The Sixth Language: Learning a Living in the Internet Age

1

The Evolution of Language and Its Impact on Learning, Work and Society in the Internet Age

The Dynamic Nature of Language

Language is not the passive container or medium of human thought whose only function is to transmit and communicate our ideas and sentiments from one person to another. Language is a "living vortices of power" (Innis 1972, v, McLuhan's foreword) which shapes and transforms our thinking. Language is both a system of communications and an informatic tool. Without verbal language our mental life would be reduced to feelings, emotion, and the processing of our perceptions. Verbal language makes conceptualization, abstraction and reflection possible. Our ability to use verbal language is what differentiates us from the rest of the animal kingdom. Other animals are capable of communicating with each other but the range of what they can express is limited to small number (less than 50) of signals. Human verbal language, on the other hand, is generative so there are an infinite number of possible messages or meaning that we are capable of composing and communicating.

Language is a dynamic living organism which is constantly growing and evolving. Not only does spoken language grow in terms of its increased semantics and new syntactical forms it also evolves into new forms of presentation and expression. In this book we will develop the hypothesis that speech, writing, mathematics, science, computing and the Internet form an evolutionary chain of languages. Two of the languages mathematics and writing we shall see emerged at exactly the same point in time around 3100 BC followed approximately 1000 years later by science. Within my life time two languages have appeared in rapid succession, computing and the Internet, the fifth and sixth language. I hope to demonstrate that computing and the Internet (which includes the World Wide Web) will play a role as important as that of any of the four languages that preceded them many years ago.

We shall also discuss the rapid way in which we have moved from an industrial era economy to one based on computers and information some fifty years ago and how we are in the midst of still another transformation fueled by the Internet and the management of knowledge which we must carefully distinguish from information. As we are passing through the transition from the Computer age to the Internet Age and at the same time from the Information Age to the Knowledge Era some of the observations which will be set in print could take on new meanings and nuances. I hope my readers will feel free to dialogue with me and share their thoughts in this time of rapid change and therefore I would like to invite them to email me their comments, if they would be so kind, to logan@physics.utoronto.ca.

The Origins of This Study

This study began as an attempt to understand how computers could best be used in the educational arena. My research, conducted at the Ontario Institute for Studies in Education in Toronto (OISE), involved the classroom observation of the use of computers (Sullivan et al. 1986) and two theoretical studies (Logan et al. 1983; Logan 1986b) conducted for the Ontario Ministry of Education. My work in computer applications in education was carried out against the backdrop of work I had begun with Marshall McLuhan in which we studied the effects of the phonetic alphabet and literacy on the development of deductive logic, abstract science, codified law, and monotheism (McLuhan and Logan 1977). My approach to understanding computers in education was therefore strongly flavored by the communication theories of McLuhan and the notion that the computer is a medium of communication. My own work in theoretical physics, on the other hand, which relied heavily on computers, made me equally sensitive to the information-processing aspect of computers. Therefore, at the very outset of my study to understand the impact of computers on education, I regarded the computer as both a communication medium and a tool for processing information.

At the same time that I was considering the role of computers in education, I was also extending the work I had begun with McLuhan on the alphabet to include the role that other written notations played in the history of ideas. I was fascinated by the work of Denise Schmandt-Besserat who showed that the origins of writing and mathematical notation can be traced to the small clay tokens that were used for accounting purposes in the Middle East from 8000 to 3000 B.C. (Schmandt-Besserat 1992). It was as a result of the consideration of her work along with my own on the alphabet effect (Logan 1986a) that I recognized that all written forms of language - whether it be writing or mathematical notation - have both a communications and an informatics dimension, as is also the case with computers. It was at this point that I formulated the two main theses of this book:

- all forms of verbal language have both a communications and an informatics dimension that facilitates human thought;
- speech, writing, mathematics, science, and computing form an evolutionary chain of languages.

