Introduction

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Revolution, it is fair to say, has become one of the most overworked words of the latter half of the twentieth century. Its use with respect to information and communications technology (ICT) can be justified on the basis of the remarkable innovations that have appeared in the past ten years or so. But is it more than a revolution simply in technology? To believe writers such as Nicholas Negroponte, John Naisbitt, Peter Drucker, Daniel Bell, Alvin Toffler, and Sherry Turkle, the impact of this technology on society marks a turning point in human history comparable to the invention of printing or perhaps even of written language itself: an event that will fundamentally and irreversibly change the way we live, think and work.[1] This view is encapsulated in a recent book by Frances Cairncross (1997) entitled, *The Death of Distance: How the Communications Revolution Will Change our Lives.* Peter Drucker has suggested that we should certainly expect this to produce a "change in the human condition." If futurologists are prone to hyperbole, these claims nevertheless should not be dismissed out of hand. We are probably still at a very early stage in the "revolution," however defined, and already there are indications of important and far-reaching social and political consequences. The aim of this collection of essays by experts writing from a Canadian or British standpoint is to place these developments into perspective, to describe their main characteristics and to outline their practical implications for society, so far as they can be assessed today.

The new communications technology is the product of scientific innovation stretching back two centuries and more, but rests on a combining of three items that have made their appearance only in the past 30 years: the microchip, optical fibres, and the laser. The microchip allows the rapid processing of information represented in binary form; the laser enables the information or data to be "read" quickly, and the optical fibres enable it to be transmitted from one processor to

another, to a remote monitor or elsewhere. One feature of the new technology is the speed and scale of the processing and transmission that has become possible. In 1995 world use of telephones for all transmissions stood at 60 billion minutes; by the year 2000 this total is expected to reach 95 billion minutes. In 1996, less than five years after the Internet became accessible to the public, the ITU estimated that there were 60 million users; by 2001 the number is expected to rise to 300 million (Rowbotham 1997). Computers are now being purchased for home use at a cost of £1,000 or less that use processors with speeds of 450 MHz, faster than all but the largest machines of 30 years ago. Peter Nicholson, a leading industry specialist and contributor to this volume, reports that Nortel will soon produce a 160 gigabit fibre which, he points out, will provide "bandwidth sufficient to transmit the text of 35,000 full-length novels every second." A hundred years ago even the fastest of the dozen electric cables spanning the Atlantic was capable of transmitting little more than a hundred words a minute.

A second feature of the new technology is what is known as "connectivity." Because all the information is converted into digital form for processing, there is no essential distinction between text (symbols), image and sound including the human voice. Processing allows the information to be stored, interchanged, copied, manipulated, edited, and integrated with other information: hence the emergence of multimedia. Not only is there convergence of media, but we are also witnessing the convergence of carriers. Cable networks, created to distribute television broadcasts, now also carry radio and telephone services. Computers with modems enable the exchange of e-mail and faxes, and with appropriate software the reception of television signals as well as photographic images from still or video cameras. Telephone networks provide data links. Television sets — easily adapted to receive both aerial and terrestrial signals — can also carry visual text (as will digital radio when it appears shortly), and in Britain as of this year television has become interactive. The Internet carries radio and television signals, electronic newspapers, voice messages, and other media and can be accessed through computers but will soon be accessible through a range of other devices, including, as demonstrated in one recent British prototype, microwave ovens.

The epitome of the communications revolution, and sometimes treated as a synonym for it, is the Internet. Developed in the United States for reasons of national security and now accessible free to all users, it provides protocols that enable computers (processors) to "speak" to one another through the medium of a telephone link. By integrating the two basic components of the communications revolution — computers and telecommunications — it allows networking on a global scale. Whereas broadcasting provides uni-directional communication from one source to many, and the telephone provides interactive communication normally on a one-to-one basis, the Internet enables interactive communication among

a potentially unlimited number of participants. Further innovations continue to appear in bewildering number, Andrew Reddick, a Canadian expert on consumer applications, in his contribution to this volume lists some of them: PCS (personal communication services — wireless digital telephone), cellular phones (analogue and digital), MMDS (microwave multipoint distribution systems — broadcasting, and likely Internet, and telephony), LMCS (local multipoint communications systems providing broadcasting, pay-per-view, video-on-demand, Internet, data, telephony), Direct-to-Home satellite, and advanced cable and telephone services. To this list should be added "Intranets": complete communication services now being provided by British Telecom (BT) and its competitors for large firms and organizations (Rowbotham 1997).

