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Innhold

Introduction

There is a growing ethical concern in our society regarding the widespread use of information technology. A significant contributor to this is the phenomenal growth of the World Wide Web and the availability of Internet access to "everybody". This has introduced a number of new questions about old issues like free speech, privacy, anonymity and copyright, to mention some. In this area it is valid to say that one experiences an ethical gap that needs to be filled, but it is not obvious in what way this should and could be done.

Another important factor is the ever growing complexity of software systems. This has, quite justly, created the feeling that no single person can be expected to foresee and control all the effects, and especially the unwanted effects, that the software might have on society. Almost daily one hears about incidents in which flaws and unexpected behaviour in software systems have been a real danger to life and health or have cost organizations huge amounts of money. One very important question in this context is who is and who should be responsible for both the quality and the impact of the software, and what would be the prerequisite for them to be able to carry out their responsibility.

So, there are a lot of open questions about ethics and IT, and we, as a modern society, are still working on the answers. But one thing should be obvious; the IT professional plays an important role in all this. Therefore, it is important that the IT professional has the necessary awareness both of the possible ethical challenges that exist in his profession, and of his own part in meeting them. And as a consequence that the education we give IT students focuses adequately on ethical issues.

One could argue that there is nothing new, that the ethical questions resulting from the use of the Internet and from the sophistication of modern software are nothing but old questions in new wrappings about what is good, moral behaviour. And as a consequence, that the IT professional would have no special need for ethical awareness. But even if that were true, is it really to be expected that an IT professionals would have a "natural" ethical competence? And the realty of the situation is a growing consensus that modern IT definitely has created something new, or what James Moor (Moor [1985] 2004 page 9 in Tavani) refers to as "conceptual muddles". That is areas where we neither have a conceptual understanding of what is going on, or ethics for dealing with it.

So, the conclusion must be that we cannot expect our IT professionals to have the necessary ethical competence without having spent some time understanding ethics and pondering specific ethical questions and dilemmas created by IT. Realizing that, more and more educational institutions are making ethics a natural and focused part of their educational programme for IT students.

This is however not the case in the three years education programme in Software Engineering (bachelor's degree) at the university college, where I teach. But this is something that we have decided to change, for the reasons argued above. My concern in this paper is, as a follow up of that, to determine and to give my recommendations about what kind of education in ethics is appropriate for our IT students. That is; what topics to include and what approach to use.

In order to do that I will make an initial analysis followed by conclusions and recommendations. This means exploring the following topics and questions:

- *A look at ethical theory* It is natural to start with a brief look at some ethical theory. Whatever follows, I believe that an insight in ethical theory is needed as an introduction

to any ethical challenges and any ethical problems that education might introduce the students to. Tavani (2004) gives an overview of ethical concepts and theories that will be useful.

- *What's so special about computers*? In this section I will try to explore a bit what Tavani refers to as cyberethics, what is meant by that term and why it is valid to talk about a special ethics for the study of moral, legal and social issues involving cybertechnology. I will try to find possible reasons why the wide use of computer technology, and especially the use of Internet, poses such an ethical challenge for us and why our old notions of "good, moral behaviour" will not adequately support us in our dealings with cybertechnology.
- *Responsibility for IT professionals*. After having discussed the type of new ethical challenges in the age of cybertechnology, the next question is: in all this, what is the role of the IT professional? What kind of ethical awareness and competence can we expect, and specifically, what should be the responsibility of the IT professional in the shaping and development of modern IT systems? In this section I will explain the tree types of ethics that Tavani discusses: professional ethics, philosophical ethics and descriptive ethics and narrow the further discussion to professional ethics for IT professionals.
- *A look at professional codes of conduct*. The purpose of educating IT professionals in ethics could be simplified to say it is a question of giving them the right tools to use when challenged by an ethical question. In this section I will start to evaluate some candidates for such tools. Many professions have established professional societies, which in turn have adopted codes of conduct. This is also the case in the computing profession. It is therefore necessary to look at one or more of these and evaluate both their content and usefulness as guidelines for the IT professional in ethical conduct. I have chosen the IEEE/ACM Software engineering Code of Ethics and Professional Practice (SECEPP), version 5.2, (In Tavani 2004, appendix C), because I believe it to be the most applicable in this context.
- *Objectives – what should we aim at?* The above topics and discussions should be a basis for formulating the most important of all – the objective of teaching ethics to our IT students. I stated earlier that the main objective is to give them practical tools to use when faced by an ethical challenge. It is true, but as an objective it is far to narrow. I think a good objective might be something like: *The objective is to give them enough awareness of ethical thinking in general, and ethical challenges pertaining to cyberethics in particular, to raise their awareness and prepare them for the ethical challenges they will meet in their profession. It is further a goal to give them practical guidelines that can assist them in finding an ethically legitimate response when faced with ethical questions.*
- After deciding on the objective, it is time to start answering the question: *what to include in their curriculum*. Here I start with a closer look at a recommendation from IEEE-CS / ACM: Computing Curricula 2001 Computer Science – CS280 Social and professional issues, and what it has to say about ethics. I will then discuss what limitations there are on our freedom to make "the ideal ethics course": limitations caused by limited time, the competition from other important topics and regulations from the government with respect to what has to be included in the curriculum for these students (bachelor *ingeniørfa*g). Based on this I will make a recommendation of topics for inclusion in their curriculum. I might make two lists: what I think ideally should be included and what I understand it is possible to include, given the limitations.
- And finally: *How to do it – the approach*. By approach I mean answers to questions such as: Taught as a separate entity or discussed in the context of more technical issues? Focus

on theory or focus on “real life” examples? What mix to choose of readings, project work, discussions in class and lectures?

