AUTHOR(S): HERON, M.

TITLE: Ethics in computer science.

YEAR: 2016

Publisher citation: HERON, M. 2016. Ethics in computer science. In Laplante, P.A. (ed.) Encyclopedia of computer science and technology. 2nd ed. Abingdon: CRC Press.

Ethics in Computer Science

Michael James Heron

Twitter: @drmichaelheron

Robert Gordon University, Aberdeen, Scotland, m.j.heron1@rgu.ac.uk, http://michael.imaginary-realities.com,

KEYWORDS

Ethics, professional conduct, ACM, BCS, IEEE, Case of the Killer Robot, Scandal in Academia

ABSTRACT

Ethics within the field of computer science represents a rich and vibrant topic with almost universal applicability both within and without the profession. In this chapter, the author discusses some of features that combine to give the topic unique nuance: the frictionless nature of data transmission; the ease of automation; the power of privacy and anonymity; and the increasing speed and affordability of computing resources. Regardless of the topicality and reach, it can be difficult to communicate the need for professional understanding of computer ethics. This chapter also discusses how advocates of computer ethics as a ongoing topic for professional development can help contextualise and communicate the need to reflection to others.

INTRODUCTION

Issues of ethics within the professional and academic disciplines of computer science are often an afterthought. For technically minded practitioners, the topic can seem to be of dubious relevance and of only marginal utility. For academic faculty it is often a topic which is considered little more than an exercise in showing token compliance with course aims, university guidelines or the requirements of external accreditation. The challenge of developing an effective understanding of ethics within a fast-moving field such as computing is often under-estimated. The need to

continually curate and update professional understanding is daunting. The challenge is especially pronounced when practitioners have little formal experience with moral philosophy, and no coherent framework within which to contextualise the topic. Despite this, the growing trend of professional accreditation within computer science mandates an understanding and acceptance of a formal code of computer ethics. This in turn creates a growing need for professional and academic study and analysis of a topic which is often not well addressed with the community of practise.

Interesting ethical case studies can motivate practitioners beyond what the dryness of any given topic's material itself may permit. Simplistic or overly specific analysis on the other hand can demotivate, robbing even inherently fascinating material of much of its depth and interest. The way in which the topic is presented subtly influences the perception that practitioners have of the material. Where its inclusion in academic curricula is mandated by the outside pressures of professional accreditation, the lack of internal faculty motivation can lead to uninspired, perfunctory courses. Such courses are suitable for ticking a box on a checklist, but grossly ineffective in motivating students to take a proactive interest in the topic for its own sake. This in turn disincentives professionals – having often been forced into the topic for pedagogical reasons they are less likely to seek to develop an ongoing relationship with the topic in professional life. While formal educational context is not necessary to develop an understanding of issues within computer science, the roots of an appreciation of the topic are normally planted in a formal pedagogic context. Thus, those professionals who have built an appreciation of the topic have a role to play as advocates to those who have not.

That the topic receives such short shrift is unfortunate because the intersections of computers, morality and society represent perhaps the most universally accessible form of applied practical ethics. Unlike the unique features that characterise other forms of specialised professional ethics, the issues that are raised by computers are ubiquitous and the impact they have on society is instantly identifiable. Much of what defines professional ethics in law and medicine is far removed

from everyday experience and thus the issues are difficult for outsiders and novices to truly appreciate. However, we are all impacted every day by the implications of computers within society. From the relatively mundane impact of automation on employment to the risk to our identities posed by high profile hacking cases - we all have stories we can tell about how we have been impacted by the information economy of modern society. Everyone is qualified, to a greater or lesser degree, to discuss and analyse these situations because we are all participants one way or another. As such, it is possible, and highly desirable, for an understanding of computer ethics to be considered a tool worthy of continued self-study; professional discussion; and academic analysis.

BODY OF TEXT

An Overview of Computer Ethics

One of the first things that must be done to convince others of the necessity and value of computer ethics is to identify why it is a field worthy of its own investigation, and this in turn requires us to disabuse an audience of the notion that ethical behaviour is simple, or even 'default'. Most of us believe in our own inherent moral compass, even when its reading is distorted by the context in which we operate (1). It is easy to fall into the trap of believing ethics is simply an issue of 'common sense'. Our own moral compasses are aligned through a lifetime of small experiences which have washed away doubts and uncertainties through constant friction. Few of us ever take an opportunity to deeply consider our own moral codes for inconsistencies or overlaps, and as such we often cannot see when our own sense of morality is impacted upon by social context or peer pressure. Without being challenged we can lapse into a comfortable familiarity that we know ourselves and our views on what is right and wrong. This over-confidence can skew our sense of what is and is not ethical when we are faced with complex scenarios; power differentials; or unexpected contexts. To address this issue, we need to consider first what it means to be a moral agent, and what it means to 'do the right thing'. This is not an easy topic, and the relative abstraction of the discussion often fails to chime with the expectations and preferences of busy

professionals – especially when they are functioning within a technical and applied field of study such as computing.

