

I would like to argue that ethics education has a (limited) place in a Computer Forensics course as well as the Computer Security Curriculum in general and that it is not only possible but appropriate to teach some ethics as an engineer, scientist, or investigator. I will present an approach (developed by the Markkula Center for Applied Ethics at Santa Clara University for use by Silicon Valley firms) that allows students to investigate ethical problems in the traditional case based style without engaging in discussions on the foundation of morality.

This essay is written for the practitioner of IA education.

2. GOALS OF ETHICS EDUCATION IN INFORMATION ASSURANCE

Ethics, broadly speaking, is about living the “good life”, the life that leads to human flourishing. Teaching ethics goes beyond moral casuistry; it invites us to search and strive for a full life, which is also a moral life. Already this identity of the good with the moral life is disputed. Plato for one held that knowing the good one would want to do it, whereas his successor Aristotle thought that teaching ethics to people who did not want to be good was useless.¹

We (at least I) teach ethics first in order to instill the desire and the resolve to be ethical in our students. We want our students to see themselves as part of an interrelated humanity to which they contribute as responsible professionals. However, the desire to be ethical in isolation does not suffice. Rather, to be mature moral agents, we need the capacity to recognize ethical problems as such, the knowledge to assess them, and creativity to find ways around them. Technical expertise enters in all these steps. However, the typical general education ethics course is open to students with widely different interests and areas of expertise and typically cannot address the transition between technical expertise and ethical assessment. While the mere act of devoting some resources underlines the importance of ethical behavior for professional in our field, education in the interchange of technical expertise and ethical assessment presents an additional, more important reason to incorporate Ethics in the IA curriculum.

Right reason needs foundations besides mere facts. To draw a simile to (Hilbertian) Mathematics, the facts might be the axioms, but we also need logic to derive theorems. The grammar of moral reasoning is the subject of normative ethics and constitutes the arguments and rules by which moral judgments are made and defended. Fortunately or unfortunately, we have lost a common ground. While the vast majority of the members of our modern pluralistic society strive to be moral, there exists no longer a consensus on the foundation of ethics. It appears that the usual sources of morality (God, divine revelation, the Spirit, tradition, the good of the worker class, the good of humanity, inalienable rights, the greater good of the community, the sacredness of property etc.) still exist and thrive as sources of morality, but we cannot expect those with which we interact to share them. We can no longer teach ethics from a privileged point of view, but we can make use of an experiential fact, namely that people of good

will arguing from their respective perspective will often come to similar ethical conclusions and even more frequently find the interchange of ideas and perspective useful. Thus, seemingly paradoxically, a pluralistic and post-modern society as ours can (and wants) no longer to define the ideal of the good and moral life for all its members, but still can find a consensus on norms of behavior in the vast majority of cases. Our teaching ethics needs to take cognizance of this diversity.

In a fast-moving discipline, technical development often outpaces our capacity to recognize the social and moral consequences of its use and even more our capacity as members of a profession to agree on a common conduct. Development of rules of conduct are important, adherence to them is part of being a professional, but rules of conduct alone do not suffice in all situations. In Computer Forensics, one might easily find oneself in a stressful situation where the codes of conduct do not offer sufficient guidance and where strong outside pressure is applied. Even if a code gives guidance, novices in the profession need to be mentored in a way that strengthens their resolve to behave in a professional and ethical manner and follow the guidelines. For this reason alone, one needs to talk about ethical issues in class.

Naturally, the amount of time and resources devoted to Ethics in a technical course is quite limited. While Ethics has a place in an IA curriculum, the typical instructor with the technical expertise needed has no formal ethical education and should not be pushed into a role that (s)he can only fill with difficulty. An overenthusiastic instructor might even be tempted to inappropriately push a religious-philosophical agenda in the classroom.

Teaching ethics in IA supplements ethical education as part of a general education curriculum or even specialized courses such as a “Software Ethics” or “Engineering Ethics” course. For instance, it certainly needs to be supplemented with exposing students to the duties of belonging to a profession including adherence to codes of ethics such as the Software Engineering Code of Ethics and Professional Practice.

