Nanoethics: Ethics For, From, or With Nanotechnologies?

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Abstract: The concern for ethics is a *leitmotiv* when dealing with nanotechnologies. However, the target of this concern is far from being obvious, and the word 'nanoethics' itself has no clear-cut definition. Indeed, nanoethics is usually said to be 'the ethics of nanotechnologies', but it is never specified whether this 'ethics *of* nanotechnologies' is 'an ethics *for* nanotechnologies' or 'an ethics *from* nanotechnologies'. This paper aims to show that these two characterizations of nanoethics (for/from) imply different problems, but that they are both insufficient, even if necessary, to build a definition of nanoethics. In conclusion, I stress the idea that neither a 'top down' nor a 'bottom up' nanoethics are sufficient to characterize the ethics of nanotechnologies and that a 'reflexive equilibrium' is necessary in order to understand nanoethics as an ethics *with* nanotechnologies.

Keywords: *nanoethics, moral cognition, applied ethics*.

1. Introduction

The statement that nanotechnologies do inevitably imply ethical questions is most often found in institutional reports as an indisputable statement of fact. It even seems to be the case that the emergence of nanotechnologies has caused the birth of an entirely new branch of ethics. Moreover, a new word, 'nanoethics', was coined and an eponymous journal, *Nanoethics*, was born in 2007 in order to provide a forum for analyzing the specific difficulties raised by nanoethics.

The best beginning would be to define nanoethics. For example, we could start by characterizing the two terms that form the word: 'nano' and 'ethics'. The problem is that this is something of a mission impossible as the definition of the nanotechnologies stands as an open question. If we take the broad definition of nanotechnologies as concerning a particular scale where certain properties are likely to appear, then the question of whether these particular properties engender the emergence of specific ethical problems remains open:

a change in scale does probably not justify on its own the emergence of a new branch of ethics known as 'nanoethics'.

Do we really need nanoethics, or in other words, how do we justify philosophically the existence of nanoethics? Here is the broad question addressed by this paper. More precisely, this is actually only a way of asking another question: *are there problems that are both nanotechnologies-specific and ethics-specific?* The point here is to find out whether nanotechnologies do specifically create moral problems that would give us moral grounds for promoting or rejecting them, or for authorizing them under certain conditions. Otherwise, it could simply be that nanotechnologies do not, in themselves, raise any specifically ethical issues, and that they are neutral from a moral point of view.

I will argue that the relationship between ethics and nanotechnologies is twofold, and that, for this reason, the concept of 'nanoethics' must be submitted to a precise conceptual analysis. Although the definition of nanoethics is usually taken as 'ethics of nanotechnologies', the meaning of the 'of' here remains obscure[1]. Should it be understood as an objective genitive – where nanotechnologies would be the object of ethics – or rather as a subjective genitive – where nanotechnologies would be the subject of ethics? The problem dealt with in this article could therefore be redefined in these terms: should nanotechnologies be understood as ethics *for* nanotechnologies or as ethics *from* nanotechnologies?

If 'nanoethics' is to be understood as an ethics *for* nanotechnologies, then the direction of fit is from ethics to nanotechnologies, and consequently nanotechnologies should adjust to ethics so as not to be in conflict with them. On the other hand, if 'nanoethics' means ethics *from* nanotechnologies, then the direction of fit is from nanotechnologies to ethics, and it is then up to ethics to adapt to nanotechnologies.

The simplest way to deal with this question is probably to rest on the traditional major divisions in ethics: on the one hand, between the two fields of ethics and, on the other, between the major theories of ethics.

As for the first division, the two fields of ethics are meta-ethics and normative ethics. Roughly speaking, the purpose of normative ethics is to determine whether things or actions are right or wrong, fair or unfair, caring or uncaring *etc*., while meta-ethics is the study of the meaning of moral terms and of the epistemological status of moral judgments. Normative ethics can, in turn, be subdivided into two major branches: theoretical ethics and applied ethics.[2] Applied ethics deals with concrete situations and specific fields. Meanwhile, theoretical ethics consists of different ethical theories, the three main ones being virtue ethics, consequentialism, and deontology. The first emphasizes virtue or character, the second consequences, and the last duty.

