The future of computer and communications services

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INTRODUCTION

Rigorous studies of the future have become relatively commonplace in the past decade. This has been especially true in fields of rapid technological and social change. Two of these areas, the computer and communications industries, have been the subject of increasing interest and examination in the past few years. The development of complex technological, regulatory, social and institutional interrelationships between these two industries and increasing recognition of their impact on the future of the economic, social, and political framework of modern nations has led to this intense interest. The future of these industries has been the subject of inquiry in both Canada and the United States by many governmental and institutional bodies as well as by groups within the affected industries. The purpose of this paper is to examine a number of these studies and outline their projections of events as they impact upon the members of the developing post-industrial societies.

The utilization of computer based systems with widespread communications links has been commonplace for some time in the military, space, corporate, R and D, and educational sectors of the economy. However, with few exceptions to date, these systems have not had any significant impact upon the everyday life of most North Americans. This situation is starting to change and it is this area that will be examined in the following analysis. The impacts to be explored include the potential widespread adoption of Computer-Assisted-Instruction services in both the classroom and the home. The use of computer and communications capabilities to substitute for inter- and intra-urban business travel will also be discussed. The future of various computer based services that could be provided in homes will also be forecasted. In all cases, factors that favor or mitigate against the adoption of the various services will be examined.

FORECASTING THE FUTURE

Forecasting in general

Forecasting the future is an integral part of everyday life in both the private and institutional sense. In many cases individual decisions are made with some implicit model of the short and intermediate future in mind (e.g. plane schedules, weather conditions, stock market trends, consumer price trends, expected career paths, real estate conditions, etc., etc.). Longer term forecasting of economic indicators in the business and governmental sectors has been common for decades. In economics the tools used are mainly the various forms of trend analysis and extrapolation. Science and technology have also been forecasted by knowledgeable observers using various approaches. The emergence of Policy Research Institutes ("think tanks") and the need to forecast broader futures for many organization planning activities has led to the development of many new technological and social forecasting techniques since World War II.

Delphi analysis

One of the important developments in the forecasting field has been the creation of a number of techniques that rigorously collect, analyze, and disseminate qualitative forecasts on expected developments in a particular area of interest. Generally these forecasts utilize the consensus opinion of groups of "experts" in the field under review. In relatively rare cases the output may be from a single individual who is acknowledged to have a talent and track record for developing plausible futures i.e., "genius" forecasting and scenario building—some science fiction authors have been acknowledged (usually posthumously) to have this gift of clear vision. One technique that collects and analyzes opinions from a group of experts on a particular subject under defined conditions has been called the "Delphi" technique by its original inventors at the RAND Corporation. The Delphi technique has evolved considerably since its development at RAND in the early 1950's. The basic RAND definition is described as follows:

"The Delphi technique is a method of eliciting and refining group judgments. The rationale for the procedures is primarily the age-old adage 'two heads are better than one', when the issue is one where exact knowledge is not available. The procedures have three features: (1) Anonymous response—opinions of members of the group are
obtained by formal questionnaire. (2) Iteration and controlled feedback—interaction is effected by a systematic exercise conducted in several iterations, with carefully controlled feedback between rounds. (3) Statistical group response—the group opinion is defined as an appropriate aggregate of individual opinions on the final round. These features are designed to minimize the biasing effects of dominant individuals or irrelevant communications, and of group pressure toward conformity."

Material from Delphi studies has been selected for this paper since this literature has the richest store of forecasts on the future applications of computer-based communications systems. It should be stressed that there cannot be any one “right” forecast of the future. The material outlined below illustrates expert opinions developed at specific points in time. Each will have unique built-in biases. Proponents favoring the use of various new systems or technologies usually forecast their widespread adoption at an earlier date than other observers. Others may forecast what they would like to see happen rather than what may be socially, politically, or financially likely. On the other hand, many of those invited to serve on Delphi panels are in positions to help influence the future through their decisions and actions, that is, they help invent the future. The combined viewpoints presented here should balance out these potential biases and outline plausible directions for the future.

Computer and communications forecasts

Examination of the available forecast data base for computer and communications capabilities indicates that there are many projections available on a pure technology base. That is, many studies on hand have outlined expected developments in science and technology. However, studies that examine in any detail the adoption of technological capabilities by end-user groups in society are far rarer. The first area explored, educational technology, has been reviewed by the greatest number of user oriented research efforts. Selected examples are illustrated in this paper. The Bell Canada Delphi research findings are integrated with the results of other examinations to present a more extensive data base. The substitution of business travel through the use of new computer and communications capabilities is more virgin territory. Some broad scenarios and general research have been conducted but the data base is much thinner. The final area of interest, future home computer and communications applications, has been the focus of generalized analysis for the past few years and is currently being examined by many organizations in North America.