One of the difficulties associated with incorporating ethics and morality into professional life is the sheer scale and depth of the topic. There are accumulated millennia worth of moral and ethical writings that would fire all arguments within the crucible of debate. These debates encompass the relativists (2), such as myself, who believe there are no absolute moral truths and that subsequently all moral debate is a matter of perception and rational analysis. It encompasses the absolutists, who believe in the intrinsic right or wrong of particular actions (3). It encompasses Kantian moral philosophy (4) which assesses the 'will behind the action' and permits for bad things to be done for noble reasons, and vice versa. It also encompasses Utilitarian ethics (5), which argues that only the outcome of an action should be used in forming moral judgements on its morality. It is a rich, fascinating, vibrant area of philosophy that can leave busy professionals absolutely cold. While structurally it makes sense for the foundations of morality and ethics to be formally discussed as they relate to professional practice, the effect is often only to confirm every doubt that practitioners have had about the relevance of the topic to their daily lives.

Computing is a topic that is largely about application – even theoretical computer science has at its core the assumption that there will be some tangible output from the abstract concepts and theories that have been explored. As such it is usually far more productive to focus on computer ethics as a rich branch of applied philosophy. In this, we do not need to trouble ourselves overly with the theoretical underpinnings of morality and can focus instead on ethics as an evaluative and corrective tool – something that can be applied to professional dilemmas to resolve them. Integrated into the topic, it's possible to explore the foundational concepts that have otherwise gone by the wayside. Applied computer science is best experienced in context and from multiple perspectives. From the point of view of multiple participants and agents within, it is possible to explore the full moral space of ethical judgement. Understanding these implications within a

professional discipline requires an effective framework within which such applied ethics can be shown to have value beyond 'common sense', and in this we can outline the tensions between ourselves and society in several layers. This is the primary challenge in computer ethics within computer science – resolving the tension between the theory and day to day practise.

In this respect it is useful to enforce a distinction between what are commonly and informally treated as two largely interchangeable terms – ethics and morality. It doesn't matter particular the definitions adopted, only that they are rigidly applied – this rigidity is part of what makes the techniques discussed later in this chapter a useful evaluative and analytical tool. Fundamentally, this approach recognises that for applied ethics it is more important to have an imperfect framework that can be easily understood by those uninterested in the nuance and caveats than it must adhere to perfection.

Computer science then benefits from a functional separation of roles. In this framework, **morality** is defined as an emergent property that is the consequence of thousands of small experiences within individual lifetimes. The construction of this code usually begins with the family, where parents instil in their children the foundational framework for judging right and wrong. This is not necessarily done as conscious instruction but is instead a natural outcome of familial osmosis. We calibrate our moral code by how they tut at the television; how they talk about issues at the dinner table; or how they act when confronted with the world. It is a natural tendency of young children to want to please their parents, and an easy way to do this initially is to mimic the way they talk and behave. This is where our sense of right and wrong begins.

As we grow, we come into contact with other contexts where our moral code, as imparted upon us by our parents and the wider family, clash with that of others. We meet other people who don't think the same way we do. We encounter social structures that encapsulate moral messages – sometimes we find ourselves in alignment with these messages, and sometimes we find ourselves in opposition. We then must decide between what we believe and what the other entities believe.

Knowing that something cannot be right and wrong at the same time, we resolve our cognitive dissonance (6) by mentally deciding between three options:

1. Reduce the importance attached to the conflicting belief, so that we can reject the clash as being situational.
2. Reinforce our own beliefs so that the dissonant beliefs can be discarded as an unusual exception.
3. Change our own belief, or reject the dissonant belief.

The strength of cognitive dissonance as a force for altering our moral frameworks is considerable, and is one of the primary ways in which we gradually evolve our viewpoints through our lives. The logical conclusion of this process being undertaken in isolation by the billions of individuals upon the planet is to accept that not everybody will believe what we believe. We may be philosophically resigned to that inevitably (such as in moral relativism) or we may hold those who hold incompatible beliefs to be on the wrong side of an absolute moral chasm (such as in moral absolutism). Regardless, we cannot dismiss these clashes – we can simply choose how we are to interpret their presence.

In such cases, it is clear that we cannot rely on morality alone to negotiate modern society. We need some way in which we can adjudicate when moral frameworks clash. This is where **ethics** come in – as a defined code of conduct to which all individuals within a community must adhere. In the largest, compulsory case, we could call them 'laws'. We may find ourselves in disagreement with laws, but we know there are consequences for disobeying. Other ethical codes are opt-in, although often there is a degree of peer-pressure; assumption of acceptance; or coercion involved. When we choose to accept a particular religion, we choose to align ourselves with the code of ethics involved. We may disagree with some of the individual elements, but those that follow the religious covenant can all largely agree on what the 'right' decision would be within the context of these codes – or at least, can agree on what the parameters of disagreement may be. We don't adopt such external

ethical frameworks without philosophical and cognitive angst – we may find our own sense of self in conflict with the ethical structures within which we function. Sometimes we have multiple codes of ethics, and they all cohere – that's the ideal outcome. More often we have multiple codes of ethics where their remits overlap and they are not in perfect alignment – how we resolve these conflicts is an important part of how our morality is expressed. Sometimes there are consequences for violating a code of ethics. Sometimes there are not. In all cases, it is up to us to decide what is right and wrong by analysing our ethics against our sense of morality; balance the consequences versus the cost; and then decide what has to be done. It is in these overlaps and grey-areas where truly interesting ethical decision-making thrives. We often cannot easily appreciate the value of formal ethical instruction when all we are deciding between is an obvious right and an obvious wrong.

