THE CHURCH IN CYBERSPACE

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The Coming Impact of the Computer on the Church

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For: Andrew, Aletha, Jotham, Timothy, Ryan, and Jennifer.
You will see God work.

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Contents

1 — Introduction

“On the eve of All Saints, when Frederick the Wise would offer his indulgences, Luther spoke, this time in writing, by posting in accord with current practice on the door of the Castle Church a printed placard in the Latin language consisting of ninety-five theses for debate.”[1] From this apparently simple action arose a reformation of theology and morals which thundered through the Church.

Martin Luther (1483-1546) called for a reform which in many ways was the same as that sought by John Wycliffe (1325-1384) in England and John Hus (1373-1415) in Bohemia. But the reforms of Wycliffe and Hus were silenced by a jealous Church. The Church tried to use the same tactics to silence Luther. They failed for a variety of reasons: in Germany peasant sympathy lay with Luther, the Church was loosing its control over the state, the civil rulers and the common people were loosing their patience with the sin and corruption among members of the Church hierarchy, the Renaissance opened the world to new ideas, and the Holy Spirit had prepared men to seek as their highest end the glory of God.

But these reasons do not seem to provide a full explanation for why Luther was successful where Wycliffe and Hus were not. All of these factors were, at least partially, present in the days of Wycliffe and Hus. The answer may lie in another significant element underlying the reforms of Luther which was not available to the earlier reformers. Luther had access to a communication machine which made his message of reform the talk of Europe. Wycliffe and Hus had no such means of reaching the world.

The printing press was invented sometime around 1450. During its first half century, it had only a limited impact on the culture of Europe. It was used essentially to automate a process which had for millennia been labour intensive. It was used primarily for publishing the classics of the past to make them less expensive, and therefore more widely available. However to Luther, the printing press made available new forms of communication that were beyond the experience of anyone in the Middle Ages.

Five years before Luther became a monk, Desiderius Erasmus (c1466-1536), a Dutch humanist, published his first book. It was a volume of proverbs taken from Latin and Greek sources. It was not long before Erasmus acquired fame throughout Europe, and he came to realize the potential of printing. He began to produce books at a steady pace. He published a large number of the Greek and Latin classics, both in translation and in the original languages. He also prepared the first printed Greek New Testament, and wrote poetry, plays, essays, and apologies defending the Church and himself. He laid the foundation for a new world of communication.

Into this world stepped the monk from Germany.

Today the world still feels the impact of Luther's nails on the door. Ireland is torn with strife,

separate school systems exist, Anglicans and Catholics dance around accord, and Evangelicals argue about whether or not to accept Catholics as Christians. Outwardly the effects of the Reformation are still with us. But in the life of the Church and nations of the West, the effect of the Reformation is fading into darkness. Donald Macleod, professor of Systematic Theology at the Free Church College in Edinburgh, editor of the *Monthly Record*, and a well known speaker at Reformed conferences, summarizes the situation this way:

> Modern evangelicals are dancing on the tombs of the prophets. We pay willing and fulsome tribute to the heroism of Luther. But will we follow him? Modern Protestantism is in a bigger mess than 16th century Catholicism, but no one is nailing theses to the gates.[2]

October 31st 2017 will mark the 500th anniversary of Luther's action. What will be the state of the Church on that day? Will it be trapped in superstition, plagued with corruption, splintered by selfish factions, weak in its faith, clinging to a works-based salvation, and ineffective in its witness for Jesus? Or, will the Church be a vibrant reformed and reforming organism which will be challenging 21st century civilization with the Lordship of Jesus Christ over personal lives, over the Church and over nations?

Who will be nailing theses on the gates? On what gates will they nail them? Who will lay the foundation for a new world of communication? What will it be?

The computer was invented sometime around 1950. During its first half century, it will have had only a limited impact on the culture of the West. It is used essentially to automate processes which have for centuries been labour intensive. So far it has been used primarily for automating the systems of the past to make them less expensive and therefore more widely available. However, the computer will soon make widely available new forms of communication that are beyond the experience of most of us in this century.

> There are really two computing eras ... we're moving into the second one. The first one we've been living with for thirty-five years. ... We've been exploiting the calculational capabilities of computers — number processing — and we've been exploiting the stuff called data processing, which is a fancy way of saying filing and retrieving, and that's it. That's all we've been doing with computers even though we've known from the mid-1930s and the theorems of Turing ... that computers were universal symbolic processing devices capable of any kind of symbol manipulation whatever. ... We are making the transition now from the era of calculating and data processing to the era of symbolic reasoning by machine.[3]

We are situated at the beginning of a new age. In the next twenty five years we will see developments in computer and communication technology which today exist only in the realm of science fiction. But the impact of these developments on society and the Church will likely go beyond the realm of science fiction into areas that we cannot even imagine today.

In this book I wish to look at selected trends in the development of computer and communication technology which will probably have an impact on the Church, whether for evil or good. The trends which I consider are drawn from extensions of the 'traditional' data processing capabilities of the computer and also from the area of symbolic reasoning by machine. My time horizon for these trends is the next twenty five years. This is significant, for in about twenty five years we will observe the 500th anniversary of the year in which Martin Luther nailed his ninety-five theses to the door of the cathedral.

Some writers have suggested ways in which a personal computer could be used for the work of the Church.[4,5,6] Johnson in his book *The Pastor and the Personal Computer*[7] provides a description of how computers work and guidelines for how to select a personal computer for your Church; and he gives suggestions for how a PC (personal computer) can be used. He suggests that a PC can be used for word processing of bulletins, newsletters and sermon outlines, for keeping church accounts, for maintaining mailing lists, and for maintaining lists of sermon illustrations, hymn usage, evangelistic contacts and birthdays.

These writings serve to awaken Church leaders to the possibilities of using small computers to assist in the office work of the Church. Other writers suggest ways in which personal computers can be used in Sunday School instruction. The focus of what they have written is on current technology. They are suggesting ways in which you can apply computers which you can buy today at your neighbourhood computer store or from the classified advertisements in a magazine. If your church is not currently using a PC, you should consider seriously some of their suggestions. Using a computer can save time in administrative work and improve its quality.

The focus of this book, however, is not on using current technology for administrative purposes in the Church. Rather, it is on the potential impact of technology which is just starting to appear in the leading edge firms, and is still under development in the hardware and software laboratories, or is only 'vapourware' (an idea or dream) among the more creative engineers. My purpose is to review some of the trends which appear to be developing in computer technology, and to project these trends in time and in terms of their potential impact on society and the Church.

Such a consideration is needed if an editorial which appeared in *Christianity Today*[8] is any indication of the state of thinking about technology among the leaders in the Church and our educational institutions. In this editorial the president of Taylor University identified seven challenges which will face the Church as it enters the new millennium. The seven he listed are: privatization and entrepreneurship, biotechnology and human responsibility, pluralism and ethnicity, authority and individual freedom, environmentalism and stewardship, haves and have-nots, and church and parachurch. These are not future challenges of the next millennium, they are all challenges facing the church right now, and the Church is largely failing to meet them by being on the offensive.

Kesler's list is off the mark in a key area. He only mentions technology once – in the area of bio-medical ethics. He overlooks entirely the revolution that is underway in the area of computer

technology and telecommunications.

Three years after *Christianity Today* published Kesler's editorial, it finally devoted a significant article to the subject of the "information age." The article is entitled *Cyber Shock*,[9] and has the following as its lead-in: "New ways of thinking must be developed for the church to keep pace in the coming information age." The article covers many of the topics considered in this book, but the title speaks loudly about the state of the Church. The Church should not be in shock over the changes that have occurred, and will occur, in the information age. To the extent that we are in shock, to that extent we have been sleeping while the world is being transformed by a revolution.

This revolution is being thrust forward at light-speed, and there is apparently a blind spot afflicting much of the leadership in the Church and religious educational institutions at all levels. The Church is going to be blind-sided by the most significant revolution in the history of mankind.

If we do not prepare, we will miss great opportunities to use the tools of this revolution for God's glory, and will be ineffective in controlling the negative impact which inevitably will arise. This provides the primary reason for why I have written this book. My hope is that from reading this book, more leaders in the Church will be prepared for the coming technological revolution.

As I consider five key areas of technology which will affect the Church and the way it carries out its mandate, my hope is that more leaders in the Church will see some of the real potential of the computer and communication technology for furthering the work of Christ's kingdom, and the potential dangers which will hinder the work.

The key areas of consideration in this book are:

- **Digital Communications** — The developing digital telephone and cable TV networks will become an Electronic Highway carrying all communication in the 21st century. Electronic mail and video phones are going to change the way that we interact with one another and the way that we carry out our work, personal business, and recreation. This will affect the way we practice our religion.

- **Electronic Publishing** — The Electronic Highway will support a paperless society which will use electronic bulletin boards and electronic publications for the distribution of information. This will affect the way we publicize our religion.

- **Voice Processing** — The conversational computer will be able to hear you as you speak and answer you in spoken English (or, say, Korean). This will bring about a significant change as most people in our society become functionally illiterate. This will affect the way we present and preach our religion.

- **Data Banks** — As electronic publishing becomes widely accepted, and as information currently in printed form is digitized, there will be an implosion of information. All of the world's recorded knowledge will be gathered into central data banks which will be accessible from any entry port (e.g., personal computer) on earth. This will affect the way we document and research our religion.

- **Computer-Aided Instruction** — The computer will prove to be a better instructor than humans in many areas. Courseware will be developed to teach students at all levels and in a wide variety of subjects. Dramatic changes will result from the breakdown of centralized, publicly funded school systems. This will affect the way we educate our children and our future pastors.

The technological developments in each of these areas will affect both society and the Church, and there will be both negative and positive impact. Some of the negative impact on the Church which may result from the wide-spread use of computers in society include:

- People may want to get their religion from the Electronic Highway rather than from personal attendance at a Church service.

- An electronic narcosis may afflict society.

- The Church is going to be challenged by a society in which young people obtain most of their information about the world from the Electronic Highway.

- People will learn to filter out any message on the Electronic Highway which they do not wish to hear. This will include the message of the Gospel.

- Serious reading by the general population is going to decline even more, over the next twenty five years, as people begin to interact with the computer in a conversational mode.

- Centralized data banks may be regulated to exclude anything with a Christian content.

Some of the positive impact which may result from the wide-spread use of computers in society include:

- People within the Church around the world will find it easier to keep-in-touch.

- The free flow of information may bring about the destruction of closed societies such as those supported by Islam.

- Electronic publishing will make it easier and cheaper for the Church to communicate with an audience of hundreds of millions.

- Computer-assisted translation will bring the Gospel and Christian teaching to a worldwide audience.

- Data banks containing the world's knowledge base may facilitate a review of the history of the Church and encourage Christians to think more deeply about their beliefs.

- Computer-Aided Instruction will help the Church reach both those within and without the Church with high quality courseware.

Chapters 3 through 8 evaluate the trends in computer technology and assess the coming impact of the computer on the Church. However, before looking at the new technology, I will present a brief historical review of the impact of the printing press on society and the Church (Chapter 2). The purpose of this review is to show by analogy that the impact of technology is great. If the analogy holds true, which I believe it does, we can expect an even more significant impact as the presence of computer technology continues to expand into all areas of our lives.

By 2017, the 500th anniversary of Luther's nailing the *95 Theses* to the cathedral door, the computer will be part of everyone's life to a greater extent than the telephone and TV are today. The new forms of communication which will be brought into use will have the potential for a far greater impact than the printing press had when it was introduced. The question which the Church must face is: will it master the technology for Christ, or will the technology master us, and make us into 'slaves'?

Every leader in the Church has a responsibility to become involved in the computer revolution; at least to understand technology and its application. We must be involved in setting biblical standards for its use, and ensuring that it will remain a vehicle for the progress of the Gospel.

In an advertisement, Westminster Theological Seminary stated: "Will you be ready? — Forming Culturally Sensitive Pastor/Theologians for the Church Tomorrow. — 2000AD."[10] It is interesting that the artist who prepared the ad chose to use an LCD (Liquid Crystal Display) style of character for the '2000AD' text. The message is clear, the Church of the 21st century will face a revolution in communication technology. This revolution will be greater than that brought about through the printing press.

New developments in the computer and communications industries are coming every day. Winds of change are about us, and I hear a rumble of thunder. Is this rumble a rumble of the army of fear and oppression, or is it the rumble of a coming reformation of the Church?

Notes

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3. George Johnson, *Machinery of the Mind: Inside the New Science of Artificial Intelligence*. (New York: Random House, Times Books, 1986), p. 234.
4. Russell M. Dilday Jr., *Personal Computer: a New Tool for Ministers* (Nashville: Broadman Press, 1985).
5. Jim Hoogeven, "The PC and The Local Church," *Covenanter Witness*, November, 1987.
6. See *Christian Computing* for many examples.
7. William R. Johnson, *The Pastor and the Personal Computer: Information Management for Ministers* (Nashville: Abingdon Press, 1985).
8. Jay Kesler, "Vision Quest — Seven Challenges Face the Church as it Enters a new Millennium. How will it Respond?" *Christianity Today*, October 5, 1992.
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10. *Christianity Today*, October 21, 1988.

2 — The Textbook of History

Indulging in Print

Sometime around 1450, in the city of Mainz in Germany, Johann Gutenberg (c1400-1468) took out a mortgage from a rich goldsmith for the development of a printing press which would use movable type. This press was probably used for printing a letter of indulgence issued by Nicholas V, dated 1451. It is ironic that the oldest dated and printed document of which copies exist, is a letter of indulgence. Sixty-six years later it was Luther's printed attack against indulgences, distributed throughout Europe, which sparked the Reformation.

By 1470 use of the printing press had begun to spread throughout Germany and into Holland. A letter by Guillaume Fichet (1433?-1480) of Paris speaks of this amazing invention:

> There has been discovered in Germany a wonderful new method for the production of books, and those who have mastered the art are taking it from Mainz out into the world. ... The light of this discovery will spread from Germany to all parts of the earth.[1]

Later Erasmus, in the ecstasy of his sales, would call the printing press the “greatest of all discoveries.”[2]

But not everyone was as enthusiastic as Fichet or Erasmus. “In the Middle Ages every monastery was its own publishing house, and a monk with writing desk, ink, and parchment was his own publisher.”[3] The livelihood of monasteries was threatened, and copyists protested that printing would deprive them of income. Some of the elite in society (who could afford hand-copied books) saw the printing press as a mechanical vulgarization and feared that it would cause a reduction in the value of their manuscript libraries. Leaders in Church and State were concerned about the printing press because they saw in it a possible means of spreading subversive ideas.[4]

The introduction of the printing press broke the monopoly of the monasteries as the publishing houses of Europe. It also changed forever the nature of publishing. Until then, publishing was understood to be the preservation of the past.

> Their whole stock-in-trade was what the modern publisher would call a backlist. The book was not expected to be, nor dared it be, a vehicle for new ideas carrying messages from contemporaries to contemporaries. Instead it was a device to preserve and amplify the treasured revolving fund of literary works.[5]

The age of the copyists was not the age of the author. Writers would not always give credit to other writers with a quote; and when they did, it was practically impossible to give a clear indication of

the source of the quote. There were no standards for publishing; for chapter, section, and page numbering; or for making citations. In addition, writers who were composing original material were often reluctant to make a claim of originality. They did not want to take the risk of being blamed for innovation. “In the great age of manuscript books, anonymity was dictated by technology, orthodoxy, and prudence.”[6]

However, with the introduction of the mass production of books, paradoxically, the product of the individual became more distinct, and authorship became prized. “As never before, the individual ‘author’ was encouraged in his efforts at individuality and could be rewarded for his peculiar product. Originality became both respectable and profitable.”[7]

The copyists of the monastic system were highly venerated during the Middle Ages for their preservation of the past through copying[8] and also for their prodigious memories.[9] But their status fell with the introduction of the printed book. Copying became an inefficient and expensive way to publish. And the printed book became “a new warehouse of memory, superior in countless ways to the internal invisible warehouse in each person.”[10] Memorization became unnecessary, and soon drifted into the area of ‘mere stunts’.[11]

The monasteries were also held in wide respect for their copy rooms and libraries. This veneration of books was carried over into the Renaissance movement in Europe, with its emphasis on the classics. Around 1400 the assembly of large libraries became a popular past-time. Later significant examples include the Medicean Library (founded around 1450) and the Vatican Library (founded in 1453). A scriptorium and library were considered to be essential parts of any well equipped school or monastery.[12] It is estimated that in the libraries of Europe, before 1500 there were 30,000 to 35,000 titles in 20 million copies;[13] less than one book per person. Seventy percent of these were in Latin.

The introduction of the printing press changed the nature of publishing by moving it out of the hands of the monks and into the hands of entrepreneurs motivated as much by profit as by any other factor. Printing also moved books from secure libraries into the hands of the public and diminished the prestige of the monks as the guardians of the world's knowledge. The portability of the book broke the monopoly of the libraries, almost all of which were under the control of the Church. Books no longer had to be chained to reading cubicles, and lay and clergy could have libraries in their own homes. These changes set the stage for social, political and religious reform which rocked Europe for the next 400 years.

Vernacular Society

The printing press was a principal force in the movement of Europe out of the Middle Ages into the era of nationalism. “Of the many unforeseen consequences of typography, the emergence of nationalism is, perhaps, the most familiar. Political unification of populations by means of vernacular and language groupings was unthinkable before printing turned each vernacular into an extensive mass medium.”[14]

Medieval vernaculars had changed considerably in the four hundred years before the invention of the printing press. By the seventeenth century, vernaculars across Europe had crystallised.[15] Spelling and grammar became uniform,[16] and a simple, clear literary prose began to appear.[17] "The triumph of the printed book soon brought the triumph of the languages of the marketplace. ... Vernacular literatures in print shaped thinking in two quite disparate ways. They democratized, but they also provincialized."[18]

The ideas and dialogue which were once confined to the few, became the common property of the many. New ideas could be thrust upon men in masses, and multiply. This broke the old barriers and opened new horizons.[19] "Print, as it were, translated the dialogue of shared discourse into packaged information, a portable commodity."[20] As these new ideas were absorbed, a new homogeneity arose around the printed word. De Tocqueville (1805-1859) explained how the printed word "achieving cultural saturation in the eighteenth century, had homogenized the French nation."[21] Similarly William Cobbett (1763-1835) in his *A Year's Residence in America*, written in 1795, speaks of everyone being a reader, able to converse on any subject. "Book culture had created the new man in America."[22]

This homogeneity, which was fostered by typography, affected every area of life. "The uniformity and repeatability of the book ... created modern markets and the price system"[23] and invaded the arts, science, industry, politics and religion.

> With print Europe experienced its first consumer phase, for not only is print a consumer medium and commodity, but it taught men how to organize all other activities on a systematic lineal basis. It showed men how to create markets and national armies. For the hot medium of print enabled men to *see* their vernaculars for the first time, and to visualize national unity and power in terms of vernacular bounds.[24]

> The press also had a daemonic power to open the world and diffuse knowledge. ... Merely by its power to multiply the product, the printing press would be a champion of freedom, providing myriad unstoppable channels for dangerous facts and ideas, sending out countless items which could not be traced or withdrawn. Once the printing press had done its work, there was no force on earth, no law or edict, that could retrieve the message.[25]

The Press of Politics

The feudal system of the Middle Ages was formed around oral communication. But the printing press supported the introduction of new forms of social organization. Writers furnished the population with new ideas, and instilled in them a new temperament and disposition.[26] As these ideas took hold, political change became inevitable. National cultures arose around the formalized vernacular languages, and the old systems of government were replaced with new ones.

To give you some idea of the impact of the printing press on political systems I have selected the following quotations:

> The effect of the discovery of printing was evident in the savage religious wars of the sixteenth and seventeenth centuries. Application of power to communication industries hastened the consolidation of vernaculars, the rise of nationalism, revolution, and new outbreaks of savagery in the twentieth century.[27]

> From the writings of Milton, Sidney, Harrington, and especially John Locke's *Two Treatises on Government*, the colonists drew moral support in their disputes with the homeland in the Revolutionary era.[28]

> In early 1776 an able and persuasive Englishman, Thomas Paine (1737-1809), published a pamphlet at Philadelphia with the title of *Common Sense*, which had an enormous effect on public opinion. ... It converted thousands to the necessity of separation. The turn-over of opinion, once it had begun, was rapid.[29]

> Paine's words were intended for mass appeal. *Common Sense* came at the psychological moment, and its trumpet call to independence shook the waverers and forced them into line. With a sure instinct Paine touched the deepest emotions of Americans by appealing to them to turn their backs on the outworn institutions of the Old World and to create in America a new society.[30]

> The French Revolution [was] long prepared by the homogenizing print process ...[31]

> The citizen armies of Cromwell and Napoleon were the ideal manifestations of the new technology.[32]

> Napoleon (1769-1821) is on record for saying that “three hostile newspapers are more to be feared than a thousand bayonets.”[33]

The Printed Word

Immediately after its invention, the printing press was used primarily by the Church. Most of the readers were in the Church hierarchy, and their books were the primary items requiring publication.[34] The Bible in Latin was the first book to be printed with the new invention of movable type. It appeared in 1456 from two presses. The *Gutenberg Bible* (or *Mazarin Bible*) of 42 lines per page was actually published by Fust to whom Gutenberg had surrendered his press and prepared plates, because of bankruptcy. Gutenberg himself published a 36-line Bible known by a number of names (*Bamberg Bible*, *Schelhorn's Bible* or *Pfister's Bible*), apparently in the same year.

Thereafter, the printing press was used to print formal publications of the Church such as indulgences and small books to aid private and family devotion. Many of these were in the vernacular and were of a simple evangelical nature. The printing of the Bible and these devotional books was a significant aspect of the means God used to bring about the Reformation. One philosopher has stated that "there probably would have been no surging revolt against the dead forms of Christianity, had it not been for the invention of the printing press in the middle of the fifteenth century."[35]

When Martin Luther issued his Ninety-Five Theses, printing was already an established technology. However, Luther did not yet appreciate the value of this medium. He took no steps to have his theses published. He was simply posting his theses for the purpose of debate among the local scholars and leaders of the Church. "But others surreptitiously translated the theses into German and gave them to the press. In short order they became the talk of Germany."[36] Because of the printing press "the Ninety-Five Theses had a circulation which was, for the time, unprecedented. They were known throughout Germany in a little over a fortnight; they were read over Western Europe within four weeks."[37]

Luther quickly came to realize the value of the printing press. By February of 1519 Johann Froben (1460?-1527) a printer in Basel, reported that he had never seen copies of any publication so quickly exhausted as those which he had prepared of some of Luther's works. Six hundred copies had been sent to France and Spain, and Zwingli in Switzerland had ordered several hundred copies for distribution among the people.[38] Bainton, a biographer of Luther,[39] indicates the extent to which the printing press played a role in the furtherance of the Reformation:

> Feverish missionary activity was to win most of northern Germany within a decade of the Reform. This success was achieved through a wave of propaganda unequalled hitherto and in its precise form never repeated. The primary tools were the tract and the cartoon. The number of pamphlets issued in Germany in the four years 1521 through 1524 exceeds the quantity for any other four years of German history until the present.[40]

Will Durant also indicates the power of the printing press for the cause of the Reformation. He, of course, had a negative perspective on the events of that period, and had no love for the spread of the Gospel message. Nevertheless, he could not deny the importance of the printing press, and reported its use by Luther:

> Printing fell in with his [Luther's] purposes as a seemingly providential innovation, which he used with inexhaustible skill; he was the first to make it an engine of propaganda and war. ... Printing was the Reformation; Gutenberg made Luther possible.[41]

In the early decades after the invention of printing, it was a risky business to commit one's entire livelihood to so new a technology.[42] Gutenberg went bankrupt at least twice while attempting to

introduce this technology, and printers suffered at times the confiscation of their equipment at the hands of an unsupportive Church.

Printers and those making use of the printing press were adventurers willing to take a risk for a good cause. They understood the value of applying this technology as a means of reform and as a means of presenting the Gospel. They used the printing press as the public address system of their age.[43] They amplified the small quiet voice of individual monks and clergy into a voice of thunder.

> Printing ... did not produce the Renaissance, but it paved the way for the Enlightenment, for the American and French revolutions, for democracy. It made the Bible a common possession, and prepared the people for Luther's appeal from the popes to the Gospels; later it would permit the rationalists' appeal from the Gospels to reason. It ended the clerical monopoly of learning, the priestly control of education. ... It facilitated the international communication and co-operation of scientists.[44]

Notes

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2. *Ibid.*, p. 160.
3. Daniel J. Boorstin, The Discoverers (New York: Vintage Books, 1985), p. 493.
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5. Boorstin, op. cit., p. 493.
6. *Ibid.*
7. *Ibid.*, p. 531.
8. *Ibid.*, p. 494.
9. *Ibid.*, p. 482-484.
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11. *Ibid.*
12. *Ibid.*, p. 495.
13. Marshall McLuhan, The Gutenberg Galaxy (Toronto: University of Toronto Press, 1962), p. 206.
14. Marshall McLuhan, Understanding Media: the Extensions of Man (New York: Signet Books, 1964), p. 161.
15. McLuhan, The Gutenberg Galaxy, p. 232.
16. *Ibid*, p. 231.
17. Hiroshi Inose and John R. Pierce, Information Technology and Civilization (New York: W. H. Freeman and Company, 1984), p. 5.
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21. McLuhan, Understanding Media: the Extensions of Man, p. 29.
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28. Michael Kraus, The United States to 1865 (Ann Arbor: The University of Michigan Press, 1959), p. 208.
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30. Kraus, op. cit., p. 216.
31. McLuhan, The Gutenberg Galaxy, p. 162.
32. *Ibid*., p. 222.
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34. Klaus Bockmuel, Books: God's Tools in the History of Salvation (Vancouver: Regent College, translated 1986), pp. 10-11.
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36. Roland H. Bainton, Here I stand: A Life of Martin Luther (Nashville: Abingdon Press, 1978), p. 63.
37. Lindsay, op. cit., p. 230.
38. Bainton, op. cit., p. 93.
39. Bainton, op. cit.
40. *Ibid*., p. 238.
41. Durant, op. cit., p. 368.
42. Boorstin, op. cit., p. 515.
43. McLuhan, The Gutenberg Galaxy, p. 197.
44. Durant, op. cit., p. 160.

3 — Computer Revolution

Expected Revolution

It was just over fifty years ago that *Scientific American* reported the following:

> Days of laborious computation by trained mathematicians are no longer necessary at the Massachuset Institute of Technology. A new one-ton machine with many complicated levers and gears will in a single action solve nine simultaneous equations.[1]

This 'monster' was the precursor of the electronic computer, and preceded it by 9 years. The first true digital computer is reported to have been ENIAC, which was built in 1946. It contained 18,500 vacuum tubes, and was as much of a 'monster' as the mechanical computing machine mentioned above. Even though it was an electronic device, it could not do much more than the MIT invention.

Contrast these 'monsters' with the inexpensive computing devices which are available today. You are all probably aware of how the size and price of hand-held digital calculators dropped dramatically during the 1970s. Today a calculator the size of a credit card costing about a dollar, can perform calculations which make ENIAC look like a 'moron'.

I am writing this book on a computer which contains the equivalent of 16 million vacuum tubes, and takes up the space of two hardback dictionaries. It has a sophisticated word processing package with a 100,000+ word dictionary. This computer can be purchased for under $2,000. Other desktop computers are becoming available which contain the equivalent of over 4 **billion** vacuum tubes and can access trillions of characters of data in small external storage devices. It is predicted that "by the year 2000, it will be possible to build integrated circuits with one billion transistors."[2] These machines will operate in the range of one trillion operations per second.[3] And fifteen to twenty years after that ... ?

The developments which have occurred in computer technology over the past 50 years are staggering. Yet it does not appear that there will be any limit over the next few decades to the continuation of these developments. But the developments in hardware technology is really not important in isolation from its impact on society, and more importantly to us, on the Church.

Fifty years ago the majority of North Americans worked either in primary industries (such as farming or mining) or in secondary industries (such as steel manufacturing). Today over half of the North American work force is involved directly or indirectly in creating or processing information. This includes workers in the traditional professions such as ministers, accountants, teachers, lawyers, and clerks; and it also includes those working in newer professions such as advertising, financial services, electronic publishing, telecommunications, scientific research, engineering, and computer systems.

With so many workers involved in the processing of information it is clear that the nature of our society has changed significantly since the Second World War. Much of this change can be attributed to the arrival of the computer and associated telecommunication technologies. However, it is likely that there will be even more change in the next twenty five years. As a greater percentage of the work force becomes involved with the processing of information, there will be an increased need for tools (such as the computer) to process this information. And, as these tools become more commonly available, their impact will become greater.

Whether for good or evil, we have introduced a technology which has put our society onto an escalating spiral path. More computers will be needed to process the increasing volumes of information, and the introduction of more computers will make our society into a more information-intense society. "Today we live on the frontier between five centuries of mechanism and the new electronics, between the homogenous and the simultaneous."[4]

The transitional era in which we live has been called the 'third wave' (the first being the agricultural revolution and the second being the industrial revolution), the 'second industrial revolution', the 'information age' and the 'computer age'. Whatever you wish to call this new age, without a doubt we are in the midst of a revolution.

In the end, this revolution will be as significant as that which began with the introduction of print technology 500 years ago. As we have seen, the Reformation and the rise of the Nation States can be largely attributed to the introduction of the printing press. The following quotations give an indication of the revolution which we can expect as the result of the introduction of the computer:

> When Gutenberg overturned 1500 years of scribal practice, he set about performing the tasks of the scribes to the greater convenience of his customers ... But the new reality was a change in the nature of knowledge. ... A change in the storage and dissemination processes of information must bring in its train a major shift in the realities of information power and in the relationship[s in] all of society ...[5]

> All the effects of print technology now stand in stark opposition to the electronic technology. In the sixteenth century the whole of ancient and medieval culture stood in equally conflicting relation to the new print technology.[6]

> At last, through the digital computer and through data services, information technology has united all media and forms of information. In the future, all will be served by the same technology, and all will be integrated in our life, work and recreation.[7]

> The idea is that the changes through which we are now going are every bit as tremendous as those which transformed the world of local communities based on subsistence agriculture into the world of sprawling cities, machines, mills, and factories.[8]

> Like any other extension of man, typography had psychic and social consequences that suddenly shifted previous boundaries and patterns of culture. In bringing the ancient and medieval worlds into fusion — or, as some would say, confusion — the printed book created a third world, the modern world. ... Electric means of moving of information are altering our typographic cultures as sharply as print modified medieval manuscript and scholastic culture.[9]

> The old world of the industrial revolution that we inherited from the past is clearly in upheaval. This chaotic period is certainly creating serious difficulties. But this period of chaos is a fertile one, for the chaos is caused by the coming of a tremendous new age.[10]

Silicon Saviour

Since the invention of the computer, many writers have expressed opinions about how this revolution will change society, and even man. Some, such as Robert Jastrow in an essay in *Time*, take an evolutionary perspective. Jastrow sees the day when computers will replace man as the intelligent life force on the earth. He says that:

> judging by the record of the past, we can expect that a new species will arise out of man, surpassing his achievements as he has surpassed those of his predecessor, *Homo erectus*. Only a carbon-chemistry chauvinist would assume that the new species must be man's flesh-and-blood descendants, with brains housed in fragile shells of bone.[11]

His view, based on the evolutionary presupposition that man is progressing from a primitive state to an advanced state, leads him to the materialistic conclusion that:

> man will ... provide for computer reproduction, as he does today. In return, the computer will minister to our social and economic needs. Child of man's brain rather than his loins, it will become his salvation in a world of crushing complexity.[12]

Jastrow is not the only writer who has replaced God with the brain-child of man — a god after man's own image. Diane Butler, for example, states: “The whole made possible by telematics holds infinite promise, not only for us, but also for our children.”[13]

James Martin, a former IBM database expert, a writer of dozens of books, and a ‘guru’ in the computer industry, also preaches salvation by computer. He says in his book *The Wired Society* that “faced with the dilemmas of our age it is imperative that we employ benevolent technologies to tackle our problems and build a better world. ... To heal, we have to move to new technologies, new types of consumer products, new ways of generating and spending wealth.”[14]

Martin may be an expert in computer technology but in his books he appears to lack an understanding of history and of the Bible's teachings. He seems to have missed the fact that the writings of Plato (*The Republic*), Thomas More (*Utopia*) and Sir Francis Bacon (*New Atlantis*) failed to predict the emergence of a new humanity. And, he does not appear to heed the failures of the later Utopian Socialists of the 18th century and the failures of the systems which developed from this socialism: Marxian Socialism and modern liberalism. He gives no consideration to original sin which pollutes man and makes impossible any utopia which is not established under the kingship of Christ.

But he is not alone in his view. Even the eminent group of scientists in the Club of Rome who originally became news with their world simulation model, written about in their book *Limits to Growth*, presented the view that the computer will be man's saviour. In their projection of computer and related technology, they stated that "we seem called on to build a heavenly welfare society on the earth without the assistance of an almighty god. ... We must use our limited resources at the highest possible efficiency [here is the importance of the computer] if we are to realize anything approaching this goal of paradise on this sinful earth — indeed, if we are to avoid sliding to a situation more closely approximating purgatory, or even hell."[15]

The Missing Revolution

Although as a Christian I cannot agree with the view that the computer will be the saviour of the human race, I can agree that developments in computer and associated communication technology will "turn the world upside down." Yet, this change will not be as some might predict. For example, when Apple introduced its first personal computer, there were many who predicted that in only a few years every home would have a computer for indexing recipes, reconciling the bank account, keeping inventories of hobby collections (records, stamps, etc.) or for accessing information data banks (stock quotations, airline route information, etc.). However, about the only uses most people have found for home computers are for playing games and word processing. There are of course many businessmen, engineers and computer professionals who have found home, portable, and lap-top computers to be valuable, since they allow them to bring their office work home with them.

The predicted demand for home computers has probably not been realized for the following reasons:

- **Computers have not been convenient to use** — To perform many home-tasks with the present generation of computers is less convenient than performing them in the traditional way. To use a pen and hand-calculator to balance a check book is simply easier than turning on a computer and typing in each transaction.

- **The services provided, to date, are not often used at home** — The number of accesses to current computer systems for most home applications would be very limited. The average household might write two or three cheques per week, or make airline reservations twice a year.

- **TVs and computer displays do not provide photographic quality graphics** — To date, the commercial trials of selling information to the public using home computers or TVs accessing computerized information data banks (videotext) have been unsuccessful because of the low resolution of the image available on screens, the slow speed of communicating the information, and the low volume of information which is of any practical use to a household.