Organization of the forecasts

Presentation of a number of differing forecasts on the same subject in a simple manner is difficult and sometimes misleading. Each study uses different definitions, assumptions, and styles in result presentations. Delphi study results are often presented graphically but well conducted studies also outline the panelist's background assumptions, comments, reservations, etc. as a modification and/or amplification of the results summarized in the statistical charts. This background material cannot be included here although it is very valuable information for analysis.

The results of several studies on a particular subject will be summarized here graphically in the following manner (see example - Figure 1).

1. A map of the future is presented as a series of concentric rings moving out from the center which is today (1972). Each ring represents a five-year time period.
2. Forecasts of an event are presented in the form of a small circle placed in a particular five-year time period. This forecast only represents the median estimate of the Delphi panel. The inter-quartile range (middle 50 percent) of the forecasts which is normally illustrated in Delphi results has been ignored for the sake of simplicity.
3. The forecast circle is divided into two halves: e.g.,

The top half of the circle includes the Delphi panel's estimate of the expected percentage penetration of the service into the applicable universe (e.g., 20 percent above). The universe is defined in the charts (no. of schools, homes, business, etc.). The lower half of the forecast circle illustrates the panel's estimate of the probability of the forecast actually occurring (i.e., 3 or 30 percent above). In cases where either type of the above information is not available in the original study, the half circle is solid. The number to the left of the forecast circle references the source of the material. The sources are included on the figure at the bottom.

While this process may appear somewhat complicated initially, it should enable comparisons between several forecasts on a subject on one chart rather than cross-referencing between a number of figures and charts.

Figure 1 Forecast comparisons - Example
FUTURE APPLICATIONS OF COMPUTER AND COMMUNICATIONS SERVICES

Educational technology

Introduction

The educational technology field has been the subject of a large number of studies in recent years. This is the result of several factors. Educational advancement has been a dominant national concern in North America for the past two decades. It has been assumed that a high degree of educational training in the population is a key to continued rapid economic growth and international standing. The education market has been a large one, although most of the money has gone into salaries and physical plants in the past. Many large corporations have regarded educational technology as an emerging growth market and have entered with computer and communications based instructional aids. This has resulted in the funding of pilot systems in a few centers and research into the larger potential markets for these systems. The R & D complex in government and industry has also sponsored considerable activity in this field. These and many other factors have combined to produce a large number of Delphi studies in the educational area. The selective sampling below illustrates some of the findings of this research.

Computer-assisted instruction (C.A.I.)—Definition

C.A.I. is one of the earliest off-springs of the merger of computer and communications capabilities that could have a significant impact on the everyday life of students. C.A.I. embraces the remote use of computer capabilities by students who engage in a number of instructional activities. C.A.I. systems can provide very basic as well as sophisticated capabilities. These include:

1. Drill and Practice systems (DP): a supplement to the regular curriculum taught by a teacher. The computer can relieve the teacher of the burden of routine work by reinforcing learning and at the same time provide practice work for a student at his own pace and level of complexity.
2. Tutorial systems (T): those which take over the main responsibility of developing skill in a specific area. The instructions permit freely constructed responses on the part of the student and will analyze each student’s comprehension in greater depth and detail than is possible for a teacher with a classroom of twenty or thirty students.
3. Simulation systems (S): the student can change the inputs and vary the parameters.
4. Socratic Dialogue systems (SD): participative programs where the student helps develop the course. These systems would need extremely large branching facilities.
5. Instructional Games systems (IG): creative thinking games perhaps used for group as well as individual learning experiences.\(^7\)

The Bell Canada Educational Delphi study examined the adoption of these five types of C.A.I. in three different school levels. The penetration rate examined was 20 percent of the applicable universe. The 20 percent penetration rate was considered to be well beyond the experimental stage or adoption in a few well funded but isolated centers of excellence. The 55 percent penetration rate (shown later in Figure 3) was chosen to illustrate widespread use of CAI capabilities across the educational spectrum. The Bell Panel forecasts are presented in Figure 2.

The study results suggest that Drill and Practice and Tutorial systems will be the first two types to be adopted at all levels, followed by Simulation and Instructional Games Systems. Socratic Dialogue programs will be the most complex to write and will therefore be late in gaining usage. In fact, it has been suggested that SD programs may never be adopted at the Primary level as children “have such a limited attention span and shallow interest areas that the depth knowledge that is supposed to develop from such dialogue would be useless.” (panelist quote). Most panelists agree on the programming difficulties but are not willing to concede “never.”

