



Computer Ethics from Obscure to Ubiquitous

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Abstract: This paper reviewed literature reported on computer ethics. This paper is divided into four sections, first section deals with understanding of what is computer ethics, second section deals with history of computer ethics third section discusses the Ethics code of conduct adopted by many organisations and fourth section discusses about future perspective of computer ethics. The author of this review asks questions with regards to what constitutes computer ethics and works systematically from filling “conceptual vacuum” to understanding of meta-ethical discourse of computer ethics. This paper discusses historical milestones achieved by trail blazing work of researchers from Norbert Wiener to Luciano Floridi and identifies research questions that have not been addressed sufficiently in the literature and suggest specific research areas for further investigation.

Keywords: Computer ethics; code of ethics; information ethics; flourishing ethics; uniqueness debate

I. INTRODUCTION

Computer ethics has evolved over years from obscure entity to a ubiquitous entity, though it is still young and developing. Philosophers, computer scientists, thinkers, scholars have worked over years for its establishment, from Professor Wiener to Luciano Floridi there has been a tremendous work on conceptualization of computer ethics. Computing technologies and artefacts have gone so deep in our lives that it has become part of us and our society. Its ethical issues have grown so radically and thus it is required to give it a moral framework. Even though there has been a huge research in the field, but still there is no clear consensus among communities of technical scholars and practitioners regarding computer ethics and its applications. This article provides the methodical and broad review of the literature on the ethics of computing. A sound understanding of ethics is a key component of the professional status that professional bodies such as the Association for Computing Machinery (ACM) aspire to. First section of this paper tries to answer what is computer ethics? Understanding of computer ethics is important for computer professionals like computer scientists, soft engineers and related technical experts. Second section unravels what is being done in the field and tries to give conceptual framework for computer ethics. Third section gives a glimpse of Ethics code of conduct adopted by various organizations and Last section focuses on future goals. Ethics plays a pivotal role in shaping the social and regulatory environment in which computing professionals work. Proper conceptualization of the field can help in generating better Code of ethics, better computer ethics laws and policies to deal with new and challenging ethical issues generated by the application of pervasive technology.

II. DEFINING COMPUTER ETHICS

Professor Norbert Wiener of MIT in early 1950s founded computer ethics, but it was ignored till mid 1970s when Walter Maner coined the term “computer ethics” and defined it as one that studies “ethical problems aggravated,

transformed or created by computer technology.” He suggested to apply orthodox ethical theories to these new or modified problems created by computer technology[1]. In 1985 Deborah Johnson in her book defined computer ethics as a study in which computer technology “pose new versions of standard moral problems and moral dilemmas, exacerbating the old problems, and forcing us to apply ordinary moral norms in uncharted realms.” She also believed in the application of traditional ethical theories [2]. In 1985, James Moor gave comprehensive definition of computer ethics in his article “What is computer ethics?” as “computer ethics is the analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology.” Moor’s definition is wider and aspiring than Maner or Johnson as it explained the importance of ethical issues raised by computing technology and went beyond explanation and listing of these issues[3]. Terrell Ward Bynum broadens the definition of computer ethics and suggested that computer ethics is a study which recognizes the influences of information technology on all which is related with human value like “health, wealth, work, opportunity, freedom, democracy, knowledge, privacy, security, self-fulfillment, etc”[4]. In 1990 Donald Gotterbarn gave new definition to computer ethics, getting it under the domain of professional ethics. He limited computer ethics “to those actions that are within the horizon of control of the individual MORAL computer professional” and deals with “ethical values, rules and judgements applied in a computing context based on professional standards and a concern for the user of the computing artifact”[5]. In 1999 Floridi proposed a new theory of “Information ethics” as a conceptual and methodological foundation for computer ethics. He emphasized that “Information Ethics is an ontocentric, patient-oriented, ecological macroethics”[6]. His definitions are much broader and wide ranging that it take everything into its domain, he defines it in terms of infosphere where every object whether living or non-living is an information object having “minimal moral claim” and his theory enquires about “What is good for an information entity and the infosphere in general?”, thus any action “information process” in “infosphere” is permitted or not-permitted depending on its effects on the “essence of information”[7]. Floridi’s definition offers “a valued perspective from which

to approach, with insight and adequate discernment, not only moral problems in CE, but also the whole range of conceptual and moral phenomena that form the ethical discourse"[6]. Later Terrell Ward Bynum redefined computer ethics and proposed "flourishing ethics" lending ideas from Aristotle, Norbert Wiener, and James Moor. Bynum definition validates, and promotes "the flourishing of all beings that resist or diminish – in our small region of the universe – death and disease, decay and destruction, chaos and corruption wrought by the greatest of natural evils: increasing entropy"[8].

