimilate external matter and energy through its metabolism according to its own structures, functions, programs and goals, which remain in a way unchanged.

The issue is also relevant when considering local tissue-transplantation or even transplantations of whole organs like the heart. In those cases, a very common phenomenon is the rejection of the transplanted tissue or organ. This shows the basic fact that, already at a pure biological level, we cannot simply put a structural component, no matter how efficient in itself, inside the body of an organism since the latter needs to somehow acknowledge the extraneous biological item as its own, and this is even truer when we deal with artificial devices. This recognition process is paradigmatically featured by

[4] Bostrom 2003, Subsec. 2.6; Bostrom 2009, pp. 207-208.
[5] Aristotle, *De Gen. et Corr.* [6] Varela *et al.*, 1974

the immune system, which is precisely based on a sharp distinction between the biological self and what pertains to it on the one hand, and the non-self, that is the external environment, on the other, thanks to precise mechanisms of information selection and control.[7] Any organism, indeed, catches fundamental specific signals from its environment in order to modify or condition its immediate surroundings with the aim to improve its survival chances. This demands a very delicate *integration* of several sorts of functions and activities whose equilibrium may be very easily disrupted by inappropriate substitutions or interventions. This constitutes the basic biological integration that characterizes *any* organism.

More sophisticated is the case of the brain, namely the central organ for controlling and monitoring the organism's actions on the environment and for processing sensory information providing feed-back to the control system. Here, the issue of mind uploading appears in all its troublesomeness. Usually, impairments of certain organs or functionalities, or even implementation or reimplementation of new or old functionalities, induce reorganization of the neural circuitry and of the map that the brain has of the body.[8] Already in the 1960s, it was shown that after removal of the visual cortex, cats can recover some visual ability with appropriate environmental stimulations reorganizing in this way their neural networks.[9] So, when dealing with implementation of artificial devices, even in the simple case of a common leg-prosthesis, a certain time of habituation for the brain to integrate and control the new kinematics and dynamics induced by the prosthesis is necessary. This shows that the brain organization is continuously upgraded through the individual's movements and interactions with the environment, and that the brain as such provides a sort of *second-level integration* instance with regard to the basic biological one.

Finally, we may speak of a *third level* of *integration* when higher cognitive mental and psychological processes are involved, as it is the case with human consciousness, insights, sense of personal identity across time and so on. Also such processes demand a coherent and integrating unity, generally requiring a whole-brain state able to connect even distant neural regions, and that may be seriously damaged through several neurological or psychological impairments. Even more modest implantations of devices in the human brain for empowering specific capabilities and functions could turn out to be more difficult than it is often assumed. It might be possible to enhance specific functionalities if these are relatively modular, as it is very often the case for lower-level cognitive abilities (specific perceptual abilities or motor performances).

[7] Auletta 2011a, Subsec. 12.4.4.

[8] Konishi 1986; Donoghue–Sanes 1987; Giraux *et al.* 2001; Jeannerod 2006, pp. 34-35.

[9] Sprague 1966.

But this is barely the case when we deal with intelligence and especially the capability to have *insights*, as well as the human consciousness.[10] Trying to control the whole brain could finally result in a sort of enslaving it to a machine, which would be again likely detrimental to high-level cognitive functions and to the preservation of personal identity.

Therefore, when we consider the possibility to implement new devices in the body and the brain we must carefully ask whether or not they can result noxious in a way or another to one of these three levels of integration. In pursuing their dream of mind uploading, it seems to us that transhumanists precisely underestimate this issue. It is nowadays well-known that the human brain at birth is highly immature (at least with respect to other mammalian species, primates included) and that the interactions with the physical, biological and social environment is crucial for the development of a mature brain.[11] Such interactions are mediated by the body and, as we have seen, the brain's connectivity networks are continuously modified by the interactions with the (physical, biological and social) environment throughout the whole lifespan. Furthermore, the emotional system is increasingly acknowledged as crucial also for cognitive functions and conscious decision-making processes,[12] and it is well-known that such system also relies on the endocrine system and has strict relations with somatic happenings.

As a consequence, it should be clear that the brain *co-develops* with the whole of a person. Even the transplantation of a brain would likely result in a violent rejection. We could probably assume, as a limiting and fanciful case, that it would be possible to transplant a brain in an infant body, especially in the first stages of such co-development. However, even considering this possibility practicable at all (which is not so evident), the fact remains that the result of the intervention would be the integration of the brain in the *new* body, so that this brain would no longer be the one belonging to the person from whom it was taken, but rather the one co-developing with the infant's body. If we consider that the mentioned mental and psychological processes of integration are very fragile, we may well expect that the continuity of the person would easily go lost through this procedure.

