ETICA Workshop on Computer Ethics: Exploring Normative Issues

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Abstract. The ETICA project aims to identify emerging information and communication technologies. These technologies are then analysed and evaluated from an ethical perspective. The aim of this analysis is to suggest possible governance arrangements that will allow paying proactive attention to such ethical issues. During the ETICA workshop at the summer school, participants were asked to choose one of the 11 technologies that ETICA had identified. For each of these technologies there was a detailed description developed by work package 1 of the project. Workshop participants were asked to reflect on the ethical issues they saw as relevant and likely to arise from the technology. This paper discusses the ethical views of the workshop participants and contrasts them with the findings of the ethical analysis within the ETICA project.

Keywords: ethics, emerging technologies, privacy, evaluation, norms

1 Introduction

One purpose of combining the ETICA summer school with the PrimeLife and IFIP summer school was to engage with more technically oriented communities and to expose the ETICA findings to an external audience of individuals who had expertise in areas similar to that of ETICA. The main purpose was to understand which ethical issues such experts would identify from the description of the technologies and from their own experience.

This paper briefly outlines how the descriptions of the technologies were created and how the ethical analysis within the ETICA project was undertaken. On this basis, the ethical issues of the individual technologies, as developed by workshop participants, were contrasted with those of the ETICA experts in ICT ethics.

The paper concludes by discussing the substantial differences between the two sources and reflects on the value of the similarities and differences to the ETICA project.

2   Technologies and their ethical issues

ETICA, an EU FP7 research project, funded under the Science in Society funding stream, aims to identify emerging ICTs with a view to identifying and evaluating ethical issues. The results of these investigations will then be used to review and recommend governance arrangements that will be conducive to proactively addressing such issues. The technologies considered emerging are likely to be developed within the next 10-15. To identify the technologies, political, scientific, and commercial reports of research and development of cutting edge technologies were analysed and the key technologies determined. Ethical analysis of these technologies then took place, involving meta-analysis of existing critical ethical analysis of the technologies as well as other analytical techniques, which are further discussed briefly below, and in more detail in the ETICA project deliverables.

The ETICA workshop described in this paper drew from the descriptions of technologies that were identified. These are available individually on the ETICA website (www.etica-project.eu) and as collected as deliverable D.1.2 "Emerging Information and Communication Technologies" from the publication/deliverables section of the website.

Future-oriented work always has to contend with a number of conceptual, methodological and epistemological problems (1). In the case of ETICA, conceptual issues were raised concerning the meaning of "emerging", "information", "technology" and most other central terms. Since the future is fundamentally unknown and unknowable, the claims of the ETICA project needed to be carefully scrutinized. Very briefly, the ETICA approach views technologies as at least partially socially constructed and therefore subject to interpretive flexibility. This view of technologies corresponds with those of the Social Study of Technology (SST) or the Social Construction of Technology (2-4). It is also compatible with views of technology in related fields such as Actor Network Theory (5,6). Finer point of the debate such as the distinction between interpretive and interpretative flexibility are of less importance here (7).

A further problem of prospective studies is that the possible future consequence of any occurrence, action or technology is infinite. The ability to adequately predict the future shrinks with the temporal horizon. ETICA thus had to make a reasonable compromise with regards to the temporal reach of its investigation. The temporal reach of truth claims about emerging technologies is around 15 years. The justification of this temporal horizon is that technologies that will be relevant within this time span are likely to currently being developed. An investigation of current research and development activities should thus give an indication of such technologies.

It is important to point out that ETICA positions itself within the field of foresight activities. This means that it does not claim to know the future but that the findings of the project have the character outlining possible futures with a view to identifying futures that are desirable and that can be influenced by present action. The aim of foresight activities is not to describe one true future but some or all of the following (8):

- To enlarge the choice of opportunities, to set priorities and to assess impacts and chances

- To prospect for the impacts of current research and technology policy
- To ascertain new needs, new demands and new possibilities as well as new ideas
- To focus selectively on economic, technological, social and ecological areas as well as to start monitoring and detailed research in these fields
- To define desirable and undesirable futures and
- To start and stimulate continuous discussion processes.

