ETHICS IN THE COMPUTER AGE

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ABSTRACT—Over the past decade, the ever increasing role of computer technology in all areas of our life has introduced many new ethical issues. The significant emphasis on the computer's use in illegal or immoral activities as the paradigm of computer ethics is a type of myopia which leads us to miss many of the positive issues of computer ethics. I define computer ethics in closely related ways: 1) when humans make decisions about computers and those decisions change people's lives, then human values are linked to technical issues (computer ethics explores these decisions); 2) any decision made by computing professionals during the design, development, construction, and maintenance of computing artifacts which affect other people. This combined concept of computer ethics is most useful to us when understood as a type of professional ethics similar to medical ethics or legal ethics. When computers were primarily statistical devices printing checks and writing reports, the general populace had little interaction with computers in action. During this age of computing, the definition I offer was not a good definition of computer ethics. Common examples of computer ethical issues in that earlier age had to do with programmers writing programs which perpetrated fraud in banking or stock transactions. As computers slowly and invisibly permeated most areas of our life, we entered a new age of computing in which the successful operation of the computerized processes assumed greater ethical significance. The general public had more interactions with and greater dependence on computerized processes. This change places greater significance on the activity of the computing practitioner. As the practice of computing has changed, so have the computing practitioner's ethical obligations changed in degree and kind. Understanding these obligations and responsibilities should help to enlighten the behaviors and decisions of the average computer user.

Over the past decade, the ever increasing role of computer technology in all areas of our life has introduced many new ethical issues. There has been significant emphasis on the computer's use in illegal or immoral activities. This has become the paradigm of computer-ethics issues. In this paper, I argue that this is so narrow a view of computer ethics that it can reasonably be called mistaken. This myopic view leads us to miss many of the positive issues of computer ethics. There is a positive side of computer ethics which is critically relevant to the practicing computer scientist. Moreover, this narrow view is dangerously misleading in the way it directs attention away from the more critical sense of ethics.

EARLY VIEWS OF COMPUTER ETHICS

When computers were primarily statistical devices printing checks and writing reports, the general populace had minimal interaction with computers in action. The general populace's connection with computers evolved gradually. At first, people's bank accounts were managed by the computer, and people had no direct interaction with the computer. Later, customers began to receive direct outputs from the computer, such as their paychecks, calculated and printed by the computer, or bills which the computer printed and mailed to them. The next stage in this interaction went so far as to have the customer respond to the computer by asking the customer to send a computer-readable bill back to the computer along with their payments.

During this period of time, the complete scope of computer ethics merely included the intentional misuse of the computer by ill-willed and malicious computer programmers. These programmers used their special talents to commit immoral acts. Common examples of computer-ethical issues had to do with programmers writing programs which perpetrated fraud in banking or stock transactions or writing programs which would increase medical reimbursements or mark bills paid which had not been paid. This myopic view of computer ethics as individual abusive activity for self-gain by programmers was broadened slightly. Many people became concerned with the impact of computers on society, but these concerns were couched in the same rhetoric, namely "Watch out for the evil computer genius who will use a computer to take away your job or use a computer to take away your privacy with gigantic databases." Computer ethics had to do with what "THEY" intentionally did to "US."

SETTING THE STAGE FOR THE CURRENT VIEW

Our interaction with computers has changed greatly since those early days. I believe it has gone through two significant stages. Computers began to permeate more and more areas of our life. They controlled manufacturing, ordering, and marketing processes for corporations. They improved forms of entertainment and enhanced communications. They continued to generate bills, some with highly improbable numbers. At this stage, problems generated by systems were blamed on the computer, and the world became free from ethical responsibility. It was a "computer problem." No significant change occurred here in computer ethics. Our primary interaction with computers was still primarily as recipients of computer output. The only minor change seemed to be a willingness to excuse all computer problems by blaming the ignorance or carelessness of the programmer.

Because access to computer knowledge was limited, computer developers had a freedom to build things in ways that suited their needs rather than the user's needs. If a programmer did not want to write a particular program or did not want to write it the way the customer wanted, it was common to hear programmers tell customers "Computers can't do that." or "Your company can do that because they have a different computer. Our computer can't do that." Computer programmers were like the hired gun of the wild west who came into town to fix your problem. You were given the right to identify your problem. They would determine what they thought was the best solution and implement it. You had to live with their solution to your problem.

