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But is it Unique to Nanotechnology?
Reframing Nanoethics

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Abstract Attempts have been made to establish nanoethics as a new sub-discipline of applied ethics. The nature of this sub-discipline is discussed and some issues that should be subsumed under nanoethics are proposed. A distinction is made between those issue that may ensue once nanotechnology applications become available and procedural issues that should be integrated into the decision structure of the development. A second distinction relates to the central value of the ethical issue. The conditions for the ethical debate differ depending on whether the value(s) in question is internal to the technological development (i.e. health and safety) or external to it (i.e. privacy, equity etc).

Keywords Nanotechnology · Applied ethics · Novelty · Risk assessment · Public involvement

The Failure of the Uniqueness Approach

Nanoscience and nanotechnology have quite literally brought engineering to the next level, namely to the scale of atoms and molecules.[1] Although nano-enhanced

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technologies[2] have only just begun to influence our life via every-day consumer products, in the not-so-distant future they are expected to have a major impact on a vast array of society—from medicine to energy production and from food industry to information and communication technology—inspiring some to herald nano-technology as the next "industrial revolution" [1–3]. The over-whelming potential within the development has become an important incentive for scientists and industry who wish to speed up the commercialization process of research so as to set sail toward this bright and promising future. Yet, alongside these developments another path of interest—and concern—is prompted. Here the appeal is to take the time to make a proper estimate of this ship, the vast ocean that lies ahead, and even to ask oneself: is this journey at all worth taking? These concerns are often expressed alongside the general plea for an ethics of nanotechnology.[3]

While few would wish to deny the importance of such an undertaking, finding the focus for the ethical assessment turns out to be quite a knotty business indeed. Some of the main candidates are: the potential negative impacts of health and environment [4, 5], the broader societal issues of justice and distribution of technology [5, 6], new ethical dilemmas of privacy, enhancement etc. arising from the implementation of nanotechnology [7, 8], and the more radically perilous scenarios of runaway nanobots [9]. It is not surprising that one would want to ask: are all these issues truly relevant to nanotechnology?

As a result of the abundance of possible ethical issues one might be inclined to take a reductive turn and restrict the ethical inquiry to those topics that can be more exclusively tied to nanotechnology. This tactic might be called *the uniqueness approach.* Perhaps the approach is most clearly demonstrated by commentators such as Armin Grunwald who begin their survey by asking whether nanotechnology really poses any novel ethical concerns. Grunwald insists that the ethical perspective should imply questions like "Are there developments which pose completely new questions?" [10, p. 188] or "Which of the ethical aspects of nanotechnology are specific to nanotechnology?" [10, p. 190]. Other ethics-commentators have rather avoided the question of whether the ethical issues they are exploring are unique to nano or not, while in their methodology implicitly favouring the more specific issues of nanotechnology as those of central concern [9, 11, 12].

Some recent articles have indeed expressed some scepticism against this line of inquiry [6, 13–15]—as I will argue, quite correctly—but it does appear that the approach remains appealing. Perhaps this is not surprising. If nanotechnology truly affords all the new and intriguing technological possibilities as it promises to do, one would suspect an arrival of new challenges to our society and its values. Why not then direct one's attention toward these novel societal implications? Moreover, this approach may cope with the worry that if we do not focus on the genuinely new issues, we will lack the grounds to claim that our ethics truly relates to

[2] Although I am sympathetic toward those who would like to replace the singular term with the plural term nanotechnologies, I will, out of convention, proceed with nanotechnology.

[3] It should be admitted that many of these concerns have also been addressed under headings such as *social issues* or *societal impacts* of nanotechnology. This paper will treat these issues as potentially subsumed under a nanoethics whenever the foreseen social consequences of nanotechnology are situated in discussions of whether these effects are favourable or not.

nanotechnology rather than to existing technologies and innovations. Unfortunately, this is precisely where the trouble begins.

