In the age of high technology and applied science it seems appropriate to think about how to behave morally with technology and to ourselves how we can prevent harm to others and do good when we use technology. Moral philosophers have not been very interested in technology thus far, but they will need to concern themselves with it in the future, if they want to maintain their claim that they are talking about our lives and our world in the 21st century.

I will sketch a conception of ethics of technology that has recently been referred to as Value Sensitive Design and indicate how it applies to information technology. Value Sensitive Design refers to a way of doing ethics that aims at making moral values part of technological design, research and development. It assumes that human values, norms, moral considerations can be imparted to the things we make and use. It construes technology as a formidable force which can be used to make the world a better place, especially when we take the trouble of reflecting on its ethical aspects in advance.

The idea of Value Sensitive Design was first proposed in connection with information and communication technology and that is still its main area of application. I think there were several important ideas and proponents of those ideas that lead up to it. First, there is work by Terry Winograd, Batya Friedman, John Perry, Ben Shneiderman and Helen Nissenbaum in Stanford in the early nineties. They showed that software could easily come to contain biases, arbitrary assumptions and peculiar worldviews of makers, which could affect users in various ways. Research on biases in search-technology is a good example. Secondly, legal scholars around the same time observed that regulation in society was taking place by means of computer code and software. Code functioned as law and laws would in the future literally be encoded, as Joel Reidenberg and Larry Lessig pointed out. Advocates of so-called Privacy Enhancing Technology at the Dutch and Canadian Data Protection Offices observed that this was probably the only way in which we could deal with privacy compliance and law enforcement issues given the increasing amount of laws and regulation and the vast amount of data that are processed in our society. It is
impossible to have lawyers check manually whether certain data practices are in breach or compliance with the law. The software would in the long run have to take care of that on our behalf, and not only in the privacy area. Rob Kling’s Social Informatics had been instrumental in making work in social studies in science and technology available in the ICT field and highlighted the social shaping of technology. At Renselaer Polytechnic Langdon Winner famously argued that artefacts can be used for political purposes and Deborah Johnson had articulated the ethical issues in computing. The resulting idea is straightforward. Information technology has become a constitutive technology, it partly constitutes the things to which it is applied. It shapes our practices and institutions in important ways. What health care, public administration, politics, education, science, transport and logistics will be within twenty years from now will in important ways be determined by the ICT applications we decide to use in these domains. If the discourse on user autonomy, patient centred-ness and citizen centred-ness, his privacy, her security is to be more than an empty promise, these values will have to be expressed in the design, architecture and specifications of systems. If we want our information technology - and the use that is made of it - to be just, fair and safe, we must see to it that it inherits our good intentions. Moreover it must be seen to have those properties, we must be able to demonstrate that they possess these morally desirable features, compare different applications from these value perspectives and motivate political choices and justify investments from this perspective.

**Ethics and Technology**

In order to develop the Value Sensitive Design paradigm further beyond this core idea, we need detailed case-studies which illustrate its main point, and we need to be more precise. What are values, whose values, how can they be modeled, articulated as requirements, be part of specifications, traded off, all of this and much more in a non-metaphorical sense. What about the world's most eminent scholars in ethics, are they also acutely aware of the problems of science and technology? I am afraid that I have to disappoint you. As private individuals they may well have the same concerns as their colleagues in science or lay persons, but strangely enough their work does not testify to this. If one turns to the best moral philosophers of the last fifty years for assistance and to their books and to the tables of contents of the top journals in ethics in which their work has been published one finds that technology is hardly ever mentioned. Virtually no one of the top moral philosophers of our times has discussed or analysed the role of technology in our lives. I will assume that it would be a big mistake to infer from the fact that the top moral philosophers have not addressed the ethics of technology that there is nothing to worry about.

**Obstacles for Ethics of Technology**
There are some fairly general characteristics of dominant thinking in ethics about technology, that are an obstacle to an adequate conceptualization. I shall leave a variety of technological determinisms out of consideration for the moment.

Technology as black box

Until now technology was treated in moral philosophy as a mere supplier of thought experiments and counter examples to arguments and theories. Moral philosophy is full of science fiction and adventure, full of life boats and run-away trains, brains in vats, pleasure machines, brain surgery, and pills that will make one irrational on the spot.

