Debates on tech-related moral dilemas usign ethical theories to teach engineering ethics

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ABSTRACT

A significant number of universities where engineering is taught acknowledge the influence on society and the environment of the scientific and technological practice, as well as the ethical problems it presents, and the need to provide their students with courses covering this as a subject. The accelerated pace of innovation in these fields amplifies the issue.

Computer Engineering schools are no exception. So, the IEEE/ACM Computer Science Curriculum 2013, identifies social issues and professional practice as key knowledge areas that computer undergraduate students must learn. Students should be knowledgeable about the interplay of ethical issues, technical problems, and aesthetic values that play an important part in the development of computing systems.

The authors have taught for many years an optional course about the social, and environmental aspects of ICT as well as ethics. In this paper, the authors propose an approach to study ethics in Computer engineering schools. The approach consists in providing students with general ethic frameworks to reason about moral dilemmas as well as providing the basics of deontology. The lessons are complemented with case studies where technology is a key factor. Students are assigned roles to work on the cases and in the end, a discussion is done in the classroom.
After the lessons, the authors have observed that students are able to understand and use the tools provided by the teachers to reason about moral dilemmas.

1   INTRODUCTION

1.1 Section 1

The existence of computers and computer networks has been identified as a source of a new class of ethical and social issues since the early days of digital computers [1]. Today it is obvious the pervasiveness and ubiquitousness of the moral, ethical, social, legal, and political issues related to information technologies (ICT).

For example, the technological not-so-distant promise of Self Driving Cars raises complex questions in a lot of dimensions: (1) moral "If technology is proven statistically better at preventing deaths and accidents than the humans, should we use it? should we make it mandatory?"), (2) ethical "Can we delegate ethical decisions to machines whose behavior we don't fully understand?", (3) social "Do we want a significant percentage of the labor force with automation? ", (4) political "How are we going to deal with the consequences and the loss of economic and political power of the ones laid off? ", (5) geo-strategic "What nations control the technology behinds the self-driving cars moving around in our country?", (6) legal "How do we structure a legal framework to regulate self-driving cars?", (7) security "How do we ensure the cyber-security of our cars and utilities?". But these questions and even more complex ones appear again for almost any new technology: smartphones, drones, 3D printers,

the internet of things, social networks, the web, face recognition technologies, big data, and every single application of (shallow) AI (artificial Intelligence).

But all of the cited technologies, their sophistication, capabilities, and impact are connected with exponential-like tendencies like the ones expressed by Moore's Law (the number of transistors per square inch in a processor doubles every 18 months), Metcalfe's Law (the potential utility of a network is proportional to the square of the number of nodes), and similar observations that strongly suggest that the curve of technological change is exponential. According to Kurzweil, the technological development we are going to experience during the 21st century will be equivalent to 20,000 years of progress at today's pace [2]. So, we should at least pay attention to the technological singularity hypothesis: "The technological singularity—or simply the singularity—is a hypothetical point in time at which technological growth becomes uncontrollable and irreversible, resulting in unforeseeable changes to human civilization" [3]. Last but not least, biology now has become a technology subject to exponential-like patterns, which makes the term "singularity" even more intriguing.

Hence the introduction of engineering ethics into the curriculum makes a lot of sense. The IEEE/ACM Computer Science Curriculum 2013, includes social issues and professional practice in the key knowledge areas that computer undergraduate students must learn. Graduates should recognize the social, legal, ethical, and cultural issues inherent in the discipline of computing. They should be knowledgeable about the interplay of ethical issues, technical problems, and aesthetic values that play an important part in the development of computing systems [4].

The Barcelona School of Informatics (Facultat d'Informàtica de Barcelona - FIB) at Universitat Politècnica de Catalunya (UPC) on 1991 started including the subject of ethics in a specific course in the Informatics Engineering graduate program [5] For more than 30 years this course has been a space for experimentation on how to teach the subject of ethics to informatics engineering students. This paper describes one of the teaching strategies applied.