The pattern of adoption of these systems follows that of CAI systems in general, gaining initial usage at the higher level institutions and then subsequently being utilized by the lower level schools. Of course, experimentation with these systems at all levels will be an ongoing process.\(^8\)

Examination of several forecasts of CAI usage must be presented on a more general plane. Most studies only

<table>
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<tr>
<th>SYSTEM*</th>
<th>PRIMARY SCHOOLS</th>
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* Defined in text. *Median panel response


Figure 2—Usage of C.A.I. systems in 20 percent of schools
Figure 3—Computer assisted instruction—Forecasts

forecast the use of CAI as one overall service package, not the five types of services shown in Figure 2. The forecasts of adoption of general CAI services by several studies are illustrated in Figure 3. Figure 3 is subdivided into three sections which show the future use of CAI in: (a) universities (b) schools and (c) homes.

**CAI use in universities**

Much of the pioneering work in CAI has been undertaken at universities. However, it is interesting to note that most available forecasts of CAI adoption are in the school or home areas. The Bell Canada Delphi panelists forecast 20 percent penetration into the university environment by the end of the decade. Widespread adoption was expected in the first half of the 1970's. These forecasts implicitly assume continued funding of prototypes. Production of content material for CAI systems is another important pre-condition. An analysis of the various supporting and inhibiting factors for the adoption of C.A.I. of all types will conclude this part of the analysis.

**CAI use in schools**

The several sets of forecasts illustrated in Figure 3 relate to CAI adoption in schools. Initial adoption thresholds in this field are not expected by the various Delphi panels until the early to middle 1980's. An exception to this is the forecast of the Bell Canada panel which projects 20 percent penetration in secondary schools by the late part of this decade. The Institute for the Future (IFF) study: *Some Prospects for Social Change* . . . projects 30 percent adoption in the early eighties at a .5 probability or in the late eighties at a .5 -.7 probability. The Bell study for primary schools predicts a similar time frame for addition of CAI services.

Widespread adoption (55 percent) of CAI is forecast by the Bell Canada study within approximately five years after early (20 percent) threshold adoption for the various school levels (including universities). The Bell group of panelists felt that once the threshold penetration was reached, dissemination of CAI capabilities throughout the various levels of the school system would occur rapidly. This "bandwagon" effect has been demonstrated many times before in other fields. The philosophy of "S" curve (logistic or Gompertz curve) trend extrapolation supports this contention.

The Parsons and Williams forecasts for "widespread" adoption are earlier than the other predictions. A number of factors should be considered when comparing these estimates to the others.

(a) The study was undertaken in an earlier period (1968) than some of the more current research. The feelings of optimism for the future of educational technology were much more euphoric in the late sixties than they are in the early seventies.

(b) This study had many European panelists. The control of most educational funding is much more centralized for many European countries than in Canada and the U.S. Hence, widespread CAI adoption could occur faster in Europe than in North America as a result of more central decision making and funding processes.

(c) There are probably implicit differences of definition for the term "widespread" between the studies.

These factors and the interpanel differences help illustrate the "soft" nature of qualitative forecasting. Different groups invariably will have somewhat varying views of the future even if the factors noted above could be held constant when conducting and comparing studies.

In summary, most of the forecasts for the use of CAI in the educational system do not expect any significant rates of adoption until the 1980's. CAI system growth will continue to be an evolutionary process, assuming that the various roadblocks that develop can be overcome. The developers and promoters of various CAI systems often forecast widespread development and societal benefits in the nearer future. A more balanced viewpoint from several groups of knowledgeable individuals indicates a cautious optimism.

**CAI use in the home**

Many futurists and speculators on the prospects for what is sometimes termed the "wired city" include CAI as one of the important services to be offered in the home.
The logical provision of CAI services to the home implicitly assumes that the computer hardware, software, and content material is already available from school usage at zero cost and can be accessed cheaply from the home. Additional implicit assumptions also include low cost communications capabilities, terminals, and a consumer demand for the service (beyond that required for ill or handicapped students). Institutional roadblocks and red tape are also assumed to be overcome.

This network of implicit assumptions (often not outlined in popular scenarios) is reflected in the conservatism of the various forecasts illustrated in Figure 3. The Bell Canada panelists forecast "some use" (no percentages given) of CAI capabilities in the home by secondary students in the late 1970's and in the early 1980's for university students. The panelists also considered such factors as the availability of portable acoustic-coupled terminals which could help make supplementary CAI service in the home available before permanent terminals would make it a routine part of home educational activities. The 20 percent penetration rate shown in the forecast circle with the dotted line relationship to the solid circle forecasts illustrates the panel's forecasts for 20 percent of the homes to be equipped with the audio-visual communications capabilities that would make effective CAI-type home service possible. Of course these technical capabilities could be used to provide many other services into the home as well.