Equally startling is the proliferation of services available through the Internet and the uses which individuals, groups, and institutions are making of it. A number of the leading newspapers in Britain, Canada and elsewhere, whose readers have particular need of real-time information on the state of play in the financial markets or market-sensitive political developments, have recently begun to provide online and constantly updated versions of their papers to subscribers. Libraries — inevitably one of the most radically affected institutions, as illustrated by the fact that the relevant professional qualification is increasingly labelled not librarianship but "information science" — have gone online with not only their catalogues and other finding aids but also a growing part of their holdings. Telemedicine, involving diagnosis and interventions by medical specialists at centres remote from the surgery or operating theatre, is now on the verge of becoming routine practice. Banks, having for some years provided retail services through telephone access to computerized data records, now also offer the alternative of retail services online. Financial markets everywhere are migrating from physical trading floors to virtual floors, made possible by the new technology. Governments of all levels are similarly starting to provide services through web-sites. The British prime minister, Tony Blair, promised before taking office to link every school and hospital to the "information superhighway." The National Grid for Learning and a networked information service for health care are now being constructed. Blair has since set a target for government to make a quarter of its dealings with the public available electronically by the year 2002, whether through computers, telephones or (interactive) television (Muid 1997). Government organization itself as well as individual departments of state are being transformed by the same technology. As this Introduction is being written, the Foreign and Commonwealth Office, which created a publicly accessible web-site only last year, has announced the demise of the diplomatic telegram: problems of security having been overcome, communications between Whitehall and overseas missions will be transmitted by e-mail without the delay hitherto involved by the

requirement of encoding and decoding (Independent on Sunday, 16 August 1998). The Canadian counterpart, the Department of Foreign Affairs and International Trade, has already embraced the concept of "virtual diplomacy," having recently invested heavily in a new telecommunications platform, Signet, even while making substantial reductions in current and capital spending (Smith 1997). The list of applications could be extended almost endlessly, given that use of the Internet continues to grow exponentially.

Contributors to the present volume by and large have chosen to paint with a broad brush, dealing not with specific applications but rather with the broader social, economic, and political implications of the technological innovation — in short, with the extent or depth of the revolution. Differences of viewpoint will be readily apparent. Among the contributors are both enthusiasts and sceptics as well as others who are rather harder to categorize. Nonetheless they share several points in common, a few of which deserve summarizing here. The first is the general recognition of the near impossibility of predicting where information and communications technology is leading even in its practical development. Nicholson, whose job is precisely to advise on commercial investment in ICT, acknowledges the extreme uncertainty of commercial involvement in the so-called "information superhighway," and the possibility that the technology might temporarily outstrip its practical usefulness notwithstanding the potentially huge social benefits (as well as commercial profits) that can be expected to result from its further development. Thus, despite the huge growth of the telecommunications industry during the past 30 years, a question-mark hangs over its future, and the concept of market failure may have a particular relevance in this sector.