Background analysis

A brief look at ethical theory and tools for evaluating cyberethics issues

It is not possible to have an ethics course without a firm basis of ethical theory. The main objective would be to give the students an understanding of ethical thinking, and very important, that there is more than one response to a given ethical problem that can be defended as ethically legitimate, depending on what moral theory is applied and how it is applied. In other words, they should understand that ethics is not an algorithmic approach to find the right answer, but more a tool for analyzing and understanding moral dilemmas. And they should be familiar with a set of ethical theories that can guide them in their deliberation on the ethical challenges they will meet in their profession. Further they should get some help in understanding the validity of logical argumentation – what characterizes a valid argument, and how to discover typical fallacies in argumentations.

The question then is not if, but how much and in what way this should be presented.

Tavani in his textbook *Ethics and technology* (Tavani 2004) deals with these topics in chapter 2 and 3. In my view he does this in an excellent way that is well suited as an introduction to ethical theory in the context of an ethics course for IT students.

What’s so special about computers – cyberethics

Before discussing what should be the ethical concerns and responsibilities of the IT professional, it is important to know a bit more about the area where these concerns arise. This is the objective of this section where the term cyberethics is defined.

Cyberethics and cybertechnology

Cybertechnology is a widely used term, and is generally understood to refer to a broad spectrum of computing and information technology, not only the Internet but also devices connected to privately owned computer networks and stand-alone computers. Tavani, (2004), uses the term *cyberethics* to refer to the field of study that examines moral, legal and social issues that involves cybertechnology. Cyberethics can be understood as branch of applied ethics; it examines practical ethical issues and is concerned with analyzing specific moral problems that pertain to the use of cybertechnology. It is further important to notice that it is both a wider term than Internet ethics; because it is not limited to the use of Internet but includes a wide range of computing and communication devices, and also a wider term than the professional ethics that pertains to computer professionals, because it concerns both the inherent properties of the technology and the way it is used.

One important question is whether it is valid to speak of cyberethics as something special. Do we in fact have a special branch of applied ethics which involves special issues that should be given special attention and requires their own ethical solutions? Tavani (2004, pages 6-10) discusses this with reference to two schools of thought regarding this question. One school would argue that theft is theft and murder is murder, whether it happens with the aide of the Internet or not, and that cybertechnology is simply just the latest in technology aiding the same old crimes. Others argue that there are in fact some forms of behaviour that would not

be possible without cybertechnology, and it is for that reason that we can talk of new ethical problems and cyberethics as something distinctive. One important reason could be that the technology is unique; unique in speed, capacity, complexity and substance.

Tavani argues that this in it self is not enough to justify the conclusion that the moral questions associated with the use of the technology are unique, and if we focus only on the moral issues themselves as moral issues, there seems to be nothing new. There are just the old questions of privacy, autonomy, fairness, justice, responsibility and respect. Still Tavani (2004, pages 6-10) concludes that there is in fact a uniqueness that validates a "new ethics". Why such a conclusion?

Here he refers to an article of James Moor "What is computer ethics" (Moor [1985] 2004, pages 8-10 in Tavani) that adds another important factor to the discussion. Moor points out that what really sets computer technology apart is not the speed and capacity but its infinitely malleability. As a consequence it can generate infinitely new possibilities of human action. Some of these actions give us what he refers to as policy vacuums; that is, we have no guidelines for action. And even worse, cybertechnology has also introduced what he calls conceptual vacuums, that is, areas were don't even have enough understanding to be able to create the guidelines that are missing. This Moor points to as the main reason for treating cyberethics as something that needs a special awareness. And he introduces the term "conceptual muddles". These are the areas where we lack both the conceptual understanding of the problem and adequate ways of solving it. Moor's main point is that the important question is not whether all cyberethical issues are unique ethical issues, but whether they will need special attention. And he concludes that they will, because of the nature of cybertechnology, especially its malleability, that he says creates more conceptual vacuum than any other technology.

Here it is interesting to take a brief look at a discussion in *Etikk og informasjonsteknologi* (Hartvigsen et al 2000). In the foreword of the book the authors state that there is a need for a new ethical awareness concerning the use of cybertechnology and a need for a moral "awakening" of the IT students as to the challenges they will meet both as professional makers of the technology and as users of the technology. Later in the book, the authors argue that one important reason for this is that cybertechnology has certain properties that cause what they call "a technological estrangement and a moral breakdown". (Hartvigsen et al. 2000, pages 121-136). One interesting point that they make, is that we have a tendency to give computers human traits and at the same time we have a tendency to regard the human encounters aided by computers as encounters more with machines than with humans. So, as a result, we have some sort of a muddle, where the difference between man and machine becomes unclear and our moral awareness breaks down. As a result we might find it ok to steal someone's work on the Internet or invade someone's privacy aided by computers, even if we would never steal a physical book from that same person or peep through his window.

