COMPUTER ETHICS: A SYLLABUS FOR TEACHING ETHICS IN COMPUTER SCIENCE

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Abstract *— Teaching Ethics at Engineering and Computer Science at the European Universities is a essential for two reasons: we want students to do their job well as a service to the society, and more and more professional associations require it as part of their accreditation as a computer scientist (IEEE-CS, ACM). In this paper we are going to explain several topics: 1) the syllabus and methodology that we propose for a Computer Ethics course of 30 hours in the last course of an undergraduate degree; 2) the detailed content of the proposed syllabus; 3) the Computer Ethics resources that the teachers may use to prepare this course. We conclude that a Computer Ethics course must be put in place in all European universities and that we have the resources to do it now.*

Index Terms — Computer ethics syllabus, computer ethics resources, course methodology, professional association ethics codes.

INTRODUCTION

This paper has the aim to make a proposal and explain the syllabus, content and methodology for a Computer Ethics Undergraduate Course to be taught at the Computer Science Universities at European Universities. The course concentrates on theory and practice of computer ethics. The aim of the course is to study the basis for ethical decision-making and the methodology for teaching ethical decisions concerning computing matters.

The paper structure is the following: first we indicate the syllabus, methodology and evaluation, followed by a detailed description of the syllabus; later we evaluate the current Computer Ethics resources, ending with a conclusion.

SYLLABUS, METHODOLOGY AND EVALUATION

The syllabus that we propose is the following:

1. The Need for Computer Ethics Training and Historical Milestones
2. Defining the Field of Computer Ethics
3. Developing the Ethical Analysis Skills and Professional Values
4. Computer ethics codes
5. Sample Topics in Computer Ethics

The methodology that we suggest for this course is a participative one, mainly regarding the topics covered on the fifth chapter. The teacher can use a challenging approach during the first classes so the students get involved in the course as soon as possible. The first four chapters of the syllabus have a part of lectures together with an interactive dialog with the students.

The students read several papers and several chapters of the textbook of the course to cover each one of the chapters cited above. Participation in class and two written reports about two study cases are evaluated as 30 % of the final grade. A final exam is handed out.

THE NEED FOR COMPUTER ETHICS TRAINING AND HISTORICAL MILESTONES

Most of the professional associations have an ethics code so there professionals refer to it to act in a right way [1]-[2]. More and more the companies want that their employees work in an ethical way because it is beneficial for their business, customers and financial results [3]. The same happens with the profession of Computer Science. The difference is that Computer Science is so new and so innovative that perhaps there has not been enough time to mature this discipline. So if we want that the professionals work in an ethical manner we have to teach Computer Ethics as part of our Computer Science Curricula.

For addressing the historical milestones of Computer Ethics may be used [4], [5] chapter 1 and [6] editors introduction. At the 50s MIT professor Norbert Wiener's foundation of computer ethics was far ahead of his time. He published two books [7]-[8] where he says "Long before Nagasaki and the public awareness of the atomic bomb, it had occurred to me that we were here in the presence of another social potentiality of unheard-of-importance for good and for evil".

At the 60s Donn Parker began to examine unethical and illegal uses of computers by computer professionals. He headed the development of the first Code of Professional Conduct for the Association for Computing Machinery (ACM, eventually adopted by the ACM in 1973) and published [9].

At the 70s Joseph Weizenbaum thought that computers would soon be performing psychotherapy and wrote [10]. Walter Maner, while teaching a medical ethics course, began to use the term "computer ethics" to refer to that field

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of inquiry dealing with "ethical problems aggravated, transformed or created by computer technology". He published [11], which contained curriculum material and pedagogical advice for university teachers to develop computer ethics courses. In 1978, Bynum attended one of the Maner's workshops, and his life changed.

At the 80s James Moor published his influential article [12] and Deborah Johnson published the first and defining textbook [5] in the field. In 1991 Bynum and Maner convened the first international multidisciplinary conference on computer ethics, the National Conference on Computing and Values, which was seen by many as a major milestone of the field.