A second point is the authors' general scepticism toward technological determinism. Even the most sanguine contributors reject the assumption that the technology itself produces specific outcomes, whether desirable or undesirable. The chapter by Gordon Betcherman and Kathryn McMullen, who address the economic effects of the communications revolution in the Canadian context, is a case in point. As the authors note, Canadian firms over the past two decades have been investing an increasingly large fraction of their capital in information and communications technology, yet the effect on aggregate unemployment, productivity, and economic growth is still far from evident. Indeed, Canada has experienced the same "productivity paradox" as other countries including the United States where, despite an upswing in ICT investment that started earlier and has reached higher levels than anywhere else, successive business cycles since 1973 have come nowhere near the rates of productivity growth that were common before then. Productivity in the United States grew at an annual average rate of nearly 3 percent between 1948 and 1973 and more than 2 percent annually in the hundred years after the Civil War, but since 1973 it has averaged only 1 percent annually,

and productivity growth in the expansion since 1990 has been weaker than in comparable periods in the 1980s or the 1970s (Madrick 1998). Betcherman and McMullen accept that the explanation for this paradox is not altogether clear, not least because of the difficulty of desegregating the effects of a technology now so deeply embedded in all sectors of the economy. But all the evidence points to the conclusion that the value of the technology depends overwhelmingly on the existence of "an appropriate institutional framework," and that until firms investing in the new technology accept its implications for their organizational structure and make the appropriate changes, they are likely to secure only modest productivity gains from their investment.[2] Even then, much will depend upon political initiatives, because the flexible employment policies required to optimize use of the technology may be resisted by workers until or unless governments act to limit the (possibly short-term) loss of personal security that accompanies the introduction of flexible policies.

Rena Upitis, addressing the relevance of the new technology for education, in particular at the primary school level, and Sir John Daniel, who discusses its relevance to distance learning and research at the tertiary level, make a somewhat similar point. Upitis, without excluding the possibility of making practical use of information and communications technology, also known as the "knowledge media," in schools, sees serious dangers in jumping on the bandwagon that has begun to take off everywhere, until or unless the pedagogical value of the technology and its applications can be clearly established. Evidence exists that enthusiasts who substitute investment in computer-based programs for investment in traditional approaches to learning, on the implicit assumption that access to information is synonymous with acquiring knowledge, may seriously prejudice the educational possibilities for the young. Daniel, in contrast, has no reservations about the potential value of the new technology for education and research at the tertiary level, and cites evidence of massive benefits already obtained in the developed and the developing world from its application. However, he too is clear that the technology must be selected and adapted to meet the purpose for which it is intended, if there are to be substantial benefits. He points to the ineffectualness of putting lectures designed for the lecture hall on the Internet, and of a recent initiative for distance learning in the western United States based on teleconferencing at multiple sites (an observation corroborated in Murphy and Nixon 1997, p. 199). Both operations rely upon the new technology, but in neither case does it enhance opportunities for creative dialogue and hence for learning. Once again, the value of the technology can be seen to depend crucially upon its relationship to the institutions deploying it, and upon the sensitiveness with which the two are adapted to meet the basic objectives.

Two further points, already alluded to, deserve mention here: the implications of the communication revolution for the future of responsible government, and intimately linked to this, the danger that the new technology will exacerbate divisions in society by offering huge advantages to those with the requisite education, training, and incomes to take advantage of it while leaving the rest of society even worse off than before. Both points figure centrally in Robin Mansell's chapter. The transference of information from the printed page to digital form has, the author explains, raised profound questions about the relationship between author and text, and whether authors can hope to obtain a reasonable rent from any creative activity carried out digitally, when it can be so easily copied, stored, downloaded, manipulated, modified, re-formatted, transmitted, and re-transmitted. Experts by and large have focused their efforts on ways of strengthening copyright law; here the challenge is to strike an appropriate balance between safeguarding authorial rights and maintaining the creative potential of the new technology. But the more important point, Manse11 argues, is that in future the financial returns from the new technology will depend less on the purchase price of the hardware or software, which can be expected to continue its long-term decline, and more on the possession of specialized knowledge about their application. This is where technical skills will become most highly prized and hence where governments should be focusing their attention if they are to ensure universal access to the new technology.