Sum up and conclusion

Then, what is the conclusion of all this? I think the important points are:

- It is valid to talk about cyberethics as a special branch of applied ethics

- Cyberethics needs special attention, that is; it is not enough to use our "natural" sense of good moral behaviour when facing the ethical challenges we meet in our dealings with cybertechnology
- IT professionals must have a part in clearing up the "conceptual muddles", and therefore will need a special awareness concerning cyberethics. It is not to be expected that they have this awareness unless they spend some time studying ethics and pondering ethical questions concerning IT.
- This is important and challenging enough to be a part of their education.

In the next section I will move on to discuss a bit more what would be the role of the IT professional and what typical ethical challenges he would meet.

Professional responsibility for IT professionals

Tavani (2004, pages 10-19) speaks of three perspectives of cyberethics: as a field of professional ethics, as a field of philosophical ethics and as a field of descriptive ethics. My understanding of his description of these disciplines is that while the field of philosophical ethics might be manly a concern for philosophers and the field of descriptive ethics mainly a concern for sociologists; the IT professional should have a firm grasp of cyberethics as a field of ethics for his profession.

In Tavani's view, the field of professional ethics can best be understood by identifying and analyzing issues of ethical responsibilities for the computer professionals. And especially the ethical issues having to do with the computer professional's role in designing, developing and maintaining computer hardware and software systems. He uses the following example of possible moral dilemmas for the IT professional (Tavani 2004, page 11):

> *Suppose a programmer discovers that a software product she has been working on is about to be released for sale to the public even though the product is unreliable because it contains "buggy" software, should she blow the whistle?*

Here Tavani enters into a discussion about how broadly one should define the professional, ethical responsibility for computer professionals. He refers to Don Gotterbarn (Gotterbarn [1991] 2004 pages 11-12 in Tavani) that argues that one should not have a field of computer ethics apart from the study of those ethical issues that concern the design, development, delivery and maintenance of computer systems, and he refers to several others that take the view that a broader model is needed. The argument for this is that issues involving IT professionals have a significant impact on non-IT professionals, including both users and persons that have never used a computer. Therefore there is a wide range of ethical issues pertaining to cybertechnology that can have implications for computer professionals, both those who have direct impact and those who have a more indirect impact. While I will limit myself in this section to discuss the issues concerning those with a direct impact, Tavani (2004, page 13) sees it likely that computer students would benefit from and would find it interesting also to study the issues with a more indirect impact on them as professionals. Examples of such issues: Privacy and cyberspace, Computer crime, Security in cyberspace and Intellectual property.

A comprehensive cyberethics methodology

One important role for the computer professional might be as participant in what Tavani (2004, page 19) calls "a comprehensive cyberethics methodology" where the disciplines of

computer science, philosophy and social sciences join forces in analyzing cyberethical issues. Here he refers to Philip Brey's "disclosive method" (Brey [2000] 2004 pages 19-23 in Tavani) where the three disciplines come together with their united expertise to go through three phases: the disclosure level, where the computer professional, possibly aided by the social scientist, plays the main part in disclosing embedded features with moral impact in computer technology, the theoretical level where the philosopher analyze the situation and the application level where all three join forces in applying standard or new ethical theories to the issues.

Do computer professionals have any special moral responsibilities?

An IT professional is defined by Tavani (2004, page 90) as anyone employed in the computer, information-technology or information/communication field. He includes software engineers and software engineering teams, as well as computer-science instructors in colleges, universities, and in industry settings – those responsible for educating and training software engineering teams.

The discussion is whether all professionals have moral obligations, just by being professionals, and further, whether there are special moral obligations that differentiate the IT professional from other professionals.

Some ethics argue that professionals do have special moral obligations, just by being experts in their field and because that field has a potential to impact the general public. A professional (doctor, lawyer, etc.) might find himself in a situation where his decisions and actions can have significant social effect. In these cases, the view is that the moral obligations of professionals exceed that of the general public. (Tavani 2004 page 89-90). Further, Michael Bayles (Bayles [1989] 2004 page 90-91 in Tavani) argues that all professionals have a special obligation to their clients, to be worthy of their clients trust.

What is the significance of these points of view for the IT professional involved in developing computer systems? First, it means that he will have professional obligations to his client, in a wide sense. But it also means that he will have an added responsibility towards society, just because he is the expert and has a knowledge about the system he is making, and the possible effects of it, which exceeds the knowledge of the general public. In my point of view, it is in these crossing aspects of responsibilities that we find some of the most important ethical challenges for the computer professional. On one hand it is his job and his obligation to make a system to his client's specification, on the other hand, it is his responsibility not to partake in the making of a system that might cause harm to someone or something, independent of his client's wishes.

What then would be his moral obligations to his client? Bayles mentions honesty, candour, competence, diligence, loyalty and discretion. But as the expert in his field, it follows from the argument above that he also will have obligations to give advice to his client of what is the better system and of possible negative effect of that system.

What then would be his moral obligations towards society? From the argument given above, it would be the same as those towards his client; to be honest and competent in his work and to give advice to what is the better system and to warn about possible negative side effects. But it would also mean to put down his foot if a client wants a system that is not in the public best interest, or to blow the whistle if a system he knows is not safe is about to be released to the market.