At the 90s thinkers like Donald Gotterbarn, Keith Miller, Simon Rogerson, and Dianne Martin spearheaded projects relevant to computing and professional responsability. Bynum wanted to spread the seeds of computer ethics around the globe and sent letters to 40 universities in Great Britain. Bynum spent the first half of 1995 at De Monfort University, where the first computer ethics research center in Europe started up, Center for Corporate and Social Responsability, and launched the Ethicomp´95 conference. Reference [13] says that the time has come to build upon and elaborate the conceptual foundation whilst, in parallel, developing the frameworks within which practical action can occur, thus reducing the probability of unforeseen effects of information technology application.

DEFINING THE FIELD OF COMPUTER ETHICS

We want to answer several questions here: What is computer ethics? Is it a branch within the ethics? Is computer ethics unique? And other related question is, who should teach computer ethics?

Reference [4] says that computer ethics in the broadest sense can be understood as the branch of applied ethics which studies and analyzes such social and ethical impacts of information technology.

Nevertheless there are several different approaches that we are going to explain. To address this topic we recommend to read [4] and [14]-[17].

As we mentioned before Walter Maner [11] was the first using the term "computer ethics". Some old ethical problems, he said, are made worse by computers, while others are wholly new because of information technology. By analogy with the more developed field of medical ethics, Maner focused attention upon applications of traditional ethical theories used by philosophers doing "applied ethics", using mainly utilitarian ethics (Mill) and rationalist ethics (Kant). But Maner [18] holds that computer use has generated a series of new and unique ethical issues that could not have existed if computer technology had not been invented. Maner argues that the "the failure to find satisfactory non-computer analogies" for moral issues involving computers "testifies to the uniqueness of computer ethics".

At the other end of the spectrum are those who believe that there is nothing new or special about ethical issues involving the use of computers.

Deborah Johnson [5] has taken what could be viewed as a middle ground in this debate. Using a genus-species analogy, she suggests that ethical issues raised by computer technology can best be understood as a "new species" of (existing) generic moral problems [4].

A somewhat different approach to the question of uniqueness has been taken by James Moor [12] who argues that because computer technology, unlike previous technologies, is "logically malleable", it gives rise to "new possibilities" for human action. These new possibilities can, in turn, create certain "vacuums" to guide the new choices for action made possible by computers. Moor argues that computer ethics is needed because "routine ethics" is not able to handle adequately many of the normative issues that can and do arise from the use of computer technology. Computer ethics is a field concerned with "policy vacuums" and "conceptual muddles" regarding the social and ethical use of information technology [4].

In Donald Gotterbarn's view [19], computer ethics should be viewed as a branch of professional ethics, which is concerned primarily with standards of practice and codes of conduct of computing professionals. He has been involved in a number of related activities, such as co-authoring the third version of the ACM Code of Ethics and Professional Conduct [1] and working to establish licensing standards for software engineers [20].

About the topic of who should teach computer ethics, Deborah Johnson proposed an answer to this question in a provocative article followed by invited responses [21]. Johnson's view is that philosophers who are trained in ethics are better prepared to teach such a course. She also states that computer scientists may teach this subject if they have "the right set of readings/and or textbooks". For example, Forester and Morrison's Computer Ethics [22] is a text which has very litlle to say about ethical issues and their analysis because it is only a long list of computer crimes. Without a clear understanding of the concepts and issues that define the landscape of morality, and without an understanding of basic ethical theory, it would seem that it would be very difficult indeed for computer science instructors who have had no formal training in ethics to acomplish properly this teaching [15]

Several philosophers (Maner and Dunlop), computer scientists and engineers (Gotterbarn, Martin, White, and Shade) answered to Johnson's article, although we are going to focus only into two of them: Martin and Gotterbarn [15].

Gotterbarn [21] argues that computer science students, more than being required to learn ethical theory and philosophical argumentation, need to be taught (a) "that there are ethical issues relevant to their professional practice," (b) "how to recognize these issues".