Therefore, realizing the dream of mind uploading would at least require:

- The capability of producing an accurate map of the neuronal connections of a brain,

- The ability to single out and artificially (re-)implement the mechanisms and processes through which the brain upgrade itself following the interactions with the environment,

[10] Auletta 2011a, Sec. 21.3-21.4

[11] Changeux–Danchin 1976; Edelman 1987; Edelman 1992; Changeux 2009.

[12] Damasio 1999.

- The capability of reproducing the minute and both-ways interactions the brain entertains with the body.

This would also imply the possibility of implementing an artificial "body" able to reliably simulate, for the uploaded mind (or brain), the real body that is so crucial for brain development, upgrading, maintenance and proper functioning. As far as the aim of mind uploading is that of preserving the same *personal identity*,[13] moreover, all what precedes should be accomplished in an extremely detailed and precise way. In this sense, the transhumanist program aiming at assuring a continuity of the human self beyond the death (of the body), for not speaking of its eternalization, seem to be so far ill-grounded, affected by many lacks and exposed to serious counter-arguments.

3. Geneticism and Computationalism

The question naturally arises about the scientific background on which transhumanists have conceived their research program. Without denying a certain variety of positions, we think that most of the expressed standpoints share a view that is rooted in old-fashioned scientific research. We would like to show this in relation to two main problems: the role of genetics in the organism's development and the computational view of the brain.

Transhumanists encourage genetic manipulation in order to lower the risks of malformations or diseases as well as to enhance brain capabilities and cognitive functions. The problem here is represented by a naïve view of the complex relations between genotype and phenotype, and by a conception of the organism that often sounds too mechanistic.[14] Neither the mature phenotypes nor the brain structures are directly determined by the genome. Rather, they are the results of very complex developmental processes in which several environmental inputs and endogenous activities are involved, implying the impossibility to foresee the results of a hypothetical genome sequencing and programming for possible designed enhancements to be obtained.[15] It is very likely that such a process cannot be predetermined or controlled due to its intrinsic complexity. Let us now consider what this means for the brain in particular.

It seems to us that the transhumanist conception of the brain (and of the mind) is too simplistic as essentially based on a computationalist view.[16] The conception of the brain as a mere computing machine is in a way obsolete and it is grounded on a misunderstanding related to both the features of the computers that we could eventually implement and the functionality our brain. It is even not in accordance with the way any organism works. All or-

[13] Bostrom 2003, Sec. 2.6.
[14] Bostrom–Sandberg 2008, p. 379.
[15] Wolpert *et al.* 2002; Gilbert 2006; Auletta 2011a, Ch. 11.
[16] See Bostrom 2003, Subsecs. 2.3, 2.4, 6.1.

ganisms, bacteria included, have the capability to control their environment, being able to address and even to actively search for specific environmental signals denoting the presence of vital resources; this implies the fundamental ability of appropriately representing and referring to such resources according to vital needs and goals.[17] Obviously, the problem is much deeper in the case of humans, who make use of symbolic systems. The ability of humans to manipulate symbols allows to excogitate solutions and models that are unprecedented in our universe, whereas computers, passively following the instructions contained in their program (elaborated by human engineers), simply cannot reach that level of activity, in spite of what has been maintained in the framework of semantic computationalism.[18] Indeed, symbols are a form of dealing-with-information that is typically human.[19] Symbols (differently from signs or icons) do not have a direct representational import but are conventionally associated to some content. They are entities that are shared between a sender and a receiver, through which the receiver try to *provoke* an adequate representation of the referent in the receiver. The creation of a symbolic system requires a two-fold process of *internalization* and *externalization*. Internalization is due to the fact that symbols, lacking an immediate representational aspect, constitute an internal and closed system of semantic and syntactic relations. The external character of symbols, on the contrary, is essentially pragmatic and, therefore, *social*: a symbolic system, to exist as such, must be used and practiced within a community that shares it, which demands that symbols be connected with a public *combinatorics* of physical items (phonemes, written marks, gestures and so on).[20] Some may think that the human symbolic capability may be reduced, in a way or another, to the brain activity. Of course, the brain substrate, especially the various brain excitation patterns that always accompany higher mental functions, is necessarily required. However, such brain patterns are not symbolic in themselves but essentially representational.[21] It should also be considered that the brain processes are likely to be canalized by the mind activity. A clear hint at that may be found in the long-ranging and elaborated action planning (J. Searle's "prior intentions")[22] that are able to frame specific action-segments (Searle's "intentions in action"). Moreover, the brain excitation patterns are not the only necessary "material substrate" for the mental symbolic activity, as it requires the resorting to external physical items (as seen), as well as to the environment and the social interactions mediated by our bodies. Summing up, the idea of

[17] See Auletta 2011b.

[18] Auletta 2011a, Subsec. 6.1.2.

[19] Auletta 2011a, Ch. 19.

[20] See also Hauser 2009.

[21] Auletta 2011a, Ch. 13, especially Subsec. 13.1.2.