To start off it is fairly clear that many of the ethical challenges are, or will be, caused by the ongoing intertwining between nanotechnology and other fields of research and technology. Compared to many other emerging technologies such as cloning, smart homes and satellite radios; nanotechnology does not just pertain to a particular context of application. In fact its revolutionary strength lies in its ability to act as an improver, multiplier and enhancer of already existing technologies [16]. One might even say that nanotechnology's potential strength very much depends on precisely how *well* it will mix and mingle with other technologies. For instance, nanotechnology is currently contributing to the development of biosensors and electromagnetic sensors. Far from being an independent technological field, sensor technology has evolved within a history of "relentless integration" between microelectronics, micro optics, and micromechanics, and now: nanotechnology [17, p. 265]. Moreover, in the application of sensors, we increasingly depend on information technology. As sensors already are used for multiple purposes such as surveillance, diagnostics and patient monitoring, it is no wonder that the technology has already raised a number of ethical issues—without any influence of nanotechnology. Of course when the techniques of nanotechnology are incorporated, it is assumed that sensors can be used on a radically different scale, for instance by putting them into very small volumes including individual cells. All the same, does the nanotechnology involved in this new innovation automatically make *nano*technology the target in those cases where nanoscale sensors become problematic? Judged upon the uniqueness approach these issues in fact seem more justifiably subsumed under a *sensor*ethics rather than under a *nano*ethics as it seems quite plausible that similar applications, and hence problems, would have come about eventually even without the aid of nanotechnology.

I do not wish to deny that nanotechnology itself should be considered radically new; only that when it is applied in a broader technological and social context it is likely to be perceived as a normal extension of existing methods. Consider the term 'drug delivery'. It is used to describe the prospective application where nano-scale particles are used for transporting and releasing drugs to diseased cells. Yet, drug delivery through via hypodermic needles has existed for 150 years! And just as in the case of sensors, microtechnology has been the precursor to nanotechnology in the advancement of new delivery techniques [18]. This supports the view that nanotechnology builds upon or is built into already existing technological structures, rather than replacing existing technology. As concerns drug delivery, nanotechnology may certainly enable a more targeted treatment of the relevant parts of the body. Nanotechnology may also play an important role in enabling more effective *routes* of delivery. One example is pulmonary delivery, where nanoparticles are delivered to the deep lung tissue through inhalation [18, p. 82]. One might argue that for future patients these improvements should imply a different patient consent procedure considering the choice between the different delivery methods. However, is it fair to say that nanotechnology has *introduced* new normative questions to these procedures? Again, it seems that the novelty could just as well be located in the general progression of drug delivery technology rather than in nanotechnology.

Searching for any original phenomena that may be brought about by nanotechnology can also lead us to normative concepts such as the often quoted 'nano-divide' [15, 19]. The concept is used in the context of ethical issues of social justice and equality but appears to refer to somewhat different ideas. A nano-divide can either describe the possibility of growing injustices between people who have *access* to nanotechnology and those who do not. Or else the term refers to the divisions that arise from the *distribution of economical benefits* stemming from nano-research and industry [4]. Since it is already wealthy countries that make the major investments in this technology it can be assumed that these countries will also be reaping the economical rewards. It is also likely that the applications one invests in will cater to the specific needs of wealthy countries. The general worry is thus that there will be an increasing gap between rich and poor countries, both in terms of access and distributed benefits. Yet again, guided by the question of whether this is a special consequence of nanotechnology or not, there is certainly a risk that these issues fall outside the bounds of consideration. As Hansson notes "any new technology (including technologies that will receive more resources if we refrain from funding nanotechnology) will expectedly follow the same pattern" [19, p. 13].

Principal Objections to the Uniqueness Approach

Considering that the prospect of finding a clear-cut set of ethical concerns specific to nanotechnology seems faint, should we therefore conclude that the prospect of an ethics of nanotechnology is equally dim? According to Grunwald we should at the very least appreciate that nanotechnology does not qualify as a "new sub-discipline of applied ethics" and he then goes on to take this as a cue to be less demanding in our ethics of nanotechnology [10].[4] While I tend to agree with the first part of his diagnosis, I strongly reject the general conclusion. The lack of *unique* ethical issues in nanotechnology does not imply a lack of relevant ethical issues associated with nanotechnology. In fact it is the approach itself that should be challenged as the natural starting-point for nanoethics.

Apart from the poor success rate of the uniqueness approach there are some important reasons for opposing the strategy in principle.[5] The uniqueness approach may first of all be objected to for epistemological reasons. When discussing the ethical issues emerging from the development of nanotechnology we are dealing with largely tentative future applications. Our knowledge of which promises of nanotechnology will truly be realised is by necessity restricted. This uncertainty refers both to the innovations themselves and to the question of which ones will be most successfully commercialised by industry. As trivial as that may seem, issues of uncertainty often are put aside when giving a normative assessment of the

[4] Grunwald also advocates restricted role for ethics in technology in general [20].