All other studies referenced support the viewpoint that there will be little access to CAI in the home until the middle or late 1980's. The IFF study Some Prospects for Social Change... projects that there is a 50 percent chance of some use of CAI in the home by the early 1980's. The Parson's and Williams panelists feel that this will not occur until the late 1980's. This view is also held in another IFF study, Potential Demand for 2-way Services In the Home. The findings here are that 10 percent of the homes in the U.S. might be using CAI by the late 1980's.

All of the studies noted above expect a considerable lag between adoption of CAI in the school system and use in homes. This is a logical conclusion since many more economic, social and psychological factors have to alter before adoption occurs on a widespread basis in the home. It would appear that forecasts of the future use of educational technology in the home should be examined on a broader basis than just CAI services, as sometimes occurs in the current "wired city" literature.

Factors inhibiting CAI adoption

The forecasts above were all based upon various assumptions and qualifications outlined in the original reports. Rather than repeating them here in any detail, another recent Delphi study conducted by EDUCOM for the National Science Foundation will be referenced: Factors Inhibiting the Use of Computers in Instruction. This study is different from the ones examined earlier as it does not try to forecast dates or rates of adoption for various types of CAI in the educational system in the intermediate and long-term future. This Delphi study was designed "to identify those obstacles which have hindered the development and acceptance of computer use in instruction, and to suggest means for overcoming them." The basic factors considered were in three dimensions—educational, economic and technical.

It found that the most critical dimension was the educational one. That is, most of the issues and problems relate to the availability and quality of educational content material in the systems. There is also a lack of detailed evidence to support the claims of CAI's effectiveness in the educational process. In total, 28 of the 37 factors examined and rated in importance by the panel lay in these areas. These factors are illustrated in Figure 4.

The question of cost effectiveness was judged to be almost as important as the first issue by the panel. Three overall factors were examined: 1. CAI is usually an "add-on" cost in the educational process, 2. capital investment is high even where cost effectiveness can be demonstrated in the long run, and .3 existing systems have had poor cost effectiveness to date. The six technical issues reviewed were only regarded as moderate or slight overall inhibitors to widespread adoption of CAI. The Educom study recommends 15 action activities that will enhance the more widespread use of CAI. These are summarized in Figure 5 which is taken from the report. The Bell Canada Delphi research had similar recommendations. The important point to emphasize is that it is the human, social and financial implications that are paramount, not the technical issues. This situation is normally overlooked by computer and communications professionals or system promoters. The end user requirements cannot be overlooked if there is to be widespread acceptance of CAI.

CAI future—Conclusions

The forecasts outlined above, and the important inhibiting factors that have to be considered and overcome before CAI gets widespread adoption, leave the observer with a feeling of cautious optimism. The technical and cost factors will all be resolved with time. The social and behavioral issues will require patient planning and experimentation before they are resolved. This realistic viewpoint is not designed to downplay the importance of widespread CAI usage. Routine interaction with computers during the formative education years will create a fertile ground for the widespread acceptance of the use of computer and information processing power in all sectors of society. The students who grow up with these capabilities close at hand will expect their common availability at work, home, and even leisure activities. This will lead to a true information revolution. Until that time we can only expect the use of computer power in everyday life in cer-

From the collection of the Computer History Museum (www.computerhistory.org)
tain isolated and special situations. The rest of this paper will examine two of these situations:

1. The use of computer communications capabilities to help substitute for some forms of business travel and
2. The adoption of certain types of computer based services in the home.

**Travel—Communications substitution in business**

**Introduction**

The use of communications and computer systems in the business environment has been extensive for some time. Most business computer applications involve large volume “number crunching” activities or mechanization of existing manual procedures. The development of timesharing led to a second generation of applications and the

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<th>A. PRODUCTION DISTRIBUTION OF INSTRUCTIONAL MATERIALS.</th>
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<td>2. Lack of professional and economic incentives for development of computer-based materials.</td>
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<td>3. Lack of incentive for faculty members to expend any considerable time and effort in modifying or creating alternative, instructional methods.</td>
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<td>4. Lack of incentives for dissemination of software.</td>
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<td>5. The lack of personnel with appropriate training and talent in the diverse disciplines required; i.e., instructional psychology, computer science, engineering, educational administration, radio-TV-film.</td>
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<td>6. Application of the “textbook” or single-author model to curriculum production instead of the “movie production” model involving a highly skilled differentiated team.</td>
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<td>7. Lack of initiative with regard to distributing software and providing training and services for its users.</td>
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<td>8. Lack of appropriate mechanisms for protecting patents, copyrights, etc., for CAI materials.</td>
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<td>9. Lack of standardization of computer systems, limiting free exchange of software.</td>
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<td>10. Lack of an organization to facilitate interchange of CAI program materials.</td>
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| B. DEMONSTRATION | | | | | |
|-------------------|----|----|----|----|
| 11. Too few examples of high quality use. |    |    |    |    |
| 12. Lack of compelling evidence that CAI is more effective than other methods of comparable cost. |    |    |    |    |
| 13. Lack of carefully planned broad programs of CAI experimentation in actual school settings. |    |    |    |    |
| 14. Failure to design curricula and systems for high-impact, low-resistance “markets” where real institutional problems can be solved. |    |    |    |    |
| 15. Lack of “critical mass” in setting up programs. |    |    |    |    |