The scope of moral and ethical philosophy is mammoth and so to bring the discussion into relevance for time-pressed professionals we must tightly restrict the domain of discussion to that which is accessible. This is an exercise that must be tailored to each individual and specialism – the relevant issues of professional ethics that impact on analysts are different to the ones that will gain most traction with game programmers. There will be overlaps, but part of developing an effective understanding in applied ethics is making sure the application is appropriate for the audience.

Perhaps the most general issue that makes computer ethical discussion so complex is that an assumption of distributed responsibility is all but expected. It is very difficult within any complex social structure with any interesting ethical dilemma to point to a particular individual and say 'they're to blame'. To a certain extent, within complicated ethical dilemmas there is always a spreading of responsibility – there may be a certain person who shoulders the majority of the blame, but there are always others that contributed to the outcome. Standard ethical lenses are largely ineffective at appropriately partitioning responsibility in these circumstances, being more suited at viewing the role of the individual within a social environment. However, computing professionals are locked into not just social structures but also technical architectures. A software engineer that

writes a module that fails with disastrous consequences could point to many levels of abstraction through which the code must be mediated. Fault could be argued to lie with the operating system, with the compiler, with the programming language, with the language frameworks, or with the context of the software in which the module functioned. It is possible for there to be catastrophic failure with nobody truly being to blame. While this is true in many fields of applied ethics, it is especially true within computing because of the numerous ways in which context becomes important.

In almost every situation computing professionals are working as part of a team; or with a variety of software products and packages; or performing a wide variety of roles as the situation demands. Computing is an intensely collaborative discipline – the complexity of most computing artefacts now greatly outstrips the ability of any one individual to auteur the product. In some cases, not only is the product too complex for one person to develop, it's too complex to be developed by humans **at all**. Some of the most complex deep learning machines for example are no longer fully in the control of their developers – in many cases, they simply make decisions and analyse information in such a way that humans are effectively shut out of the process. More and more, it is becoming the case that we cannot truly understand why our most complex software and hardware products make the decisions they do.

Computing is a rare discipline in which the only real distinguishing factor between **difference in kind** and **difference in degree** is a matter of time. This is also a cyclical process. Decades of gradual accumulation of degrees often slip into difference in kind almost instantly as a tipping point is reached. At the tipping point, despite nothing fundamental having changed, the scale of availability becomes such that genuinely new ethical dilemmas are introduced. Consider for example the slow accumulation of bandwidth speed for home computers. When modems became common household items, 14400 baud speeds were common. These allowed approximately 1.8KB/s over a home telephone line. That's approximately 900 words per second – the full version of this article

would take over nine seconds to transmit in a pure text format. This sluggish throughput was fine for emails; bulletin board access; Usenet discussions; and some rudimentary early web browsing. The technology itself was transformative, making available whole new ways of interacting across wider swathes of society. This was a difference in kind over what had previously been available. As modems became faster, speeds of 33600 (4.2 KB/s) baud and 56000 (6.95 KB/s) baud became commonplace. These were differences in degree – faster, more comfortable internet, but nothing transformative.

However, as speeds continued to increase, this difference in degree once again became a difference in kind as it suddenly allowed for something that had previously been infeasible on any large scale – the swapping of large digital files. Downloading a 4 MB digital music file over a 14400 baud connection was an investment of an hour, and sending it was usually a much larger investment of time due to the difference in upstream/downstream allowances that were provided. Often, the transfer would fail – the longer the connection required, the larger the chance of something happening to interrupt it. Moving to a 128Kbs system such as ISDN-2 made that same download a five minute investment. As faster internet speeds became available to larger proportions of the population, that incremental difference in degree became a difference in kind epitomised by the rise of peer to peer file distribution systems such as Napster and Kazaa. Twenty years ago, Manning (7) would have had to remove confidential State department memos with a convoy of wheelbarrows. Now, gigabytes of data can be transferred using a thumb drive no bigger than a finger.

Major Issues in Computer Ethics

It becomes necessary then to define what about computer science brings about these transformative elements. This chapter argues it is due to the unique combination of four key elements. These are the **frictionless nature of transmission**; the easily availability of **automation**; the power of **privacy and anonymity;** and the increasing **speed and affordability** of computing power. These features help describe both the specific elements that contribute to computer ethical

dilemmas and the explosive growth of computer capability. This is as much a social phenomenon as a technical one, with each element reinforcing the other. The growth of Facebook was driven first by technology, and then by social context. The growing social popularity required evolutions of the technology, which in turn allowed further capacity for social growth. It is important to note that all computer ethical dilemmas are primarily social. It is simply the technical feature of the architecture that facilitates those social dilemmas.