[5] One might of course ask: when does a scientific field of research ever translate into a clear-cut normative domain of investigation? It is possible that the objections posed here be equally applicable to other fields of applied ethics; however, it is not my intention to discuss the general issue here.

would-be-applications of nanotechnology.[6] In many cases research predictions are treated as conclusive expert knowledge. In molecular electronics for instance, engineers expect nanotechnology will be the new paradigm of Moore's law due to the opportunities it provides in terms of size, power, and cost; anticipations that have transpired to investors and industry [21]. The reference to Moore's law is interesting indeed. This law has become the very model of reliable predictions since it so far has allowed us to predict precisely the advance in computing power. But if we are to expect the integration between nanotechnology and Moore's law itself, we should remember that we are also in the business of predicting what power the human mind has in solving complex engineering problems.

Many would say that this kind of uncertainty is not so much a matter of *whether* this conversion will happen, but *when* it will occur. But that doesn't get to heart of the matter. The point is that even if nanotechnology, within the next 10–15 years, proves to be to the next phase of Moore's law, figuring out how these advances will fit into the society of say, 2018, is a very different matter indeed. The recent advancement of computers, mobile phones and GMOs surely shows how significant surrounding societal agendas are for the way in which new innovations are realized—and for how they are received. Indeed it seems very optimistic that an advance ethical inquiry would be able to discern the unique future issues amidst an uncertain nexus of research, technology, politics, and social trends [22].

One could argue that the uniqueness approach would in some cases be at least *instrumentally* valuable for detecting issues of interest. But even then there are equally good reasons to be cautious since the approach may very well lead us in the wrong direction. One symptom of people thinking in the pattern of the uniqueness approach is the zeroing in on unlikely scenarios such as a Drexlerian "grey goo scenario" i.e. self-replicating nano-bots that run amok, breaking down matter and leaving the world in a state of grey goo. Indeed this scenario stands for a unique threat of nanotechnology. In fact, it seems that the very reason that it has received attention is precisely because of its (terrifying) novelty. Paul Litton recognises this danger and claims that the focus on such issues is completely unwarranted and that "we should not spend resources developing an ethics for a Dexlarian world" [13, p. 24]. While I'm not as sure as Litton that we should completely close off such a discussion, especially as such scenarios are connected to need to address possible malevolent use of the technology, I would like to caution against the tendency that these scenarios over-shadow other ethical issues that may be more important but not as unique to nanotechnology.

Another reason to reject the uniqueness approach in principle is that it does not line up with what people normally do when they are asked to reflect on their concerns about nanotechnology. As has been emphasised in several recent reports, a major issue for the public is the trustworthiness and accountability of scientific institutions and industry that promote nanotechnology [23, 24]. Will they produce applications that truly cater the needs of society or will they primarily be motivated by short-term profits? Obviously these concerns are also likely to be applicable to

[6] Dupuy and Grinbaum even suggest that the uncertainty of nanotechnology is so vast that it becomes its defining feature, that in turn warrants a completely new normative approach [9].

other areas of technology such as genetic engineering, biotechnology, and surveillance technology. Yet, if we want to take public concerns seriously, it would be strange for nanoethics to disregard these views by saying that they represent issues that are not specific to nanotechnology. One of the problems may very well be that ethical discourses on other technologies have not paid sufficient attention to these issues in the first place. In a time where we are trying to include different actors in society in the discussion about new technologies we should be careful not to prematurely restrict which issues are up to discussion.

Ensuing and Procedural Ethical Issues

As we have seen the uniqueness approach has the unfortunate implication that efforts are directed toward closing off issues, which are not relevant *enough* to nanotechnology. This seems entirely unproductive when really we should align ourselves with the Royal Society's recommendation to spend every effort on arising social and ethical issues, "irrespective of whether they are genuinely new to nanotechnologies or not" [15, p. 51]. The upshot of having dismissed the idea that nanoethics must represent a completely new domain of interest is that we can go back and recover some of the issues that we just put aside. These could be issues of privacy and control over medical information that were raised in conjunction with sensor technology; issues of autonomy and informed consent raised within drug delivery; and issues of justice related to access and distribution of nanotechnology products. These issues may thus be brought back into consideration as relevant to nanotechnology without any need to claim that these topics belong *solely* to nanoethics. Still, one advantage with the uniqueness approach was that it provided an agenda for nanoethics. Without it, how should we organise the discourse?

