SESSION X

WHERE THE WORLD IS HEADING

Psychological research on videotex

RICHARD F. DILLON and JO W. TOMBAUGH
Carleton University, Ottawa K1S 5B6, Canada

Videotex is considered to be a powerful, but simple to use, computer network available for use in homes, offices, and schools. Information in the form of text and color graphics can be requested and displayed on the user's television set. While retrieval of information is the first service provided on videotex, many other services, including electronic mail, electronic shopping, and electronic funds transfer, will be developed. However, in order to achieve the popularity predicted for videotex, a number of human factors and social problems must be solved. Research concerning some of these problems, and the role psychologists can play in their solution, is described.

Videotex is sometimes referred to, somewhat inaccurately, as two-way television. It makes available the power of large mainframe computers to untrained users in their own homes, offices, or schools. The user can communicate with the central videotex computer over the telephone lines, using his own color television set as a display device and a small special-purpose keypad or standard keyboard as an input device. The videotex terminal, which is an inexpensive but powerful micro-processor, serves as the interface between the user and the central videotex computer. Hundreds of computer-naïve users can be accessing a central computer at one time. Because of the projected low cost and ease of use, it is possible that videotex terminals will become as commonplace as the telephone and television. In France alone, where the French government plans to provide the telephone directory on a videotex system, there will be videotex terminals in 30 million homes by 1992 (Bright, 1981). This paper describes what videotex is, and how psychologists can contribute to the development of such an important and far-reaching technology.

AN INTRODUCTION TO VIDEOTEX

Information Retrieval on Videotex Systems

A number of different videotex systems are under development (e.g., Woolfe, 1980). For example, the French government has developed a system known as Antiope, the British Post Office has developed Prestel, and the Canadian Department of Communications, in collaboration with Bell Canada, has designed Telidon. Although there are important differences among these

systems, they all share similar functions and have similar plans for the future. In particular, they all currently emphasize information retrieval services for users, with the central computer used primarily as a massive information storage device. In current implementations (e.g., Bown, O'Brien, Sawchuk, & Storey, Note 1), the central computer basically monitors requests for information from many users at one time, finds the requested information on rapid-access mass disk storage, and sends the information over the telephone lines to the person who requested it. Such videotex systems are sometimes confused with a similar system called teletex, which "broadcasts" information repeatedly on unused parts of the television signal. In the noninteractive teletex system, a user's request for information "sets" the terminal to receive that information when it is next broadcast a short time later. Thus, there is no communication from user to central computer, as there is on videotex. This paper focuses on videotex and its interactive capability, although some of the problems discussed are common to both videotex and teletex.

Storage of information in all current systems is organized in a hierarchy or logical tree branching out from a small number of general information categories at the root node to more and more specific information as the branches spread out. In order to make the system easy to use and to free the computer for monitoring requests from many users, a menu selection technique has typically been implemented. Figure 1 shows a typical menu page as it would appear on the television screen. The user selects a topic by entering numbers on the keypad that correspond to the menu item chosen. From the general choices shown in this display, successively more detailed choices can be made. Figure 2 shows how a user works through one branch of the tree to find baseball scores. The final page that actually

This research was supported by Grant G0365 from the National Science and Engineering Research Council of Canada to the authors.

TABLE OF CONTENTS	
1.	NEWS, WEATHER, & SPORTS
2.	BUSINESS & FINANCE INFORMATION
3.	GOVERNMENT INFORMATION & SERVICES
4.	SALES, RENTALS, & SERVICES
5.	ENTERTAINMENT
6.	TRAVEL
7.	JOBS, CAREERS, & OPPORTUNITIES
8.	EDUCATION
9.	INTERNATIONAL INFORMATION

PRESS NUMBER OF CHOICE, THEN PRESS SEND

Figure 1. A typical videotex menu page.