III. HISTORICAL OVERVIEW

Norbert Wiener

Computer ethics came into being by sheer serendipity during World War II in the early 1940s by the work of MIT professor Norbert Wiener, who is considered as the founder of Computer ethics. He with other scientists was designing an anti-aircraft artillery connected with a digital feedback system to track, target and hit enemy warplanes. This scientific work of Wiener gave birth to a new field of research called "cybernetics"[9]. This new field raised serious ethical question in Wiener's mind which he expressed in 1948 in his book *Cybernetics: or control and communication in the animal and the machine*.

It has long been clear to me that the modern ultra-rapid computing machine was in principle an ideal central nervous system to an apparatus for automatic control; and that its input and output need not be in the form of numbers or diagrams but might very well be, respectively, the readings of artificial sense organs, such as photoelectric cells or thermometers, and the performance of motors or solenoids... we are already in a position to construct artificial machines of almost any degree of elaborateness of performance. Long before Nagasaki and the public awareness of the atomic bomb, it had occurred to me that we were here in the presence of another social potentiality of unheard-of importance for good and for evil. [10:27-28]

He realized that Cybernetics would have "enormous potential for good and for evil"[11]. In 1950 Wiener showed his deep concerns about computer ethics in his second book, *The Human Use of Human Beings*[9]. This book served as the beacon for computer ethics, even today it acts as a guiding light for research in computer ethics.

Donn Parker

In the mid-1960s twenty years after Norbert Wiener's foundational work of computer ethics, Donn Parker of SRI International in Menlo Park, California started a work of enduring significance, he started listing crimes pertaining to computer ethics and published many books and articles relevant to computer ethics. Parker in 1968 wrote an article "Rules of Ethics in information Processing" published in *Communications of the ACM* [12]. There were no laws at that time to deal with such crimes and to stop such unethical activities an ethics code for computers was required [13]. In 1973 Association for Computing Machinery adopted the first

Code of Professional Conduct which was headed and published by Donn Parker¹[14], [15].

Joseph Weizenbaum

Joseph Weizenbaum is most prominent and notable computer scientist who pioneered computer ethics. Weizenbaum in 1966 created a simulation script, a natural language processing program called ELIZA at MIT Artificial Intelligence Laboratory [16]. ELIZA was an Artificial Conversational Entity or chatterbot which simulates conversation. Weizenbaum used ELIZA to simulate "a Rogerian psychotherapist engaged in an initial interview with a patient." ELIZA got anthropomorphic responses, which disturbed Weizenbaum. He believed these responses particularly about ELIZA and computers in general are actually reducing human beings and making them nothing but machines. He expressed his grave concerns about computer ethics in his book *Computer Power and Human Reason: From Judgment to Calculation*. This book strongly highlights ethical issues created by overdependence of human beings on computers. His argument suggests that making choices should remain with humans and not with computers. He suggested that artificial intelligence should not be allowed to do what humans do, as computers lack wisdom.

WALTER MANER

The great work of Wiener, Parker, and Weizenbaum could not convince philosophers to recognize computer ethics as a field in its own right. It was for the first time a faculty member in Philosophy at Old Dominion University, Walter Maner, in the mid-1970s who perceived the complexity in ethical domain by the introduction of computers. He coined the term "computer ethics" and suggested that "We should study computer ethics because the set of novel and transformed issues is large enough and coherent enough to define a new field"[1]. Maner showed uniqueness of computer ethics and discussed its issues and problems in his article "Is Computer Ethics Unique?" Maner further took his research into academic domain, developed a new ethics course predominantly for computer science students. Maner in 1978 created and self-published "A Starter Kit on Teaching Computer Ethics", this starter kit was a complete suite for university teachers to start a course in computer ethics. Walter Maner's work helped bridge philosophers and computer scientists to work together on this newly designed field which he called "Computer Ethics". Maner's conceptual framework for computer ethics triggered explosion of activities in computer ethics in terms of debates, workshops and conferences.

Terrell Ward Bynum

Walter Maner in 1978 conducted a workshop on computer ethics, Bynum attended that workshop and was so inspired and convinced about computer ethics that it changed his career orientation. He started actively working on the field of computer ethics. He persuaded Maner to publish "A Starter-Kit on Teaching Computer Ethics". He in 1979

¹ [13][13](Parker, 1979)[13](Parker 1979)[5](Parker 1979)Donn B. Parker, *Ethical Conflicts in Computer Science and Technology* (AFIPS Press, 1979).

developed and incorporated a curriculum of computer ethics course for his university. He published many articles, monographs and books on computer ethics. To put emphasis on computer ethics he gave many speeches and hosted many video programs. In 1985, to establish computer ethics as new branch of applied ethics, he decided to publish a whole computer ethics issue in his journal *Metaphilosophy*, he organized an essay competition on computer ethics for that issue. This journal idea produced a seminal paper "What is Computer Ethics?" by James Moor. In 1986, Bynum joined the faculty at Southern Connecticut State University and in 1988, created the Research Center on Computing and Society, which proved to be the hub for computer ethics activities. In 1991, National Conference on Computing and Values (NCCV) funded by America's National Science Foundation was organized by him with Walter Maner. This conference was a historical attempt to dig deep into the sub topics of computer ethics like security, privacy, intellectual property issues, didactics and many more such fields. For the first time in history such a conference on computer ethics was organized which attracted not only thinkers, researchers, computer scientists and philosophers, but also people from different walks of life like lawyers, journalists, psychologists, public policy makers, even people from business background and many more. This started a new era in the field of computer ethics. This conference witnessed attendance of four hundred people from eight countries including thirty-two American states. This conference produced a rich intellectual material in terms of an extensive bibliography, video programs and monographs[4].