So, these are his obligations. What then would be the prerequisite for him to be able to carry out his obligations? Tavani discusses several important aspects of this:

He refers to Helen Nissenbaum, (Nissenbaum [1995] 2004 pages 109-110 in Tavani) who argues that there is a need for an industry standard that defines an adequate practice for development of reliable software. Such a standard, she claims, would enable us to distinguish between malfunction due to inadequate practice and malfunction that occur despite of a programmer's or designer's best effort. I do not agree completely with her view. In my opinion, the problem with this is that there exist many, if not standards, so-called industry best practises that try to function in this way. But none of them is suited for all kinds of development projects, and none of them rids the professional of the need to apply his judgement. Even if he followed a standard, he might be guilty of malpractice because the standard was not suited to the specific situation.

Further, the problem of many hands is discussed. (Tavani 2004, page 108). This is important because usually a great many people is involved in the development of a software system, and it is very difficult to find one person who in the end is responsible for a possible malfunction of the system. Every IT professional should in principle be held responsible for his work. But the problem is that he carries out his work in a context heavily influenced by the often more than ten others involved in the development, and to requirements specifications that he might not have had any influence on. It is therefore often impossible to pinpoint the blame on a single individual, and even if we did, it would most probably be unfair.

In this context, Nissenbaum stresses the importance of accountability for software systems. Accountability is important as something apart from responsibility and liability. Liability is a legal concept that typically applies to corporations, usually with some compensation involved and responsibility often has a moral connotation and is usually attributed to individuals. Accountability on the other hand does not necessary attribute blame and can apply to individuals, groups of individuals and corporations. So an entire organization could be accountable for the malfunction of software developed by its employees, even if there would be no person or persons to hold responsible for making mistakes.

Finally, Tavani discusses the issue of whistle blowing. (Tavani 2004, pages 100-106). The point is, when could or should the IT professional "blow the whistle"? Whistle blowing is defined in Tavani (2004, page 102) as: "the act of an employee informing the public on the immoral or illegal behaviour of an employee or supervisor" or alternatively as an act in which one "makes revelations meant to call attention to negligence, abuses or danger that threatens the public interest". As such it is an act that involves a certain degree of both disloyalty towards his employer and personal courage on the part of the professional. And it is not straightforward for an individual to know when it is the right thing to do. De George (De George, Richard [1981] 2004 page 104-105 in Tavani) has offered some specific conditions for when an engineer is permitted to and obliged to blow the whistle about the safety of a product. But he adds that engineers should not be required to be heroes. Others think that engineers, because of the position they hold, should be expected to make greater sacrifices than others. Here McFarland (McFarland, Michael C. [1991] 2004 pages 105-106 in Tavani) offers the interesting point of view that collectively, engineers should be held to a higher standard of social responsibility than the individual engineer. McFarland recognizes that engineers as individuals might not always have the ability, or the courage, to do the right thing, but that collectively, as a group they might succeed, and with considerable less cost to

the individual. That brings us to the next important topic, the code of ethics for computer professionals.

Code of ethics for computer professionals

Many professions have established professional societies, which in turn have adopted codes of conduct. This is also the case in the computing profession. In my quest to pinpoint the special responsibilities of the IT professionals, it will be very useful to see what guides like this have to say about the subject. It will also be interesting to evaluate both their content and usefulness as guidelines for the IT professional in ethical conduct. I have chosen the IEEE/ACM Software engineering code of ethics and professional practice (SECEPP), because I believe it to be the most applicable in this context. (Tavani 2004 appendix C)

The main objective of a professional code of ethics is to: "inspire, guide, educate and discipline the members". (Tavani 2004, page 93). They inspire by providing a positive stimulus for ethical conduct, guide and give advice for individual members when they confront situations that are morally complex, educate by informing the members of their responsibility as professionals and discipline if they specify grounds for punishing members. (Martin and Schinzinger, [1995] 2004 page 93 in Tavani). A secondary role is to alert prospective clients of what to expect or not to expect of way of service from a member of that profession. (Ladd [1995] 2004 page 93 in Tavani).

Professional codes of ethics are criticized by some for being too vague, self-serving, inconsistent, unrealistic and unnecessary. And Tavani adds (2004, pages 93-94) – they tend to be incomplete. Also there is often some confusion in the lists between responsibility for the individual contra the organisation. A different and very interesting argument against these codes comes from John Ladd (Ladd [1995] 2004 page 94 in Tavani).He argues that since ethics is basically an open-ended, reflective and critical intellectual activity and ethics is a field of study that needs to be examined, explored, discussed, deliberated and argued, to have a directive list of professional code might give the professional the misconception that there is a set of fixed answers to ethical challenges, and all there is to being ethical is to follow the directives. Nevertheless, many are in favour of professional, ethical codes, even some of the critics of certain aspects of the professional codes still have defended or praised them. Michael Davis (Davis [1995] 2004, page 95 in Tavani) argues that they are very important for engineering professions because they are central to advising engineers how to conduct themselves. Davies point out that they will guide the individual engineer in evaluating his conduct against external standards and better understand his profession.

