Keynote Address, Ethicomp 2004, Syros, Greece 14th April 2004

Ethical Challenges to Citizens of 'The Automatic Age': Norbert Wiener on the Information Society

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ABSTRACT

This article discusses the foresight of philosopher/mathematician Norbert Wiener who, in the 1940s, founded Information Ethics as a research discipline. Wiener envisioned the coming of an "automatic age" in which information technology would have profound social and ethical impacts upon the world. He predicted, for example, machines that will learn, reason and play games; "automatic factories" that will replace assembly-line workers and middle managers with computerized devices; workers who will perform their jobs over great distances with the aid of new communication technologies; and people who will gain remarkable powers by adding computerized "prostheses" to their bodies. To analyze the ethical implications of such developments, Wiener presented some principles of justice and employed a powerful practical method of ethical analysis.

COVERAGE

1. INTRODUCTION

In Chapter I of his foundational information-ethics book, *The Human Use of Human Beings* (1950, 1954) Norbert Wiener said:

> It is the thesis of this book that society can only be understood through a study of the messages and the communication facilities which belong to it; and that in the future...messages between man and machines, between machines and man, and between machine and machine, are destined to play an ever-increasing part. (1954, 16)

> To live effectively is to live with adequate information. Thus communication and control belong to the essence of man's inner life, even as they belong to his life in society. (1954, 18)

> communications in society...are the cement which binds its fabric together. (1954, 27)

Wiener believed that, in the coming 'automatic age' (as he called today's era), the nature of society, as well as its citizens' relationships with society and with each other, will depend more and more upon information and communications. He predicted that, in our time, machines will join human

KEYWORDS

Information
Ethics

Entropy

Human
Purposes

Justice

beings in the creation and interpretation of messages and communications, and indeed in shaping the ties that bind society together. There will be, he argued, machines that learn -- that gather, store and interpret information -- that reason, make decisions, and take actions on the basis of the messages which they send and receive. With the help of information technology, he predicted, mechanical prosthetic devices will merge with the bodies of disabled persons to help them overcome their disabilities; and indeed even people who are *not* disabled will acquire 'prostheses' to give them powers that a human never had before. According to Wiener, the social and ethical importance of these developments cannot be overstated. "The choice of good and evil knocks at our door," he said. (1954, 186)

Today we have entered Wiener's 'automatic age', and it is clear that he perceptively foresaw the enormous social and ethical importance of information and communication technology (ICT). Remarkably, he even foresaw – more than a decade before the Internet was created – some of the social and ethical problems and opportunities that came to be associated with the Internet. (Some examples are given below.)

2. HUMAN PURPOSES AND THE PROBLEM OF ENTROPY

Although he thought of himself primarily as a scientist, Wiener considered it important for scientists to see their own activities in the broader human context in which they function. Thus, he said, "we must know as scientists what man's nature is and what his built-in purposes are." (1954, 182) As an early twentieth-century scientist, who was philosophically alert to recent developments in physics, Wiener faced the challenge of reconciling the existence and importance of *human purposes and values* on

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the one hand, and the thermodynamic principle on the other hand that *increasing entropy* -- that is, growing chaos and disorder – eventually will destroy all organized structures and entities in the universe. In Chapter II of *The Human Use of Human Beings,* Wiener described contemporary science's picture of the long-term fate of the universe:

> Sooner or later we shall die, and it is highly probable that the whole universe around us will die the heat death, in which the world shall be reduced to one vast temperature equilibrium.... (1954, 31)

In that same chapter, however, Wiener rescued his reader from pessimism and pointlessness by noting that 'the heat death' of the universe will occur many millions of years in the future. In addition, in our local region of the universe, living entities and even machines are capable of *reducing* chaos and disorder rather than increasing it. Living things and machines are anti-entropy entities that create and maintain structure and organization locally, even if the universe as a whole is 'running down' and losing structure. For millions of years into the future, therefore, human purposes and values can continue to have meaning and worth, despite the overall increase of entropy in the universe:

> In a very real sense we are shipwrecked passengers on a doomed planet. Yet even in a shipwreck, human decencies and human values do not necessarily vanish... [Thus] the theory of entropy, and the considerations of the ultimate heat death of the universe, need not have such profoundly depressing moral consequences as they seem to have at first glance. (1954, 40–41)

3. JUSTICE AND A GOOD HUMAN LIFE

Having rescued the meaningfulness of human purposes and values, Wiener could discuss what would count as a good human life. To have a good life, human beings must live in a society where "the great human values which man possesses" (1954, 52) are

nurtured; and this can only be achieved, he said, in a society that upholds the "great principles of justice" (1954, 106). In Chapter VI of *The Human Use of Human Beings* he stated those principles, although he did not give them names. For the sake of clarity and ease of remembering them, let us attach names to Wiener's own definitions:

> *The Principle of Freedom*: Justice requires "the liberty of each human being to develop in his freedom the full measure of the human possibilities embodied in him." (1954, 105)

> *The Principle of Equality*: Justice requires "the equality by which what is just for A and B remains just when the positions of A and B are interchanged." (1954, 106)

> *The Principle of Benevolence*: Justice requires "a good will between man and man that knows no limits short of those of humanity itself." (1954, 106)

Wiener considered humans to be fundamentally *social* beings who can reach their full potential only by active participation in a community of similar beings. For a good human life, therefore, society is indispensable. But it is possible for a society to be oppressive and despotic in ways that limit or even stifle individual freedom; so Wiener added a fourth principle of justice, which we can appropriately call "The Principle of Minimum Infringement of Freedom": (Wiener himself did not give it a name.)

> *The Principle of Minimum Infringement of Freedom:* "What compulsion the very existence of the community and the state may demand must be exercised in such a way as to produce no unnecessary infringement of freedom." (1954, 106)

According to Wiener, the overall purpose of a human life is the same for everyone: to realize one's full human potential by engaging in a variety of chosen actions (1954, 52). It is not surprising, therefore, that the Principle of Freedom would head his list, and that the Principle of Minimum Infringement of Freedom would limit the power of the state to thwart freedom. Because the general purpose of each human life, according to Wiener, is the same, his Principle of Equality follows logically; while the Principle of Benevolence follows from his belief that human freedom flourishes best when everyone sympathetically looks out for the wellbeing of all.

4. WIENER'S METHOD OF DOING INFORMATION ETHICS

Wiener was keen to ask questions about "what we do and how we should react to the new world that confronts us" (1954, 12). He developed strategies for analyzing, understanding, and dealing with ICT-related social and ethical problems or opportunities that could threaten or advance human values like life, health, security, knowledge, freedom and happiness. Today, half a century after Wiener founded Information Ethics as an academic research subject, we can look back at his writings in this field and examine the methods that he used to develop his arguments and draw his conclusions. While Wiener was busy creating Information Ethics as a new area of academic research, he normally did not step back – like a metaphilosopher would – and explain to his readers what he was about to do or how he was going to do it. Instead, he simply tackled an ICT-related ethical problem or opportunity and began to analyze it and try to solve the problem or benefit from the opportunity.

Today, in examining Wiener's methods and arguments, we have the advantage of helpful concepts and ideas developed later by seminal thinkers such as Walter Maner and James Moor. We can use their ideas to illuminate Wiener's methodology, examining what he *did* in addition to what he *said*. In Chapter VI of *The Human Use of Human Beings*, for example, Wiener considers the law and his own conception of justice as tools for identifying and analyzing social and ethical issues associated with ICT. Combining Maner's ideas in his "Heuristic Methods for Computer Ethics" (1999) with Moor's famous account of the nature of computer ethics in "What Is Computer Ethics?" (1985), we can describe Wiener's account of Information Ethics

methodology as the following five-step heuristic procedure:

Step One: *Identify an ethical problem or positive opportunity* regarding the integration of ICT into society. (If a problem or opportunity can be foreseen before it occurs, we should develop ways to solve the problem or benefit from the opportunity before we are surprised by – and therefore unprepared for – its appearance.)