Suppose you are at the forking path of a down hill railway track and a trolley cart is hurdling down and will pass the junction where you stand. There is a lever which you can operate. If you do nothing the trolley will kill five people who are tied down to the track further down hill. If you pull the lever the trolley will be diverted to the other track where there is only one person tied to the track. Is it morally permissible to pull the lever? If an engineer were to remark after a philosophy paper on the trolley problem that one needed a device that would allow one to stop the train before it reached the fork in the track, and sensors to inform one about living creatures on the track, and preferably a smart combination of both, the presenter would probably remark that in that case the whole problem would not arise and the engineer would be kindly asked to leave the room, because the intervention is considered as missing the whole philosophical point of the thought experiment and is spoiling a nice philosophical discussion. But in the real world, the confused engineer would perhaps think to himself, while leaving the philosophy seminar room, it is surely more interesting to try and think about how we could come up with alternative designs of the situation so as to prevent a) loss of lives, and b) the confrontation with tragic moral dilemma’s. The presenter’s reaction, although justified - the trolley problem was indeed designed to raise other and primarily theoretical issues in ethics - does draw attention to a cast of mind on the part of moral philosophers, which betrays a lop-sidedness and even blindness regarding the role of technology as structuring our lives and imposing affordances and constraints on us. If we shift our attention from general moral philosophy to the various fields of applied and practical ethics, such as environmental ethics, engineering ethics, computer ethics and medical ethics, we find that the bulk of the work that goes on there, is still traditional applied and professional ethics, i.e. thinking about codes of conduct, the problem of dirty hands, the many hands, the many dirty hands, utilitarianism, deontological theories, virtue ethics, applied to video games, hacking, spamming, physician assisted suicide. Now these issues are of course important, but if we focus on them exclusively from this applied ethics angle we miss exactly the opportunity that I think Value Sensitive Design brings to the fore, i.e. a pro-active integration of ethics in design, architecture, requirements, specifications, standards, protocols, incentive structures, and institutional arrangements. An ethics of technology should open the black box of technology and describe its rich and heterogeneous content, and make an inventory of the degrees of freedom in the design and engineering process, which choices have been made and can be made, preferably before the problem becomes manifest, preferably before it is too late, preferably when ethics can still make a difference.
Technology and the good life

Moral philosophers not only have a tendency to forget about the way technology sets the stage for our actions in almost every sector of society and every department of our lives in transport, housing, education, telecommunication, food, energy, public administration, health care, they have also failed to see how intimately technology and the good life are connected. It is a failure the Spanish philosopher Ortega Y Gasset eloquently exposed. According to Ortega, technology should not be construed simply as a necessary condition for our survival, but rather as the production of the superfluous. Technology always aims at making life slightly more comfortable, more easy, less cold, less hungry, less painful. In principle we could do without it. The idea that somehow we could not survive without the fire, the flint stone arrowhead, clothing, cars and fossil fuel, lasagne in deep freeze and magnetrons, is of course plainly false. We could survive: our lives would be nasty, cold and uncomfortable, less convenient. Every technological device, every gadget, comes with the implicit suggestion that life would be more agreeable if we started to use it. This applies to the thumbscrew, syringe, roller skates and razor blades. Those who make the suggestion can and sometimes are mistaken, wicked, or confused (or a combination of those), but in any case their suggestion should above all be evaluated as a contribution to the good life, since the good life is the terminus ad quem of technology.

The first question which should therefore be asked with respect to technology, is whether it actually delivers the goods, whether it really contributes to the good life, however conceived.

Aristotle's radical distinction between Poesis (Production) and Praxis (Action)

Another obstacle to an adequate view of the relation between ethics and technology we have inherited from Aristotle; it is the radical distinction between genuine action on the one hand and production on the other, the distinction between praxis and poesis.