In 1995 Europe witnessed tremendous computer ethics activities, with the inception of Centre for Computing and Social Responsibility (CCSR) in England by Terrell Ward Bynum and Simon Rogerson of De Montfort University. They also organized first computer ethics conference in Europe, ETHICOMP95. This conference worked on the philosophical, professional and practical aspects of computer ethics. Its main event is scheduled after every 18 months in different countries across Europe and Asia. This series offers an environment for discussion and revival of ethical and social issues raised by contemporary computing and thereby works for the development and application of computer ethics. Ethicomp 2017 will be hosted in June of 2017 by the University of Turin, Turin, Italy. This will be a jointly sponsored event CEPE/ETHICOMP 2017.CEPE (Computer Ethics Philosophical Enquiry), deals with philosophical aspects of computer and information ethics held every 18 months since 1997, founded by Jeroen van den Hoven. In 1999, Australia joined computer ethics when two Australian scholars John Weckert and Christopher Simpson with the help of Terrell Ward Bynum and Simon Rogerson created the Australian Institute of Computer Ethics. They also organized first ever international conference on computer ethics in Australia, AICEC99[4].

DEBORAH JOHNSON

Maner's claim of uniqueness of computer ethics ignited a "uniqueness debate", which was started by Maner and her colleague in the Philosophy faculty at Old Dominion University, Deborah Johnson. Maner claimed computers created new species of ethical problems, which were not seen before introduction of computers. Deborah Johnson was not satisfied by Maner's claim of uniqueness. She believed that computer ethics is not altogether new and unique, rather it

alters old ethical problems and "give them a new twist." She believed that computer ethics is a new specie with its own set of characteristics, different from other species, "but at the same time, the species has generic or fundamental characteristics that are common to all members of the genus"[2]. Johnson later in 1985 published a Book, *Computer Ethics*, [17] which happened to be the first textbook on computer ethics and was adopted by many universities.

JAMES MOOR

James Moor in 1985 published a formative article "What is Computer Ethics?" This article not only changed the way research in computer ethics was done but also established him as one of the pioneering theoretician in the field of computer ethics [18]. James Moor broke the shackles and went past what Maner and Johnson did. He broadened computer ethics by using phrase "computer technology" which includes everything associated with computers, like software, hardware, networking etc. Moor suggested computers are "logically malleable" because computers can do any task and "the potential applications of computer technology appear limitless." He stressed on the fact that there are no laws to tackle such myriad ethical issues arising out of "logically malleable" nature of "computer technology", which Moor stated as "policy vacuums", as there was no policy to handle such issues. Moor also explained that with "policy vacuums" there is also a "conceptual vacuums", because with a particular issue there may arise many issue pertaining to the conceptualization of that particular issues, which Moor called as "conceptual muddle". Thus, it is requisite to "provide a coherent framework within which to formulate a policy for action"[19].

Moor joined "uniqueness debate" and called "Johnson's characterization of a problem of computer ethics as just another species of a fixed ethical genus" as misleading. He believed that genus can't be fixed. He had doubts about the uniqueness of computer ethics but believed that computer ethics is so novel that traditional theories can't suffice and "requires more than routine application of principle"[20]. Moor introduced the concept of "core values" basic values of human beings to deal with issues of computer ethics [20]. Moor in 1999 developed a new system of applied ethics called as "just consequentialism", which puts constraint of justice on consequentialism. This new system was created by logically connecting core values, consequentialism and Bernard Gert's deontological concepts [21].

ROBERT HAUPTMAN

In 1988, Robert Hauptman for the first time used the term "Information ethics" in his book *Ethical challenges in librarianship*. In 1992, he started the *Journal of information ethics*. Information ethics is "the branch of ethics that focuses on the relationship between the creation, organization, dissemination, and use of information, and the ethical standards and moral codes governing human conduct in society"[22]. Information ethics has evolved over the years into an amorphous multidisciplinary domain, focusing on issues related with the Internet. Cyberethics is one such example having issues related with internet and covers issues related with database privacy, intellectual property, decision making by robots, issues related with cyborg, expert systems and artificial intelligence[23].

Information ethics has made its niche into the “applied dimension” of computer science called “Computer and Information Science”[24].