Martin [21] is concerned that computer science students be taught to recognize the ethical implications of specific technological issues as opposed to being given instruction that might focus too much on abstract ethical considerations and on ethical theory. Martin's objections would appear to have two distinct assumptions: (a) philosophers who have not had appropriate training in computer science are not capable of appreciating key technical issues and thus cannot effectively teach computer science courses; (b) at least certain ethical issues involving computer technology are unique.

We agree with Gotternbarn and Rogerson [16] in that "computer ethics is unique is correct in only a limited sense. It is correct that some of the particular dicisions in computer ethics are unique but the revolutionary view that the methods and fundamental priciples of ethics are unique has not been demonstrated".

We may conclude that computer ethics is an applied ethics subject. So, the teacher must know both ethics and computer science. Therefore, this subject may be divided in to two parts: (a) developing ethical analysis skills, (b) applying these ethical analysis skills to computer science. Therefore this subject must be taught by faculty that have been trained in both, ethics and computer science discipline, if he/she wants to explain both parts of the subject.

It is not a chance that the co-authors of this paper are an engineer working at a multinational company, a philosopher working at a Business School and an engineer teaching computer science at the University. We think that these interdisciplinary skills have helped to put in place a much better paper.

DEVELOPING THE ETHICAL ANALYSIS SKILLS AND PROFESSIONAL VALUES

The most important part of the syllabus of this subject is to provide the students with the tools and methodology to develop the ethical analysis skills and professional values so they are able to decide by themselves if an action related with computer science is good or bad, right or wrong. The students will be able to identify and define the components of a structured plan for solving ethical problems and, in the process, will be able to understand the basis for their own ethical system [23].

Ethics "is the science within the philosophy that treats with human moral and duties" [26]. Moral "related with the actions of the persons from the goodness or evil point of view" [24].

That is, ethics treats human actions as good or bad [25]. Ethics as a science has been studied since the Ancient Greek philosophy: Plato, Aristotle, Epicureo, Diogenes, etc. The ethical rules are therefore the tools that help us to know what we must do. We employ the word "must" in the sense that there are certain guides of action –principles, rules, goals that help human beings to live in accordance to their own condition.. Human beings are free, although they need education and training to live as such. Nobody is worthy of living well only willing to do it. Good intention is not enough, but knowledge of what is good or bad and how to achieve it (in technical and ethical terms) is also needed.. Ethics does not depend on opinions and likeness. We only give an opinion when we are not sure about what we must do in a certain case. Although most of our decissions are opinable –because rarely there is only one alternative for solving a problem- ethics, as any other science, has some principles –that work as axioms- and draws some conclusions from certain facts that are not debatable. For example, in Medicine, it is not debatable how digestion takes place, neither which food is good for us. We may have the opinion that a food is not poissoned, but our opinion does not modify the food: if it is poissoned, it is for everybody. It is a fact.

For an ethical analysis of a given situation or action plan, we propose to use three elements: the object, the circumstances and the aim of the agent [26]. The object is what I am doing. Sometimes it is expressed through how the action is named. For example, although the physical action might look alike, it is different robbery, theft, lie and bribe. The object is not only the physical reality – in a theft, remove a think from a place to other -, but it is also its qualification: to take possession of something from other people with violence, therefore against the owner's will. The bribe's object is not only the action of giving money or other good, but it is giving money for an unjust action. The object is the joint of facts or sometimes a certain situation, an identity, a specification: remove secretly (robbery); take away with violence (theft); tell the opposite to what you think (lie); attribute to another person a wrong action that he or she did not committed (slander, calumny).