| C. THEORY OF INSTRUCTION | | | | |
|---------------------------|----|----|----|
| 16. Failure to recognize that material must be completely recognized and restructured if it is to be taught effectively with computer systems. |    |    |    |
| 17. Inadequate development of a range of computer-based pedagogical techniques. The range might include question-answers, tutorial, drill and practice, simulations, games, problem solving modes, etc. |    |    |    |
| 18. Tendency to put too much “on the computer” rather than share the presentation and testing of curriculum objectives with other instructional media. |    |    |    |
| 19. Lack of experimental data and theories in learning psychology which would facilitate the design of effective CAI programs appropriate to each age level. |    |    |    |

Figure 4—Educational problems related to widespread use of CAI.
D. EDUCATIONAL SYSTEM AND THE TEACHER

20. Reluctance of school personnel to go through reorganization and training that a broad use of CAI would entail.

21. Cautiousness and uncertainty on part of educators as to effectiveness of CAI in comparison with traditional teaching methods.

22. Scarcity of resources available to train teachers and others in the skills required to use CAI successfully.

23. Fear of educators of being reduced to a "button-pushing" or clerical role by computer.

24. Reservations as to possible negative effects of removing instructional process from social situation and replacing interpersonal feedback with mechanical.

25. Extreme diversity of, and lack of coordination among, school systems throughout the county.

26. A prevailing attitude that the computer will be used to replace poor teachers instead of making good teachers more effective.

27. Insufficiency of evaluative techniques, criteria, and agencies with which to satisfy educational standards.

28. Not enough opportunity for local school people to participate in development of CAI programs.

Source: E.J. Anastasio and J.S. Morgan, Factors Inhibiting the Use of Computers in Instruction, Educom, 1972

spread of computer usage into more routine business activities. Generally these activities were in the technical research, scientific and statistical analyses areas. The impact of widespread computer system usage has not had a significant impact on regular middle management and executive activities to date (except perhaps to inundate these people with many computer generated reports that they don't have time to read).

Intra-urban substitution

One area where information management and distribution activities may have a significant impact in the future is in the area of business travel. This can occur in two areas: Intra-urban and inter-urban travel substitutes. Some intra-urban commuting may become subject to substitution. Continuing problems with urban concentration (pollution, poor public transportation, high cost office space, employee dissatisfaction, etc., etc.) have led some to forecast the shifting of many types of occupational activities to the suburbs or even the home itself. Travel to the downtown office would only occur for certain types of meetings and activities while the more routine activities would be handled by various types of communication systems and remote access to computer stored files.

One of the Bell Canada Delphi studies examined some potential tradeoffs between intra-urban travel and computer communications services. The various forms of possible developments considered were:

1. Office Center—a central location is maintained but there is increased reliance on audio-visual capabilities to supplement travel.

(2) Home Remote Work Center—located in an employee's home with access to computer and communications capabilities as required.

(3) Neighbourhood Remote Work Center—within walking distance of employee's home. Has work spaces equipped with required computer—communications capabilities.

(4) Mobile Worker—employee uses portable terminals with required input/output capabilities.

The panel forecasts for potential adoption of these types of activities are shown in Figure 6. The Bell panelists commented that the home remote work center could create many social problems, even...
though the system may become technically and economically feasible. The problem of isolation from the intellectual stimulation that can occur in a professional work environment was mentioned. The problems of working effectively in the home environment surrounded by family and other distractions were also stressed. On the other hand, these and other panelists recognized the benefits that could accrue from reduced commuting time, urban congestion, etc. The ability to pick the work period most suitable to individual life styles was pointed out. Several panels suggested a compromise view whereby white collar workers in the future might split their work periods between working at home and in the office, depending upon the task at hand.

The neighbourhood remote work center was regarded by the panelists as another form of compromise between the extremes of continuing today's work patterns versus shifting work to the homes. This development and that of the mobile worker were forecasted to occur in the mid 1980's versus the mid 1990's for 20 percent penetration into the home work center concept.