DONALD GOTTERBARN

In 1990s, Donald Gotterbarn to fill the gap of coherent conceptualization of computer ethics, put forward his *professional ethics* approach to deal with the issues of computer ethics. He believed that Computer ethics issues considered are so diverse that it had clouded the concept of computer ethics and there is no clear consensus on its ethical positions. Gotterbarn proposed “The only way to make sense of “Computer Ethics” is to narrow its focus to those actions that are within the horizon of control of the individual MORAL computer professional”. (Gotterbarn, 1991). He believed narrowing focus on broader issues will help them get solved. His focus was on role of computing professionals as professionals and ethical decision which these professionals made while developing computer artifacts, as he believed “The ethical decisions made during the development of these artifacts have a direct relationship to many of the issues discussed under the broader concept of computer ethics[5].

Gotterbarn worked proactively for the development of professional ethics. He worked with Professional organizations in the USA, like the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronic Engineers (IEEE). In 1992, ACM adopted third version of its “Code of Ethics and Professional Conduct” created with the help of Donald Gotterbarn. He proposed a model of licensing for software engineers “I propose a model for licensing computer professionals in which there is a national standard supported by computing professionals and implemented by state governments modeled on Professional Engineer's and Para-Medic's licensing standards”. In 1997, He became Chair of the ACM Committee on Professional Ethics (COPE), he chaired the ACM/IEEE-CS joint task force on Software Engineering Ethics and Professional Practice to establish software engineering into a profession. In 1999, ACM pulled out and determined that the body of knowledge was too immature for licensing. The IEEE however continued its venture of making software engineering into a profession. These efforts lead to adoption of software engineering as profession in Canada the Canadian information Processing Society and British Columbia.

Gotterbarn also developed a computer ethics curriculum. He actively worked as vice president of ACM Special Interest Group on Computers and Society (SIGCAS). In late 1990s, he created the Software Engineering Research Institute (SEERI) at East Tennessee State University. He later created SoDIS (Software Development Impact Statements) with Simon Rogerson from De Montfort University in the UK, This program help in “Stakeholder identification” and understanding of their needs and concerns for responsible risk management and project development for individuals, companies, and organizations.

Krystyna Gorniak-Kocikowska

In 1995, Krystyna Gorniak-Kocikowska presented “The Computer Revolution and the problem of Global Ethics” in ETHICOMP95. She agreed with James Moor that computer

ethics is “logically malleable” and it has potential to bring a social revolution. Moor related this revolution with industrial revolution while Gorniak related computer revolution with the printing press revolution that occurred in 15th and 16th century. She predicted that from computer revolution new ethical theories will emerge, like theories of Bentham and Kant emerge in response to printing press revolution “a new ethical theory is likely to emerge from computer ethics in response to the computer revolution. The newly emerging field of information ethics, therefore, is much more important than even its founders and advocates believe”[25]. She argued that computer ethics will evolve into a global ethics “The very nature of the Computer Revolution indicates that the ethic of the future will have a global character. It will be global in a spatial sense, since it will encompass the entire globe. It will also be global in the sense that it will address the totality of human actions and relations”[25]. According to “Gorniak hypothesis” ethical theories which pertain to a particular geographical region will eventually become obsolete and new global ethics suitable to computer ethics will evolve “the rules of computer ethics, no matter how well thought through, will be ineffective unless respected by the vast majority of or maybe even all computer users. ... In other words, computer ethics will become universal, it will be a global ethic”[25]. Gorniak believed that computer networks do not belong to a particular region or culture, it is spreading as a global entity “Computers do not know borders. Computer networks ... have a truly global character. Hence, when we are talking about computer ethics, we are talking about the emerging global ethic”. Gorniak reinforced the concept of ongoing “uniqueness debate”, as she believed that computer ethic which is considered as a branch of applied ethics will evolve into global ethics and term computer ethics may also “disappear as a separate branch of ethics.”

Gorniak in other words stands on track started by Wiener and then continued by Maner, all of them in more or less same way believe in uniqueness of computer ethics and demanded computer ethics as new global ethics common to all regions and cultures across world. Gorniak's theory differs in Johnson's theory as Deborah Johnson believe that fundamental ethical theories will remain always but with a new twist and can't be replaced by new theories.

LUCIANO FLORIDI

In late 1990s and early 2000s Luciano Floridi developed a new computer ethics theory of “Information Ethics”. The term “Information ethics” was deliberated by Walter Maner in 1970 to name his new course for computer science students at Old Dominion University, but he used the term “Computer ethics” as it suited more to his new course. Robert Hauptman coined the term “Information ethics” in the late 1980s accentuating the issues pertinent to librarians and journalists. Luciano Floridi used the term “Information Ethics” in arduous manner for foundation of computer ethics. The work on computer ethics before Luciano Floridi was all anthropomorphic and based on longstanding orthodox doctrines such as utilitarianism, contractualism, Kantianism, or virtue ethics, Floridi for the first time widened the ambit of computer ethics and went beyond anthropomorphic concepts[6]. His theory of Information Ethics complemented the traditional ethical theories to cater all ethical situations which are beyond the scope of “macroethics”. Floridi's theory is constructed on three central concepts:” information ontology”, “the agent/patient pair” and “the infosphere”.