According to Aristotle Action (praxis) and Production (poesis) are radically different things, since making or producing aims at an end distinct from the act of making or producing itself, whereas in acting the end cannot be other that the act itself. (Nicomachean Ethics 1140 b 1 - 5) Aristotle even thinks that 'the citizens must not lead the life of artisans, for such a life is ignoble, and inimical to virtue'. (Politics 1328b 39 - 1329a 2) Action (or praxis) is the domain of ethics (phronesis). Making, engineering and producing (or poesis) are the domain of instrumental reasoning (techne), not ethics. Now this conceptual framework may have been adequate in Athens in the year 400 BC, but the world has seen great changes since then. Technology provides us with many cases where praxis and poesis are inextricably linked and where its seems difficult to disentangle them: designing a molecule in the struggle against cancer, the designing of public space against crime, or the design for sustainable development, the design of a clean room at the Nano-technology lab. Here the engineer or craftsman may engage in simple means end reasoning, but at
the same time he or she may conceive of the work as a moral enterprise and as informed by ethical reflection. He or she may also aim at creating the material conditions for others to function as moral and virtuous agents. As Webster Hood remarked already in 1968 in a discussion of Aristoteles' view on technology 'the point is that we no longer seem able to distinguish arrangements of technics from things that are not technics in any final way because we cannot distinguish means from ends in the modern technological complex'. On the basis of Broadie's interpretation of Aristotle on this point, the engineer and designer often seem to have important things in common with the statesman:

‘... the statesman can only make or bring to be the conditions of others' virtuous activity. But since he shapes the conditions precisely to make such activity possible in many individuals, the activity is the ultimate end to which he looks - an end separate from his own activity, and in this respect like a product.’


It seems that we need to relax the radical distinction between action and ethics on the one hand and production and instrumental rationality on the other hand.

Values and Design

After having identified some obstacles in thinking adequately about the relation between ethics and technology, I would now like to give you some reasons to be optimistic about the future of ethics and technology, along value sensitive design lines.

Ethics has seen some changes in the course of the last hundred years. It started in the beginning of the twentieth century as a predominantly analytical and meta-ethical enterprise. Later ordinary language philosophers arrived on the scene and continued the work with different means. In the sixties however the philosophical climate changed. Ethics witnessed its 'Applied Turn', a turn to practice and context. Especially in the USA philosophers started to realize that philosophy could contribute to social and political debates about the Vietnam War and civil rights, later on abortion and euthanasia, by clarifying notions and structuring arguments. Ever since the sixties applied ethics has been growing. Every conceivable profession and cluster of societal issues has a special or applied ethics named after itself, from library ethics to sports ethics. I think we now are slowly moving into a third phase where not only application of moral theories and applied analysis is considered a legitimate and important activity, but design questions start to make their appearance. The work of the Harvard philosopher John Rawls is - as far as I can see - one of the first that gave rise to talk about design in ethics. Thinking about social justice could in the context of his theory be described as formulating and justifying the principles of justice in accordance with which we should design the basic institutions in society. Ethicists like Singer, Pogge, Hardin, Sunstein, Goodin, Dennis Thompson do not only want to offer an applied analysis, they also want to think about some of the real world conditions, institutions and incentive structures that need to be realized if applied analyses are to stand a chance in their implementation. The design turn is
still focussed on institutional design, but the second stage will also bring into view the design of technology, technological artefacts and socio-technical systems. An interesting positive parallel development can be observed in ICT, and probably also in other engineering disciplines: a shift from technology simpliciter, to technology in context. In the first phase of its development in the sixties and seventies the social and organizational context did not matter much in the production of ICT applications. Hardly anyone bothered to ask about users, use and usability and the fit with the organisational context. Computers were a new and fascinating technology: solutions looking for problems. In the second stage of the development in the eighties and nineties - after many failed projects, worthless applications and bad investments - one gradually started to realize that there were human users, with needs and desires and real organizations with peculiar properties. It occurred to many at that time that it would be wise and profitable to try and accommodate user requirements, conditions on the work floor in the early stages of the development of applications. The social and behavioral sciences came to the aid of ICT in this period. But this is still a minimal way of taking the needs and interests of users, organizations and society into account, namely as mere constraints on the successful implementation of systems. If I am not mistaken we are now entering a third phase in the development of ICT, namely one where the needs of human users, the values of citizens, patients, and some of our social questions are considered in their own right and are driving ICT. One of the interesting examples of that approach to date is the Californian Institute CITRIS (Centre for IT Research in the Interest of Society) endowed with 320 million US dollar. The CITRIS research agenda is determined by social problems and their solution. We are at the intersection of both developments: the increasing interest in applied ethics for the design perspective and the increasing interest in technology for value aspects of design. If I am not mistaken this historical situation establishes favorable conditions for the further development of Value Sensitive Design research.