First, let us consider the frictionless aspect of computer communications, for it is this element that most underpins the way in which the others can become troublesome. Here, friction is used to describe any complication factor that stops information being transmitted from point A to point B. Consider here the phenomenon of chain letters which were common in the mid-20th century. These typically asked the recipient to copy the letter and send a number of copies on to their friends in exchange for some fictional reward, or as a preventative against misfortune. Upon receiving such a letter, the individual would have to make copies (by hand originally, but eventually via photocopiers), put the letters in envelopes, address them, stamp them, and then take them to a post box. Each stage of this process is a **frictive element** – enough frictive elements, and the overall friction of the activity becomes too much to bear. The perceived cost becomes greater than the perceived benefit. The more friction, the less chance that anyone will participate, and correspondingly the less the chance that anyone they transmit the data onto will transmit it further. Friction inhibits the virality of information. The lack of friction enhances it.

With computer communication, most of these frictive elements ceased to be relevant. A chain email comes in, and all the recipient needs to do is select ten friends from their address book and hit ‘send’. Anyone with an older relative who has just been connected up to the internet will be aware of this. While chain letters in their pure form are now comparatively rare, joke emails and ‘infoblasts’ remain relatively common. Information that never would have been sent to you physically is now commonly sent over email. Facebook and other social media platforms have

similarly removed frictive elements in the propagation of data, allowing for information both valuable and mundane to be propagated throughout interlocking social chains far more easily than once was possible. We can see the power that frictionless communication has in the way social media can be marshalled, focused and then targeted on a single individual when they transgress some perceived norm. The memetic property of certain kinds of information too allows for its propagation far beyond the actual value of the content (8) – a casual glance of any standard Facebook feed will show a blend of personal revelation; meaningful discourse; and memetic conspiracy theorising, all facilitated by the lack of communicative friction.

Linked to this is the easily mainstream availability of automation – the ability for even relative novices to script functionality for the computer to do without supervision. These range from the simplest kinds such as an 'out of office reply' to complex robots that handle sophisticated logistics in high-tech warehouses. Such automatons can work hand in hand with the frictionless nature of data transmission to allow for all human input to be removed from routine tasks. The more skill an individual has with computers, the more complicated the automation can be. The easily availability of programming interfaces, provided by most of the major internet players, makes available a vast amount of functionality to be exploited. Often this is for noble purposes, but equally often it is not. Anyone who has published an academic paper can likely find articles they have written being duplicated on other sites, without attribution or acknowledgement, as part of an automated curation process. It is a trivial task for an online retailer of dubious morality to scrape Amazon for product reviews so that they can be reposted for their own website. None of this would be **difficult** for a human to do, but it is long, tiresome, tedious labour because of the amount of cumbersome work that must be performed. A human would need to extract a product ID, look it up on Amazon, copy and paste each of the reviews into a separate document, load up their own website, find the product, and copy these reviews individually into separate entries. Computers don't get bored, or make mistakes, or become frustrated. In the process, automation is also squeezing the spaces within which unskilled labour can make a living in modern society. Automation tends to distort the

skill-base of the workforce. It increases the need for highly skilled developers and engineers while decreasing the need for those without advanced technical education. Automation creates better jobs, and it may even create a greater number of better jobs than it destroys, but it does so with a profound transformative impact on society and on the communities reformed by its adoption.

Privacy and anonymity online have become powerful ethical issues related to computing. These two concepts go hand in hand, being in many ways two sides of the same coin. Much of what characterises the often unpleasant nature of discourse online is the easy availability of anonymity. However, this is often a shallow kind of anonymity – limited to communication between end-users. Many of the most virulent social media harassment phenomenon, such as Gamergate have been driven at least in part by the ease at which throw-away accounts can be established, configured, and then set at those deemed 'acceptable targets' with minimal chance of real retribution (9). However, like most ethical issues this is a double-edged sword – the same anonymity that protects trolls and harassers also protects social activists and whistle- blowers in some of the most totalitarian and repressive regimes throughout the world. Our privacy is at risk from many vectors, and not all of them are instantly obvious. Regardless of the steps we take to protect our identities online, we are constantly leaking identifying information through the simple act of touching upon a website. The Panoptoclick project of the Electronic Frontier Foundation (10) starkly shows just how easily identified we can be by taking our browser 'fingerprint' – all the bits of information we expose to web servers. This is often a unique identifier, taking our operating system; browsers; plugins; time zone; screen resolution; and system fonts into account. Without consciously providing a single piece of personally identifiable information, our visits to websites can be precisely tracked. For large periods of times, sites such as Facebook have tracked users as they explored the web (11), and through the technique of remarketing we can find our online activities elsewhere influence the ads we are served in supposedly unconnected parts of the internet. It's easy to feel as if we are not in control of our own disclosure online. There are ways we can avoid these type of tracking systems, but they require a level of technical awareness that most casual users simply do not possess. The

frictionless nature of data communication poses risks to privacy that other forms of disclosure simply do not. Likewise as computers become more capable, it becomes easier to combine multiple data sources in a way that offers greater insight into individuals than would be possible for single data source alone. Even those concessions to privacy that are bundled up with consumer agreements and government oversight can provide insight other than that which we may willingly choose to disclose. When the National Security Agency (NSA) tracks telephone call details, they claim only to track metadata – that is, who made the call; to whom the call was made; from where the call was made; and the duration of the call. The contents of the calls may remain private, but a simple analysis of metadata can render that content irrelevant. If one knows that an individual called their gynaecologist and then called their partner and then called an abortion clinic, we do not need to know what was discussed in order to have a strong understanding of what is going on.