In studying the history of communications and information processing, we will discover that each of these five forms of language (plus the sixth language of the Internet and the World Wide Web) has its own distinct semantics and syntax. Each evolved from its predecessors as new information-processing needs emerged that preceding languages could not deal with effectively. Each builds on the features of its predecessors while adding a number of new information-processing elements of its own. Each new language eventually led to an information explosion and a new set of challenges which set the stage for the next level of development and the emergence of still another form of language, culminating in recent years in computing, the fifth language and the Internet, the sixth language. By understanding the chain of events that led to the evolution of language and the emergence of the fifth and (the sixth) languages, we will be better able

to understand the current impacts and predict some of the future effects of computing and the Internet.

There are two theoretical tools that we will use in developing our understanding of how language evolves and new languages emerge. One of the tools is the communications theories or approach of Harold Innis and Marshall McLuhan which are described in Chapter 2. A second tool is dynamics systems approach or Chaos Theory as developed by Ilya Prigogene which will be examined in Chapter 3 when we discuss the evolution of language. Evolutionary theories when they were first being developed tended to be linear, but in more recent times concepts such as co-evolution and emergence have come to the fore. We shall make use of Prigogene's notion that new levels of order emerge from chaos and that these new levels of order are, in fact, the new forms into which language evolves. We shall, therefore, not only study how new forms of language affect learning, work, social interactions and knowledge structures but also how these effects feedback and feedforward to language creating new forms of language. We will examine how new languages effect old languages and how old languages give rise to and effect the new languages.

I originally elected to examine the role of computing in education within the context of communications theory and informatics. As I began to probe my subject more deeply, I realized that the focus of my study was not only the role of computers in education but the much larger topic of the relationship between language and learning or communication and cognition.

My insight that computing contained elements of both communication and informatics seemed to apply to all forms of language. The term "informatics" is generally used only within the context of computers. It is defined in Webster's, however, as "the science of obtaining and transmitting information," and hence is not strictly limited to computers. One can therefore consider the informatics of the oral tradition or written texts as well as the informatics of mathematics and science.

These considerations led me to the realization that education should be basically concerned with the development of the skills associated with the use of all the modes of language - speech, writing, mathematics, science, computing and now the Internet or the sixth language. I saw that the informatics side of language connected to cognition and that my study overlapped three basic domains: cognition, and hence informatics; communication, and hence language; and education, or learning.

My study of the role of computers in education had suddenly expanded in what seemed like a hundred different directions but at the same time converged on my previous studies of the impact of written notations on the development of ideas and social institutions. I had begun my study to find optimal ways to use computers in education and found myself using the insights that the use of computers provided to try to understand the nature of cognition, language, workplace organization, social class, and education. I began to feel as though I was losing the focus of my study when I discovered that part of my task was to tie together these different domains, which computing seems so naturally

to integrate. I also realized that understanding the relationship between technology and cognition could provide insights that might help us devise a plan of action for education for both the school system and the workplace which would make them more responsive to the needs of an knowledge era economy.

The Four Facets of Computing and the Internet

Computing and the Internet are not just new technologies or new media of communication; rather, they are a radical new way to process and organize information and as such they represent two new forms of language respectively. To fully understand computing and the Internet and their myriad impacts, we will study them from the perspectives of technology, communications, informatics, and language. In addition, we must also understand the relationships among these four aspects of computing and the Internet. How do technology, communications, informatics, and language affect one another's development or evolution? To what extent are they distinct categories and to what extent are they just four different facets of human thought and organization?

The Social Dimension

When we think of computing and the Internet we often think of them strictly in terms of technology but there is another dimension to them, namely a socioeconomic one. All technologies have powerful effects on social, economic and cultural life. The organization of work and social-class structures are influenced by the evolution of technology, informatics, and language. Agriculture led to new forms of labor and its organization, to new settlements and a two-class social system of landowners and serfs. With the rise of the city-state and the advent of numeracy and literacy, there arose a third class - the middle class. The middle class are not the middle-income earners but rather the class that adopted literacy and learning as a lifestyle and a way to earn a living. The bourgeois values of the middle class that are disdained by many artists and members of the intelligentsia are, in fact, the values that prize learning and literacy and that led to the scientific, philosophical, and artistic achievements that have enriched our civilization. It is also the middle class that led the Industrial Revolution and the current information revolution. Understanding the role of social-class structure is another element in developing our understanding of computing and the Internet and their impact on education and work.