- **Computers are not simple to use** — To some, the apparent difficulty of using a computer has made it difficult for them to make the jump into this new technology.

- **Computers have not yet provided a truly new information medium** — "Even if all the economic and demographic preconditions exist in perfect form, for a series of new devices to be marketed *en masse* and simultaneously to societies already brimful of entertainment and information gadgetry ... of one thing we may be certain, these new devices will not take off with the rapidity of the radio in the 1920s, for they supplement and replace, rather than provide a fundamentally new experience."[16]

Underlying these shortcomings of the current generation of computing technology is a fundamental reason why the predictions have failed to be realized. The computer is in the 'horseless carriage' stage of its existence. Shortly after its invention, the printing press also went through a similar stage. The first printed books were made to look like they were produced by hand copying, and many in the Church and State resented the potential changes to the established ways. The printing press had not yet been used to develop entirely new forms of communication (e.g., the newspaper), and its potential impact was still only a distant rumble.

Computer technology, supported by a worldwide communications network, is today in much the same state as the printing press was 500 years ago. Computers are used primarily to automate tasks which have been performed manually for centuries (accounting, order processing, inventory control, library cataloguing and circulation, etc.). This automation is resented by many, both in union and non-union organizations. So the potential of the computer is still only a rumble.

However, every day the rumble is growing louder. You see the impact of computers everywhere you look. At the checkout counter in your neighbourhood supermarket or drug store, under the hood of your car, at your bank, in your entertainment devices, and at work. Computers are becoming part of every aspect of our daily lives.

Over the next decade they will become easier and more convenient to use, and will become so ubiquitous that most people will hardly notice their presence.[17] New interface metaphors are being developed[18,19] and deployed at such places as the Xerox PARC laboratory, which will make computers as easy to use as a basic telephone. These developments include the use of visual touch sensitive screens,[20] new graphics displays, the use of pens as pointing and writing devices,[21] and the creation of a new mode of computing with inexpensive flat portable computers (the Apple Newton was the first [small] step in this direction).

Computers are becoming lighter and more portable at an amazing pace.[22] Within a few years PCs with flat plasma screens will be about the size of a clipboard and not much thicker.[23] Prototypes are already under development for screens no thinker than a pad of paper.[24] These flat portable computer displays will soon provide large-sized photographic quality pictures in colour. They will allow the equivalent of full-sized magazine pages to be displayed and will operate at speeds comparable to what you can achieve when turning the pages of a magazine.

> We predict that as flat panels continue to evolve toward higher resolution and reduced power and weight, they will increasingly replace paper. In addition to their flexibility, they offer the advantage of responding to touch or stylus. These qualities all tend to simplify the most cumbersome element in modern electronics, the interface, enabling the user to take full advantage of the computer itself.[25]

These flat displays will communicate via infrared and radio signals to master computers[26] in your home or office and will be tied into high speed networks to provide access to additional information and services that are almost unimaginable today.

You will use a number of these portable information appliances for displaying different 'documents', rather than displaying many documents on one screen, as is done currently. You could, for instance, carry one of these appliances with you as you would a book, or lay three or four on a table or desk with each displaying different documents.

Along with this developing hardware technology will be new information retrieval technology which will permit you to browse quickly a vast 'sea' of documents using personal filters. These filters will permit you to access and obtain useful information quickly and structure and display it in a format that you feel comfortable with. In addition, a collaborative software agent[27,28] in your network of information appliances will maintain a profile about your work and recreation patterns and will 'anticipate' your requirements. This agent will help you find and utilize the information that will be available from the network.

Just as the significant impact of the printing press on the society was not seen for two generations after its invention, so the significant impact of the computer on society has not yet been seen. The true impact of the computer will begin to become clearer as we move into the 21st century.

Projected Revolution

Predicting the future is no simple feat. In fact, God uses his knowledge of the future as the departure for his defence of his uniqueness. He calls all men everywhere to "Present your case ... set forth your arguments. ... Bring in [your idols] to tell us what is going to happen. ... Or declare to us the things to come, tell us what the future holds so we may know that you are gods." [Isa 41.21-23]

We cannot claim to know the future. The effect of technology upon society and, conversely, of society upon technology are far too complex for us to understand and project reliably. But by noticing current trends in society and technology and by applying the analogy of history, we can make projections which are within the realm of the possible.

In the next five chapters, I look at the present trends in five areas of computer and communication technology. I make projections about where these trends may lead us over the next twenty five years. My purpose is to be specific in these projections so that the leaders of the Church can assess the potential impact of the computer on the Church.

The Church is in the information processing business. Its objective is to present the Word to the world. Therefore my focus is on trends in the technologies which relate to the processing and communication of ideas and words. Although my projections will probably not happen as stated, computer and communication technologies will have an impact on both society and the Church. The rumble is growing louder, and the storm is about to burst upon us:

> There is no longer any doubt that such machines will reshape human civilization even more quickly and more thoroughly than did the printing press. Gutenbreg's invention, which so empowered Jefferson and his colleagues in their fight for democracy, seems to pale before the rise of electronic communications and innovations, from the telegraph to television, to the microprocessor and the emergence of a new computerized world — an information age.[29]

> The personal computer could become as galvanizing as the printing press in stimulating change in the world, in creating an environment for innovation and new ideas ... Once we have thousands of ideas to harvest, we may have the chance once again to create a second Renaissance, perhaps every bit as important as the first, in the early part of the next century.[30]

> It's quite possible that the most dramatic and rewarding applications of the information superhighway haven't even been conceived of yet.[31]

Gutenberg and Luther changed forever the complexion of society and the Church. In like manner, ENIAC and the reformers who will be raised up by the Holy Spirit will bring lightning from the thunder clouds.

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4 — Highways in the Sky

The Telephone Connection

There have been a number of technical and institutional developments which have played a major role in the development of a world economy. Included are: the establishment of scheduled shipping and airline routes, the construction of railroad and highway networks, the adoption of time zones and standards for a universal postal system, and the creation of a global telephone network. Each of these developments has played a role in moving the world economy from its previous rural-agrarian base to its current urban-industrial base.

Until recently the world economy has been dominated by those networks which facilitate the movement of goods and services (through people), such as ships, trains, trucks and planes. However, technologies which support the rapid communication of information are now the dominant force in the world economy, and it appears likely that they will move the world economy from an urban-industrial base to a distributed-information base. These technologies include broadcast television and radio, and cable TV. But the primary technology supporting this change is the telephone network.

The telephone network is no longer a **telephone** network but the major communication 'highway' of the world.

> That's because the phone business is no longer just a phone business. It's a computer driven telecommunications network that in a very real sense constitutes the electronic lifeblood of countries all over the world. Everything depends on it — communications, transportation, education, business, hospitals, you name it.[1]

De-regulation in North America has made it possible for users of the telephone system to 'plug-in' a large number of different devices beside the standard voice telephone, such as: facsimile machines, telex machines, computers communicating through modems, and portable cellular phones. This connection freedom is common in almost all parts of the world. In addition, the introduction of digital lines, fiber optics, automated switching, satellite relays, and computer access ports has made the telephone network the most versatile communication network on earth.

The telephone network is simple to use and provides bi-directional and multi-directional communication (for example in a conference call), in a fully random-access mode where any point is accessible to any other point. It provides direct access to almost any point on earth, as you can see by a quick review of the front pages of any North American telephone book. It has a massive installed base of access points (approaching 1 billion[2]) and can carry voice information, music, still images (e.g., photographs), video signals, and alphanumeric data.

The importance of the telephone network will continue to grow during this decade as communication speeds on the network improve, as the network becomes able to support a greater variety of media, and as it becomes cheaper to use. The greater capacity of the network will be facilitated by the increased use of satellites and the wide-spread introduction of fiber optics (FOX).

Over the next twenty five years many more satellites will be launched. Currently one satellite has enough transmission capacity to provide every man, woman and child in the United States and Canada with a personal computer data link.[3] Each generation of satellite will handle more data more reliably and over a longer life than the previous generation.

FOX cables also carrying amazing volumes of information, and can act as substitutes for satellites. The FOX cable installed between the U.S. and Japan can provide 40,000 simultaneous circuits.[4] The installation of a FOX network has been underway in NA since the late 1970s. FOX cables have also been installed across the Atlantic, and more will be installed during this decade. This network of FOX cables will make available an inexpensive long-distance communication channel accessible to anyone on the telephone network. Fifth generation FOX technology is under development in the research laboratories, and promises to provide capacities and speeds on the network that can only boggle the mind.[5,6]

Other communication devices besides telephones, and entire networks (e.g., cable television) are being completely integrated with the telephone network. Devices on these networks are able to communicate over the telephone network with devices in remote locations. Within a few years 95% of all computer networking in the U.S. will be carried out on the telephone lines already installed.[7]

In addition, standards have been defined for the introduction of an Integrated Services Digital Network (ISDN) that "promises to change the nature of the telephone and to speed up the movement of information around the world."[8] The ISDN standard and the similar Asynchronous Transfer Mode (ATM) integrated-services platform permit many types of computers to communicate with one another, and permit the telephone network to carry images and live motion video in real-time in addition to the voice and data it already carries. By the end of this century, telephone conversations will represent only a very small portion of the information carried on the telephone network.

Field trials have been completed to test portions of the ISDN standards. Japan was the first country to begin field trials in Mitaka in 1984. The Japanese expected to have 200 cities connected to the ISDN network by 1990 and to make the network available nationwide by 1995.[9] Other countries such as Canada, the U.S., Great Britain, France, Germany, Singapore, and Italy all have, at least limited, ISDN networks available today.[10,11] The beginnings of a nationwide ISDN service in the U.S. was officially launched in the fall of 1992, and initially connected 20 major cities.[12] In early 1992, most of the regional Bell operating companies in the U.S. planned to have at least 50% of their lines in wire centres incorporating ISDN within two years.[13] By the end of the century every urban user of the telephone, and most rural users, will probably have access to ISDN services.

China is planning a major installation of telecommunication technology and expects to leapfrog the rest of the world by adopting ISDN. “Intelsat claims that satellites will be able to bring ISDN to the rest of the world during the 1990s. Intelsat claims that there are now ISDN plans in Brazil, Ecuador, India, Ivory Coast and Peru.”[14]

Similar pilots of the newer ATM protocol developed by IBM, AT&T and Northern Telecom have been conducted on a 15,000 km transpacific cable and in a network connecting universitates in Illinois and Wisconsin.[15] ATM may prove to be the standard communication medium of choice because it has the potential to integrate voice and data on a seamless network.[16]

The wide-spread use of satellites, FOX, ISDN, and ATM will make it practical to send over the telephone network the large volumes of data required to support video images. The transfer of voice information, video signals, or alphanumeric data will be practically instantaneous. Information will move at close to the speed of light (around the world 7 times in a second), and you will be able to communicate to any other point on earth as quickly as a conversation could travel from Bronx to Manhattan.[17]

Plug Compatible

Within the next twenty five years amazing new computers and telecommunication devices will become available. These will permit you to communicate via satellite and the telephone network with another person located anywhere on earth. You will have available devices such as the following:

- **A multi-display video phone** which will carry your voice on one channel, and a high resolution three dimensional image of you as you talk, on a second channel.[18,19] The ‘phone’ will also provide additional channels for carrying text or graphics which you may wish to display on a separate device while speaking.[20,21] You will be able to interact with the person at the other end of the line, much as you do while talking in his or her presence. You will be able to draw pictures, point at displayed objects, and move quickly from one ‘page’ of display to another.

  Singapore offers today live motion commercial vidoephone services across a digital network.[22] When digital networks become more common, moving images will be transmitted along with voice data.

  In the past, the commonly available technology was an obstacle to providing this kind of service. But now with faster computers, compression software and fiber optics connections it is possible to provide video phone services even on copper wires. The only remaining obstacles to the wide-spread introduction of video phones are the price and the critical mass of installed units required to make them really useful.[23]

  Companies such as Mitsubishi, Sony, Ricoh, Northern Telecom and AT&T have all introduced

video phones.[24,25,26] These video phones cost around $400 to $1,500 U.S., but as demand and production volume increases the price will probably drop. At first, the use of video phones will appear in business environments. But just as with the introduction of cellular phone, it will not be long before individuals are using video phones for personal use.[27]

- **A pocket-sized unit** in the form of a thin hinged sheet, which will act as a portable display and communication device. You will be able to obtain information from any computer to which you have access permission, or speak with any person on the telephone network, anywhere on earth.

  This unit will be powered by light so it will not require batteries or an electrical power outlet. In urban areas it will be possible to connect this unit into any telephone port. In urban or rural areas it will be possible to connect it to a small device containing a receiver and transmitter which will permit you to communicate directly with a satellite, and via the satellite with the telephone network.[28,29]

- **A flat screen with at least twice the resolution of today's TVs** or standard computer monitors.[30] These screens will be available in many sizes including wall-sized units of less than an inch thick[31] for viewing life-sized images of co-workers or TV shows, movies, graphics, and art; and smaller ones the size and thickness of a clipboard for viewing text, diagrams or video images. These smaller ones will permit you to display ‘pages’ as quickly as you can flip the pages of a book, and will be as convenient and as comfortable to use as a book or magazine.

- **A fully portable communication module** about the size of a watch or credit card you will wear on your wrist, carry in your pocket,[32] or wear like sun-glasses.[33] This module will act much like a portable telephone does today, but will be considerably smaller.

  This communication module will permit you to communicate with a computer to check, for example, your bank account and transact a transfer of funds to a store where you are currently shopping. Your voice ‘print’ will be checked, and within seconds the store's computer will register the payment.

  It will also be connected into the Personal Communications Network (PCN) which is in the planning stages in the phone companies.[34] This network will consist of small ground-based communication cells in urban areas in a Public Cordless Telephone Service (PCTS) network[35] and a world-girdling network of dozens of satellites such as the Iridium network of 66 satellites planned by Motorola[36] or the network of hundreds of satellites planned by Bill Gates. These networks will provide you with a personal phone number which you will be able to use in the office or at home. By telling the PCN where you are, a phone call could be routed to you anywhere in the world.

Many parts of the fully digital optical telecommunications network are already in place, and the devices for the next generation of personal communications are being planned today or already are under construction. For example AT&T's digital long-distance optical network is well developed

and stretches at least 140,000 kms world-wide.[37]

> Future networks will likely complement or merge with office-information systems, home-entertainment electronics, and existing communications equipment and networks. Those integrated systems will remove most geographical and media obstacles from everyday personal and business discourse. ... The move is toward something that could be called universal communications.[38]

Electronic Mail

Two and a half millennia ago the Persians established a network of mounted couriers which held together an empire of 40 million people. This empire extended over the largest area ever brought under one rule up to that time. Mail could travel from Sardis to Susa (2400 kms) in under a week.[39] The Greek historians Herodotus (484?-425 BC) and Xenophon (445-355 BC) were both impressed by this system and wrote of it with admiration. It is the words of Herodotus which have become the slogan used by the U.S. postal system and are familiar to every North American: "Neither snow, nor rain, nor the gloom of night keeps these messengers from the swift completion of their appointed rounds."

Not to be outdone, the Romans had their *cursus publicus* which tied together their administration. This postal system survived the fall of the Empire, but slowly deteriorated in the Middle Ages. During the late Middle Ages attempts were made to re-establish a postal system in Europe (for example, the Germanic *Butcher Post* of the mid-thirteenth century[40]). But nothing in Europe during this period could compare with the system established by the Khans. This system as described by Marco Polo (1254-1324) in the account of his journey to the Far East was more sophisticated than the Persian postal system, and included most of the territory which had been under Persian Rule, plus northern India, Mongolia and China.

The western world did not see the return of comprehensive postal systems until Benjamin Franklin (1706-1790) laid the foundation in the colonies and Rowland Hill (1772-1842) of England published his book, *Post Office Reform: Its Importance and Practicability* (1837). Since then the world has been brought under one postal system, under the jurisdiction of the Universal Postal Union established in 1874.

From Persia to the 20th century the movement of mail has contributed greatly to the smooth running of each civilization. However, recently there has been much dissatisfaction with the public postal system in Canada.[41] The cost of sending a first-class letter has risen 500% in the past twenty years. A letter moves no more quickly today between Toronto and Ottawa or Toronto and Vancouver than it did 40 to 50 years ago. Saturday mail service is long gone, and in many places home delivery has been replaced by neighbourhood mail drop-off locations called (euphemistically) 'super boxes'. There have been a number of mail strikes, some of which have shut down the system for weeks. Although the U.S. mail system is somewhat more efficient than the Canadian system, and the workers are not allowed to strike, there seems to be a similar degree of dissatisfaction with the U.S.

mail system.

Dissatisfaction with government run postal systems has encouraged businesses to seek alternate means of communicating internally, with other businesses, and with their customers.[42] In North America the growth of alternatives to the postal system has been astounding. As a result, the postal system in NA is dying a slow death. It is becoming essentially a service for moving 'junk' mail (advertising, catalogues, and announcements)[*], and "although paper is still the preferred medium for many ... if they could deliver the right page out of the ... catalogue to the right person, they wouldn't send the whole catalogue."[43]

The most visible alternative to the postal system is that provided by courier services. Many businesses now routinely use local couriers for intra-city delivery of mail, and large national and international couriers for moving mail overnight to almost any point in North America, and within a few days to almost any city in the world.

However, the courier system will be a temporary phenomenon, with a shorter life than the postal system. The use of couriers has arisen only because the public postal system has failed to meet the needs of businesses which can afford a faster and more efficient service. These same businesses are also those which can afford other alternatives to the public postal system. Some of these alternatives are much less visible than the brightly painted trucks and planes of the couriers since they use the telephone network to move information.

There are a number of different ways that information is being moved over the telephone system, such as telex messages and facsimile transmission. The latter is very popular in Japan where hand written communication still predominates because typewriters and word processors have been difficult to develop and use. But the method which is growing the fastest in North America is electronic mail (E-mail).

In my company we have an in-house E-mail system. With its text-editing facility I can prepare a memo or longer text document. Or I can attach text (even very long documents, voice messages, diagrams, or any file in digital form) prepared on any computer in the office into a mail message. Once I have the text or file I want in my mail message, I can send it to one or 100 correspondents in any of our branches anywhere in the world. Each of my correspondents has a PC on his desk and can read his mail at his convenience. In order to reply it is necessary for him to select the reply function from the menu, and the system automatically prepares the 'envelope' for him. He can type his reply at his PC or move it in from a word processor, computer file or any other device (such as a page scanner) which can prepare a digital file.

I find the E-mail system an effective means of communicating. It saves time when conversation is not necessary. I can also be assured that the correspondent reads the message (in fact the system will

[*] According to *USA Today* (February 9, 1994), 64% of all mail carried by the US Postal System is advertising and non-profit mailers, 18% is bills and financial statements, 11% is magazines and government mail, and 7% is personal mail.

give me the date and time when the message was read, if I request it). One example will show how the system proves effective. To make capital expenditures in our company we need approval from the corporate controller. Once I needed this approval quickly. I sent an E-mail message describing the request and the reason to the controller and to other people in corporate accounting. On that day our controller was not in Ottawa (our Canadian corporate office) but was in Washington (our U.S. corporate office). I did not know this. Nevertheless he was able to read his mail in Washington and send his approval. Once I had received his approval, I sent a copy of the purchase order via facsimile transmission to the hardware vendor (our company E-mail system allows us to send FAX messages from within the E-mail system.)

Using the E-mail system, I had obtained approval and placed the order in a few hours and for less than a dollar for communication costs. In contrast, if I had used the postal system it would have taken at least a week; and if I had used a courier it would have cost the company about twenty dollars.

The in-house E-mail system within my company has been accepted by almost everyone who has access to it, and it is being used for an increasing percentage of the communication among employees. Many national and international companies have set up an in-house E-mail system. “Messages and memos move silently and instantaneously. Terminals at every desk — thousands of them in any large organization — flicker quietly as information flows through the system, bouncing up to a satellite and down to an office half-way around the world or to a terminal in an executive's home.”[44]

Your immediate response might be one of indifference. You say that you cannot afford the cost of connecting into an E-mail system; and anyway, only one or two of those with whom you communicate has a personal computer. It may appear that the development and use of E-mail systems makes sense only for large international corporations which need to tie together thousands of employees, or for companies which have to move information quickly to save money (e.g., the banks, or stock brokers) or to stay ahead of the competition. But, "E-mail will catch on in the home. It's just extraordinarily useful and convenient."[45]

E-mail may be used primarily by businesses today, but will likely go through the same acceptance life-cycle as did the typewriter and word processor. Within a few years E-mail systems will become so widely available that you will have access to one in your home. CompuServe, as an example, provides an E-mail service which is being used by private individuals for education, hobby and personal business needs.

Consider the analogy provided by the typewriter and a PC with word processing software. In 1873 E. Remington and Sons, gunmakers of Ilion, NY, began to mass produce typewriters. The first demand for typewriters was in business, and a number of new jobs came into existence centred around the use of this new device.[46] Soon typewriters began to appear in private homes. For 100 years the sale of typewriters became a major source of revenue for companies such as Remington, IBM, and Olivetti.

In the mid-_70s a significant trend began: the computer in the form of a word processor began to replace the typewriter. Until this time computers had been used primarily for processing numeric data and, to a limited extent, text. But since the appearance of the word processor, a growing percentage of computer power has been used to process text. In twenty five years the amount of information (which today we call text) which will be received, 'massaged', stored, and transmitted by computers, will exceed any projection based upon current trends.

At first word processors were expensive, difficult to use and unreliable. Only daring companies introduced them. There were fears among secretaries, troubles with unions, numerous cost-benefit studies and installation headaches. I encountered these problems as I introduced word processors into a municipal government in the mid-_70s. There are still problems like this being encountered in some organizations. But today it is almost assumed that a company will buy word processing software and a PC rather than a typewriter. This is certainly the case in my company. In the Toronto office, we have only one typewriter left for about 150 employees, but everyone has a PC with word processing software.

Today the manufacture of typewriters is as significant as the proverbial manufacture of buggy whips. Word processing software is moving out of businesses into home and school. There are a number of universities which now require all entering freshmen to have their own personal computer with word processing software. A growing number of high school students also using word processing software. Churches and pastors, if not currently using personal computers with word processing packages, are at least thinking about the possibility. The word processor, in about 15 years, has moved from a leading edge technology to being commonplace.

As the typewriter and word processor moved from the business to the home, so will E-mail. This will happen very soon, since "the electronic mail market is starting to heat up."[47] The number of subscribers connected to commercial systems such as CompuServe, America Online, and E-mail providers on the Internet is in the tens of millions. In addition, there are large private E-mail systems. For example, around 40,000 employees in Digital Equipment Corporation send 400,000 messages per day to one another, and at IBM almost every employee is connected to an in-house E-mail system.[48] It was estimated that in 1992, in the 2000 largest companies in the U.S., there were almost 12 million E-mail users. This number was expected to increase to 27 million users by 1995.[49]

These different E-mail systems are being integrated through connections to common networks such as the Internet which has around 16,000 networks and almost two million host computers connected and many millions of users, and can be reached from 137 countries.[50,51] In addition a standard for a global directory to integrate all E-mail systems has been defined.[52]

Subscribers continue to connect to E-mail systems at a rate of over 25% per year. As more subscribers send more mail over E-mail networks, the cost per item sent will drop. This will encourage more corporations to move to E-mail systems where the increasing volumes will bring dramatic price reductions.[53] At some point, the cost of creating and sending via the postal system a one page letter, will cost over $1, but the cost of sending the same information by E-mail will cost

only a few cents.[54]

When it costs ten times as much to send a physical sheet of paper as to send the same information via E-mail, businesses will attempt to move all of their correspondence into the E-mail system, away from the postal system. Since a major source of the revenue for the postal system is business mail, it will not be long before the postal corporations will feel the effect of losing this important source of revenue.[55] As their revenue base contracts, prices will inevitably climb even higher. Corporations which deal with the public will look for ways to send bills electronically, and the average citizen will find it too expensive to use the postal system to send letters and payments. The increasing cost of moving paper will be the primary cause of most households in North America being brought into the E-mail network.

The capital costs of entering the E-mail network are not as high as might be expected. France provides the best example of the computer terminal becoming as a standard domestic appliance. As part of radical changes to the French telephone system, mass-produced terminals that cost as little as $30[56] are being installed in every home.[57] The French system provides each phone subscriber access to an electronic telephone 'book'[58] and 15,000 other services such as the *USA Today* data base, and electronic shopping and banking.[59,60] There are currently over 5 million subscribers to this system, and at the peak 100,000 additional subscribers were being added each month. The agency set up to establish this service expected to recoup its investment in five years.[61] The French Minitel system is now going global and is available in the U.S..

In North America, computer terminals/phones are already available (e.g, the Display Phone made by Northern Telecom). By the end of this century North Americans will be able to purchase compact display phones instead of the touch-tone phone of today. When produced by the millions these will cost around $30.[62] But their purchase may be subsidized by corporations such as the phone company, banks, large department stores or utility companies which will find it cost effective to have customers connected to the E-mail network.

In addition to display phones, over a third (approaching half) of all homes in North America have a personal computer. Most of these computer can be modified to access the E-mail network. Also cable TV suppliers are integrating their networks with the Internet.[63] It is technically feasible today to supply every home in NA (currently connected to cable TV), with access to the Internet E-mail network.

However E-mail terminals are paid for or supplied, every home with a phone, TV or computer will be connected to the E-mail system within twenty years. The conventional postal systems will be replaced with an electronic substitute[64] which is being built around the telephone system — the highway in the sky.

Homeward Bound

The construction of highways has had a significant impact on the production, work, consumption, and recreation patterns of North Americans. Today North Americans seem to spend a major portion of their lives in cars and life seems to be centred around the automobile. Most people (at least 85%[65]) commute to work by car, often spending more than 30 minutes driving each way. Suburban shopping malls and cinemas surrounded by acres of paving have become the symbol of our age.

The Church also has been affected by this phenomenon. What church would not include in its advertising a notice of ample parking along with the availability of air conditioning and nursery services? Highways have contributed to the development of large regional commuter churches with vast parking lots and programs for everyone. This in turn has had a destructive impact on the neighbourhood church.

But the age of transportation and the age of the commuter may be nearing their end for a number of reasons. First, the cost of moving goods and people likely will increase as the earth's supply of petroleum declines. Alternate sources of power for automobiles and trucks will become available but probably will be more expensive than gasoline or diesel fuel. Goods locally produced in factories designed for ‘mass customization’, and from regionally available raw materials will be cheaper than goods produced in distant parts of the continent or in foreign countries. It will also become more expensive to move people to and from their places of work or recreation. This may result in a change in people's behaviour and reduce the amount of commuting that they are willing to do.

Second, the increased cost of transportation will be accompanied by the increasing availability, and decreasing relative cost, of powerful new communication devices which will profoundly affect the way people work together.

> The industrial economies are now in the early stages of another transformation that may ultimately be at least as significant [as the industrial revolution].
>
> Changes in the economies of production and transportation drove the revolution of the last century. The revolution underway today will be driven not by changes in production but by changes in coordination. Whenever people work together, they must somehow communicate ...[66]

AT&T, Bellcore, Xerox PARC and other similar organizations have been using permanent video links and video phones in an experimental capacity within some of their offices for a number of years. Reports indicate that the person using this form of communication “senses in his conversation an enhanced feeling of proximity and intimacy with the other party.”[67]

The advanced communications devices which will become available in the next decade will make it even easier for many people to work together from remote locations. The workplace is being transformed by these electronic media. “Engineers quitting for the day pass design problems over time zones much like a baton in an endless relay race; companies call upon researchers separated by

oceans to collaborate on complex projects. Corporate E-mail is breaking down hierarchies by making upper managers more accessible and speeding up the pace of research."[68] Many of the information intensive jobs in the 21st will be performed by people using video phones, E-mail and links to computer networks.

The accessibility of the communications network from office or home, will make it increasingly easier for people to work form their homes and unnecessary for them to commute regularly to a place of work. An example was documented in the business section of the *Toronto Star*.[69] The article describes how Delta Hotels has established automatic telephone routing for some of its reservation agents. These agents are supplied with telephone and computer terminal links and can access the same information as agents working in the central reservation area. This arrangement is especially effective for part-time work as it eliminates the travel requirement. The article states: "Callers don't know they've reached 'Sally' the helpful reservation agent in her kitchen. Neither does the Delta computer on Church St., which distributes the calls to a free agent."[70]

Another example is what IBM has accomplished in Toronto. It was able to cut over $40 million from its annual real-estate costs by providing technology to about 900 of its employees. This technology permits the employees to work from their homes and cars and to visit small regional offices around the metro area only as required.[71]

Third, more than half of the work force in NA is already employed in jobs which involve the production or manipulation of information. This percentage will probably increase as the resource extraction and manufacturing jobs become more automated. As the percentage grows, the use of the communications network will also increase.

These trends — the increasing financial and social cost of commuting; the increasing availability of digital communication links in the home, and the use of E-mail and video phones; and the increasing percentage of the work force involved in information processing — will likely reduce the amount of commuting and change the manner in which people perform their work. They will be 'telecommuting' rather than commuting to work.

Access in the home to the new communication media (e.g., cable shopping networks, America Online, the World Wide Web on the Internet, etc.) will also make it possible for people to do some (or all) of their shopping,[72,73] and much of their schooling and business (such as banking[74] or consulting a lawyer) from their homes. They will even be able to 'see' a doctor from their home or consult with a specialist from a remote clinic. This may be accomplished using the emerging 'virtual reality' technology which will permit a doctor to provide treatment almost as effectively as when being present with the patient.[75]

Shopping at home has been possible for generations. Sears has had its mail and phone order catalogue, magazines have carried thousands of classified ads for products which can be purchased through the mail, and TV has carried advertisements for kitchen products, records, and other consumer goods. Shopping from home is not a new phenomenon. But the nature of this

phenomenon will change over the next twenty five years. In Canada the Home Shopping Network became available across the cable TV network in 1987.[76,77] Over 25,000 products were initially made available on this network. Goods purchased over a toll-free telephone connection were shipped via couriers in their delivery area, and in remote locations by Canada Post (another death blow to the postal system — the postal system was left with the unprofitable deliveries).

In the U.S., the J. C. Penny Co. launched a $40 million pilot project in Chicago (with Cableshare) to provide its Telaction home shopping system to 125,000 homes. J. C. Penny said that, depending on how the system fared in Chicago, it would extend the service to 20 major cities within a year, and to more than 60 centres during the next five years.[78] At the time other companies, including Abercrombie & Fitch, American Airlines, American Express, Kinney Shoe Corp., Marshall Field's and Speigel, all expressed an interest in the use of Telaction.

IBM and Sears also worked together on a computerized information and shopping network called Prodigy. From 1984 through 1988 they invested $400 million in the service and introduced it in 1988 in San Francisco. The service became available nationwide through computer access and through cable TV. Prodigy includes Dow Jones information, *USA Today*, brokerage services and many shopping services, including grocery shopping.[79,80]

With the arrival of the World Wide Web and electronic-commerce, the commercial services such as Telaction and Prodigy are being folded into Web-based service offerings. E-commerce is still somewhat immature due to the complexity of providing secure electronic funds transfer. But with companies such as Microsoft and the major credit card vendors working frantically to provide secure transactions, E-commerce will likely become a major force in the 21st century economy.

When the TV broadcasting and cable TV networks begin supporting HDTV (High Definition TV), home shopping will get another boost. HDTV will give twice the resolution of current TV which will provide bigger (even wall sized) screens, with a sharp image. The products shown on these TV or computer screens will be more clearly defined than on present screens, and for example, it will be possible to see what clothing will look like on an image of yourself.[81] This will improve the visual presentation of goods and make it more likely that consumers will be attracted to make purchases through the network rather than in person.

Another key development which will make home shopping an attractive alternative will be the increasing efficiency of the network to supply competitive information about products. Shopping by browsing around a ‘video mall’ as if you were actually in the store[82] will be augmented by databases of competitive information about products which can be accessed for a fee. In addition there will be more accurate pricing information. A purchaser will be able to make a query and determine which supplier will provide a specified product (e.g., a standard appliance), with a 3 year warranty, delivered to her door. This type of electronic shopping will have a significant economic impact by changing the nature of advertising and marketing, by providing, theoretically, a more efficient market and by shifting the line between retailing and distribution.[83]

"Telecommunications facilities can act as a substitute for much travel, with people able to see each other ... at a great distance."[84] It will be possible to carry out consultations with lawyers, bankers (for example to obtain a house mortgage), financial consultants, counsellors, and other professionals via video phones. Documents, identification, and authorization will all pass over the digital network. The Los Angeles County Courts are moving in this direction already. A system is being used which allows lawyers to file briefs directly from their offices without having to make an appearance in court. Nearly two dozen court systems are using video conferencing for arraignment proceedings and for meetings with lawyers and probation officers.[85]

The next logical step will be to administer a trial via video conferencing, using for example, the VideoWindow developed by Bell Communications Research.[86] Initially this type of system will be used for corporate suits — for example, one dealing with the use of a copyright — for which there is no requirement to have a live jury present. As the capabilities of the communications systems become more sophisticated, face-to-face communication will be replaced by an electronic equivalent: video-to-video communication.

James Martin reported another use of a video phone at Boston's airport. It was not possible to have a doctor at the airport for the occasional emergency. Also it was difficult to get a doctor to the airport quickly because of heavy traffic in the tunnel going to the airport. A nurse on duty at the airport was connected to a downtown hospital via a video link. When it was necessary to consult a doctor, the nurse and patient could be at one end of the link and any doctor on call at the hospital at the other end. The nurse had equipment in the clinic at the airport which she could use to let the doctor hear the heart rate of the patient and obtain a close up view of any part of the body.[87]

This form of telecommuting will, within a decade, permit doctors to perform endoscopic surgery on patients remotely. They will be assisted by 3D cameras manipulated by robot arms.[88] Pathology specialists are now able to perform diagnosis on tissue specimens for remote rural hospitals, the images and diagnostic instructions can be transmitted over standard telephone lines.[89] Doctors at the Hotel-Dieu de Montreal Hospital in Quebec have demonstrated the use of a robot arms to successfully operate on the gall bladders of three patients. Their conclusion is that this technique could be especially useful in rural hospitals where skilled surgeons are not always available.[90]

In remote areas of Canada, telemedicine is being used to provide medical services.[91] Within the next few decades it will be possible for any person in his home to communicate with a doctor, and, where a visit to a clinic is not necessary, to obtain a diagnosis[92] and even a prescription.[93] The prescription could then be ordered over the network from the nearest pharmacy. Doctors already use the telephone for some forms of diagnosis and even for renewing prescriptions. They will quickly adapt to new communication devices which will make it quicker for them to provide services to their patients.

