On the Importance of Teaching Professional Ethics to Computer Science Students

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Abstract. In recent years there has been an increase in the general public awareness of the ethical aspects of technology. The attention given by the media to computer-related disasters in technical systems such as the explosion of the Ariane 5 rocket in 1996 and the Therac-25 computerized radiation machine overdoses has stimulated interest in Computer Ethics.

Most engineering is performed within profit-making organizations operating within a complex structure of societal and regulatory constraints. Engineering has a direct and vital impact on the quality of life of people and the services provided by engineers are required to take into consideration the safety, health and welfare of the public. Engineering Ethics is therefore of relevance to the majority of people within Computing. Research Ethics or Educational Ethics apply to those professionals in Computing who are active within research and education. Other branches of Ethics such as Healthcare Ethics and similar may apply to other Computing professionals.

The field of Computing has its own particular ethical problems that are important to address and therefore Computer Ethics has developed as a specific field of study. It is vital to recognize that prudent ethical judgment is a crucial, integral part of professional computing skills.

A code of professional ethics appears when an occupation organizes itself into a profession. It is central to advising individual professionals how to conduct themselves, in judging their conduct, and to an understanding of a profession.

The aim of this paper is to shed light upon the significance of teaching ethical issues in the field of Computing. It argues that education in ethics should be incorporated into computing curricula. Experience from the course Professional Ethics in Science and Engineering given at Mälardalen University in Sweden is presented.

Introduction

Today computers play an essential role in industry, commerce, government, research, education, medicine, communication systems, entertainment and many other areas of our society. Professionals who contribute to the design, development, analysis, specification, certification, maintenance and evaluation of the many different applications of computer systems have a significant impact on society, making thereby beneficial contributions to society, but also, possibly, some less positive.

To ensure that their efforts will be used for the general good, Computing professionals must commit themselves to making Computing a beneficial and respected profession, promoting an ethical approach to their professional practice.

Computing Curricula 2001, The Joint Task Force on Computing Curricula of IEEE Computer Society and Association for Computing Machinery (ACM), emphasizes strongly professional issues, making it a part of a core curriculum for computing see Websites [1].

In Sweden, only certain colleges and universities offer their students an opportunity to study professional ethics. The Royal Institute of Technology, KTH for example has courses in

Engineering Ethics and we at Mälardalen University have developed a course in Professional Ethics in Science and Engineering, presented for the first time in 2003.

1. What is Computer Ethics

"There are few things wholly evil or wholly good. Almost everything...is an inseparable compound of the two, so that our best judgment of the preponderance between them is continually demanded." Abraham Lincoln

Computer ethics might be defined as the analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology. (Moor, 1985)

This sense of the word "ethics" is linked directly to the original sense of the Greek word *ethos*, which meant "customs", as did *mores* the Latin root of "morals".

Ethical problems arise most often when there are differences of judgment or expectations about what constitutes the true state of affairs or a proper course of action. The engineer may be faced with contrary opinions from within the firm, from the client, from other firms within the industry, or from government. An individual makes ethical decisions, in his/her capacity as a member of different groups. In order to make ethical decisions, an engineer interacts in many directions and within many different contexts, each of which can show the actual situation in a different light. For example, solving the problem on the relation individual – colleagues – management could lead to certain choices, which e.g. do not necessarily coincide with the views of his/her own family or friends, or the clients, authorities, societies or other industries.

When faced with a moral/ethical dilemma, a professional must be able to make rational and well-motivated decisions. Courses in Ethics can help professionals by offering tools and methods helpful in such situations.

2. Uniqueness Debate in Computer Ethics

The basic *principles* of ethics are constant, no matter in which area they might be applied. The principles of medical ethics, legal ethics, and computer ethics are not different from one another. However, new circumstances related to the computer do raise new questions about *how* these principles are to be applied, introducing the concept of *policy vacuums* designated thus by Moor, see Moor 1985, Johnson 2003, Tavani 2002 and references therein, and Barger, 2001. A general comment can be made regarding the uniqueness debate. Similarity is always *relative*. Two things that are similar are always *similar in certain respects*. *Uniqueness* is a matter of focus and context. Looking at the set of all possible ethical problems, different patterns can be recognized permitting their grouping into medical ethics, political ethics, environmental ethics, business ethics etc. The criteria for grouping problems within certain fields are several. One is the importance of the ethical problem. The other is its specific and unique character. Tavani 2002 concludes his article on the uniqueness debate stating that the computer ethics issues are both philosophically interesting and deserving of our attention, no matter whether those issues are unique ethical issues.