There are many approaches on how to introduce the study of ethics in ICT curricula. Some are focused on the importance of the process of ethical decision making, which places an emphasis on the process it takes to reach conclusions [6,7]. Other researchers focus on professional practice considering that ethics education should focus on practical applications, on the ability to solve ethical problems morally or technically [8]. In this line of work, Johnson proposes ethics education as a set of activities that provides students with basic knowledge about codes of ethics. The goal is to develop their skill at interpreting and applying these codes and standards because this will provide students with the necessary skills to handle ethical issues once they enter in their professional lives [9]. Samson [10] adds that codes of ethics provide valuable guidelines to achieve ethical behavior and to assess moral responsibility in a profession.

Nygard [11] thinks that apart from ethics it is necessary to teach the social implications of a given technology, because it helps students in ICT develop their ethical reasoning skills and an appreciation for the complex impact that technologies have on society. They work by exposing the students to as many of the cultural, social, legal, and ethical issues in the discipline of computing as possible in order to broaden their appreciation and understanding of complex issues. Barceló at UPC, and Gordon at the University of Hull [12] took a similar approach.

Bowden proposed an ethics course based on case problems, ethical theory, acting in the public interest (or whistle-blowing), the study of codes of ethics, and the role of the professional society. A similar approach is presented in [13,14].

Reviewing the related work authors propose an example of a case study in a mandatory course in a master degree in sustainability to reason about moral dilemmas using philosophical thinking. The case study includes the particularities of computer science that requires technical understanding of the domain.

The rest of the paper is organized as follows: Section two describes the methodology used for the lectures about ethics as well as an example of a case study and how we worked this case in the class. Section three presents the findings provided after working the case and section four presents the conclusions of this work.

2 METHODOLOGY

2.1 The course

The case study we proposed is applied in a mandatory course of the Master's degree in Sustainability offered by the Sustainability Institute also at UPC. The course is called "Fundamentals of business ethics and innovation" (FEEI from now on) and is taught in English language to an audience of local and international students. FEEI has three main topics: 1) Ethics applied in the field of engineering and legal frameworks for the development of professional activity in engineering, 2) Corporate social responsibility and Ethics in companies and organizations, and 3) Innovation. The course is taught in English language and the students are local, national and international, they are aged between 25 and 40 years old and they split evenly in genders.

Our approach to teach ethics is explained next. First, we cover the basics of ethics, morality, and culture, and how they are connected. Then we present ethical theories as tools to make moral decisions. We differentiate workable ethical theories from now workable ethical theories, and then we go through a selection of ethical theories and we analyze how they work by working on examples and short cases. The chosen theories (in the order they are taught) are Kantianism, Rule and Act Utilitarianism, Social Contract, and Virtue Ethics.

This part provides us with frameworks to identify and reason about moral dilemmas where the application of technology is involved. We can also make moral decisions about it and

present and rebate arguments in favor or against it. With these two lectures we provide the basics of philosophical thinking.

Then to put these lectures into practice we present two cases to the students. The first one is about identifying important moral values when reasoning about morals. We use them to do a role play case where students have to argue in favor or against certain moral issues.

The second case is usually something of high profile in the news, where technology is involved - and the nuances of understanding right the technology are important - and where we can find a moral dilemma. Again, the case is a role play where students have to use ethical theories to argue in favor or against certain moral issues. This case is the focus of this paper.

Then, we have a final lecture about codes of ethics and acting in the public interest (whistle blowing) that are followed by a case study.

In this paper we are going to focus in the cases we use to work ethical theories. We think that technical knowledge cannot be separated from the reflection about its impact or how it affects society. No technology is neutral, usually the pros are presented as benefits for society as arguments in favor of its introduction, but often cons or negative side effects appear when the new technology is being used. So, engineers must have a critical spirit about new inventions and how they will affect society. To do so the philosophy, sociology and history are good tools as proposed in the framework of CTS (Science, Technology and Society).

2.2 The case example

Here is an example of a case study presented to the students in winter 2022. The case title is "*Crowdfunding the war in Ukraine with Cryptocurrencies*".