When these new communication and computing devices are in place, they will probably have more impact on society than the other networks, such as highways, TV broadcasting, and the simple telephone network, have had:

> Like the clock, the Net has the potential of being a technology that alters who we are as well as what we do. It will also impact our work habits, organizations, and transportation systems.[94]
>
> With the elimination of distance as a significant communications cost factor, some tantalizing new prospects are opened up for the exploitation of the Electronic Highway concept.[95]
>
> As with any social innovation, such communications-for-travel substitutions raise the possibility of future shock.[96]
>
> [An] internal study of HP's E-mail systems suggest that the "potential for real change caused by a medium which allows widely separated people to aggregate their needs is, in fact, quite frightening."[97]

In short, cities will be transformed as the Information Superhighway develops. We will have to rethink spatial relationships, transportation connections and telecommunication linkages among homes, workplaces and service providers. Housing will have to be reconfigured ... The weakening or disappearance of traditional gathering places will require the creation of different foci for community life ... Offices, hospitals, schools, and shopping centers will fragment and recombine in surprising ways as virtual transactions and telepresence relax traditional requirements of proximity. ... This restructuring will take place on a massive scale.[98]

As people move to the communication network from commuting, there will likely be some impact on "the social and economic landscape."[99] For example these changes may lead to economic decentralization.[100]

What will people do with the extra time made available through the reduction in driving? What will happen to North America's infatuation with the 'freedom' provided by the automobile? Will there be fewer social problems as the tensions caused by commuting on densely packed highways are reduced? How will families cope when parents can work from home and children can 'attend' classes from home? Will marital problems increase or decrease? Will people need sources of face-to-face social interaction or will they be satisfied with social stimulation over the communication network? Will a new rural society emerge, as the cities die, since it will be no longer necessary for people to live in close proximity to carry on most of their daily activities? Or will people move into denser areas to have personal contact with people in recreation since they will have little of this contact in their work, business and shopping?

These are tough questions to answer. It is difficult to predict where technology is taking us. But we can suggest some possible directions and their impact, both bad and good, on the Church.

Mount Ebal

There are numerous distractions for the average North American which have made regular church attendance ‘unnecessary’ or ‘difficult’: Sunday religious TV programs, Sunday televised sports, wide-open Sunday shopping and recreation, weekend visits to the cottage, family events, over-time work, and household chores. The Electronic Highway will add even more distractions.

In addition, people who become accustomed to carrying out many of their transactions on the Electronic Highway may expect to get all of their religion from the same medium. Work at home, shop at home, bank at home — why not ‘attend’ church at home? The Electronic Highway could potentially have a greater impact on the Church than did the advent of the TV evangelists and TV broadcasting of church services, and continue the trend toward the privatization of religion. A Toronto futurist has written that:

> One of the older members of my church once commented that when she was a girl her family's whole social life — and therefore, most of their entertainment — arose from being members of the local church, with the suppers and parties that arose out of such membership. Today television, movies videos and computer games have all given us ways of getting our entertainment out of a box, instead of from the company of people around us.[101]

Beside contributing to the continuing trend toward the privatization of religion, the Electronic Highway will likely also add another destructive force. Our society is showing signs of an electronic narcosis. Isolation, alienation, fear, a negation of responsibility and depression are all symptoms of this narcosis.[102] Many of these can be traced to our electronic wonderland of TV, radio, cassette recorders, video recorders, compact disk players, computer games, and electronic toys. With the widespread introduction of new services on the Electronic Highway we can expect to see this narcosis increase.

Ray Bradbury in his book *Fahrenheit 451* describes a society in which books are banned, and electronic gadgets rule. He published this book in 1953, yet it still gives a good indication of what may be the result of the Electronic Highway on society. One character (Clarisse) says the following:

> “I'm very social indeed. It all depends on what you mean by social, doesn't it? Social to me means talking to you about things like this.” She rattled some chestnuts that had fallen off the tree in the front yard. “Or talking about how strange the world is. Being with people is nice. But I don't think it's social to get a bunch of people together and then not let them talk, do you? An hour of TV class, and hour of basketball or baseball or running, another hour of transcription history or painting pictures ... but you know, we never ask questions, or at least most don't; they just run the answers at you, bing, bing, bing, and us sitting there for four or more hours of film-teacher. That's not social to me at all. It's a lot of funnels and a lot of water poured down the spout and out the bottom, and them telling us it's wine when it's not.”[103]

Will people be content working, carrying out their personal business, taking their education, and

participating in some forms of recreation from home, via the Electronic Highway? Will they be happy using it for much of their communication with the world outside of their homes? Some futurists such as John Naisbett and Alvin Toffler believe that people will not be happy doing this.[104]

One writer has said that "machines may be used as time-savers ... but for most of the population, terminals will never be 'face-savers', the blinkings of a user-friendly screen will never replace a friendly smile."[105] Toffler thinks that the lack of face-to-face contact on the job will rekindle the tradition of strong family life and deep community involvement. He believes that the 'electronic cottage' will "touch off a renaissance among voluntary organizations."[106] And Marshall McLuhan said that "the 'simultaneous field' of electronic information structures, today reconstitutes the conditions and need for dialogue and participation, rather than specialism and private initiative in all levels of social experience."[107]

The services provided by the Electronic Highway will likely become as 'necessary' in the future as is the telephone today and the electronic narcosis will increase. But at the same time people will wish that they could be rid of the whole world of technology. This love/hate relationship will increase the tensions in society.

Toffler thinks that this will bring out the voluntary spirit in society. He may be right. However, current trends indicate that support for voluntary organizations is declining in both financial and time contributions. This decline could probably be traced to a number of causes including increased government provision of social services, a divergence from the biblical ethic and the increasing alienation caused by electronic narcosis.

I do not think that the 'electronic cottage' is going to bring out the voluntary spirit in society. Instead it is going to increase the need for human services which can decrease alienation and fear. "There is plenty of fear. Fear of what might happen if we don't, and fear of what might happen if we do computerize. Love is the only known antidote for fear."[108]

Society will not be able to solve the problems of alienation and fear, with government or other solutions founded by man. True peace and love are ultimately only available through Christ. And it is the voluntary institution established by Christ, the Church, which carries the message of love. "As one of the few remaining personal interactive communities within society, the church has a responsibility and unique opportunity to embody the redemptive love of Christ."[109]

The Church should lead the world in the use of the Electronic Highway as it did the use of the printing press. But it must also plan to balance the cold world of electronics with the warm personal love of the Gospel which touches human hearts. The Church can either succumb to the forces of privatization and narcosis wrought by the Electronic Highway or it can work against these forces and provide antidotes.

The Church must refocus its current efforts into building a strong fellowship of believers that meets together to share the love of Christ with those in their community. Martin Marty has said that "we

have tens of thousands of local congregations, active centres of life for people, in witness and in work ... All of these churches are now too localist; they don't see their neighbours' needs and it's hard to get networks going. ... We need to stimulate our imaginations to see how we can all work together. That's our challenge for the future: to put our imaginations and our efforts into our churches."[110]

Mount Gerizim

Keeping in Touch

"Radio and television have done much to homogenize culture. In England fifty years ago there was a wide variety of regional accents. ... Today the strong accents and provincial vocabulary are largely gone. Nearly everyone speaks with the range of accents used on radio and television."[111] This homogenizing impact of radio and TV extends beyond the ubiquitous voice of the announcer. News of events in the Middle East is watched on TV sets at dinner from Germany to Japan. The whole world sees the same news, and almost as it is happening. Marshall McLuhan made much of this, and coined the phrase 'global village' to encompass this and similar phenomena of the electronic age.

However, this immediate, collective, and simultaneous awareness is limited to editorial content considered to be significant by the major news gathering agencies. News of the local and personal has not had the benefit of access to the electronic network. People living apart from their friends and families in another hemisphere (such as missionaries) or in remote communities (in Northern Canada, for example) are almost as isolated today as they would have been 50 years ago. Communication by air-mail letter still takes days and using the international long-distance telephone system still seems expensive for daily communication.

Marshall McLuhan's global village has in some ways not yet been realized. But this is changing. Access to the world through direct dial on the telephone network is the first step. When we can communicate with anyone, via a video phone, anywhere on earth for little more than it will cost to make a local connection, isolation will be reduced. Those in remote locations will be able to keep informed daily, or more frequently if they choose, of events in their home community. They will not only be able to hear about a nephew taking his first steps; they will also be able to see it. At this point, much of the global village will become a reality.

This extension of computer and communication technology into the realm of personal communication will be a significant benefit for missionaries and for other church workers who are called upon to travel a lot or to be away from home for extended periods.[112,113] They will be able to keep themselves informed and maintain contact almost as easily as they would if they were living in the next subdivision:

> Fast changing technology is having effects around the world — in missions as in many other endeavours. The Interdenominational Foreign Missions Association board has decided that its quarterly bulletin, *IFMA News*, is no longer needed in view of the new means of communication. The association's new executive, Hohn H. Orme, explained, "Communication today in the world of missions is at a level never imagined just a few years ago. Desktop publishing, faxed prayer sheets, electronic mail networks, computers, and modems are common in our agency office."[114]

There could also be potential benefits for the home-bound, such as the elderly. However, here I am not as convinced that the impact of technological changes will be positive. Even today with two or more telephones in every home we don't bother to contact the home-bound with any consistency or degree of care. It is possible that the changes in technology will make them feel more isolated than the most distant missionary feels. A blank video display is more forlorn than a silent bell on a phone.

Beyond the immediate and personal level of communication, the Electronic Highway will be an effective means for improving the institutional level of communication within the Church. In my denomination the members of a Presbytery extending over 1500 kms were able to use rudimentary offerings of the telephone system to hold a conference call for conducting a business meeting. This saved considerable travel expense and time and met with favourable response by most who participated. When video conferencing becomes inexpensive and readily available, meetings such as this will become the norm, where personal face-to-face meetings are not required.

The institutional church will also be able to use the network for keeping members informed. The Southern Baptists were one of the first denominations to establish a computer-communication network. One of their members has stated that "looking back years hence, we'll probably see it was really a baby step into a fledgling technology, but to us now its a gigantic step which we suspect will alter our lives considerably. Not even our boldest visionaries can predict what the impact of this giant step into electronic networking will be."[115]

The Open Road

For years no private individuals in Romania were allowed to own a photocopier; the reason: such devices might have been used for duplication and dissemination of forbidden thoughts. Near the end of his dictatorship, President Nicolae Ceausescu, turned his attention to even the lowly typewriter.[116] The words of the decree which he issued to control typewriters is as follows:

> The renting or lending of a typewriter is forbidden. Every owner of a typewriter must have for it an authorization from the militia, which can be issued only after a request has been made. All private persons who have a typewriter must, in the next few days, seek to be issued with such an authorization.

> Such a request, in writing, must be sent to the municipal militia, or the town or community militia, wherever the applicant happens to reside, and the following details must be supplied: first and second name of applicant; names of his parents; place and date of birth; address; profession; place of work; type and design number of the typewriter; how it was obtained (purchase, gift, inheritance); and for what purpose it is being used.
>
> If the application is granted, the applicant will receive an authorization for the typewriter within 60 days. On a specified date, the owner of the typewriter must report with the machine at the militia office in order to provide an example of his typing. A similar example has to be provided every year, specifically during the first two months of the year, as well as after every repair to the typewriter. If the application is refused, the applicant can lodge an appeal, within 60 days, with his local militia. If the appeal is dismissed, the typewriter must be sold within 10 days (with a bill of sale) or given as a gift, to any person possessing the necessary authorization. Anyone wishing to buy a typewriter must first of all apply for an authorization. Anyone who inherits a typewriter or receives one as a gift must apply for an authorization at once.
>
> Defective typewriters which can no longer be repaired must be sent to a collecting-point for such materials, but only after the typewriter's keys, letters, numbers and signs have been surrendered to the militia.
>
> If the owner of a typewriter should change his address, he must report the new address of the typewriter to the militia within five days.[117]

As has often been said: “truth is stranger than fiction.” If this passage was included in a spy novel, the average reader would think it was only a parody. But this was no novel, and it shows the extent to which a communist dictatorship was willing go to keep its people from publishing.

This same attitude has been reflected by the actions of other dictatorial regimes. A few years ago, an article in *Time* reported that the Soviet Union was allowing some private businesses to operate. But among those enterprises which are still prohibited “is the politically risky business of publishing.”[118] In China “more than 10 million illegally published books” were confiscated and 200 unlicensed publishing houses and more than 40 printing plants were closed.[119] In Saudi Arabia the government Ministry of Information has imposed a ban (and large fine) for the importation of satellite dishes which are used to receive uncensored television programs from outside the country.[120]

The Bible has often been the subject of confiscation. For example, in 303 A.D., Diocletian published an edict declaring that all churches were to be destroyed and all Bibles and liturgical books were to be handed over to the authorities. Wycliffe's and Tyndale's English translations were

confiscated by a jealous Church and King. In this century Communist,* Islamic and other totalitarian dictatorships have tried at different times to stop the selling, distribution and even the reading of the Bible.

Ray Bradbury in his book *Fahrenheit 451* speaks of a society in which books are banned; and since all buildings are made of fire-proof materials, the fire department's role is to burn books. The principal character in the story (Montag a 'fireman') begins to steal books from the burning sites, and becomes attached to books. One of the books he keeps is the Bible:

> Montag showed her [his wife] a book. "This is the Old and New Testament, and ..."
>
> "Don't start that again!"
>
> "It might be the last copy in this part of the world."
>
> "You've got to hand it back tonight, don't you? Captain Beatty *knows* you've got it, doesn't he?"
>
> "I don't think he knows *which* book I stole."[121]

> Mildred's mouth twitched. "See what you're *doing*? You'll ruin us! Who's more important, me or that Bible?" She was beginning to shriek now, sitting there like a wax doll melting in its own heat.[122]

Montag took the Bible to Faber to get it copied before he would give it back to Beatty.

> "It's been a long time. I'm not a religious man. But it's been a long time." Faber turned the pages, stopping here and there to read. "It's as good as I remember. Lord, how they've changed it in our 'parlours' these days. Christ is one of the 'family' now. I often wonder if God recognizes His own son the way we've dressed him up, or is it dressed him down? He's a regular peppermint stick now, all sugar-crystal and saccharine when he isn't making veiled references to certain commercial products that every worshipper *absolutely* needs."[123]

After fleeing from the police Montag comes upon a group which has saved books by memorizing them. He meets Granger who tells him:

> "*We're* book burners, too. We read the books and burnt them, afraid they'd be found. Microfilming didn't pay off; we were always travelling, we didn't want to bury the film and come back later. Always the chance of discovery. Better to keep it in the old heads, where no one can see it or suspect it. We are all bits and pieces of history and literature. ..."[124]

---

* Russia seems to have softened in its view of the Bible. They have permitted the importation and sale of Bibles, the Bible has also been discussed on Soviet TV, and in the Soviet a youth newspaper, where it was said to be a positive source of morals in contrast to atheism, and the Ten Commandments have been introduced in some schools as their moral code.

Granger makes reference to microfilm as a means of preserving books. This has been the media of choice for the long-term preservation of textual information. But with the new technology now available, we can preserve books (particularly the Bible) in digital form on magnetic and optical media. A Toronto-based firm (Optical Recording Corp). has announced the Hi-Lite data card.[125] This card is the same size as a credit card and holds 200 million characters of text. The Bible has just under 3,600,000 characters. Each of these cards could hold 55 copies of the Bible!

However, of more significance than the high density optical storage of digital information is the ease with which copies of the Bible can be made on the digital network. "The Bible, which took Gutenberg five years to set into type, could be transmitted in one half second on one satellite channel."[126] This is one of the most important features of the new technology. If over the next few decades all homes are wired into the comprehensive communication network which I have been describing it will be possible for you to send within seconds a copy of the Bible's text to any other person on the network. He will be able to read the Bible on any display in his home, or on a portable computer.

The ability of the communication network to make many copies of a document and distribute these throughout the world will present many difficult problems for writers and publishers. The concept of a copyright will be practically meaningless when copies of a document can be made in seconds anywhere on earth. This power of computers on the communication network will make the photocopier into the 'quill pen' of the 20th century, and is already creating a legal nightmare,[127,128] The National Writers Union in the U.S. claims that electronic publishers are violating their copyrights and that they are losing tens of millions of dollars.[129] It is clear that it is necessary for writers, publishers and lawmakers to re-think the entire concept of the ownership of information.

Marshall McLuhan notes that the concept of authorship and copyrights was much less important in the manuscript age prior to the invention of the printing press.[130] Possibly the use of the computer for the distribution of text will change the meaning of the ownership of information to something similar to that which was common before the invention of the printing press.*

However, it will be this amazing ability of the communication network to copy and distribute information, which will be of great benefit to the Church. It will be practically impossible for anyone (even the censors in a totalitarian regime) to stop the dissemination of the Bible through this communication network. "Radio, television, telephone, facsimile transmission, and now E-mail are so common worldwide that not even a Powerful Government can control what information its citizens have."[131] The only way that it will be possible to stop the transmission of the Bible's text will be to remove the communication network, as the Romanians tried to do with typewriters.

Monitoring transmissions on the network will probably not work, for the volume of communication will be too great. Also, it will be possible for people sending transmissions to pass the text through

* I discuss the issue of copyrights more fully in chapter 7 – Information Implosion.

encryption algorithms. One such encryption algorithm which has proven to be difficult (though not impossible) to decode uses the multiplication of two very large prime numbers. This encoding device allows the recipient to publish in a public directory his key which is fed into the algorithm by the sender. Other, even more powerful and secure encryption, algorithms have been proposed.[132]

Encryption algorithms could be used to provide security on ring-type networks where anyone can read the data passing by. Banks and corporations passing sensitive information are already using data encryption. Within twenty five years this capability will become available on the electronic mail network used by the average person.[133]

In North America, and the rest of the West, the communication network will be so much an underlying part of the way society functions that it will not be possible to remove the network without destroying the economy, academic institutions, scientific research and even the government itself. This will tend toward the preservation of certain freedoms, the most important of which will be the freedom to communicate the text of the Bible or any other religious material to anyone else on the network. Sadly, this freedom will not guarantee that people will read the Bible, any more than they do today when Bibles can be sold and purchased freely at any bookstore.

In the previously communist countries, the movement to a digital communication network proved to be a means of providing new freedoms. In the Soviet Union there were fewer phones per capita in the early 1970s, than in Fiji[134] and the use of photocopiers and computers was tightly restricted. But the Soviet Union found it difficult to keep up with the West when it restricted telecommunication and computer technology. As a result it had to start making personal computers more available in order to encourage wide-spread familiarity and skill with computers.[135]

> Soviet leaders realized in the mid-1980s that failure to computerize would doom their nation to economic and military decline. Faced with the choice of opening society to modern information technologies or losing their superpower status, Soviet reformers opted for the former.[136]

Also as the Soviet Union moved away from paper based administrative systems (driven by rising costs) toward a paperless and 'cashless' society, it became necessary for it to open up the communication channels.[137]

> [This] reflects the problems faced by many totalitarian countries in their efforts to computerize. Personal computers, in particular, foster individualism, and governments find it difficult to monitor the spread and the uses of the technology. Those governments then face a dilemma: by fostering economic progress through extensive computer use, they run the risk of eroding their totalitarian power.[138]

In 1987, the New York-based *Journal of Commerce* estimated that there were over half a million privately owned computers in Poland.[139] The Solidarity movement used personal computers for communication and preparing printed publications. Once when the Polish government cut

telephone communication lines to prevent news spreading, the Solidarity supporters used the computer communication network of the state bank (Noradowy Bank) to keep information flowing.[140]

The leaders of the Solidarity movement found that using magnetic disks for storage was much better and safer than paper. One leader described a raid situation in which he and others were trying to eat piles of paper as the police arrived.[141] In comparison one small disk storing about 200 pages of text could be rendered unreadable with a magnet or by bending. Disks were also easier to transport and to hide.

In similar fashion the FAX machine played a significant role in the resistance movement around the time of the Tianamen Square incident in Beijing.[142] Direct dial computer-based bulletin boards and the worldwide E-mail network were also instrumental in providing information during the attempted coup in 1991 in Russia. While tanks surrounded the Russian parliament, resisters were able to communicate with the outside world through the Internet E-mail network.[143,144] The electronic network "resists control by governments or any central authority ... it is a force for democratization of governments and social change."[145]

> The world revolution of communication technology has surely played its role here: even totalitarian systems cannot be made completely impervious to radio broadcasts; and an activist with a personal computer, a printer, and a fax machine is a one-man revolutionary movement. In turn, the ubiquity of information has made it impossible for communist leaders to deny the fact that their countries are worse off than their Western and East Asian counterparts.[146]

It may be that computer technology (and specifically the communication network) will be the means that God chooses to use to break down the falsehood of Islam, just as he has been using it to bring about the collapse of Communism. But will he also use computer technology to break down the materialistic hedonism of the West?

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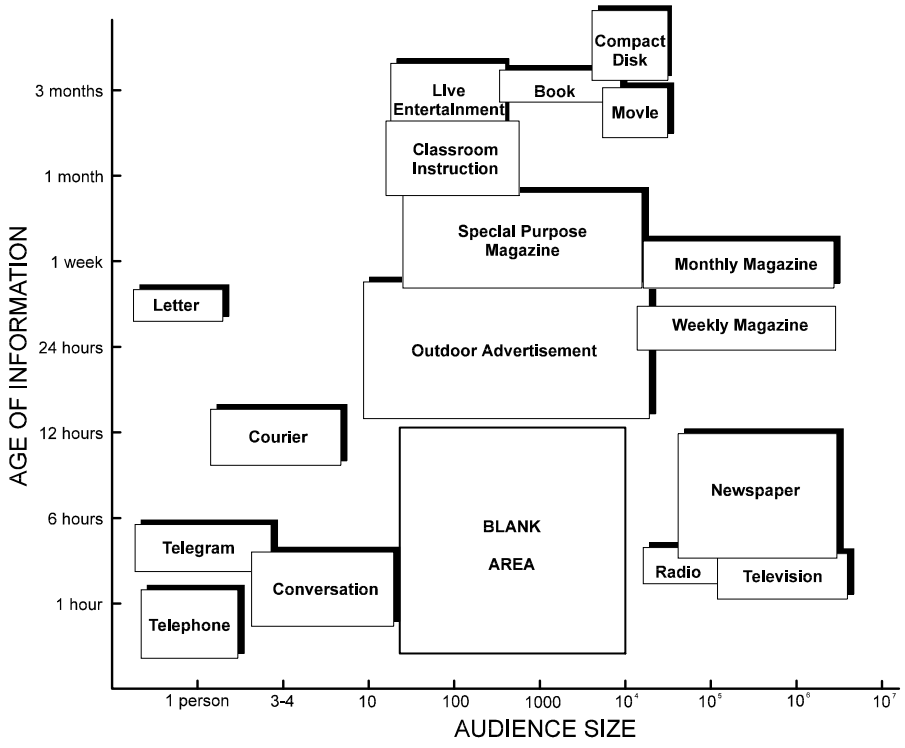
5 — Broadcast or Narrowcast?

Message on Medium

Marshall McLuhan in his book *Understanding Media*, stated: "in a culture like ours, long accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of a shock to be reminded that, in operational and practical fact, the medium is the message."[1] He goes on to explain his famous conclusion: "'the medium is the message' because it is the medium that shapes and controls the scale and form of human association and action."[2] The Electronic Highway as a medium will shape the message as profoundly as any other medium.

The Electronic Highway will continue to carry the media which are common today (telephone, data, radio, and television) but will also support the new media which are beginning to emerge. These media will fill a void in an area which the Ministry of Posts and Telecommunications for Japan has identified (see the blank area in the figure below).[3] This area is the one in which innovations in



communications will have the greatest impact.

In the figure, the vertical axis indicates the length of time between the origination of the information and its reception. The horizontal axis indicates the size of audience the information normally reaches for a given medium. "A blank area clearly emerges for topical information of a moderately

specialized (i.e., small audience) kind; it is into this empty terrain that the new electronic information systems will make their appearance during their pioneering period."[4]

From the Church's perspective, the area in the lower left portion of the figure is the one of most concern to an individual congregation. Communication within a congregation is supported by personal conversation, the telephone, and hand delivery (essentially the same as a courier) of documents such as church bulletins and prayer calendars. Above the blank area, are the published media most commonly used by the Church (books and special purpose magazines). In addition, in this area are other media used by many churches: classroom instruction, CDs (or records and tapes), and movies (or video tapes).

To the right of the blank area are the media which reach large audiences. The Church (for example, as denominations, but only a few individual congregations) currently uses radio and TV and has some large-audience magazines (e.g., *Christianity Today*, which recently went on-line[5]). To a limited extent the Church also uses the newspaper media in the form of congregational advertisements on the religion page.

The blank area represents media which reach limited audiences (100 to 10,000 people) with information which is less than 12 hours old. At present this void is not filled by TV, radio and urban commercial newspapers as they are too expensive to use for reaching audiences of this size. Special purpose magazines and books can be produced by the Church for small audiences at a per unit cost which is not significantly greater than the per unit cost for large audiences. However, it takes longer than 12 hours to prepare a document and distribute it through the mail.

E-mail will be one of the technologies to fill this void. E-mail is generally oriented to smaller audiences and falls within the lower left quadrant of the figure, along with telephone conversation, and personal conversation. But there are two emerging media which will also ride the Electronic Highway and seem to be likely candidates for filling this void. These are electronic publishing and electronic bulletin boards.

These two media will tend to collapse the outer edges of the figure into the blank area. Electronic publishing, which will eventually replace conventional publishing, will allow a person to prepare high quality pages while composing the text. Type-set text produced on one screen will be ready for display on any other viewer's screen within seconds of the last correction. This will collapse the time frame for producing special interest, weekly and monthly magazines. The top and upper-right edges of the figure will be pushed down toward the blank area as the time to produce text is reduced.

The electronic bulletin board along with electronic publishing will provide many of the services such as advertisements, classified ads, and local news, now provided by newspapers. The audience for an electronic bulletin board can be as large or as small as desired, with very little incremental cost for additional members of the audience. This will tend to collapse some of the information currently provided by newspapers into the blank area. In fact it is likely that newspapers will disap-

pear entirely during the time frame under consideration in this book. “Newsprint is doomed, ... within five to 10 years, portable tablet-computers will be displaying electronic text pleasing to the eye.”[6]

Much of the right-hand edge of the figure will also collapse into the blank area with the arrival of the econosis discussed in chapter 7. Radio has already undergone changes since the introduction of TV, and has found a niche as background sound. It is unlikely that its role will change much over the next twenty five years. However, the role of TV will likely change. It will still be called upon for live broadcasting of news and some entertainment, but will be replaced as the source of some forms of entertainment such as movie viewing. Movies will still be viewed on screens in the home (i.e., televisions), but the signal will not be broadcast. Rather, each viewer will select from an information supplier the entertainment he wishes to view at the time he wishes to view it. Some short-term information such as news will also be obtained from database services rather than from TV broadcasting.

The collapse of the right-hand of the figure into the blank area will be very significant. The Electronic Highway will provide for the development of new media which will likely replace some of today's broadcast media — magazines (e.g., Time and Newsweek) and newspapers — and modify significantly television as a broadcast media. This change will result from the introduction of technologies — E-mail, electronic publishing, electronic bulletin boards and database services — which will allow information to be narrowcast[7,8] rather than broadcast. The new technologies are going to transform the role of the old technologies, and also transform society. For as McLuhan said: “the medium is the message.”

Paperless Society

The rising cost of moving correspondence, bills and other communication in the form of paper will be the primary factor in the change to E-mail from postal systems and courier systems. It also will be rising costs which will push our society to paperless communication for other forms of information.

As the cost of distributing and delivering heavy piles of newsprint continues to rise, the operating profit of newspapers will disappear.[9] In the U.S., the circulation of newspapers has declined from 124%[*] of households in 1950, to 63% today.[10] This decline in readership has resulted in some advertisers (e.g., supermarkets and department stores) moving to other means of reaching their audiences such as the door-to-door distribution of flyers. If the cost of a newsprint-based newspaper continues to increase, the additional cost will be reflected in increased costs to both advertisers and readers. This will encourage even more advertisers to seek alternatives to the daily newspaper.[11]

The trend away from a newsprint-based newspaper has already begun. “By early 1981, the Toronto

[*] Many households bought both a morning and an evening paper.

Globe and Mail was using a domestic satellite to send facsimile pages to Vancouver and Montreal."[12] The *Globe and Mail* is Canada's national newspaper and is available across the country in every city early each morning. It is sent out from Toronto in digital form and printed in regional printing plants in remote locations. *USA Today* in similar fashion, is broadcast throughout the U.S., and printed locally. It is only a short step from making a newspaper available electronically in remote printing shops, to making it available to anyone with access to the publisher via a communication link.

In fact the *Globe and Mail* was a pioneer in making the contents of the newspaper available at personal computers. Since November of 1977 the entire text of the *Globe and Mail*, including extensive indexing, has been available on-line trough a service called InfoGlobe. An abbreviated version of the *Globe and Mail* along with a Boston and LA newspaper are available through Pointcast, an electronic newspaper service. However, most people who read the *Globe and Mail* still read it in paper form while eating breakfast, on the train while commuting to work, or at their desks in the office to start the morning.

Newspaper publishers are moving beyond just making available the text portion of their publications. For example the *San Jose Mercury News* is available in full coloured layout (including such things as weather maps, photographs and charts) in electronic form either through direct dial or through CompuServe or America Online. The 'newspaper' can be down-loaded through the Electronic Highway to a PC and viewed off line. For those wanting to craft their own 'newspaper' commercial software called *Journalist* is available. It can be used with CompuServe (for example) to search for, and download, a selection of news articles from many publishers and assemble these into a custom layout for viewing.[13]

The development of electronic publishing is already becoming a reality. There are a number of specialist fields which have moved to paperless forms of information circulation.[14,15] The intelligence community in the United States as early as 1972 was a major user of systems which permitted preparation, indexing, distribution and retrieval of extensive quantities of information.[16] In some scientific research and medical and engineering disciplines, articles are submitted electronically. The articles are sent to reviewers, electronically. Then the editor prepares the accepted articles for publication at his terminal or PC and makes the latest issue of the publication available to all subscribers over an electronic network. Those who need paper copies can always print them when they wish; but from composition to final consumption, it is not necessary to use paper.

The book publishing industry is moving in a similar direction. Most authors today are using word processors to prepare their manuscripts. Accepted manuscripts can now be made available to publishers in digital form. The publishers can edit the text on computers and add typesetting information, and submit the digitized text to the printers. The technology is also available today for delivering this digital text to subscribers.

Of course important questions relating to royalties and copyrights[*] need to be worked out before text in this form will become widely available. And there are also some technical problems at the display end which must first be solved before digital delivery of publications will become the norm.

It is uncomfortable to sit at a computer display (with 24 lines of 80 columns) and read large quantities of uniformly sized text. It is easier to scan the headlines or section headings of a large page and focus in on the items of interest to read in more detail. Also, current computer screens in wide use do not accommodate high resolution graphics or photographic images. This makes it difficult to supplement text with illustrations. These two problems may lead some to ask where is the promised coming of the supposed revolution in textual news dissemination.

One writer with degrees in linguistics and library science has said that "the computer is superfluous"[17] since it does not provide information that the average householder wants and not in the form he wants it. Another writer has said "certainly paper will not vanish. Books are marvels of easy access."[18] I think that these comments are too simplistic and do not show an understanding of how quickly computer technology is changing. The devices for viewing text will improve significantly over the next two decades (as I pointed out previously in the section entitled *Plug Compatible*) and the cost of providing paper copies of text (especially highly time-sensitive text such as that found in newspapers) will increase substantially over the cost of providing text in electronic form. In a few years it will be easier and cheaper to obtain and use an electronic 'newspaper' or 'book' than it is to obtain a paper one today.

In the past few years desktop publishing has become one of the hottest areas of development in the computer industry. The flexibility and functionality of the software available for desktop publishing is astounding.[19] Using software which costs less than $500, a person can typeset a document (such as a newsletter, a policy manual or a full-length book) and print multiple copies for local distribution, or print a camera-ready copy for use in offset printing. I have such capability in my home, and the whole set-up cost less than $5,000 (including computer, software, and a high quality laser printer).

It will soon be possible for any one with a computer to prepare in his home, publications (e.g., a news 'magazine', or a 'book') containing text, coloured graphics and photographs, and accompanying animation and sound effects. He will be able to send these publications to any other person connected into the electronic communication network.

A person wishing to view the material which he sends will begin by using what is referred to as 'greeking'. This expression comes from the commonly used phrase 'its all Greek to me'. Greeking in a desktop publishing system permits a person to view an entire page. The finer details (such as small print) are replaced with a grey shading. This allows the viewer to read only the headlines or section headings of a document. He can then zoom in on the portion of text that he wishes to display in more detail.

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[*] I discuss the issue of copyrights more fully in chapter 7 – Information Implosion.

Other sophisticated methods will be developed for use when viewing publications on a computer display. For example, the headlines could be presented as one level of indexing. The next level could display a short abstract of the text. The next level could provide the text itself. Going to deeper levels could allow access to background documentation (e.g., footnotes), and even to source documents, spoken speeches which were quoted, or sound examples (e.g., music) which were referred to in the text, and video segments. There will be a convergence of interactive computing with the textual news sources feeding newspapers, and the 'live' dimension of television video.[20] This technology is called hypermedia, and is discussed further in chapter 7.

Electronic publishing benefits from the intangible nature of the digital medium which makes it easy to copy and distribute information. The production of the original text is a fixed cost, which is essentially the same regardless of the type of publication. Even excluding the capital cost, it is becoming cheaper to use word processors and desktop publishing systems than typesetting and manual paste-up. And once the equivalent of camera-ready pages is produced, the cost of electronic duplication and distribution is far cheaper than printing and shipping printed documents.

In addition to lower cost, paperless publications have the advantage of reliability. You would not have to wait for a late newspaper or retrieve a soggy one from the front steps, or miss an issue of your favourite magazine because a sorter in the post office decided to place it on his coffee table. Computer communication systems can be set up to guarantee delivery. If the communication network is inoperable, the computer will try again later, and keep trying until the document is successfully transmitted. The computer sending the document will wait for an acknowledgement message from the receiving machine indicating a complete reception before it finally concludes the transmission.

Using techniques such as those being developed today for desktop publishing, and techniques not yet invented or even dreamed of, it will become possible to provide an electronic 'newspaper' which will be easy to view on a display screen about the size of a clipboard. In the morning you will connect the portable display unit to the information network and store in seconds the latest news. You will then view this information on your light-powered portable display unit anywhere you wish to carry it. Within a few years you will be able to function in a paperless society.