Floridi's theory like Medical Ethics, Bioethics and Environmental Ethics is a patient oriented. His theory extends its domain over human as well as non-human and perceives everything that subsists as "informational" objects interacting in an environment which he called "the infosphere". Floridi emphasizes that Information Ethics is "characterised as a biologically unbiased extension of environmental ethics, based on the concepts of data-entropy/infosphere/entropy rather than life/ecosystem/pain". He got his object concept from the object-oriented analysis paradigm (OOA). He argues that these "Information objects" like humans and non-humans which can be anything from animals to electronic objects or an intellectual property can act as "agents" initiating a process and affecting other objects which acts as "patients".

The agent and the patient are discrete, self-contained, encapsulated packages containing:

- the appropriate data structures, which constitute the nature of the entity in question (state of the object, its unique identity, and attributes)
- a collection of operations, functions or procedures (methods), which are activated by various interactions or stimuli, namely messages received from other objects (message passing) or changes within itself, and correspondingly define (implement) how the object behaves or reacts to them. [26]

Floridi theory of Information ethics differs with Wiener's theory as he suggests Information Ethics is an "Environmental Macroethics" grounded on the idea of data entity instead of the concept of life. Floridi further suggested that Object initiating any process, action or event may have deleteriously effects on infosphere. Floridi calls such harm as "entropy". Floridi emphasizes that Information Ethics defines what is ethically right or wrong. He suggested four basic ethical laws.

1. Entropy ought not to be caused in the infosphere (null law)
2. Entropy ought to be prevented in the infosphere
3. Entropy ought to be removed from the infosphere
4. Information welfare ought to be promoted by extending (information quantity), improving (information quality) and enriching (information variety) the infosphere.[6]

Floridi envisages that every entity in "infosphere" possesses a "a *Spinozian* right to persist in its own status, and a *Constructionist* right to flourish, i.e. to improve and enrich its existence and essence"[6]. Floridi gave a shift to Computer ethics from human-centric and bio-centric to onto-centric. The human-centric and bio-centric theories don't take into account non-human entities. Floridi's Information ethics is unbiased and takes into account whole "infosphere" and "lowers the minimal condition that need to be satisfied, in order to qualify as a center of moral concern".

Terrell Ward Bynum

Terrell Ward Bynum in 2006 summed up the work of various scholars like Aristotle, Norbert Wiener, James Moor, Luciano Floridi and many more to propose a new theory which redefines computer ethics. He called his new theory

for computer ethics a "Flourishing Ethics" inspired from Aristotle's theory. His theory is deeply rooted in traditional ethical theories and at the same time "informed and grounded by recent scientific insights into the nature of living things, human nature and the fundamental nature of the universe – ideas from today's information theory, astrophysics and genetics". Bynum advocates to extend traditional ethical theories to cover all aspects which are beyond the reach of these theories. Flourishing Ethics has one part specifically dealing with "actions, values and characters" of human beings which Bynum called "Human-Centered FE". The second part is general that deals with everything contained in universe, he called it "General FE"[8].

IV. CODE OF ETHICS ADOPTED BY PROFESSIONAL ORGANIZATIONS

Many organizations have adopted Ethics code of conduct to outline computer ethics for their members. The list presented here is not exhaustive, but few are presented here for comparison.

The Code of Fair Information Practices

U.S. Dep't. Of Health, Education and Welfare, Secretary's Advisory Committee on Automated Personal Data Systems, Records, computers, and the Rights of Citizens in 1973 adopted code of fair information practices based on following five principles:

1. There must be no personal data record-keeping systems whose very existence is secret.
2. There must be a way for a person to find out what information about the person is in a record and how it is used.
3. There must be a way for a person to prevent information about the person that was obtained for one purpose from being used or made available for other purposes without the person's consent.
4. There must be a way for a person to correct or amend a record of identifiable information about the person.
5. Any organization creating, maintaining, using, or disseminating records of identifiable personal data must assure the reliability of the data for their intended use and must take precautions to prevent misuses of the data. [27]

In 1980, Code of Fair Information Practices was overtaken by OECD's 1980 Guidelines on the protection of Privacy and Transborder Flows of Personal Data[27].

The Internet Architecture Board

The Internet Architecture Board previously Internet Activities Board posted in 1989 is a committee of the Internet Engineering Task Force (IETF). Its main task is to check the ethical and appropriate usage of internet and endeavors to maintain privacy and security by offering concrete technical basis, even when there are serious threats by pervasive surveillance[28].