In what follows I will argue that the social importance of the computer as a revolutionary machine together with its specific features do give rise to new ethical problems and legitimize the introduction of the field of Computer Ethics. Following is the list of the unique features of computing technology.

Logical malleability. Computers are logically malleable in that they can be shaped and moulded to perform any activity that can be characterized in terms of inputs, outputs, and connecting logical operations (Moor, 1985). Computers are therefore used as tools for representation, modelling and simulation and they are a materialization of our conceptual knowledge of the world. For our epoch they are The Revolutionary Machine in the same sense as the steam engine was for the industrial era. The ethical consequences of the fact that the computer is an artifact defining our present day culture are many. Computing has become a complex and growing part of society – with profound and broad social implications. To be able to understand the problems within the field a specific technical expertise is necessary.
One can ask the following question in order to elucidate the uniqueness issue: Why not car ethics? Even though the automobile is almost as ubiquitous as a computer, the ethical questions (safety and environmental impact) related to cars are conceptually relatively simple and already taken into consideration by other ethical disciplines. The complexity of ethical issues related to computers, together with their prominent cultural role and the fact that an understanding of the technical details of the problems involved is often necessary to be able to see its ethical implications clearly provides a foundation for Computer Ethics as a specific applied ethics discipline.

*Speed. A*n example in which speed can have ethical consequences is when, after reading some posting or e-mail, a person responds with an e-mail in which she/he uses an immoderate tone, a tone which would not have been used if she/he had taken the time to write a traditional letter or had contacted the recipient in person or by phone. Speed and the simplicity of handling large amounts of data are connected with some other ethical problems such as privacy and security.

Storage of huge amounts of data. Once recorded and shared with other computers, information about people (accurate or inaccurate) can invade privacy in a way never before possible in history. The ease with which data saved in a computer can be manipulated (as if they are greased (Moor 2004)) makes the use of surveillance, monitoring and spyware methods really easy from the technical point of view.

Identity. It is possible with a computer to steal another person's identity, forge a message, or send a message anonymously. Present day vague identities make possible "spam", for example. There is an ongoing ethical debate about the pros and contras of anonymity, and under which condition it can be an acceptable way of communication.

Internationality. Computer communication does not stop at national boundaries. What is considered legal in one country might be forbidden in another country.

Copying. Images, text and sound can be copied with a computer in a few seconds by a few clicks and can easily be used without attribution to the author or out of context. This causes the ongoing discussion about intellectual property.

Openness and availability. Computer networks make it easy for the user to come across a virtually unlimited amount of diverse information, even in cases of e.g. pornography, gambling, or sites with any kind of propaganda or superstition, which might be difficult to handle for certain groups of users. Cyberstalking is an example mentioned in Tavani 2002. Even spam and other unwanted messaging is a consequence of the openness of the system and availability of the data (e-mail addresses for example).

Power mediation. Computing is still a well-educated-younger-male-dominated field. This domination can be seen as an inequity. The computer is increasingly becoming such a basic

tool that it is wrong for certain social groups not to have equal access to it, especially in the e-government era. The related ethical questions are the power distribution, equal opportunities, equity, fairness and justice.

Privacy. Computers make very suitable tools for among others surveillance, collecting data about people and relating data about different people in order to disclose their habits and patterns of behavior. Those methods can be used to enhance public security and safety, but also to invade the privacy of the citizen. The concerns about the privacy protection for citizens result in an *intentional design for democracy*, which is a project to incorporate privacy protection into technology design and practices.

3. Codes of Ethics and Professional Conduct

How can we work to ensure that computing technology advances human values? It is necessary to integrate computing technology and human values in such a way that the technology advances and protects human values, in preference to harming them.

Professional societies in science and engineering publish their ethical codes or guidelines. See Websites [4-11] which present a sampling of ethical codes from societies of professional engineers and scientists. Some differ widely in their content, because of their origins and their specific purposes, but the topics covered by others and the general ethical standards they articulate are similar.

Codes of Ethics express the consensus of the profession on ethical issues. At the same time they are a means of educating the general public about the ethical norms and values of the profession. An essential characteristic of a profession is therefore the need for its members to conform to its Code of Ethics.

Professional codes of ethics should be understood as conventions between professionals.