The Wittenberg Door

October 31st, 1517 is a milestone in the history of the New Testament Church. On that day Martin Luther nailed his 95 theses to the door of the Castle Church in Wittenberg. However, Luther was doing nothing out of the ordinary, for this was common practice in his day. The cathedral door was the bulletin board of the late Middle Ages. He had little idea that within weeks his theses would be translated and printed in almost every European language, and that from his simple action would arise a wind to sweep clean the Church.

The bulletin boards of the modern era are newspapers, radio and TV, and more recently the World Wide Web. Through advertisements in newspapers or on television, unions, concerned citizens groups, political parties, and special interest groups are able to present their position for consideration. However these two media are 'broadcast' media and as such are generally expensive to use. They reach a large and diverse audience causing the impact of 'posted' items to be diluted. This makes it difficult to bring together the parties which are affected by the advertisement. In addition, it is usually not possible through these media to carry on a meaningful debate on the issues presented.

In a few years we will see the wide-spread use of a public bulletin board technology, built around the Web, which will provide both a means of narrow-casting a message and a means for fostering debate. This technology is already being introduced in E-mail systems, in some of the information utilities, and occasionally as stand-alone services which can be accessed for the purpose of query and discussion.

Community Memory in San Francisco was apparently the first computerized bulletin board, It appeared in the early 1970s as the product of a non-profit organization. Terminals connected to the bulletin board were installed in the public library and in a health food store near the Berkeley campus. There are now over 50,000 publicly accessible computerized bulletin boards in North America (up from 10,000 in 1987[21]) and 92,000 worldwide.[22] They are the trendy communication medium for the 1990s.[23] The largest of these is the Usenet which has about 2 million readers.[24] Most of the computerized bulletin boards today are implemented on commercial services such as America Online, or on the Internet.

A computerized bulletin board has a number of advantages over bulletin boards in any other medium.

- The posting cost for an audience of 10 million is no more than for an audience of one, this makes the medium accessible and inexpensive.[25]

- Communities sharing common goals can be formed around reciprocal special interest forums on the bulletin board. This is not possible with one-way media such as magazines (except to a limited extent through the letters to the editor).[26]

- It is an excellent medium for perishable information (e.g., announcements of meetings, or the availability of unsold tickets)[27] yet it allows for the recall of information as often as desired (as opposed to radio or TV).

- It allows responses to be posted and made available to all viewers, thus encouraging debate on an issue.

- Debate can be carried out on the electronic network with alternate opinions and ideas being posted as additions to the original posting. Usage is not restricted, anyone may post items on the

bulletin board.

- Forceful personalities who dominate live brainstorming sessions, lose their ‘pulpits’ when the discussions go electronic. This lets the participants focus on the ideas rather than on the people generating the ideas.[28]

- Messages can be selected based on profiles used to classify material posted on the bulletin board. This allows participants to review only items which are of potential interest to them.

There are however some serious problems with electronic bulletin boards. One of the major problems is the ease with which a computerized bulletin board can be abused. For example, the police officer responsible for the Metropolitan Toronto Police's public bulletin board indicated that he was aware of solicitation by male and female prostitutes ‘advertising’ in some computerized bulletin board systems.[29] Also, controlling junk mail is a problem in E-mail and computerized bulletin board systems. The cost of general broadcasting, or of posting for general retrieval, is very low when compared with the cost of postage, and it is tempting for an advertiser to ‘hit’ everyone rather than only those whose profiles he would normally select.

Personalized filters will be introduced in E-mail and computerized bulletin boards to help control the large number of items mailed and posted.[30] A filter will allow readers to peruse only items which have a profile consistent with a predefined set of attributes. These attributes can be ones coded into the ‘envelope’ of the item posted in the bulletin board, or they can be key words in the text. The attributes and key words will cause items to be included in (or excluded from) a selection.

It will take time for the electronic bulletin board to become widely accepted. However, it will become as common as TV is today. Within a decade it will have become a social ‘necessity’.

Mount Ebal

The introduction of E-mail, electronic publishing, and electronic bulletin boards will introduce a new era of inexpensive communication with audiences of any size and composition. For example, the cost of posting a full-page document on an electronic bulletin board for an audience of one million recipients will be less than today's cost for a small classified ad in a metropolitan newspaper. Similarly, the cost of mailing one million items via the electronic network will be less than one-tenth of the cost of sending the same number of items by the current postal system. This will be both a curse and a blessing for the Church.

Using this inexpensive medium, any special interest group, cult or religion will have access to bulletin boards for posting, or to the electronic mailbox of everyone on the network. When the power of the Electronic Highway is ‘discovered’, great confusion will arise from the mass of information that will be published, posted, and mailed.

It is also possible that the government will attempt to regulate the content of information flowing on the Electronic Highway. If they do, it is likely that religious publishing, advertising, posting or mailing will be restricted. However, as discussed in the previous chapter, controlling the message content on the electronic network is going to be very difficult. It will be more difficult than controlling what people carry in their cars on the highways of North America.

Instead of government control, people will purchase or develop filters[31] for controlling the information they receive. Some of the filters that will be developed will include:

- Lists of information sources from which information will be accepted. If the source does not appear in the list the filter will not select the information from the knowledge base, view the posting, or accept the mail. This will be equivalent to having an unlisted telephone number but will work in reverse.

- Key words which will trigger rejection or acceptance of text.[32] The text of a document could be scanned by 'intelligent' software and rejected. For example, a person not wishing to view Christian material of any kind could reject any document with combinations of these words *Bible*, *Christ*, *Jesus* and *salvation*, unless the source of the document was already in a list for immediate acceptance.

- Abstract viewing. Documents on the Electronic Highway will usually have a short one- or two-line abstract. It will be possible to read items which pass filtering in abstract mode first, before they are either rejected or read in detail.

Narrow-casting and filtering will bring about the complete 'privatization of information'.[33] This will compound further trends already at work in our society. The quest for privacy has become a major feature of late 20th century North American society. The private automobile is a standard feature of almost every home, rich or poor. Nuclear families often replace extended families. Entertainment is private with video-cassette players replacing movie going, personal TVs replacing family viewing, and personal portable stereos replacing the kitchen radio. Religion also is becoming a private matter, which is expected not to be displayed in public.

Privatization of information will increase the isolation of individuals and families, making their need for the love of Christ more immediate, but at the same time it will make the public presentation of the Gospel more difficult. This may finally bring the Church to the realization that the most effective method of reaching the hordes of spiritually lost is through what some have termed 'friendship evangelism'. The Church must reach out personally in friendship and love to a society suffocating in its self-created solitary confinement.

Mount Gerizim

"A man is known by the company he keeps." This old quip can be rephrased for the 20th century as: "A man is known by the books he has authored." It seems that the more books a person has written the more he is viewed with respect and as an authority. This respect of men for their publication list certainly affects the secular academic institutions where there appears to be much pressure to publish. Sadly, the Church also plays the same game.

However, the nature of publishing is going to change. It will soon be possible for almost anyone to compose a document at a PC and format this in a highly professional manner. Desk top publishing systems (such as Ventura and Aldus Page Maker) are able to drive professional quality laser printers (at densities of up to 1000 dots per inch). The output from these systems is indistinguishable from that produced by the largest publishing house.

When software such as this becomes common and available to the average person, it will be possible for anyone to publish a document such as an article, essay, brochure, pamphlet, or book. Once a writer has prepared the text of his document he will have access to the same network for distribution as will be available to the commercial publishing houses. In fact, it will be difficult to distinguish between high quality documents published by an individual and those published by a commercial publisher. The ease with which documents will be distributed, copied electronically, and viewed on large high resolution screens will make printing unnecessary.

In addition, the cost of printed copies will be far higher than the cost of electronic copies. Furthermore it will be practically impossible to prevent copying of documents. Today the cost to photocopy an entire book is probably about the same as the cost to purchase the book. To a certain extent this limits the amount of illegal copying of books. However with music, videos, and computer software, copying is almost always cheaper than purchasing the published original. Copying in these areas has almost become a matter of course, although in many cases it is still illegal. Private copying of electronic documents will fall into the same class.

Electronic publishing is going to put low-price and open-access pressure on commercial publishing houses and necessitate the re-definition of the legality of copying. Initially there will be institutional resistance to this new form of communication. But as individuals begin to publish on the network the concept of publishing will dramatically change. I believe that new forms of publishing will be a benefit to the Church for the following reasons:

- It will be easier than it is today for people to prepare and distribute information within the Christian community, and within the wider population. It is possible that the publisher as a middle-man will be eliminated entirely. However, publishers may still have a role to play as editors and as bodies putting their stamp of authority on a publication.

- The editorial control of the publishers will be diminished. This will mean that publishing houses will lose some (if not all) of their control over the types of material which are put on the market. This will be a good counter measure in an industry that is dominated by theological liberalism and in love with depthless pulp.

- The commercial nature of writing and publishing will change. It is probably going to be very difficult for an author to make a living from his writing, since it may be impossible to control the copying of documents and therefore impossible to guarantee the payment of royalties to an author and costs to a publisher. This may mean that those who write will be more likely to write because they believe that they have something to say, and less because they expect to gain financially. This will take us back to the early days of the printing press where "the creative writer, the man of ideas and inspiration, wrote his books because he wished to express himself and not to make money."[34]

- It will be considerably cheaper to publish. About the only significant cost will be time. The actual preparation and distribution of a document will be inconsequential. This will make it possible to proclaim biblical truths on even the most limited budget. There will be nothing to stop a local congregation from publishing a neighbourhood newsletter except a lack of motivation.

- Since anyone will be able to publish, there will be a reduction in the amount of awe that seems to accompany those who have successfully published a book. This will not diminish the importance of good communication and substance in content. Those with important messages for the Church will still be recommended on the network and heard.

A while ago I looked over some material published by the Jehovah's Witnesses. In looking at this material I was amazed on two counts. First, I was amazed at how carefully they disguised their false doctrines. Second, I was amazed at the professional nature of the writing and presentation of the material. This is a marked change over the poor quality of a few years ago. This presents a problem for the Church, since:

> Too many people seem to believe that if it is in print it must be true, and it must be every bit as important and urgent as claimed by the author.
>
> The false cults certainly know the power of print. Unfortunately, among evangelicals, many erroneous interpretations of Scripture and unbiblical programs have gained the support of sincere but mistaken people. Because print comes across with such an air of finality, unbiblical ideas have become national institutions.[35]

But at the same time there is now a great opportunity for the Church. In the past many congregations and denominations holding consistently to biblical truth have had no hope of publishing material with the professional appearance and quality that some of the cults have been able to achieve. The cost would have bankrupted them very quickly. But the Electronic Highway will act as a great equalizer. The cost of using the Electronic Highway, electronic publishing and public bulletin boards will be within financial reach of almost any congregation or arm of the true Church. Satan will hate this. For money alone will not be able to buy a hearing. The truth will be available as readily as falsehood. It also will be packaged as professionally. For those who bother to

look into religion, the distinguishing attribute between truth and falsehood will not be superficial. Both messages will be on the same medium. By their works they will be judged, and the truth of the Gospel will stand.

Will the Electronic Highway be used for evangelism? Using it for bulk mailing will probably not be effective, as people will soon learn to filter out 'junk' mail when it is not of interest to them. But there may be ways in which the Electronic Highway will be used to spread the Gospel. For example, "in one project testing the field of electronic communication for church use, the Lutheran Church in America supplies a weekly electronic newsletter to The Source, a computer communication data base"[36] accessed by the public.

But as a tool for evangelism, the greatest difficulty in using the Electronic Highway will be the problem of attracting strangers. The challenge which will face the Church is how to provide an information service which will be of interest to the average non-Christian and will also give an opportunity for directing the user to spiritual questions and answers.

For example, in Toronto a Baptist pastor started an 'evangelical electronic bulletin board system' called Bible Talk. The system allowed users to submit questions for discussion and answers. The pastor answered some of the questions and called on others on the network to assist with the preparation of answers. He said that the service gave young people the chance to ask questions in an environment which they found non-threatening. In addition, the text of the Bible was available. There was also a section with information to help young people deal with drug abuse, a section for announcing upcoming church activities, a section for placing prayer requests, a number of games, and an area for private and public correspondence.[37] The same ideas can be implemented easily today on the Word Wide Web.

"Communication takes place only between persons within a common context; in this context they may share a common aim, a common problem, a common curiosity, a common interest. In other words they must share a community of interest."[38] Within a church denomination a bulletin board service provides an effective means for members to keep in touch, particularly in large congregations or at the regional or national levels. Examples of broader-based Christian services include the Christian Community Network (http://www.christcom.net), Seed Sowers (http://www.saved.com), and Gospel Communication Network (http://www.gospelcom.net) which includes over forty organizations such as Inter Varsity, the International Bible Society and the Navigators. This form of networking works well because the members share a community of interest.

For the Church, the Electronic Highway will likely be of primary benefit as a communication medium for those already within its scope. Reaching the unchurched on the Electronic Highway will probably be more difficult than reaching them through radio and TV. However, I wait to be surprised. Creative individuals working by the grace of God may bring this invention of men into the service of God, for the salvation of souls.

Notes

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6 — A Twenty-First Century Pentecost

Tongues of Babel

Have you heard a computer 'speak'? Probably, you have heard the telephone information service respond to your request for a number with a synthesized voice which reads out the number. Or you may have heard your bank balance read by a computer or heard appliances, clocks, and children's toys and games 'speak' to you with a robotic voice. Most of these applications are simple uses of a powerful tool — a computer which can speak. Within a few years business and domestic applications of this tool will become more and more common and complex, as the software which produces a voice matures.

A number of companies have developed products for voice synthesizing. These products vary in their range of ability. Sophisticated examples include the MITTalk system[1] which first became available for licensing by industry in 1979, Text to Speech (TTS), a product of a Swedish firm (Infovox AB of Stockholm),[2] Bellcore's ORATOR,[3] and a product called The Reading Edge from Kurzweil Applied Intelligence.[4] A less sophisticated product is TextAssist from Creative Technologies which came bundled with SoundBlaster cards. These products take typed text as input and convert it into spoken words. This type of software has a number of current applications. For example, when customers of a bank "want to get information about their accounts, all they need nowadays is a push-button telephone. They dial the bank's computer and are answered by a synthesized voice system that asks for their ID numbers and what options they require. By using the phone buttons, they can get synthesized voice answers to most questions about their financial status."[5]

Speech synthesizing systems like these will also be used to provide information about airline schedules, the weather, and stock quotations. It will be possible to have the text of E-mail messages read to you over the telephone or on a personal computer or to have the contents of a newspaper article read out. "Infovox believes that since speech is the most natural form of communication, it will become a highly popular method of interaction between people and machines."[6] IBM has developed a 'human-centred' system for its line of PowerPCs which interacts "with the users through 'conversational surrogates' — computer generated faces whose eyes and facial muscles move as they speak."[7]

Ears of Tin

A second related technology is voice recognition. "A revolution in office automation is just around the corner with the perfection of voice recognition technology."[8] Desktop computers can now be directed by voice commands. Commercial voice recognition systems, available today, have limited vocabularies (of a few thousand words) and have difficulty accepting input at normal conversational speeds. But this software is being continually improved, and within a few years software on

personal computers will be sophisticated enough to allow a person to speak at a normal rate to give commands or dictate text.[9] Some see this as an extension of our normal way of communicating,[10] while others believe that natural language interaction with machines will be too clumsy and slow.[11] I believe that voice communication with machines will eventually become as common as leaving messages on an answering machine is today.

At present, commercial voice recognition systems are being used for such things as data entry at meat auctions, routing baggage at airports, entering medical reports in hospital emergency rooms, selecting options from the telephone company, and entering inspection results on assembly lines for printed circuit boards.[12,13,14] In applications where a person's hands are in use, voice commands to direct a machine provide the equivalent of a third hand and increase safety and productivity. These systems generally recognize a limited vocabulary, only isolated words or deliberate speech where words are enunciated carefully with gaps between the words, and only after they have been trained to the operator's voice.

In the computer laboratories are prototype systems which may eventually recognize continuous speech found in a normal conversation in almost any ambient environment.[15] These will support a large vocabulary (100,000+ words) and cross a range of accents. This form of speech recognition will take some time to develop for general commercial use, for the following reasons:

- The approximately 40 phonemes (sound units) used in English may be combined in many ways, and the pauses in spoken English often do not occur between words. Instead two phonemes, one from the end of one word and the other from the beginning of a second word, can be joined together with the pause being before or after the joined pair (coarticulation) and can occur in phrases such as *gas station* or *this ship*. This makes it difficult for a computer to map the sound onto models and to distinguish words.[16]

- Certain words are rarely enunciated when we speak, for example, *a*, *and*, and *the*. Also, we tend to slur some words together and a person listening supplies the missing letters. This can be shown by placing noise over one letter on an audio tape. The listener will report hearing both the sound of the letter and the noise.

- Homonyms (such as: *to*, *too*, and *two*, or *four*, *for* and *fore*) are difficult to decipher, and the software has to have a set of built-in contextual rules for establishing which word was used.

- Computers do not yet have the advanced capability to add contextual information to what they are ‘hearing’.

- It is difficult for a computer to pick out the sound of the voice of the person addressing it from the voices of others nearby and the general noise in the environment.

However, these problems are being addressed in commercial research labs such as at Bell Northern Research[17] and in the universities.[18] Commercial products with increasingly powerful generalized

voice recognition systems are continually appearing from companies such as IBM,[19] Apple,[20,21] Toshiba,[22] Siemens[23] and other, smaller, companies.[24,25,26] Research work in Artificial Intelligence "suggests the possibility that someday language-understanding systems ... will be able to learn to parse new types of sentences, continually expanding their own grammars to encompass more and more of natural English."[27]

Within the next decade the voice-operated computer which can take dictation will become common.[28,29,30] The hardware and software for voice recognition is under development at such places as Microsoft, IBM, and MIT's Brain and Cognitive Science Lab. Initially the talkwriters (such as IBM's Personal Dictation System,[31] or Dragon System's Dragon Dictate[32]) will have to be trained by the operator. A list of words and phrases will be read to the computer a number of times at various speeds. From this, the computer will build models of the user's speech patterns. Eventually generic voice recognition by computer may become a reality. The nearness of this reality can already be experienced with VoiceType which is bundled with OS/2 Warp. This software has generic voice recognition capabilities within a limited domain.[33]

When talkwriters become widely available, a person will be able to communicate with the talkwriter at about 150 to 180 words per minute. This is about twice the speed an experienced secretary can type, and considerably faster than the average manager can type. This will change the nature of preparing text in offices:

> The early technology used a typist ... because it was klutzy ... today we have scribes called typists. But as soon as the new technology makes it easier to capture the message, to correct it, store it, retrieve it, send it, and copy it, we will do all those things for ourselves — just like writing and talking. Once the klutz-factor is eliminated we don't need the typist.[34]

> Dictationists will be relics of the past in the office of the future. By the year 2000, there will be no stenographers' pool. In place of the steno pool will be computerized voice machines into which office personnel will dictate their letters. When they're finished dictating, they'll push a button that instructs the machine to type the letter. ... As it's typing, the machine talks the letter through to the person who dictated it.[35]

The talkwriter is but the first step towards a new medium for communication. Initially, the text of a letter (or any document) which has been entered on a voice decoding machine will be printed. But once the information is in digital form, there will be little reason for printing it on paper. With the development of convenient display devices, it will be easier and cheaper to display the text on an electronic screen. But this will be only the second step.

The third step, which will introduce a totally new medium, will be the elimination of the display of text. "In the future, working with computers will be more like working with people. The machines will understand and respond to human speech — even recognize the person addressing them."[36] It will no longer be necessary for a person to display the text of a letter or other document. Instead the

recipient will ask the computer to read the text to him (at any speed). It will not be necessary to hear the text at the same speed at which it was spoken.

I have a variable speed tape recorder which allows me to record at normal spoken speed but to play back at up to twice the speed. It electronically removes pauses and other small slices from the voice, but leaves the pitch unchanged. It only takes a few minutes to get used to a person speaking at twice normal speed, by slowly increasing the speed of the speaker. I used this tape recorder during some of my course work to allow me to reduce the time (by half) it took to listen to taped lectures. The retention rate of information is higher since concentration is more acute and the mind does not have time to wander as when listening to a speaker at a normal rate.

The computer will be able to read out information at any requested speed. If it reads it out at twice normal spoken speed, you will hear it at about 300 words per minute. This is the speed at which a good visual reader is able to read text. Listening to a computer read text will not take any longer than visual reading and may result in improved comprehension on the part of the person listening.

The talkwriter and its replacement, the fully conversational computer, will first appear in commercial office environments. But the use of the conversational computer will quickly move into all areas of life, including the home. A person wishing to communicate with another person will be able to use this new medium instead of, or **with**, E-mail and the telephone. This will be similar to sending a cassette tape by mail but cheaper. It will be as simple to use as a telephone.

In this medium you will be able to dictate a message on your personal computer in your office or home and direct the computer to send the message to an associate. Within seconds the message will be waiting in his electronic mailbox. He will be able to display the message if he wishes (even though you spoke it) or will be able to hear it spoken (through a built-in speaker, or headphones) with an exact replication of your voice. If he has a sense of humour he may change the gender and accent of the voice and hear you talking with a German or Japanese accent.

The development of the conversational computer will require us to change the way we view personal communication. “Once we use electronics we should ask, what is the best form for a message? Does it need to be written at all? Once we are able to have messages delivered almost instantaneously, the way we utilize them changes completely.”[37] The impact of this new medium is going to be significant.

Simultaneous Translation

Another advance in computer technology which utilizes both voice synthesization and voice recognition, is simultaneous translation by computer.

Automated translation by computer has been the subject of much research for as long as there have been computers. Early work was quite optimistic.[38] For example, Marshall McLuhan said in 1964

that "today computers hold out the promise of a means of instantaneous translation of any code or language into any other code or language. The computer, in short, promises by technology a Pentecostal condition of universal understanding and unity."[39]

However, it was soon realized that generalized language translation is very difficult. Translation from one language to another cannot be done simply by looking up words in a translation table (dictionary), or even by adding knowledge about the grammatical rules of both languages. In the same year that McLuhan made his prediction it was noted:

> Work in mechanical translation has come up against a semantic barrier. ... We have come face to face with the realization that we will only have adequate mechanical translation when the machine can 'understand' what it is translating and this will be a very difficult task indeed. ... 'Understand' is just what I mean. ... Some of us are stepping forward undaunted.[40]

Automated translation fails where general information about the world is needed in order to make a meaningful translation. Human translators work within this context (almost without realizing it) and can move ideas as well as words and phrases from one language to another. Computers do not have this context within which to work, and it is difficult (I believe impossible) to provide them with this context to make generalized language translation a reality.

The problem can be illustrated by reference to language constructs such as idioms, similes, metaphors and other figures of speech. For example, in Old Testament Hebrew the expression 'son of eighty years and six years' (Gen 16.16) is translated into English as 'eighty-six years old'. In New Testament Greek the expression 'on the it' or 'in the presence of the self' (e.g., in Acts 2.1) is translated into English as 'together'. A classic example used by those who are writing about automated translation by computer is the expression 'time flies like an arrow'. How is the computer to interpret this? Is it to get a stop watch and time a bunch of flies like it would a flying arrow? Or is it being told that a type of creature, a 'Time Fly', likes an arrow (to eat)? Or is it being offered a statement about the speed with which time passes? Another example can be illustrated by the word *round* which can be used as a verb (round up cattle), noun (first round), adjective (round table) or preposition (round the world).

Even though it will be difficult (impossible?) to develop programs and databases for computers which will make generalized translation possible, specialized translation within known contexts will become possible.[41,42] At present, translation systems are applied well in highly specialized environments. For example, "a Canadian system called METEO successfully translates English meteorological bulletins into French. This is possible because such bulletins are written in a very simple consistent language. It is only occasionally that the machine translations need any correction."[43]

Xerox is using computers to translate manuals from English into other languages. The manuals have a restricted grammar, and about 80 percent of the translation is acceptable, and the rest can be

corrected by human translators in much less time than it would take to translate the entire manual.[44]

Other translation systems are being developed and utilized in various contexts. In 1989 the European Community was undertaking a large ($30+ million, and 80 researchers) project called Eurotra to develop a technology to provide machine translations from one European language into any one of the others.[45] This project has evolved into Systran "which today converts hundreds of thousands [of documents] a year, although the quality is still rough."[46] In Japan at Toshiba and NEC, similar work is underway.[47]

There are a number of vendors in North America selling translation systems including Microtac Software and Globalink Translation System. These companies have products for translating among languages such as English, German, French, Spanish, Russian and Italian. The basic software is available for the IBM Personal Computer and costs around $100. Apple has a similar product for its Macintosh line of computers which will work with 31 different languages.[48]

Some of these personal computer-based products display the text of the two languages in parallel columns and provide text processing features or work with standard word processing packages such as WordPerfect, and permit the human translator to operate with the text to improve machine translation. Other software products work as voice translators and not only translate text, but recognize the user's spoken words and translate these into a foreign language.[49,50] At Carnegie Mellon University a speech-to-speech translation system has been demonstrated and has won for the person conducting the research an award at an international artificial intelligence conference.[51,52]

The existing automated translation systems indicate that translation will work best in situations where the context (world model) is limited. This will be the case when conversational computers become available. They will have built-in personal-characteristics modules to retain the voice templates of the individuals talking with them. But these modules will be able to do more than just recognize voice patterns in order to abstract words. To abstract words correctly, they will be programmed to learn new words, idioms and phrases used by the individuals speaking with them. These will be recorded in their databases. When the machine does not recognize a string of sounds, it will ask the speaker to repeat them and to provide an explanation of the meaning.

Over a period of extended use each person's computer database will come to contain almost the entire spoken vocabulary and collection of sub-sentence units he uses for communicating with the computer and with other people. This will be a major step along the path to automated translation.

Additional research will be done in defining the syntactic rules for source and destination languages. Noam Chomsky set the direction for this area of study in his work *Syntactic Structures*.[53] The practical outworking of the theoretical work is beginning to appear. Products such as Grammatik from Reference Software and Rightwriter from RightSoft have a significant knowledge of the English language and will alert an author of grammar and punctuation mistakes, and possible style (e.g., extensive use of the passive voice) and syntax errors. They also will point out misused,

archaic, trite, awkward and pretentious phrases, and the use of jargon and trademarks.[54,55]

Shortly many other products like Grammatik will become available. But these will be only the first generation. Within the next few decades amazing products will be introduced which will have a detailed 'knowledge' of language structure, and will be able to 'learn' as they interact with humans.[56] Accurate automated translation will become a reality when the computer 'knows' the complete context of an individual's spoken and written language and has a set of precise syntactic rules about a number of languages.

The very powerful computers and software which will be available in the next few years will make possible the automated 'instantaneous' translation which Marshall McLuhan predicted in 1964. You will be able to speak to your conversational computer, and the person with whom you are speaking will be able to hear you in his own language.[57]

Wizards and Drones

"New technology results in unemployment. This is arguably untrue over the long run, but there is little disagreement that workers who have certain skills are made obsolete at the time when new technologies displace older ones and manufacturing processes change."[58] The introduction of the conversational computer will make obsolete many jobs such as those filled by typists, typesetters, and order-entry clerks.[59] Some already live in dread of the day when they will be "replaced by a computer."[60]

The problem of job displacement because of technological change is not new. It has been a problem from the days when copyists were put out of business by the printing press. Since then there have been major shifts in the employment base of western economies, such as those caused by the Enclosure movement, the industrial revolution of the 18th century, the invention of automobiles and tractors to replace horse-drawn conveyances, the rural-to-urban migrations which continued in the West until after the Second World War, and the movement from an economy based on resource extraction and manufacturing, to one based on services.

Since the Second World War, government cushions such as unemployment insurance, retraining, and relocation programs have been applied as attempts to help displaced workers. But the greatest single factor in the provision of new jobs has been the dramatic increase in the size of the economy. The employment base has increased to absorb a large working force of women and the baby-boom population, along with those displaced from their jobs because of changing technology.

The Church has not been a strong player in dealing with the problems of unemployment and job displacement. In fact it has given over to the government some of the functions which the Bible prescribes as within the jurisdiction of Deacons. I do not think that the Church's role in the economy will change much over the next twenty five years. The government's power to interfere in the areas of job creation and economic programs is too great, and the Church too weak to have much say in

these matters. But the Church may have a role in helping those displaced by the new technologies, the Church will need to work at the local congregation level and re-establish its mission as a loving and caring community. It must assist those within its bounds (and where possible, beyond) who are displaced by the introduction of new technologies.

It is difficult to predict how our society will be structured after the introduction of the conversational computer. Its introduction could have a dramatic impact on the employment base of the West, and there may be mass job displacement.[61] The Church should watch carefully as this new technology is introduced. If trends indicate that significant changes are beginning to occur, then the Church should begin to deal with the problems which will result from widespread unemployment, frustration and fear.

At least some job displacement will be an immediate and direct impact of the introduction of the conversational computer. But a more subtle, yet probably more significant impact, will be in the area of literacy.

Illiteracy is a popular topic of concern of governments,[62] social scientists,[63] educators[64,65] and critics of public education.[66] It has become a 'media event' like cocaine, AIDS, and the urban homeless have been. The *Toronto Star* ran a major series on the topic. One of the headlines read "Illiteracy in Canada an 'Astonishing' 24%." Another read "Illiteracy No. 1 Problem."[67] An article a few years later on the same topic was headlined: "Teaching Reading: Are our Schools Failing the Test."[68] The situation is apparently similar in the U.S.[69] and in Great Britain.

There is a similar concern over the decline in standard test scores.[70] The decline in test scores and the apparently increasing degree of illiteracy are both attributed to an increased amount of TV watching.[71,72] Marshall McLuhan stated that "the culturally disadvantaged child is the TV child. For TV has provided a new environment of low visual orientation and high involvement that makes accommodation to our older educational establishment quite difficult."[73]

Children in North America watch as much as 10,000 hours of TV by the age of 16. Adults watch on average three hours a day.[74] This time is not spent on reading. But, even so, only a portion of this time would be spent on reading, even if there were no TV. If there has been a decline in literacy, how much TV has contributed to this, and how much illiteracy there actually is,[*] are difficult questions to answer. Regardless, illiteracy is a problem in the current economic system.

The concern about illiteracy arises from two sources. It is believed that informed decision making

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[*] *Scientific American* reported in 1979 on an article by John R. Bormuth in *Visible Language*. Bormuth"argues that there is no good evidence that the level of reading and writing skills is lower than it used to be and is declining, and that on the contrary a large and growing proportion of the population have attained a high level of literacy and the volume and economic value of written communication have been increasing." ("Science and the Citizen: The Literate U.S.," *Scientific American*, March, 1979.) Bormuth's arguments seem to be based on second-hand evidence (such as the increased number of library circulations) rather than on direct evidence, such as surveys. Nevertheless, the number of illiterates in North American society may not have increased as dramatically as the newspaper and magazine headlines claim.

in our western democracies relies on information gained through reading, and almost all jobs in our information-based society require the ability to read.[75] The latter seems to be of more immediate concern, since:

> [C]hanges in the job market have been reducing opportunities for persons who have difficulty reading and writing. An automobile industry task force found that 80 percent of production operations are expected to involve computers by 1990. The impact upon illiterate workers will be tremendous.[76]

> Today millions of people are excluded from the job market because they are functionally illiterate. Even the simplest jobs demand people capable of reading forms, on-off buttons, paychecks, job instructions, and the like.[77]

"Literacy skills affect seemingly simple daily matters as well as complex learning and study, and thereby have tremendous influence on a person's life."[78] A level of literacy below what is termed 'functional literacy' makes it difficult for a person to read road signs and maps, use a telephone book, read grocery ads, in-store signs and labels on food, complete application and taxation forms, take the written test for a driver's licence, and perform various job-related duties. "Reading and computation skills are fundamental, and print is not replaceable. Only the literate person can meet the demands of a highly organized, complex, and changing society. The gap between the ideal of a literate society and the reality is great."[79] As Alvin Toffler says in *The Third Wave*: "in Second Wave societies ... illiterates were economically doomed."[80]

Notice, however, that Toffler uses the past tense. The problems faced by illiterates in our society may be temporary from the perspective of the next century. One of the most significant impacts of the conversational computer will be a changed requirement for general literacy in our society.

Brian Herbert is a science fiction writer who in his novel *Prisoners of Arionn* shows one way in which people may 'read' books as they use bookcorders. In San Francisco, in 2086 we read:

> When Henry crawled into bed, Rachel was there, slouched against two pillows with her Biblecorder on her lap. A lighted fiber optics scanner traversed the open page, transmitting words to Rachel via a wire that led from the unit to the silver and black earphones she wore. Henry heard the low, monotonous murmur of a minister's voice from the machine and made out: "The Holy Bible, Old and New Testaments, Copyright 2037 by Bookcorder International."
>
> Rachel always listened to the title page before proceeding to the text.
>
> "Philippians Two," Rachel said, speaking into a tiny microphone that protruded from the binding. This microphone was connected to the base of a flexible plastic tube that dangled over the open pages. The business end of this tube was an electric-eye scanner, and at Rachel's command the tube bent low and nudged pages until Philippians Two

> was beneath the electric eye. The unit also contained a computerized concordance, so that it could be instructed to find particular passages.[81]

Stanislaw Lem, a Polish science fiction writer, in his book *Return from the Stars*, also gives a good idea of how people could 'read' a few generations after the introduction of the conversational computer:

> I spent the afternoon in a bookstore. There were no books in it. None had been printed for nearly half a century. And how I had looked forward to them, after the microfilms that made up the library of the Prometheus! No such luck. No longer was it possible to browse among shelves, to weigh volumes in the hand, to feel their heft, the promise of ponderous reading. The bookstore resembled, instead, an electronic laboratory. The books were crystals with recorded contents. They would be read with the aid of an opton, which was similar to a book but had only one page between the covers. At a touch, successive pages of the text appeared on it. But optons were little used, the sales-robot told me. The public preferred lectons — lectons read out loud. They could be set to any voice, tempo, and modulation. Only scientific publications having a very limited distribution were still printed, on a plastic imitation paper. Thus all my purchases fitted into one pocket, though there must have been almost three hundred titles. A handful of crystal corn — my books.[82]

This is not just science fiction. In 1993 Sony introduced a product called Data Discman Electronic Book Player, although it did not seem to gain any market profile. With this product, a three inch optical disk and a small hand-held computer could read out-loud the books stored on the disk.[83]

Early in the next century a person applying for a job as a electrician (for example) will be asked a series of questions by a computer (or human interviewer with the computer listening in). The answers to these questions will be recorded automatically in a database saving the effort of data entry. The computer will take a voice print (giving a more accurate identification than a finger print), and, if requested, will check with the police computer to determine if the person has a criminal record. It will also verify the factuality of the information provided with the computers at the applicant's former places of work.