The IEEE/ACM Software Engineering Code of Ethics and Professional Practice (SECEPP)

This is a joint code of ethics for software engineers developed by the ACM and IEEE. It is organized in two main parts: a short version and a full version. The guide comprises eight core principles:

- *Public*: the software engineer shall act consistently with the public interest
- *Client and employer*: The software engineer shall act in a manner that is in the best interest of their client and employer, consistent with the public interest
- *Produc*t: the software engineer shall ensure that their products and related modifications meet the highest professional standards possible

- *Judgement*: the software engineer shall maintain integrity and independence in their professional judgement
- *Management*: software engineering managers and leaders shall subscribe to and promote an ethical approach to management of software development and maintenance
- *Profession*: software engineers shall advance the integrity and reputation of the profession consistent with the public interest
- *Colleagues*: software engineers shall be fair to and supportive of their colleagues
- *Self*: software engineer shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

In the discussion in Tavani (2004 page 92-95) about ethical codes in general, it was noted that they could be at the same time too vague and too specific; too vague to be of any use, and too specific to allow for necessary ethical reflection. In the case of SECEPP, supporters believe it achieves an ideal balance between the general and the specific. The preamble to the short version summarizes aspiration at a high level of abstraction; the specific clauses included in the full version give examples of how these aspirations change the way software engineering professionals act as professionals.

So, what role could this code have in educating IT students? I think it definitely has to be given a thorough examination. For the students it will serve all its designations: to inspire, to guide, to educate and maybe to discipline. Used in the context of an ethics course the possible shortcomings of the code would not be critical. On the contrary, it would be an important aspect of the course to educate the students in evaluating and making use of a code like this as a guide and as a supplement to their own judgements. As the code states in its preamble to the full version (IEEE-CS/ACM Software Engineering code of ethics and professional practice, version 5.2 as recommended by the IEEE-CS/ACM Joint Task Force on Software Engineering Ethics and Professional Practices, Tavani 2004 appendix C):

- *the code is not a simple ethical algorithm that generates ethical decisions ..…ethical tensions can best be addressed by thoughtful consideration of fundamental principles, rather than blind reliance on detailed regulations. These principles should influence software engineers to consider broadly who is affected by their work; to examine if they and their colleagues are treating other humans with due respect; to consider how the public, if reasonably well informed , would view their decisions; to analyze how the least empowered will be affected by their decisions; and to consider whether their acts would be judged worthy of the ideal professional working as a software engineer. ….. Public Interest is central to this code.*

Sum up – what are the important points of this section?

I think the important points are:

- An IT professionals (like other professionals) will have moral obligations towards society, because they are experts in a field that has a potential impact on society. They will also have a professional obligation to their clients, such as honesty, competence and discretion, and they should be expected to give advice regarding what is the better system and possible negative side effects of software systems.

- Some argue that the responsibility of computer professionals should be narrowed down to issues concerning design, development, delivery and maintenance of computer systems, while others take the view that a broader model is needed. I narrow my discussion of the responsibilities of the IT professional to those issues that have a direct impact. I will, however, take into consideration Tavani's view that IT-students will also benefit from discussing the more indirect issues in their curriculum. One important reason for this is the computer professional's role in the interdisciplinary activity for analyzing cyberethical issues that Tavani refers to as a comprehensive cyberethics methodology
- When discussing the responsibilities of IT professionals, the problem of many hands is an important one. Usually a great many people are involved in the development of a software system, and it is very difficult in the end to find one person who is responsible for a malfunction of a system. An IT professional should always be responsible for his work, but in most cases it would be wrong to blame one person for a possible malfunction of a software system. Nissenbaum stresses the importance of accountability for software systems and states that rather looking for one person to blame an organization should be accountable for possible malfunction of software developed by their employees
- A computer professional, like other professionals, has a moral obligation to "blow the whistle" about unsafe products. But because this always includes a certain degree of disloyalty towards his employer and some personal courage on his part, it would be more effective if the act of whistle blowing was carried out by the professional body rather than by the individual
- Many professions have established codes of ethics for their members. So also the computer profession. While such codes of conduct have shortcomings, they are important because they can "inspire, guide, educate and discipline the members of that profession". The shortcomings are said to be that they are at the same time "too vague and too specific". Used in the context of an ethics course, these shortcomings would not be critical and the guide would be an important part of the course.

Objectives – what should we aim at?

The above topics and discussions should be a basis for formulating the objective of teaching ethics to our IT students. I stated earlier that an objective might be to give them practical tools to use when faced by an ethical challenge. It is true, but as an objective it is far to narrow. In my point of view this would be a good objective for an ethics course for IT students:

> *The objective is to give the students enough awareness of ethical thinking in general, and ethical challenges pertaining to cyberethics in particular, to raise their awareness and prepare them for the ethical challenges they will meet in their profession. It is further a goal to give them practical guidelines that can assist them in finding ethically legitimate responses when faced with ethical questions.*

How to teach ethics to IT-professionals

Based on the above discussions, I move on to the main objective of this paper, the recommendations for the ethics course for my students. I will discuss both the curriculum – the topics to include, and the approach – the way to do it. But first I will take a brief look on what is a recommended from the Joint Task Force on computing curricula of the IEEE Computer Society/Association for Computing Machinery.