Andrew Reddick, also concerned with access and exclusion, identifies somewhat different problems, notably the steeply increased burden on consumers of services provided by the new technology, and the danger that governments themselves may exacerbate the problem of exclusion created by the new technology. Already governments throughout the western world are creating a potentially serious problem by allowing market mechanisms to govern access to the telephone, which has come to be regarded by most citizens of western society as an essential service. The problem will become more acute if governments transfer to the Internet services hitherto available through other means, without providing convenient access to the Net or the training to use the new technology. But whereas Manse11 and Reddick ask if governments will recognize the problem of universal access and adopt the appropriate policies to address it, Leslie Pal examines the effect of the communications revolution on the ability of governments or states to act. Are the determinists correct in their apocalyptic vision of power and authority migrating from existing political authorities to a virtual world regulated by laws of its own? Does the new technology mean inevitably the emasculation of the nation state and perhaps the re-emergence of the city-state as the basis of government, or the empowerment of individuals and the reinvention of direct plebiscitary democracy? Pal does not minimize the potential changes that may result from the

communications revolution. But his answer, necessarily tentative, is to reject the extreme determinist view. States as well as individuals will seek to exploit telecommunications to their advantage; states after all are already among the largest users of ICT. And individuals will continue to look to the state for many services. As for multiparty democratic systems and tbe relationship between parties, leaders and electors, there is as likely to be an increase in demagogic manipulation as in enhanced individual influence.

In Canada the more immediate issue is the relationship between the new technology and national unity, and in particular its effect upon the cultural coherence of the country which may determine its political coherence as well. These two developments seem linked by the way ICT has increased ease of entry into radio and television broadcasting, and the decline in the CBC's share of prime-time television viewing to below 10 percent in the predominantly English-speaking parts of the country. To the many Canadians who regard the CBC as an essential underpinning for the nation, this has been cause for considerable hand-wringing. Yet the CBC's demise seems a virtually inevitable concomitant of the communications revolution, and will only be accelerated by further developments such as the integration of broadcasting and the Internet. But to Richard Collins, whose chapter ranges widely over the political debate, there is nothing inevitable about the CBC's fate. In Britain, he observes, public service broadcasters still retain the majority of prime-time viewers, and pressures stimulated by technical change have prompted them to adopt institutional reforms which are significantly improving their efficiency and dynamism. The more basic question, he suggests, is whether public service broadcasting or cultural unity matter for the future of the state. He posits a sceptical answer, but accepts that in Canada they are widely believed to matter: that the narrative of Canadian national survival presented through television programming is an essential glue if the country is to hold together. This being the case, he affirms that remedies are available by adapting some or all of the British innovations; there is little about the direction that television broadcasting is taking that is inevitable, and public service broadcasting has great potential for the foreseeable future.

One of the most confusing and contradictory issues in current literature on the communications revolution is its impact on spatial relationships, To believe some accounts, the inexorable logic of the revolution is to remove the necessity of bricks and mortar for much of the economy, which becomes a largely "weightless economy," and to undermine the logic of cities created in the industrial age. With business activity migrating to cyberspace, workers are freed to live where they like, their jobs having become virtual, that is to say constrained by neither time nor place. Yet, as Vincent Mosco observes in his chapter on place, the owners or executives of firms in the new communications industry display a remarkably

strong attachment to specific places. They initially congregated in California's Silicon Valley, and more recently have also formed concentrations in Silicon Valley North outside Ottawa and the Golden Triangle west of Toronto, in England around Cambridge University, and in Scotland's Silicon Glen. Others meanwhile are seeking to emulate the success of California's Silicon Valley in lower Manhatten and just outside Kuala Lumpur. The irony is not just that physical spatial relationships seem to matter crucially to the commercial interests at the cutting edge of the communications revolution, but that the technology which promises to liberate us from the constraints of industrial age cities is being manufactured in communities lacking the basic essential of freedom, namely responsible government. Belief in the necessity of proceeding on these lines, Mosco argues, is one more example of the shallow thinking that surrounds the whole subject.