Once the person is hired for the job, his instructions will be provided from computerized policy and procedure 'manuals'. But he will not have to read these. He will be able to listen to an overview about the company and be told what other sections apply to his job. At any time he will be able to ask the computer questions to determine what the procedure is for a specific task. If one exists, the computer will tell him what to do and will be able to display photographs, diagrams and video sequences illustrating the method of performing the task. The computer will also be able to supply answers in 'virtual reality' with generated images superimposed on special goggles. "For example, electricians could walk around buildings and see wiring behind the walls instead of deciphering blueprints."[84] Or a worker assembling an electrical device or component would not have to consult a manual. He would see a virtual step-by-step template appear on his work table.[85]

If an answer to the electrician's question does not exist, he will be connected immediately to his human supervisor who will give him specific instructions. The computer will listen in on these instructions and will record them (in effect learning) and be able to answer the specific question if asked again.

The employee's pay will be automatically deposited in his bank account. He will be able to use the money in his account to effect transactions electronically. He will not be required to sign his name. He will complete the transaction via a voice-activated electronic funds transfer (EFT) network. The security check will be based on his unique voice print.

At no time in the employee's interaction with the machine or in the performance of his duties will it be necessary for the employee to read more than a few words. In fact, it may not be necessary for him ever to read. The conversational computer will not only affect the skilled trades (plumbers, electricians, etc.), but it will also affect all unskilled, service, clerical, administrative, managerial and professional jobs.

Most of us have been educated in highly academic environments and have obtained a major portion of our knowledge from reading. We have a bias towards reading and find it difficult to believe that it will be unnecessary to read to carry on the intricate functions of our society. But if you stretch your imagination I think that you will be able to see that there will be very few jobs which will **require** the ability to read when the conversational computer becomes available.

When it is no longer necessary to read, most people will not bother to read, or even to learn how to read in depth. Within two generations of the arrival of the conversational computer we will be living in an essentially post-literate society. People will be functionally illiterate. Reading will be confined to such things as advertisements, and signs.

Three technologies (voice synthesization, voice recognition, and automated translation) when combined, will create the conversational computer, which in turn may cause considerable job displacement and widespread illiteracy. The nature of the changes which may result we can only guess at today. But it is likely that there will be a dramatic restructuring of society in some form. “One theory has it that society in the near future will require only two types of workers: highly educated technical experts and a pool of low-paid unskilled workers.”[86]

Whether the wizard-drone theory is valid is the subject of much debate among economists, sociologists and engineers. They can debate all they want, but soon the computer is going to join the debate. Rather than join the debate, we in the Church should watch the trends and plan to be at the leading edge with the Gospel of salvation and with love.

Mount Ebal

How will an illiterate society affect the Church? Is it important that church members be able to

read? These are difficult questions to answer. However, it is clear that since the Reformation, reading by both clergy and laity has been emphasized in most branches of the Church. The modern missionary era (circa 1700 - present) has used instruction in reading as a means of gaining access to a culture, as a means of raising the level of self reliance of a group of people, and as a means of presenting the Gospel. The original Sunday School movement also included instruction in reading for the urban poor.[87] Writing of John Wesley, William Iverson says:

> John Wesley led a movement that was not born of bare enthusiasm. ... It was a book movement, a reading revolution. He insisted that his helpers "steadily spend all morning in this employ, or at least five hours in the twenty four." A young evangelist says, "But I have no taste for reading." Wesley answers (with a 'certain violence', as William Barclay points out) that the young man should "contract a taste for it, or return to his trade." ... Wesley wrote a mere 371 books. ... Yet Wesley was an activist.[88]

Iverson is among those who believe that reading is essential for an educated ministry, and presumably for an educated congregation. He says that "the secular generalist such as Toynbee and the Francis Schaeffer types, religiously speaking, are the need of the day."[89] He concludes his defence of reading and diligent study with these words. "Read as though your life depends on it!" Ernest Reisinger is another author who argues for the power of the printed word. He says that "the ministry of books can be used to evangelize, teach, train and expel ignorance as it has done in the past. A cursory glance at history should convince us that God has used books and literature to enlighten blinded peoples and nations."[90]

Reading is viewed as the single most important skill for the creation and maintenance of modern civilization. It is seen by McLuhan as the means of introducing sequential and linear thought into a society:

> Nonliterate people simply don't get perspective or distancing effects of light and shade that we assume are innate human equipment. Literate people think of cause and effect as sequential, as if one thing pushed another along by physical force. Nonliterate people register very little interest in this kind of 'efficient' cause and effect, but are fascinated by hidden forms that produce magical results.[91]

> Neither Hume nor Kant detected ... our Western bias toward sequence as 'logic' in the all pervasive technology of the alphabet. ... Only alphabetic cultures have ever mastered connected lineal sequences as pervasive forms of psychic and social organization.[92,93]

> Even our ideas of cause and effect in the literate West have long been in the form of things in sequence and succession, an idea that strikes any tribal or auditory culture as quite ridiculous, and one that has lost its prime place in our own new physics and biology.[94]

Reading is seen as an important means of gaining insight and understanding about the world. Ray

Bradbury, in a recent interview express his concern with the demise of the book and the lack of reading ability among today's kids.[95] In his novel *Fahrenheit 451*, he expressed this same concern, especially when Montag and the other 'firemen' went to burn the house of a woman who has been discovered with books.

> "You can't ever have my books," she said. "You know the law," said Beatty. "Where's your common sense? None of those books agree with each other. You've been locked up here for years with a regular ... Tower of Babel. Snap out of it! The people in those books never lived. Come on now!"[96]

> "Master Ridley," said Montag at last.
>
> "What?" said Beatty.

> "She said, 'Master Ridley.' She said some crazy thing when we came in the door. 'Play the man,' she said, 'Master Ridley.' Something, something, something."
>
> "'We shall this day light such a candle, by God's grace, in England, as I trust shall never be put out,'" said Beatty.
>
> Stoneman glanced over at the Captain, as did Montag, startled.
>
> Beatty rubbed his chin. "A man named Latimer said that to a man named Nicholas Ridley, as they were being burnt alive at Oxford, for heresy, on October 16, 1555."
>
> Montag and Stoneman went back to looking at the street as it moved under the engine wheels.[97]

> [Later,Montag to his wife Mildred:] "You weren't there, you didn't *see*," he said. "There must be something in books, things we can't imagine, to make a woman stay in a burning house; there must be something there. You don't stay for nothing.[98]

The novel *The Name of The Rose* by Umberto Eco, illustrates the same idea: books and reading are viewed as an important means of gaining insight about the broader world.

Reading is considered to be the best way of building general knowledge. In his story *A Municipal Report*, O. Henry has Azalea Adair say: "I have travelled many times around the world in a golden airship wafted on two wings — print and dreams."[99] James Coleman says that "for those who read widely, the ratio of vicarious experience to direct experience grew as their range of reading increased."[100]

With a similar lesson, an article in *Scientific American*, states that "both public opinion and scientific evidence are converging on the view that the best way to facilitate vocabulary growth in school-children is to have them read as much as possible."[101]

Reading is believed to be the source of serious thought, which leads to originality, creativity and spiritual insight. Bradbury, in *Fahrenheit 451* speaks of a girl whose family the 'firemen' believe to

have books:

> The girl? She was a time bomb. The family had been feeding her subconscious, I'm sure, from what I saw of her school record. She didn't want to know how a thing was done, but why. That can be embarrassing. You ask Why to a lot of things and you wind up very unhappy indeed, if you keep at it. The poor girl's better off dead.[102]

Many other writers state that reading is important as a means to serious thought. Some have stated the following:

> We all realize that printing is an extension of the pen. Now we have the quantum leap into word processing, but in the end the dynamic is not in the pen, printing press or computer print-out; it is in the ideas and in the words (in our case) which convey the truth of God's Word to convert the soul, cleanse the life, inspire, instruct and bless.[103]

> Here in the West we are in danger of coming full circle: The visual media created by modern science may ultimately undermine literacy, turning us back into an image-based culture. If that happens, will only an elite be taught to read?[104]

> Although I am not against the computer revolution (the computerization of libraries and the vast amounts of information available in computer networks is a great boon), I do think there is a danger when pictures and voices replace written words as the primary means of receiving information. The danger is especially acute for those of us who put so much stock in a rational understanding of a revealed Bible.[105]

Even though there is a lot of concern about the apparently increasing amount of illiteracy and there are strong arguments demonstrating the importance of a literate society, it is also worth noting some points which may give a different perspective on the importance of reading.

Some writers believe that TV and other electronic media provide important experiences which are perhaps more valuable than those gained through reading. For example, we can consider what Coleman and McLuhan say. I quoted above from Coleman to illustrate the role of reading in providing knowledge about the world. But he then added the following:

> The emergence of electronic methods of communication such as television has shifted the balance between direct and vicarious experience toward vicarious experience for all of us, and it has done so most strongly for the young. Instead of information poverty they now confront information riches.[106]

McLuhan also speaks favourably of the electronic media as a means of providing knowledge:

> In a group of simulcasts of several media done in Toronto a few years back ... the

> students performed better with TV-channelled information and with radio than they did with lecture and print — and the TV group stood *well* above the radio group. ... [Another] time each medium was allowed full opportunity to do its stuff. ... Television and radio once again showed results high above lecture and print ... however, radio now stood significantly above television. ... TV is a cool, participant medium. When hotted up by dramatization and stingers, it performs less well because there is less opportunity for participation. Radio is a hot medium. When given additional intensity, it performs better. It doesn't invite the same degree of participation in its users.[107]

McLuhan had an obvious bias against literate societies and in favour of primitive tribalism where communication was oral and essentially one-to-one. Thus he states that "the era of mechanized printing led to a pedestrian mode of thinking, writing and doing."[108] This has led one Christian critic to respond by stating that McLuhan believed "that the medium of linear type (and hence the printed page) produced a public mentality that was stilted and demeaning to the sensory and imaginative elements in human nature."

McLuhan's "naivete about human nature" needs to be kept in mind when considering his statements. But we also need to balance this with his observations about the way in which all media have profound and subtle influences on human nature. This applies to the written word as much as to TV. McLuhan has shown that there is also a bias on the part of those who argue strongly for the supremacy of the written word over all other forms of communication.

Literacy tends to bring detachment. For, as McLuhan said, "the literate man or society develops the tremendous power of acting in any matter with considerable detachment from the feelings or emotional involvement that a nonliterate man or society would experience."[109] McLuhan idealized the pre-literate societies, and so had a bias against the modern literate society. Nevertheless, his observation is true. It is further supported by a casual observation made by Philip Yancy in a article on sin which appeared in *Christianity Today*.[110] Yancy noted his rationalizing and detachment as he wrote from his "air-conditioned office, with strains of classical music filling the room."

General literacy is considered by many today to be essential for the preservation of civilization. Yet many civilizations have existed in which only a small portion of the population was literate: the Babylonian, Assyrian, Persian, Greek, Roman, Han, Omayyad, Mogul, Ottoman, Aztec, Incan, and Ming Empires. It is typical of our ethnocentrism that we feel that to be 'civilized' a culture must be like our own.

It is arguable whether the western attitude to general literacy has really had a long-term, beneficial impact on the quality of society. Literacy has contributed as much to the spread of Communism and evolution as it has to the spread of the Gospel.

> We cannot conclude ... that a high level of literacy always accompanies individualistic or egalitarian social policies. Contrary to a common assumption, literacy is not inherently liberating — neither a necessary effect nor a reliable cause of democratic

> values. Literacy is malleable, capable of serving many functions. "Nazi Germany was one of the most educationally advanced nations on earth," according to Pattison, "and the dissemination of reading and writing skills must have been universal. ..."[111]

The degree of degeneracy in North America (homosexuality, adultery, violent crime, abortion, murder) is as high (higher?) as that of any other culture on earth. We have stressed the importance of literacy for the past 200 years, yet we live in a modern Canaan.

In this regard, Spurgeon is reported to have said that "The sale of irreligious books is a mainstay to the cause of evil... Think of the infidel publications of England and what is worse than that — the silly trashy novels, from which people learn all sorts of mischief, and which debauch the mind of England: these things do infinite damage, I believe, to people's souls ..."[112] His proposed solution was "to scatter good books all over the land."

His approach may have appeared to be the best solution to the problem over 100 years ago. It may have appeared that the best means of counteracting the evils of what was then in print, was for Christians to put more good material in print. But, in light of the fact that Christians have written and published (e.g., Banner of Truth Trust) more good material this century than in any other century, and in light of the events of history since Spurgeon (e.g., the worldwide acceptance of Darwinianism and Marxism, two World Wars, the sex-revolution, the sweeping materialism that has consumed Eastern and formerly communist countries, etc.), is it really the case that "scattering good books" everywhere will counteract evil?

The reality is that most people are not reading the good material that is available. The reality is that we are heading into a post-literate era in western civilization. Whether we like it or not, this is reality. More good books will not help at this time.

Professor Sir Edmund Leach, provost of King's College, Cambridge, writing in the *Observer* said:

> Reading, writing and arithmetic are still basic skills if you want to end up as a synthetic member of the 19th-century liberal middle class or as a still more synthetic member of the 19th-century Whig aristocracy, but these categories no longer represent 'the ruling class', and the associated cultural values (despite their continued gross over-representation in the school curricula) are no longer the dominant cultural ideology.[113]

A science fiction writer looking about 25 years forward, has given a similar projection of the general decline of reading:

> Rife's key realization was that there's no difference between modern culture and Sumerian. We have a huge workforce that is illiterate or aliterate and relies on TV — which is sort of an oral tradition. And we have a small, extremely literate power elite — the people who go into the Metaverse, basically — who understand that information is power, and who control society because they have this semimystical ability to speak

magic computer languages.[114]

You may disagree strongly with the viewpoint expressed in these quotations. You may feel that it is important that we return to the principles of an education based on reading. You may believe that if only our schools would return to the basics we would be able to restore some sanity and bring our culture back from its 'future shock' and the brink of destruction. But we have started on the path to a new form of communication, and we must face this reality. As Sir Edmund Leach states: "A few centuries from now the study of 20th century alphabetical texts will have become the quaint specialism of a few learned academics, the equivalent of the tiny coterie of present-day scholars who can read ancient Egyptian in its cursive hieratic form."[115]

Regardless of your view about the importance of literacy, you have to face the fact that today the majority of the population in western countries does not open the Bible, let alone read it for serious study. In addition, many trends make it clear that we will be living in a post-literate society within a generation. It is important that you consider the role of the Church in this kind of society and consider how it is going to reach unchurched illiterates with the Gospel.

Fergus Macdonald, the Moderator of the Free Church of Scotland said that "the transition towards a post-literary society cannot be ignored, for at the centre of our life and witness lies a Book."[116] He says further that "it will become increasingly necessary in our book-shy age to provide 'bridges' to the Bible." He suggests the use of "leaflets, published in a user-friendly format" and the use of a good translation in modern English. The use of these will help the "habitual non-reader" to become interested in reading the Bible. He says that this is necessary since "in our post-literary society many people react negatively when a large book is thrust before them."

Macdonald is correct that we need to ease people into serious reading. However, if in fact reading will not be necessary to function in 21st century society, the Church may have to re-evaluate its emphasis on reading. Macdonald hints at this in his address when he suggests that "in our preaching and teaching we have to make greater use of parables and visual aids in order to arrest attention and get our message across."[117] This will make literary and academic preachers cringe.

It is true that by reading the Bible many people have been saved. This is surely the reason that organizations like the Gideons and other Bible societies stress the importance of getting the written word into the hands of unbelievers. But there is a fundamental question which needs to be addressed. Is it essential that people **read** the Bible?

Paul says that "faith comes from **hearing** the message, and the message is heard through the word of Christ." (Rom 10.17) The Bible seems to be largely a collection of writings which were intended to be read aloud. Although there are instances of private personal reading of Scripture spoken of in the Bible, there are also many instances where the text was read aloud to the congregation or others. (E.g., Ex 24.7, Deut 31.11, Josh 8.34, II Kings 22.8 (recited), Neh 8.3,8, Jer 36.6, Luke 4.16, Acts 13.27;15.21, Col 4.16, I Thes 5.27.)

The public reading of Scripture is required by the *Directory for the Public Worship of God* in the *Westminster Confession of Faith*. It states that "all canonical books of the Old and New Testament ... shall be publicly read in the vulgar [common vernacular] tongue, out of the best allowed translation, distinctly, that all may hear and understand." This has been the practice of Christendom at Sunday services. Scripture, creed, tradition and practice all indicate that the Bible is intended to be read aloud.

The text of the Bible in the original languages often shows that it was intended to be read aloud. There are many word plays which are based on the similarity of the sound of two Hebrew or Greek words or phrases. "It is easy to gauge the degree of acceptance of print culture in any time or country by its effect in eliminating pun, ... alliteration, and aphorism from literature."[118] The text of the Bible has a cadence intended for oral reading rather than silent reading. This is clear when considering, for example, the book of Hebrews:

> In an argument that merits recognition, he reserves the term 'rhetorical' for those features that are best recognized when listening to the Greek pronounced aloud. His argument is based on the premise that because of the lack of printing technology, orators were more prevalent than authors and speeches more popular than books in a society that produced the Biblical book of Hebrews. He argues that all written literature of that time took shape under the influence of oration and according to the conventions of rhetoric (literature was expected to be read aloud, even when reading to oneself, as apparently was the habit of the Greeks).[119]

The tradition of the scribes was to read aloud. This tradition continued in the Middle Ages among the monks. Augustine in his *Confessions* indicates his surprise when he saw Ambrose reading silently: "When he read, his eyes moved down the pages and his heart sought out their meaning, while his voice and tongue remained silent."[120] The rule of Saint Benedict said: "after the sixth hour, having left the table let them rest on their beds in perfect silence; or if anyone wishes to read by himself, let him read so as not to disturb the others."[121] Benedict made this rule "since no one had yet learned to read with the eyes only."[122]

When punctuation marks were entered into manuscripts during the Middle Ages, their purpose was to indicate to the reader where to put emphasis. They were intended for the ear and not for the eye.[123] For example the '?' and the '!' were both originally intended for the oral reader of a text.[124]

> After Charlemagne, when punctuation first became common it was an aid for speaking, or for reading a printed text aloud to an illiterate audience. To help the reader follow the principles of elocution ... which incidentally helped a listener follow the meaning. By the later seventeenth century more printed matter was intended for silent reading. Then punctuation came to be governed by syntax and aimed to show the structure of a sentence.[125]

We have lost sight of the origins of reading. We do not realize that silent reading is a relatively modern phenomenon, covering a period of less than a quarter of the time since Christ's first coming.

We have also lost sight of the reason why Jesus through the Holy Spirit and the human authors of the Scriptures, wrote the Bible. This was done since, as the *Westminster Confession of Faith* states, "it pleased the Lord, at sundry times, and in divers manners, to reveal himself ... and afterwards, for the better preserving and propagating of the truth, and for the more sure establishment and comfort of the Church against the corruption of the flesh, and the malice of Satan and of the world, to commit the same wholly unto writing; which maketh the holy scripture to be most necessary; those former ways of God's revealing his will unto his people being now ceased." The word was written down by God to preserve it.

The Bible was given in written form for the preservation of its important message. But once preserved, the proclamation of this message is to be carried out by example, teaching and preaching.

Eusebius in his *Ecclesiastical History* speaks of a letter written by Jesus to Agbarus, king of Syria. Whether or not Jesus actually wrote this letter would be difficult to determine. Even if he did, the letter has not been included in the canon of Scripture. Other than this letter, there is little indication that during his time on earth Jesus directly committed any of his teachings to written form. "Aquinas considered that neither Socrates nor Our Lord committed their teaching to writing because the kind of interplay of minds that is in teaching is not possible by means of writing."[126]

The presentation of the Gospel will not cease in the illiterate society of the 21st century. Rather than attempting to fight the move to a different basis for communication in society, the Church as the instrument for Gospel presentation must be prepared to use effectively all of the proper means available. We must look for ways to ensure that the Bible in its entirety can be heard in the language of the day and that people are challenged to "think and act on the basis of principle, reason and purpose." For, "the fact is, that if people cease to think for themselves it becomes very difficult to communicate the Gospel to them."[127]

Mount Gerizim

The conversational computer will be a blessing to those in the Church who are blind or have poor eyesight. They will be able to speak with the computer and have it perform selected tasks. They will also be able to have the computer read books and news to them. As E-mail and electronic funds transfer, activated by voice, become more common they will be given a greater degree of independence. The conversational computer will also be useful to the handicapped who will be able to instruct the computer by voice rather than having to press keys.

Bible translation will benefit from the conversational computer. Automated Bible translation is not yet a reality, but research being conducted by Wycliffe has taken a major step in that direction. Their

technique called Computer-Assisted Dialect Adaptation (CADA) helps translators working in one dialect of a language take advantage of the work already done in a related dialect. This approach has been used in Guatemala to adapt the Central Cakchiquel New Testament into Eastern Cakchiquel. According to the translators the machine can do 80 to 90 percent of the work of translating, allowing the human translators to concentrate on corrections and improving the flow of the translation.

A major benefit is the time that is saved. Wycliffe estimates that there are 1,000 languages in Africa, 500 of which are related in families. In New Guinea and Indonesia similar language groups are found. This approach to translating the Bible "can markedly advance Wycliffe's ultimate goal of God's Word in the language of every man."[128] Automated translation will also be used to make available in other languages the large body of theological works available in English.

Another benefit of the conversational computer will be simultaneous translation. Within the next twenty five years personal-characteristics modules will become available which will allow preachers and teachers to speak in their own language, but be heard in any language which has been programmed into the computer. This will give access to a worldwide audience, and give the world greater access to the Gospel. It will no longer be necessary for a missionary to spend months in language training before he can begin to present Jesus Christ.

"The history of the progress from script to print is a history of the gradual substitution of visual for auditory methods of communicating and receiving ideas."[129] But the introduction of the conversational computer is going to reverse this trend and reemphasize the importance of the spoken word over the written word. McLuhan and others have indicated this in their writings:

> Electricity and electronics have carried us back to the spoken word.[130]

> Prose remained oral rather than visual for centuries after printing. Instead of homogeneity there was heterogeneity of tone and attitude ... so language was the last art to accept the visual logic of Gutenberg technology, and the first to rebound in the electronic age.[131]

This will be a blessing for the Church, for much preaching today is powerless. "The problem is universal. There is not a denomination or fellowship of pastors that does not designate powerlessness in the pulpit as its greatest weakness."[132] There may be many causes, but without doubt one cause is that most preachers "are men of books and not men of people."[133] Another cause is that most preachers are also men of books and not men of the spoken word. Most preachers are trained via the written word rather than the spoken word. They get relatively little opportunity for training in the skills of public speaking. And the instruction they are given is largely from men skilled academically in their particular disciplines, but not at all skilled in effective oral communication.[134]

Preachers in the early Church, the Middle Ages and the Reformation were trained extensively in

oral communication. They studied rhetoric and debate, and were expected to be able to communicate effectively with the spoken word. Today lip service is given to effective communication. Yet presbyteries and licensing boards continue to permit men to occupy pulpits who dull their congregations into numbness. Solid content is useless if everyone is asleep.

The introduction of the conversational computer is going to refocus the attention of our society on the spoken word. Powerless preaching will empty churches. So the Church will have to act against powerless preaching, and of necessity pay more attention to the medium carrying the message.

Powerful pulpit preaching is going to get an assist from the conversational computer in a second way. People are going to become tired of constant interaction with machines. "Preaching is a highly personal activity, perhaps especially in the electronic age when the hunger for love and authentic relationships is slaked but not satisfied by the pseudo-intimacy of television."[135]

Listening to a live preacher who can effectively communicate the Gospel of hope is going to be a refreshment after the emotionless world of the machine. In his science fiction story *Time Considered as a Helix*, Samuel Delany speaks of the prophets for their age:

> Nobody could explain it. All they could do was proclaim her Singer. Why did the institution of Singers come about, springing up in just about every urban centre throughout the system? Some have speculated that it was a spontaneous reaction to the mass media which blanket our lives. While Tri-D and radio and news-tapes disperse information all over the worlds, they also spread a sense of alienation from first-hand experience. (How many people still go to sports events or a political rally with their little receivers plugged to their ears to let them know that what they see is really happening?)[136]

The prophets for every age are the preachers of the Gospel. No one will be able to explain it, but the electronic age is also going to be an age of effective powerful pulpit preaching.

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134. Lloyd J. Averill, “The Art of Saying Something,” *Christianity Today*, October 21, 1988.
135. R. Paul Stevens, *The Equipper's Guide to Every-Member Ministry* (Downers Grove: Intervarsity Press, 1992), p. 32.
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7 — Information Implosion

Angels on the Head of a Pin

When I began writing computer programs in high school in the late 1960s we used the latest IBM technology. When our programs ran, we had the entire machine available to us but had access to only 64,000 characters of internal memory. In addition, on that machine external storage of data on a disk drive was expensive. It cost over $100,000 to store 150 million characters of data so we had to store our programs on punched cards.

As I look back at this situation and compare it with the computer power I have on my desk as I type, I sit in awe. My personal computer has an internal memory of 16 million characters and an external disk drive which will store about a billion characters of data. But my personal computer is a 'baby' when compared to what is commercially available today. A single desktop personal computer today can have billions of characters of internal memory, and trillions of characters of storage in external memories. What will be available in another 15 to 20 years?

Most of the data stored for immediate access on computers is stored in magnetic form, on disks coated with an iron oxide (or similar) medium, much like that used on audio cassette tapes. This form of storage has been improved significantly in the past 25 years. In 1967 information could be stored at a density of about 20,000 characters per square inch of space on a disk. Today over two million characters can be stored per square inch. In a few years it will be possible to store over 1 billion characters in about one square inch of magnetic media.

Even with these advances, the storage of digital information on magnetic media may soon be replaced by storage on optical media. These media can have densities of many times that of magnetic storage.[1] Optical media are similar to the CD disks used in home stereo systems. On non-erasable disks tiny holes are burned or moulded into the surface of the disks. The information is read back by bouncing laser light off the disk. The holes reflect the laser light differently than the rest of the surface area on the disk. Since laser light can be focused very precisely, the small holes on the disk can be very close together. Thus high densities of storage can be achieved.

An optical CD-ROM can store textual information equivalent to that found in over 500 books. Thus a library of 1 million books could be stored in optical disk form, on a set of shelves on a single wall. Today many disk manufacturers such as 3M and Kodak are producing optical disk systems that can store 1 trillion characters of data and provide access to any piece of this data in less than 10 seconds.[2]

Within a few years we can expect the storage density of new optical technologies to increase by at least a factor of ten. Within 15 years it will be possible to store the equivalent of a one million book library in the space of a shoe box.[3] This storage device will probably cost around $500. It is even

possible that within 20 years a library of 30 million books could be stored in the space occupied by a postage stamp![4]

The increasing density of storage media is significant and will have profound effects on the availability of information. But of equal significance will be the increased storage life of the media. Magnetic media deteriorate over time, even when not used. Data stored on magnetic tapes can become unreadable within 20 years. In contrast, non-erasable optical disks will last much longer. Current manufacturers suggest that the data will still be readable on optical disks after 100 years.

Optical disks do not wear-out with use since they do not come into physical contact with the read heads. And if they are not mistreated, for all practical purposes they are indestructible. This is one of the reasons that the U.S. National Archives is preserving their documents on optical disks.

The longevity of the data on the disks is based on the assumption that the format of the data will still be known in the future, and that there will be hardware available to read that format.[5] The long-term readability of formatted data will become less of a problem as general standards (such as Unicode for representing various linguistic systems, with or without an alphabet) are developed. In addition, important information in data banks will be regularly transferred to new storage formats and to improved storage technology. Although there may be some loss of content through time, once the information is in digital form, the loss will be far less than is being experienced through the deterioration of paper-based documents.

Digital Documents

The dramatic reduction in the cost of storing information, will make it far less expensive to store documents in electronic form than in paper form. This will lead to a rapid expansion in the number of documents created, stored and displayed entirely with computers. Also, as I discussed earlier (in the section entitled *Paperless Society*), the production of paper documents, even where computers are used, will become less desirable as the relative cost of paper storage continues to rise and as computer displays become cheaper, less bulky, easier to use and more capable of showing high resolution multi-page images.

Computer-assisted "document preparation has until recently been almost exclusively oriented towards hard-copy output as the end product. Interactive text-editing terminals, electronic typewriters, word-processors, and integrated office automation systems are a highly visible part of a dramatically improving document input technology but are primarily a means of generating paper output on computer-controlled typesetting machines or printers."[6]

Most 'documents' which are created today on a computer look very similar to printed typeset documents. This mirrors a step in the original development of printed documents. At first "printed books were doctored by eraser and paintbrush to give them the manuscript look, revealing the nostalgia of book lovers ... attached to the 'handmade' product."[7] In a similar fashion most of the

documents being produced today on computers resemble the printed page, revealing the nostalgia of print lovers ... attached to the 'typeset' product.

Thirty years ago Marshall McLuhan noted this process: "Today with the arrival of automation, the ultimate extension of the electro-magnetic form to the organization of production, we are trying to cope with ... new organic production as if it were mechanical mass production."[8] The organic production and use of digital documents will be a more profound change in the nature of the document than that which was caused by the printing press.

Hypertext

The printing press created new types of documents (e.g., newspapers and magazines) undreamed of in the days of hand printed manuscripts, created new audiences for documents, and introduced to a wide audience linear text which according to McLuhan had an influence on the nature of thought in western culture. Sequential thinking, according to McLuhan, is largely the result of working with sequential text.

> The new time sense of typographic man is cinematic and sequential and pictorial.[9]

> The invention of typography confirmed and extended the new visual stress of applied knowledge, providing the first uniformly repeatable commodity, the first assembly line, and the first mass production.[10]

> It was not until the experience of mass production of exactly uniform and repeatable type, that the fission of the senses occurred, and the visual dimension broke away from the other senses.[11]

> With print there is more complete separation of the visual sense from the audile-tactile.[12]

If linear text resulted in sequential thought, what will be the impact of the mechanisms being devised to allow computer supported references from any piece of text to many others?

Hypertext (or 'non-linear' text, as it is sometimes called) is not a new concept, and has been used for the organization of information in libraries. Librarians use *see* and *see also* references in their cataloguing systems for directing users to related references. Writers and researchers using 3 X 5 cards have also used the concept of hypertext for taking notes. The concept of hypertext is also exhibited in a study Bible's chain reference system or in a collection of technical papers which, through a series of footnotes and references, tie together a chain of related works.

However, these examples are limited models of the type of hypertext which can be achieved with a

computer. Library cross-references relate only to author, subject and title authoritative headings but not to the detailed text of the works. Manual research filing systems and biblical chain references, although they contain cross-references within the body of the text, are limited in scope. Bibliographic references in a collection of works are difficult to follow, since one needs access to all the unpublished works, journals, books, and other publications cited in the work being read.

In the realm of computer supported hypertext "windows on the screen are associated with objects in a database. And links are provided between these objects, both graphically (as labelled tokens) and in the database (as pointers)."[13] The links between nodes of text can connect two documents; a word, sentence, or paragraph in one document to a word, sentence or paragraph in other documents; or a primary node of text to 'footnotes', additional in-depth material, reviewer's comments, or contrary arguments.

"In addition to ... traditional ways of interacting with books, the dynamic nature of computer displays allows one to explore completely new viewing paradigms."[14] Hypertext supports a range of new operations for looking at documents:

- References can be traced easily and quickly, in the same document or in different documents. A reader of hypertext can have one document displayed on his screen and can follow the links by opening windows on the screen with text from other documents.

- New references can be added to a document. A reviewer can add a counter argument and link it into the document, without affecting the integrity of the first document. Future readers can access the reviewer's comments or read a counter argument, if they wish.

- Many views of text (sequential, hierarchical, layered [e.g., tables of contents]) can be supported.

- A viewer can request a simple abstracted overview of a document or access varying levels of detail, for example he could review a hypertext medical handbook[15] at various levels of detail: table of contents, topic summary, or detailed text.

- Sets of text modules can be strung together in various ways, supporting the preparation of unique documents for different classes of readers.

- Ideas can be presented with little overlap since blocks of text can be referenced from a number of sources.

- Alternate versions of a passage can be compared side-by-side in two windows.

- Documents can be correlated by key phrases or ideas. A hypertext version of the *Oxford English Dictionary* is an example.[16]

- "Analogues to all the conventional ways of viewing hard-copy material can be devised for use with on-line documents, including leaving a trail of book marks, highlighting important material, making marginal notes, spreading out multiple pages (as from a looseleaf binder), quick alternation between a glossary and main text, etc."[17]

As anyone who uses the World Wide Web extensively knows, there is one major disadvantage of hypertext. It is easy to get lost in a hypertext document, or to become lost in 'hyperspace'.[18] A reader of a large document may find it difficult to find an obvious 'starting' point or to find a previous section that had been read. This problem will not be easily solved, but help can be provided to the reader in the form of query and search mechanisms, and by placing milestone markers — for example, the use of different colours at different levels.

There are many research projects which have been undertaken to develop hypertext into a viable approach to handling information. These projects have had creative names such as Boxer, Intermedia, Neptune, Plane Text, SYNVIEW, Textnet, Hyperties, WE, Xanadu, and ZOG.[19] Some of the results of the research has been applied on the Web, but there is still a lot of work that needs to be done to make navigating and finding information on the Web easier. Eventually descendants of these laboratory systems will become common and hypertext databases of most of mankind's literature will become widely available. At that point, the current hypertext browsers will be replaced by information organizers and 'intelligent' agents. The concept of linear text processing (e.g., reading a book from cover to cover) will no longer be the 'normal' approach to 'reading'. Instead readers will navigate through text with alternate paths (e.g., paths for a novice and expert) or will read novels with many branches at critical decisions and many conclusions.

Square Pegs in Square Holes

In order for hypertext to become as effective and pervasive as print media, it will be necessary for hypertext systems to support the inclusion of documents from various sources and in various formats (e.g., books, journal articles, spreadsheets, formulas, music scores, etc.). This will require the creation (or *de facto* acceptance) of standard electronic document formats that go beyond the current, very limited, hypertext markup language (HTML). Document markup is the process of encoding text with labels. Labels can be used to identify heading levels, paragraph types, underlining, indentation, etc.