Finally, as computers get faster the conceptual limits on what is feasible become less binding. What takes a minute to accomplish today will, assuming Moore's Law or some variant holds true, take half a second in ten years. We may baulk at a database query that spans multiple collections if it takes sixty seconds to complete. We would not think twice at a half second delay for the same query. A password that takes twenty four hours to crack today will take around five seconds in twenty years. However, there is an additional aspect here that also acts as a multiplier on the availability of processing power – the growing affordability of computing devices. Even today it is easy for intractable computing problems to be tackled through chaining together cheap devices into an ad-hoc supercomputer. Availability of hardware platforms such as the Raspberry Pi and other low-cost units can make available creative and affordable networks of plug-in computing power. Realistically, the only difference between an intractable processing challenge and a trivial one is the passage of time and the budget available. This accessibility of processing power creates ethical complications across the board. Privacy is threatened by the ease at which extensive, cross-platform data mining can be performed. Faster processing means more cycles become available for even more complex automation, and for the scale of that automation to expand in line with the availability of resources.

We gain a lot from the pace of computing evolution, but we must be mindful too of what we risk losing as a consequence.

Computer Ethics and Professional Conduct

However, complexity is true of all interesting ethical decision making and not an intrinsic element of computer ethics in particular. Computing is widely seen as a professional discipline, but unlike many equivalent professions it does not require adherence to a fixed code of conduct. There are codes of professional ethics such as those defined by the British Computer Society; the Association of Computer Machinery; and the Institute of Electrical and Electronics Engineers. However, lacking professional membership in any of these does not prohibit individuals from practising computing. Instead these professional bodies pitch themselves on the 'value added' that they bring. They offer access to literature; networking opportunities; or professional certifications. They align themselves to the higher and further education sectors through accreditation (12). This ensures that those that complete an accredited path of study have easy or automatic acceptance into the professional body at a suitable grade. Part of this accreditation usually involves the need for formal instruction in computer ethics, making use of the body's own code of practise. This is part of what makes computer ethics a difficult sell – adherence to these codes is voluntary and predicated only on the perceived value of professional membership. No-one will be barred from participating fully in a computing career if they choose not to engage. The various disciplines of computing have largely slipped into the category of professional careers without ever regulating themselves with the rigour of other disciplines.

In many respects this voluntary aspect of professionalism has distorted understanding of what professional behaviour actually involves. This has a consequence of underpreparing practitioners for the complex issues that might might arise within the workplace. Most of us have a passing familiarity with at least some elements of computing legislation and issues of intellectual property, but few are well equipped to navigate what has become an incredibly litigious field of work.

Courtroom battles over software code and practises are now relatively commonplace, including such well known incidents as Apple versus Samsung (13) and A&M Records versus Napster (14). These are not necessarily restricted to the high-profile disputes of billion-dollar companies. The open source movement has achieved many positive things – however, it has also fractured the issue of licencing with dozens of different agreements which enable or restrict the rights of others to the use, adoption and modification of computer programs (15). Knowing what an open source licence permits is a large part of knowing whether it is available for effective use, and it is not always obvious what may be allowed. Large companies will have individuals, or teams of individuals, available to advise on what is and is not permissible. Smaller organisations may find themselves at the mercy of the understanding of their 'IT person' who may not have had any formal instruction on the legal and ethical complexities of their profession. Even standard software installation licences are full of densely worded legalese. Indeed, these are often so wilfully obtuse that most of us click through without even reading. We leave ourselves unsure as to what we may have actually agreed. In some cases, this has led to people signing away the right to monetize their own intellectual property or given large organisations the right to use it without restriction in support of their own corporate endeavours.

The importance of computing is such that in any given jurisdiction there will be several, often highly complex, acts of legislation that bind how computers and data can be used. Hobbyists running their own websites or producing their own software packages may find themselves in breach of the law; in breach of software patents; or found to be infringing upon intellectual property, without ever realising they had done anything wrong. Other professions have more robust mechanisms for preventing this, and also come with an infrastructure of institutional support for handling violations or conflicts. Within the field of computing, many operate without the benefit of professional membership and have little recourse or support when things go wrong. Even those who achieve the necessary standing to join a professional association may simply not see the need until it's too late. Professional skills are often an afterthought and seen as too 'soft'. The networking opportunities

that such membership can bring are likewise undervalued in a field which lacks a default assumption of professional collegiality. The values of professional membership in computing as an economic signal are disputable, and upholding the codes of conduct to which an individual may be expected to adhere can seem like an unnecessary chore as a consequence.