This understanding of the aims of foresight fits well with the ETICA project. It renders the entire project feasible because it underlines that there is no claim to a correct description of the future but only one to a plausible investigation of possible options and outcomes. This raises the question of how such a claim to a plausible description of possible futures can be validated: the question of methodology.

The identification of emerging ICTs was done by undertaking a discourse analysis of discourses on emerging ICTs. Sources of this discourse analysis were on the one hand governmental and funding publications and on the other hand publications by research institutions. The rationale for the choice of these sources was that that the cover the visions and intentions of influential technology R&D funding and at the same time include views on what is happening in R&D organizations. Taken together they should thus give a reasonable view of which technology developments are expected. The analysis of these texts was undertaken by using the following analytical grid, which allowed for the distinction of technologies, application areas and artefacts. In addition it allowed for the early identification of ethical, social, or legal questions as well as technical constraints or capabilities.
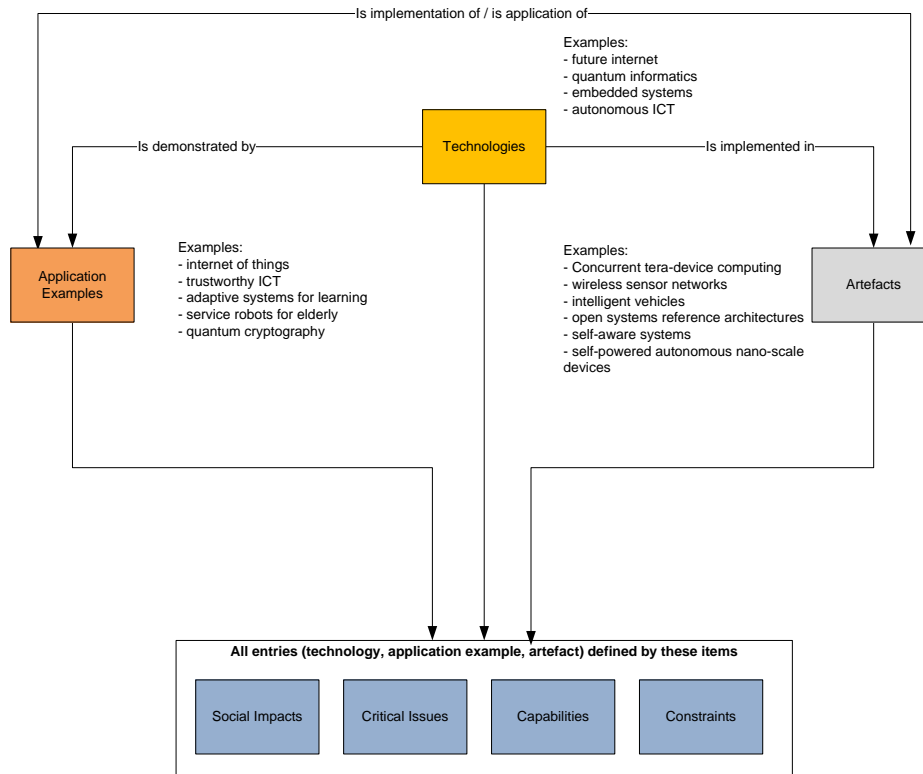
Figure 1: Categories of data analysis (analytical grid)

During the data analysis it became clear that there was going to be a large number of technologies, application examples and artefacts that could be identified. In order to render these manageable and to facilitate ethical analysis and subsequent evaluation, it was decided to group the findings into general high-level technologies. The description of such technologies was meant to illustrate their essence, i.e. the way the technology affects the way humans interact with the world.

The analytical grid proved helpful in indicating which of the analysed items were related and thereby pointing to the most pertinent ones. It provided the basis for the identification of top-level technologies for which detailed descriptions were developed. For each of these top-level technologies, the description was constructed on the basis of the data derived from the analysis of discourses but also drawing on additional data. The structure of the technology descriptions was:

- Technology Name
- History and Definitions (from discourse analysis and other sources)
- Defining Features ("essence" of technology, how does it change the way we interact with the world)
- Application Areas / Examples
- Relation to other Technologies
- Critical Issues (ethical, social, legal and related issues as described in the discourse)

- References

The method just described provides a transparent and justifiable way of identifying emerging ICTs for the purpose of foresight, as described earlier. It can nevertheless have blind spots because it relies on interrelated discourses by governments and research institutions. It was therefore decided to use several methods to ensure that the list of technologies was reasonable. These consisted of a set of focus groups with technology users, a survey of technology development project leaders, and a crosscheck with an amalgamated list of technologies from current futures research.