To sum up, we teach ethics to emphasize the need for high ethical standards in our profession. We also need to train the recognition of ethical problems and the gathering and evaluation of relevant facts. The grammar of ethical reasoning employed needs to be open to different perspectives. The IA instructor should not be overburdened with teaching an alien field. What I propose fulfills these requirements. The question of norm establishment, i.e. of what constitutes sound moral reasoning is left out and replaced by answering simple questions from very different perspectives. The emphasis is on gathering facts, evaluating them technically and morally, but not on the foundation of moral reasoning.

3. GENERAL PROCEDURE

Normative ethical theories fall into certain categories such as rule-based systems (the Kantian Imperative, the Golden Rule) or Consequentialist theories. We collect some basic approaches to Normative Ethics in Modern Western Philosophy, and reduce them to simple questions. When faced with a potential ethical issue, we ask these questions and try to come to a decision based on the answers. This simple procedure frequently (but not always) leads to a conclusion because most ethical questions are not intrinsically hard, that is, most approaches or sometimes even

¹ We might see ourselves as good Aristotelians if we bemoan the knowledge fallacy exhibited by some regulatory body that condemns middle and higher management of an unethical company to attend ethics seminars.

all approaches lead to the same conclusion. I will come back to this point below.

We approach an ethical question within a general framework consisting of several steps. The first and often most important step is the recognition of an ethical problem. In the second step, we gather all relevant material. Of course, deliberating a problem can lead us to recognize the need for further information so that this step and the following can be intermingled. Thirdly, we approach the problem from different viewpoints, asking questions that – we hope – shed new light on the problem. Fourthly, we have to come to a decision. The often forgotten fifth step is to revisit the results of our decision.

Before we go into the details, allow me to point out the advantages and the disadvantages of this approach. A first advantage is the relative simplicity of the approach. It provides a common framework to discuss an ethical case and in most cases, it will give a decision. By discussing the aspects of an ethics case we might find a way to avoid the technical problem. To give an outdated example, the conflict between rights to privacy and the need to monitor employee behavior, including internet and email use (in an organization that needs to protect intellectual property) can be largely avoided through a well-disseminated official use and monitoring policy. The approach invites teamwork, but does not presuppose it. It enables meaningful discussion by providing a language in which to discuss an ethical dilemma.

The greatest disadvantage of the procedure is a lack of philosophical correctness. Our approach is syncretistic, combining several traditions each of which thinks of itself as superior. It also does not address convincingly the identity of the good and the moral life, i.e. it does not answer the question why one would want to be ethical. In addition, there are certain cases where the approach will not suggest a solution.

Teaching a programming language or other technical skill does not merely teach the skill but also teaches the art of programming and a way of thinking. Similarly, teaching an Ethics method should do more than teaching just another skill. In the case of our method, it asks the student to argue from different viewpoints, to identify constituents (those affected by the decision to be made), and to identify markers that indicate an ethical problem. These components exercise a student’s capacity for empathy, i.e., of feeling like someone else and therefore sensitizes them to others.

Recognition of an Ethical Problem: We often realize the existence of an ethical problem through indicators such as damage (to people, institutions, society, and environment) or conflict. Not all wrongs are ethical wrongs, but those that diminish the dignity, hopes, or rights of people have often an ethical problem at their core.

Gathering of Relevant Information: Determining the stakeholders and the possible options for actions complement the basic facts of any ethical problem. In practice, we would also gather the different ways of dealing with the issue at hand. In a class-room case, we might defer this step.

Approach from Different Perspectives: In the Markkula Center for Ethics framework for Ethical Decision Making, no single philosophical stance is used to approach an ethical problem. Rather, a number of different ethical approaches are condensed into a small set of questions. Answering these questions will at

the very least illuminate the problem at hand. The approaches chosen are consequentialism or utilitarianism, a rights approach, and a common good approach. They are complemented by the criterion of justice and by virtue ethics. More about these will be said in the next section.