The Bell Canada panel findings have been compared to those of several other studies to determine whether or not these forecasts were unduly pessimistic. Figure 7 follows the basic format of the earlier comparison chart. However, in this case, each of the forecast circles has a brief description explaining the forecasted item in more detail. These views are also conservative when compared to those of some of our more utopian social thinkers and planners. This reflects the broader variety of material available when compared to the CAI studies. The chart is divided into halves, the upper half indicating the forecast of activities that might occur in the home and the lower half indicating the availability of supporting technology in the home. An overall evaluation of these forecasts indicates that the various groups who have examined the likelihood of these work functions occurring in the home share a similar conservative viewpoint to the respondents of the Bell Canada study (top half of Figure 7). Low threshold market penetration (2 percent-5 percent) for services such as remote secretarial service, remote access to company files and person-to-person (clerical etc.) services provided electronically in the home is not expected until the middle or late 1980's. Significant acceptance of middle management activities at home (5 percent) or of total work hours at home (10 percent) is forecast for the 1985 to 2000 time frame. In summary, the Bell Canada panelists' forecasts actually look optimistic when compared to the views of other study findings.

The second half of Figure 7 displays some of the terminal and computer capabilities that may be available in the homes of the future. These types of capabilities would be necessary before many of the work activities forecast above could take place effectively. It is interesting to note here that most studies forecast 10 percent-20 percent penetration of the technology in the homes before the work function shifts significantly to the home. This lag may be as much as 10 years or more.

The overall conclusion to be drawn from the available forecasts for intra-urban substitution of travel by computer/communications capabilities is that this will not occur in a widespread fashion until very late in this century. The build-up period prior to the work location shift will see an increasing proliferation of remote technological capabilities in the home. Once again the main deterrents to change are expected to be social, not technological in nature. Individuals will need to develop new attitudes toward working in physical isolation, and in electronic partnership with their fellow employees or professionals. Home life likely will be restructured. The secondary benefits and changes involved with this form of social engineering must be examined as well. Employers will have to shift their attitudes toward "managerial spans of
control” when the “knowledge” workers are no longer physically present. Literally hundreds of questions of this nature will have to be examined and answered before computer communications and work systems are restructured to favor the widespread substitution of intra-urban travel by computer based communications systems.

Inter-urban substitution

The substitution of inter-urban business travel by various types of communications services is quite different from that of intra-urban substitution. In this case, travel tends to be less frequent but more expensive in terms of time and money. The purposes for business travel can be slotted into a number of different categories. Certain forms of travel are quite repetitive and might be substituted for by teleconferencing systems using various combinations of audio/visual/computer capabilities. This area has begun to receive some attention from various researchers in the social field as well as those in the communications field. Figure 8 illustrates various forms of transportation of men, material and information, and speculates on their substitution possibilities. Figure 9 indicates some of the results of a survey of the opinions of business executives toward the use of various communications media in specific situations. The overall conclusion is that as the complexity of the communications task increases the perceived felt need for face-to-face contact is greater.

The behavioral research cited above illustrates the types of thinking being directed toward the question of inter-urban travel substitution. Bell Canada has several proprietary, current research activities in this area. The key point to consider when forecasting the future in this area is that the basic technology is available now. Prototype audio, 2 way television, and computer controlled teleconferencing systems exist today and are being used. Future directions in technology will only provide further subsidiary improvements (e.g., wall size flat color T.V. screen for visual teleconferencing) or cost savings. The main thrust in the current research efforts is to identify the types of business travel interactions that can be substituted and the best combinations of teleconferencing systems to meet the user needs. The penetration rates for business travel substitution will be almost totally dependent on behavioral factors rather than technological ones.

Computer and communications services into the home

Introduction—Bell Canada study design

The discussions of CAI and travel/communications substitution each reviewed the forecasts in those areas that impacted on the home. The general conclusions of the referenced material were quite conservative, compared to previously published forecasts. This prompted the Business Planning Group to initiate a study to examine consumer acceptance of a broad range of potential new computer based communications services in the home.

The choice of forecasting techniques was especially difficult here. The use of the traditional Delphi methods to elicit the opinions of recognized “experts” in relevant fields left a considerable gap in the information base. This gap was knowledge of the attitudes and feelings of the potential consumers, that is, the housewives, toward “wired city” services. This school of thought stated that when it came to rating potential acceptance of these potential services, the housewives were in fact the only group of “experts” on the subject. The conclusion of this debate was to develop a new modified Delphi technique that utilized both “Experts through research” and “Experts through experience” (housewives). These two homogeneous Delphi panels examined and debated the market potential of various wired city services into the home. The emphasis was on services, not technology, and on analyzing the “comments” feedback from the panelists as well as their statistical estimates. This emphasis on comments helped get at the underlying reasons for the various conclusions reached by the two panels. The developer of this technique has called it SPRITE (Sequential Polling and Reviewing of Interacting Teams of Experts).