[22] Searle 1983; Jeannerod 2006, pp. 1-8, 62-66, and 135-143; Auletta 2011a, Subsec. 14.1.3.

mind uploading turns out to be encouraged by a limited and misleading view of the brain and the mind that does not take into account all the mentioned sophisticated aspects and the deep intertwinement of the biological, physiological, environmental and social components involved.[23]

4. The Transhumanist Strategy

Having seen which is the background of transhumanism, we may ask about the perspectives. From this point of view, we may consider two main issues:

The transhumanist hope of achieving at least partial results;

The *posthuman* as a transhumanists' *"blind* perspective".

About *point 1)*, one has to admit that transplanting brains and mind uploading is not what transhumanism is all about. Indeed, particular solutions have been envisaged or emphasized to deal with a number of concrete problems. The common, general tenet seems to be the employment of pioneering technology to improve human capabilities,[24] and it is explicitly acknowledged that also partial results are welcome in the transhumanist perspective:

> «Success in the transhumanist endeavour is not an all-or-nothing matter. There is no "it" that everything hinges on. Instead, there are many incremental processes at play, which may work better or worse, faster or more slowly. Even if we can't cure all diseases, we will cure many. Even if we don't get immortality, we can have healthier lives. Even if we can't freeze whole bodies and revive them, we can learn how to store organs for transplantation. Even if we don't solve world hunger, we can feed a lot of people».[25]

If the issue at stake is that of trying to cure diseases, to have healthier lives, to achieve more reliable techniques, to conserve organs for transplantation, or to alleviate the world-hunger problem, it is not clear what is the additional value of transhumanism relative to the current work of many organizations dealing with these problems. Very likely, however, the real purpose here has to do with a radical turn in the general strategy with respect to the current scientific-technological research as to the establishment of a trend aimed at promoting further improvements of human capabilities raising the level of functional and cognitive standards as such, in an effort not necessarily addressed to disease healing or to injure recovering; this raising of human standards is a free choice allowed by technological means currently available or still to be developed. In this sense, truly interesting as it may be, the approach should take into account some general considerations at least since it may suffer a latent but potentially dangerous contradiction. On the one hand, it envisages a rather liberal and futuristic approach with respect to the experimentation and

[23] Auletta 2011a, Secs. 24.4-6.

[24] Bostrom-Sandberg 2008.

[25] Bostrom 2003, Sec. 6.3; see also Bostrom 2011.

intervention on the human subject; on the other, it seems to rely on scientific views that are sometimes not sufficiently updated and in line with the most recent developments, as we have tried to show in what precedes. Therefore, a more careful assessment of the matter seems to us quite relevant as we need to understand which are the limits of technological developments that can be predicted in the span of 50 years or so, and which are, therefore, the correct and reliable research strategies[26] that we should undertake (especially if we take into consideration that any technological strategy has its costs).

Moreover, let us point out that the transhumanist claims involve also a number of deep ethical issues. It will suffice to consider that, currently, most the governments all around the world forbid the experimentation on the human subject, preventing it by means of specific protocols that are to be subscribed by every scientific research group. This casts additional worries about the interventionist strategy. Finally, another important issue to be attentively considered is the deep social transformations that the diffusion of such invasive procedures would bring about, with the consequent repercussions on political and legislative systems. Recently, some prudence has been manifested by the supporters of transhumanism as to the risks that a sharp "interventionist" strategy may have. It has also been acknowledged that the status of ethical debate on new technological developments is significantly behind the impressive rate of technological development itself.[27] The notion of "existential risk" has been introduced for taking into account those threats which, should they realize, would either annihilate Earth-originating intelligent life or permanently and drastically curtail its potentials.[28] This notion is also intended to provide the background for delineating political and ethical indications and prescriptions to the purpose of avoiding (or at least lowering the probability of) unintended direct or indirect catastrophic consequences of the technological development on our species.[29] However, as the transhumanist strategy involves a direct application of experimental procedures aimed at intervening on the equilibrium characterizing the integrity of human subjects, our main point is that such an approach should take into account the different aspects of the human person involved and therefore be *scientifically* assessed mainly in relation to the three levels of integration of the human organism and person we referred above. Furthermore, we think that it is worth trying to frame these issues also within a responsible philosophical and theological view addressing fundamental anthropological questions. The anthropological question is indeed a too big question (which raises a considerable amount of collateral problems) to be confined in some specific field of studies. This should be the reliable ground on which rooting the debate on the future of humanity.

[26] Auletta 2011c, especially pp. 52-55.
[27] Bostrom 2011.
[28] Bostrom 2002, esp. Secs. 1 and 2.
[29] Bostrom 2002, Sec. 9.

Therefore, setting by now aside ethical and social aspects, it seems that times might be unripe to undertake experimentally invasive research project on the human subject that we are just now beginning to understand in its multifaceted complexity.