New standards for the communication of contextual information in textual, graphical, pictorial, and musical formats are in fact being developed. Recognizing the importance of document portability, "representatives of publishers and of organizations with large publishing costs have joined in an effort to establish an industry-wide standard."[20] In its *Electronic Manuscript Project*, the Association of American Publishers endorsed a standard for document markup. Logos, which manufactures Bible software, has worked with a number of CD publishers to develop a similar standard. Within a few years, HTML will be replaced or will evolve to include a broader set of capabilities for handling most forms of digital information.

From an author's and publisher's viewpoint, the advantages of having a recognized standard include the following:[21]

- Authors will be able to share and collaborate on electronic documents.
- Publishers will not have to rekey documents, thus eliminating an error-prone expensive task.
- Proof-reading of text after authoring will be reduced since the content will not change. Only the presentation format will be changed.
- Subsequent editions and revisions will be easily produced.
- Documents will be included quickly and easily into online data bases and the Web.
- Text indexes for query systems will be easy to produce.

Hypermedia Navigation

Hypermedia is an extension of hypertext. It seems to have been first described by Vannevar Bush, president of the Carnegie Institution in Washington. In an article "As We May Think" published in *Atlantic Monthly* he wrote: "Consider a future device for individual use, which is a sort of mechanized private file and library ... in which an individual stores his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged supplement to his memory."[22] Bush was thinking of what a modern personal computer can do, thirty years before the personal computer was invented.

As in hypertext, the indexing and retrieval capabilities of computers are used for storing and accessing information. But hypermedia allows text to be used in novel ways, and it accommodates other media besides text. For example:

- A visually impaired person will be able to display text with a large font and in high contrast. Those not wishing to read, or unable to read, will be able to have the text read to them. For example software such as TextAssist, inexpensive software for Microsoft Windows, will read aloud any selected text from e-mail messages, Web pages, or documents stored on the a PC.
- Footnotes will no longer be 'foot' notes at the bottom of the page or end of the document. Instead a reader will be able to point to any text portion or object on the screen highlighted in some fashion (e.g., with colour, or a small symbol) to access an additional layer of detail about the object under consideration. For example, if the text made reference to Martin Luther, a

viewer could point (with a mouse) to his name and access a whole library of information about him, including pictures of him, hymns written by him (which could be listened to as well as read), sermons written by him, biographical information about him, and documents written about him.[23,24,25,26]

- Animated diagrams or interactive computer dialogues will be incorporated into a document. For example, a hypermedia mechanic's service manual will show various components of a car on the screen. The mechanic will point to one component, have it decomposed into its constituent parts, see an animated or videotaped scenario of how to trouble shoot or repair the part, request inventory information on the availability of a part, and (if necessary) place an order for the part.[27] The Society of Automotive Engineers has developed standards for such a system.[28]

- "A document could automatically contact its author by telephone for in-depth discussion."[29]

- The cursive letters of the Arabic script, and Hebrew type, could be displayed. English text and Arabic and Hebrew text can be automatically intermixed, with the English being displayed left-to-right and the other text being displayed right-to-left.[30]

Grolier, Compton's, Microsoft, National Geographic, and many other companies have introduced electronic encyclopedias and 'picture books' which incorporate the features of hypermedia. The cost of manufacturing a disk is under $5. Updates of the entire contents can be sent annually. In addition, a hybrid approach for information dissemination can include hyperlinks to recent Web-based updates to the content of the CD.

There are thousands of CD titles for use with a computer, and the number of products is at the point of 'explosion'. Examples include:

- The *Doomsday Book* published in Britain contains 40,000 colour pictures and 250,000 pages of text, and numerous maps. It includes information on every region down to the smallest hamlet in Great Britain. It even includes floor plans of interesting historic buildings.[31]

- An impressive example of hypermedia technology is Microsoft's Musical Instruments which displays a collection of the world's instruments. Choices can be made by geographic location, by instrument name, or by class of instrument. Individual instruments can be viewed on the screen with an explanation of their key parts. And the instruments can play a scale or a representative piece. The voices of most of the instruments are recorded at digital CD quality.

- National Geographic is developing a series called *The National Geographic Wonders of Learning CD-ROM Library* with dozens of titles on CD disks.

- Columbia University has released disks with 45,000 rare architectural drawings including some by Frank Lloyd Wright.

- The Getty Museum's collection of illuminated manuscripts has been preserved on video disk.

- A collection of 130,000 sketches, watercolours and pastel drawings from the Louvre in Paris has been assembled into a CD collection.[32]

- Cornell University worked with Xerox to record about 1,000 of its endangered volumes on optical disk. They were able to remove the old volumes from the shelves and replace them with new copies printed on acid free paper. In addition they were able to provide these volumes online.[33]

- The Library of Congress plans to digitize the most important materials from its collection and portions of collections in other libraries.[34]

- Compton's offers a CD with over 600 classical books, and many popular reference sources are available in digital form, including: *The World Almanac and Book of Facts*, *The American Heritage Dictionary*, *The U.S. Zip Code Directory*, *The Chicago Manual of Style*, *Bartlett's Familiar Quotations*, *Roget's Thesaurus*,[35] *Business Writer's Handbook*, *Associated Press Style Book*,[36] and the *Oxford English Dictionary*.[37]

- Bible concordances and Bible texts are also available,[38,39] as are CDs containing hundreds of titles including Bible versions, study guides, commentaries[40], and educational products such as *Charlton Heston's Voyage Through the Bible*.

- The Electronic Bible Society is making available in CD format collections of English and American Puritan writers, the works of Luther, the Church Fathers, and hundreds of other authors.[41]

- The *Mindware* catalogue lists many titles including: *Composer Quest* — explore the world of music through the lives of composers, *Great Cities* — trip-planning guide through 10 great cities, *USA Wars: Vietnam/Korea*, and *World View* — 100 photos of Earth and the other planets as seen by NASA.

Apple Computer and Microsoft are among the companies which have introduced software tools which provide support for the creation of hypermedia documents. The software "is designed to let users create, organize, and access various types of information, including text, graphics, video, music and voice."[42] Icons displayed on the screen can be programmed to perform tasks such as dialling the telephone or conducting searches.[43]

These hypermedia products are now standard equipment on all Macintosh computers and in Windows for IBM-compatible PCs. Most PCs are sold with built-in CD-ROM drives and stereo sound systems to support these first generation hypermedia systems. By the end of the century

second generation systems will be part of the 'toolbox' of every computer. With the acceptance of active documents in a 'dynapaper'[44] environment (thin, light, high-resolution computers) the static, serial book will become ancient history, just as it is in the science fiction book called *Earth*:

> The air carried thick aromas, but Nelson tried to ignore all those deceptively natural sensoria for the archaic paper reading device in his hands.
>
> If only it were a modern document, with a smart index and hyper links stretching all through the world data net. It was terribly frustrating having to flip back and forth between pages and crude, flat illustrations that never even moved! Nor were there animated arrows or zoom-ins. It completely lacked a tap for sound.
>
> Most baffling of all was the problem of new words. ...
>
> When he'd complained about this, earlier, Dr. B'Keli only handed him another of these flat books, something called a 'dictionary', whose arcane use eluded him entirely.
>
> *How did students back in TwenCen ever learn anything at all?* he wondered.[45]

Econosis

Digital information stored in repositories interconnected on the Electronic Highway (the Internet or a future equivalent) will become the library of the future. All the information that they contain will be accessible with advanced searching search techniques.[*] Current generation programs include such features as complex Boolean searching (*and*, or, *not*), proximity searching (associated words within so many words of one another), and similarity searching (matching on word mix by percentage). More advanced search techniques will conduct 'random walks' through extensive sets of databases and identify related materials in databases not specifically referenced for a search.

The information found in a search will be communicated across the high speed networks of the Electronic Highway to multi-window high-resolution computer displays. Everyone with an entry port will be able to access vast quantities of shared information.[46,47,48]

Some futurists have referred to this type of technology contributing to an information explosion. But, rather than an information *ex*plosion, there will be an information *im*plosion, as all the knowledge of the world is aggregated into central information clearing houses, for which I have invented the term *econosis* (house of knowledge).

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[*] For example, a search technique has been developed which can read through 100 million characters in around 10 seconds and find articles (or any other text aggregate such as a paragraph, chapter or book) which fits a complex set of search qualifiers. (See Jim Schefter, "Super Searcher," *Popular Science*, November, 1987.)

Each econosis will provide a combination of services, including publishing, abstracting, organizing, and indexing information. As a publisher, each econosis, will provide a sub-set of knowledge. Each will initially be organized around a particular set of topic (e.g., medical information, chemistry research, travel consulting, automobile repair manuals, etc.). Most will also provide general information (e.g., world news) purchased from an econosis providing a world news service. The staff of the econosis will be skilled in many areas of the subject matter collected within the econosis. In addition, they will have cataloguing skills for preparing a set of hypermedia links among the database components.

Within twenty five years a number of the specialized econoses may form into consortia and their subscribers will be able to access a broader range of information through one source. At some point in the not too distant future there may be a few large econoses which will contain or index and reference major portions of the world's documented knowledge base. This has been the goal of some recent research projects. For example, "the long range goal of the Xanadu project has been facilitating the revolutionary process of placing the entire world's literary corpus on line."[49]

The foundations for a comprehensive hypermedia econosis has already been laid. There are at least 23,000 data banks from over 1,500 sources in North America, and this number is growing rapidly.[50] Some of the larger suppliers of data bank services are CompuServe, America Online, The Source (owned by Reader's Digest), Dun & Bradstreet's information utilities, and McGraw-Hill's Publications Online. The World Wide Web and indexing services such as Web Crawler and Yahoo! already act in some ways as a super-econosis, loosely connecting many sources of information. However, these services are becoming strained with the volume of data, and do not include most of the information for which an access fee is charged.

Data banks can be grouped into reference and source data banks.[51] Reference data banks have pointers which direct users to sources of information. For example they contain bibliographic citations, abstracts[52] of printed literature (journals, books, newspaper articles) and non-published works (e.g., doctoral theses), audiovisual materials (films, videotapes). An example of this is the NY Times' Information Bank which provides over 2 million abstracts of news and editorials since 1969. At least ten other newspapers and over 50 magazines are also abstracted in this data bank.[53] Another example is the OCLC EPIC and FirstSearch reference services which provide about 50 different abstract databases including Medline (containing medical and scientific abstracts), *Humanities Index*, and the *Reader's Guide to Periodical Literature*, and the OCLC Online Union Catalogue.

The second type of data bank contains full source information. These data banks can contain statistical information such as census and survey data presented in time-series form, often by geographic area and industry. Others contain scientific information such as the composition of chemical compounds or engineering handbook data. Others contain the full text of articles written for newspapers and news magazines or published in technical journals.

InfoGlobe of Toronto, the first commercially available on-line newspaper in the world, is an

example of a specialized source data bank. It contains the text of all issues of the *Globe and Mail* since 1977. This is updated daily. All the text is fully indexed for rapid retrieval of information. InfoGlobe also contains the annual data for about 2000 Canadian corporations for up to 12 years, business information from over 1000 different sources (including The *Financial Times*, *Economist*, *Washington Post* and the *Guardian*) and a complete listing of all stocks (daily high, low, close and volume for the last 250 trading days, and weekly, since 1982) on six North American stock exchanges. Nexus of the Washington Post provides a similar service. It contains the full text of the *Washington Post* since about 1979, and much other information.

U.S. data banks such as CompuServe, for example, provide news and financial information, entertainment and shopping services with thousands of products available, and special-interest forums where subscribers can exchange information. CompuServe is probably the largest econosis today. And yet it is but a shadow of the econoses which will be available in twenty five years. The future econosis will not only display text and some limited graphical information. It will be a rich hypermedia environment with unbelievably vast quantities of information in textual, verbal, graphical, pictorial, video, animated and musical formats.

To gain an appreciation of what is happening in the development of the econosis you can 'surf the Web', or consult, in a public library, a data bank directory such as:

- Directory of Online Databases
- The North American Online Directory

The information in the econosis of the future will come from many sources. Much of it is presently in archives and libraries around the world, but only in paper or microfilm formats. It will be necessary to transform this information into digital form via scanners and digitizers.

The U.S. National Archives is an example of an information base which is available largely in paper form only, but which will be soon available in digital form. The National Archives has undertaken a pilot project to transform a portion of its 15 billion documents into digital form stored on optical disk. The optical scanning technology used on this project is similar to that developed for the Landsat satellite program. The purpose of the pilot project is to compare the long-term suitability of optical disk storage with paper and microfilm. It is expected that the quality of the digital image will be better in many instances than that of the original, since computer image enhancement technology can be applied during the scanning operation.[54]

Eventually much of the information in the archives will be converted to digital form. When this step is taken, a vast research base of original material will become widely available. It no longer will be necessary to handle fragile documents and to obtain and refile them manually. In addition, the documents will be accessible at any display screen anywhere on earth.

Similar projects are underway at the Library of Congress (which has the largest repository of knowledge in the world) and other archival institutions such as Cornell University and Yale.[55] It is

expected that by the year 2000, a core part of the Library of Congress' collection will be online and accessible through the Electronic Highway.[56] Similarly, at the Archivo General de Indias in Seville, Spain historical maps, letters, rare books, and other documents are being converted to optical disk, and will be accessible through high-capacity lines.[57,58]

The transformation of books into digital form will proceed in a similar fashion. Text scanners have been available for over 20 years. The simple ones scan a document and transform it into a series of dots. These dots can be stored, displayed and transmitted across a network. This is the principle underlying facsimile transmission. Many businesses use facsimile (FAX) transmission to send documents among their branches or to other businesses.

This method of page scanning however retains the page only as an image. No ‘knowledge’ of the contents is available to the computer. However, software has been available for almost as long as scanners, which can process the dots and determine what alphabetic characters are represented. This process is knows as optical character recognition, or OCR.

Pure text without embedded diagrams or pictures is relatively easy to convert into digital form. Various fonts can be read by the computer and stored. The text digitized by this software can be processed and indexed in the same way as text prepared originally at a computer keyboard. More sophisticated OCR software is being developed to find text on complex pages and separate the text from images.[59] As this software matures, it will be quite simple to transform entire libraries into digital form. This is being done for example at Columbia University's Law Library.[60]

Only one copy of a particular book need be digitized to be available to many users of the econosis. It will not be necessary for every library to digitize its entire collection. Libraries working together will be able to share the load of digitizing material held in many collections by having each library take a portion of the material held in common. In addition, each will have to digitize the portion of its collection which is unique. Libraries are already familiar with this approach to sharing work. They currently share cataloguing services through central clearing houses such as OCLC, where one master copy of a catalogue record can be accessed by many libraries.

It is becoming easier and easier to move the material in printed books, journals and magazines, into digital form. So, the major problem with the creation of the information base for an econosis with the same material as a modern library is no longer a technical one. Rather, it has become a problem with the existing copyright laws. As you have probably noticed, almost every book published today has a statement in the front which says something like this: “no part of this publication may be reproduced, stored in a retrieval system, or transmitted by any means — electronic, mechanical, photocopy, recording, or otherwise — without the prior permission of the owner.” This is **the** stumbling block to the creation of the full scale econosis. As one technical journalist has said:

> One sticking point for hypermedia is copyrights. If they are too restrictive, no one views the work, if too permissive, producers get no remuneration and incentives. Indeed, some say the success or failure of multimedia may be driven less by technology than by the

> economics of authoring — including the procurement of copyright material.[61]

And, as another writer has said:

> Your copyright ends, emotionally, at my modem. I can copy, move, merge, edit, lift and delete anything I want any way I want. E-Texts have no quotation marks. They are baud-rated into an intrinsically public domain and immediately expropriated into a thousand private domains.[62]

The first books to be available in an econosis will be those of enduring value for which the copyright has expired (for example, the King James Version of the Bible). As Christians we should be sensitive to the rights of an author to receive compensation for his work, whether it is a book, a musical composition or software. We should never copy copyrighted material beyond what is permitted by law, and certainly never to avoid having to pay for the material.

However, it appears that the current laws and approaches to copyright and ownership will not be able to last much longer. The power of the computer to copy anything, from text and pictures to music and software, will make change necessary. Eventually the concepts of a copyright and the ownership of information will have to change because "once digitized, information is free to slip from the old physical 'bottles' to which we have always attached our protective marks and into its natural home, Cyberspace. On-line, it will be as hard to own or contain as air."[63] Current laws will change as the econosis accessed via hypermedia systems becomes the normal source for obtaining information.

Microsoft and other companies have projects underway in their research labs to define ways for handling small transaction fees for information use and for permanently marking the source of copyrighted digital material. Whether or not their research will result in practical approaches will not be known for a few years. It seems unlikely that they will be successful, it is just too easy for a person to make a copy of any information in digital form. Instead, new concepts of payment for authors and publishers will have to be established, such as charging for advertising or for services.[64]

Another type of information which will be available will be that prepared totally on computers and made available electronically through computer networks. Massive amounts of the information which will be in the econosis of the future are already being produced in digital form. The cooperative news sources are largely computerized today. Stories filed with these news bureaus are available to news media subscribers in digital form. Much more is filed by reporters than appears in print. In fact, only about ten percent of what is collected is ever used.[65,66] The editors of the news media choose the information which they wish to incorporate in their publications. The rest is left out.

If this information were available in an econosis, a subscriber could conduct searches on subjects and keywords of interest and obtain many documents. Included would be stories which had reached the public through a printed or electronic publication, and also those which had not been formally

published.

Another major source of information in the econosis will be electronic publications. The electronic publication is already a reality in some specialized scientific disciplines.[67,68] InfoGlobe is also an example of an electronic publication, since the text of the *Globe and Mail* is available electronically as well as in printed form. Many of the components are already in place; and when the general public has access to cheap high quality display devices, magazines and journals will be submitted, transmitted for review, edited, announced, published, and made available to subscribers completely in electronic form.[69,70]

Initially the electronic publication available on-line will be essentially an on-line mirror of what is available in paper form.[71] But it will eventually become quite different from a paper publication. A paper publication is relatively static and difficult to revise. In contrast an electronic publication can be revised in seconds. One author refers to this as the "infinite article and fungible journal." He goes on to say that:

> No published academic article need ever become 'dated'. Every author who writes electronically with a word processor and 'saves to disk' can instantly revise every article, even old ones, on the basis of later findings, peer criticism or new developments.[72]

The electronic journal is not purely in the future. In 1991 there were over 100 electronic journals, and by 1994, according to the *Directory of Electronic Journals, Newsletters and Academic Discussion Lists*, there were over 400 electronic journals.[73]

Another source of information in the econosis will be consumer information such as that currently available through videotext services (e.g., Prestel in Great Britain, and Antiope in France) and data banks (e.g., The Source and CompuServe). This information already exists in digital form. The list is practically endless but includes, transportation schedules, price lists and shopping catalogues, telephone and similar directories, and legal and medical advice in self-help form.

As the level of consumer information in the econosis increases, the usefulness to subscribers will increase. In current systems, both the level of information available and the number of subscribers is growing. When a threshold level of subscribers and data is reached, there will be a rapid increase in the amount of information and the number of new subscribers. The two will be mutually supporting. When there are more subscribers, more organizations will find it worthwhile to load their information. With more useful information available, more people will find it worthwhile to subscribe to the service.

Electronic Alexandria

The library as we know it will die out during the next few decades. In its place will arise the

econosis, an electronic library which will store most of the books ever published, and vast numbers of journals, papers, and periodicals.[74] Many writers and organizations have seen this coming change. The following are a few examples:

> The information revolution of the 1980s and 1990s offers us a step towards a new kind of Alexandria, i.e., towards an abundance of information of universal availability ...[75]

> He uploads it to the CIC database — the Library, formerly the Library of Congress, but no one calls it that anymore. Most people are not entirely clear on what the word 'congress' means. And even the word 'library' is getting hazy. It used to be a place full of books, mostly old ones. Then they began to include videotapes, records, and magazines. Then all of the information got converted into machine-readable form, which is to say, ones and zeros. And as the number of media grew, the material became more up to date, and the methods for searching the Library became more and more sophisticated ...[76]

> For the past three years, the ACM Publications Board has been developing its vision for the future of publication in the electronic age ... We envisage a diminishing role for print journals and exiting new programs around an ACM digital library.[77]

> We must begin now to deal with this cresting, irresistible wave of digital media, one that comprises the most powerful vision of communication ever known on Earth. It is a vision in which the bulk of all significant knowledge and recordable events will be inevitably recast into discrete, computer-negotiable pulses.[78]

> Ignoring the new organizational interfaces being brought about by digital libraries because paper is still dominant is unwise for authors, editors, publishers, booksellers, and readers.[79]

There are a number of reasons why we will see this shift. First, is the inability of current libraries to keep up with the flood of paper.

> Academic libraries are buying proportionately less and less of the newly arriving literature. New publications are increasing in cost and in volume by a factor larger than the general increase in the economy. At the same time libraries are becoming more labour-intensive and space-consuming. ... In the world as a whole there are now more than 50,000 journals pouring through university and academic presses every year. They are increasing in size at a compound rate of 4 percent a year. It is common for journals to double their size every five years. At this rate, it has become clear that the traditional forms of publication and systems of access to published material are defeating their own objective of circulating information to those who need it.[80]

In addition the cost of subscribing to technical journals continues to rise faster than the budgets of

libraries. Many libraries are deacquisitioning journals.[81] Instead of subscribing to some journals they borrow them through inter-library loan. This results in fewer subscribers and an increased cost for an individual subscription. "Established publishers could find their livelihoods threatened, if they fail to react quickly."[82]

Second, is the limitation of the book as a media for disseminating information. A book requires a lot of unnecessary space (consider the amount of 'white space' in every book) and can only be in one place at a time. "The book's limitation lies in its physical size and rigidity. A functional modern school ought to have a library equivalent to that of a small university, but that information ought not to be contained within books. It ought to be available at any student workstation via student enquiry."[83]

Third, there is the increasing requirement of a large clientele for more specific information in a variety of subject areas and in numerous media. No library is able to meet this challenge adequately. In fact libraries no longer supply only printed matter. They circulate videotapes, records, talking books, sheet music, computer software, etc. All of this information will be available from an econosis.

Fourth, the econosis will replace the library because it will become a utility for the movement of information. It can take months and even years to publish a technical journal or book. "We are rapidly moving towards a stage in the evolution of machine-read material in which the researcher will function in a wholly different way from the past. An on-line terminal will be the basic means for not only acquiring relevant information but also for collecting notes and personal abstracts. For sending out letters to colleagues and reading them, for composition and 'publication' of research reports."[84,85,86]

> An author can draft his material, send it to colleagues for review and criticism, automatically transpose into his own work diagrams, charts, and tables from other works, check his own references automatically, and use a full range of text-manipulation devices. ... The gradations of publications between individuals, groups, and general publics can be achieved essentially through the same machinery.[87]

Electronic journals are available today in the science, computer science and engineering disciplines. They are written, published and prepared by researchers who share a common E-mail network (e.g., the Internet[88]) or access a common data bank such as COMPMAIL+. COMPMAIL+ is accessible to members of the Computer Society of the Institute of Electronic and Electrical Engineers (IEEE). Members can use the E-mail facilities of this network, post and scan items on the electronic bulletin board, read abstracts of more than 650 journals, conduct keyword searches on newswire data banks, and prepare and submit conference papers.

COMPMAIL+ is linked into the standard communications networks such as the Internet. The linking of various scientific and engineering computer communication and publication networks is "historically unprecedented and largely unheralded. ... Its ultimate impact on scientific progress will

be profound. ... Over the next few years, the explosive growth of a national high speed computer network linking universities and industries will enable thousands of researchers ... to conduct research and collaborate with one another ... Experts say that, by the end of the century, some one million scientists could be linked by the system, the first all inclusive scientific network in history."[89]

This approach to communication and document preparation is moving beyond the *hi-tech* professions. For example, in San Francisco the Coordinated Asbestos Insurance Trial used the equivalent of a specialized econosis and an electronic journal. Each of the 30 lawyers in the courtroom and the presiding judge had displays on their desks which could access over 1 million pages of text in the data bank prepared for the trial. Lawyers could query the information in the data bank to find appropriate exhibits. As they prepared new material they could reference any of the existing material and then add their documents for immediate availability to the other lawyers. In addition, they could summarize information in the data bank to produce statistical reports.[90]

This form of information interchange is a fundamental transformation in the process of intellectual communication. The computer has reduced the cost of preparing typeset text, "but at the same time [has] introduced the possibility of a further series of changes (which [are] far from complete) which [will] ... change the whole nature of the medium. Thus it was also in the early days of printing, when the Gutenbergian principle was introduced to reduce the labour of copying text but stayed to change the nature of text itself and its role in society."[91]

Fifth, the traditional library will disappear as more members of the general public acquire personal computers for communication with businesses, to pay bills, to effect the transfer of funds, to purchase goods, to communicate, to access information data banks, and for entertainment. When these devices become widely available, the owners will expect the econosis to provide the information which is now available in a public library. Arthur C. Clarke's book *2010*, the sequel to *2001*, hints at this direction:

> The tiny cubbyhole he used as his inner sanctum was equipped only with a swivel chair, a desk console, and a blackboard flanked by two photographs. ... There were no books, and not even paper and pencil on the desk. All the volumes in all the libraries of the world were instantly available at the touch of Chandra's fingers, and the visual display was his sketchbook and writing pad.[92]

By 2010, we will probably see the end of Carnegie's bequest. As the library of the 19th century disappears the role of librarians will change from being collection builders and cataloguers to being information retrievers and problem solvers.[93]

Mount Ebal

Compared with the new electronic tools of the econosis the old methods of books, pens, and

typewriters will soon "belong to the horse-and-buggy era. The new urban peasantry could be those without the means to acquire the technology of the information era. The chasm between the information rich and poor may be vast."[94] The information poor will be those who cannot afford to purchase the technology, or more likely those who cannot (or will not) learn to use the new technology.

The price of a gateway into an econosis will not be expensive. The monthly cost will be less than the cost of a cable TV hook-up or a telephone connection, and will be accessible through either network. Regardless, there will be some who will not be able to connect to the network.

However, the bigger proportion of the information poor, may be among those who cannot or will not learn to use the new technology. The current public information 'tools' are not used by the majority of the population. Will it be any different with the next generation of tools? Today the library is "a sprawling information network ... yet it has failed to capture the popular imagination. Only one in four adults currently uses these facilities. And if information is perceived as concentrated in the hands of a few, it is not for want of trying to make it available to the 'masses'. But even with outreach programs, storefront libraries and bookmobiles — the ultimate in 'taking it to the streets' — libraries remain middle class institutions serving a small section of the population."[95]

The new tools in some ways will be easier to use than paper based libraries. For example, they will not require a person to leave home in order to access information, and information will be available through the same tools that will be used for entertainment and personal business, such as shopping and banking. But at the same time these tools will be more difficult to use. Hypermedia will be many levels more complex than an encyclopedia. It will require considerable skill to navigate through the vast information bases containing most of the world's documented information. Most people will use the new technology only for the necessities of survival in 21st century society. However, they will not know how or want to learn how to go beyond the surface into the depths of the econosis. They will be the information poor.

Another problem with the econosis will be its introduction of additional levels of abstraction. "Since a letter is already an abstract representation of speech, a symbol for actual language, the leap to digitized representation of letters adds yet another layer of abstraction. Without doubt, the expansion of the fourth level means increasing intellectualization of reality."[96] An econosis using hypermedia not only adds the abstraction of digitization; it also adds levels of abstraction into the organization of information itself.

TV has been criticized for blurring the distinction between reality and fiction. The econosis will carry this another step. For those who use the econosis for work, personal business, entertainment and personal communication, 'reality' will be contained within the display console of their gateway. Although T. S. Eliot was not thinking of the econosis when he wrote *Choruses From 'The Rock'*, part of this poem seems to express well how the implosion of information could well lead to a user's disconnection with reality:

> All our knowledge brings us nearer to our ignorance,
> All our ignorance brings us nearer to death,
> But nearness to death no nearer to GOD.
> Where is the Life we have lost in living?
> Where is the wisdom we have lost in knowledge?
> Where is the knowledge we have lost in information?
> The cycles of Heaven in twenty centuries
> Bring us farther from GOD and nearer to the Dust.[97]

Of concern also should be the ownership of the econosis. "The owners of media always endeavour to give the public what it wants, because they sense that their power is in the medium and not in the *message* or the program."[98] But Christians know that what the public wants is not always what it needs. For example, most people do not want to hear of their responsibility before God and of the necessity of belief in Jesus and repenting of sin. Yet this is what they need!

If the econosis or the Electronic Highway is controlled by a non-Christian government or by a non-Christian business which has no respect for God and his revealed will, we can expect to see censorship and editing of explicitly Christian material. This censorship of content exists today in newspaper publishing and in libraries. For example, library material which has been available for years is being removed from the shelves to be replaced by material which is considered to be more 'politically correct'.[99]

Censorship of content also exists with other forms of media. For example, in both the UK and Canada religious organizations are not permitted to develop their own TV networks. One could argue that the U.S. experience with so-called 'Christian' TV is not exemplary. But at least, to this point, there is less direct regulation of the content on the medium.

The degree of control of information will be inversely proportional to the extent to which information is concentrated in one or a few econoses. If the entire population receives its information from a very limited repository of information, we can expect the bias to be exceptionally strong. "It is foolhardy ... to assume information resources will forever go largely unregulated."[100]

Mount Gerizim

Where an econosis has not been purged of Christian content, current news about events in the Church will be available much more quickly than it is today in religious periodicals, and will be available in more depth than it is in religious broadcasting today.

But I believe that the most exciting aspect of the creation of an econosis will be the availability of access to the knowledge base of the world. The econosis will provide a source of all of the available theological work published through the past 2,000 years. This widespread availability of biblical

material may contribute to a reformation of the Church since it is possible that we will see a return to a more serious consideration of the application of biblical principles to daily life, much as was seen in the days of Luther.

A list of examples of the objects which will be available in the econosis in hypermedia form includes: manuscripts of the Old Testament and New Testament, Greek and Hebrew texts, all the classics of the Church fathers,[101] all the books and articles of any significance written within Christendom, scores of tunes used within the Church, vocal selections sung in different liturgical traditions, images of historically significant documents, pictures of prominent Christians of the past, maps,[102] and pictures or diagrams of famous churches and archaeological digs.

Digitized sources for the information which will be in the econosis are appearing today. At Princeton Theological Seminary a Professor used computer image enhancement techniques to process an early 2nd century codex containing an erased translation of the Gospels. The purpose was to process out the dark image of the text written over the translation and to highlight the erased text which left a faint image when photographed under ultraviolet light.[103] These computer images, and similar ones of manuscripts, could be made available in an econosis and be available to anyone interested in viewing them.

It is interesting to see how God has worked out the preservation of the text of the Bible. The ancient scribes counted scrupulously the letters in the Old Testament when they copied the text. Because of their efforts the text of the Old Testament is amazingly consistent across the families of manuscripts. From their work Rabbi Aqiba (died ca. AD 132) developed a standard text. He emphasized the importance of a standard Hebrew text to counteract the Christians who used primarily the Greek *Septuagint* version of the Old Testament.

As "the work of the [Old Testament school of] scribes came to an end around the beginning of the sixth century after Christ"[104] God raised up the Massoretic scribes. They continued the tradition of the ancient scribes until about 1000 AD. The manuscripts which they copied are the ones on which most of the printed Hebrew texts of the Old Testament are based today. During this period God was also preserving the Greek New Testament text through the copying practices of the monks.

When the printing press was invented, there was a solid tradition of careful copying; and also many old manuscripts were still available. The printed text of the Bible quickly became very reliable. In the past 300 years a number of significant Old Testament (e.g., the Dead Sea Scrolls) and New Testament (e.g., papyri which are copies of portions of John's Gospel from about 200 AD) manuscripts have been added to the collection. The printed text of the Bible is essentially word-for-word that which was written by the original authors. God has preserved the manuscripts long enough to make them available to those preparing the printed text.

Interestingly, he has also preserved them long enough for computer technology to become available. With this technology images of the manuscripts can be made. These images for all practical purposes are indestructible. Identical digital copies can be made many times, and spread throughout

the world. Long after the copies on papyrus and vellum have deteriorated, computer images of these manuscripts will be widely available. It seems likely that computer technology will make these manuscripts available "as long as the earth endures."

Another source of digitized Christian material has been prepared by Westminster Theological Seminary and Trinity Evangelical Divinity School. They have prepared digitized versions of the Hebrew Old Testament and the Greek New Testament.[105,106,107] At Westminster, they compared two computerized Old Testament texts to produce a 'cleaner' version, and then compared this version against a version edited in Israel. Differences in the encodings were compared against a facsimile of the Leningrad Codex and printed editions of the text. The end product is a machine-readable accurate version of the 4.5 million characters of the Old Testament. The long-term goal of the project calls for the morphological tagging of each word and encoding for syntactic analysis. This text will be available in the public domain at minimal cost.[108]

At Trinity Evangelical Divinity School, the GRAMCORD project created a computerized version of the 26th edition of the Nestle-Aland text. Each word was tagged with its morphological characteristics (for example the case, person, and gender of a noun). Although other computerized tagged texts exist (e.g., the Friberg Database based on the 3rd edition of the United Bible Societies text), the GRAMCORD system includes retrieval routines and analytical programs. The text and some of these tools can be purchased for $500. Additional work is underway to include the Septuagint, writings from Josephus, writings of a Greek writer not influenced by Semitic language or thought, and the text of some of the papyri.[109]

It is now possible to have a computer display the encoded versions of the Old Testament and New Testament text with a Hebrew or Greek character set. The text can be searched by the computer and displayed on the screen with the corresponding English text from a number of different translations. The *Christian Computing* includes in each issue a number of advertisements for PC-based products which provide these capabilities.[110]

The underlying encoding of the texts will be used by researchers. They will be able to study the patterns of word usage and sentence structure. This will be helpful in the debate over the authorship of books of the Bible. For example, researchers at Haifa's Israel Institute of Technology found that the documentary hypothesis (J.E.P.D) of the book of Genesis (which claims that four sources written over hundreds of years were assembled about the time of Ezra into the final form of the book) is not supported by computer analysis. The study based on over 50 criteria of language behaviour shows instead "that it is the work of a single writer and that the J.E.P.D theory must be 'rejected or at least thoroughly revised.'"[111]

Moises Silva of Westminster Theological Seminary has said that "some scholars in the humanities — and biblical students in particular — would argue that the greatest value of computer technology for their research lies in th[e area of literary analysis.]"[112] You may not be involved directly in this work, but you will see the benefits of it.