Step Two: If possible, *apply existing 'policies'* [as Moor would call principles, laws, rules, and practices that already apply in the given society] *using precedent and traditional interpretations* to resolve the problem or to benefit from the opportunity.

Step Three: If existing policies appear to be ambiguous or vague when applied to the new problem or opportunity, *clarify ambiguities and vagueness*. [In Moor's language: identify and eliminate 'conceptual muddles'.]

Step Four: If precedent and existing interpretations, including the new clarifications, are insufficient to resolve the problem or to benefit from the opportunity, one should *revise the old policies or create new ones using 'the great principles of justice' and the purpose of a human life* to guide the effort. [In Moor's language, one should identify 'policy vacuums' and then formulate and ethically justify new policies to fill the vacuums.]

Step Five: *Apply the new or revised policies* to resolve the problem or to benefit from the opportunity.

These policies enable a citizen to tell whether a proposed action should be considered ethical

It is important to note that this method of engaging in Information Ethics need not involve the expertise of a trained philosopher (though such expertise often can be helpful). In any society, a successfully functioning adult will be familiar with the laws, rules, customs, and practices (Moor's 'policies') that normally govern one's behavior in that society. These policies enable a citizen to tell whether a proposed action should be considered ethical. Thus, all those in society who must cope ethically with the introduction of ICT – whether they are public policy makers, ICT professionals, business people, workers, teachers, parents, or others – can and *should engage in Information Ethics by helping to integrate ICT into society in ways that are socially and ethically good*. Information Ethics, understood in this very broad way, is too vast and too important to be left only to academics or to ICT professionals. This was clear to Wiener, who especially challenged government officials, business leaders, and public policy makers to wake up and begin to address the 'good and evil' implications of the coming information society.

5. UNEMPLOYMENT AND THE 'AUTOMATIC FACTORY'

After World War II, Wiener became concerned about the possibility that unprecedented unemployment could be generated if 'automatic factories' were created with robotic machines to replace assembly-line workers and with information processing devices to replace middle-level managers. Such a factory would "play no favorites between manual labor and white-collar labor". (1954, 159) An automatic factory, said Wiener, would be very much like an animal with a computer functioning like a central nervous system; industrial instruments such as thermometers and photo-electric cells serving as 'sense organs'; and 'effectors' like valve-turning motors, electric clutches, and newly-invented robotic tools functioning like limbs:

> The all-over system will correspond to the complete animal with sense organs, effectors, and proprioceptors, not...[just] to an isolated brain. (1954, 157)

Such a factory, said Wiener, would need far fewer human workers, blue-collar or white-collar, and the resulting industrial output could nevertheless be copious and of high quality.

Wiener noted that there is at least one good feature of 'automatic factories' that speaks in favor their creation; namely, the *safety* that they could offer to humans. Since such factories would employ few humans, they would be ethically preferable for the manufacture of risky items like radioactive products or dangerous chemicals. Far fewer people would be killed or injured in cases of emergency or accident in such a factory. Nevertheless, Wiener was concerned that the widespread creation of automatic factories could generate massive unemployment:

> Let us remember that the automatic machine...is the economic equivalent of slave labor. Any labor which competes with slave labor must accept the economic conditions of slave labor. It is perfectly clear that this will produce an unemployment situation, in comparison with which the present recession and even the depression of the thirties will seem a pleasant joke. (1954, 162)

> Thus the new industrial revolution is a two-edged sword. It may be used for the benefit of humanity. ...It may also be used to destroy humanity, and if it is not used intelligently it can go very far in that direction. (1954, 162)

Wiener was not a mere alarmist, however; nor was he just a theoretician. Instead, having identified a serious threat to society and to individual workers, he took action. In the early 1950s, he met with corporate managers, public policy makers, and union leaders to whom he expressed his deep concerns about automatic factories. By 1954, when he published the Second Revised Edition of *The Human Use of Human Beings*, Wiener had become optimistic that his warnings were being heeded. (1954, 162)