One way to go in this muddle is to confine the investigation to those relevant future scenarios that are likely to arise *at least in part* as an effect of nanotechnology; issues that, as Vivian Weil puts it, "need to be dealt with before they ripen into big problems" [7, p. 1976]. Reflecting on future "nano-scenarios" seems to be a broad and popular way to go, and many of the issues mentioned in previous sections are likely to be candidates for such an assessment. Let us then call the issues of such an assessment such *ensuing* ethical issues.

One thing to keep in mind is that nanotechnology may not only *generate* new problems, but also contribute to *resolving* other ethical conflicts. One example might be nano-enhanced tissue engineering that is currently being developed for more effective treatment or replacement of diseased organs. If successful, this technology may make organ donors more or less redundant, thereby seemingly solving some existing ethical issues of organ donors and organ trading. At the same time tissue engineering could engender new conflicts as it may turn out to cost more than most people can afford. Tissue engineering might also be problematic in those contexts were it is used for enhancement rather than for therapeutic purposes. One might even argue that traditional organ donating has created a positive interdependence in society where everyone is at once a possible donor and possible receiver—a relationship one might argue is worth promoting rather than replacing.

Clearly a proactive discussion on these ensuing issues is important. While the inherent uncertainty in the development should not be ignored, it is equally unwise to just stand back and wait for products to become available before entering a debate. One important task may be to evaluate different *alternative* paths of nanotechnology development. As suggested by Hansson one idea is to assess alternative developments according to our current preferences in order to trigger a kind of regret avoidance i.e. don't do that, you may come to regret it [25]. Different potential uses of nanotechnology might then be compared to situations where nanotechnology for some reason is not advanced to the level one is anticipating or some applications fall through. From such a reflection one might also be better equipped to anticipate potential ethical dilemmas. Ideally such an activity should be married with different public participatory activities, thereby involving different perspectives of the development, and should also have some real effect on the governance of nanotechnology. Furthermore such an assessment encourages participants to consider a breadth of issues and therefore avoids the uniqueness approach's mistake of prematurely delimiting the agenda.

Nevertheless we should remind ourselves of another constraint of the uniqueness approach, namely that there might be issues that fall entirely outside the framework of ensuing issues. This is clearly illustrated if we return to the so-called 'nano-divide'. As we saw the possibility of an unjust access and distributed benefits of technology does not relate specifically to nanotechnology but is primarily the outcome of social and economic processes. In fact, since technology on its own seldom brings about divides in society, we might again be inclined to take issues of equality as peripheral to nanoethics. I believe this would be a mistake indeed. In fact it is precisely because political and economical considerations play an important part in the control, access, and distributed benefits of nanotechnology that we already can address them—however not as ensuing but as *procedural* issues. That is, addressing ethical issues of equity is not a matter of preparing for the divide to open up in front of us, but of ensuring that the issues are included in policy-making and regulation.

The justification for dealing with justice at a procedural level can be found in John Rawls' famous criticism of utilitarianism. Rawls' view is that the role for social institutions is not to *promote* certain goods (pleasure, welfare etc.), given by a particular consequentialist doctrine, but to *fairly distribute* certain basic liberties [26]. In this sense, he claims, justice latches on to what is right independently of any particular good. Considering the profound influence Rawls' ideas have had on ethics and political philosophy, it is curious that in the debates over nanotechnology, injustice continues to be referred to as a risk—something to watch out for in the future. The lesson from Rawls is that one should consider different nanotechnological possibilities primarily from the view of whether they can cater basic liberties and be as fairly distributed as possible. One of the rare examples of a rather Rawlsian approach to nanotechnology is Salamanca-Buentello et al. who analyse nanotechnology in view of how it can be developed specifically to meet critical challenges in developing countries [27]. One may object to their examples but they do put the question of whose liberties and whose interests should be the guide for the nanotechnological development into focus.

It seems that one of the main keys to addressing concerns for power, just access and distributed benefits as procedural issues is to open up the innovative and regulatory process to a broader range of participants. The idea is simply that if nanotechnology truly holds a promise for all, then the decision process should be open enough to allow for an ongoing input from the public. Of course public engagement and participation is often stated as a criterion for a sound technology development; what I am suggesting here is that *this* is the level where we should address concerns for a just distribution of nanotechnology as well as its associated economical benefits. Similarly a broader public involvement from the public in nano-innovation and regulation enables a more democratic guide to which areas of research should be promoted and which products should be developed.