About *point 2)*, the final goal of the transhumanist strategy is to establish a *posthuman* being "whose basic capacities so radically exceed those of present humans as to be no longer unambiguously human by our current standards".[30] On this view, a transhumanist is "simply" a person who encourages the reaching of such a "new being" by applying advanced technological means to present-day human organisms. Because of the many different approaches envisaged in the transhumanist movement, the notion of posthuman is irremediably vague and subject to individual speculations. It is also explicitly admitted that «it is difficult for us to imagine what will be like to be a posthuman person».[31]

Thus, as the posthuman-state to be reached is, by definition, so undetermined and unspecified, the transhumanist may stop worrying about the specific steps to be endorsed to reach such a state. The only methodological imperative that should animate the transhumanist would be something like: do all what may conceivably enhance the present human condition and, sooner or later, a posthuman will emerge as a consequence of such process. This order of argumentation, however, seems to us to explain away the real problem at stake, i.e. the one of envisaging a concrete and manageable scientific-technological research strategy able to lead to specific results. In other words, a clearer understanding of the aims to be reached and the means to be employed should be a prerequisite for undertaking a so engaging scientific and technological research program like the one discussed here. This casts some doubts on the actual effectiveness of this approach in solving the specific problems which humanity faces. No ambiguity should be left about the connections between the current concrete problems, the way to solve them or at least to cope with them, and the ultimate goal of the posthuman condition.

5. Culture and Self-canalization

Notwithstanding the limitations and worries so far expressed, transhumanism actually grasps a fundamental dimension of the humankind: the tendency to improve its conditions, to overcome its limits, to elevate its status to a higher level, and even to defeat death. This is indeed a connatural attitude of humans as it is expressed in the search for truth, in arts and literature, in moral thinking, in religious beliefs, and so on. From this standpoint, the appeal of tran-

[30] Bostrom 2003, Sec. 1.2.

[30] Bostrom 2003, Sec. 1.2.

shumanism to consider "the future of humanity as an inescapable topic" is to be acknowledged in its real and concrete import.[32]

The point that we want to make in this section, however, has to do with the context, means and perspectives for such a topic to be appropriately faced; we shall argue that the human tendency to improvement has its proper place in the exclusively human phenomenon that is *culture*. We shall also see that culture is the way in which humans perform their own *self-canalization*. In a later section, we shall also argue that culture and self-canalization may well be seen as the conditions for another typically human feature: *self-transcendence*.

Now, as also the word clearly suggests, transhumanism is a cultural movement essentially related to a way of thinking about the human condition. Indeed, we have seen in the last section that it represents an anthropological conception, or at least it brings on the table anthropological problems. It is, however, suitable to settle this kind of problems in a more mature, scientifically based, and philosophically elaborated anthropological background that, as we shall see, also resorts to some key theological tenets. The exigency to take into account all these three disciplines (namely, science, philosophy and theology) for the problem at hand depends on the fact that, whereas many domains of research (and of reality) have been taken up by one of the three and abandoned by the others, the issue of the human being remains a core theme for them all.

To begin with, it is worth trying to understand the phenomenon of human culture in an evolutionary perspective with a special focus on the systems of inheritance. The first acknowledged form of inheritance in evolutionary biology is, of course, *genetic* inheritance. All the life forms resort to this mechanism for transmitting to future generations the genetic information necessary (but not sufficient) to build a new organism belonging to the concerned species. It is worth mentioning that very elementary living beings, like bacteria (which, strictly speaking, lack a true development), have essentially the sole genetic mechanisms securing inheritance, and they indeed show a high level of genetic variability which is also ensured by the so called horizontal gene transfer (i.e. the acquisition of genetic sequences from other cells of the same or a different species without any parental relation). Then, the bacterial "model" of dealing with environmental uncertainty is to intervene in the generation of variance itself. A quite recent achievement in biology has been the acknowledgment of another mechanism of inheritance: the *epigenetic* one. Roughly speaking, this mechanism is active in all the organisms that have some form of development or growth that brings from an immature individual to a mature phenotype. This growth occurs by means of a deep and complex interconnection between the organism and its environment, so that

[32] Bostrom 2009, pp. 186-189.

in most cases an environmental niche is established smoothing the effects of natural selection. This niche represents the context in which subsequent generations grow and live. The multicellular eukaryotic model of dealing with environmental uncertainty is to intervene in the mechanisms of selection by smoothing their effects.