6. LONG-DISTANCE COMMUNICATIONS, TELEWORKING AND GLOBALIZATION

Besides the automatic factory, Wiener envisioned other ways in which information technology could affect working conditions. For example, he foresaw what today is called 'teleworking' or 'telecommuting' -- doing one's job while being a long distance from the work site. This will be possible, he said, because of communications technologies like telephones, 'Ultrafaxes', telegraph, teletype, and long-distance communications technologies that are bound to be invented in the future. Performing one's job at a distance – even thousands of miles away – is possible, said Wiener, because

> where a man's word goes, and where his power of perception goes, to that point his control and in a sense his physical existence is extended. To see and to give commands to the whole world is almost the same as being everywhere. (1954, 97)

As an example, Wiener imagined an architect in Europe supervising the construction of a building in the United States. Although an adequate building staff would be on the construction site in America, the architect himself would never leave Europe:

> Ultrafax gives a means by which a facsimile of all the documents concerned may be transmitted in a fraction of a second, and the received copies are quite as good working plans as the originals. The architect may be kept up to date with the progress of the work by photographic records taken every day or several times a day, and these may be forwarded back to him by Ultrafax. Any remarks or advice he cares to give...may be transmitted by telephone, Ultrafax, or teletypwriter. (1954, 98)

Thus long-distance communications technologies which were available even in the early 1950s made it possible for certain kinds of 'teleworking' to take place.

In addition, Wiener noted that the long reach of such communications technologies is likely to have significant impacts upon *government*. "For many millennia", he said, the difficulty of transmitting language restricted "the optimum size of the state to the order of a few million people, and generally fewer." (1954, p. 91) Exceptions like the Persian and Roman Empires were made possible by improved means of communication, such as messengers on 'the Royal

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Road' conveying the Royal Word across Persia, or the dramatically improved roads of the Roman Empire conveying the authority of the Emperor. By the early 1950s, he noted, there already were global communications networks made possible by airplanes and radio technology, in addition to the telecommunications technologies mentioned above. The resulting globalization of communication, he suggested, may even move the world community toward some kind of world government:

> very many of the factors which previously precluded a World State have been abrogated. It is even possible to maintain that modern communication...has made the World State inevitable. (1954, 92)

By today's standards, the long-distance communications technologies of the early 1950s, when Wiener published *The Human Use of Human Beings,* were very slow and clumsy. Nevertheless Wiener identified, even then, early indications of 'contemporary' information-ethics topics like teleworking, job outsourcing, globalization, and the impact of ICT on government and world affairs.

7. DISABILITIES, PROSTHESES AND THE MERGING OF HUMANS AND MACHINES

Norbert Wiener's foundational Information Ethics works were concerned with possible and actual impacts of information technology upon human values, such as *life, health, security, knowledge, resources, opportunities*, and most of all *freedom*. He focussed not only upon harms and threats to such values, but also upon benefits and opportunities that information technology could make possible. Wiener and some colleagues, for example, used cybernetic theory to explain two medical problems called 'intention tremor' and 'Parkinsonian tremor'. The result was the creation of two information feedback machines, called 'the moth' and 'the bedbug', to prove that the cybernetic explanation of Wiener and his colleagues was correct. The machines were successful and

made a positive contribution to human health and medicine. (1954, 163–167)

A second project of Wiener and his colleagues was the creation of a 'hearing glove' that could be worn by someone who is totally deaf. This device was designed to use information technology to convert human conversation into vibration patterns in a deaf person's hand. These tactile patterns would then be used to help the deaf person understand human speech. Although the project was not pursued to completion, it did lead to the creation of other devices which enabled persons who were blind to find their way through a maze of streets and buildings. (154, 167–174)

A proposed prosthesis project that Wiener described in *The Human Use of Human Beings* (1954, 174) was an iron lung that would be electronically attached to damaged breathing muscles in a person's body and would use the patient's own brain to control his breathing. This project would physically merge a person's body with an electronic machine to create a functioning being that is part man and part machine.