User sees:	<table><tr><th colspan="2">TABLE OF CONTENTS</th></tr><tr><td>1.</td><td>News</td></tr><tr><td>2.</td><td>Weather</td></tr><tr><td>3.</td><td>Sports</td></tr><tr><td>4.</td><td>...</td></tr><tr><td>5.</td><td>...</td></tr></table>	TABLE OF CONTENTS		1.	News	2.	Weather	3.	Sports	4.	...	5.	...																
TABLE OF CONTENTS																													
1.	News																												
2.	Weather																												
3.	Sports																												
4.	...																												
5.	...																												
User selects #3 and sees:	<table><tr><th colspan="2">SPORTS</th></tr><tr><td>1.</td><td>Hockey</td></tr><tr><td>2.</td><td>Baseball</td></tr><tr><td>3.</td><td>Football</td></tr><tr><td>4.</td><td>...</td></tr><tr><td>5.</td><td>...</td></tr></table>	SPORTS		1.	Hockey	2.	Baseball	3.	Football	4.	...	5.	...																
SPORTS																													
1.	Hockey																												
2.	Baseball																												
3.	Football																												
4.	...																												
5.	...																												
User selects #2 and sees:	<table><tr><th colspan="2">BASEBALL</th></tr><tr><td>1.</td><td>Scores</td></tr><tr><td>2.</td><td>Future games</td></tr><tr><td>3.</td><td>Team standings</td></tr><tr><td>4.</td><td>Statistics</td></tr></table>	BASEBALL		1.	Scores	2.	Future games	3.	Team standings	4.	Statistics																		
BASEBALL																													
1.	Scores																												
2.	Future games																												
3.	Team standings																												
4.	Statistics																												
User selects #1 and sees:	<table><tr><th colspan="4">BASEBALL SCORES</th></tr><tr><td>New York</td><td>6</td><td>St.Louis</td><td>4</td></tr><tr><td>Chicago</td><td>3</td><td>Pittsburg</td><td>1</td></tr><tr><td>Montreal</td><td>4</td><td>Philadelphia</td><td>3</td></tr><tr><td>.</td><td></td><td></td><td></td></tr><tr><td>.</td><td></td><td></td><td></td></tr><tr><td>.</td><td></td><td></td><td></td></tr></table>	BASEBALL SCORES				New York	6	St.Louis	4	Chicago	3	Pittsburg	1	Montreal	4	Philadelphia	3	.				.				.			
BASEBALL SCORES																													
New York	6	St.Louis	4																										
Chicago	3	Pittsburg	1																										
Montreal	4	Philadelphia	3																										
.																													
.																													
.																													

Figure 2. Menus shown while selections are made by a user interested in finding information about baseball scores.

contains the information, in this case the baseball scores, is called a document. Documents can be one page or many pages in length, and there are thousands of these pages available in the videotex tree.

It is important to realize that the computer does not generate information. It simply retrieves information that has previously been stored in the data base by persons known by the Orwellian title of "information providers." Advertisements, entertainment, and information for videotex is being produced under the same types of commercial arrangements followed in providing television content. As a result, at the present time, most systems are in an experimental stage and data bases are not well developed. A major question is whether independent information providers in North America will, indeed, improve the quantity and quality of documents

that will appear on videotex. It is expected that users will be able to subscribe to a number of different data bases, having different cost arrangements, including free service (e.g., for department store advertisements), a fee based on number of pages accessed, or a monthly subscription fee. Some data bases will be for specialized clientele (e.g., a stock market data base, agricultural data base, airline schedules, etc.), and others will be more general in nature (a combination newspaper, encyclopedia, yellow pages, and consumer catalog). Ultimately, the information that appears in the data base will depend on what people want and are willing to pay for.

Videotex Graphics

One of the major features of videotex systems is that data-base information can be stored in text form and in color graphic form. At present, these capabilities are limited by the technology available. One of the major limitations is the resolution of current home color television sets. Text is displayed with a maximum of 20 lines, with up to 40 characters per line. This text resolution is less than one-half the capability found on most noncolor CRT terminals. Graphic resolution is also limited. Maximum graphic resolution possible on a standard color television set is approximately 256 by 256 pixels.