This study examined four main types of home services as well as ten types of information retrieval from the home. These were grouped by considering whether they were either a) fully interactive services, or b) limited interaction services. The services studied are shown in Figure 10. Detailed service definitions given to the panelists to facilitate their analysis will not be repeated here.
Study findings

An overall review of the findings of this research indicates that there were not very many significant differences between the experts and the housewives. The main differences that emerged were usually based upon fundamental attitudes in one group or another toward the acceptability of particular service features. The groups maintained their independent viewpoints although in less crucial cases, the experts sometimes agreed to shift their viewpoints toward those of the housewives. The study results are presented as overall evaluations of various service options rather than median estimates of the possible future dates of service penetration.

(a) Remote Shopping Service

The panelists felt that the facilities of a shop-from-home service would be used mostly for the purchase of articles such as grocery dry goods, perishable goods (other than meat), small appliances, and drugs and cosmetics. Meat, clothing, and large appliances were rejected by about half the panelists. They did not expect users of the service to pay much of a price premium (over and above the current cost of shopping) for the service. The main benefit of the service seemed to be the convenience aspect rather than any perceived cost reduction. Preferred methods of payment for this prospective service appear to be through charge accounts (favored by the experts) and the remote banking option (favored by the housewives).

Several panelists, both experts and housewives, made the comment that shopping trips fulfilled many more needs than the traditional purchasing of goods. It seems that if a remote shopping service is to become widely accepted, alternative outlets for housewives' social drives will have to become available.

(b) Remote Banking Service

Over eighty percent of the panelists expected that a checkless banking service (once developed) would be used for transactions involving retail stores, transportation tickets, contractual payments, and utility payments. Use of the service in restaurants was rated only slightly less likely (about sixty percent indicating it would be used). The experts on the panel felt that all of the possible optional features of the service were "very desirable" when ranked on a five point scale between "essential" and "definitely not desirable"; the housewives differed insofar as they felt that an overdraft privilege was less desirable and that an automatic payroll deposit feature was essential in any such feature. On the matter of costs for this service, both groups of panelists expected them to remain about the same as that for conventional banking transactions, regardless of what type of transaction was being considered. Hard copy of all transactions received at regular intervals was rated the most useful form of documentation for this service. In regard to soft-copy, or non-filable copy, the experts were generally more receptive to this form than were the housewives.

(c) Electronic Security Service

The panelists felt that the automatic detector/alarm would be most desirable for the detection of smoke and/or fire, natural gas fumes, and intruders in the home. The threats receiving lesser ratings were carbon monoxide, high levels of radiation, and dangers such as flooded basements and frozen pipes. In the event any of these threats were detected, the panelists thought that an alarm to the proper emergency group would be more desirable than an alarm to a neighbor's home or an alarm ringing outside the home to be heard (hopefully) by anyone in the vicinity. An alternative type of alarm system provided a set of push-buttons in the home which would act as normally operated fire alarms or burglar alarms, but would also be equipped to summon help for accidents in the home, poisonings, et cetera. Panelists indicated that this type of alarm service would be most desirable for signaling the presence of fires or intruders to the proper authorities. Householders would expect to pay more than their present insurance costs if they could obtain this service, according to the panelists. This reflects the idea that the cost of the service to the household would be slightly greater than the expected reduction in insurance premiums for a home with the service. One of the expert's comments covers this point well: "The differential insurance losses would probably be nil. The real pay-off is one's increased perceptions of safety."

An interesting observation throughout this part of the study was the housewives' greater acceptance of these security oriented services. They found all the services more desirable and felt householders would be willing to pay more for them than did the experts.

(d) Programmed Education Service

The results of the study regarding programmed education in the home were interesting because of the differences between panels. The housewives felt the service would be most useful for older (over 18 years) age groups and stressed the impact of the service on continuing adult education. The experts thought it would be most useful for school age (5 - 18 years) children. Both groups felt the service should offer a broad range of subjects in order to maximize the use of the service. In the words of one of the experts, "The consensus reflects the point that as much as possible should be available on the system so that it can be useful to the widest possible audience. On a per
tonal basis, only a few subjects would be of interest." The experts and housewives both felt that courses provided through the service would not be free, but would cost less than comparable institutional courses.

(e) Limited Interaction Services

The Limited Interaction Services were grouped into several categories. The first grouping was Consumer-Oriented Services (Consumer Shopping and Service Guides and the Consumer Rating Service). The statistical response of the panelists indicated that these services were fairly important improvements over the current non-electronic means of providing them. However, this estimate was qualified with a very low estimate of the monetary value of these services. The median payment estimates lay between “free” and “less than $1 per month.” A review of the panelists’ comments in this area revealed strong negative feelings toward these electronic services in the minds of many respondents who were quite satisfied with the current means of obtaining consumer services.