Another project like that was the creation of a mechanical hand to replace a hand that had been amputated. Wiener and some Russian and American colleagues worked together to develop such a hand, some of which were created in Russia where they "permitted some hand amputees to go back to effective work". (1964, 78) Electrical action potentials in the remaining forearm were generated by the amputee's brain when he tried to move his fingers. These potentials were sensed by electronic circuits in the mechanical hand and used to run motors which closed and opened the mechanical fingers. Wiener suggested that a kind of 'feeling' could be added to the artificial hand by including electronic pressure sensors that would generate vibrations in the forearm.

Besides using prostheses to help persons with disabilities, said Wiener, people *without* disabilities will eventually use prostheses to give themselves significant powers that human beings never had before:

> Thus there is a new engineering of prostheses possible, and it will involve the construction of systems of a mixed nature, involving both human and mechanical parts. However, this

type of engineering need not be confined to the replacement of parts we have lost. There is a prosthesis of parts we do not have and which we never have had. (1964, 77)

The dramatic new powers of man/machine beings could be used for good purposes or for bad ones, and this is one more example of Wiener's point about "good and evil knocking at our door":

> Render unto man the things which are man's and unto the computer the things which are the computer's... What we now need is an independent study of systems involving both human and mechanical elements. (1964, 77)

In today's language, a being who is part human and part machine is called a 'cyborg'. In the 1950s, when Wiener wrote *The Human Use of Human Beings*, he did not use this word, but he did see the urgent need to consider the ethical issues that were bound to arise when such beings are created.

8. ROBOT ETHICS AND MACHINES THAT LEARN

In addition to ethical concerns about man/machine beings, Wiener also expressed worries about decision-making machines. The project that originally led him and some of his colleagues to create the new scientific field of *cybernetics* during World War Two was the development of an anti-aircraft cannon that could 'perceive' the presence of an airplane, calculate its likely trajectory, aim the cannon and fire the shell. This project made it clear to Wiener that humans possessed the scientific and engineering knowledge to create decision-making machines which gather information about the world, 'think about' that information, reach decisions based upon that 'thinking', and then carry out the decisions they had made.

Besides the anti-aircraft cannon, Wiener discussed other decision-making machines, including the checker-playing (i.e. draughts-playing) computer of A. L. Samuel of the IBM Corporation (1964, 19) and various chess-playing computers (1964,

Ch. II). Samuel's checker-playing computer was able to reprogram itself to take account of its own past performances in checker games. It made adjustments in its own playing strategy until it began to win more frequently. Although Samuel created this game-playing computer, it learned how to

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defeat him consistently by playing games against him. Wiener also discussed chess-playing computers. In his day, they played chess very poorly, although some of them were able to learn from their 'experiences' and improve their playing skills to some extent. Wiener predicted, as many of his colleagues also did, that chess-playing computers would eventually become excellent opponents, even for chess masters.

Although machines that play checkers or chess do not pose major ethical challenges, they nevertheless demonstrate the fact that computerized devices can be designed to learn from their 'experiences', make decisions, and act on those decisions. Wiener noted that, in the 1950s and 1960s, both the United States and the Soviet Union – following John von Neumann's view that war can be seen as a kind of game (1954, 181) – were using computers to play war games in order to prepare themselves for possible nuclear war with each other. He was most concerned that one or the other of the two nuclear powers would come to rely, unwisely, upon war-game machines that learn and reprogram themselves:

> [Man] will not leap in where angels fear to tread, unless he is prepared to accept the punishment of the fallen angels. Neither will he calmly transfer to the machine made in his own image the responsibility for his choice of good and evil, without continuing to accept a full responsibility for that choice. (1954, 184)

the machine...which can learn and can make decisions on the basis of its

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learning, will in no way be obliged to make such decisions as we should have made, or will be acceptable to us. For the man who is not aware of this, to throw the problem of his responsibility on the machine, whether it can learn or not, is to cast his responsibility to the winds, and to find it coming back seated on the whirlwind. (1954, 185)

War and business are conflicts resembling games, and as such, they may be so formalized as to constitute games with definite rules. Indeed, I have no reason to suppose that such formalized versions of them are not already being established as models to determine the policies for pressing the Great Push Button [of nuclear war]...(1964, 31–32.)