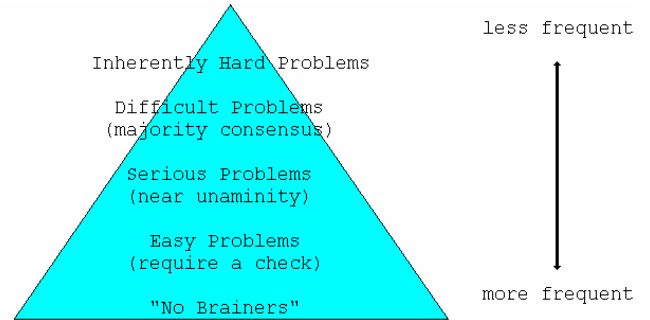


Figure 1: The Ethical Complexity Pyramid

The questions are not detailed enough to do justice to the philosophical traditions behind them. Answering them all will also not solve all ethical questions. However, they will solve most problems and they will inform our discussions of all of them. We can call an ethical problem “intrinsically difficult” if different approaches lead to different resolutions. I claim as an empirical fact that most ethical problems are not intrinsically difficult, though they tend to be very prominent. Issues such as abortion, the use of weapons of mass destruction and warfare, and the medical treatment of severely malformed newborns come to mind as examples. The most common ethical questions are no-brainers, issues that are so obvious to the normal person that there is no need to discern ethically in order to behave ethically. Serious and difficult problems where only a majority of approaches gain consensus are much rarer and the inherently difficult ones are extremely rare. This is the experience of many ethics board in hospitals that by design consist of members of very different backgrounds.

Making a Decision: Ultimately, we need to leave discernment behind and make a decision.

Revisiting the Decision: It is impossible to “unring a bell”, but individuals and organization profit from learning from past mistakes. Making it a habit to revisit past decisions allows us at least to learn from our past mistakes.

In practice, these steps will not be completely separated. For example, while considering actions from different perspectives, we might find slight alterations to the proposed action that remove certain objections.

4. ETHICAL PERSPECTIVES

4.1 Consequences

Utilitarianism (or consequentialism) evaluates an action by its consequences. Often, this results in a simple calculus in which we identify all stakeholders and then evaluate the effects that the planned action has on them. This calculus is not without its problems. Sometimes, benefits are not comparable as when a palliative treatment also diminishes life expectancy. Sometimes, the benefits are not evenly distributed and an element of

unfairness is introduced. For example, am I allowed to rob Bank of America for a few cents in order to give a needy person a free and much needed meal? In this case, should I evaluate the benefit of an action or the benefit of a rule? (The first would be strict action utilitarianism, the second one rule utilitarianism.) In addition, mathematical game theory has shown that a mathematically completely sound utility function cannot exist. Despite all of these draw-backs, utilitarianism's promise of a simple calculation is quite attractive. We thus ask:

What are the benefits of the intended action? What are the harms created? Who benefits and who is harmed?

4.2 Rights

The rights approach demands that we act in ways that respects the dignity of other persons by honoring and protecting their legitimate moral rights. It identifies fundamental civil, political, and economic rights that merit protection because they pertain to the dignity of the human person. The approach suffers from a possible proliferation or disregard of fundamental rights. It also does not present a solution if fundamental rights conflict. It fits well in our societal reliance on legal action in order to remedy societal ills. We thus ask:

Whose rights are respected or infringed by this action? What are those rights?

4.3 Common Good

The common good approach is based on a vision of society as a community whose members are joined in the shared pursuit of values and goals that they hold in common. In this view, the good of the individual is inextricably bound to the good of the whole. As such, it is a much needed antidote to the antisocial strain of "rugged individualism" that is an important part of the American mythos. In our pluralistic society whose members identify themselves in various ways as members of subgroups, it is however not easy to identify the community in which the decision has to be made. We ask:

What is the community (or what are the communities) in which the decision has to be made? What is the common good?

4.4 Fairness

Equals should be treated equally and unequals unequally.
Aristotle

Fairness is a single criterion that any just action has to fulfill. Fairness has nothing to do with retribution but rather prevents us from singling someone or some group out for reasons that have nothing to do with the matter at hand. We ask:

How fair is the action? Does it treat everyone in the same way or does it show favoritism and discrimination?

4.5 Virtue

Virtue ethics sees the human being as one that continuously forms and redefines itself in the quest for reaching its full human potential. It focuses on attitudes, dispositions or character traits such as honesty, trustworthiness, integrity, compassion, et cet. By learning and practice, the exercise of virtue becomes a habit. The

habits then make up the human person. These virtues are not individual virtues but related to a community.

Virtue ethics can provide very deep insights in some cases, but in others, it falls flat, because not all weighty decisions define the human being. In my experience, it rarely can contribute to the solution of an ethical problem in Information Assurance of Computer Forensic, but when it can, it will connect the discerners with the deeper desires of her soul. In virtue ethics, we ask:

How does this action define me as a human person? How does it define us as a company, an organization, a society, etc.? What do I or what do we want to be and become?