Three modes of storing and transmitting graphic information have been developed: bit-mapped graphics, alphamosaic, and alphageometric representations (e.g., Milton, 1981). In the bit-mapped graphics mode, the central videotex computer stores color and brightness information arranged in an m by n matrix (e.g., 256 rows by 256 columns). This information is sent, one point at a time, to the terminal. Pictures drawn using this technique are slow to display, often taking minutes to complete, and they are expensive and difficult for the information provider to draw. In the alphamosaic technique, the complete picture is stored in a 40 by 20 array in the central computer and is transferred to the terminal on request. Thus, pictures are formed by using graphic characters of the sort found on inexpensive personal computers (e.g., on the Commodore PET home computer). This technique has the advantage that it allows use of inexpensive graphics terminals with fast transmission speeds, but it has two limitations. First, resolution is poor relative to the other two modes, and, second, the poor resolution is built into the stored representation of the picture. To appreciate this limitation, the alphageometric approach must be understood. The alphageometric approach does not store pictures on the central computer but stores picture description instructions (known as PDIs) instead. Picture descriptors provide information such as the starting point, diameter, color, and brightness of a circle. This coded information is stored on the central computer and sent to the terminal that interprets and displays the information. The terminal itself is a microprocessor with software to generate graphics, and the circle that is drawn using

alpheometrics is determined by the capability of the terminal and display. With high-resolution systems, a high-resolution circle will be drawn, and with low-resolution systems, a low-resolution circle will be drawn, but both will come from the same picture descriptors stored on the central videotex computer. The alpheometric terminal is more expensive, but it has a number of advantages. This approach provides (1) the ability to use existing data-base pages with higher resolution as graphic technology improves, (2) efficient central computer storage of graphics, (3) ease of drawing graphics by information providers, and (4) relatively fast transmission speed over the telephone lines. Regardless of the mode used, future graphics capabilities will include photographic facsimile and high-resolution graphics with animation and three-dimensional images.

Other Videotex Functions

Until now the videotex approach has emphasized keeping the user's task simple and keeping the computer's task simple by offering only information retrieval with a menu selection approach for retrieval. Maintaining the philosophy of simplicity while providing the many services planned for future versions of videotex will be a challenge to system designers. In the future, many services, including electronic mail, teleshopping, electronic funds transfer, monitoring and control of analog and digital information, and telesoftware, will be provided in addition to information retrieval.

Electronic mail will allow users to construct and/or choose messages that are sent to the videotex terminal of the desired recipient. The transfer may occur from one videotex terminal to another, but, at least initially, messages will be passed through the central videotex computer. The central computer will notify the recipient of the presence of a message, but if the recipient cannot respond, the message and notice of receipt will be stored. Two major advantages of a videotex electronic mail system are that (1) the message can be stored even when the recipient does not "answer" and (2) the message can be stored just like any other piece of information in the videotex information tree. Techniques for insuring that only the desired recipient has access to the private information portion of the data base are being developed.

Once the capability to pass information from one user to another is developed, the videotex system can be used for teleshopping. In teleshopping, the message is a request for items from an electronic catalog that is, itself, incorporated as information in the videotex data base. If shopping is accomplished through videotex, there is no reason that payment cannot also be accomplished through videotex (Bright, 1981; Harker, 1981). France, for example, is developing a credit card that contains a microprocessor for use with a special card reader attached to a videotex terminal. Evaluation of such a system is scheduled for field trials in late 1981

(Harker, 1981). In the videotex future, transfer of money will be simplified to transfer of information about money.

The combination of a large central computer and a small but smart terminal can be used for many other services. For example, the videotex terminal can be used to monitor such things as the heart rate of a cardiac patient, a burglar alarm, level of fuel in a tank, and so on. The information can be "passed" through the central videotex computer to the appropriate recipient (hospital, police station, fuel oil supplier) using the standard messaging system or a modified messaging system. Similarly, the "information" sent from the central computer to the videotex terminal can be control commands for turning lights, appliances, and equipment on and off, regulating a thermostat, and so on.