The second category was termed Information-Oriented Services (Demand News, Demand Entertainment, Demand Education). Both groups of experts regarded Demand Entertainment and Education Services as ones that would be used widely if available at a reasonable cost. These two services were regarded as significant improvements over the current means of providing the services. However, once again there were many negative comments directed toward the services, especially from the housewives. These centered around their low opinions of the potential quality of Demand Entertainment Services and the sterile and impersonal nature of Demand Education Services. Both groups also had many negative opinions toward the value of Demand News Service. The common point stressed here was that there are many alternative media sources for news information.

The third grouping of services was called Home Management-Oriented Services (Household Guide and Electronic Bulletin Board Services). These services were also regarded as somewhat questionable electronic duplications of current activities being handled quite well by the present media. The personal touch of the supermarket bulletin board was stressed by several housewives. The experts were more optimistic toward the services’ acceptability since they were more efficient than current means. Both groups saw very little economic value in the services.

The final classification was Data-Oriented Services (Personal Filing Services and the Home Calculator). These services were the least attractive to the housewives. The experts also felt that these services were ahead of their time for normal homemakers and would only appeal to professionals working at home.

Study findings—Conclusions

Several points seemed to emerge clearly from this research effort. Planners, marketers, researchers, etc. in the computer and communications fields often appear to feel that the new capabilities they are creating technologically will be of great benefit in the home. However, most of the services that these “experts” are designing for the “wired city” are mere electronic substitutions for many low cost or free methods of obtaining the services today (note: the consumer considers advertiser supported or subsidized services as effectively “free”). The experts are planning for the use of these services by other people, that is, the impersonal thing called “the market.”

On the other hand, we have the housewives, the potential consumers of these proposed services. The housewives represented on the panel were from an innovative modern community of upper middle class citizens, near Montreal, Quebec, (e.g., the most likely type of consumer to be offered these services in the near future). This panel reacted to the proposed services in two ways. Their statistical responses often indicated that they felt the various services would be widely accepted by “people in general.” However, their comments which were carefully encouraged and analyzed, clearly indicated that these women felt that the services might be acceptable to “people” or their neighbors, but not themselves. The housewives appeared to reflect the conventional wisdom of many readily available futuristic visions of the computer/communications fields in their statistical responses. When their own feelings were probed, they were often less than enthusiastic toward the services.

The housewives’ conservatism seemed to be based on a desire to maintain a personal relationship in many of their day-to-day activities. The new services were often regarded as efficient but impersonal. Many of the respondents volunteered fears of being shut off from the world in an electronic prison. The recreational nature of many daily events such as shopping was often overlooked by experts. Housewives also regarded the home as a place that did not have to be operated on a totally efficient manner. As one respondent commented: “Sometimes it is less convenient to be so well organized.”

These findings do not mean that the various services outlined above will not be offered to the public or eventually accepted by them. However, most services will start with professionals working in the home or with housewives who have many other activities beyond normal home duties to help maintain their contact with people outside of the home. As new forms of outside activities develop for housewives over time, they will come to depend upon electronic substitution for many of the old ones that seem so important today. Once again the trend is evolution not electronic revolution.

CONCLUSIONS

The theme of this paper is probably clear by this point. Development of computer based communications systems and their attendant technologies is going to continue at a rapid pace. Many of these advanced systems will be utilized in business, government and institutions. The devel-
opment and acceptance of systems that interface directly with the ultimate users is going to continue to be a slow and painful process. These systems will have to be designed and redesigned with the human element (and frailties!!) at the center. Emotional and "irrational" human considerations will determine the extent and timing of the use of CAI, travel/communications substitutions, and wired city services. The development of the more sophisticated systems will be based upon the structures financed by mass and demand entertainment services as well as similar educational services. There will continue to be centers of excellence in specific North American locations where pilot systems are trialed and refined. However, these systems can only be regarded as crude models of widespread systems to be in use toward the end of the century, not as mirrors of a future that will be upon us in a few years.

REFERENCES

1. Examples here include: 

2. Airline reservation, ticket and hotel reservation, on-line banking and credit checking systems are examples where the individual has second hand personal contact with computer and communications systems.

3. Readers interested in technological forecasting are directed toward a number of excellent books on the subject which include: 

4. The most extensive review of Delphi to date may be found in: 


6. A review of several of these studies may be found in: 
   Ibid (foregoing two paragraphs).


10. Ibid, p. 41.

11. Ibid, p. 44.


14. Ibid, p. 44.