5. APPRAISAL OF THE PROCEDURE

In his influential work "After Virtue" [MI84] Alistaire MacIntyre diagnoses conceptual incommensurability of rival arguments in the great moral debates of our time (such as abortion, the waging of war, or academic freedom). In addition, moral discourse can no longer use concepts which are part of a larger totality of theory and practice which imbued sense to the human project. A post-modernist [L94] culture no longer has the ambition or the capacity to generate this overarching synthesis from which moral values are derived. The procedure makes a virtue out of a necessity by using irreconcilable ways of ethical discourse. Even the questions within a single approach are an irenic compromise that does not do justice to the complexity of the ethical positions within utilitarianism, common good theory, etc. But since it aims lower (to provide meaningful ethical discourse by taking different ethical perspectives) it is also more often successful.

We teach ethics because we want future professionals to behave ethically. We fall (possibly) into the knowledge fallacy if we assume that we teach ethical behavior by teaching ethical decision making. We might just have to have trust in the educational enterprise that humanizes the student through opening a world of different perspectives with a common commitment to the Good.

6. EXPERIENCES TEACHING THE MARKKULA APPROACH

I have now taught Computer Forensics four times at Santa Clara University at the graduate and at the undergraduate level. I devote most of a one hour lecture period to giving a presentation on the method and I reinforce this with class room discussions of a few questions. I also include one ethics question on the final or demand and ethics paper. Some classroom exercises (20 minutes in a graduate class) are necessary to discuss the various approaches at least once. When I first decided to include the ethics component at the urging of the then Computer Forensics Educators Working Group (a small group of educators supported by an NSF grant at the University of Tulsa under Sujeet Sheno and Mark Pollitt), I was concerned about the culturally and religiously diverse student body that we have in our graduate program at Santa Clara University. It turned out that the students were quite willing to try it out (and some were outright intrigued), but that cultural differences limited the students' capabilities to make a coherent argument. At the end of the course however, the ability to apply the framework to an ethical problem was strongly correlated to technical skills.

In my undergraduate class, I ran into the problem of students that already had an Ethics course. In the time-honored manner of good students, many decided to not read or heed the instructions and instead deliver an ethics paper as they had done before. Under these circumstances, it is important to remind students that this is a technical course and they are to deliver according to specifications. A relatively large number of students also forwent their computer engineering skills and made technically unsound statements. For example, in the case of spamming back (an engineer bombards a spamming site selling illegal software copies with fake purchase requests in the hope of setting off the credit card company's monitoring), many identified this as credit card fraud or assumed that the credit card company would spend large amounts of resources on these fake credit card orders. None of which is of course true, since more than a valid credit card number is needed to make a purchase.

I came to teaching Computer Forensics with a strong background in Computer Science and Engineering and a limited philosophical and theological background. I was thus in a better position than many of my colleagues to implement this module, but I am not a trained ethicist. Reflecting on my experience, I would wager that everyone qualified to teach at the college level and willing to look at an ethical problem from different approaches is capable of teaching this approach. After all, it discards the philosophical subtleties and precisions that make reading philosophy a difficult undertaking.

The desired student outcome for this class is two-fold: A recognition of the need for professional and ethical behavior in our discipline (which is hard to measure), and a capacity for coherent ethical reasoning.

7. EXAMPLE CASE

I now present a sample case for classroom or laboratory discussion (in small groups). The discussion can be relatively short; 30 minutes should suffice. Alternatively, it can be used to assess outcome as a sample case to be solved. The discussion that follows the case description gives a summary of the outcome of the method. As a regrettable artifact of a case based teaching method, we discuss only one possible action. In practice, coming up with an alternative that avoids ethical problems and still "solves" the case is the preferred outcome. Unfortunately, assessing student work becomes much more difficult. Creative solutions should be discussed in class after the exercise is finished or after student work is handed in.

The case of the booby-trapped software

A software company strongly suspects that one of their employees is selling essential portions of one of their products used to remotely administer equipment through radio to a competitor. The management enrolls a few trusted senior engineers and has them engineer a faulty routine that is made officially part of the code base, but exchanged for its predecessor before the product ships. Indeed, in the following winter, a pipeline administered by their competitor's software spectacularly fails.