The Impact of Computing and the New Media on Learning and Work

"The future of work consists of learning a living in the automation age . . . Electric automation unites production, consumption and learning in an inextricable process . . . Paid learning is already becoming both the dominant employment and the source of new wealth
in our society." (McLuhan 1964, 346-51)

Long before the advent of microcomputers, local area networks (LANs), and the Internet, Marshall McLuhan predicted that information technology would make dramatic changes

in the structure of work and education. He was right. We are in the midst of a profound information revolution in which computer technology is changing the way we organize work and learn about our world. Knowledge, not capital, is the new source of wealth. Yet paradoxically, our education system is in total crisis. Our schools are not working because they do not provide students with the type of training and education they require to cope with today's economic realities. But this is only one aspect of the problem. Despite significant unemployment, jobs go unfilled because of the lack of skilled personnel, and many who are employed are not properly trained to do their jobs effectively. There is a significant mismatch between the needs of the workplace and what the educational system is delivering. The root of the problem is that we do not have a proper understanding of the role of education in the knowledge era. We are still operating on a model of education that is a holdover from the industrial age. Computing, telecommunications, the Internet and other forms of information technology have created a new environment and a whole new set of challenges.

One of the purposes of this book is to deal with the mismatches between school and learning, between education and work, and between computing and organizational structures inherited from the industrial age. It is about rethinking and reformulating the way we go about learning and preparing ourselves for work. It is a search for the new meaning of education. A cliché, perhaps, but a central question for a society in the midst of an information and knowledge revolution.

In order to conduct the search for the meaning of education and its relevancy to work, we must examine the nature of cognition, or thinking, itself and how it is affected by language, information technology, communication media, socioeconomic institutions, and social-class structures. If the information environment in which we live is an extension of our psyches, as McLuhan claimed, and it is undergoing rapid and profound change, then so too is the way we think, process information, learn, organize and manage work, establish our values, set our goals, and formulate our aspirations. This book will examine all of these questions holistically. Not only do we have to question the relevancy of our education system, we must also examine our lifestyles. In the knowledge era, we can no longer compartmentalize our activities into education, work, and recreation as we did in the industrial era. This fragmentation no longer works, because of the speed at which technology changes plus the fact that work and the production of wealth is now knowledge-based. We can no longer divide work and learning. Life in the Internet Age or the knowledge era only becomes meaningful when we integrate work, learning, and leisure time, whether we run a business, program a computer, or compose symphonies.

In describing the profound changes through which we are living, I have tried to strike a balance between optimism and pessimism. This is not a "technology gee whiz" book - the future is going to be automatically better, full of opportunities, and more satisfying. Nor is it a doom-and-gloom book, although for some caught in the avalanche of information, the future will be full of challenges. We face the possibility of electronic sweatshops, unemployment, and displacement. Computing and automation for all their efficiencies have increased the length of the work week, not reduced it. Many workers whose skills are overtaken by technology find themselves suddenly unemployed and, at a certain age,

unemployable. This book tries to strike a balance between the service and disservice of information technology. It attempts to deal with reality as it is, not the hyped reality of the techno-enthusiasts nor the distorted reality of the techno-phobic and those displaced by technology. I hope the reader will better understand the current information revolution and as a consequence be able to take advantage of new opportunities rather than become a victim of the massive change which is wiping out many traditional jobs and ways of doing things.

Why Our Schools Don't Work

Our schools are based on an industrial model with a delivery system patterned on the factory. Millions of schoolchildren are taught the same content in the same linear sequential order guided by a uniform curriculum dictated by a centralized bureaucracy at a municipal school board or state department (or provincial ministry) of education. Teachers continue to deliver an old style of book learning which does not take into account the nature of today's information-age economy or even some of the needs of day-to-day living. Students do not find enough relevancy in their schooling to take it seriously, which explains the high drop-out rate.