If machines that play 'war games' are used by governments to plan for war, or even to decide when to "push the nuclear button", said Wiener, the human race may not survive the consequences. Woe to us humans, if we allow machines to make our decisions for us in situations where human judgment and responsibility are crucial to a good outcome. Decision-making machines must be governed by ethical principles that humans select. But if such machines learn from their past activities, how can we humans be sure that they will obey the ethical principles that we would have used to make those decisions? Even in 1950, therefore, it was clear to Wiener that the world would need to develop a genuine *robot ethics* -- not just science-fiction 'laws of robotics' from a writer like Isaac Asimov (1950), but genuine rules to govern the behavior of decision-making machines that learn. Today, Wiener would not be surprised to hear that there exists a branch of software engineering to deal with robot ethics. (See Eichmann, 1994; and Floridi & Sanders, 2001.)

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Woe to us humans, if we allow machines to make our decisions for us

9.   ARTIFICIAL INTELLIGENCE AND PERSONAL IDENTITY

Wiener's cybernetic analyses of living organisms – including human beings – as well as his consideration of learning machines, led him to comment on a variety of ideas that, today, are associated with AI (artificial intelligence). He did not have a rigorously worked out theory of AI, and many of his comments were guesses or speculations; but, taken together, they constitute a significant perspective on human nature and intelligence; and they have profound implications for the concept of personal identity.

Wiener would consider many of today's AI questions – like whether machines could be 'alive', or 'intelligent', or 'purposeful' – to be essentially *semantic questions* using words that are far too vague to be used for scientific purposes:

I want to interject the semantic point that such words as life, purpose, and the soul are grossly inadequate to precise scientific thinking. These terms have gained their significance through our recognition of the unity of a certain group of phenomena, and do not in fact furnish us with any adequate basis to characterize this unity. Whenever we find a new phenomenon which partakes to some degree of the nature of those which we have already termed 'living phenomena,' but which does not conform to all the associated aspects which define the term 'life,' we are faced with the problem whether to enlarge the word 'life' so as to include them, or to define it in a more restrictive way so as to exclude them. (1954, 31)

Now that certain analogies of behavior are being observed between the machine and the living organism, the problem as to whether the machine is alive or not is, for our purposes, semantic and we are at liberty to answer it one way or the other as best suits our convenience. (1954, 32)

Wiener thought of both human beings and machines as physical entities whose behav-

ior and performance can be explained by the interaction of their parts with each other and with the outside world. He sometimes spoke of human beings as a "special sort of machine". (e.g., 1954, 79) In the case of humans, the parts are atoms that are combined in an exquisitely complex pattern to form a living person. The parts of a non-human machine, on the other hand, are much larger and less finely structured, being simply shaped 'lumps' of steel, copper, plastic, silicon, and so on. Nevertheless, according to Wiener, it is physical structure that accounts for the 'intellectual capacities' of both humans and machines:

> *Cybernetics takes the view that the structure of the machine or of the organism is an index of the performance that may be expected from it....* Theoretically, if we could build a machine whose mechanical structure duplicated human physiology, then we could have a machine whose intellectual capacities would duplicate those of human beings. (1954, 57, italics in the original text)

Consistent with this view, Wiener regularly analyzed human intellectual and psychological phenomena, both normal and pathological, by applying cybernetic theory to the various parts of a person's body. In the early 1960s, because of the relatively large size of electronic components (compared to the neurons in a person's brain), and because of the tendency of electronic components to generate much heat, Wiener expressed doubt that humans would ever create a machine as complex and sophisticated as a person's body or nervous system. (1964, 76) Today, perhaps, he would change his mind, given recent progress in microcircuit development.

