TELIDON FIELD TRIAL EVALUATION:

TECHNICAL ISSUES

BY: THE STAFF OF BEHAVIOURAL TEAM

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FOR: THE DEPARTMENT OF COMMUNICATIONS

DATE: MARCH 31, 1983

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VOLUME I ✓

II

Behavioural Team

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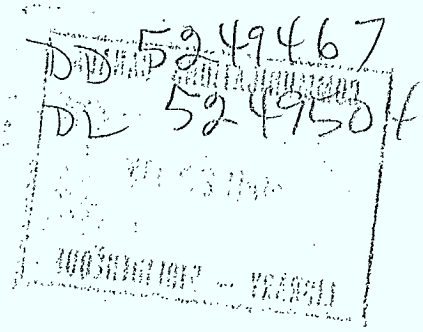

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Executive Summary

This report summarizes all that Behavioural Team could learn about user happiness and industry effectiveness during the Telidon field trials. Our purpose was to support the development of this techology and thus the report is configured as a positive contribution to the success of Telidon. The resulting 380 page document was based on data from:

** a review of data collected by the field trial operators,
** interviews with members of the Telidon industry and information providers,
** a review of past lab and human-factors information.
** a telephone survey of 96 users in Canada and the U.S.,
** and behavioural observations conducted at public terminals.

Documentation for the generalizations below may be found in the body of the report. In any instance where there is no specific reference either the privacy of our respondents would be compromised or it is the opinion of the authors.

General Reactions

General reaction of field trial users was neither strongly negative nor strongly positive. Telidon, as represented in the field trials, should not compete head-to-head with existing alternate media (i.e.

newspapers). 61% of telephone respondents said using Telidon to access information is less worthwhile than using the newspaper; 12% said it was more worthwhile. Other reports offer similar findings.

Some Positive Points

According to users, some favourable aspects of Telidon are:

1. the novelty of the technology,
2. the initial entertainment value of the graphics displays,
3. the games, and
4. the fact that use was interactive.

Main Dissatisfactions

65% (62) of telephone respondents said "yes" when asked if they had experienced frustration or aggravation using Telidon.

The main dissatisfactions are with database information. These are:

1. there is no range of information,
2. there is no depth of information,
3. information is not timely, and
4. information is neither complete nor detailed.

Many of these issues are merely by-products of the newness of Telidon and of the critical-mass paradox. Because the field trials were an

experiment, IP's did not develop many pages and many potential IP's did not even participate. Our best information indicates that potential IP's still are reserved about committing resources to existing Telidon services.

Another dissatisfaction for users was speed of the system, specifically log-on delays. A somewhat lesser annoyance is the time required for repetitive and/or detailed graphics displays. These problems are more acute when the user's application brackets the amount of time available for use as in a classroom.

The problems reported for database organization were that it is hard to retrace steps or get to other information branches. Users also found it tedious to go through so many levels for such (often) limited information. Again, this is not a technical problem but one of start-up pains. As the number of terminals proliferates, IP's will increase as well.

Technical Reliability

Technical difficulties were not a major problem in users' minds although 54% of those in our telephone survey said "yes" when asked if their [Telidon] equipment had ever broken down. There was some variation among the trials: the range was from 20% to 65% with equipment problems.

Use

Generally peak residential use occurs during late afternoon and early evening. Some 60% of telephone survey respondents' reported using Telidon in the afternoon or evening, while 5% reported morning use.

This is very similar to results reported by other studies. Late afternoon use tends to be by children; early evening use is by adults. Some trials reported peaks during the morning hours, although these were smaller than the evening peaks.

Session length varies substantially, depending on terminal location, setting, and information available. Our behavioural observations revealed an average session length of 4 minutes and 21 seconds for public teletext. According to our telephone survey, 63% typically viewed Telidon for 20 or more minutes while only 8% used it for fewer than ten minutes per session, on average. Viewing time seems to be a function of user intent, as well as timely, comprehensive information.

Residential Telidon use is often a social situation. But the equipment must be designed to support group settings.

Women and older people are much less likely to use public Telidon (based on our first-hand observations of public terminals); prime users in public locations tend to be younger teenaged boys.

The highest rate of approach in public situations occurred when the previous user had left an index page on the screen.

Page Display

The time required to transmit the page seems to be too long for many users. (42% in the telephone survey said "often", 35% "sometimes" when asked how often they felt page display takes too long to begin being drawn on the screen.)