Not every aspect of the school system is a failure. Many students endure. Doctors, engineers, lawyers, and accountants continue to be trained. The success of our schools is limited, however. Today's educational system serves yesterday's needs by training managers and technicians to fit into a hierarchically structured industrial organization that is rapidly disappearing. Two practices of the schools are counterproductive: one is dividing the curriculum into subject disciplines and thereby encouraging specialism; the other is too much focus on content and not enough on process. Our school system must prepare individuals for the new demands of post-industrial society by providing them with both a knowledge base and a set of information-processing skills. It is unbelievable that most students graduate from university and/or high school with little or almost no computer skills at a time when computing is an indispensable part of life in the work place for the majority of professions. This, to me, is a major indictment of our education system.

Even though the failure of the school system has been recognized for a number of years, little, if any, remedial action to make structural changes has taken place. This is due in part to the conservative nature of the education community. The main reason for the failure, however, is that contemporary education lacks a mission that is in tune with today's social and economic environment, which has evolved and changed at a much faster rate than our schools. It is not so much that the content of the curriculum is out of date as it is that the style of education is not suited to contemporary needs and challenges. Stopgap measures like adding computer science to the curriculum or using computers and the Net as teaching tools will not remedy the ills of education. "Schools have already spent billions on computers - 97% of the 110,000 elementary and secondary schools in the U. S. now have them. But scores on standardized tests in math and reading are no higher than they were in 1970. The history of technology in education has not been a stellar one" (Business Week, Nov. 11, 1991, 158). We see from this quote that computers

had penetrated nearly all schools by 1991. In the time since then computers are more part of the school curriculum with the addition of the Internet but one still hears the same complaints that their use has not yet resulted in increased learning. In fact, there has been a back to basics movement implemented in some jurisdictions like Ontario where there has been a greater emphasis on the skills associated with the use of writing and math.

Approaches that consider how computers and the Net can be used to achieve present educational goals without considering how the entire educational enterprise should change are doomed to failure. The increased use of computers and the Net alone will not solve the problem. We must also learn to use computers and the Net differently than the way they are now being employed. "The evidence of our neglect of philosophy as it applies to educational computing lies in the absence of a significant body of discourse on what computers ought to be used for in education . . . Where is the literature debating what the aims or goals of computer education should be? Such literature exists, but it is extremely meager" (Maddux 1988, 6).

The role of the microcomputer in the school and the workplace needs to take on a new meaning. From the classroom perspective, the computer is not a tool to automate teaching but an environment in which students can learn and develop their cognitive skills through exploration and discovery. In the world of work, the computer is not just a tool to increase productivity but a learning environment in which employees continuously develop their information-processing and communication skills. Computers and the Net can facilitate a program of lifelong learning, another critical dimension in reformulating our thinking about education. Education must not stop once the student leaves school; it must become a lifelong process which integrates work and learning.

Integrating Work and Learning

If the key to survival in the knowledge era is to "learn a living" by integrating work and learning, then we must understand the relationship between education, work, and technology. Since knowledge workers and information technology are driving the changes in the information-age economy, the relationship between learning and work has to undergo radical change. Moreover, the rapid rate at which technology is changing is forcing the integration of education and work. Schools that provide students with knowledge of the latest developments in their field but do not equip them with the skills to update that knowledge are failing their students. On the other hand, employers who ignore the role of training and education in their operations are equally derelict in their duties to both their employees and their organization.

As the purpose of this book is to determine the most effective way to organize learning in our schools and in the workplace within the context of the new information environment of computers and the Net, we must reformulate the relationship between schooling, education, and work. Schooling and education are no longer synonymous. The model inherited from the industrial age within which school-based and industrial-based educators have traditionally operated is one in which learning and working are two separate activities that correspond to two distinct time periods in the life of an individual.