The full list of technologies which survived several rounds of review, amalgamation and delimitations is as follows:

- Affective Computing
- Ambient Intelligence
- Artificial Intelligence
- Bioelectronics
- Cloud Computing
- Future Internet
- Human-machine symbiosis
- Neuroelectronics
- Quantum Computing
- Robotics
- Virtual / Augmented Reality

Table 1: List of emerging ICTs

Before coming to the views that workshop participants had on these technologies, it is necessary to say a few words on the way in which they were ethically analysed within ETICA. Very briefly, the ETICA work package 2, which was tasked with undertaking the ethical analysis, chose a descriptive and pluralist approach. This means that, instead of relying on a particular ethical theory, such as Kantian deontology, utilitarianism, virtue ethics or more current approaches such as discourse ethics, the analysis reviewed the literature on ICT ethics and accepted as ethical issues what was presented as such.

The term ICT ethics was chosen because it reflects the EU FP7 attention to ICT. The review of ICT ethics was based on the more established fields of computer and information ethics. Computer and information ethics can be understood as that branch of applied ethics which studies and analyzes social and ethical impacts of ICT (9). The more specific term 'computer ethics', coined by Walter Maner in the 1970s, refers to applying normative theories such as utilitarianism, Kantianism, or virtue ethics to particular ethical cases that involve computer systems or networks. Computer ethics is also used to refer to professional ethics for computer professionals such as codes for conduct that can be used as guidelines for an ethical case. In 1985, Jim Moor (10) and Deborah Johnson (11) published seminal papers that helped define the field. From then on, it has been recognized as an established field in applied ethics, with its own journals, conferences, research centres and professional organisations. Recently, computer ethics is related to information ethics, a more general field which includes computer ethics, media ethics, library ethics, and

bioinformation ethics (12). For contemporary overviews of the field, see Floridi (13); Tavani & Himma (14); and Van den Hoven & Weckert (15).

The field of computer ethics is also institutionalised inside ethics, e.g. in the International Society for Ethics of Information Technology (INSEIT) and outside applied ethics for example in several working groups of organisations for IT professionals such as the Association for Computing Machinery (ACM), International Federation for Information Processing (IFIP) and national professional organisations across the globe.

The approach taken was to mine the literature on ICT ethics, initially using a biometric tool that showed proximity between terms in the literature. Using this tool as a starting point, a detailed review of all technologies was undertaken. Where the ICT ethics literature did not show any relevant issues, literature from adjacent fields was used. The primary ethical analysis was based on the defining features of the technology. Where these did not lend themselves to ethical analysis, the application examples were considered. Overall the aim was to identify a broad spectrum of ethical concerns that can be used by researchers, funders or policy makers to ensure that ethical issues are addressed early and appropriately. For a more detailed description of the identification of technologies and their ethical consequences see (16).

Having now outlined the way in which the technologies were identified and their ethical analysis was undertaken, the next step is to compare these ethical analyses with the findings and intuitions of the summer school workshop.

3   Findings

This section contrasts the views on the ethics of emerging ICTs of participants in the workshop with the findings of the ETICA project. For each of the technologies discussed, the paper first summarizes the main points by the workshop participants. These were captured and transcribed after the workshop. In a second step we then outline the ETICA findings. These are summarized from the ethical analysis that has been published as deliverable D.2.2, Normative Issues Report and is available from the "deliverables" section under "publications" of the ETICA website (www.etica-project.eu). The technology descriptions that underlie the following discussions are also available from the same source in deliverable D.1.2, Emerging Information and Communication Technologies Report.