IEEE/ACM Computing Curricula – CS280 Social and professional issues

The Computer Society of the Institute for Electrical and Electronics Engineers (IEEE-CS) and the Association for Computing Machinery (ACM) have, as a joint effort, developed curricular guidelines for undergraduate programs in computing. The guidelines include:

- the CS body of knowledge
- the CS undergraduate core – that is, the topics that represents core material in the body of knowledge
- learning objectives for the body of knowledge
- curriculum models that is, six approaches that have proved successful
- detailed course descriptions for 47 courses that are part of the various curriculum models

In addition, they have identified more that 80 additional advanced courses that would be appropriate for undergraduate programs. As part of that, we find a description of a course called: *Social and professional issues* with the following syllabus:

- History of computing (1 core hour)
- Social context of computing, introduction to the social implications of computing (3 core hours)
- Methods and tools of ethical analysis; making and evaluating ethical arguments, identifying and evaluating ethical choices (2 core hours)
- Professional and ethical responsibilities (3 core hours)
- Risks and liabilities of computer-based systems, historical examples of software risks (2 core hours)
- Intellectual property (3 core hours)
- Privacy and civil liberties (2 core hours)
- Computer crime (3 hours)
- Economic issues in computing (2 hours)
- Philosophical framework, utilitarianism, deontological theories; problems of ethical relativism; scientific ethics in historical perspective (2 hours)
- Elective topics (17 hours)

As shown in parenthesis, each of these topics is marked with a recommended time spent on that topic in class and also whether the topic is considered a core topic of the course or not. The recommended time is the time that would have been spent in class by introducing the topics in a traditional lecture. But this does not imply a recommendation that the material is in fact presented as a lecture. And it important to notice that the marked time is not the total time needed to study the material. For each recommended hour one should allow for three hours work outside class. The total hours of the recommended material are 40 hours, which gives a total time of 160 hours. For the core topics, the hours in class are 16 with a total of 64.

The IEEE/ACM recommendation gives very little advice on how to teach the recommended topics. There is a brief note, saying that the different topics might be included in several other courses, or might be taught as one unit, one course:

> *In many ways the ideal approach is to include discussion of the material in a wide variety of courses so that the students have the chance to consider these issues in the context of each technical area. Unfortunately this strategy sometimes fails to have the desired effect. Unless faculty members commit to give this material serious consideration, social and professional issues are often given low priority in the context of other courses, to the (effect that it) sometimes wind up being left out altogether in the press to cover more traditional material. To ensure that students have a real opportunity to study this material, many departments choose to devote an entire course to social and professional issues. Programs that adopt this strategy must make sure they make the material relevant to students by discussing these issues in the context of concrete examples that arise in computer science.*

(Computing Curricula 2001). When we look at the recommended topic in this course and compare them with my earlier discussion, it is noteworthy that:

- The philosophical framework is not a part of the core recommendation
- Professional and ethical responsibilities have a core part, but the problem of many hands and the difference between personal responsibility and organizational responsibility are not discussed
- The core topics cover both what was earlier referred to as issues with a direct impact (issues concerning the design, development, delivery and maintenance of software systems) and issues with an indirect impact (the impact of cybertechnology on society in a broader sense), but perhaps with a major focus on the indirect issues

What to include – the curriculum

I will now move on to discuss which topics to include in an ethics course for our students. But first it is important to have a look at some limitations that must be taken into consideration.

Governmental regulations

Our students follow a programme for a bachelor degree in "*ingeniørfag*". That means that their curriculum is regulated in a broad sense by the government (Utdannings og Forskningsdepartementet (UFD) *Rammeplan for ingeniørutdanning*, 2003). In these regulations we find a recommended body of knowledge, learning objectives and a framework for what and how much should be included of the different topics.
In the objective, we find the following:

> *Grunnutdanningen i ingeniørfag har som hovedmål å utdanne ingeniører som kombinerer teoretiske og tekniske kunnskaper med praktiske ferdigheter, og som tar et bevisst ansvar for samspillet mellom teknologi, miljø, individ og samfunn…*
>
> *…etter endt studium skal kandidatene kunne: …forstå og praktisere profesjonell og etisk ansvarlighet…*
>
> *(Translated: the basic education in "ingeniørfag" has, as its main objective, to educate "ingeniører" that combine theoretical and technical knowledge with practical abilities and assume a conscious responsibility for the interrelationships of technology, environment, human beings and society*

… after completing their education the candidates should be able to …understand and act upon both their professional and ethical responsibilities)

The body of knowledge is classified in five parts: mathematical and natural sciences, social issues, technical issues, elective topics and a capstone project. Of these topics, social issues are given a total of 15-20 "*studiepoeng*" and shall cover: economics, languages, communication, organizational theories, administration, management, laws *and ethics*. This shows that ethics has to compete in its category with many recommendable topics.
In principle, there could be room for ethics in the 10-20 "*studiepoeng*" of elective topics, but in my point of view it is not realistic to plan for it. There are so many highly recommendable topics that could be included in our student's curriculum. Ethics is only one of them, and we have to recognize the fact that since it is not a technical topic, in the core of their education, it is easy to give it low priority. Everyone agrees, in principle, that ethics is very important. But when ethics has to compete with more technically oriented topics like advanced databases, advanced programming, etc. recognized by both students and teachers as more important, it is easy to see that it might loose in the competition.

The point is, I have been given an opening for including ethics in our curriculum, but I can not expect to find room for the ideal ethics course. There have to be serious compromises. In my situation, ethics at the moment is planned as a part of a 6 "*studiepoeng*" course that shall cover management of IT projects and communications as well as ethics. Optimistically, I might plan for ethics as approximately one third of that course, which means 2 "*studiepoeng*", which again translates into 40 to 50 hours of work, as compared to the recommendation from IEEE/ACM of 160 hours, all topics included, or 64 hours, only core topics included.