Another ethical issue, which was discussed earlier, was the reliability and accountability of research and industry and the risk of a public distrust. While the uniqueness approach was held inadequate for dealing with these concerns (as they are probably equally applicable to other emerging technologies); the problem is perhaps even more apparent if we deal with the issues as if they merely concerned the prospect of a future backlash, i.e. an ensuing issue rather than a procedural issue. A better solution would be to locate matters of trust within the conduct and arrangement of research institutions and industry and their openness toward media and public. The fact of the matter is that access to information really does matter to people. Still, although open communication about research and potential products is a prerequisite for building trust, it is equally important to find ways to hold different actors, both from the research community and from industry, accountable to their stated objectives.[7]

Internal and External Values of Nanotechnology Development

Although the adequacy of the uniqueness approach for a nano*ethics* has been refuted, the approach turns out to be highly relevant to nanotechnology risk assessment;[8] indeed, one might say that the novelty theme has been directly transposed from the discourse on nanotechnology health and safety management to ethics. What made nanotechnology so interesting to begin with, were the special properties that matter receives when engineered at the nanolevel and yet this very potential is precisely why nanoparticles are anticipated to carry not only beneficial qualities to the human body and the environment—but damaging ones. For instance the very fact that nanoparticles may diffuse through the blood–brain barrier and

[7] In making this distinction it is worth stressing that one need not make any priority between ensuing and procedural ethical issues. If the reader detects any emphasis on the procedural issue from my part, it is only because it appears that matters of justice, research priorities and mistrust are either situated at the wrong end of the analysis (as potential consequences) or overlooked as ethical topics altogether.

[8] Our vernacular conception of risks might of course include other societal risks related to nanotechnology such as risks of increased international competition, public alienation of science etc. Although these issues are not discussed in this paper, I incidentally believe they are better understood as procedural rather than ensuing issues.

transport treatment to cancer tumours raises the worry of what uncontrolled effects nanoparticles will have on healthy parts of the body.

Although nanoparticle research is only a small part of nanotechnology at large, it is usually the focus of risk assessment. Several recent government agency reports have unanimously called for further research on the potential hazards of nanotechnology to health and the environment, particularly pertaining to the risks of manufactured nanoparticles [28]. As the toxic properties have been shown to vary significantly when substances such as metal oxides and carbons are reduced to the size of 100 nm or less [29], it is critical that policymaking should take the size-specific toxic qualities into account. A nanofiber such as carbon nanotubes is for instance anticipated to be highly biopersistent, making medical applications especially problematic [30]. It is also quite clear that as the engineering of new nanomaterial is augmented, we will see an increase in the amount of particles released. A full-blown exposure assessment must thus take on questions of the particular toxic qualities of the particle, whether the particle enter the skin, the lungs, or the intestinal tract as well as in what situations people are likely to be exposed.

These possible toxicological risks are often brought up in conjunction with the ethical issues of nanotechnology discussed in the previous section. Certainly the link does go beyond the sheer admission of critical perspectives of nanotechnology. One is finding ethical criteria for determining whether certain risks are within an acceptable limit for an individual or groups of individuals. In those research environments and industries that deal with the study or production of nanomaterials, we should take care in specifying levels that will safeguard and secure the rights of researchers and employees. This calls for a just and open procedure similar to the one addressed in the previous section [31].

It seems clear that the concern for possible risks on health and environment will give good reason for ethical debate in itself. At the same time, however, taking a closer look at the core values on which these concerns reside will also provide us with a valuable contrast to the ethical issues mentioned earlier. It seems that when we recognize risks, we simultaneously acknowledge values of health, safety, and environmental sustainability (or remediation). These values are not just threatened by new technology; in fact these values are often identified as objectives in the very development of technology. This can be understood in two senses. The first one is rather straightforward, namely that the central areas where nanotechnology together with other technologies promises new possibilities, are those which are critical to health (i.e. medicine, diagnostics) and the environment (i.e. energy production and water treatment). For other applications of nanotechnology values like health and safety are inherent to the development in the sense that the new technology needs to *accord with* these values either to be promoted in the first place, or in order to be successfully brought in to the market.[9] To see an example of this we only have to look at an area such as the food industry where nanotechnology is anticipated to

[9] Although I believe that the argument applies to both values of health and environmental sustainability, I should say that the latter has only in recent years become a key concern for technological development and is probably likely to be secondary to values of health and safety.

have a major impact on food packaging precisely because it offers *energy efficient* methods for *safe* packaging. Of course, it may turn out that a particular application be counterproductive to health or environmental sustainability. But then one reason there has been such an emphasis on risk assessment is precisely to secure that these values are in fact adhered to. Above all, a failure to satisfy the aims of health and environmental safety does not disprove intentions to develop nanotechnology precisely to these ends.