Now, in our view, *culture* should be considered as a third form of dealing with environmental uncertainty: inventing a new form of inheritance, that is, of transmission of information to subsequent generations.[33] Culture, indeed, may be defined as a set of behaviors, tools, traditions, and learned skills that are symbolically shared by the members of a community and are phenotypically transmitted from one generation to another through non-genetic channels.[34] Moreover, as we shall see, culture may be regarded as the human way of transforming, rebuilding, and arranging the environment. In this sense, it represents the specific way for humans to construct their environmental niche. Therefore, culture has an adaptive value. In order to understand this point, we should first consider that, in general, adaptation means an increased organism's capability to control its environment; this in turn implies an increased capability of exerting *information control*.[35] Now, in a previous section we have already seen some of the characters of the human symbolic activity. Culture presupposes the symbolic activity as well as constitutes the context in which the latter develops. On the basis of the internalization/externalization process, *shared* symbolic systems and networks (i.e. cultures) represent a new and highly efficient form of dealing-with-information. Perhaps, the most striking adaptive trait of culture is that it makes information production and management cheaper and more accurate.[36] For instance, by reading a textbook on molecular biology, it is possible to assimilate in a few months what has required the joint effort of hundreds of research teams over many decades.

The symbolic activity of humans, in its two-fold dimension of internalization and externalization, gives rise to a *mental space*. As we have seen, mental activity is made possible by the use of a *combinatorics* of physical items that are *conventionally* associated with meanings. The combinatorial and conventional character, and the consequent recursive property, of the symbolic mental activity allows for it to be virtually unlimited and unbound to specific outcomes. This feature of the mental symbolic activity enables humans to elaborate notions (like infinity, irrational or imaginary numbers, God, etc.) and conceptual frameworks (e.g. elaborated action plans, scientific theories, political systems, cults, and so on) that have no direct representational content and linkage with the physical reality, as well as to combine them recursively. This poten-

[33] Auletta 2011a, Sec. 9.8; Jablonka–Lamb 2005, pp. 119-46 and 162-66.
[34] Auletta 2011a, Subsec. 22.3.1. [34] Auletta *et al.* 2008.
[35] Richerson–Boyd, p. 113.

tial limitlessness, however, results constrained within in any specific cultural manifestation. A culture, indeed, is constituted by a well-defined set of rules, fundamental assumptions, practices, conventions, strategies for future developments and so on. Such a set is determined and deliberately accepted by the members of the community identifiable with that specific culture. Therefore, the human being shows a unique capacity, in comparison with any other known life-form, of *self-determining* the conditions of life in which the members of a community and their descendants are *forced* to go on. Moreover, in such a process we often discover that the parameters defining a specific problem also strongly confine the possible solutions. Even in the cases in which there is a certain initial variability, as time goes on, most humans converge on certain technical or conceptual solutions that are considered more or even the most appropriate. Thus, such constraining process is conventional but not arbitrary, and it is in this sense that culture is *intrinsically* characterized by what we call *self-canalization*.[37]

Briefly speaking, we may say that every radical choice we make in our life, orienting (canalizing) our own efforts and energies towards the pursuing of a general goal or a mission in life, is an act of self-canalization that we renew in everyday engagement. For example, we may acknowledge such an act when a person deliberates to become a physician, a marathon runner, a cook, or even in the case of a religious conversion, thus undergoing training, discipline and sacrifice.

Self-canalization refers to humans voluntary subjecting and bending themselves to principles or laws that they discover as not being dependent on their will although the paths leading to such discoveries are freely chosen and fully contingent. Indeed, the motivation to undertake a certain training is always irreducibly individual, but the result that one can eventually produce, if relevant, have a value that immediately transcends the individual dimension.

This is especially true for knowledge: in the course of our experience, thanks to our commitment and creative but rationally pondered efforts, we can unveil general truths or constraints in nature to which we freely accept to submit our reason (or will). We reach those truths, yet they go far beyond our capacity of wielding our arbitrary power on them, thus requiring an acceptance of, or an assent[38] to, them as something ultimately received rather than produced. The progressive discovery of truths about the natural world proceeds essentially by formulating theoretical hypotheses related to observed phenomena and successively testing them. Theoretical hypotheses are in general abstract constructs resulting from human free invention and imagination.

[37] Auletta 2011c, pp. 216-225.

[38] H. Newman stresses that an act of assent is not a mere reiteration of a conclusion but an act that gives an absolute acknowledgment to the conclusions that we draw from inferential processes (see Newman 1870, Ch. 1, § 1 and Ch. 6).

However, in the course of the scientific enterprise, some of these theoretical elaborations achieve a certain degree of universal validity as the research we undertake grasps essential regularities actually present in nature that can account for a large number of different phenomena. Therefore, we may see how an intellectual enquiry, obviously carried out through contingent ways of investigation, brings to a universal dimension of intelligibility standing beyond the particular standpoint of single scholars, so that, in principle, all of them might converge on it. The knowledge that has been achieved in this way is precisely an example of what humans freely accept, choose to share, spread and further develop within a future-concerned perspective that also implies the education of children, that is, of our descendants.

In this perspective, the history of human culture essentially tells the ways in which self-canalization has been performed giving rise to different social and communitarian contexts. When many people in a certain political-social context embrace a common ideal, such individual radical choices may lead to radical historical changes, as for example in the case of the American Revolution.