Neuroelectronics

The participants in the workshop were mainly concerned by the effect that neuroelectronics would have on human identity and dignity. Issues such as the potential for invasion of psychological processes or accidental (or intentional) changes of personality were raised, with some concern about neuroelectronics being used as "advanced lie detectors", bringing along with it problems associated with what makes something the truth, and causing power imbalances. Participants were

also concerned with the idea of the "reification" of human beings: i.e. the reduction of humanity to its brain functions.

The most pressing issues, however, for the workshop, were the issues of informed consent and whether one can fully understand what's happening with neuroelectronics, and the misuse of such technology in areas such as intentional changes of personality, or advanced torture methods.

These concerns are well in line with ETICA's analysis of neuroelectronics, which raises the issues of responsibility and liability issues for the potential for harm through neuroelectronics. The analysis also touches on the issues of agency and autonomy, which, it argues, could be altered. Not only might cognitive enhancements amplify autonomous capacity, but this new-found ability to know one's self may promote further human autonomy through further control over one's mind. However, this could also lead to a "God complex" which could end up being detrimental to agency and autonomy. Informed consent is also considered a major issue, with issues of consent for the mentally ill or convicted criminals a particularly difficult problem.

Although the idea of a "lie detector" is not mentioned in the ETICA analysis, there is some analysis of the issues of brain image processing, which could be used for such a purpose. Of particular note is the idea of "potential crimes", in which this sort of technology could be used for identifying "criminal thoughts". The question of whether one could be held accountable for such thoughts as if they were a real crime is another difficult issue. Similarly difficult is the interpretation of data retrieved from neuroimaging.

The ETICA analysis does not include the issues of torture or personality change specifically, although it does suggest that there could be significant impacts of peer pressure, advertising, and other social effects (enhancement of cognitive skills, overcoming disabilities, use as a "technological fix" to deeper social or personal problems) that could be considered factors that might contribute to personality change.

Affective Computing

Affective computing is technology that aims to achieve emotional cognition through simulation, recognition, and/or realization of emotions.

In the workshop, the participants were concerned about the accuracy of behaviour interpretation. What sort of information is being used to determine the response of technology such as a robot that "learns" your emotions? Participants were also concerned by the potential for a society in which robots "learn" how best to deal with people becoming accustomed to obsequiousness. Additionally, they were worried about who might have access to these patterns of behaviour, and whether they might be useful for a third party, such as business, law enforcement, etc.

Other concerns were voiced about the social side of this sort of computing, whether it was appropriate for, say, a computer gaming community to know what emotions a player is experiencing, and whether it might affect the play of other members. The issue of allowing gaming companies to know what emotions were being felt during play of their games arose as well: this could be used to identify the most addictive

parts of games, or the sorts of people who might become addicted to games, which could seriously affect a person's autonomy.

Finally, the participants raised the question about who ultimately benefits from this sort of information: although there can be benefits to many people, is it worth the trade-off in terms of privacy, identity, and autonomy?

The ETICA analysis reflects the problems of persuasion and coercion, taking it further than the problem of addiction identification and into the realm of manipulation, which can cause people to change their behaviour significantly. It also confronts the issue of identity in a realm of emotive robots, especially the fact that technology that is convincing in its ability to interpret emotions could cause the user to have unrealistic expectations of it. Privacy was also mentioned in the ETICA analysis, echoing the sentiment of the workshop participants by discussing issues such as mass databases of affective information, and the relaying of personal affective information over the internet to third parties. There was no discussion about benefits or tradeoffs specifically, nor cheating on online games, although the former is mentioned within the specific examples, and the latter a more general issue that is found in already present gaming situations.

Bioelectronics

The description of bioelectronics raised some more existential questions amongst participants. One of the biggest issues was the question of what it is to be human. Since bioelectronics can, like neuroelectronics, enhance natural human abilities, there was a concern that it could slowly shift the idea of what a "normal human" could be. Equally concerning was the dehumanizing potential of the technology and the possibility of immortality through bioelectronic techniques (bypassing the normal aging process).

There were also serious potentials for misuse of the technology, through things like surveillance and remote control of human actions. These raise the issues of privacy and security of people and their data, and the informed consent that might need to be given to allow this sort of technology to be "installed". Finally there were concerns about how this technology could increase the digital divide: bioelectronics that enhance human functions would probably only be available at first to the rich, and could then give those with access to it an unfair advantage in life.