The circumstances modify more or less importantly the object of the human act. The circumstances that affect the moral act may be classified into: who, what, where, with which means, why and when. A special and very important kind of circumstances is the consequences (expected or unexpected; direct or collateral) of the action. For example, when an executive bribes a civil servant there are certain circumstances to take into account. It is different that the bribe is done by a top executive than by an employee, because the top executive states a policy (who). It is different to bribe with 10 € than with 100.000 € (what); at the civil servants's office (where); with own money or with company money took away from the company (means); getting an authorization through an illegal system (why); the civil servant had the urgent need for money (when). There are extenuating and aggravating guilty circumstances. An action that it is considered wrong because of its object cannot change into a good one because of the circumstances, but a good action defined as such by its object might change into an unacceptable one because of the circumstances.

The agent's aim is the subjective purpose that the agent pursues, that is, the reasons that moves the agent to act in such a way. A bad action remains being so although the

good intention of the agent. So the finality or purpose does not justify the use of bad means to achieve it.

For an action to be qualified as ethically acceptable it has to be accepted in terms of its object, the agent's aim and a correct proportion of the circumstances –also consequences, with a special attention to the negative side-effects- involved.

COMPUTER ETHICS CODES

In this part of the subject it is going to be reviewed the most famous Computer Science Codes. We may mention the following:

1. Association for Computing Machinery [1].
2. IEEE-CS/ACM on Software Engineering [2].
3. International Business Machines.

Given several examples of professional codes of ethics related to computing, the student will be able to compare and contrast these examples, discussing their commonalities, differences, and implications [27]. Computer ethics codes are tools that may and must help to the professionals and students, but it is more important that the students build their ethical analysis skills at the undergraduate program as stages of moral development as a basis for moral education [28]. At United Kingdom universities most programs are concentrated on the British Computer Society course accreditation requirements, which currently requires only a little more than awareness of legal issues [27].

SAMPLE TOPICS IN COMPUTER ETHICS

Here the alumni are going to apply the knowledge got in the previous parts of the course to specific computer science related situations in nowadays environment.

The detailed proposed syllabus for this part of the subject is the following:

1. Computer crime and computer security
2. Software theft and intellectual property rights
3. Computer hacking and the creation of viruses
4. Computer and information system failure
5. Invasion of privacy. Privacy in the Workplace and on the Internet
6. Social implications of artificial intelligence and expert systems
7. The information technology salesman issues

A business case will be proposed to the alumni for each of the topics mentioned above. The alumni will prepare it at home and it will be analysed at the class. There are textbooks that we will cite later that collect some good business cases to be used here.

COMPUTER ETHICS RESOURCES

We are going to mention some of the resources that a teacher may use to build the curriculum of the computer ethics subject [14]-[15].

The main conferences are the following:

- Computer Ethics Philosophical Enquiry (CEPE). Sponsored by ACM.
- ETHICOMP (International Conference on the Social and Ethical Impacts of Information and Communications Technologies).
- Ethics and Technology.
- ISTAS (International Symposium on Technology and Society). Sponsored by IEEE.

The main journals and periodicals are the followings:

- Ethics and Information Technology (ISSN 1388-1957).
- The Information Society: An International Journal (ISSN 0197-2243).
- Computers and Society (ISSN 0095-2737) is a quarterly periodical of the ACM-SIGCAS.
- EEE Technology and Society Magazine (ISSN 0278-0097) is quarterly periodical published by IEEE-SSIT.

The main textbooks recommended are the following:

1. Top of the list by bibliography: Johnson's [5]. An excellent reader to accompany it is [29].
2. Recommended by the authors [26] and perhaps [30] or [31] for the fist part of the subject and Forester&Morrison [22] for the second part.
3. Bynum&Rogerson [6] is updated (2004) and is a complete course, that may take the first position.
4. Reference Spinello's [32]. A reader for it is [33].

Reference [15] includes a list of books published between 1997 and 2001 years; and a list of earlier textbooks, as well as a list of additional teaching resources is included in [34]. For a comparative review of five textbooks of the 90s you may look at [35]. Regular bibliography updates appear annually in print in two quarterly publications: June issue of Computers and Society; once per volume in Ethics and Information Technology.