The videotex terminal, since it is a small computer, can do anything a small personal computer does. One interesting application being developed for videotex is telesoftware. This is the capability to store a computer program as the "information" in a videotex data base, with the program downloaded over the telephone lines to the terminal memory. With this capability, the central videotex computer serves as a peripheral mass storage device for programs and data to be used in the terminal. With this capability, the videotex system gains back the degree of flexibility that the basic videotex system gave up in favor of simplicity of operation.

It should be apparent that every one of the capabilities of videotex is available elsewhere. By integrating all these functions, plus making provisions for others that we cannot anticipate at this time, into an inexpensive, easy-to-use system, the average person can have access to computers that are currently available only to a select few. If videotex succeeds as predicted, the home of the future, office of the future, and school of the future will undergo considerable change. The remainder of this paper discusses some of the issues involved in the development and introduction of videotex that we feel must be addressed by psychologists.

RESEARCH OPPORTUNITIES FOR PSYCHOLOGISTS

Three different types of participants who are typically not computer experts will use videotex. These are the information provider, the data-base administrator, and the end user. First, the information provider, typically a graphic artist, creates pages and transfers them to electronic form by using the capabilities of special computer facilities referred to as information provider terminals. Second, the data-base administrator has responsibility for incorporating documents prepared by information providers into the data base and maintaining the general organization of the data base. Third, the end user, in home or office, makes use of the videotex services that are available (e.g., retrieving information from the data base). While the characteristics of the

work performed are different for these people, all three will typically have little computer experience, and yet they must function at an acceptable level for videotex to succeed. Consequently, in this section, we will examine some of the issues associated with usability of videotex by the end user, information provider, and data-base manager individually, before we take a more general view of social issues concerning the system as a whole.

End Users

Issues associated with the end users range from specific issues about the design and use of input and output devices to considerations associated with dialogue and data-base design. As videotex develops, an increasing number of people will have to use it if growth in videotex services is to continue. For this to happen, three elements are essential: (1) The user must be able to successfully carry out a dialogue with the system in order to request information, (2) the user must be able to locate the desired information in the data base, and (3) the user must judge the information, once found, to be of satisfactory quality.

Very little research has been reported in which the ability of persons to utilize videotex has been examined. Consequently, in a field study, we unobtrusively recorded responses of visitors as they used an early prototype of videotex in a museum (Tombaugh & Dillon, Note 2). In spite of the fact that videotex is supposed to be easy to use, approximately 40% of those who tried failed to produce a single correct response from the system. Examination of user protocols indicated that this problem could be attributed to three factors: poorly prepared instructions at the display, an unfortunate choice of symbols for the keypad, and error messages that were noninformative and intimidating. These problems were easy to modify in later versions of videotex, but they indicate the importance of pretesting user reactions to instructions, keypad, and error messages.

In a follow-up of our observations at the museum, we became interested in developing good instructions and on-line "help" for videotex users. An additional goal was to devise methods to integrate testing of naive users into the development phase. We felt that even the most hurried development could benefit from naive user testing during preparation of materials. We prepared an on-line "New User's Guide" to give minimum information on use of the system and a series of "help" pages designed to answer common questions of users. Field testing is still ongoing to determine which parts of the help system are accessed most often and to evaluate the adequacy of organization and content. However, the initial development and testing phase proceeded rapidly, at little cost, and with considerable modification due to test results. In preliminary tests, users were given a drawing of the input device and a printed or drawn set of the instructions, organized into pages as they would appear on videotex. By watching one or two persons

attempt to "walk through" these materials, unclear and misleading phrases were isolated and modified.

We have made a number of tentative generalizations from this research that we plan to test systematically in the future (Dillon & Tombaugh, Note 3): First, development of instructions should incorporate user testing. Even the expert, armed with previous observation of users and with guidelines for preparing instructions, can improve instructions by watching naive users trying to follow the instructions. Second, investment of the time to test users will result in faster and more appropriate modification than more traditional methods of quality control, such as review by experts or supervisors can. Third, assessment of user satisfaction with the material in the laboratory, even when paper-and-pencil techniques are replaced by the actual medium, may not generalize to the actual environment in which the material is used. Our New User's Guide, well received in a laboratory environment, was considered to be too long and repetitive when shown to a neighborhood group in a home environment. Thus, testing for clarity and testing for acceptability may require different techniques.