ETICA found that many of the issues related to bioelectronics are similar to those of neuroelectronics. Furthermore, there is relatively little literature specifically on bioelectronics. For an ethical analysis, there is also overlap with human machine symbiosis. The main issues identified by ETICA are safety, risk, and informed consent; anxieties about the psychological impacts of enhancing human nature; worries about possible usage in children; the digital divide, privacy and autonomy.

Robotics

In the discussion about robotics, the distinction between social and ethical issues was raised. The particular examples (human performance, military, companion robots)

were discussed separately, with different issues considered important for each application.

The first application (human performance improvement) raised the issue of the digital divide as a social issue, considering, like bioelectronics, the sort of technology that would be developed would be quite expensive to make, and so only be open to the rich (at first). The ethical issues that were raised were the questions of why this sort of technology might be developed at all, and what kinds of performance might be improved. The concern here seemed to be about equality of people, and what this entails in terms of human enhancement through robotics.

As for the military application, the issue of "swarms" of autonomous robots was discussed. Issues considered social by the participants included the potential for environmental damage by these robots, and how much control was had over the robots. The issue of control led to the ethical issues of responsibility for the robots' actions, what sorts of decisions the robots could potentially make: could they be trained to kill? And if so, how reliable would they be at identifying the correct targets? Another issue raised was that of "remote controlled killing", where the real people involved in the war could just "show up at the office" potentially anywhere in the world and control the outcomes on the battlefield. However, one more positive suggestion was the idea of remote medical administration, but even that raised issues: do we use the robots just to save "our side", or civilians, or who? And then, who is responsible for these decisions, and how detached are they from what's actually happening?

Finally, the companion robot raised several issues, mainly the social issues of the digital divide, the sorts of interactions one could have with the robots, and the robot's rights, particularly when it comes to applications such as "sex bots". The main ethical issue identified was responsibility, particularly as it concerns the use of these sorts of robots, the programming that goes into them to "learn", and what happens when something goes wrong.

Robotics, as a research field that has been established for several decades, has created a significant amount of literature on ethical aspects. In the ETICA analysis a first point raises was that of privacy which can be threatened by the mobility of robots, which gives them new capabilities of collecting data. Robots can contribute to tele-presence, which can be morally desirable, for example where people are removed from danger, but can also lead to social exclusion. A core issue is that of robot autonomy. While this is linked to the difficult philosophical question what constitutes autonomy, it also has knock-on ethical consequences such as responsibility or liability of robots in case of problematic behaviour or the question whether robots can or should be made to behave in an ethically acceptable manner. This then is directly linked with the question whether and what stage robots should be the subject to ethical or legal rights.

A further ethically challenging development is that of a possible competition between humans and robots and robots possibly overtaking humans. This is linked to the question of the social consequences of large-scale use of robots, which promise to raise particular issues if robots become very similar to humans. The competition between humans and robots is, however, not linked to futuristic and autonomous human-like robots but can be observed at present, for example when robots take over human work and thereby cause unemployment.

Quantum Computing

The quantum computing discussion was also quite existential, looking back to some of the more fundamental questions of humanity and technology. Questions like "what is reality?" "What is it to be human?" "What is space?" and "What is consciousness?" were brought about as a response to the technical potential for this technology. The discussion also touched on what sorts of decisions computers should be making, and what sorts of applications quantum computing might have in reality. However, the issues of motivation for development of quantum computing were also examined: could it be used for the common good, dealing with large amounts of data for public health threats, pandemics, or mass movement of people? Could it be used to "save humanity" by allowing for space travel (tele-transportation)? Or does it only have an economic drive behind it?

One participant suggested that because quantum computing is a scientific instrument, there could be no real social or ethical issues, although some of the potential applications, it was argued, could have some issues. Such applications, like quantum memory, also caused the participants to question their ideas of what memory is, as well as how this sort of memory could be used. There were concerns about the possibility for quantum computing to circumvent the security and encryption mechanisms in contemporary use. This was considered a social issue, that is, that it would mean that people would be concerned about security of data and whether encryption is working. A quantum information network, with data "appearing in the moment" was considered a double-edged sword, since it could be used for the common good (such as in pandemics, etc.) but also had a strong economic imperative for data-mining purposes.