There are two good reasons for highlighting these distinctions. First, all three theories of ethics are generally recognized as being a sound basis for supporting ethical arguments in the public arena. The problem here is whether we can morally justify the promotion, conditional authorization, or prohibition of nanotechnologies for ethical reasons. Secondly, it is a widely held view that nanoethics is nothing more than a new avatar of applied ethics, usually likened to biomedical ethics or environmental ethics.

Contrary to this widespread conception, this article aims to show that no theory of ethics on its own provides a satisfactory argument for our 'need for nanoethics', and that the problems raised by nanoethics should be considered not only from the point of view of normative ethics, but also, above all, from the point of view of meta-ethics. In other words, I would like to demonstrate that nanoethics should be seen less as ethics *for* nanotechnologies and more as ethics *from* nanotechnologies, and it is precisely for this reason that the links between ethics and nanotechnologies (or more accurately the converging technologies NBIC) are particularly important.

2. Nanotechnologies and normative ethics: ethics *for* nanotechnologies?

Do the three main theories of normative ethics allow bearing a moral judgment about nanotechnologies into the public arena? Let us examine each of them – in a (necessarily) simplified way.[3]

2.1 Nanotechnologies and virtue ethics

One of the striking features of the prophetic discourses on nanotechnologies is their insistence on their capacity for 'improvement'. According to the transhumanists, nanotechnology opens the path to a 'post-human' era when humankind takes over natural evolution and starts to 'model' itself in order to 'enhance' its physical and cognitive abilities. Nanoethics should thus take the form of a moral positive judgment: nanotechnologies are morally good because they allow us to 'enhance' ourselves.

Their ethical justification generally purports to be based on the most ancient of theories of ethics, virtue ethics. More particularly in the Aristotelian tradition, it deals with excellence of character, in actions as well in thought and intention. The purpose of virtue ethics is to determine what type of person we want to become. It aims as helping us to decide how we should act to become this type of person. For this reason, virtue ethics could be seen as

carrying with it the idea of self-improvement, of improvement of one's attitudes and actions, but this is stamped with a sense of moderation.

Is the transhumanist' attempt to identify nanoethics with virtue ethics legitimate? There are at least three reasons why the adoption of virtue ethics in this case is problematic.

First, the 'enhancements' promoted by transhumanists are a long way from the ideal of moderation promoted by virtue ethics and look more like what antiquity described in disapproving terms as immoderation (*hubris*). Secondly, virtue ethics is primarily an ethics of self-improvement in the sense of moral education and effort. In this sense, it stands in complete contradiction with the almost instant enhancements that would be permitted by the nanotechnologies, which in this regard look more like a form of doping. Thirdly, virtue ethics is tightly bound with a sense of community, which is completely different from the idea of individual and self-centered enhancement through nanotechnologies. This is in contradiction to any desire to build society. Consequently, we are still in the presence of a logic that does not really get inside the problem of nanotechnologies. What makes this all the more invalid is that it seems implicit in the political perspective underlying the transhumanist' constant call to promote nanotechnologies.

1.2 Is nanoethics consequentialist?

While virtue ethics is usually used by transhumanists to make their case (wrongly, as we have just seen), consequentialism is the strand of ethics most often used to back up official discourse, though rarely explicitly. Would, then, consequentialism be a good candidate for nanoethics?

The main characteristic of consequentialism is that it judges whether an action is morally good or bad in the light of its consequences. It tells us what we should do and how we should decide the best course of action. In its original version, put forward by Hutcheson, consequentialism suggests promoting 'the greatest good of the greatest number'. So consequentialism, in its broadest sense, evaluates whether an action is morally positive or negative on the basis of its consequences for the largest number of individuals.