With the Greek and Hebrew Bible texts and texts of other ancient documents available from the econosis, a person will be able to do complex research and word studies. For example, he will be able to find all word usages (including compound structures such as all verses containing two identified words or word patterns) with a simple search command, and will not have to look through concordances and word-study books. Tools for this purpose are already becoming available for personal computers For example the HyperBible available for the Macintosh contains the text of the Bible, a chain reference, and an atlas.[113] Other products available for the IBM PC such as Bible Works, Logos, QuickVerse, and Bible Windows, include similar capabilities.

It will be possible to conduct a similar study on theological subjects of interest. You will be able to scan large numbers of books and articles to find anything written on the subject under consideration. Books that have gone out of print, articles in obscure publications, writings of the Church Fathers contained in expensive volumes, and up-to-date opinion, will all be accessible for inclusion in any research.

The econosis will change the nature of how we process information. The researcher/writer who has read* a lot will no longer be able to impress us with his long bibliography. In addition, the widely publicized opinions of one writer will not command as much attention. Everyone will have access to the same sources.

Because all source material will be generally available to all readers, it will become necessary to apply more critical thought to information being digested. You will find when you do your search, for example, Presbyterian writings on a particular subject, but also Roman Catholic, Lutheran, and Baptist writings (and even material from the cults). Initially, this will overwhelm many readers.

However, I think that when readers are confronted with opinions and ideas which vary widely, critical analysis becomes necessary. For example, the liturgical tradition to which I belong includes the exclusive singing of the Psalms in public worship, unaccompanied by instrumental music. Most evangelical Christians have no idea that this was the prevailing form of worship in most protestant churches in NA until the mid-1700s and in many denominations until late in the last century. Today the idea of exclusive Psalmody is seen as peculiar. If, however, all the material written on the subject were included in an econosis, many more Christians would stumble on the idea and begin to pursue the historical and theological perspectives of the matter.

The econosis is going to make it very difficult for any thinking person to ignore ideas beyond his tradition. As one writer in the Smithsonian has commented, the new media will likely open up a new way of thinking:

> The reasonably permanent inscribing and interpreting of word order is not just an affair of scribes, elites and ideologies, in other words. As the written memory grew and could

* Recall that I have argued that serious reading will essentially die out among the general population, and may die out even among intellectuals. When I speak of writing think of 'information dissemination' and when I speak of reading think of 'information gathering'.

> be called back for review, it opened a cognitive window on a new world of ideas.
>
> For all of the random noise and incoherence accompanying them, could our new capabilities for almost limitless information storage and retrieval have a comparable generative effect?[114]

With so many differing opinions fighting for recognition, Truth will stand above the crowd. The impact may be as great as when the ploughman in England was first given the Bible in his native language. The Holy Spirit may choose to use the econosis as the means of encouraging people to consider truth, and in so doing bring about a revival of Christianity and a reformation of the Church.

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8 — At the Feet of the Rabbi

The Senile Rabbi

Education is part of every organized community. It is the process by which a community passes to the next generation the traditions and concepts which are considered essential for that community's survival. The Church, as a community, is no exception.

Early in the Bible we read that handing on the traditions was considered to be an important part of true religion. The LORD said: “Abraham will surely become a great and powerful nation, and all nations on earth will be blessed through him. For I have chosen him, so that he will direct his children and his household after him to keep the way of the LORD by doing what is right and just.” (Gen 1.18,19)

From the days when the nation of Israel was being organized in the desert to the fledgling New Testament Church at the time of the Apostles, the members of the Church have been instructed to pass on the traditions to the next generation. (e.g., Deut 4.9,10, 11.19; Luke 1.4; Acts 1.1,2; II Tim 2.2; Titus 2.1)

That the purpose of education is to pass on the traditions of a community, seems to be self-evident. However, there seems to be increasing debate about even this fundamental *why* of education. To add to the complexity of the ‘problem of education’ there is also a great debate raging about the *how* of education. This can be considered from at least three different dimensions: material (content), method (philosophy, technique) and mode (format, structure).

Education reformers (from libertarian to Christian) may be concerned about one or more of these aspects of the *how* of education. For example, one reformer may be advocating that parents be provided with a choice of mode (e.g., private schools versus public schools), yet feel that a particular philosophy of education may be applicable to both the private and public schools. Or, a particular (Christian) educator may dislike the content (e.g., the theory of evolution) but accept the same philosophy and structure for teaching. Another reformer may be satisfied with the material which is taught but feel that it should be communicated in a non-traditional environment (e.g.. school's without walls).

There is confusion among educational reformers about how to solve the problems of education largely because they do not clearly distinguish among these different aspects of the *how* of education. And in fact they no longer have a clear definition of the *why* of education. It is probable that the main reason structured education (i.e., that provided in the elementary, secondary, and university programs) is in serious trouble is because it no longer has a clear understanding of why it exists. In addition, it is becoming increasingly clear that education today is using material, methods and modes that are inappropriate for the needs of our society and economy, and in many cases are

wrong both morally and didactically.

The roots for our current approach to structured education, are to be found in the monastery schools of the Middle Ages, and prior to that in the Greek model for training young men for public office. During the Middle Ages a standardized curriculum of seven liberal arts was developed. This curriculum has changed somewhat over the past 1000 years. For example, there is now a secondary emphasis on physical education and manual arts. Some courses have been dropped (e.g., Latin), some changed (e.g., rhetoric and dialectic), and others added (e.g., computer science). But these changes have been primarily in material (content) and not in method (technique) or mode (format). The approach to education is still largely structured around a formal setting where a teacher attempts to impart his or her knowledge to the students in a context removed from the dynamic of the world in which the knowledge is supposed to be used.

Changes have occurred in the past 100 years in the method of education as 'progressive' theories have come to prominence, but not as much in the material or mode. The formal development of these theories appears to have its roots with Rousseau (1712-1778). He advocated education based on a naturalistic approach which would allow children to learn 'naturally' through an interaction with their environment. These ideas were put into practice in various forms during the 18th and 19th centuries. Some elementary schools were organized around the concepts of experience and observation rather than verbalism and memorization.

These experiments have given way to philosophies developed from the writings of thinkers such as William James (1842-1910) and John Dewey (1859-1952). The approach to education which developed from their writings consists of two premises:

- Education is not preparation for life; it is life based on experience.

- Education cannot prepare for life unless it mirrors the realities of life.

According to this philosophy of education, the process of education, and the school, must reflect society in miniature. Thus education becomes a process of socialization through sharing and participating in group activities. This philosophy of education is at root flawed because there is no acceptance of moral absolutes and it makes no judgement about the culture but rather accepts is as normative. However, it is the next step taken in this philosophy which presents an even greater difficulty. According to this philosophy, the learning process must begin with the interests of the child rather than with subjects (content) imposed on the child as normative. The growth of the child is the end of education rather than a means to an end. Education has in theory no higher a goal than to help the child realize his potential and to become a socialized being.

Approaches to teaching based on this philosophy of education have been incorporated into North American school systems to various degrees, but have not proven to be successful. In fact it could be argued that this philosophy of education has been one of the major contributing factors in the decline of our public school systems.

From the early 1970s onward a great deal of dissatisfaction has been expressed over the declining quality of the schools in North America. James Coleman, John Holt and Ivan Illich were among the early authors who wrote about the failure of the schools and the need for radical changes. Some of their ideas were implemented, and a number of counter-culture adherents formed alternative schools or attempted home schooling. One author summarizes their concerns as follows:

> The major themes of radical criticism have centred around the political, social, and economic power of the school. One concern has been that public schooling under the control of a national government inevitably leads to attempts by the educational system to produce citizens who will be blindly obedient to the dictates of that government, citizens who will uphold the authority of the government even when it runs counter to personal interest and reason.[1]

Illich in his book *Deschooling Society*[2] showed clearly how the institutional schools are an extension of the prevailing humanistic philosophy underlying North America, and that their primary purpose is to indoctrinate students in this philosophy. He also showed that teaching is confused with learning, that drill for skill-development was no longer being practised, that schools were acting basically as 'baby-sitting' services to keep young people busy, that they were not giving young people useful skills for living and working in the 20th century, that society is 'schooled' to accept service instead of value, and that certification by the institutional system is considered of more value than any learning acquired outside of school.

Illich suggested breaking down the institutions and replacing them with reference services to educational services and educators-at-large, skill exchanges in which people would be willing to train others, and peer-matching networks for discussion and learning.

However true his critique, his proposed solutions would not have dealt with the real problem of the humanistic philosophies underlying our whole society. In addition, setting up reference and referral services in 1971 would have produced as much bureaucracy as is found in the public schools which they were intended to replace. Finally, his proposed free-for-all approach rests too much on the belief that man is inherently good. Illich expresses the view that if given an unfettered opportunity to learn, young people and adults (through continuing education) will naturally seek out the best education for themselves. This is naive.

Although conventional education theorists do not agree with the proposed solutions of the radicals, they nevertheless have had to admit that there are serious problems with the current approach to eduction. One writer in an article entitled *Deschooling? No!* states:

> Our schools are neither dead nor dying, but neither, unfortunately, are they marked by a degree of vitality and energy that befits the grandeur of their mission. Paradoxically, even ironically, the writings of those who would bury us may well stimulate ... an infusion of new life.[3]

Another has said:

> Ways must be found to break the lockstep, the system by which all pupils proceed at the same pace through the same curriculum for the same number of years.[4]

After more than 25 years of criticism of the educational system in North America, there has been little progress in improving the system. In spite of various attempted solutions — programs initiated by presidents, states, and provinces — and millions of words having been written on the subject, the problems are still with us and looming larger every day. It seems clear that the public educational system in North America is only a few years away from colossal collapse.

Some of the critiques of the current approach to providing schooling include the following:

- Schools are structured for a past era and are teaching content which is no longer relevant.[5,6]

- Schools are cheating our kids because they do not teach the basics,[7] or moral standards such as family values.[8]

- Schools are not teaching content which is needed for life in our (technologically complex) society.[9,10]

- Schools are using outdated educational methods and modes which turn off students.[11,12]

- Schools are not held accountable to normative curriculum standards.[13]

- Schools are plagued by too much bureaucracy and administrative overhead.

- Schools are designed for failure. They emphasize the attainment of credentials rather than real learning and achievement of skills. Their approach to education is designed around norm-based testing which means, by definition, at least half of the learners will be a failure, rather than around certification-based testing in which every motivated learner can be a success.[14]

- Schools fail to produce eminent achievers because the school environment is really oriented to socializing and not educating children. “Is it really a good idea to send your 6-year-old into a room full of 6-year-olds and then, the next year, to put your 7-year-old in with 7-year-olds, and so on? A simple recursive argument suggests this exposes them to a real danger of growing up with the minds of 6-year-olds. And, so far as I can see, that's exactly what happens. Our present culture may be largely shaped by this strange idea of isolating children's thought from adult thought.”[15]

- Schools need to be challenged to perform by the requirement that students be able to pass national (or jurisdiction-wide) tests to "counteract the *laissez-faire* approach of the sixties."[16]

- Schools are under funded. A series of articles appeared in *Fortune* magazine dealing with the problem of the schools. In one article, the author provided a summary of what business leaders at a workshop suggested were some of the ways to improve the schools in U.S. They suggested many things such as the involvement of business in community programs especially with children of single parents, better marketing of educational reforms, better text books and curricula, more effective use of television, a reduction of administrative positions in school boards, and nation-wide exams in core subjects. But the primary thrust of their conclusions seems to be that what is needed is provision of more money to provide up-to-date technology for the schools.[17]

  "Give us more money, and we will solve the problems of education," is the cry of many in the educational establishment. But it is clear that more money does not solve the problems in the schools, in fact it seems to be almost the opposite: the more money a school board spends per student, the worse the education that student receives.[18,19,20]

- State-run public schools do not have competition, and because of this have a monopoly on mediocrity.[21,22,23,24,25] Some critics of the schools who hold this view claim that if there were more competition, for example funded through a voucher program, there would be a marked improvement in quality in all schools. The *Edison Project* is an attempt to apply the belief that the best way to provide education is in a for-profit context. However, it is based on a *new age* philosophy and will likely be just as bad as what it is intended to replace.[26]

  Obviously there are many, including most members of the National Education Association, who feel that a plan such as the proposed introduction of vouchers is not what is required to improve education.

  Some Christian commentators are also not in favour of such a scheme. They argue that it would increase government control over education by making private religious schools subject to tighter government regulations.[27,28]

  Others such as Lewis J. Perelman, argue that to provide competition by giving students a chance to attend a different *box* does not go far enough.[29]

- Schools are thought to be ineffective because they were designed for an original mandate (e.g., as sorting centers for the labour market, or to actively promote the Christian religion) whereas these functions have become outdated, outmoded or even illegal and now schools are being called upon to carry out functions (e.g., to be caretakers and child-advocacy agencies) for which they were not designed.[30,31]

- Schools are in trouble because eduction theorists have paid too much attention to the process of

education and not enough to the *product* — students who meet specific threshold goals. Schools need to establish and meet these specific product goals which are defined in terms of their outcomes. But this concerns many Christians who see this as an opportunity for indoctrination in *new age* thinking of our morally bankrupt culture.[32,33,34]

- Schools are based on a system of knowledge transmission which rewards students who can memorize facts, or more accurately isolated *factoids* where there is no context for, or connection among, the pieces of information.[35,36]

Without a doubt publicly funded schooling in North America is in trouble. It suffers from bloated operational costs, is highly inefficient in providing learning to students, is not clear on what its purpose is, and suffers from the intrusion of government[37] (in ownership, compulsion, regulation and political manipulation). In addition current theories of public education (which deal with the method and mode) are grounded mostly on air. They are based on relativistic views of morality and a pluralism where all ideas are equally valid (except for those based on biblical morality), and they emphasize seeking rather than finding truth and self-realization rather than social responsibility. This is the reason for the cry for reform and renewal of the schools from every segment of society.

However, David Gordon, a self-confessed follower of Freud and Dewey, states that "to a large extent school self-renewal is an impossible idea."[38] He argues that it is impossible for a school [and by extension a school system] to step out of its system of paradigms and renew itself on a new philosophical foundation. His arguments are similar to those of Thomas Khun, who in *The Structure of Scientific Revolutions*[39] argues that existing paradigms are used to interpret all data, and filter out any data which does not fit within the established framework. New paradigms are not developed by self-renewal but through revolution.[40]

Into this chaos come communication and computer technology with their power to change radically not only the techniques of education but also the philosophy underlying it.

> Education is ... the last major activity in the western world yet to be mechanized. It is, essentially, hand labour, just as cloth-making was in the 1700s and farming in the 1800s. Because it is difficult to make profitable large-scale ventures out of hand labour, corporations have been content to let education remain part of the infrastructure. As mechanization in the form of electronics approaches, however, education will inevitably be looked upon as a potential commodity.[41]

The Sixty-Four-Thousand-Meter Question

The potential of the computer for creating a new approach to education and for supporting a new philosophy of education is enormous. The Electronic Highway, a conversational computer, and an econosis containing the world's knowledge base in hypermedia form will produce a revolutionary environment for education. This new environment will make the current approach to schooling as

obsolete as is the one-room schoolhouse.

It will be the Electronic Highway which will permit Computer-Aided Instruction (CAI) or hyper-learning to become widely recognized as an alternative approach to schooling. Fiber-optics cables will carry computer-based courseware from a 'school' (or econosis) to the students. A school will no longer need to be a place where students congregate, rather, it will be the source for courses, assignments and general information. In fact, teachers themselves will not need to be physically present either.[42] They will be able to communicate from their homes with students anywhere on earth.[43]

In Canada, Athabasca University has been operating, for a number of years, a program which uses satellite broadcasting to provide classroom instruction to students in the far north. In the U.S., the National Technological University (NTU) "claiming neither a campus nor a regular faculty" was formed a few years ago in Fort Collins, Colorado.[44,45] The NTU broadcasts via a satellite to about 1200 graduate-level engineers and scientists working at over 80 corporate sites. About one third of the broadcasts are live from courses offered at Boston University, Georgia Tech, Purdue and other universities. The rest of the courses are videotaped for delayed broadcast.

This approach to schooling is not significantly different from the use of videotapes for instruction. Videotaped courses have been available for a number of years in areas ranging from history and language training to auto mechanics and computer language instruction. But the use of TV broadcast and videotaped courses for instruction has had only limited success. Marshall McLuhan summarized the problem:

> Merely to put the present classroom on TV would be like putting movies on TV. The result would be a hybrid that is neither. The right approach is to ask, "What can TV do that the classroom cannot do for French, or for Physics?" The answer is: "TV can illustrate the interplay of process and the growth of forms of all kinds as nothing else can."[46]

Television has failed as a successful medium of instruction in schools for two reasons. First, the unique character of the medium has not been used to its potential.[47] TV can be used to blend the voice of a lecturer with animation or video sequences of historical scenes or physical experiments. Sound effects and visual effects can also be used to enhance the presentation. The result will be very similar to a well produced documentary. However, it is expensive to prepare a course in this format. The average school or university cannot afford to produce hundreds of documentaries. So, they fall back to video taping a lecture. A video tape of a dull lecturer does not make exciting viewing.

Second, TV is a non-participatory medium. It fails in the classroom as a medium for learning when it is used to deliver instruction through knowledge transfer.[48] Students generally do not find it to be an engaging environment for learning.[49] At least in a classroom students can ask questions or interact with the instructor through body language. A videotaped lecture rambles on as the student

becomes restless and then bored, unless he is highly motivated.

The Electronic Highway, in contrast, will make it possible to change the very nature of education. First, it will be easier to share the cost of producing expensive computer-based courseware over a much broader base, as it will be available from an econosis to thousands of students who will be charged a small fee for use.

Second, students will be able to interact with the instructor via the Electronic Highway (as has been proposed for schools in North Carolina[50]) through what is now being called 'distance education'.[51] Where the course is being made available live, students will be able to ask questions. Their images will be picked up by their video phones connected to their PCs and spliced into the broadcast image of the instructor as an inset frame. Where the course is not live, it will still be possible for students to ask questions via their conversational computer. The question will be routed automatically to a mail box associated with the course. An answer may be available immediately from artificial intelligence software which will search the knowledge base in the econosis, or from human instructors monitoring the courses being viewed. Or an answer could be prepared off-line and mailed to the student via the electronic network.

A prototype of the Electronic Highway applied to education, has been in use for a number of years. A consortium of seven school districts in Minnesota has been formed to share courses via a two-way TV system. Specialized courses such as foreign languages and advanced mathematics are prepared by one school district and made available to students in other districts. This gives all students access to a richer range of courses. Administrators in the school district are also able to use the system to hold their joint meetings, making long-distance travel unnecessary.[52]

Going beyond the use of two-way television, is a degree program at the University of Phoenix. This program offers bachelor's degrees through an on-line communications network. Students can attend the lectures in virtual classroom and contribute to the dialogue through their computers. Similar programs are offered by Purdue, Boise State, City University in Belleview, Washington and Nova University in Fort Lauderdale.[53,54]

The Electronic Highway and the conversational computer have the potential to change the nature of schooling.[55,56] In twenty five years it is likely a majority of students may be learning in home schooling environments.[57] They will be receiving much of their instruction over the Electronic Highway.[58]

The Computer as Tutor

The impact of the Electronic Highway and the conversational computer alone will be great. But far greater will be the impact of the conversational computer communicating over the Electronic Highway, and accessing computer-based courseware in hypermedia form from an econosis. Until recently much of the available courseware has had only limited. The software has been somewhat

simplistic (e.g., spelling games and math quizzes) and has not had access to very fast computers with sufficient amounts of memory to supply a depth of information. “Critics of new information technology point out, with some justice, that the new courseware available so far for use in the new machines is inadequate in quality, quantity, and variety.”[59]

The IBM Personal Computer appeared just over ten years ago. Since then there has been a dramatic increase in the number of schools and homes with IBM PCs or PC clones (using the same operating system as the IBM PC), or competitors such as offerings from Apple. In 1981 18.2% of the schools in the U.S. had microcomputers. By 1985, 92.2% had them.[60] The current rate of penetration is probably approaching 100%. But are the schools using the computers, and how are they using them? A ratio of one computer per school or even one per every fifteen students makes a computer nothing more than a novelty, and not an integral tool in the learning process.

The lack of vision with respect to the use of the PC in education on the part of most teachers and educators, is a key reason for why the thousands of computer-based courseware offerings are largely ignored and under utilized. Because the market is so small, the production of courseware is still in its infancy. Why is it that computers and automation have been incorporated intimately into most other aspects of human endeavour from the office environment to games for children, but have been relegated to the back corner of the typical classroom?

The main cause is not the lack of money. It is the lack of competitive advantage for schools to acquire computers and computer-based courseware. The current system of education favours the inefficiency of the Middle Ages, and has not “changed discernably since the Venetians taught fractions to groups of mercantile students in the mid-15th century.”[61] The educational bureaucracy seems to measure success purely in terms of the amount of money it can spend, and has little incentive to become more productive. In turn there is little financial incentive for companies to produce courseware.[62]

When the bloated publicly funded educational system crashes on the heads of its administrators, there will be a mass movement in society toward creating a totally new system of education which will be more productive and efficient in providing useful training. At the foundation of this movement will be the computer and computer-based courseware. In the next twenty five years we can expect to see developments in courseware which will dazzle even the most hardened sceptic.

There are a number of ways in which the computer is better suited as a tutor than is a human. The computer has unlimited ‘patience’ and can continue presenting exercises, examples and tests at the student's own pace, until the student has mastered a particular skill. Computer-based courseware can be designed to vary the pace and direction of a course. It will repeat areas where the student is weak until they are mastered, or will jump over sections if the student is moving quickly. This will provide individualized instruction, providing the equivalent of a private tutor. Courseware using artificial intelligence and knowledge rules for decision making can incorporate the “best judgement and total experience of the world's best educators.”[63]

In addition, a computer does not 'forget'. Computer-based courseware can draw upon a massive file of exercises, examples, or test questions best suited to the needs of the student. For example, a courseware module could have 10,000 carefully formulated algebra problems with detailed explanations of the problems and how to solve them. These could be graded from simple to complex and made available to the student as needed. The average teacher/textbook combination could not compete with such courseware.[64]

Computer-based training can outperform most human instructors in many ways. For example, a system has been developed at Technion-Israel Institute of Technology in Haifa which can be used to help the deaf learn to speak clearly. The system includes a device which displays graphically the pattern of a word or phrase spoken by the student. This pattern is compared with a correct pattern, and deviations in pitch, pronunciation, intensity and frequency of vocal sounds are displayed. By repeated trials students can make their spoken communication conform to the correct visual pattern.[65]

Computer-based courseware can be grouped into the following categories of usefulness:

- **Drill and Practice** — The computer presents drills to reinforce what has been taught in the traditional way, or is used independently to learn a new skill.

  Examples: spelling tests, math quizzes, tonal matching when practising singing, learning to play a musical instrument through a MIDI interface (e.g., Note Play and Play it by Ear), typing exercises (e.g., Typing Tutor and Mavis Beacon Teaches Typing), geography tests where a map is displayed and the student is asked to point to a country or ocean, etc.

  A controlled study at a school in Pittsburgh, of the use of computers to teach math with the aid of a computer (as a central resource), showed that students tended to spend more time at their work (coming early and staying late) and were more engaged in learning math. In addition the study showed that the teacher spent more time with each student and especially with weaker students.[66]

- **Tutoring** — The computer presents a course of study and asks questions at appropriate stops in the material. It branches to in-depth review as necessary or skips to new material as the student masters what has been presented. Using hypermedia the computer would be able to present text, pictures, maps, voices, music, sound effects, animation, and video images.

  Examples: self-paced automobile repair; geometry, statistics algebra, trigonometry, or calculus (e.g., the Platinum Set); grammar; history or language courses (e.g., Transparent Language).

  Arthur C. Clarke in his sequel to *2001*, *2010* saw the potential of computer-based coureseware for teaching languages:

> The young Russian spoke the slow, careful English of a student who had had more lessons with an electronic tutor than a human teacher.[67]

- **Games and Simulations** — These allow the student to experiment without having real consequences on the environment, and to learn by playing.

  Examples: flight, automobile or other equipment simulators, computer software code walkthroughs,[68] counselling case-studies or scenarios, stock investment games, urban planning (e.g., SimCity) scientific experiments, games such as chess or backgammon.

  One author has indicated that using a computer simulation game such as Life[69] students can learn to:

  - define a problem
  - distinguish between assumptions and observations
  - make observations
  - verify observations
  - make tentative explanations
  - make and test predictions
  - revise an explanatory system.[70]

  "If there were good simulation building tools available, instead of reading about physics, students could build simulated rocket ships, or instead of reading about democracy, students could try running a country."[71]

- **Problem Solving** — The computer can be used by students for creative problem solving. While solving problems the students will be learning in an integrated context.

  A notable example is the *Jasper Series*. In the *Adventures of Jasper Woodbury* problems are presented to the student such as an emergency call coming in to rescue a injured eagle from a mountain side. Learners must use a number of mathematics skills to come up with a creative solution to the emergency. They need to be able to calculate the amount of fuel it would take to get a light plane to a nearby meadow and what weight it can carry. They need to compare this option with others such as going in by jeep. Time and distance calculations are necessary.[72]

  In this learning situation concepts are learned as tools and as by-products of the learning process rather than as arbitrary facts. There are now a number of episodes in the *Jasper Series* available on video-disk which provide opportunities for using algebra, statistics and geometry.

  Another example of a software tool that falls into this category is the popular game *Where in the World is Carmen Sandiego?* Many teachers are 'sneaking' this game into their classes because they find that it gets the kids interested in learning facts about geography while helping them

learn problem solving strategies.[73]

- **Dialogue** — Artificial intelligence systems can carry on conversations in a Socratic mode. They can present large bodies of information and query students on this information. Or the student can ask questions and be led into new areas of discovery.[74] The computer can analyze the logic used by students, assess their understanding or their knowledge and direct them to areas where they are weak or need additional study.

  On the Electronic Highway students can collaborate on work and share their experiences world-wide. Some American students at the elementary level have been using the Internet to communicate with students in England and in Russia.[75] Communicating on the 'net' has far more appeal to children today, than does letter writing, and yet it accomplishes the same purpose.

  Another instance of the use of the Electronic Highway was in the *Eratosthenes Project*. A number of students around the U.S. participated in this project to measure the circumference of the earth. By measuring the angle of the sun at exactly the same time in various locations they were able to obtain accurate data for the calculation.[76]

- **Discovery** — Using hypermedia in an econosis students can explore the world's knowledge base either in structured or unstructured mode. They will have access to powerful query, searching, abstracting, sorting, and processing utilities which will make the process of learning and discovery almost as exciting as the exploration of a new continent or a distant planet.

  An excellent, although already dated, example of a discovery tool is the *Beethoven* product developed by Robert Winter and distributed by Microsoft. It is a CD product with a recording of the 9th Symphony, images of the score, and commentary. *Encarta*, another product from Microsoft is an interactive encyclopedia which encourages learning by 'wandering around'.

  So many other titles are now available that a large catalogue would be needed to list them all.

- **Creative Work** — A computer can be used for analysis and creation of original work in art, literature, and music. The machine can help teach perspective drawing and explain the concepts behind isometric projections. Artificial intelligence programs can be used to show thousands of pictures by masters with an analysis of them (e.g., the focal point, perspective lines, use of colour, shading, etc.) In addition, students can use their computers to create their own artwork.

  A computer can also be used to present an analysis of written or musical compositions. Students can also use their machines to write essays, books, newspapers, and journals and for musical composition.

CAI Anxiety Syndrome

Teachers in general have not been very supportive of the concepts behind computer-aided instruction. And to a large extent the lack of use of computer-based courseware is due to the fact that the courseware has not been able to get past the 'gate-keepers',[77] the teachers who seem to have a vested interest in keeping technology out of their classrooms. "Criticisms are rife among teachers, at all levels."[78] Their criticisms can be summarized as follows:

- The writers of courseware are generally not educators. Teachers and students have not been involved very often in the preparation of the software.
- The courseware has little relationship to what is taught in the schools.
- The content is not kept up-to-date.
- The courseware is of poor quality and does not sustain student interest.[79]
- There is not enough variety in the offerings.
- Computers in classrooms have brought a lot of frustration, there is no reason now to believe "the promise of a technology miracle."[80]
- There is a serious lack of standards for copyrights and portability, making it difficult to get sufficient copies and to operate them on different machines.
- The courseware does not take full advantage of the medium.
- Programmed instruction is dehumanizing.
- There may be an over-dependence on mediated learning.[81]
- There may be increased educational elitism among those who have courseware against those who do not.[82]
- The public educational system may be weakened by students' access to educational opportunities outside of the schools.[83]

Many of the complaints made by teachers about computer-based training are currently valid. However, some of the complaints are similar to those heard among other groups of employees as they were first experiencing automation in their industries. David Hawkridge in his book *New*

Information Technology in Education stated: "Teachers' unwillingness or inability to change roles when new information technology is introduced is paralleled by similar attitudes among industrial workers, office staff, farmers, priests and many others."[84]

There is now a lot of computer-based training and educational courseware available. But as yet it is seen as an inferior adjunct to the educational process rather than as an important independent means of education. This attitude to the role of computer-based training is similar to that toward the book when it was first introduced. "In the past ... the creation of the book was considered an impediment to education because it broke the pattern of memorization and personal ownership of knowledge represented by the Socratic tutor. Few would now consider general education viable without books."[85]

Putting In the Beef

Eventually the computer will fulfil a major role in education, and may actually replace many teachers, or change their role significantly.[86,87]

> Teachers have roles as providers of knowledge, diagnosticians, tutors, judges of achievement, disciplinarians. ... New information technology may change that situation, putting students in control and asking new roles of teachers as technicians, selectors of course ware, individualisers of instruction, managers, schedulers and advisers.[88]

> Where are the teachers? They are in school, working with small groups and meeting with individual students. They are teaching courses that do not lend themselves to technology-mediated instruction. They are supervising mentors. And they are developing new curricula. Teachers remain the heart and soul of the institution ...[89]

> Bill Graves, Director of the Institute for Academic Technology at Chapel Hill, compares the teacher's new role to that of a guide: "Learning becomes an exploration — like a rafting trip. You're the explorer, and you have along a guide who has organized the event, and lines up the resources — the equipment and the maps."[90]

This role change may be hard for some to believe and accept. But if present trends continue, teachers will soon be looking for new jobs, if they have not adapted to CAI. Computer-based courseware will replace many of them because it can do at least as good, and in many cases a better job of teaching than can most teachers,[91,92] and at a lower cost. For example:

> [T]here's a growing volume of hard evidence that shows that heavy doses of interactive multimedia delivered in schools can dramatically raise reading and knowledge levels ...[93]

At one conference for manufacturers of compact disks, one commonly heard complaint was "Where's the beef?" The developers of interactive compact disk products were promising interesting uses, but "when pressed for descriptions of early CD-I products, the software developers fell back again and again on vague generalizations — 'creative products with vision.'"[94] This criticism applies mainly to CD-I products targeted for the entertainment market, but the need for creative products with vision applies also in the computer-based courseware field.

There is a lot of software available for the educational market. Hardware manufacturers (e.g., Apple and IBM PC), software manufacturers (e.g., Microsoft), book publishers (e.g., Grolier) and entertainment companies (e.g., The Children's Television Workshop — the producer of Sesame Street) are all producing computer-based courseware. As the market for courseware grows, many new jobs will be created for people who can prepare and maintain quality courseware. The preparation of courseware will require a large work-force of creative and skilled personnel.

The role of teachers will change early in the next century. Some will be employed as preparers of computer-based courseware. These 'teachers' will first have to determine the best ways of meeting the needs of students.[95] Then they will have to prepare courseware using the full potential of a hypermedia environment. This will require creativity, skill in organizing and communicating information, and skill in all types of media.[96]

Others who would have become teachers will become instead advisers to students. They will help them pick the best computer-based courseware for their needs, and will be available to answer questions which go beyond the capabilities of the software. In addition, they will develop means of assessing the capability of courseware, and will provide feedback on the success of courseware to the developers.

The role of teachers will change over the next twenty five years. For those willing and able to adapt to CAI, there will be new opportunities in the field of education.

Mount Ebal

CAI will permit students to learn at home and at their own pace,[97] if they have the discipline.[98] This will undoubtedly result in problems because of the general lack of discipline among young people, and the lack of educational structure in many homes. In addition their being at home (i.e., not in school) could lead to additional social problems. Our society is structured around having most children up to about age 18 'locked-away' in school for 9 months of every year. Many parents would not be able to cope with having their children around all day. This problem would be compounded if the parents also begin to work from home.

Computer-based courseware would permit most students to acquire a year's worth of education in a couple of months. This would produce a population of children and teenagers with unstructured free time. Our economy is not organized to provide employment for people in this age-group, nor are

there currently other ways to keep them busy.

In general:

> CAI promises to break down the lock-step approach to learning wherein all learners, grouped by age instead of by aptitude or achievement, learn the same material at the same pace. But this promise may cause problems the experts don't foresee: CAI threatens the traditional role and authority of teachers, threatens the institutional role of children, threatens the modern routine of family life ordered around a nine month, full time involvement by offering children the possibility of learning at home whenever they please. CAI still has a large mass of societal inertia to overcome.[99]

Because of the chaos which could result under this scenario, the humanistic and atheistic school boards may actually strengthen their hold on children. Legislation will be 'required' for keeping children 'off the streets'. This legislation will appear under the guise of providing social contact and social skills for children.

> Even if the cable replaces the schoolroom so children can be taught at home, the kids will have to go to school two or three days a week just for the social contact.[100]

> Education (and society) will exploit new information technology selectively, not universally and indiscriminately. Many traditional values, such as personal contact between teacher and learner, will be upheld ... Schools will not be deinstitutionalised ... because children will still need them and so will their parents.[101]

Thus, the most significant factor which will cause resistance to CAI will be the fact that most people in western societies want the schools to play 'nanny' to their children. Most mothers are no longer at home to be with their children, and most parents could not cope with their children being home most of the time.

Another problem is that CAI will increase the amount of learning that is done through mediated means. At present, the average child spends a considerable amount of time learning from TV. With CAI the computer display will become the primary means of education. Learning by doing and by seeing reality will become less common. "What will happen as educational spending is **shifted** from other areas? Some fear that children will grow up imagining that the only **significant** information is the kind that can be stripped from a text, stored on a database, and retrieved. What of narrative, fiction, poetry, and the spiritual dimensions of life?"[102]

The Church may have a role to play in finding ways to employ children and teenagers in activities which provide them opportunities for social contact, learning by doing and the challenge of meaningful pursuits. For example, as the population ages over the next twenty five years, there may be opportunities for children and teenagers to be actively involved in geriatric outreach programs. This would provide young people with useful 'educational' activities and help reduce the loneliness

of the elderly.