In this model, the school years of childhood and early adulthood are when basic learning takes place and determines to a large extent what kind of work will be pursued and how far the student will go in life. With the exception of those lucky few who have participated in a co-op program, the work undertaken by students during their school years is usually unrelated to their professional development and is undertaken solely to earn money. The focus of working life, on the other hand, is not about learning but about earning a living. Some time during this period is devoted to training or professional development, depending on the nature of one's job and the attitude of one's employer. Because the focus of a business organization is on the bottom line, the amount of resources and employee time devoted to learning is frequently quite limited. The concept of "just-in-time training" in which an employee is only provided with enough instruction to perform the tasks at hand is a perfect example of the minimal attention paid to education by most employers.

The separation of the domain of schooling and childhood from that of work and adulthood can be traced to the early days of the industrial age. Before this period, formal education was provided for a tiny minority of the population who were the extremely privileged members of the aristocracy or the bourgeoisie. For the vast majority, there was no formal schooling and precious little childhood. Children began to work as soon as they could perform chores that would contribute to their families' survival. Their only learning was apprenticing with their parents to learn their trade.

It was the industrialization of Europe that led, beginning in England, to a system of formal education for the masses as well as to the invention of the concept of childhood. It was at this point that a clear separation was made between learning - that is, school learning - and work or holding a job. This separation was almost complete except for the short training period just after a student left school, during which time he learned the tricks of his trade. What he learned during this brief on-the-job apprenticeship would last a lifetime. This model has endured and still provides the foundation for our current education system and the induction of young people into the work force. But it is beginning to break down. The main reason is that the nature of work and the use of technology are changing. Perhaps more importantly, the rate of change is accelerating. Industrial-age schools were originally organized like factories and were mandated to mass-produce uniform and
standardized graduates who could be easily integrated into the industrial system as both disciplined workers and consumers. The system worked because the methods and techniques of information processing which were paper-and-pen-based did not change within the time frame required to educate a young person. In fact, they did not change very much within the lifetime of an individual.

Now the rate of change in technology is forcing transitions in the education system. The idea of lifelong learning is slowly gaining credence. Unfortunately, however, it has not led to any structural changes in either the school system or the operation of the workplace. A great deal of lip service is paid to the idea, but neither the schools nor industry seem willing or able to commit the resources to make lifelong education a reality. Whatever commitment is now being made to lifelong education is being made by

individuals. The long-term solution to this mismatch will require a serious commitment by both the school system and industry, but it would immediately solve two major problems: the irrelevancy of schooling as a preparation for work, and the need to constantly upgrade skills because of the rapid changeover of technology.

Eleven Critical Questions

In order to achieve the goals of an integrated understanding of language, learning and work based on the recognition of the unity of communications, cognition, and education, I have formulated eleven basic questions that are critical for our study and will be addressed in this book (the numbers in paratheses indicate which chapters address these questions):

1. What is the relationship of language, communications, information, technology and knowledge? (3,5)
2. What are languages and how do they effect learning, work, and social interactions? (3, 4)
3. How does language evolve and new forms of language emerge? (3)
4. How will computers and the Internet change our notions of what we mean by communication, information processing, language, learning, education, and work? (5,8)
5. How is computing changing work patterns and the organization of social institutions? (6)
6. How can computing be harnessed to inculcate students with the desire for lifelong learning? (6,7)
7. How can work be organized to naturally promote learning? (6,8)
8. How can education in the workplace be better organized to improve productivity so that learning becomes a life-long activity and workers are properly trained to do their jobs? (6)
9. How can computers and the Internet be used to achieve present educational goals? (7,8)
10. How will present educational goals change to accommodate changes in the nature of work due to the widespread use of computers and the Net? (7,8)
11. How can the school system be restructured so that the goals of education and the vocational needs of society in the Internet Age or knowledge era can be better matched? (7)

Only by addressing these questions can we make our schools and workplaces relevant to our needs and create an atmosphere conducive to lifelong learning. Given that microcomputers and the Internet have been in use in the workplace and in schools such a relatively short time, our understanding of this technology is still primitive. Educators and managers have only begun to explore the possible uses of microcomputers and the Net. This book, however, addresses the many issues raised by the eleven questions above and provides a framework within which they may be addressed in the future so that computers may affect education and work in a positive way. The study begins by examining the ideas of Harold Innis and Marshall McLuhan who pioneered the study of the impact of communication media on social systems.