**Values in Design**

Value Sensitive Design assumes that values and normative assumptions can somehow be incorporated, embodied in designs. How can this be? What does it mean to say that. Let us look at some very real and mundane examples outside the ICT field:

- An eye hospital in the Netherlands was renovated and redecorated. The redecoration and painting of the interior was done in bright colours, but hardly used contrast. The light switches in rooms were white on white walls, pillars in the hall were in the same colour as the background walls against which they were perceived (or better not perceived) by patients. -In parts of Amsterdam in the beginning of the twentieth century Architects of the Amsterdam School decided to place hooks in the ceiling for a dinner table lamp eccentric, so as to prevent the tenants to have their lamp above their dinner table in the middle of the room, which they thought was not aesthetically pleasing.
- The British developed pretty unsophisticated weirs in colonial India, which allowed roughly only two positions: water flow and blocking of the waterflow. The amount of
water was regulated by means of the timing of the aperture. The Dutch in their colonies in the Dutch Indies developed and perfectioned their weirs in order to allow for the calibration of the waterflow. This is a consequence of the political philosophy and the associated tax system which in the case of the British implied that they could only levy taxes on land that had some water supply. In order to get their money the British just had to see to it that some water was available. The Dutch however had a different system which implied that they levied taxes on the production of the land. Therefore it was in their own best interest to regulate the water supply to serve the crops whenever that was necessary in their growth cycle. The fine tuning and the more sophisticated weir design were a consequence of the views on productivity, value and taxation.

In all of these cases aesthetic, moral, perfectionist, political and economic values shaped the artefacts, built environment and technology. By doing so they affected the space of action and the lives of users, patients, inhabitants, and farmers.

*Value Sensitive Design in ICT*

In ICT values and norms shape human actions in the same way. An example: Introduction of ICT applications in hospitals may have unforeseen effects with moral implications. So-called Picture Archive Systems are now introduced. This may change traditional and robust knowledge practices. Before the introduction of PACS typically a team of doctors stands around a neon lit glass wall from which X-ray photo’s hang. Colleagues typically provide their interpretation of what they are looking at. One doctor may correct the opinion of a colleague or give his dissenting opinion. The radiologist may tell about the new X-ray equipment. This gathering constitutes an epistemic or knowledge practice, and a pretty interesting one for that matter: it allows for discursive checking, correcting and supplying information, which can be scrutinized by others. This practice may now become less common because of the introduction of picture archive systems for digitized medical images. The unit cost for high resolution screens on the desks of individual doctors is going down. This architectural decision to provide individual doctors with relatively cheap high resolution viewers may give rise to a different epistemic practice which is highly individualistic, and provide less opportunity for critical valuable inter-collegial discussions. If no one would be aware of this change, it will not be compensated for in the design of the relevant Computer Supported Cooperative Work systems that come with the new Picture Archive System. A contribution along the Value Sensitive Design (VSD) lines: 1. analyses the presuppositions, assumptions, theories that were used in making the medical imaging software; 2. establishes whether those who base clinical decisions on these images, have the knowledge and expertise to give correct interpretations and can thus take responsibility for their decisions; 3. incorporate a fine-grained analysis of task responsibilities in the design of the information flow in the hospital context. Responsibility, accountability, liability are design problems. We should not embark on using these socio-technical infrastructures without careful thought to responsibility design. We cannot expect anything but puzzlement, debate, law-suits if we do not think about systems design
in terms of these moral categories in advance and if we do not imposed a clear responsibility structure in advance.

The former director of the MIT Computer Science Lab Dertouzos gave his view on the future of computer science in his book The Unfinished Revolution. He sees a future which is human centric, interdisciplinary and sensitive to moral values and human needs. I think Dertouzos is right, ethics will have to deal with the technological staging of human action and technology must be construed as dealing with the good life in recognition of the fact that engineering and ethical activity are intertwined and not radically separated. In the early days, Dertouzos remarked, 'If you needed technology you bought it, like potatoes, to serve your loftier humanistic goals. That's how technologists became known as practitioners of the "servile arts".' That view as we saw above may have been acceptable when technology was a small part of our lives. 'Today, higher purpose may originate,' as Dertouzos observes, 'with technology, as in the invention of the Web by a full-fledged technologist. Many sites with a purely social purpose, developed by technologist, are already in operation. No pure humanist could ever have come up with these ideas, without also understanding technology. Technology will be as important a contributor to noble endeavours and understanding our world as humanistic ideals were and will continue to be. Keeping the technologists separated from the humanities will keep us from discovering these new territories.'