Wiener's view that human beings are sophisticated physical entities whose parts are atoms enabled him to speculate, in Chapter V of *The Human Use of Human Beings,* about the possibility of creating a complex mathematical formula that would completely describe the intimate structure of a person's body. If one were able, he said, to send this formula across telephone lines, or over some other long-distance communications network, and if the formula enabled someone or some device at the

other end to 'reassemble' the person – atom by atom – then it would be possible for that person to travel long distances instantly via telephone or some other communications network. Today, Wiener's physiological account of human nature, including human intellectual and emotional capacities, is widely shared by many scientists and other thinkers, including biologists, physicians, psychologists, and philosophers, to name but a few examples. When this view is combined with Wiener's ideas about electronic 'traveling' over communications networks, a number of challenging questions arise regarding a human being's personal identity. Wiener himself did not explore these questions, but they are worth mentioning here:

1. 'Traveling' in this manner would require that a person be 'disassembled' into atoms at the starting point and 'reassembled' at the destination. Since the original atoms themselves do not travel across the network (only the mathematical formula travels), new atoms must be used at the destination. Does this mean that the traveler is gently 'killed' at the starting point and then carefully 'resurrected' at the destination?
2. What if the person's identity formula somehow gets scrambled while traveling over the network? The 'reassembled' person at the destination could be significantly different from the original one. Who is this new person? Where did the original person go? Could the new person, on behalf of the original person, sue someone for murder? – manslaughter? – bodily harm? – breach of contract? Would all these issues become moot points if the original person is simply 'reassembled' correctly at the original starting point? Could the 'new person' at the other end then be killed because he or she was a 'mistake'?
3. What if a person's identity formula is sent across the network, but his or her body is not disassembled? The 'traveler', in other words, stays home and remains alive just as he or she was? If a person is nevertheless 'reassembled' at the destination, using the formula that was sent across the network, who is that new person? He or she would have all the memories, knowledge, personality traits, and

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so on, of the original person. Indeed, he or she would have a body – atom for atom – identical to that of the original person. This 'new' person would be more than a clone of the original, since a 'clone' in today's sense of the term would start out as a baby, and not be 'reassembled' as an adult. The 'new' person also would not just be the twin sibling of the original person, since such twins have different memories and different past experiences. The new person would be a perfect copy of the original one, whose knowledge and memories would then begin to diverge more and more from the original person's as time goes on.

4. What constitutes someone's unique personal identity? Perhaps it is the mathematical formula that fully describes his or her physiology at any given moment. But this would mean that someone's personal identity changes from moment to moment as his or her body changes. This conflicts with our usual view that a person keeps his or her identity over a lifetime.

5. Suppose someone stores away complete identity formulas corresponding to my body on my tenth birthday, my twentieth birthday, and my thirtieth birthday. Then, on my fortieth birthday, he or she 'reassembles' all three past versions of me. Who is 'the real me'? Are they all me? Who can claim to own my property? Who gets to go home to my wife and live with her? Why?

6. If a 'life insurance' organization stores away one of my personal identity formulas and always 'reassembles' me anew when I die, does this mean that I have been granted something approaching eternal life? If the 'resurrected' me always has the same original memories, knowledge, personality, etc., does this mean that I get to relive part of my life many different times, taking different paths? – marrying different partners? – holding down different jobs?

10. CONCLUSION

Norbert Wiener was a scientist, an engineer and a mathematician; but he also was a philosopher with the vision to see the enormous social and ethical implications of the information and communication technologies that he and his colleagues were inventing. His creative tour de force, *The Human Use of Human Beings* (1950, 1954), was the first book-length publication in Information Ethics; and it instantly created a solid foundation for that subject as a field of academic research. Wiener's many contributions to this field – in books, articles, lectures and interviews – not only established him as its 'founding father', they continue to provide a rich source of ideas and issues to inspire Information Ethics thinkers for many years to come.

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