Computer Ethics Institute (CEI)

CEI is a consortium founded in 1985, a first organization to frame ethics of information technology. CEI in 1992

produced The “Ten Commandments of Computer Ethics” in the paper "In Pursuit of a 'Ten Commandments' for Computer Ethics" by Dr. Ramon C. Barquin's[29].

1. Thou Shalt Not Use a Computer to Harm Other People.
2. Thou Shalt Not Interfere with Other People's Computer Work.
3. Thou Shalt Not Snoop around in Other People's Computer Files.
4. Thou Shalt Not Use a Computer to Steal.
5. Thou Shalt Not Use a Computer to Bear False Witness.
6. Thou Shalt Not Copy or Use Proprietary Software for Which You Have Not Paid.
7. Thou Shalt Not Use Other People's Computer Resources without Authorization or Proper Compensation.
8. Thou Shalt Not Appropriate Other People's Intellectual Output.
9. Thou Shalt Think about the Social Consequences of the Program You Are Writing or the System You Are Designing.
10. Thou Shalt Always Use a Computer in Ways That Insure Consideration and Respect for Your Fellow Humans.

National Conference on Computing and Values

In 1991, The National Conference on Computing and Values (NCCV) was held on the campus of Southern Connecticut State University addressing six specific areas [30]:

- Computer Privacy & Confidentiality
- Computer Security & Crime
- Ownership of Software & Intellectual Property
- Equity & Access to Computing Resources
- Teaching Computing & Values
- Policy Issues in the Campus Computing Environment

NCCV emphasized on following four main values for computing:

1. Preserve the public trust and confidence in computers.
2. Enforce fair information practices.
3. Protect the legitimate interests of the constituents of the system.
4. Resist fraud, waste, and abuse.[31]

ACM Code of Ethics and Professional Conduct

In 1972, ACM adopted first code, the Code of Professional Conduct. In 1992 ACM adopted the Code of Ethics and Professional Conduct[32]. ACM aspires highest professional and ethical standards, the Code of Ethics and Professional Conduct enforces such desires and it is mandatory for all ACM Members to:

- Contribute to society and human well-being.
- Avoid harm to others.
- Be honest and trustworthy.
- Be fair and take action not to discriminate.
- Honor property rights including copyrights and patent.

- Give proper credit for intellectual property.
- Respect the privacy of others.
- Honor confidentiality.[32]

ACM also has its ethics code for computing professionals:

- Strive to achieve the highest quality, effectiveness and dignity in both the process and products of professional work.
- Acquire and maintain professional competence.
- Know and respect existing laws pertaining to professional work.
- Accept and provide appropriate professional review.
- Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks.
- Honor contracts, agreements, and assigned responsibilities.
- Improve public understanding of computing and its consequences.
- Access computing and communication resources only when authorized to do so.[32]

IEEE CS/ACM Code of Ethics and Professional Practice

In May 1993, IEEE Board of Governors established steering committee. In late 1993 ACM Council authorized Commission on Software Engineering and in January 1994, both ACM as well as IEEE formed a joint steering committee “to establish the appropriate set(s) of standards for professional practice of software engineering upon which industrial decisions, professional certification, and educational curricula can be based”[33]. Joint Steering Committee put forward four goals :

- Adopt standard definitions
- Define required body of knowledge and recommended practices
- Define ethical standards
- Define educational curricula for undergraduate, graduate (Masters), and continuing education (for retraining and migration).[33]

Joint Commission Steering Committee created three task forces to accomplish above goals:

- Software engineering body of knowledge and recommended practices.
- Software engineering ethics and professional practices.
- Software engineering curriculum.

The meticulous efforts of the ACM and IEEE–CS after extensive reviews from version 3.0 to 5.2, adopted a code of professional practices for software engineers. In October 1998, version 5.2 was unanimously adopted by both societies[34].

Future of Computer ethics

Computer ethics is relatively a new field, in just more than a half century it has witnessed a tremendous revolutionary changes on many fronts. On one side information technology is so dynamic that it always demand to fill “conceptual vacuum” and “policy vacuum” and on other

side it's meta-philosophical and conceptual foundation keep changing as well.

James H. Moor in his paper "The future of computer ethics: You ain't seen nothin' yet!" divided computer revolution into three stages "introduction stage", "permeation stage" and "the power stage". He emphasized that we are now in third stage where information technology raises enormous critical ethical, social, political and legal question[35]. Information technology has so radically changing that it demands the change in its professional practices and its rules pertaining to society. Keeping these issues into consideration, The Association for Computing Machinery's Committee on Professional Ethics (COPE) is given responsibility to build the Code 2018 Task Force and accomplish three projects up to 2018: Updating ACM's Code of Ethics and Professional Conduct, revising the enforcement procedures for the Code, and developing new media to promote integrity in the profession[36]. Code 2018 will work on following principles:

- The Code should continue to document the ethical and professional responsibilities and obligations of computing professionals.
- The Code should express the consensus of the computing profession on ethical issues.
- The Code should be used as a guide to decision making.
- The Code should educate both the public and aspiring professionals about the professional obligation of all computing professionals[37].