In more general terms, self-canalization should be regarded as the continuous generation of variety and novelty and the simultaneous free acceptance of constraints that restrict the space of possibilities. In this sense, self-canalization is a fundamental process on which our culture is grounded. It is important to stress that this process does not imply a determination or a denial of our single free choices. Rather, as the word suggests, it stands for the subsequent canalization of all our everyday choices under the guide of universal principles or laws to which we may partake typically as members of a human community that recognizes and shares those principles and laws. Therefore, the intrinsic self-canalizing character of culture is such that it continuously back-effects on itself.

The free acknowledgment of formal truths and their voluntary acceptance, the process of education of new generations typical of any cultural system, the fact that humans voluntarily undergo learning processes, as well as the acceptance of laws, precepts and moral obligations are all evidences of the natural capability of humans to go beyond their purely biological dimension. Precisely here we see a possible point of convergence between our approach and the most interesting tenet of transhumanism: the grasping of the human tendency to improve its conditions, to overcome its limits, and to elevate its status to a higher level. However, whereas transhumanism seems to currently focus on the enhancement of the human biological organism, we see in culture (socially integrated technologies included) and in the mental symbolic activity of humans the most proper place for such tendency to be pursued. Indeed, culture as self-canalization (in its historical development) already represents a form of improvement, advancement and progress to which humans

are naturally inclined and through which we transcend our individual perspective. Moreover, while the transhumanism only considers the tendency of humans to "go beyond", self-canalization stresses both the self-transcendence and the necessary self-limitation that allows for further progress, and in this way is also intrinsically open to a theological dimension.

6. Ecological Implications

Before turning on some theological considerations, let us approach some ecological implications concerning the transhumanist relying on technology. As it is increasingly clear, current developments in technology may indeed endanger or seriously damage the ecological system of our planet. Nevertheless, it is also to be taken into account that, probably, the only way to *avoid* the risk of Earth's resources overexploitation and consumption is to be found in a responsible development and use of new-generation technologies.

We think that the problem needs to be assessed starting from the clarification of the relations between highly complex organisms, and humans in particular, with their natural environment. If it is certainly true that these organisms are subject either to minimal and gradual fluctuations or to more radical changes of environmental conditions, it is equally true that they are able to actively modify or mould their surrounding environment according to their needs,[39] in the process of *niche construction*.[40] We may say that the ontogeny of a huge number of multicellular organisms, from insects to mammals, is deeply characterized by niche construction as the continual effort to consistently control environmental situations by both exploiting favorable conditions and smoothing unfavorable ones, as far as it is possible. Since the formation of a suitable environmental niche is a direct outcome of organisms action during their lifespan, often in interaction with other organisms, a local environment (i.e. a niche) can be recognized only in relation to the organisms living in it. Indeed, a process of *co-adaptation* between organisms and local environment is continuously at work. Moreover, since a perfect control on environmental conditions remains impossible even for the highest life-forms, we have to take into consideration the *integration* of pressures (coming from biological and not-biological surroundings) that affect (and select) organisms on one side and the outcomes of organisms cumulative work in niche construction on the other. It is easy to see that the modifications introduced in the environment especially by the adult members of a population will contribute to determine the situation in which the next generations (also including members of different species) will grow and, in turn, perform a further

[39] See, for instance, Lewontin 2000. Indeed, already E. Schrödinger (1958) drew the attention to the point. [38] Odling-Smee *et al.* 2003: Auletta 2011a, Sec. 10.3.

modifying action, thus bringing to a feedback process occurring over time, which has strong evolutionary relevance. Finally, the interactions between different species and different niches bring about the formation of even wider and more complex networks, that is, of ecosystems in which communities of organisms together with the physical environment turn out to be reciprocally dependent.

Now, humans have developed maybe the most advanced way to build an appropriate niche, which also gives rise to particular effects on other species, on wider ecosystems rather than only on locally confined areas, and possibly on the whole ecology of our planet, as it is especially the case for technologies that have been produced since the twentieth century. Leaving aside for the moment these latter developments, we would like to stress that humans are the only organisms able to exert control on the natural environment *reshaping* and even *reinventing* it according to conscious purposes, desires, values, and spiritual exigencies. Typically, human symbolic thinking and communication represent a totally new kind of relation between con-specifics. As we have seen above, the symbolic activity characteristic of humans allows for the structuring of a mental universe. This process may be regarded as similar to the way in which other organisms construct their local niches; yet, such a universe finds a particular distinctive character as it is symbolically shared in a dynamical process of social and linguistic interchange.[41] These capabilities pertaining to the human species allow for our continuous building of *ideal models* about possible relations of cause and effect with respect to the natural world that we inhabit. This is an abstract conscious operation in turn indispensable for designing tools and devices to purposefully re-invent our environment in countless different shapes.