However, in the early 1980s, with the advent of personal computers, the world changed and "WE" became "THEM." The computer became a tool which was accessible to us. We too could write programs and use this tool to meet our needs. We also had access to software which previously had only been located on large corporate computers. The personal use of computers changed the face of computer ethics. However, I think this was only a slight change. Ethical issues expanded because the base of potential abusers of computer powers enlarged, it now included "US." More people could produce fraudulent data with computers. Along with the advent of the personal computer, there was an increase in its functions. Word processing became a potential vehicle for unethical behavior as it made plagiarism easier. Ordinary disk copying made theft so easy that people have difficulty conceiving of it as theft. The concept of computer ethics was now an issue which reached beyond the nefarious computer programmers and now included malicious and ill-willed, personal-computer users and owners. However, the ethics were the same. Issues in computer ethics just includes those kinds of acts we view as unethical in other contexts (e.g., fraud, theft, trepass, harm, and dishonesty).

Although there was little real change in the concept of computer ethics, the advent of personal computers did improve our awareness of the almost unlimited power of computers. We became aware of alternate solutions to our problems and that the computer was more flexible than we previously had been led to believe.

However, there is another significant element to the evolution of computer ethics. Computers have become invisible. In a typical day, our lives are controlled by a large number of unseen but critical computers. Consider a normal day going to work. The digital alarm wakes you up, in your climate-controlled apartment, where you heat your breakfast in the microwave, then start your electronic ignition car, step on the gas controlled by a computerized carburetor, step on your computer-controlled breaks, stop at the computer-controlled red light at the intersection, when the program in your carburetor chip hits a bug and propells your car into the intersection at 60 miles/h. As computers slowly and invisibly permeated most areas of our life, we entered a new age of computing in which the successful operation of the computerized processes assumed greater ethical significance than it ever had when it merely printed reports.

THE OTHER REALM OF COMPUTER ETHICS, PROFESSIONALISM

The general public has more interactions with and greater dependence on computerized processes. This change places greater significance on the activity of the computing practitioner. As the practice of computing has changed, so have the computing practitioner's ethical obligations changed in degree and kind.

Ethical concerns now go beyond the normal realm of ethics to include all the issues of professional software development. Poorly developed software negatively impacts peoples' lives. Let us look at some of the extreme examples in which "software kills." The example

of the computer-controlled carburetor which randomly accelerates a car's speed to 60 miles/h was responsible for several injuries. There is a pacemaker which has been installed but which has a programming bug in it which leads to a 1% failure rate. The process of replacing the pacemaker has a 2% fatality rate. So one person of every 100 who has this pacemaker installed will have a significant heart attack and may die. What happens when the program that controls your anti-lock breaks fails? Consider the ethical issues involved when the simulator program used to train your pilot teaches the pilot to move the yoke in a certain way in a particular type of crisis but the plane actually nose dives to the left when this maneuver is done in flight. It is no longer sufficient for computer developers to operate with a cowboy mentality that says anyway we get the job done is sufficient. This leads me to my broadening of the definition of computer ethics.

A BROADER SENSE OF ETHICS

I define computer ethics in closely related ways: 1) when humans make decisions about computers and those decisions change people's lives (then human values are linked to technical issues and computer ethics explores these decisions); 2) any decision made by a computing professional during the design, development, construction, and maintenance of computing artifacts which affect other people. The first clause includes the early sense of computer ethics, and the second clause includes the broader sense of computer ethics. This combined concept of computer ethics is most useful to us when it is understood as a type of professional ethics similar to medical ethics or legal ethics.

What is the difference between being a professional and being a hired gun? Initially, the concept of a profession was the commitment to a way of life with high moral ideals, e.g., the profession of faith to a monastic order. The concept of a profession now embodies the possession of a set of skills and a commitment to use those skills in a certain way. The failure to use the skills in the accepted way is considered a violation of professional ethics.

Professional ethics is distinct from personal ethics. One's commitment to follow a set of professional ethics is a personal ethical commitment, but the professional ethics are standards adopted by the professional community. These standards get codified by professional societies in codes of ethics, licensing standards, and standards for professional practices.

A simple example will show the difference between a professional and a hired gun. So far, we have focused on the technical skill of the hired gun. The possession of this skill also is a necessary condition for a computer professional, but there is another significant element in professionalism. Good professional judgement is not purely technical judgement. What would you think of a physician who, when asked by a patient to cut off both of the patients arms at the elbow, said "I will do it right now. I have been specially trained in surgery."? Even if the physician did this in a technically skilled fashion, we would not say he was acting professionally. Where was the exercise of the values for the well-being of the patient in this judgement. Technically, he chose the correct scalpel and anesthetic. What he failed to do was to condition his technical judgement by a set of moral values. Accepting a role of professional also carries with it a commitment to a set of ethical principles.