A lot of thought must be given to the coming impact of CAI on education and society. There will be an impact whether or not we want to face it. The Church should be at the forefront shaping and guiding this new adventure.

Mount Gerizim

The three areas in which the Church will benefit from the application of CAI:

- The increasing availability of high-quality computer-based courseware.
- The use of distance learning.
- A dramatic re-evaluation of the nature and role of education in our society.

Sunday School computer-based courseware is available which can be used for instruction of youth.[103] This material currently includes drills, quizzes, games, stories, and tutorials. As courseware becomes more common, it will be used by the Church for providing the best of Bible instructional material to anyone on the Electronic Highway who wishes to access the material.

The availability of a broad-range of Christian computer-based courseware may mean that average Christians will have a better understanding of the Bible, theology, and church history than they do at present. It may also provide non-Christians with an opportunity to learn about the Bible and Christ in what they consider to be non-threatening ways. It may be that the Holy Spirit will use courseware as a means of bringing many into the Kingdom of God.

Those wishing more in-depth material will have access to advanced computer-based courseware at the Bible school or seminary level. For example, courseware is available to assist those learning the biblical languages.[104] This general availability of theological educational materials will have at least two effects. First, it will increase the level of serious consideration of theology. Second, it may provide alternatives to the current approach to seminary training:

> There is nothing wrong with this ideal [a well-trained ministry], but it has always been seriously flawed in its Calvinist version: a *bureaucratically trained, academically certified* ministry ... The theological seminary as an institution is a dinosaur ... The institution has outlived its usefulness in its traditional form ... Formal certification is the today model for all education ... This worship of academic certification has always been the weak link in Calvinism as an institutional phenomenon ... Almost everything that a seminary imparts academically could be achieved much more effectively by a notebook computer and a 5-inch CD-ROM laser disk that contains 350,000 pages of printed materials ... Requiring students to come to a central campus is ridiculous. This requirement tends to eliminate married men with families — the people specified by Paul as those qualified for the pastorate.[105]

CAI on the Electronic Highway will permit those working in other professions to pursue a theological education from their homes at times convenient to them. Some schools are already providing computer-based theological education[106,107] and "[m]any of the 224 members of the Association of Theological Schools (ATS) are investigating how to use new technology in educational settings."[108] This will make the qualification of pastors more dependent on godliness and the ability to preach than on educational certification.[109]

Although the Church will probably find CAI useful for biblical instruction, many Christians may be more concerned about the impact of CAI on general education. They will undoubtedly agree with many of the criticisms of the public school system presented earlier in this chapter. Both the libertarians and Christians[110,111] have identified the same problems, even though they start from different philosophical bases. Unfortunately, the libertarians (and many Christians) have ultimately no better a solution than the conventional educational theorists.

As educators have argued among themselves in the twenty years which have passed since Illich wrote his book *Deschooling Society*, the public school system has become more tightly controlled by government, and has continued to deteriorate. During this period evangelical Christians have been very active in forming separate schools and in home schooling. But this has not always gone smoothly.

You may have heard of the problems in Nebraska, in some counties in Michigan and in other states where Christians have been harassed for opting out of the public school system. Also, you have probably heard some of the debates about whether tax money should be used to provide vouchers for students enrolled in private (religious) schools, or whether a person should have to pay taxes to fund the public schools while the children are enrolled in private schools. From a Christian perspective, the stranglehold of the government and public school system has tightened beyond acceptable limits. Some Christians are advocating non-violent and (even violent) civil disobedience.

I believe that CAI may provide an opportunity to break the stranglehold of a humanistic government and school system. Here are some ideas on how the CAI is going to change radically the nature of education as we know it:

> But what if there were a third way, one that does not rely on permission or tax dollars from the government, or large amounts of private money to subsidize non-public education? I have seen the classroom of the future, and it is in space.[112]

> Many believe that the new information technology will be cheap and will so increase opportunities for learning ... that existing educational systems will be irreparably damaged, even rendered obsolete. Learning will be moved, to a far greater extent than at present, from schools and colleges to homes and places of work.[113]

> Technology can make life-long learning a reality. With electronic tools, people can learn virtually anytime and place they chose without obstacles such as poor transportation, fear of street crime, or lack of expert teachers. Technology makes learning a private and personal experience and seems to motivate learners.[114]

> Used well, [educational] technology presses for longer and flexible work periods, more complex relationships among the disciplines in learning, the creation and maintenance of considerably more diverse and personal relationships in and outside the school, and activity structures which necessitate management skills unfamiliar to many.[115]

In fact, CAI is going to make necessary a reevaluation of the fundamental questions regarding the purpose of education, the philosophy of education, the best methods and techniques to be applied, and who should be responsible for education — parents or government-controlled school systems.[116,117,118] All this will take time since reorganizing (or dismantling) the existing public school system to utilize fully the educational resources of technology will require vision and persistence, and involves much frustration fighting the political and education establishment.

James Coleman, writing in 1972, did not then see how computer communication and CAI could have an impact on education and the schools. But he still understood from the trends that he saw then, that electronic media would reshape the purpose and role of the school.

> Throughout their history, schools have been the community's gateway for information. Schools have been a source of, and guide to, books — and books were the principal door to the world beyond one's own experience ... Schools as they now exist were designed for an information-poor society, in part to give a child a vicarious experience through books and contact with a teacher. Obviously that function is altered radically by television, radio, and other media outside the school ...

> Two aspects of the communication structure of information rich, open societies are destroying two classical functions of the school. Information richness removes the functions of the school in extending the child's horizons through vicarious experience; and information pluralism removes from the school the function of shaping the child's values through selectivity.[119]

Christians can have an opportunity to shape the philosophy and content of education under CAI. If they can formulate a biblically-based philosophy and get on with the production of computer-based courseware, they will have an opportunity to have a Christian influence on our culture.

> Free men do not wait for the future; they create it. The difficulties and problems in that venture are to them not a hindrance but a challenge that must be met. Those critics of the schools who wait for the state or society to act work on the same premise of the primacy of the group. The futility of their cause is thus foreordained. Free men do not look to the state for the opportunities and results of freedom.[120]

A key question is: who will take the leadership in the creation of biblically based CAI environment for learners of various ages and learning needs?

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9 — A Rumble of Thunder

Dominion of the Machine?

In his novel *Erewhon*, Samuel Butler (1835-1902) describes a hidden culture which had been ahead of Europe technologically, but had revolted against a society dominated by machines. After the revolt, the Erewhonians had settled into a society which no longer permitted the use of machines with a complexity greater than machines found in the late Middle Ages. In a series of chapters containing excerpts from the Erewhonian book called *The Book of the Machines*, Butler outlines a debate which was current in late 19th century England. This debate centred around the nature of the machine and whether or not the machine can be considered to be 'living'.

Writing in 1872, Butler says:

> I would repeat that I fear none of the existing machines; what I fear is the extraordinary rapidity with which they are becoming something very different to what they are at present. No class of beings have in any time past made so rapid a movement forward. Should not that movement be jealously watched, and checked while we can still check it? And is it not necessary for this end to destroy the more advanced of the machines which are in use at present, though it is admitted that they are in themselves harmless?[1]

> The lower animals progress because they struggle with one another; the weaker die, the stronger breed and transmit their strength. The machines, being of themselves unable to struggle, have got man to do their struggling for them: as long as he fulfils this function duly, all goes well with him — at least he thinks so; but the moment he fails to do his best for the advancement of machinery by encouraging the good and destroying the bad, he is left behind in the race of competition; and this means that he will be made uncomfortable in a variety of ways, and perhaps die.[2]

> Complex now, but how much simpler and more intelligibly organised may it not become in another hundred thousand years? or in twenty thousand? For man at present believes that his interest lies in that direction; he spends an incalculable amount of labour and time and thought in making machines breed always better and better; he has already succeeded in effecting much that at one time appeared impossible, and there seem no limits to the results of accumulated improvements if they are allowed to descend with modification from generation to generation ... This is the most alarming feature in the case.[3]

Over one hundred years ago Butler addressed an issue which is almost as controversial today. Will machines (computers) become so 'intelligent' that they will replace mankind as that component of the created order which has dominion over the rest of the created physical realm?

Butler wrote *Erewhon* shortly after Darwin (1809-1882) published his book *The Origin of Species* (1859) and was influenced greatly by it. He seems to have held a mechanistic view of life. As a result, he could not distinguish between the inanimate creation and the animate creation. This led him to the conclusion that eventually machines would replace mankind.

This view is prevalent today among many who hold the same philosophy. They believe that soon we will have computers which will have enough intelligence that they will be able to take over the world. Science fiction writers have often dealt with this theme. A familiar example is the computer HAL in Arthur C. Clarke's *2001 A Space Odyssey*. HAL sabotaged the space voyage beyond Mars and took over the ship.

The belief that computers will soon replace man is based upon a mechanistic and evolutionary view of life. This viewpoint holds that man is only a small step in the chance evolution of non-living non-rational matter into living and rational beings. According to this view, the process of evolution continues. The next steps of evolution will eventually result in the replacement of carbon-based intelligence (mankind) with silicon-based intelligence (computers). But this evolutionary and mechanistic view of life ignores the fact that God created man as a unique being and endowed him with special attributes, including a rational soul which cannot be fabricated in the material realm.

As man cannot be greater than his creator, so machines will never be greater than their creator. Therefore, as Christians we do not need to be concerned about a future model of computer which will become animated, have a will of its own, and conquer man. Our concern rather should be focused on the role of the computer in society and the impact its **use** will have on humans and on the Church.

We must be concerned about how men will use their machines rather than about the machines themselves. The Erewhonian ‘solution’ was to outlaw machines. This ‘solution’ is not found just in fiction. It was the approach of followers of a man named Ned Ludd. The Luddites, around 1810, attempted to stop the industrial revolution by destroying machines in the hosiery and lace mills in Nottingham and in several other English cities. The Luddites ‘solution’ failed, as does this same ‘solution’ when applied by postal workers or printers who destroy equipment in an attempt to stop change.

Our approach to the information revolution as Christians must not be that of the Luddites who feared both change and automation. Rather our approach must be based on wisdom, guided by the following principles:

- We should be infected by a spirit of optimism. We must always remember that the Sovereign God is in control of all the events of history. The computer and the tools of the modern communications network were invented under God's providential rule. He will never permit man to exercise evil to the depths of his depravity, and use these tools exclusively for evil. God will turn these inventions of man into instruments which he will use to crush the head of Satan. God

always gets the last laugh. “The One enthroned in heaven laughs; the Lord scoffs at them.” [Ps 2.4]

- We must take responsibility for events in this world. “From a Christian perspective, we are ultimately responsible to our Maker for the way we live. What AI [Artificial Intelligence] tempts us to do is to sidestep that responsibility by passing the burden to the machine.”[4] As Christians we must maintain the balance between God's sovereignty and our responsibility.

- We must acknowledge that most inventions from the hand of man have both good and bad dimensions. Because of God's general grace, unregenerate men are able to invent useful tools. However, because of the stain of original sin infecting the inventor, inventions always have a dark side to them. But in the hands of Christians guided by biblical principles, the tools of man can be of great service for the Kingdom of Christ. Christians should capture for Christ all the inventions of men, which are not inherently evil, and put them to work for the cause of Christ and his Church.

- We must face the fact that every aspect of the 21st century world will be dependent on computers. Christians should be the trend-setters in the application of this technology, rather than spectators being passed by. By their example, Christians should demonstrate to unregenerate men the way to exercise a proper dominion over the created order.

- We must not become so infatuated with new technology that we forget our primary purpose, which is to “glorify God and to enjoy him forever.”[5] “The danger of grasping new opportunities in telecommunications is that we get sucked into silicon idolatry.”[6] We must resist ‘silicon idolatry’ and see the computer as only a tool, and not as our saviour.

If you are a Christian, there are a number of specific ways by which you can apply these principles and capture the computer for Christ. Some of these are identified in the following sections.

Ring Liberty's Bell

Governments will attempt to control computer and communication technology as they discover the ‘dangerous’ ways in which this technology can be used:

> Computer technology, despite its image, is now essentially radical; it tends to decentralize; it is best fitted to the individual and the community. ... The centralizing forces will have to work hard against the natural imperatives of the technology in order to neutralize its potential for a rebirth of individual and community control over information and education.[7]

The Electronic Highway will soon be carrying an incredible variety of information from, to, and about North Americans. It will carry personal and business communication, customized electronic news journals, data bank queries and educational information, consumer shopping orders, invoices and electronic transactions, and personal medical records. All of this information, in theory, could be made available to government monitors of the Electronic Highway. “It requires little imagination to see how a totalitarian government could pervert the achievements of the information revolution into the omnipresent and irresistible instruments of control for a self-perpetuating fascism.”[8]

The totalitarian and socialistic tendencies of humanistic governments will cause them to develop, or mandate, means for controlling and monitoring the free flow of information on the Electronic Highway. In the U.S. for example, the FBI is very concerned about the difficulty of tapping multiplexed, digital, and fiber optics phone lines. They have requested legislation that would require all telephone equipment to be designed so that they can tap any conversation.[9] Similarly, the National Security Agency has been putting a lot of pressure on the U.S. Government to restrict the use and sale of encryption devices which would permit private parties to interact without the fear of electronic monitoring.[10,11]

Some of the arguments with respect to government monitoring of the Electronic Highway have merit. For example, electronic transactions between drug dealers could be tapped and used as evidence against them. But the arguments defending the maintenance of the privacy of personal communications seem to out-weigh the government's ‘need to know’.

The fact that so much private information is being carried on the Electronic Highway leads many to fear that privacy is essentially no longer something that citizens can expect.[12,13,14,15,16] The possibility that governments will try to regulate the free flow of information on the Electronic Highway should be a concern to all of us. But what concerns me even more than the possibility of regulation by government, is the lack of concern shown by most Christians. The fight for privacy on the network seems to be left largely to organizations such as the Electronic Frontier Foundation, which appears to take an essentially libertarian viewpoint. Where are the Christians who are concerned for maintaining the rights of personal privacy within the balanced context of laws which are based upon God's law?

I believe that Christians should ‘fight’ for communication freedom on the Electronic Highway. This freedom will help to ensure that truthful information can be made available even when there are many who wish to suppress the information. For example, the global E-mail networks, which are currently very difficult to control by governments, were used recently to disseminate information contradicting official propaganda. This was the case in the former Soviet Union, China, and Serbia and Croatia,[17] where alternate accounts from the official government ones, were made available to the West via E-mail and FAX.

We should encourage our elected representatives and their appointed agencies to disallow regulations which hinder the free flow of content on the Electronic Highway or which permit monitoring of the content on the highway. We should take this stand because the “free flow of information can be most hazardous for an authoritarian regime.”[18] The free flow of information is

essential for the proclamation of the Gospel.

There are ways in which you can help to prevent an abuse of the Electronic Highway by governments. One way is to use the network as soon as feasible for all types of communication. The more the network is used, the more difficult it will be for the government to monitor or control the information flowing through the network. The newspaper publishing industry in the West provides an example of this. "The newspaper and other forms of publishing had become so tightly held within the mechanisms of an industrial economy that governments felt it possible to loosen their grip upon an industry that was already too prolific to be supervised completely."[19]

Any government desperate enough to control every means of communication of its citizens could remove or strictly licence the installation and use of telephones. But as the numerous other devices which use the telephone network (or Internet), proliferate this control will be made excessively difficult, for example:

> If the Net is ubiquitous, affordable, easy to access, tunnelled with encrypted passageways, and based on multiple competitive channels, no local tyranny will be very effective against it.[20]

> Totalitarian regimes cannot exist without full control of information, but it is impossible to control information when you have tens of thousands of personal computers, modems and faxes.[21]

> Conservative activists in the United States have discovered that the route to power travels along the information super-highway ... [T]here's no doubt that many more conservative messages are zipping around the country ... [T]he spirit of empowered conservatives seem to be summarized best by a caller from Clarksville, Ark., who proclaimed: "I thank God every day for Net."[22]

> [E]ach assault on freedom-of-the-Net will breed technical work-arounds. Cybercrats can't ourfox cypherpunks [sic.]. ... The information revolution will transform the politics of power just as surely as the broadcast media did 70 years ago. Only this time, power will devolve back toward its sources, not inward toward demagogues seeking to gather it. The net will subvert the centralized economic and social control mechanisms tat allowed the great welfare-warfare states of the 20th century to dominate our commerce, our psychic landscape and even our definition of who we are. [23]

Therefore, you should not resist using E-mail and other forms of electronic communication. These new forms will be upon us soon, and will become as common as the telephone is today. Instead of resisting (for whatever reason), look for opportunities to maximize the diversity of communication media you use, and thereby make it that much more difficult for governments to limit your ability and freedom to communicate.

"When a technology is new, we cannot foresee its social and environmental effects. But by the time they become apparent, it is too late or too difficult to do anything about it."[24] However, as Christians we know that the natural inclination of man's heart is to use technology for evil. Therefore, we know in general what are the consequences of giving an authoritarian regime unlimited licence to control the communication of its citizens. Therefore, another way you can help to preserve the freedom of communication is by becoming more aware of the role and work of the CRTC and FCC and other bodies regulating communications in North America.

You should take the time to understand the importance of maintaining an unregulated, truly competitive, service-supplier industry.[25] "It is critically important that the Electronic Highways ... be open to everyone."[26] Where possible, you should become involved in establishing government policy.

Especially important areas for you to consider are listed below.[27,28,29]

- **Equality of Access** — Anyone should be permitted to use any devices connected to the network, to send information to anyone else on the network without interference of any kind, and to provide any kind of information without interference.[30] How can governments be constrained so that they don't limit freedom of access to the Electronic Highway? How can private interest groups be controlled so that they do not limit access?

- **Non-Discriminatory Tariff Rates** — Rates for the transmission of information should be consistently and fairly applied on the basis of published rates. How will charges be defined, for example, by number of bytes (characters) per kilometre per time unit or by source of content? How can competition among carriers and equipment suppliers be encouraged to ensure low costs?

- **Content/Container Separation** — The supplier of the network should not be involved in the definition or specification of the content of the information which may be sent across the network as this may stifle both competition and free speech.[31] This separation is not currently practised in most TV networks today, making it difficult for certain parties to gain access to TV time. Should there be a monopoly supplier? Who will ensure that sufficient band-width or frequencies are made available to allow the free flow of information?

- **Privacy of Communication** — The content of information transmitted on the network should be known to only the sender and the recipient. There will have to be a fine balance maintained here. Using the Electronic Highway for communication of fraudulent, subversive or pornographic information will be easier and cheaper than through the current postal system. Should there be controls to stop evil information from being sent? How should it be monitored? Who will provide the definition of 'evil information'? How should it be controlled? Who should control it? How can the flow of information be controlled and still leave free the communication of the Gospel?

- **Guaranteed Delivery** — A transmitted message should reach its recipient, even if there are hardware or network failures. No machine or human filter should be applied to the communication without the sender's or recipient's approval. Who should be allowed to monitor and interfere with the delivery of messages on the Electronic Highway? For what reasons? Under what conditions?

"Respect and protection for the individual has long been a duty supported by Christian churches in the West."[32] This duty will fall upon us as we face the challenge of maintaining freedom on the Electronic Highway.

Offer Meaning

As computers take on new roles in every part of our lives, there will be changes in the way people work, obtain their schooling and use their recreation time. This will likely cause a change in the amount of time people spend in their homes, and cause a redefinition of work. The trend toward increased telecommuting to work is evident. In the U.S. in 1993 41 million people worked from home (compared with 39 million in 1992).[33] In the Los Angeles area 4.7 million workers worked from home on a full time or part time basis in 1990. In 1994, the number of workers was up to 8.7 million.[34] As someone once said: "as goes California, so goes the nation." This is only the beginning. This trend will likely escalate, and within a decade there will be a similar dramatic increase in telecommuting to school and to obtain recreation services (e.g., video-on-demand).

The trend toward telecommuting will increase the amount of time people spend isolated in their homes and may increase the amount of free-time that people have, especially children and adolescents. These changes will undoubtedly cause social problems. Families are likely to be disrupted and there may be increases in juvenile delinquency and boredom. There will likely be less face-to-face social interaction, and people may find their work less meaningful and challenging. Overall people may feel more isolated.

The Church is going to have to meet these challenges. For example, it will have to offer ways to involve teenagers in activities which will give them meaningful challenges and help them find their place in society.

The Church will also have to take more seriously the definition of roles for each member in a congregation. Where people have other meaningful communities, roles in the Church do not appear to be as necessary. But in a society where the Church is one of the few personal communities, meaningful roles in the Church become essential. The Church will not be effective in its ministry or outreach if it assumes that people living in cyberspace can have their spiritual needs met through the Electronic Highway. The truly effective congregations in the next few decades will be those which can offer meaning to their members in the context of the growing sterility of cyberspace.

Man was designed by God for involvement in a community, and to obtain meaning within that community. The concept of an elite group of professional clergy who perform most of the work in the Church does not provide opportunities for community involvement and personal meaning within the Church community. To be effective, the Church must change its approach. It must provide meaningful opportunities for involvement and service. The leaders of the Church must obey Paul's instruction "to prepare God's people for works of service, so that the body of Christ may be built up ..." [Eph 4.12]

As the Electronic Highway connects to every home, "we will need some creative approaches in ministry and evangelism proposed by innovative ministers who are not afraid to meet changing conditions with new ideas."[35] The Church will have a unique position in society as an institution in which people can find meaning while working together for a useful cause. The Church will be given the opportunity to hold together a community.

Offer Love

The Electronic Highway will change many of the ways that people interact. Face-to-face communication may decline. As a result, the Church may see a further decline in attendance at worship services as people attempt to fulfil their religious urges from the Electronic Highway. If this happens it will be consistent with what seems to be the pattern for the impact of electronic media on the Church. There apparently was a decline in attendance when the radio began to carry religious broadcasting.[36] Religious broadcasting on TV has apparently had a similar negative impact on the Church:

> There are several research findings suggesting that religious television programs may be detrimental to the local church. A religious program on television may be effective in awakening within viewers dissatisfaction with their present situation. ... Far from being a complementary service to the local church, therefore, broadcasters appear to be providing an overlapping service, one traditionally provided by the local church.[37]

> Some experts say if current trends are to continue, major Christian denominations will turn *en masse* toward television preaching as a means to convey their respective messages, a medium which for years has been dominated by individual evangelists. ... There is a distinct possibility that all this technology could backfire on church leaders.[38]

> Television, like any tool of communication, is in itself neither good nor bad. But recent history makes it clear that it is a tool to be handled carefully ... It is filled with characteristics and practices that at best limit its value as a ministry tool, and at worst pose a threat to the spiritual health of those who use it.[39]

The Church will have an opportunity to meet the challenge of the Electronic Highway through the

community aspect of its nature. The people of God sharing fellowship with one another will be one of the few places where people can find warm human contact. But to be effective in providing this, the Church must become less inward-looking and reach out in love to a society suffering from an 'electronic narcosis'.

Challenge the Age

Another challenge which will face the Church is how it will reach people with the message of the Gospel in an age of isolation. People living in cyberspace will lead progressively more physically separate lives. In small private communities, the concept of **public** space, morals, and religion will become less meaningful to the majority of people.

Christians in the West have fallen for the myths of the separation of church and state and pluralism, and have largely given up on the public domain. Christianity is no longer considered to be the religion of the nation or to have an influence on its morality and behaviour. Rather faith and belief have become a private matter. During this current century the Church has allowed the Gospel to become progressively more distant from the mainstream of culture. While absorbing the outward materialism and morality of the culture, the Church in turn, has largely been unable to provide a challenge to the pagan heart of the culture.

The Church has become progressively more isolated from the culture, and has essentially no idea about how to relate or communicate the Gospel to the culture.

> The task of relating to those who do not share evangelical assumptions may be more difficult than it was a generation ago. An elaborate evangelical subculture provides for many a safe haven from the storms of diversity. It is now possible to proceed from kindergarten to a Ph.D. within evangelical confines, to listen to evangelical media from morning until night, and to consume a steady diet of evangelical books and magazines. Studies show, for instance, that the burgeoning evangelical media empire — radio, television, and popular music — retains minimal audience beyond evangelical borders despite claims that the unchurched are being reached. By constructing a culture of their own, evangelicals run the risk of being less capable, and sometimes less interested, in communicating with neighbours different than themselves.[40]

How is the Church going to break out of its cocoon and make its message heard? "Entering the electronic age, organized religion does not appear to rise above ... 28th place in offering direction for national policies."[41] The Church is silent most of the time and ineffective when it does speak.

This silence can be blamed in part on the inability of portions of the Church to gain a hearing. The media are largely controlled by individuals and organizations which are not supportive of the Gospel or of the Church. "Outside of humorous or superficial references to church and clergy,

nearly all characters in the modern media are drawn to act as though religious faith has no relationship to daily decisions and actions. God is even more remote than outer space and the future has no relation to the present."[42] The Church gets no support from the media.

In addition, the Church is often excluded from these media because of the cost of using them. It is expensive to purchase 'space' or 'time' in the mass media such as newspaper, radio and TV. Many congregations and denominations cannot afford to use these media for presenting their message. This seems to be particularly the case with those portions of the Church which take seriously the doctrines emphasized at the time of the Reformation.

The congregations or denominations which can afford to purchase access to the mass media often seem to waste and misuse their opportunity. This especially seems to be the case with those using TV. One writer has observed that "there is not even one serious daily news program presented from a Christian perspective on the world. Most evangelical talk-shows and on-air preachers tend to express shallow, undeveloped ideas of the implications of biblical truth to the various issues of the day."[43]

Most TV shows produced in the name of Christ seem to be as shallow as the average fare of non-religious TV. This may be because the 'Christian' TV shows are produced according to the same standards as the rest of what appears on TV. In the opinion of televangelists, "television broadcasting ... is a God-given gift. Yet television is the epitome of the secular life, a marketing medium for consumer products and a show place for glamorous celebrities and stars. Televangelists rail against it as a source of godlessness, pornography, licentiousness, and mind control. But the inescapable fact is that they are part of the television world. Television techniques have enabled them to succeed."[44]

"While in their messages the paid-time religious preachers strongly criticize and even condemn secular society, in the staging and promotion of their programs they use criteria and celebrities from this same society to demonstrate their validity."[45] It may be this obvious inconsistency between their message and their actions which has led many to a lack of trust in televangelists. This lack of trust is shown through a recent Gallup poll. This poll found "that 23 percent of those surveyed said television evangelists are 'trustworthy with money', while 63 percent said they are not. In 1980 a similar poll found 41 percent saying the evangelists were trustworthy, with 36 percent saying they were not."[46]

We cannot point to the Church's use of TV with satisfaction, as we can to its use of the printing press. We cannot find success on the 'tube' as we can between the pages. The question confronting us is: how will we use the new means of communication which are now becoming available? Will we repeat the mistakes of the televangelists, and turn the Electronic Highway into the carrier of meaningless foam? Or will we follow in the footsteps of Luther and use the Electronic Highway to cleanse the Church and challenge the age?

The Electronic Highway will provide an inexpensive channel which will be open to all

congregations and denominations. It will support a spectrum of new media and information processing technologies which can be used for establishing the supremacy of biblical truth. These include:

- **Electronic publications** in standard textual form or in hypermedia form. Electronic publishing will permit the Church to produce high quality publications for not much more than the cost of entering the information into a computer. The appearance should rival anything produced by highly-financed publications such as the weekly news magazines.

- **E-mail and electronic bulletin boards** which should permit the Church to reach a large constituency without the large cost now associated with using the public mail system.

- **Computer-based courseware modules** based on a Christian philosophy of education, which the Church can prepare to offer the world an educational alternative, while the current publicly funded, centralized education system crumbles.

- **Translation services** to transform the written or spoken words of any individual into any other language 'known' by the computer. This will permit the Church to share the fruits of biblical study and historical research across all the cultural groups on earth.

- **Query and retrieval of information** from central econoses. Christians will place in an econosis a vast theological library. Each item in this vast data store will be accessible through a PC. This may encourage more serious research and the return to the study of the lessons of church history among Christians.

The Church must articulate goals and standards for using the new technology. It should develop approaches for producing high-quality material which can reach unbelievers with the Gospel. Let us avoid two possible scenarios which will waste this opportunity from God:

- Let us not turn the Electronic Highway into the peddler of trivia, and

- Let us not miss the opportunity to use the power of this new means of communciation by misunderstanding the significance of what is happening in cyberspace.

The first scenario can be illustrated by a passage from Bradbury's book *Fahrenheit 451*:

> Give the people contests they win by remembering the words to more popular songs or the names of state capitals or how much corn Iowa grew last year. Cram them full of noncombustible data, ... so ... full of 'facts' they feel stuffed, but absolutely 'brilliant' with information. Then they'll feel they're thinking, they'll get a sense of motion without moving. And they'll be happy, because facts of that sort don't change. Don't give them

> any slippery stuff like philosophy or sociology to tie things up with. That way lies melancholy.[47]

In the example above, the communication media were used for the trivialization of knowledge. In the example below, also from a science fiction story, called *Julia's Dilemma*, it is the media themselves which are trivialized. The significance of a society existing in cyberspace was totally misunderstood.

> The original fellows had dissipated the endowment, first in publishing books with no hope of sale and finally, as an understanding of the future caught up with them, in rather stilted computer-aided learning routines. Unfortunately, they had not realized that in the meantime the population at large had ceased to be text literate but was instead image literate. That is, their understanding of the world around them was once more conditioned by images and sounds as had been the case with their distant ancestors. People just didn't read much anymore.[48]

We are on the frontier of cyberspace, and have entered a transitional period between ages. The changes will be as significant as those brought about by only a few other transitions in the history of humanity. How the Church enters cyberspace will likely be as significant as other key events in history such as the appointment of Moses to shepherd God's people; the conquests of Alexander the Great and the introduction of Greek civilization throughout the Mediterranean world; the birth, death and resurrection of Jesus; the commissioning of the twelve Apostles; the conversion of Constantine; the invention of the printing press; and the challenge of the Roman Catholic hierarchy by Luther.

As the Church enters cyberspace it will be forced into conflict with all that this age considers valuable and important. This conflict is what the Church needs, since "[a] basic advantage of cultural clash and transition is that people on the frontier between different modes of experience develop a great power of generalization."[49] The Church has not had this power for centuries, and instead has been coasting on the legacy of the Protestant Reformation.

As the Church moves forward into the new frontier "we need to burst out of the wineskins of the conventional and create whole new ways to seek first the kingdom of God in our lives and in our mission."[50] May God permit the Church to be at the leading edge of this frontier to challenge the technological age of the 21st century with the Gospel.

Be Men of Issachar

We are told in I Chronicles that the men of Issachar who joined David at Hebron were men "who understood the times and knew what Israel should do." [I Chron 12.32] You should be like the men of Issachar. You should understand the ways in which technology can have an impact on society and on the Church. You should not sit by in 'blissful' ignorance. You should read about and experiment

with the new technology.

We all must understand that it is impossible for the computer to have **no** impact on the Church. The question is, will the impact be for good or evil? If we do not understand the technology in which our civilization is already being immersed, there will be little hope that the Church will be able to use the technology for good. We will be like the monks in the monasteries left holding goose quills, while the printing press cranked out hundreds of pages a day. Marshall McLuhan summarized their plight:

> Had the Schoolmen with their complex oral culture understood the Gutenberg technology, they could have created a new synthesis of written and oral education ... The oral Schoolmen did not meet the new visual challenge of print.[51]

The Church has been print-bound for centuries. It has tried to change this through its use of TV, but has had less than outstanding success. While it has made forays into the world of TV, the Church has continued to use print. But the current ineffectiveness of print can be seen by the stream of tracts left on the sidewalk behind a street-evangelism team, or the kitty-litter boxes lined with a neighbourhood church's newspaper.

The Church must face the reality of the new information age. It will not be an age of print, regardless of what we may hope. "To a large extent, this new world will be created through a new digital information technology that allows a convergence of modes, one information technology that can serve both our eyes and our ears. ... Technology will have profound impacts on culture — impacts on all our arts and letters."[52]

We need men of Issachar who can understand the times and know what the Church should do. We need men of vision who can show us how to use the new technology for the work of the King.

Control Technology

On the 500th anniversary (2017) of Luther's protest against indulgences what will be the role of computer technology in society? What will be its role in the Church? We cannot give a definitive answer. We can, however, suggest possible directions based on the current trends, and we can play a role in the direction that these trends will take.

After God had created man, we read that "God blessed them and said to them, 'Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground.'" [Gen 1.28] God blessed man and made him ruler over the inanimate and animate realms within the physical creation. This dominion, under God, extends to computer and communication technology.

As Christians we have been blessed with a responsibility for the application of technology. This responsibility means that we must bring technology into the service of the Church and under the Lordship of Christ. We must control technology, or others will control us with it. We must not accept the outcome of these trends as 'given' or 'inevitable'. We must understand the history of technology, the philosophy underlying its invention and application, and the ways it can be used and misused in the Church. We must accept responsibility for the shape of the future.

It was evangelical Christians in NA who, following in Luther's footsteps, drove the development of popular communication through the printed word. They transformed the ground rules of print.[53]

> Between 1790 and 1830, nearly 600 religious magazines were founded. ... Evangelicals such as those who backed the various Bible societies pioneered in print technology (e.g., cheap stereotyping, steam-powered printing, and mechanized papermaking). And they were leaders in conceiving innovative ways of distributing the printed word.[54]

Will evangelical Christians be the pioneers in cyberspace? Or, will they resist in the mistaken belief that by turning back to the old way — basic education emphasizing reading — we will be able to arrest the decline of western civilization? Will they continue to hope for a return to the printed word, when it is no longer effective in reaching a perishing world? Will they be like the monks who clung to the hand copied manuscripts until they were drowned in reams of printed pages? Will evangelicals allow secular humanists to commandeer the technology of cyberspace for their liberal causes, or will they take command for the Kingdom?

In the next two decades we can expect to see changes in computer technology which will make obsolete many current modes of communication, create new modes of communication, and change forever the remaining modes.[55,56] From these changes we can expect both blessings and curses. It is our responsibility to control the application of computer and communication technology so that the blessings outweigh the curses. "Christians who have always been in the 'communications business' ('in the beginning was the Word') should be among the first to realize the crucial significance of these new technologies. Opportunities exist for us to shape the new technologies in a responsible manner. Do we recognize those opportunities? Are we ready for them?"[57]

I hear a rumble of thunder. This rumble signifies the dramatic power of the computer for the cause of the Gospel. This rumble is a warning of the workings of the Holy Spirit in the Church. By God's grace, this rumble will unleash a reformation which will shake the world.

Notes

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