Then, culture is the properly human way to create an adaptive ecological niche. Here we see a deep integration and entrenchment between the biological and the cultural dimension. Culture somehow absorbs the biological dimension of niche construction, and it does so exactly thanks to its self-canalizing character that confers to any fundamental human activity a deep projective dimension undertaken in view of its possible, expected and *planned* future effects. At the individual level, it is quite clear that no single choice or act is performed without thinking to its future effects and consequences. At a supra-individual level, the building of roads, aqueducts, ports, schools, monuments, churches and temples, but also, to a certain extent, communication systems, holiday villages, shopping centers and so on are always designed not only for their proximate employment but also (and sometimes mainly) for their future effects on life-style, welfare, market, advancement of knowledge and, in a word, *enculturation* of future generations.

[41] Auletta 2011a, Secs. 18.1 and 19.1.

We wish to emphasize that any cultural tradition can exist only as far as it has a *local* character. A religious tradition, for instance, can exist only if there is some local event (like a miracle or a revelation) and if there are specific places considered as sacred. Even material culture (e.g. culinary or craft traditions) is always linked to the availability of locally specific supplies. Of course, material culture often affects other (and higher) cultural levels (think, for example, to the oriental ceremony of tea). Moreover, the limitations of the past technologies and the limited dimensions of populations had a less invasive impact on the natural environment thus preserving the local character of human cultures.

As a matter of fact, today we find ourselves dealing with a transformation that involves the very meaning of cultural traditions. It seems, indeed, that mankind is more and more entertaining a radically different relationship with the environment involving the progressive abandon of the local dimension in favor of the global one. It might even be said that whereas the animal's niche construction is a limitedly local process of co-adaptation, the human species more and more tends to cope with the global (planetary) environment, thus expanding its reshaping capability to the whole Earth's ecosystem, although the control of this hugely complex system still remains out of our reach. In any case, the objective tendency to cope with the global environment may well represent another qualitative difference with respect to past technological possibilities, an issue that transhumanism has promptly realized. Transhumanists may perhaps still have a unclear strategy but have probably well understood such main trend of our epoch. However, the broadcast social process we are experiencing is not simply a matter of technology but is one of the main characters of the deep social transformation called "globalization", which could even menace the endurance of specific cultures, at least without some wariness. Of course, the issue of globalization would deserve an assessment provided by different specific fields of investigation. In any case, for what human culture is concerned, such a development seems unavoidable and, as far as we can understand, deeply rooted in the human nature, in both its tendency to universality and its urge to adapt the world to its needs and to improve its life-conditions. The question is whether or not such a development will wash out any kind of local traditions. In other words, the striving of self-canalization toward universality cannot mean or imply any devaluation (or annihilation) of the concrete, local and even biological, roots of human culture. Faced with such an enormous problem we can only hope to favor a process of sensitization for not easily dismissing our own traditions before finding anchor-points that are objectively more valuable.

7. Drawing some theological conclusions

An opportune theological reflection may turn out to be extremely helpful as to these topics. Indeed, the Christian theological tradition acknowledges a

dimension of self-transcendence that could be brought in harmony with the objective tendency of humanity that we have analyzed at the end of the previous section. Moreover, Christian theology, in its representing a specific tradition, may contribute to cope with this general problem without overlooking the dimension of the local aspects of human culture. In this way, theology may offer an interesting anchor-point in a situation in which the debate is fully open.

In particular, we would like to draw the attention on the issue of human stewardship towards the natural world, and the acknowledgment that God entrusted the created world to our care. We think that stewardship may acquire its full meaning in the light of the new Creation (the second coming of Jesus and the resurrection of the dead), that is, through an eschatological perspective that transcends but should include what we call history, nature or science.[42] In such a perspective, the coming of God's Kingdom should not be conceived as a denial of the first (current) Creation in a kind of ontological dualism (disqualifying the material dimension), but in terms of an eschatological duality between the present age and the age to come.[43] Indeed, the Christian message deals with the resurrection of the whole person, that is, of the bodily person. Accordingly, St Thomas points out that the intellect is the form of the human body to which it is united not accidentally, and that also the perfection of the body is required for beatitude.[44] Thus, God's Kingdom may be expected to represent a transfiguration of the person and of the whole of Creation,[45] implying the enhancement and ennoblement of the dimension of matter and not its negation or annihilation.

Now, we humans are called to take care of the created world in the perspective of the coming of God's Kingdom "on earth, as in heaven" but this obviously implies that we have to perform this duty without presuming to dominate the Earth (or creation): we are stewards of the created world rather than its tyrants. We can only contribute to the realization of God's providential plan, yet we cannot determine or predetermine in any way this process and not even know whether or not we are the only intelligent beings involved, or whether we shall succeed or not.[46] In other words, we are called to follow God's will, avoiding the arrogance of elevating any of our ideas, ideologies, parties, society, group or whatever form an Utopia may take, to be the door or the leverage for the Kingdom of God. This demands great modesty but also a great sense of responsibility, requiring a deep engage-

[41] Wright 2007, pp. 105-106.