Many dimensions are generally taken into account when weighing up the predicted or assumed consequences of nanotechnologies. On the one hand, the main risks are to health, the environment, and freedoms. On the other, the anticipated benefits of nanotechnologies are in a way the reverse side of the coin, since they help to reduce pollution and develop green energies. In the healthcare field, they are likely to extend the capabilities of both diagnostic and therapeutic instruments.

There are nevertheless two reasons why it is difficult to promote consequentialist nanoethics. First, the exact consequences of nanotechnologies are not as yet totally predictable precisely because the unexpected is what makes

them of interest.[4] Second, as Grunwald (2005, p. 191) suggests, the costs – particularly connected with toxicity – do indeed have an ethical aspect. However, these are not *in themselves* ethical problems, but rather, in the first place, scientific and technical problems. For this reason, I suggest to coin them 'second order ethical issues'. It does not mean that they are not ethical issues, but that they are not ethical issue *prima facie*. These 'second order' ethical issues should not hide or obliterate first order ethical issues.

Moreover, as Jean-Pierre Dupuy (2007) points out, to confuse ethics with cost/benefit analysis is to fall into the following traps: i) to act as though ethics can be reduced to nothing more than a cost/benefit analysis; and ii) to act as though every ethical issue should be dealt with as part of an economic analysis of the risks. Not only is any calculation of this kind extremely uneasy because the positives and negatives are like two sides of the same coin, but it is also difficult because analyzing the (positive and negative) consequences is far from all there is to consequentialism in that this conception, as we saw, is based on the theory of good being what provides the best outcome for the greatest number of individuals. Hence consequentialism cannot be a valid candidate for nanoethics.

1.3 Is nanoethics deontological?

Last but not least, what about deontological ethics? This does not judge the rightness or wrongness of actions according to their consequences, but rather says that duties exist in themselves and that rightness and wrongness are inherent to particular actions.

This is the position most commonly used to support the moral condemnation of nanotechnologies. It generally takes the form of a rejection, sometimes of any interference with the course of nature or divine creation, and sometimes of what is seen as an attack on integrity, or even human dignity. These three motifs – nature, divinity, and dignity – obviously have different meanings but the *leitmotiv* is substantially the same: the ethics are defined negatively by the prohibition of certain actions (or interventions).

The first version concerns the non-disturbance of the natural or divine order. Surprisingly, it thus places nature and divinity on an equal footing. According to this argument, progress in the nanotechnologies would not only cross physical barriers in an unprecedented way but also spiritual and moral barriers by overturning the pre-established order. As Catherine Larrère (2007) points out, these arguments demand different responses, one of fact and the other of principle. Factually speaking, it is hard to criticize interference with the natural order since this is a constant of human activity. As far as principle is concerned, interference with the divine order would not be criticized as such in a secular society.

The second version, invoking human integrity or even dignity, is trickier, and has become *a leitmotiv* in both official texts and public discussions or reports on nanotechnologies. However, the most flagrant problem here is that it is difficult to give any clear meaning to the concept of 'human dignity', which functions as a portmanteau word to avoid any deeper arguments to support a condemnation – which is exactly the problem because what we are looking for here is the basis for a moral argument on nanotechnologies. For this reason, deontological ethics cannot persuade us that nanoethics is necessary.

We can therefore say that none of the three great moral theories work as a serious candidate for nanoethics. Worse still, on analysis, they all look like the types of argument used to defend a pre-existing position, whether this is optimistic (virtue ethics), pessimistic (deontology) or a mixture of the two (consequentialism). Thus, seeing nanoethics as ethics *for* nanotechnologies seems to take us up a blind alley; none of these theories, on its own, allows us to argue satisfactorily within the public debate and do not offer a complete theory, able to answer in a coherent way to any ethical concern raised by nanotechnologies. They cannot, therefore, be seen as a 'recipe' to be applied as a 'ready-to-think', but more as a sort of 'toolbox' for thought, allowing us to think up the ethics of nanotechnologies. There is no ethical theory that is 'tailor made' for nanotechnologies; this ethics thus remains to be constructed with the tools of normative analysis.