The progress in Computer technology and its myriad application are so pervasive and demanding that applied ethics need to be updated to satisfy its demands. It trigger changes in terms of new policies to deal with these issues and new code of professional ethics. Moor's hypothesis better explains this scenario:

Moor's Law: As technological revolutions increase their social impact, ethical problems increase[38].

Computer ethics as a discipline is also growing, lot of work has been done for its theoretical underpinning. Norbert Wiener who founded computer ethics did not gave a metaphysical theory. After Wiener there were many theories given for foundation of computer ethics as a subject, initiated by James Moor. The debate is conflicting and intense. Parker believed that computer ethics has no foundation. Gotterbarn proposed computer ethics as a professional ethics, Krystyna Gorniak-Kocikowska proposed that computer ethics will evolve into "global ethics". Deborah Johnson argued that computer ethics will disappear. Luciano Floridi presents an ontological "Information Ethics" theory. Terrell Ward Bynum proposed "flourishing ethics" theory. The foundational debate is still going on and lot of work needs to be done for conceptualization of computer ethics.

The vast applications of Information technology triggers future ethical concerns and it demands new laws, policies, ethical code, theoretical foundations and lastly work is to be done to get professionalism into computer engineers by integrating ethics into computer science curriculum.

V. CONCLUSION

There is a worthwhile conclusion to be drawn from the above that computer ethics has established itself as a discipline in its own rite. The current study identifies historical milestones achieved in computer ethics and its future perspective. Such study may trigger formation of new computer ethic laws, policies and new conceptual framework.

As a starting point the presented paper provides comprehensive definitions of computer ethics as per the giants of the field. The next section provides a historical overview of computer ethics again as per the giants of the field. We discussed "uniqueness debate" and foundational problems of computer ethics. Various theories like "Information Ethics" of Luciano Floridi and "Flourishing Ethics" of Terrell ward barn was discussed. The next section discussed about Ethics code of conduct adopted by many organization. The final section discussed on the future perspective of computer ethics, few predictions and a call for further research in the field of computer ethics which is still in its infancy.

VI. REFERENCES

- [1] W. Maner, "Is computer ethics unique?," 1999.
- [2] D. G. Johnson, *Computer Ethics*. Prentice Hall, 2001.
- [3] "Moor: What is Computer Ethics." [Online]. Available: <http://web.cs.ucdavis.edu/~rogaway/classes/188/spring06/papers/moor.html>. [Accessed: 20-Mar-2017].
- [4] T. Bynum, "Computer and Information Ethics," in *The Stanford Encyclopedia of Philosophy*, Winter 2016., E. N. Zalta, Ed. Metaphysics Research Lab, Stanford University, 2016.
- [5] D. Gotterbarn, "Computer Ethics: Responsibility Regained - ProQuest," 1991. [Online]. Available: <http://search.proquest.com/openview/fdd917c9e0dbb6018e73d2e11d53229f1?pq-origsite=gscholar&cbl=1820941>.
- [6] L. Floridi, "Information ethics: On the philosophical foundation of computer ethics," *Ethics Inf. Technol.*, vol. 1, no. 1, pp. 33–52, 1999.
- [7] L. Floridi and J. W. Sanders, "Mapping the foundationalist debate in computer ethics," *Ethics Inf. Technol.*, vol. 4, no. 1, pp. 1–9, 2002.
- [8] T. W. Bynum, "Flourishing Ethics," *Ethics Inf. Technol.*, vol. 8, no. 4, pp. 157–173, Dec. 2006.
- [9] T. Bynum, "Computer and Information Ethics," in *The Stanford Encyclopedia of Philosophy*, Winter 2016., E. N. Zalta, Ed. Metaphysics Research Lab, Stanford University, 2016.
- [10] N. Wiener, *Cybernetics Or Control and Communication in the Animal and the Machine*. MIT Press, 1961.
- [11] K. E. Himma and H. T. Tavani, Eds., *The handbook of information and computer ethics*. Hoboken, N.J: Wiley, 2008.
- [12] "Computer Ethics." [Online]. Available: http://www.comphist.org/computing_history/new_page_5.htm. [Accessed: 24-Feb-2017].
- [13] O. M. Prieto, "Computer Ethics."