We turn now from questions concerning use of dialogue to questions concerning the ability of users to find information on videotex. A number of investigators, testing subjects who used menu selection from the hierarchical data base, have indicated that users have considerable difficulty in locating information on videotex data bases (e.g., McEwen, Note 4). These studies typically involve asking users questions such as "Who won the baseball game between the St. Louis Cardinals and Montreal Expos last night?", with users attempting to find answers by searching the data base. Using widely different data bases and retrieval methods, these studies consistently show that users access approximately twice as many pages as are optimally necessary in finding material. It is clearly difficult for users to decide where information will be located in the hierarchy. Yet, the use of menu selection from a hierarchical data base is fundamental to the first generations of videotex, not only because it is supposedly easy for naive users to use, but also because it requires very little computer processing time. By incorporating different types of retrieval methods, such as key-word searches, a great deal more computer time must be dedicated to each individual. Consequently, in our laboratory, we have been looking at ways of improving user ability to find information without changing the basic retrieval strategy. We have looked at different methods of organizing the material in the hierarchy, by categories or alphabetically (McEwen & Tombaugh, Note 5), and at the effects of previous experience with a printed directory, organized in categories (Dillon & Eastcott, Note 6). In summary, while the failure rate (the number of questions on which the user gives up) is affected by improvements in the data base and by previous experience with the printed directory, the

tendency of the user to retrieve twice the optimal number of pages continues to occur with widely different data bases and experimental designs. The problem is inherent in searching a tree with many levels by menu selection, since a single error in traversing a tree requires retrieval of at least two corrective pages: (1) go back (either retrace the steps or return to the beginning) and (2) try another path. Thus, a menu approach to information retrieval may have to be abandoned or supplemented in future generations of videotex. Research into potential alternatives to menu selection is needed and should be undertaken by cognitive psychologists with sufficient training in various data-base management systems to appreciate the practical constraints of computer-based information retrieval and data-base management.

Finally, the question of user satisfaction with the material on the system is of interest so that guidelines on the type of material that result in user acceptance can be established for information providers. By surveying the existing documents in videotex systems, it is clear that there are huge variations in a number of parameters: time required to display the graphic, amount of detail, use of color, use of motion, extent to which the graphic adds to the understanding of the page or is simply decorative, and so on. We are currently conducting a study to determine which of these many factors actually affect user ratings. Both first-time users and experienced users will rate a sample of existing graphics. From the results of this study, those factors that seem to be most important in influencing user preference will be identified, and a prototypical set of pictures will be generated for more systematic variation of the features. Understanding user preferences is a first step in providing guidelines for information providers, as discussed in the next section.

Information Providers

Research associated with information provider terminals is needed, and some interesting issues, such as those shown in Table 1, can be identified. Most of the categories shown in Table 1 are concerned with usability of the information provider's terminal. Because the information provider is an artist, not a computer expert, issues having to do with dialogue design and training will be particularly important. At present, most information provider terminals include a keyboard and drawing device, such as a joystick or digitizing tablet, for input, and both a standard alphanumeric terminal and a television display for output. The television screen shows the graphic being drawn, and the CRT is used to display the information provider/computer dialogue. Typically, the functions available to the information provider are presented in a menu, and then when the information provider selects one function (e.g., draw a circle), the program prompts the user for more specific information (e.g., for the center and radius of the circle). The menu pages we have seen tend to be cluttered with many functions, and the methods of changing from one mode