We deal with this case according to the Markkula Center scheme even though there is only one possible action to evaluate. The damage to the environment resulting from the company's

deliberate action sufficiently indicates an ethical problem. As far as the gathering of facts is concerned, a complete solution would specify any additional assumptions made, but would also indicate a list of stakeholders, such as the company and its management, the company's engineers engaged in creating the booby-trapped, its thieving employee, the competing company, the end-customer, all those directly or indirectly suffering from the environmental disaster, those participating in the economic process, and possible the environment itself. We then progress to the evaluation of the action using the different sets of questions:

Consequences: The company benefits from its action directly and indirectly through the harm done to its competitor. Everyone else is harmed. The thief presumably is a target for retribution by her accomplices, the competitor loses sales, the end-customer has to deal with the financial fall-out of the accident, and those directly or indirectly hit by the accident are of course also harmed. Even discounting the harm to the thief and competitor (on the assumption that the competitor knew that it was engaging in theft), the balance of benefits and harms is against the action.

Rights: The company has a right to its intellectual property. Whether the competing company has any rights is doubtful, but it also seems to have lacked due diligence because it did not test code obtained from the thief. The end-customer has a right to well-tested software and a right not to receive software with a booby trap. (Whether this right violation is attributable to the company or to its competitor or to both is unclear and depends on the deviousness of the software trap.) The public at large has a right to enjoy the environment without degradation. The latter rights violation alone gives a negative evaluation. Even a thief retains certain rights such as the right not to be bodily harmed (by putting her on a mafia's hit list, for example).

Common Good: The company's action protects the common good in as far as it imposes a certain justice in that evil-doers cannot enjoy the fruits of their illicit action. In almost every other aspect, it is detrimental to the common good. Even in a competitive business environment, sneaky actions such as this one destroy the business climate, and even more so, between software producers and consumers. Additionally, the whole of humanity suffers from one more instance of environmental degradation.

Fairness: This action is – in our limited understanding of the word – fair because the action does not single anyone out based on irrelevant criteria. The company neither knows the thief and its booby-trap is not geared to anyone in particular.

Virtue: In this approach, we ask in what way the action defines the company. Very often, as here, the result is not very enlightening (the company is assertive and sneaky and does allow anyone to "mess with it"), but when the approach contributes it tends to contribute heavily.

When it comes to making a decision, we come to the unanimous decision that this action is not ethical, since the company cannot ethically undertake an action with such undefined consequences and dangers to innocent by-standers. It thus turned out to be a "simple" problem in the hierarchy of ethical problems.

8. Additional Sample Cases

The case of spamming back

An engineer is fed up with spam email inviting her to buy cheap, pirated software. She writes a script that goes to the advertised website(s), that fills in the order form with bogus information and then she sends a few thousands of these false order data to the spammer in order to have the credit card companies drop the spammer as a business associate.

The case of the anti-worm

A system administrator has just discovered a buffer overflow vulnerability in a popular shopping cart application. Unfortunately, the software company designed the shopping cart application denies that the vulnerability exist. The system administrator however has run a proof of concept attack that was successful on her installation. She also found a simple way to patch it, but she is afraid of the legal implications of publishing the exploit and the patch. She can write a worm that scans for the vulnerability that propagates to a vulnerable site, then patches the security hole, and finally scans for more vulnerable sites. She is quite certain that the worm activity at a vulnerable site is quite limited and only utilizes system and network resources moderately.

An appraisal of the technical difficulties of “ethical worms” can be found in “Malware” by Skoudis [SZ04] that is required reading in my class.

9. CONCLUSIONS

Teaching ethics in a technical discipline is warranted by the needs of the profession and by the needs of our students to be prepared. Ethics courses in the liberal arts are valuable, but what we in Engineering have to contribute is our knowledge of the facts. We

cannot devote large resources to teaching ethics, but a single lecture and some exercises (inside or outside of the classroom) not only demonstrate our belief in the strict standards of professional behavior but also significantly contribute to our students capabilities to face ethical challenges. It will be supplemented by an ethics component in other classes that talks about codes of conduct. Furthermore, the simple and practical approach developed for the needs of Silicon Valley business managers allows us to teach ethics in a way that is respectful of the religious and ethical differences in our student bodies. It also allows educators with very limited philosophical or theological training to teach ethics.

10. ACKNOWLEDGEMENTS

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