[42] Wright 2007, pp. 83 and 214-217.

[42] Aquinas, *S.Th.*, I, q. 76, a. 1, a. 6; II.I, q. 4, a. 6.

[43] Wright 2007, pp. 52-63, 104-119, and 159-176.

[44] Wright 2007, pp. 156-158.

[44] Wright 2007, pp. 156-158.

ment from both a moral and a religious point of view.[47] It is worth stressing that these theological considerations also imply that there cannot be such thing like a continuity or progress that, starting from any of the aspects of the created world, deterministically guides us towards the accomplishment of the new Creation. This is the reason why the conflation of God's Providence with an idea of finality ruling the first creation (and therefore giving it a certain "direction of march") clashes with the core of our religion. Such an idea does not take seriously into account the dimension of evil in all its forms, not only moral but also physical and metaphysical evil, resulting in a fundamental inability to cope with this problem in a way that is simultaneously positive and realist.

Now, within the sketched theological context, we should take into consideration that an educated and responsible employment of new-generation technological means may eventually permit to perform our duty of stewardship[48] toward the created nature in a beneficial way that, right until yesterday, was unfathomable as not having comparable historical antecedents. Indeed, today we have the opportunity to accomplish stewardship through a smoother control on the natural world without resorting to gross or rough mechanical techniques to transform the environment according to our needs. It is a matter of gently canalizing natural phenomena, maintaining existing constraints as far as possible and establishing new ones when necessary. We should also take into account that this may assume a crucial relevance in dealing with problems possibly derived from globalization (especially in the so-called Western societies and, now, in the developing countries) such as overconsumption and Earth's resources overexploiting. Even if the technological development of the last few decades doubtlessly brought about ecological dangers and damages, it is also possible to think that subtler economical and political strategies based on innovative technological findings might well represent an adequate solution to the problem.[49]

Finally, as we have seen, one of the main focus of trashumanists' eagerness to employ new generation technologies to improve our condition is the issue of prolonging human life; some of the most radical transhumanists even believe humans to eventually become immortal. Although obviously naïve, this raises the huge problem of the essential desire of humans to endure forever, which is also a basic feature of the religious feeling. The most dramatic condition of humanity is the felt contradiction between a mind that longs for universality and a body that is necessarily limited. Perhaps not by chance, Schrödinger considered dealing with time, and in particular the effort to over-

[47] Wright 2007, pp. 218-224 and 228-229.
[48] *Gen* 1:26-28; *Catechism*, numbers 2402 and 2415. See also Gray 2001.
[49] Heap–Comim 2008.

come temporal limitations, as *the* theological question as such.[50] Again, we are inclined to think that a theology of new creation centred on salvation and redemption, and essentially grounded on the Resurrection of Christ bringing about the overcoming of death might be helpful to solve that contradiction as well as to lead our goals and our hopes to a more mature state.

Summarizing, we would like to suggest that the point is not merely in acquiring more and more powerful technological means; rather, by transcending our pure biological dimension and spiritually establishing a community with our Creator, we should elevate ourselves to be conscious partakers of His providential plan for the Creation. We have seen that humans have powerful means to intervene on the world, but also have the capability to understand their limits and to acknowledge that what they discover and achieve throughout their activity is not dependent only on their arbitrary will. What is required for promoting stewardship is the passage from the (selfish) ability to canalize ourselves, and our own descendants, to the (altruistic) capability of canalizing the entire world by means of both our powerfulness and the awareness of the limits that we freely acknowledge. It is here that a qualitative change in the way we intervene on the world according to self-canalization may bring us to implement the intrinsic human dimension of *self-transcendence* in a more integral way. Self-transcendence has indeed been regarded in relation to the constitutive openness of the human being to the divine transcendent reality, to the possibility of recognizing it as independent of individual will or ideas, and to the faculty of freely acting adhering to it.[51] From our point of view, this implies the acknowledgement that we are part of the created world, as any other created being, but also in the special position to become partakers in God's care of creation.

ABSTRACT: *Transhumanism is a recently born movement fostering the employment of advanced technological means for improving human capabilities and overcoming human physical limitations. What follows is an attempt at critically assess the movement, its strategies, its goals as well as the conceptual tenets underlying it, taking also into account some of the key scientific topics involved. Our main point is that any kind of technological intervention should respect the fundamental integrity of the human being, as it can be acknowledged when considering the biological, the neurological and the personal levels, the latter one being basically characterized by consciousness and intentionality. We shall also consider the relevance of the intellectual challenge represented by the transhumanist movement for an understanding of the human culture at large, for finally proposing some brief theological conclusions regarding the stewardship that mankind is expected to exert on the created world, as well as the issue of human self-transcendence.*

KEYWORDS: *human being, consciousness, human culture, intentionality, transhumanism.*

[50] SCHRÖDINGER 1958, p. 149. [49] RAHNER 1976.

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