These would be issues for professional bodies alone to concern themselves with, but it is an important drawback when attempting to encourage the development of ethical analytical skills for professional practitioners already stretched for time. The default buy-in of mandatory professional responsibility is not available to act as a justification. Some professionals will be interested in the topic for its own sake, but for others it's a topic of study that can be difficult to tackle when they'd rather be sharpening or expanding their technical toolkit. Most of the real life issues of professionalism that arise from a deficiency of computer ethics instruction are so specific, so complex, and so intractable that they defy any attempt to extract generalised lessons. For those embedded within the situation they often cannot be seen as dilemmas at all except with the benefit of hindsight and emotional distance. Examples of ethical complexity within computing rapidly 'rust' as the technical and social structures within which we function evolve. An instructive scenario that may have been perfect five years ago may be entirely anachronistic for a modern audience – in order to continue the use of such material, extensive historical context may be required. The Case of the Killer Robot (16) for example contains a situation where members of the development team argue over the use of the Waterfall Method as a development methodology for a highly interactive piece of user-facing software. Prototyping is discussed as a new-fangled technique, unproven and untested. Software design has moved on since then, and in order to effectively communicate the impact of this controversy it's necessary to teach that context which cannot be assumed by default. This is true in all disciplines, but especially true in the extremely fast-paced world of computing.

Computer Ethics in Context

This then raises the question of how we address this contextual complexity. We must consider how we can encourage and facilitate an on-going and evolving professional consideration of ethical responsibility. This requires a three-pronged approach, aimed at addressing these issues:

1. We must build buy-in when communicating the need for the topic. We cannot rely on the necessity of professional accreditation to do this for us.
2. We must focus on the applied aspect of the topic, with reference to the kind of day to day dilemmas that professionals will most likely face.
3. We must offer a lens on the topic that is particular to the complexity of computing ethics itself. There will be some overlap here with other topics of ethics, but those elements which make computer ethics distinct should receive the greatest focus.

This in itself has to be handled at two levels – the professional level, and the educational level. To a certain extent, student buy-in is pedagogically irrelevant – if a topic is necessary, it should be taught regardless of student perceptions. Most would agree however that this approach is unhelpful, and exacerbates the vicious cycle of disincentivisation as discussed above. When attempting to bring professional understanding of the topic to the fore, advocates must aim to do a better job in motivating the necessity of the subject – while not all professionals will have an opportunity to formally investigate the topic in a context which allows for extended dissection of the issues, it is important to facilitate an attitude that encourages extended self-directed study and reflection as well as a peer-driven discussion and collegiate debate.

For both groups, the issue is the same: To address the '**what'** of a topic without first addressing the '**why'** makes everything that follows much more difficult. Buy-in is a necessary pre-requisite for ensuring vibrant engagement; mature contemplation; and facilitating the ongoing inculcation of professional values. Largely, this requires overcoming the first great assumption – 'this is all just common sense'.

One way to set the context of this discussion is through exposure to the most sobering experiments in social psychology. Exploring the Milgram Experiment (17), the Stanford Prison Experiment (1) and the Asch Line Conformity experiments (18) can help disabuse individuals of the default assumption that they themselves can be trusted to do the right thing. Material on each of these experiments is commonplace, and the first two in particular have extensive documentaries with video footage that ensures the findings cannot be easily dismissed as biased or sensationalised reporting. Importantly, these two experiments in particular also provide a first formal introductory question for individuals to consider – 'were these experiments ethical?'.

These studies are not without their critics but their findings remain amongst the most ethically interesting in psychology. Miligram and Asch also have the benefit of being amongst the most replicable results in the field, and the variants of these experiments offer valuable lenses through which to assess human actions. Importantly though, they force professionals to consider 'would I do the same if I were in this scenario', and to be confronted with the possibility that under a particular combination of circumstances even good people can be compelled to do bad things.

An introduction to the topic that focuses on challenging the assumptions of the target audience can be a memorable way to introduce the complexity of the issues without beginning with the evolution of moral philosophy. Each of the studies is self-contained and offers its own tool to deconstruct and reconstruct practitioner assumptions. Miligram shows that we can potentially all be compelled to do bad things with only minor coercion. The Stanford Prison Experiment shows the power that social context plays in constructing ethical standards. The Asch Line Conformity experiments show the role that peer pressure plays in conformity, and also shows the power that simply standing up for what is right can have on others in a group. All of these are valuable lessons that help set the context of the topic as well as provide some of the necessary psychological tools for navigating within against such situations in the future.