3. NBIC and meta-ethics: ethics *from* nano-technologies?

Should we then conclude that nanoethics is a red herring and – what is not necessarily exactly the same thing – that nanotechnologies do not raise any ethical problem? This question requires a twofold response.

The 'need for nanoethics' – the calm, worried, or enthusiastic passion (depending on who you talk to) that nanoethics excites – could be a symptom of what the French moral philosopher Ruwen Ogien calls a "moral panic" (Ogien 2004, p. 46). This means imagining the worst because of deeply rooted prejudices and refusing to pay the intellectual price of certain rights by failing to take into account the point of view of those we are claiming to defend. This would lead to a kind of paternalism demonstrated by both the supporters of nanotechnologies and its opponents.

The diagnosis of moral panic does not mean that there are no ethical problems in relation to nanotechnologies. Rather, it suggests that these can only be analyzed satisfactorily using ethics *for* nanotechnologies. Hence the

second way of looking at the issue of whether we need nanoethics: in view of the blind alley we are led up if we take nanoethics to mean ethics *for* nanotechnologies (in the sense of ethics applied to nanotechnologies), perhaps it would be more worthwhile to reframe the problem by looking at it as ethics *from* nanotechnologies, or more specifically from the NBIC (Nano-Bio-Info-Cognition).

In this section 'nanoethics' is primarily considered as 'NBIC ethics'. What is special about this is that it forces us to look at ethics from a different perspective. For this reason, the second part of this paper argues that we first need to analyze the problems underlying ethics *from* nanotechnologies, and that consequently nanotechnologies relate as much, if not more, to a meta-ethical investigation as to an applied ethics one.

4. 'NBIC ethics'?

In his emphasis on the convergence of nanotechnology with biotechnology, information technology, and cognitive sciences, Jean-Pierre Dupuy points out that the ethical issue regarding nanotechnologies should not be separated from the 'metaphysical research program'[5] underlying NBIC. According to him, NBIC revives the program of the mechanization of the mind, leading both to its dehumanization and deconsecration. He also explains that cognitive sciences actually play the role of conductor in the quartet NBIC. He raises two points that are essential to this argument: first, the importance of integrating a reflexive analysis of nanotechnologies into a more general debate on the NBIC; and second, the meta-dimension of the NBIC program.

Dupuy relies on the well-known report by Roco and Bainbridge entitled *Converging Technologies* to support his idea of the central importance of the cognitive sciences to the NBIC program. In W.H. Wallace's contribution, we read:

> If the Cognitive Scientists can think it,
> the Nano people can build it,
> the Bio people can implement it, and
> the IT people can monitor and control it. [Roco & Bainbridge 2002, p. 13]

Despite being one of the pioneers in the development of cognitive sciences in France, Dupuy constantly criticizes the sterility of the conception of the human mind that he feels they promote, because he believes that by mechanizing itself, the human mind is taking the risk of dehumanizing itself (see, in particular, Dupuy 2000). However, his criticism stresses the cybernetic dimension of the cognitive sciences to the detriment of their more psycho-linguistic dimension – rooted in the Universal Grammar theory suggested by

Noam Chomsky. Indeed one cannot dispute that cognitive sciences originated in cybernetics, but it is hard to reduce any cognitive approach to the naturalization/mechanization/artificialization trio the way Dupuy does.

Still the guiding role of cognitive science must be taken very seriously. Not so much in relation to this metaphysical research project but more in relation to our reflexive analysis of the challenges of the NBIC program. The cognitive science can also be a tool to help us think of the revolution produced by the NBIC not as something internal but as something external, because they investigate our processes of knowledge and understanding, including our moral cognition. Then the first line of Wallace's quatrain – "If the Cognitive Scientists can think it" – does not necessarily have to be understood in the sense of the metaphysical program criticized by Dupuy. It can be understood in a different way, as meaning that the cognitive sciences enable us to reflect on the significance of the NBIC revolution for ethics. So nanoethics – or 'NBIC ethics' – should be thought of not (or not only) in relation to a metaphysical research project, but as demanding a meta-ethical discussion on our part of what good and bad are. Consequently, we shall now evaluate the scope and limitations of the cognitive sciences, as far as this question is concerned.