Web-based resources contain material useful for preparing a course syllabus, and others research projects, and are reviewed at [36]. The URLs for many of the individual sites were accessible when the paper was written [37], but nowadays most of them are no longer available.

We have found surfing at the web several very helpful web sites for computer ethics teachers. Reference [38] includes several articles that may be used as a complement to any textbook, and the main conclusions of the first computer ethics conference launched by Bynum at 1991, where one track was dedicated to the topic "Teaching Computer Ethics." This website is also linked to Bynum and Rogerson's new text book [6].

CONCLUSION

Currently 38% universities in Spain have a Computer Ethics course, and 53% have a Computer Ethics, Computer Law or similar courses, and 17% of them have both Computer Ethics and Computer Law courses [39]. Therefore there is a gap we must fill. We have showed in this paper that we have available good resources to prepare a Computer Ethics course for our European Universities. So let's do it. Why wait?

REFERENCES

[1] Association for Computing Machinery (ACM), "ACM Code of Ethics and Professional Conduct", available on line at www.acm.org/constitution/code.html , 1992

[2] IEEE-CS/ACM Joint Task Force on Software Engineering Ethics and Professional Practices, "Software Engineering Code of Ethics and Professional Practices", available on line at seeri.etsu.edu/Codes/TheSECode.htm and at www.computer.org/compute/code-of-ethics.pdf , 1991

[3] Internacional Business Machines, "Normas de Conducta Comercial de International Business Machines, S.A., y sus Subsidiarias", 2005.

[4] Bynum, T, W, "Computer Ethics: Basic Concepts and Historical Overview", Stanford Encyclopedia of Philosophy, available on-line at plato.stanford.edu/entries/ethics-computer/, 2001

[5] Johnson, D, G, *Ética Informática*, Universidad Complutense de Madrid, 1996; original as *Computer Ethics*, Englewood Cliffs, New Jersey: Prentice Hall, 2003. The first version of the book is published as Computer Ethics, Prentice-Hall, 1985.

[6] Bynum, T, W; Rogerson, S, *Computer Ethics and Professional Responsibility*, Blackwell, 2004.

[7] Wiener, N, *Cybernetics: or Control and Communication in the Animal and the Machine*, Technology Press, 1948.

[8] Wiener, N, *The Human Use of Human Beings: Cybernetics and Society*, Houghton Mifflin, 1950; second edition revised, Doubleday Anchor, 1954.

[9] Parker, D, "Rules of Ethics in Information Processing", *ACM*, Vol. 11, 1968, pp. 198-201.

[10] Weizenbaum, J, *Computer Power and Human reason: From Judgment to Calculation*, Freeman, 1976.

[11] Maner, W, *Starter Kit in Computer Ethics*, Helvetia Press, 1978.

[12] Moor, J, "What Is Computer Ethics", *Metaphilosophy*, Vol. 16, No. 4, October 1985, pp. 266-275. Republished at [6].

[13] Rogerson, S, "The Ethics of Computing: The First and Second Generations", The UK Business Ethics Network News, Spring 1996.

[14] Tavani, H, T, "Computer Ethics: Current Perspectives and Resources", *APA Newsletter on Philosophy and Computers*, Vol. 99, No. 2, Spring 2000, pp. 166-170, also available on-line at www.apa.udel.edu/apa/publications/newsletters/v99n2/computers/feature-tavani

[15] Tavani, H, T, "Teaching Computer Ethics Courses: Controversial Issues", Curriculum Challenges, and Current Resources, 2001, available on-line at www.fine.lett.hiroshima-u.ac.jp/fine2001/tavani_e.html

[16] Gotterbarn, D, Rogerson, S, "Computer Ethics: The Evolution of the Uniqueness Revolution", 1999, available on-line at www.ccsr.cse.dmu.ac.uk/staff/Srog/teaching/cepe.htm

[17] Gotterbarn, "The Use and Abuse of Computer Ethics", *Journal of System Software*, Vol. 17, No. 1, 1992, pp. 75-80, also available at www.sothernct.edu/orgainzations/rcss/resources/teaching/teaching_mono/gotterbarn

[18] Maner, J, H, "Unique Ethical Problems in Information Technology", *Science and Engineering*, Vol. 2, No. 2, 1996, pp. 137-154.