The ETICA ethical analysis of quantum computing suffered from the fact that little is known about quantum computing at the moment and practical applications are difficult to discern. Due to sub-atomic scale of aspects of quantum computing, it may raise concerns that are similar to those of nanotechnology, which, however, is outside of the ICT-related scope of ETICA. Otherwise quantum computing is often portrayed as a qualitative and quantitative improvement of current computing. It can thus contribute to the exacerbation of established ethical issues of computing. One of the few applications that are discussed in the literature on quantum computing is that of encryption. It is sometimes speculated that quantum computers could render current encryption methods redundant and would require new methods of encryption. Corresponding and resulting issues would then be those of security and information assurance, but possibly also questions of freedom of speech or censorship.

In addition to such applied questions, the ontological nature of quantum computing and its ability to link matter-like and idea-like things, it may change our perceptions of reality and also of ethics.

Future Internet

In the discussion on the future internet (which included things like the Internet of Things), there were just a few issues that were raised as being emergent issues, particularly the logistics and responsibility for monitoring of (for example) health

conditions (especially rapid response), which would be possible with the technology, and the delegation of decision making, that is, if it is a computer or a person who makes decisions about the sorts of responses necessary. Also identified was the issue of user autonomy: with so many decisions being made for you by machines or externally, it could take away the autonomy of users that would otherwise need to make the decisions themselves. Finally, the participants identified a need for balancing these pros and cons of the future internet technology, since there could be many of both sides: machines making decisions are cheaper, faster, and could be more effective, but without the proper checks and balances could allow people to "slip through the gaps".

Future Internet, with its components of the internet of things, the semantic web and cognitive networks was seen by ETICA as raising a number of potential issues. Incorporating meaning into internet structures by adding to available data and meta data can raise issues of privacy and data protection. Resulting questions can arise concerning trust and acceptance of technologies. New capabilities can lead to further problems of digital divides and intellectual property. This includes the question of openness and regulations of new networks and infrastructures. A final important thought was that of the sustainability implications of the future internet and its projected increase in energy consumption.

Cloud Computing

The description of cloud computing was considered not entirely accurate, but even still some issues were raised about the information within the technology description. For example, participants discussed the problem of providers not telling users what their data is being used for: email providers might be reading email (through sophisticated programs) that might be used to profile the user in order for ads to target them better. However, the mechanisms and use of the data are not usually explained very well to the users. Profiling, it is noted, is a widespread general problem with cloud computing. Since the providers have access to a lot of data from lots of individual sources, it becomes very easy for an economic incentive to inspire use of that data, even if it becomes anonymised. Everything from location information (which could be sensitive) to what is written in a document or photographs taken could be used to discover the habits and profile of the user. Even anonymisation is not foolproof, since much of the data within these sorts of documents could be identifying in their content.

One of the other big issues of cloud computing is that of provider lock-in. Since providers provide a service, users have a significant incentive to continue to pay for the use of that service, particularly if the service makes it difficult for them to export their data in easy-to-read or standard open formats. In some cases it could be difficult to "quit" a service contract, since you run the risk of losing data. Also, in a related issue, if you wanted to actually delete the data from your cloud computing account, it could be very difficult to ensure it is fully gone. Computer service companies make extensive backups, for example, and it could be impossible to remove data permanently from the cloud.

Some other issues involve security of data: large quantities of data and possibly personal information are particularly interesting to black-hat hackers who might want to sell this information for nefarious purposes. Also, the lack of physical access and control of the machines on which the data resides was brought up as a potential issue.

Finally, applications and software being outsourced to the cloud raise some potentially serious legal issues regarding jurisdiction and intellectual property ownership of data.

The ETICA analysis of cloud computing, which to some degree is an existing technology, covered similar aspects as that of the workshop participants. A core issue is that of control and responsibility. If data or processes are moved to the cloud, then who has control over them and who is responsible for what happens to them? This is related to the "problem of the many hands" which stands for the difficulty of attributing causal relationships and thus responsibility to individuals. This lack of control means that users of cloud services may lose their autonomy, or at least their ability to make informed choices. Such problems cover the issue of ownership, which is often difficult to clearly delimit in cloud applications. Cloud computing thus raises the spectre of monopolies and user lock-in.