Having addressed the issue of value, addressing the topic requires an approach that is aimed at showing relevance to day to day dilemmas. In this, advocates must be careful to avoid too many 'black and white' moral scenarios, or scenarios where there are obvious right answers. Real life moral dilemmas are difficult because they are almost always dappled in shades of grey. When the right thing is obvious, we do not torture ourselves over the correct course of action – only whether we will **follow** the correct course. It's important to focus on building the capacity for professionals to consider the moral implications themselves, and to make informed and ethical decisions in situations where there may not be a right answer. It's necessary to stress we are not attempting to indoctrinate what is right and wrong, but instead providing the tools needed to be able to decide which is which in complex scenarios. In this way, we avoid push-back against internal moral codes – in multicultural society we will rarely be able to expect any kind of consistency in assumed attitudes. We must be mindful of religious; social; and national contexts. We gain little in arguing with what other professionals believe to be right, but we gain much by ensuring that they are able to articulate and debate why they possess the beliefs that they do. It is important to note here that this must be handled in a non-judgemental manner – while it's difficult, if not impossible, to meaningfully discuss professional ethics in a truly 'safe space', it's also important to make sure nobody feels attacked for their views. A computing professional should be able to articulate an ethical viewpoint without forcing their interlocutors onto the defensive.

The approach advocated by this chapter is instead for advocates to make available fictionalised dilemmas within the context of a generic case study. This partially obviates the need to find and curate real world examples, and addresses the topic in a form accessible to all disciplines. The role of computers within the case study should be core, but the knowledge of computers required to fully understand it should be minimal. Ethical issues though are almost always about **how** computers are used. The ethical study should be supplemented where possible with relevant examples from real life, to ensure that professionals have access to a body of literature that is continually grounded in reality. These examples can be used to flavour the topic rather than confine

it. The Case of the Killer Robot (16) draws many of its ethical dilemmas from contemporary computing. The Scandal in Academia (19) (20) likewise draws in dozens of real-world examples in the construction of its narrative. Nothing in the Scandal actually happened, but events **very much like them** happen all the time. Both of these studies break up the narrative into easily digested units, and these units take the form of diegetic newspaper articles discussing the emerging crisis at the heart of their various organisations. These articles are quite small, and can be read and digested by busy professionals within small periods of unallocated down-time. The encapsulated ethical lessons within are small enough to be discussed collegially and meaningfully within coffee breaks. It is possible then to avoid the issue of 'rust' in the scenario while also ensuring that the dilemmas are suitably nuanced to invite contemplation and the evaluation of multiple points of view.

Contemplation is critical to the success of a model like this – the most effective technique is not to explain the right decision, but instead to encourage a thoughtful approach to deciding on moral responsibility. Both the Scandal in Academia and the Case of the Killer Robot adopt a technique where the initial facts of the story are supplemented by additional facts as time goes by. These later revelations often raise questions about previous judgements as the actions of participants are revisited from different viewpoints. This technique achieves two things – it gives professionals a chance to fully explore a topic and arrive at a judgement based on the information available, and it also ensures they fall into the habit of challenging their own judgements when new information is presented. True ethical decision-making requires the understanding that we often must make decisions without having all the facts, and that we must be willing to revisit our decisions as new information comes to light.

The use of fictionalised case studies also neatly deals with some of the main risks that might come from discussing real life examples, especially those that are derived from our own personal or professional experience. When we draw from our own lives we run the risk of being guilty of libel, slander, or general misrepresentation of motives or method. We may not intend mischief, but

humans are fallible information processing devices. Regardless of how we may remember an incident we will be coloured by our own perceptions of what happened. We likely were not in full possession of all the facts, and we can only guess at the intentions of major players. The Scandal in Academia was inspired by many incidents in the lives of the authors, but none of these are adopted without alteration. Many incidents are merged. Other incidents are separated out. No individual in the Scandal represents a real life person, although many of them are combinations of people with whom the authors are acquainted. Not all the real life ethical issues are derived from academic contexts, although all have been edited to fit the study. In the accompanying discussion pieces on the newspaper articles, only those incidents which are externally reported in the academic or professional literature are used as supplementary examples. Real life experiences are confined entirely to ad-hoc anecdotes where appropriate. In adopting this system when including supplementary material, advocates meet our professional obligations to ensure that we do not pass on what may be privileged information; we do not pass off our own incomplete understanding as canonical; and we do not misrepresent the actions or characters of people we know. The use of real world examples is valuable to show that these are not abstract issues being discussed, but it must always be done mindfully and respectfully of our own professional obligations. Where edits are made to create an appropriate discussion unit, we must make sure that individuals cannot be identified and that identifying contextual details are removed or likewise modified.

Most, although not all, of the ethical examples, real-life or otherwise, should be focused on the role that computers play in the unfolding drama. It should be possible for professionals to see how things would have gone differently were it not for the elements that make computer ethics distinctive. We should be careful not to imply that ethical issues are unique to computer science but we should be equally careful to ensure that we do not underplay the role of the distinctive elements discussed above. The lack of friction, ease of automation, risk to privacy and the speed of evolution are all hugely important to understanding why we must treat computer ethics as its own distinct

entity. It won't be possible to emphasise all of these equally in all scenarios, but some blending where all are represented is best to fully explore the topic.