One could figure out a way of including some of the topics in other courses, and some of them are in fact a natural part of discussions like: What is quality of computer systems, and who is to decide? Or: How to do risk analysis for software development. Here, the word ethics might not be mentioned at all, but these discussions would all the same be very important for raising their awareness about their ethical responsibilities as computer professionals.

The situation of the students

Another important limitation or obstacle might be found in the students' attitude. Or to phrase it more directly, ethics might not be the favourite topic of the average, 20 year old computer student. So, what would be the implication of that? On one hand, this is not an argument; we still have to give the students what we consider to be in their own best interest. On the other hand, it is important to take this into consideration when we design the course. We want the students to benefit from the course; not only in gathering the obligatory "*studiepoeng*", but in such a way that it makes a difference to their ethical awareness and the way they feel about their professional responsibilities. Otherwise it might be just a waste of time and effort both for us and for the students. So, how do we do that? There is not an easily obtainable answer to that. Ideally, I think that ethics is best discussed with people that have both some life experience and some professional experience, of which the 20 year old computer student has neither. Generally, I always find it very demanding to give answers to people that has not yet asked the questions. Faced with such a situation, one should always put great care in raising the students' awareness about the problem, before discussing the solution. Translated into our ethics course, one should start by giving them real life examples of ethical challenges pertaining to their profession, before ethical theory is discussed at all. More about that when I discuss the approach.

The curriculum for an "ideal" ethics course

In this section I will give an overview of what I would include in an ethics course, if I were free to shape it the way I think it should be. Here I have aimed for a full 6 "*studiepoeng*" course, which should be a total of 120 working hours for the students. I have marked each section with recommended hours spent, and in this has used the same way of marking the time as is used in the IEEE/ACM computing curriculum That is, for each hour marked one should multiply by four for getting the total working hours for the students. In the next section I will discuss the realism of this course in my context, since I have only one third of the time that I recommend to spend on ethics. Please note that while the sequence of the topics may be the logical one from a contents point of view, it might still not be the sequence in which the topics are best introduced to the students. More about that when I discuss the approach.

Why ethics for IT professionals (2 hours)

Objective: The objective is to give a strong defence for (give an understanding of) including an ethics course in a technical education

Topics: Defining cyberethics, Is it valid to talk about cyberethics as something apart, Three perspectives on cyberethics, Typical cyberethical challenges

I discuss these topics in more detail on pages 3-4 in this paper under the heading: *What's so special about computers - cyberethics*

Ethical theory (6 hours)

Objective: The main objective would be to give the students an understanding of ethical thinking, and very important, that there is more than one response to a given ethical problem that can be defended as ethically legitimate, depending on what moral theory is applied and how it is applied. They should be familiar with a set of ethical theories that can guide them in their deliberation on the ethical challenges they will meet in their profession. Further they should get some help in understanding the validity of logical argumentation – what are valid arguments, and how to discover typical fallacies in argumentations?

Topics: Defining ethics and morality, A look at ethical dogmatism, relativism and pluralism, Four representative ethical theories (virtue ethics, social contract, consequentialism, deontology), Critical thinking skills and construction of valid arguments.

I discuss these topics briefly with reference to an excellent text book (Tavani 2004) on page 3 in this paper under the heading: *A brief look at ethical theory and tools for evaluating cyberethical issues.*

Ethical issues for IT professionals (6 hours)

Objective: The main objective is to give an introduction to typical ethical challenges for the IT professional and foster awareness and understanding in the students of their role and responsibilities in society as IT professionals.

Topics: Professionalism and ethical responsibilities for IT professionals, The IT-professionals role in an interdisciplinary activity for analyzing cyberethical issues, The problem of many hands and an introduction to accountability, Blowing the whistle, Introduction to the IEEE-CS/ACM SECEPP

I discuss these topics in more detail on pages 5-10 in this paper under the heading: *Professional responsibility for IT professionals.*

Cyber ethics in a broader sense (4 hours)

Objective: Cybertechnology has a significant impact on society in general. Therefore it is important that IT professionals gain an understanding and awareness about typical cyberethical issues, even if they have a more indirect impact on them as professionals. The objective of this section is to give that understanding.

Topics: Privacy and cyberspace, Computer crime, Security in cyberspace, Intellectual property

I have not gone into these topics in any detail in this paper, except that I am in favour of Tavanis' view (2004, page 13) that computer students would benefit from and would find it interesting to study some cyberethical issues with a more indirect impact on them as professionals. See also pages 5 and 10 in this paper. For reading on these topics, one could use either Tavani (2004) that treats these topics in an excellent way in chapters 6-10, or one could use Hartvigsen et al. (2000). Both books give excellent examples of typical cyberethical dilemmas in these areas.

Elective topics (12 hours)

Objective: the objective is to give the students opportunity to explore some of the ethical issues in depth.

Topics: A whole range of topics could be included; the topics in the previous section are a natural choice. This part should be a mix of guest lectures on specific topics and project work where the students should be (relatively) free to pick the topic of their interest. The project work should be carried out in groups and the result presented in class.