Once data is part of a cloud it is hard to avoid its use for different purposes, as function creep is difficult to predict or control in clouds. This adds to the concerns about privacy. Such concerns are particularly virulent in clouds, which, as global technical systems, will find it difficult to address culturally or locally specific concerns.

Virtual and Augmented Reality

The last technology discussed in the workshop was that of virtual and augmented reality. The participants were particularly concerned about crime in virtual reality settings. For example, they were wondering whether avatars could commit crimes. One participant noted that avatars can make legal contracts in current VR settings (Second Life, Massively Multimedia Online Games, etc.). The question of whether sex in virtual worlds would be considered adultery, and other legal and illegal sexual activity occurring online, with the famous "rape in cyberspace" being mentioned as an example of real world sexual occurrences that can also happen within virtual reality systems. The workshop participants concluded that perhaps a redefinition of crime could be required for within virtual reality settings.

However, more advanced virtual reality technology that was more immersive caused the participants to wonder whether it would be ethical to raise a child entirely within a virtual reality world, or if people should be allowed to spend most of their time in virtual reality. The question of whether prisoners could be put into VR was also brought up, given the potential effect on the person within the virtual world.

Another problem was that of the digital divide. Like so much technology, much of it is expensive and thus more likely to be used by the rich before the poor. The participants were also concerned about "Matrix"-like scenarios, where the population could "live" unknowingly in a virtual reality while being "farmed" for their resources in reality. This dehumanization and loss of dignity seemed to be important issues for the participants.

The ETICA analysis highlighted similar issues. An initial concern was the relationship between VR / AR and well-being. This touches on the question whether positive experiences that are conducive to a good life can be made in a non-real environment. Virtual or augmented realities may tempt individuals to escape from real challenges or responsibilities. Moreover, such artificial environments may have harmful consequences for users. Such harm may be psychological (e.g. addiction) or physical (e.g. motion sickness). Users may furthermore find it difficult to distinguish between "real" and "virtual", raising practical problems but also philosophical questions about the nature of this division. Many of the VR / AR applications are in the area of gaming which raises ethical concerns about the violence that can be found in many such games. A corollary to this problem is that question of the relevance and ethical evaluation of virtual harm or virtual immorality (e.g. virtual murder, virtual child sexual abuse).

Digital divides may again arise as ethical problems due to the inequity of access to VR / AR technologies. Immersion in virtual environments can lead to the question of autonomy of the user and their ability to control their environment. The numerous issues surrounding VR / AR raise difficult questions concerning the responsibility of designers and producers of such devices.

Conclusion

This comparison of workshop participants' perceptions and ETICA analysis shows that there is a significant amount of overlap. In some cases ethical issues of emerging ICTs are already widely discussed and people are aware of different positions. Some ethical issues are recurrent and already subject to regulation. Notable examples of this include privacy/data protection and intellectual property.

Other problems are less obvious or less widely discussed. Many of them raise fundamental philosophical issues concerning the question of what we believe to be real and good, how we come to such judgements and how societies as a whole develop their views on this.

Among the interesting differences between the summer school workshop participants and the ETICA analysis is the amount of attention paid to particular application examples. The technology descriptions used as primers for the exercise all contained approximately five different application examples used to allow the development or deduction of core features, which are also then listed in the descriptions. The workshop participants were mostly drawn to these applications and based much of their discussion on them. The ETICA analysis, on the other hand, aimed to base the ethical analysis on the more general defining features. As a result many of the issues discussed in the workshop referred to specific applications, e.g. robots in healthcare or in the military.

Due to the overarching theme of the summer school being privacy, this topic was much on the participants' minds; this is reflected in the discussion on the technologies. Since data collection and sharing is often the focus or a side effect of many emerging technologies, this is unsurprising, but it also reflects the particular concern for privacy that the participants had.

From the perspective of ETICA the exercise showed that the ethical analyses are compatible with what a set of educated lay people would see. It also raises the question how more detailed and application-oriented analyses could be introduced into ethical discussions. The workshop can therefore be seen as a success.

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