CONCLUSION

While there is nothing truly unique about the ethical issues that themselves are raised with regards to computer science, there is a unique collection of elements that create opportunities for distinctive ethical dilemmas. Unlike many other professions where equally distinctive dilemmas may manifest, there is no requirement for computer practitioners to attain professional accreditation. This in turn removes one of the key motivations for practitioners to develop and sharpen their ethical frameworks as part of ongoing professional development. Computing professionals, especially those new to the field, can be under-prepared for the many subtle implications that come from a career in a computing intensive discipline. The frictionless nature of modern communication permits a rapid virality, or even memetic propagation, of content we may not wish to be distributed beyond a certain privileged group. Easy availability of automation allows for routine, yet ethically troublesome, activities to be performed without human intervention. The internal architecture of the internet too acts against our natural human desire for meaningful privacy even as anonymity is wielded as a weapon against us by internet trolls and online vandals. All of this is exacerbated by the speed at which computers get faster and cheaper – that which is technically infeasible today will be trivial to accomplish in a decade. This creates considerable pressures on the way we design and build computing systems and products.

Unlike most industries, within computing a difference in degree often becomes a difference in kind purely as a result of incremental improvements in technology. This requires a level of vigilance in the way we assess the impact of our work on wider society. Technology cycles between transformative, to routine, and back to transformative purely as a consequence of the incremental evolution of design. The most revolutionary impacts of computing have come largely from the accumulation of capability rather than via bold or radical new designs. Society has changed radically

as a result of the presence of computing, and our ethical toolkits for assessing our role within those changes have not evolved at nearly the same pace.

With all of this, the development of a professional understanding of computer ethics has arguably never been as important as it is now. There are many useful and powerful instructional tools available to professionals looking to develop these skills – case studies; psychologically relevant experiments; and more. When used properly, these can create very satisfying program of self-directed study that can help professionals build up their own ethical decision making toolkits. With this, we can ensure that we are all properly equipped to deal with the ever increasing complexity of a world being transformed on a daily basis by the rapid adoption of computing technology.

ACKNOWLEDGEMENTS

My thanks go to Pauline Belford for her help in the construction and editing of this chapter.

REFERENCES

1. Zimbardo, P. The Lucifer effect: Understanding how good people turn evil. Rider Books: London, 2007.
2. Harman, G. Moral relativism defended. The Philosophical Review 1975, 84(2), 3-22.
3. Harman, G. Is There a Single True Morality? In Moral Relativism: A Reader; Moser, P; Carson, T. Eds. : Oxford University Press: Oxford, 2001. 77-100.
4. Quinton, JJ; Williams, B. Utilitarianism: For and Against. Philosophy 1974, 49(188), 212-215.
5. Baron, M. Three Methods of Ethics: A debate. Blackwell: Oxford, 1997
6. Festinger, L. A Theory of Cognitive Dissonance. Stanford University Press: Stanford. 1957
7. Brevini, B., Hintz, A., & McCurdy, P. Beyond WikiLeaks: Implications for the Future of Communications, Journalism and Society. Palgrave Macmillan: London. 2013
8. Weng, L., Menczer, F., & Ahn, Y. Y. Virality prediction and community structure in social networks. Scientific reports, 3: 2522. 2013.
9. Heron, M. J., Belford, P., & Goker, A. Sexism in the circuitry: female participation in male-dominated popular computer culture. ACM SIGCAS Computers and Society 2014, 44(4), 18-29.

10. Eckersley, P. How unique is your web browser?. In Privacy Enhancing Technologies; Atallah, M; & Hopper, N. Eds.; Springer Berlin Heidelberg : Berlin, 2010, 1-18

11. Krishnamurthy, B., & Wills, C. E. On the leakage of personally identifiable information via online social networks. In Proceedings of the 2nd ACM workshop on Online social networks 2009. 7-12.

12. Joint Task Force on Computing Curricula. Computer Science Curricula 2013: Curriculum Guidelines for Undergraduate Degree Programs in Computer Science. 2013.

13. Cusumano, M. A. The Apple-Samsung lawsuits. Communications of the ACM 2013. 56(1), 28-31.

14. Langenderfer, J., & Cook, D. L. Copyright policies and issues raised by A&M Records v. Napster: "The shot heard round the world" or "not with a bang but a whimper?". Journal of Public Policy & Marketing 2001, 20(2), 280-288.

15. Heron, M., Hanson, V. L., & Ricketts, I. Open source and accessibility: advantages and limitations. Journal of Interaction Science 2013, 1(1), 1-10.

16. Epstein, R. G. The case of the killer robot: stories about the professional, ethical, and societal dimensions of computing. John Wiley & Sons Inc: Hoboken, 1996

17. Milgram, S. Behavioral study of obedience. The Journal of Abnormal and Social Psychology 1963, 67(4), 371.

18. Asch, S. E. Studies of independence and conformity: I. A minority of one against a unanimous majority. Psychological monographs: General and Applied 1956, 70(9), 1.

19. Heron, M. J., & Belford, P. Ethics in context: a scandal in academia. ACM SIGCAS Computers and Society 2014 44(2), 20-51.

20. Heron, M. J., & Belford, P. Power and perception in the scandal in academia. ACM SIGCAS Computers and Society 2015, 45(2), 11-19.