5. A cognitive basis for ethics: nature or artifice?

Moral cognition is a rapidly expanding field of research in which Noam Chomsky's theory of Universal Grammar plays a leading role. Without going into detail on the contemporary conceptions of moral cognition, one can say that the Universal Grammar certainly considers that there is some automation of cognitive structures, but it also puts a limit on this automation.[6] The Universal Grammar postulates that we are equipped with mental structures that enable us to develop certain skills during the course of our psychological development. But it does not determine in which manner these skills shall be developed, or rather it suggests a plurality of manners to have them developed. For example, we are capable of acquiring language and developing a number of 'humanly possible languages' and (why not) of 'humanly possible moralities'. However, we are not predestined to learn English rather than Mandarin, or to be consequentialist rather than utilitarian, for example. Furthermore, we establish the rules of scholarly grammar ourselves (sometimes by justifying them), and we do the same when it comes to the reflexive standards of our moral judgments.

From a physiological point of view – though it would obviously be incorrect to claim to be a 'born ethicist' the way people talk about a 'born mathe-

matician' – we know that certain areas of the brain are particularly involved when we form moral judgments.[7] We also know that if these areas are damaged – congenitally or by accident – our moral capacity is disrupted. In short, the cognitive sciences show that our moral judgments depend on natural bases of 'humanly possible' moralities, though the judgments themselves are not *pre-determined* by these natural bases.

This approach does not simply reduce ethics to its natural bases, but instead takes into account the limitations that our moral capacity imposes on the 'humanly possible' moralities – even though their definition remains a matter of debate. If the humanly possible moralities are natural, the reflexive moral judgments we choose are human-made, *i.e.* 'artificial'. Ethics would not then be *reduced* to something natural, even though it *depends* on biological capacities.

That is why the question of ethics *from* nanotechnologies is enriched by the study of moral cognition. If the NBIC program brought about changes altering our mental structures and therefore the architecture of our cognition – for example, by inserting chips, through nanomaterials or by genetic engineering – then they would alter the humanly possible moralities. This hypothesis becomes plausible with 'neuro-nanotechnologies' aimed at repairing and treating neuron defects with the help of nanotechnological materials. They have the capacity to transform the brain's circuits and alter the neurology of morality. So, specifically, nanotechnologies may, even in the absence of defect or injury, alter our morals artificially and possibly also involuntarily.[8]

Nanoethics cannot therefore be envisaged without reference to meta-ethics, for two reasons. On the one hand, it underlines the need to highlight the changes that the NBIC program could make to 'humanly possible' moralities – though these moralities could surely also be described as 'humanly possible' (or should they be described as 'post-humanly possible'?). On the other hand, the change due to nanotechnologies cannot dispense with ethical reflections because they cannot simply be reduced to the functioning of the material basis of our judgments, whether these are natural or technologically modified.

In other words, the question of whether we can accept, for moral reasons, a change in the field of 'humanly possible' moralities is open: there are ethical reasons why certain types of changes should be accepted or rejected. Neuro-nanotechnology offers almost unprecedented possibilities of changing the architecture of our moral capacity. Trickier, and more unrealistic (for the moment at least), is the possibility of secondary effects on the architecture of our moral cognition, caused by improving our physical or cognitive capabilities.

In this sense, nanoethics has more in common with meta-ethics than with applied ethics, and raises issues similar to those raised by evolutionary ethics, which suggests that the basis of our moral architecture is the product of natural evolution. There is however one (important) difference: nanotechnological evolution may or may not be deliberate and is the outcome of human technology rather than of natural selection, *i.e.* we can choose whether or not to accept it and we can adjust it and direct it.

6. Conclusion and perspectives

In conclusion, four comments deserve to be made following this very preliminary analysis.