David Morrison, Michael Svennevig, and Julie Firmstone draw upon data from their massive survey of private use of computers, telecommunications, and other technology in Britain to address similar questions about the "revolution," particularly its effect on individuals as consumers and parents. As in the workplace, spending on computers and related communication technology for the home has been rapidly rising, but according to the authors much of it seems to be driven by the equation of the technology with progress and the fear among parents that their children will be left behind if they are not thus equipped, The authors undertook extensive investigations to determine whether the new technology has been accompanied by any significant change in user attitudes toward technology or in their pattern of social relations, whether there are signs of a fundamental change in the human condition, as Drucker and others anticipate. They conclude that so far there are no such signs. Social relations and the structure of individual personality, on the verge of radical transformation if we are to believe the MIT-based writer Sherry Turkle (1995), seem virtually unaffected. Predictions of the virtuahzation of the high street or main street, with retail services migrating *en masse* to web-sites out on the Internet superhighway, seem equally improbable, And echoing Upitis, they warn against relying upon ICT as a panacea for governments reluctant to finance the traditional delivery of education to the young into the twenty-first century. As they point out, technology can have something like a revolutionary effect on individuals when it satisfies large and hitherto unfilled demands, as in the case of the railway, the motor car, and more recently the television: the first two innovations offered unprecedented mobility, and the third access to inexpensive and endlessly changing entertainment from the comfort of home. As yet, there is little indication that the new communications technology does more than allow individuals to do more easily or economically what existing and widely available technology -the postal system, the telephone, television — allows them to do already.

The chapters in this volume, commissioned for the 1997 session of the Canada-United Kingdom Colloquia, speak primarily to the contemporary situation in Canada or the UK. This invites the question of whether there is anything distinctive about the experience of the communications revolution in these countries that deserves special attention. At one level the answer must be no, since neither country could be said to have gone beyond the experience of the United States where much of the technological "revolution" originated, and also because one of the central features of the "revolution" is its globalizing tendency and indifference to national boundaries, But at a second level the communications revolution, however defined, has a special relevance for Canada and the UK, and this for several reasons. Both countries have been shaped crucially by communications, Canada largely because of its thinly spread population and vast territory, Britain because of its world empire and unique concentration of world markets for money, bullion, metals and other commodities, investment instruments, insurance, shipping, and insurance. Britain was the pioneeer in public service broadcasting, providing the model for Canada to emulate a decade later. These services are still widely regarded as essential agencies for national unity, but they both now face unprecedented challenges owing partly to the new technology, and the unity of both Canada and the United Kingdom are facing similar strain. To add to the list of reasons, the two countries have been pioneers in the field of distance learning. And both countries have an important presence in the communications industry, Canada through BCE and Nortel among others, Britain through firms such as BT and Cable and Wireless. As Mosco points out, they also have their local equivalents of Silicon Valley, placing them at the cutting edge of technical innovation. Finally, both countries rank high on the list of per capita income, and both are advanced democracies. The practical import of this is that on the one hand they can, and indeed are, capable of introducing the new technology faster and in far greater quantity than poorer countries. But on the other hand they are also bound to confront the consequences, and in particular those affecting democratic institutions and the problem of exclusion.

The speed of technical change in the communications field means that in a year or two the contributors to this volume would probably illustrate their points differently, were they to take up their subjects again. The issues they deal with, however, and the insights they offer seem certain to remain acutely relevant well into the next millennium.

NOTES

1. See the discussion in the chapters by Pal and Mosco in this volume; also, from an American perspective, Moynihan, *The Coming American Renaissance.*
2. The stress on "institutional framework" finds an echo in much of the recent literature on the "communications revolution." Typical is the observation of Gordon Smith (1997), deputy minister of foreign affairs, on the introduction of ICT into the Canadian diplomatic service: "This leads me to a fundamental point: for the transition to a technologically savvy diplomatic corps to work, it must be made a managerial priority. In my view only about 10 percent of the challenge is a technical one; the other 90 percent lies below the surface in an organisation's culture, human resource priorities, and operating procedures."

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