This gives us good reason for identifying values that concern health, safety and environmental sustainability as *internal* to the nanotechnology development. However, this is not the same as claiming that these are the *only* values at stake for technology development—far from—only that they have an implicit motivational, and perhaps more importantly, *justificatory* role. This fact that 'health' is a given in both the development of nanotechnology and the managing of its risks, reflects its privileged status as a largely uncontroversial value. These internal values can be set apart from what might be referred to as *external* values such as privacy and justice that are not usually thought to have sprung from intentions or expectations within technology development, but rather thought of as an external criterion that nanotechnology, to be ethical, should adhere to.

This is not tantamount to saying that there will not be variations in what should rightfully be considered an internal and external value. For instance, in the development of a nanotechnology quantum encryption key, 'privacy' might be more correctly classified as an internal value and 'environmental sustainability' external.[10] Perhaps the more precise point is that it first of all is helpful to the ethical discussion to make explicit which values are internal or external to the development. Certainly in the paradigmatic cases 'health' will represent an internal value and 'equity' an external but ultimately it will depend on the particular application of the technology. Nor does this mean that an external value, say 'freedom of choice' is in someway to be considered as controversial *in itself*; but rather that we cannot count on it being a value contained within the development. However the value will become controversial when blocking technological development or when it is raised in relation to other principles and values.

This brings us to another reason for appreciating a distinction between the issues that concern internal values and those which (also) relate to external values. Namely that there will be occasions when these values conflict with each other and these are situations that could be considered key targets of ethical discussion. One clear example is the developments in nano- and biotechnology that enable individuals to live longer lives. The aim of advancing medicine and diagnostics for health purposes is in itself taken to be entirely uncontroversial. Yet since the aggregate in the long run entails an increased life expectancy of the population, this may lead to problems on the socio-economical level, which is not entirely unproblematic. Hence, alongside any risk assessment, we need to make room for a critical ethical discussion about whether increased life spans are truly a route we want to take (and again if it allows unfair advantages to the wealthy). Another example is using biosensors for monitoring patient health but that on the other hand could imply

[10] I am grateful to an anonymous reviewer for raising this important objection.

infringements to the patient's privacy. In these cases it important to realise that health, and to a less extent sustainability, will have precedence in the sense that they are core values in technological development and can also be assumed to be backed up by public opinion. Of course an ethical analysis may oppose this relation of controversy, but it needs to pay attention to the implicit normative stance research has already taken.

Summary

This paper has argued against the uniqueness approach in constituting nanoethics as a field of applied ethics on instrumental as well as on principal grounds. The fact that the ethical issues that raised by nanotechnology are, or will be, caused by the ongoing intertwining between nanotechnology and other fields of research and technology should not be taken as a sign that nanotechnology lacks important ethical issues in its own right, but that there is something suspicious with an approach that aims to find the unique issues in the first place.[11] While "uniqueness" may certainly be a justified concern for risk assessment of nanoparticles, in ethics this tactic may even lead us completely astray as there is no guarantee that the issues we might consider the most particular to nanotechnology are also the ones most pertinent to the ethical debate.

Nevertheless, there are other ways in which a new technology can affect the ethical discourse than by generating novel issues. The second aim of this paper has therefore been to suggest two distinctions within nanoethics towards an improved framework of normative investigation and discussion. First it distinguishes between *procedural* ethical issues that occur in the management and decision-making of nanotechnology, and *ensuing* ethical issues that may arise once nanotechnology is applied to other technological fields and products. The second distinction runs across the first one and seeks to shed some light on the different motivational dimensions in the development of nanotechnology. Here I contrast *external* ethical issues of nanotechnology such as justice and privacy, to those which refer to *internal* values of the development, such as health, safety and sustainability.

As a final note I believe these distinctions shed light on some central ideas involved in the call for further public involvement in nanotechnology. The first distinction may serve as a dual justification for public involvement. At the same time as we are creating a forum for early normative deliberation on ensuing issues; we are also, at least to some lengths, ensuring that procedural issues of equality and democracy are addressed. The second distinction might rather serve as a framework for the kind of discussion we want the public to engage in. Do we want to find criteria for risk acceptance or do we wish to open the discussion, so that the core values of technology development are called into question?

[11] The uniqueness claim might have been both genuine and important for those seeking funding or other institutional support for ethics research on nanotechnology. I hope that it is clear from what has been said in this paper that such support should be equally legitimate without the claim of dealing with unique issues.

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