Having a code of ethics allows an engineer to object to pressure to produce substandard work not merely as an ordinary moral agent, but as a professional. Engineers (or doctors, or clergy, etc.) can say "As a professional, I cannot ethically put business concerns ahead of professional ethics." Davis, 1991.

Harris, Pritchard, 1995 summarize Stephen Unger's analysis of the possible functions of a code of ethics:
"First, it can serve as a collective recognition by members of a profession of its *responsibilities*. Second, it can help create an environment in which *ethical behaviour is the norm*. Third, it can serve as a *guide or reminder* in specific situations…Fourth, the process of *developing* and modifying a code of ethics can be valuable for a profession. Fifth, a code can serve as an *educational tool*, providing a focal point for discussion in classes and professional meetings. Finally, a code can *indicate to others* that the profession is seriously concerned with responsible, professional conduct."

It is important to notice that codes must be interpreted and used properly in practice:

"Codes of ethics are created in response to actual or anticipated ethical conflicts. Considered in a vacuum, many codes of ethics would be difficult to comprehend or interpret. It is only in the context of real life and real ethical ambiguity that the codes take on any meaning.

Codes of ethics and case studies need each other. Without guiding principles, case studies are difficult to evaluate and analyze; without context, codes of ethics are incomprehensible. The best way to use these codes is to apply them to a variety of situations and study the results. It is from the back and forth evaluation of the codes and the cases that thoughtful moral judgements can best arise.", see Websites [9]

4. Why Study Professional Ethics?

"Would you tell me, please, which way I ought to go from here?"
"That's depends a good deal on where you want to get to."...
(Alice in Wonderland, Chapter VI, L Carroll,1865)

What is the point in studying engineering ethics? What can be gained from taking an ethics course? A professional ethics course is not about preaching virtue so that immoral and amoral students will adopt a certain established set of beliefs.

Rather, it means to increase the ability of concerned engineers, managers and citizens, to first recognize and then responsibly confront moral issues raised by technological activity. The goal is to foster moral autonomy, i.e. the skill and habit of thinking rationally about ethical issues, as well as to improve the ability to think critically about moral matters. For the role of computer ethics in the Computer Science Curriculum see Bynum T. W**.**, 2004 and Moor J. H., 1985. So: why learn Ethics? Here are some reasons:

- To deal with the true nature of computing as a service to other human beings. (Gotterbarn 1991)
- To convey a sense of professional responsibility not covered in other courses
- To sensitize students to computer ethics issues
- To provide tools and methods for analyzing cases
- To provide practice in applying the tools and methods to actual or realistic cases
- To develop in the student good judgment and helpful intuitions - ethical autonomy.

5. Professional Ethics in Science and Engineering Course at Mälardalen University

Following the lines of reasoning presented in this article, we have developed a course in Professional Ethics at Mälardalen University, intended in the first place for Computer Science and Engineering students. Its outline resembles equivalent courses at other universities. The emphasis is on *cultivating sensibility to ethical problems*, the development of moral autonomy, ethical pluralism and critical thinking.

The course gives an insight into the ethical problems important for professionals in Engineering and Science. It forms a framework in which professional and ethical issues can be analyzed, and builds up an awareness of various views of ethical issues as well as the ethical responsibilities of professionals.

The topics include, among others, the social context of a profession, conflicts between loyalties to different principles such as safety and economy, precautionary principle and environmental impact, integrity, privacy, ownership, etc. Fundamental moral theories are presented as the introductory part of the course.

We discuss Codes of Ethics (such as IEEE, ACM, Responsible Conduct of Research), and examine a series of case studies which have led to ethical dilemmas. At the same time we develop critical thinking and argumentation techniques.

The course is delivered through a combination of lectures, guest lectures, classroom training (discussions with role play), and training in writing essays. For Professional Ethics Course Syllabus 2003, see Websites [11]

6. Professional Ethics Course Evaluation

Our first year experiences have been very positive. Students have participated actively in discussions, case studies and research on chosen topics. They have shown interest even in general ethical concerns in other fields such as medical ethics or arms control. Even predominantly technically-minded students were able to assimilate and use philosophical concepts introduced by the introductory theoretical part of the course. The examination forms for the course were the writing of a research paper on an ethical topic of interest and an oral presentation of a chosen topic (such as intellectual property, environmental ethics, privacy etc.) followed by an in-class discussion led by the students responsible for the actual presentation. See more under Website [15]

7. Conclusions

The growing importance of computers in modern society makes Computer Ethics essential both when it comes to the issues related to the profession such as safety, security, privacy, environmental impact, quality, and similar and also in the everyday use of computers which gives rise to numerous ethical dilemmas.