How to do it – the approach

As stated earlier, I might plan for ethics as approximately one third of a 6 "*studiepoeng*" course, which means 2 "*studiepoeng*", which again translates into 40 to 50 hours of work for the students, and approximately ¼ of that in class. This is fare from ideal, and I have to select my topics and the way they are presented very carefully to get the most out of this situation. Because of the limited time I can not cover the previously mentioned topics in the way I think they should be covered. That gives me two options: I can limit the number of topics or I can keep all the topics, but cover them in a more summary and/or superficial way. I will do a combination.

For organisation of the students' work I will divide the students into groups of four and let them do most of the assignments in groups. Their assignment work would be an important part of the course, and should be partly accountable for their grade.

As textbook I will use either Tavani (2004) or Hartvigsen et al. (2000). At the moment I am in favour of Tavani.

The curriculum

I will have the following agenda, please note that the marked hours are hours spent in class and that the total working hours for the students would be approximately four times that number.

Examples of cyberethical challenges - lecture and discussion in class (2 hours)

I will start by giving the students real life examples of ethical dilemmas or challenges pertaining to cybertechnology. Both Tavani (2004) and Hartvigsen et al. (2000) have some excellent examples that I am sure would catch their interest and attention. And recently there have been some spectacular examples in the news that have sparked public discussions with very adverse views represented. These examples would be cyberethical issues more indirect to their profession and not narrowed down to professional ethics for them as designers and developers of computer systems. The examples should be a basis for a discussion in class of what the students think is right or wrong in the different situations.

I would then move on to discuss the term cyberethics a little bit and try to explain why people like Tavani (2004) and Hartvigsen et al. (2000) find it legitimate and useful to treat cyberethics as something that needs special attention.

Cyberethical issues - assignment with presentation and discussion in class (2 hours)

I will give the groups the assignment of finding their own examples of real-life cyberethical challenges, which should be discussed among the group members. The discussions should be documented and each of the groups should be prepared to present the example and the discussion in class as a basis for further discussion. It would not be possible or worth while to have all groups present, so a selection must be done.

Ethical theory - lecture (2 hours in class)

Then it is time to introduce some ethical theory. Here I would like to find a guest lecturer with a background in philosophy and a solid understanding of cybertechnology. Preferably a young person that might convince them that ethics is not the food only for grandmothers (like myself) but highly relevant also for a young, aspiring computer professional. The theory to cover would be a brief definition of ethics, a look at ethical dogmatism, relativism and pluralism and a brief introduction to representative ethical theories.

Privacy and intellectual property – lecture and discussion (2 hours in class)

The notion of privacy and the threats against privacy is very central when discussing cyberethics. This might have been covered some in the first lecture, as examples of cyberethical challenges, but might be worth exploring a bit more. They same goes for intellectual property. In both cases, there are laws and regulations in Norway that the students should know about. They should also know that neither the notion of privacy or of intellectual property is universal, and that laws and regulations in different countries would vary accordingly.

Professional ethics for IT professionals – lectures and discussion in class (2 hours in class)

The main objective of this part is to introduce them to the special ethical challenges and responsibilities they will meet as professionals in their field. Topics to be covered would be: professionalism and ethical responsibilities, the problem of many hands, blowing the whistle,

responsibility to the customer and to society, introduction to IEEE / ACM SECEPP and some of the discussion about codes of conduct in general.

Elective topic with presentation in class (2 hours in class)

A fair proportion of the students work should be on an in-depth study and discussion of a chosen topic. Topics could typically be on the topics covered in the previous sections. Good examples would be: on privacy or intellectual property, on the different ethical challenges for the IT professional as a professional or on a discussion about codes of conduct. In this study they should use examples, preferably from real-life, and they should try to apply some ethical theory in their discussion.

The students should be prepared to present their work in class as basis for discussion among all students. Since it is not time for all groups to present, a selection among the groups must be made.

Conclusion and sum up

The aim of this paper has been to explore how ethics could and should be introduced as part of the curriculum of IT bachelor students at the Sør Trøndelag university college. I take the view, in accordance with Tavani (2004), that cyberethics is an area of applied ethics that needs special attention and that the IT professional would have an important role in this. Further it is my belief that the average IT professional would not have the ethical awareness needed unless he has spent some time studying ethical theory and pondering specific ethical questions and dilemmas created by IT. It is therefore important that the education we give IT students focuses adequately on this.

In this paper I have explored a bit the nature of the ethical challenges that an IT professional will meet. The challenges stem from ethical issues that affects him directly, as a result of his role in the shaping and development of IT systems, but also from the more indirect issues, those that come as a consequence of the widespread use of IT technology in society. Even if he has no direct role in the shaping of this technology, it might be his responsibility as a professional to speak up or act on behalf of the public, because of his professional expertise. A broad discussion about these challenges, both the direct and the indirect ones, should be the core of an ethics course, together with some guidelines that can aid the students in finding ethically legitimate solutions to these challenges. Important such guidelines are a set of ethical theories. Likewise, a code of conduct developed by the IT profession (SECEPP developed by a joint committee of IEEE-CS and ACM), might prove useful in this context.

While there is a broad consensus that ethics is an important topic for the IT students, it is still not easy to make “the perfect ethics course”. The reason for this is the competition from other important topics and the limited amount of time available in their curriculum for such topics as ethics. In my recommendations I have therefore had to make serious compromises, both of the number of topics to be covered and the depth of their coverage. Still I feel confident that the topics and the approach that I recommend in this paper will be both beneficial and interesting for the students in question.

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