Table 1
Research Issues Concerning Information Providers

Input-Related Issues	
What input devices are needed? (keyboard, drawing devices)	
How can each device be made easy to use? (layout, labeling, supporting programs, dialogue)	
What is the best method of instructing users? (classes, training manuals, on-line tutorials)	
Output-Related Issues	
What is an effective format for dialogue? (menu organization, windows, special prompts)	
How should error messages be presented? (placement, length, wording)	
In what form can the graphic be displayed? (static, dynamic, with format indicators)	
General Work Station Design	
What placement of input and output devices is best?	
What other resources are needed at the work station?	
What environmental factors will reduce fatigue?	
Functions	
What functions should be provided? (draw, write, color, edit, display, etc.)	
How does each function get selected and used? (dialogue design)	
What can be done to minimize training time? (embedded training, on-line help, supporting documents)	
Quality of Product	
What guidelines are needed for information providers? (timing, color, amount of detail, etc.)	
How can these guidelines be effectively presented? (on videotex, on film, on paper)	

of operation to another (e.g., from adding text to modifying text, or from drawing pictures to inserting text) are not clear.

The systems that will eventually be most popular for information providers will not necessarily be those with the most functions, but they will be those with the most easy-to-use functions. In addition, as is true in most applications in which there is a need to train workers, it will be desirable to minimize training for new employees. Well written, on-line tutorials and supporting documents are necessary. Research to develop good dialogues and training methods is needed. A number of different types of psychologists can contribute to the development of optimal usability for information providers.

The final topic in Table 1 concerns the problem of creating pages of information that are well received by users. At the present time, information providers are not sufficiently aware of the dynamics of drawing on videotex. Unlike an advertising layout in a magazine, the graphic picture on videotex develops in time, in the order that it was drawn. In addition, the more detail in the picture, the longer it takes to be presented. In a review of cognitive and perceptual research on use of visual images, Mills (Note 7) summarizes research that suggests that simple outline drawings are identified more quickly than are more detailed pictures, such as photographs. Thus, it can be hypothesized that, in the tradeoff between time and detail, users will prefer simplicity. However, there are many examples of slow graphics on

videotex; a random sample of 30 graphic pages included five pages requiring more than 30 sec to develop. Thus, guidelines are needed for information providers, and, in addition, these guidelines must be presented in such a way that they will be utilized effectively.

Data-base Manager

The final, and most neglected, individual involved with videotex is the person who has the responsibility for keeping the hierarchical data base in good condition. This person must take the pages of information prepared by information providers and insert them in the appropriate place in the data base. In addition, this person needs the capability to perform all of the functions typically associated with data-base management: Pages must be deleted, moved, or modified so that the data base is kept current. At present, because of the small volume of information involved in the demonstration data bases and the small number of people who have to be trained to interface with this aspect of the system, very little is being done to support the data-base manager. Making a change in the data base of systems we are acquainted with is slow and difficult and requires direct access to the central computer when it is off-line. Yet large portions of the documents on the videotex system will need to be updated frequently (e.g., news, weather, sports, advertisements, schedules, stock market quotations, etc.). Thus, a mature system will have to provide efficient tools for working on data-base management, with the majority of the work being done on an off-line system. Psychologists with some training in data-base design and knowledge of data-base management systems should be involved in the design and testing of such a system and in the training of data-base managers.

Social Issues

Videotex is in its initial development stages and displays only a rough outline of the form it may take by the end of this century. The systems operating today in production models, field trials, and demonstrations will soon be replaced by improved products now under development. Plans are now being made for advanced systems that will appear in 1 or 2 years. Thus, there is a need for individuals trained in evaluation research to participate in the field trials and a need for individuals trained in technological assessment to participate in predicting the long-term social impact of the new system upon society as a whole. The former will be asked to plan evaluations of the field trials and to collect, analyze, and interpret data on utilization and attitudes toward the system. In Canada at the present time, one field trial has been completed, and at least five others are in various stages of planning or operation (Phillips, Note 8). The major difficulty for evaluators at the present time is that the data base is so small and the service so restricted that use of the system, as well as its impact, will be very limited.