The aim of ethics courses in science and engineering is to increase the ability of future professionals to recognize and solve ethical problems, to accept different ethical perspectives and ethical pluralism. It develops the skill and habit of thinking rationally about ethical issues and in that way prepares students for the challenges of their profession. Experiences from the Professional Ethics in Science and Engineering Course at Mälardalen University are very encouraging.

Our conclusion is that it is both necessary and possible to make Computer Ethics an integral part of computing curricula, which is the natural way to ensure its integration in the culture of the profession.

References

Barger R. N., 2001, Is Computer Ethics unique in relation to other fields of Ethics?
http://www.nd.edu/~rbarger/ce-unique.html

Bynum T. W., 2004, Computer Ethics in the Computer Science Curriculum. Supplementary materials for the book *Computer Ethics and Professional Responsibility*, edited by Terrell Ward Bynum and Simon Rogerson.
http://www.southernct.edu/organizations/rccs/resources/teaching/teaching_mono/bynum/bynum_human_values.html

Davis, M., (1991), Thinking like an engineer: The place of a Code of Ethics in the practice of a profession", *Philosophy and Public Affairs,* 20.2 150-167.

Gotterbarn, D. (1991). The capstone course in computer ethics. Proceedings of the National Conference on Computing and Values, New Haven, CT.

Harris, C. E., Jr., Pritchard M. S. and Rabins M. J., 1995, *.Engineering Ethics: Concepts and Cases,* Wadsworth Publishing

Johnson, D. G., Computer Ethics, 2003, in The Blackwell Guide to the Philosophy of Computing and Information (Blackwell Philosophy Guides), 65-75

Ladd, J., 1991, The quest for a Code of Professional Ethics: an intellectual and moral confusion, *Ethical Issues in Engineering*, Ed. Deborah G. Johnson. Englewood Cliffs, NJ: Prentice-Hall, 130-136.

Luegenbiehl, H. C., 1991, Codes of Ethics and the moral education of engineers, *Business and Professional Ethics Journal* 2 (1983): 41-61. Rpt. in Ethical Issues in Engineering. Ed. D. G. Johnson. Englewood Cliffs, NJ: Prentice-Hall, 137-154.

Martin, M.W., Schinzinger, R., 1996, *Ethics in Engineering*, McGraw-Hill

Moor, J, 1985, What is Computer Ethics, *Metaphilosophy* 16(4): 266-75.
http://www.southernct.edu/organizations/rccs/resources/teaching/teaching_mono/moor/moor_definition.html

Moor, J., 2004, Towards a Theory of Privacy in the Information Age. Computer Ethics and Professional Responsibility. Edited by Terrell W Bynum and S Rogerson. Blackwell Publishing

Tavani, H., 2002, The uniqueness debate in computer ethics: What exactly is at issue, and why does it matter?, *Ethics and Information Technology* 4: 37–54, and references therein

Websites

[1] http://www.computer.org/education/cc2001/index.htm *Computing Curricula 2001*

[2] http://www.ele.uri.edu/People/Faculty/daly/criteria.2000.html Accreditation Board for Engineering and Technology (ABET**)** *Engineering Criteria 2000 Third Edition*

[3] http://www.scu.edu/ethics/practicing/decision/framework.html, A Framework for Ethical Decision Making

[4] http://www.asce.org/inside/codeofethics.cfm American Society of Civil Engineers Code of Ethics

[5] http://www.acm.org/constitution/code.html ACM Code of Ethics and Professional Conduct

[6] www.ieee.org/about/whatis/code.html IEEE Code of Ethics

[7] http://www.computer.org/tab/seprof/code.htm Software Engineering Code Of Ethics And Professional Practice (Ieee-Cs/Acm Joint Task Force On Software Engineering Ethics And Professional Practices)

[8] http://www.iit.edu/departments/csep/PublicWWW/codes/engineer.html Codes of Ethics for Engineering

[9] http://www.iit.edu/departments/csep/PublicWWW/codes/ Codes of Ethics Online

[10] http://legacy.eos.ncsu.edu/eos/info/computer_ethics/ Ethics in Computing "site map"

[11] http://www.idt.mdh.se/kurser/cd5590/