Since the start of the invasion of Ukraine by the Russian army, a lot of reactions have ensued: From the almost unanimous condemnation of the UN to logistical aid to the Ukrainian defense forces not in the form of humanitarian supplies but also war vehicles, weapons, and ammunition.
The MAD doctrine (Mutually Assured Destruction) advises that countries with nuclear weapons should not engage directly. Hence NATO and EU countries have started to apply unprecedented economic sanctions, like the exclusion of Russian banks from the SWIFT international banking communications, the ban of imports and exports from and to Russia (not including oil and gas by the time being), and the direct seizing of actives owned by Russian oligarchs in western countries, including Switzerland and Monaco. Media associated with the Russian government (like Russia Today) have been canceled on platforms like Youtube, Twitter, and Facebook in several countries. And this is just the tip of the iceberg of the cyber-war that arguably was already ongoing. For example, the cyber activist group Anonymous has declared war against Russia and has allegedly hacked media servers in Russia to expose news about the war in Ukraine to the Russian population. The Russian government has passed legislation that makes spreading "false information" about the war a crime punishable with up to 15 years of prison.

In this scenario, thousands of citizens worldwide have started donating cryptocurrencies (Bitcoin and Ether) to wallets owned by the Ukrainian government. This constitutes an unprecedented fact in history: the crowdfunding of a war effort in a country by foreign citizens. The Ukrainian government has decided to take advantage of this situation and promised the airdrop of tokens to the Ethereum wallets that had donated until a given deadline. This caused a significant increase in donations, including hundreds of thousands of micro-donations not motivated by solidarity but as speculation.

2.3 The assignment

The students were presented with the previous text introducing the study case and were given a week to prepare arguments in favor or against the actions described. They had to work in groups on the Moodle platform of the school. A special Moodle grouping (https://docs.moodle.org/400/en/Groupings) was created where the students were put in groups randomly. Each group was tasked to develop arguments in favor or against the case and using only arguments consistent with one or two specific ethical theories (Kantianism, Virtue ethics, Social Contract Theory and Utilitarism). The students had available a specific Moodle Forum to collaborate online to prepare the case.

After a week, a two-hour debate was conducted in the classroom, moderated by the professor. The more relevant arguments and rebaits were written on the blackboard. And at the end of the session, the class voted on the more compelling arguments.

3   RESULTS

In this section we are going to discuss the findings of the case study in the classroom.

The groups that work using the Kantianism ethical theory provided with arguments in favor and against the donations using cryptocurrencies. The most voted arguments in favor of the dotation were the next.

If roles were reversed one would welcome the help. This was the most voted argument. The second most voted argument was that the action springs from good intentions (not treating others as means to an end).

Students identified three arguments to rebate the previous ones. The arguments are:

1. Is it not self-interest? Isn't the action done out of fear and using the Ukrainian land as a shield for the West?

2. Good intentions should not lead to providing weapons.

3. This donation could backfire and make wars more gruesome (like Napoleonic wars after the French revolution, when all the people of the state got involved in the war effort) and it would certainly benefit and incentivize the weapons industry.

The groups using the utilitarian morals agreed that they had to minimize human and animal suffering. Those in favor of the donation argued that in the long term, stopping an authoritarian tyrant with a record of invading countries is necessary to prevent suffering. Ukrainians will suffer more under the Puttin's yolk than if they surrender.

Those against the crowdfunding argued that in the short term the best bet to stop suffering is to stop the war. Crowdfunding Ukrainian's defense only makes it worse, and what will come later is unknown. These two points are in heavy dispute with a slight majority on the side in favor.

The groups using the social contract theory in favor of the crowdfunding explained that the donation is an example of participatory democracy (vote with wallet). They also base their arguments using the United Nations Charter Preamble (first paragraph) that states: "We the people of the United Nations Determined to save succeeding generations from the scourge of war, which twice in our lifetime has brought untold sorrow to mankind, and to reaffirm faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women and of nations large and small, and to establish conditions under which justice and respect for the obligations arising from treaties and other sources of international law can be maintained, and to promote social progress and better standards of life in larger freedom".

The groups that argued against the crowdfunding stated that a social contract for believers in the Christian religion states that you shall not kill.

4   SUMMARY AND ACKNOWLEDGMENTS

This paper presents an example of case study used to work the ethics topic in a mandatory course in the master degree of sustainability at UPC. The case study is an example of didactical resource that we use in our lectures to help students develop their philosophical thinking. This resource can be adapted to other courses where ethics is taught to engineers. The idea is to adapt the case to de specific domain of the engineers so that it presents an ethical dilemma.

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