Professionals have a special responsibility to avoid or prevent harms which goes beyond our everyday responsibilities not to harm others. Claims like this have been the basis for legal decision in medicine and engineering and, recently, have been the basis for decisions in computing. Professionals have been found guilty of "indifference to their professional duties." The claim that professionals have a special responsibility is generally argued on two grounds; one is an argument based on an implicit contract that a professional has with society, and the

other is based on the moral obligation to society to use special knowledge wisely. The importance of computer-science knowledge to the lives and well-being of the public entails a consequent responsibility to use this knowledge in a way that protects and benefits the public.

There are several marks of a profession. It is an occupation requiring special, usually advanced, education and skill. This education has a solid foundation in theory. In computing, there are standard bodies which have defined a minimal undergraduate curriculum. The hired gun does not require any background knowledge.

The professeional's knowledge and skill are vital to the well-being of society. Professional activity should always be viewed as a service to society. I think the failure to see that computing products are used only to serve the needs of others and the failure of the professional to keep the welfare of the user in mind has led directly to several instances of unethical behavior. There are several causes for these failures. One cause is simple ignorance. We train computer scientists to solve problems, and the examples we use, such as finding the least common multiple for a set of numbers, portray computing as merely a problem-solving exercise, analogous to doing a crossword puzzle. Solving the puzzle is an interesting exercise, but it lacks significant consequences.

The failure to realize that computing is a service profession to the user of the computing artifact has significant consequences. One result of this is seen when we consider the case of a programmer who was asked to write a program that would raise and lower a large x-ray device. The programmer wrote and tested his solution to this puzzle. It successfully and accurately moved the device from the top of the support pole to the top of the table. The difficulty with this narrow problem-solving approach was shown when a x-ray technician told a patient to get off the table after a x-ray was taken and then the technician set the height of the device to "table-top-height." The patient had not heard the technician and was crushed under the machine. The programmer solved a puzzle but did not consider the user. The responsibility to the user should have led the programmer to implement a check whenever the machine was lowered to table top.

Computing is a service industry. All computing artifacts are designed to be used. Computing has had a tendency not to see itself as a service industry. Even the term "user" carries with it a derogatory connotation. Computer programmer is one of only two occupations that I know of in which customers are called "users." There is a recent example of this attitude before the courts. A defense contractor was asked to develop a portable anti-aircraft system. The system the contractor developed effectively destroys aircraft, but it also occasionally kills the person who launched the missile. The company has declared that this is not a problem because they "are in full compliance with the specifications given to them by the user." Being a professional involves using one's special skills to give careful and constant consideration to the impact of the service on others. This consideration is guided by a set of ethical principles. For a fuller explanation of this distinction, see Gotterbarn (in press).

This failure of professionalism now has been rejected by computer organizations. There are indications that it is rejected by the courts as computer practitioners are being found guilty of negligence.

PROFESSIONAL ETHICS AND THE NONPROFESSIONAL

The establishment of professional standards and codes of conduct has a very broad impact. These standards help to guide nonprofessional behavior. Because physicians have the standard of applying antiseptic to open wounds, the lay person is guided in how they should handle open wounds. The same is true for software development models. Understanding these obligations and responsibilities should help to enlighten the behavior and decisions of the average computer user.

BOTH SENSES OF ETHICS

Treating ethics simply as an intentional immoral activity with a computer misses all of the professional issues raised here. It also misses' what is really new in computer ethics and covered in part 1 of my definition. The ubiquitousness of computing requires that we rethink many standard ethical positions. Local community standards have been used to define obscenity. This concept of local community has been severely tested. Someone from one community in Tennessee uses the internet to access information in another community in California >1,000 miles away. The information in California is not regarded as obscene, but it is regarded as obscene in Tennessee. Has the person in California committed a crime. Peter Zimmerman developed a powerful public key ecryption program which he made available free on the internet. He is being charged with exporting military hardware (this is the way the government classifies encryption programs). The ethical standards and privacy conventions for surface mail do not clearly apply to electronic mail. Electronic mail on a university computer has been ruled to be university documents. If the university is a state institution, your email can be accessed by anyone using the Freedom of Information Act. These are but a few of the new ethical issues raised by computing.

Computer ethics as broadly conceived includes these new issues which the public needs to be aware of and includes all of the issues of professional practice. With the narrow view of computer ethics, computer ethics was primarily a reactive enterprise allocating blame to the ill-willed. However, with this broader concept of computer ethics, it is possible to approach the subject in a proactive way, developing guidelines and standards to guide us in activities as computer users and computer professionals.

LITERATURE CITED

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