1. The idea of nanoethics understood solely as ethics *for* nanotechnologies is rather unsatisfactory and seems to proceed more from a form of 'moral panic' than from a rational debate in the public arena. None of the three main ethical theories (virtue ethics, consequentialism or deontology) is *on its own* a good candidate for nanoethics. However, this difficulty probably reveals, more than anything else, the weakness of trying to find among the theories of ethics an 'off-the-peg' response to the problems created by the nanotechnologies, rather than the lack of moral problems they pose.

2. Perhaps it would be better to consider nanoethics not as an answer, but rather as a form of *questioning*. It should not be thought of as an 'applied' or 'ready-made' ethical theory, but rather as an invitation to build a 'tailor made' ethics for nanotechnologies.

3. Nanoethics echoes traditional problems regarding the notion of 'human nature' – and not 'human dignity', which we looked at in the first part of this paper – and the specific nature of living things (though this disappears at the nano scale), in ethical terms: Should we be transforming ourselves and thereby taking over biological evolution? To what extent? For what purposes? These three questions invite us to debate what is good and what is right to do; they invite us to ask questions arising undoubtedly as much, if not more, from 'fundamental' philosophy as from 'applied' philosophy.

4. Finally, it is the question of normativity itself – that is, how we construct our standards – that is here at stake. In other words, the NBIC are certainly an object for ethics, but they also end up challenging what is traditionally considered a divide between meta-ethics on the one hand, and normative ethics on the other. Therefore, we should be looking at the role of NBIC as part of the reflexive, dynamic movement of ethics. And

perhaps 'NBIC ethics' should be seen more as a mode of questioning rather than a preconceived solution to the fundamental problems raised by the NBIC program. In short, nanoethics should be seen as ethics *from* the nanotechnologies as much as ethics *for* the nanotechnologies. We need a *'tailor-made' ethics, co-constructed with the converging technologies* using methods that we still need both to think of and to implement in practice. Nanoethics is neither ethics *for* nor ethics *from* nanotechnologies. It is both for and from. The conjunction of an ethics for and from nanotechnologies is nothing but the twofold movement of an ethics *with* nanotechnologies.

Acknowledgments

Notes

1   This distinction is different from the one drawn between ethics 'for' and 'in' nanotechnologies, suggested in Grunwald 2005.

2   The inconvenience of this division is twofold: it suggests, first, that applied ethics is nothing more than the application of theoretical ethics and, second, that ethics could therefore be either all theory or all practice, with no relationship between the two. In my opinion, this separation should be thought of more as a continuum from theory to practice, or an inclination (towards the concrete or the theoretical).

3   It is important to stress that the question is examined from a *de facto* and not from a *de jure* point of view: the question 'are the main moral theories able to offer *de jure* a satisfactory moral account of nanotechnologies' shall *not* be examined in this paper.

4   One peculiarity of the NBIC program in which nanotechnologies play a role is precisely that it plans to generate the unpredictable. On this subject, see for example Dupuy 2004.

5   Dupuy (2007) refers to Popper, who defines this as the world vision underpinning scientific research.

6   By way of a quick explanation, they aim to determine on the one hand whether or not moral cognition proceeds from a specific field, whether it should be thought of in the same way as language or another cognitive capability, and finally whether it is modular (and if it is, in what sense). Personally, I have put forward the idea

that our moral capacity should be thought of as a structure with several levels, the first of which is automatic, intuitive, and precocious (much like the cognitive core), while the second operates reflexively, evaluating the intuitions of the first level, where necessary.

[7] For a brief explanation, see Greene & Haidt 2002.

[8] Furthermore, nanotechnologies coupled with the BICs have the capability to interfere with our free will and to move our body artificially, so we lose control of it. For example, if a patient has damage to the spinal cord, he or she may be able to control the shoulder muscles but not the arm or hand muscles. These can be controlled by artificial electrical stimulation, using neural implants. This electrical stimulation imitates the natural process, yet it is artificial and is capable of being produced against the patient's will. Such an eventuality does not concern the architecture of our moral capacity but does invite us to rethink the concepts of responsibility, separating intention, action, and consequences.

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