[19] Gotterbarn, D, "Informatics and Professional Responsibility", *Science and Engineering Ethics*, Vol. 7, No. 2, 2001.

[20] Gotterbarn, D, Miller, K, Rogerson, S, "Software Engineering Code of Ethics", *Information Society*, Vol. 40, No. 11, 1997, pp. 110-118.

[21] Jonhson, D, Martin, Gotterbarn, "Who should teach computer ethics? & Responses, reprinted at *Computers and Society: SIGCAS Reader 1996* (editor B. Jawer), New York, ACM Press, 1996, pp. 2-7.

[22] Forester, T, Morrison, P, *Computer Ethics*, MIT Press, 1994.

[23] Barger, R, N, "CAPP471 – Computer Ethics Syllabus", University of Notre Dame, available online at www.nd.edu/~rbarger/capp471syl.html

[24] Real Academia Española, "Diccionario", 21st edition, 1992.

[25] García, J, M, "La Ética como Asignatura en los Estudios de Informática", *Ethicomp'96*, Madrid, Spain, 1996 pp. 79-90.

[26] Gómez, R, *Ética Empresarial. Teoría y Casos*, Colección Empresa y Humanismo, Rialp, 1990.

[27] Turner, E, Roberts, P, "Teaching Computer Ethics to IT Students in Higher Education: An Exploration of Provision, Practice and Perspective", *Ethicomp2001*, 2001, Gdansk, Poland.

[28] Kohlberg, L, "Stages of Moral Development as a Basis for Moral Education", B. Beck, S, Crittenden & E.S. Sullivan (eds.), *Moral education – Interdisciplinary Approaches*, 1971, pp. 30-41, Toronto, University of Toronto Press.

[29] Deborah, J, Nissenbaun, H, *Computing, Ethics & Social Values*, Englewwod Cliffs, New Jersey, Prentice Hall, 1995.

[30] Fleddermann, C, B, Engineering Ethics, 2nd edition, ESource – The Prentice Hall Engineering Source.

[31] MacIntyre, A, C, *After Virtue: A Study in Moral Theory*, 2nd edition, Notre Dame, Notre Dame University Press, 1984.

[32] Spinello, R, *Cyberethics: Morality and Law in Cyberspace*, Sudbury, MA, Jones and Bartlett Publishers, 2000.

[33] Spinello, R, Tavani, H, T, *Readings in Cyberethics*, Sudbury, MA, Jones and Bartlett Publishers, 2001.

[34] Tavani, H, T, "Teaching Computer Ethics" (Section I of A Computer Ethics Bibliography), *Computers and Society*, Vol. 25, No. 2, 1995, pp. 8-18. Available online an updated version up to 1998 at www.rivier.edu/faculty/htavani/biblio.htm

[35] Tavani, H, T, "Selecting a computer Ethics Course book", *Computers and Society*, Vol. 26, No. 4, December 1996, pp. 15-21.

[36] Tavani, H, T, "Internet resources for teaching Computer Ethics Courses", *American Philosophical Association (APA) Newsletter*, Vol. 97, No. 2, Spring 1998. Available online at www.apa.udel.edu/apa/archive/newsletters/v97n2/computers/tavani.asp

[37] Jewet, T, "Open location", *Computers and Society*, Vol. 26, No. 4, December 1996, pp. 36-38.

[38] The Research Center on Computing & Society at www.sothernct.edu/organizations/rccs/resources/teaching/

[39] Lazaretti, A., Barroso, P, Melara, G, Teaching Computer Ethics at Spain and Portugal Universities, Ethicomp'95, abstract available at

www.ccsr.cse.dmu.ac.uk/conferences/ethicomp/ethicomp2005/abstracts/44.html

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