Projections into the future are required to identify the potential impact of videotex as a mature and well developed system. Assuming that videotex becomes widely implemented, it may offer such diverse services as information retrieval, electronic banking and teleshopping, electronic mail service, computer-aided instruction, games, and electronic polling and voting. The benefits and dangers of these and other potential services must be identified and planned for. Plowright (Note 9) divides the analysis into two major types—those associated with the manner in which videotex is implemented, and socioeconomic consequences. For example, as videotex develops, the following questions must be resolved: Who will have access to terminals? How will their privacy be protected? Who can put information on the system? Will it be censored in any way? In addition, with regard to the socioeconomic consequences, what impact will videotex have on employment, lifestyles, and institutions such as schools and government? Psychologists who are interested in this type of prediction and planning will want to become familiar with methods of technological assessment (Armstrong & Harman, 1980), which include diverse techniques, such as scenario writing, interviews with experts, trend projection, and modeling.

SUMMARY

Videotex is an example of a computer system being developed for nonsophisticated users. Its development is only beginning. A large number of different input devices, terminals, dialogues, and functions will be developed around the basic concept. Changes will occur in the organization, character, and quality of information included in the data base. This change is essential. In its present form, videotex does not offer the variety of services or a sufficient data base to insure that it will be a commercial success. Only if the problems of the sort indicated in this paper are addressed will videotex evolve into an acceptable product. Further, most of these problems are not engineering problems; they are human problems. It is unrealistic to assume that engineers will solve them. Who is better qualified to solve psychological problems than psychologists?

REFERENCE NOTES

1. Bown, H. G., O'Brien, C. D., Sawchuk, W., & Storey, J. R. *A general description of Telidon: A Canadian proposal for videotex systems* (CRC Technical Note No. 697E). Ottawa, Canada: Department of Communications, 1978.
2. Tombaugh, J., & Dillon, R. F. Use of videotex in a public setting. In R. F. Dillon (Chair), *Psychological research in the development of Telidon*. Symposium presented at the meeting of the Canadian Psychological Association, Toronto, 1981.
3. Dillon, R. F., & Tombaugh, J. Providing help to Telidon users. In R. F. Dillon (Chair), *Psychological research in the development of Telidon*. Symposium presented at the meeting of the Canadian Psychological Association, Toronto, 1981.

4. McEwen, S. A. An investigation of user search performance on a Telidon information retrieval system. *Telidon Behavioural Research 2*. Ottawa, Canada: Department of Communications, 1981.

5. McEwen, S. A., & Tombaugh, J. *Comparison of two information retrieval methods on videotex: Tree-structure versus alphabetical directory*. Manuscript submitted for publication, 1981.

6. Dillon, R. F., & Eastcott, J. E. *User satisfaction and performance with two methods of retrieving information from a simulated videotex system*. Poster presented at the meeting of the Eastern Psychological Association, New York, 1981.

7. Mills, M. I. A study of the human response to pictorial representations on Telidon. *Telidon Behavioural Research 3*. Ottawa, Canada: Department of Communications, 1981.

8. Phillips, D. A. *Evaluation of Canadian Telidon field trials*. Paper presented at Research Methods: Videotex, the Individual and Society, France-Canada Seminar. Ottawa, Canada: Department of Communications, 1981.

9. Plowright, T. *Research and the social aspects of videotex services*. Paper presented at Research Methods: Videotex, the

Individual and Society, France-Canada Seminar. Ottawa, Canada: Department of Communications, 1981.

REFERENCES

- ARMSTRONG, J. E., & HARMAN, W. W. *Strategies for conducting technology assessments*. Boulder, Colo: Westview Press, 1980.
- BOWN, H., O'BRIEN, C. D., SAWCHUK, W., STOREY, J. R., & TREURNIET, W. C. Telidon videotex and user-related issues. In P. Kolars (Ed.), *Processing of visible languages 2*. New York: Plenum, 1980.
- BRIGHT, R. D. The telematique program. In *Proceedings of Videotex 81 International Conference and Exhibition*. Middlesex, England: Online Conferences, 1981.
- HARKER, W. C. Banking and videotex. In *Proceedings of Videotex 81 International Conference and Exhibition*. Middlesex, England: Online Conferences, 1981.
- MILTON, P. Telidon: How it works. *Canadian Electronics Engineering*, 1981, **25**, 20-23.
- WOOLFE, R. *Videotex: The new television/telephone information services*. London: Heyden & Sons, 1980.