- [14] D. B. Parker, *Ethical conflicts in computer science and technology*. AFIPS Press, 1979.
- [15] D. B. Parker, S. Swope, and B. N. and Baker, "Ethical Conflicts in Information and Computer Science, Technology, and Business," *eweb:93959*, 1990. [Online]. Available: <https://repository.library.georgetown.edu/handle/10822/835399>. [Accessed: 25-Feb-2017].
- [16] J. Weizenbaum, *Computer Power and Human Reason: From Judgment to Calculation*. W. H. Freeman, 1976.
- [17] D. G. Johnson, "Book Excerpt: Computer Ethics, Second Edition by Deborah G. Johnson (Prentice Hall, 1994)," *SIGCAS Comput Soc*, vol. 23, no. 3-4, pp. 10-14, Dec. 1993.
- [18] "SIGCAS Making A Difference Award 2003 — SIGCAS - Computers & Society." [Online]. Available: <http://www.sigcas.org/awards-1/awards-winners/moor>. [Accessed: 26-Feb-2017].
- [19] J. H. Moor, "What is Computer Ethics?," *Metaphilosophy*, vol. 16, no. 4, pp. 266-275, 1985.
- [20] J. H. Moor, "Reason, Relativity, and Responsibility in Computer Ethics," *SIGCAS Comput Soc*, vol. 28, no. 1, pp. 14-21, Mar. 1998.
- [21] J. H. Moor, "Just consequentialism and computing," *Ethics Inf. Technol.*, vol. 1, no. 1, pp. 61-65, 1999.
- [22] "ABC-CLIO > ODLIS > odlis_i." [Online]. Available: http://www.abc-clio.com/ODLIS/odlis_i.aspx. [Accessed: 11-Mar-2017].
- [23] "Ethical Challenges in Librarianship by Hauptman, Robert: Oryx Press, Phoenix, Arizona Softcover - Riverwash Books (IOBA)." [Online]. Available: <https://www.abebooks.com/Ethical-Challenges-Librarianship-Hauptman-Robert-Oryx/5690348991/bd>. [Accessed: 11-Mar-2017].
- [24] "A brief history of information ethics," *BiD: textos universitaris de biblioteconomia i documentació*, Dec-2004. [Online]. Available: <http://bid.ub.edu/13froel2.htm>. [Accessed: 11-Mar-2017].
- [25] K. Gorniak-Kocikowska, "The computer revolution and the problem of global ethics," *Sci. Eng. Ethics*, vol. 2, no. 2, pp. 177-190, Jun. 1996.
- [26] L. Floridi and J. W. Sanders, "Artificial evil and the foundation of computer ethics," *Ethics Inf. Technol.*, vol. 3, no. 1, pp. 55-66, 2001.
- [27] A. Cavoukian, "Go Beyond Security—Build in Privacy: One Does Not Equal the Other," *CardTec/SecurTech*, vol. 96, pp. 14-16, 1996.
- [28] "Overview | Internet Architecture Board." .
- [29] "Computer Ethics Institute." [Online]. Available: <http://computerethicsinstitute.org/barquinpursuit1992.html>. [Accessed: 25-Mar-2017].
- [30] "Humanist Archives Vol. 4: 4.1021 Conf: Computing and Values (1/373)." [Online]. Available: <http://dhhumanist.org/Archives/Virginia/v04/1016.html>. [Accessed: 25-Mar-2017].
- [31] "Introduction to Computer Ethics." [Online]. Available: http://www.infosectoday.com/Articles/Intro_Computer_Ethics.htm. [Accessed: 25-Mar-2017].
- [32] R. E. Anderson, D. G. Johnson, D. Gotterbarn, and J. Perrolle, "Using the new ACM code of ethics in decision making," *Commun. ACM*, vol. 36, no. 2, pp. 98-107, 1993.
- [33] D. Gotterbarn, K. Miller, and S. Rogerson, "Software engineering code of ethics," *Commun. ACM*, vol. 40, no. 11, pp. 110-118, Nov. 1997.
- [34] D. Gotterbarn, K. Miller, and S. Rogerson, "Software engineering code of ethics is approved," *Commun. ACM*, vol. 42, no. 10, pp. 102-107, Oct. 1999.
- [35] J. H. Moor, "The future of computer ethics: You ain't seen nothin'yet!," *Ethics Inf. Technol.*, vol. 3, no. 2, pp. 89-91, 2001.
- [36] B. Brinkman, D. Gotterbarn, K. W. Miller, and M. J. Wolf, "All Hands on Deck for ACM Ethics: Updating the Code, Revising Enforcement, Promoting Integrity," *SIGCAS Comput Soc*, vol. 46, no. 3, pp. 5-8, Dec. 2016.
- [37] B. B. Wolf Don Gotterbarn, Keith Miller, Marty J., "Making a Positive Impact: Updating the ACM Code of Ethics." [Online]. Available: <http://cacm.acm.org/magazines/2016/12/210367-making-a-positive-impact/fulltext>. [Accessed: 27-Mar-2017].
- [38] J. H. Moor, "Why We Need Better Ethics for Emerging Technologies," *Ethics Inf. Technol.*, vol. 7, no. 3, pp. 111-119, Sep. 2005.