Display time also tends to be perceived as too long. (79% (76) of telephone respondents said "yes" when asked if they ever thought that pages take too long to finish being drawn.) Graphics page display tends to be the culprit. (86% of telephone respondents mentioned "graphics" as type of page they recalled to be slow.)

Other findings are: that the use of paragraphs can lead to 15% increase in reading speed; and optimum spacing affects reading speed, but not accuracy. Also, smaller type size increases reading speed and larger type size reduces search time. Finally, headlines, colours, and "bullets" help skimming, but not exhaustive reading.

Page display time is a major consideration, and establishing the best role for graphics requires urgent attention.

IP's are asking for help in page design. Successful pages are critical to their continued support of this medium.

Perceptions of Physical Telidon

The major user perceptions of physical Telidon are:

1. Telidon is not portable. This reduces its usefulness, both perceived and actual.

2. Screen sizes used in field trials are about right (any change should increase the sizes).

3. Labels on keypads/boards are confusing when they appear between the rows of keys

4. Cords and cables are thought to be unattractive and inconvenient.

5. Ease of equipment use is related to previous experience with other similar devices. (This can hinder or enhance learning, depending on the similarity of the equipment.)

6. User complaints about equipment design relate to size of units and/or number of pieces.

7. Aesthetics were not important to most users.

The Telidon Industry

Overall, the Telidon industry developed hardware, created pages, and operated field trials with not unreasonable competence. The relations among the Network Providers, Database Operators, Page Creators and their clients, the Information Providers are examined in some depth in the report. There was a general deficiency in quality of management and in the collection of management information. Many of the study recommendations relate to organizational issues within the industry.

Major Conclusions / Recommendations

1. It is not clear who is "in charge" of Telidon. That is, who is the Publisher?

2. For a mass retail-like activity, great naïveté is shown in human-factors, cognitive psychology, and market research. Numerous examples of improvements are given in the text.

3. Due to the range of skills of users and due to the number of new users (everybody!) far greater intelligence is needed in the terminals. This is also important because of the "serial character" of Telidon.

4. Present user interaction protocols and most existing hardware are not recommended for continued use in public terminals without substantial and immediate improvement. It is counter-productive to offer to the unselected public services which insufficient numbers of them can successfully access or use agreeably. Home users can tolerate existing hardware on an experimental basis.

5. Of all the barriers to the effective proliferation of Telidon, none is so oppressive as the page creation bottleneck. The broadly held antipathy to text and to

paper-borne information has hindered the industry. The emphasis on graphic prettiness and the weakness in text-handling software have led to several dire consequences. The problems of page creation are considered in a long chapter in the report. This chapter includes a task-analysis of the technician's job. Behavioural Team condemn one of the page creation terminals.

Some further observations...

Telidon industry personnel should take advantage of the potential for timely information, and emphasize information which is complementary to that in more traditional media (at least initially, until Telidon use becomes more "entrenched" in the public).

Designers should pay close attention to the portability aspects of equipment. (These will likely increase the usefulness of residential, and perhaps business Telidon.)

Designers should also build upon user liking of Telidon's interactive aspects.

A pay-for-service situation will increase the numbers of situations where time is money. Therefore, any factors (technical reliability, search strategy possibilities, etc.) which increase delays will be of

greater importance than is evident from this study. Also greater will be the range and degree of dissatisfaction voiced by paying users generally.

Industry efforts are needed to stress standardization in a broad context, including:

1. compatibility of equipment designed and built by various manufacturers; and

2. consistent use of labels and symbols on equipment, in operating instructions, and on screen displays.

There is a need for coordination of efforts among all the industry participants. (Often there are conflicting goals such as the "universal database" of database operators, and the need for more local database information to encourage community use.)

Industry roles need to be defined. Much of the "fuzziness" in which Telidon currently lives needs to be sharpened for effective growth.

The labels on keypads/boards should be directly on the keys they refer to.

Public locations should have terminals at approximately eye level, to encourage passers-by to use them.

Screen instructions should be stressed (especially in public settings, few users would read through hard-copy material before starting to use the system), using full-length prompts wherever possible.

We hope you will want to read - or at least, to examine - the whole report. It is filled with hundreds of specific observations and innumerable suggestions for improving videotex services.

Behavioural Team

1. Introduction

1. ABSTRACT

This chapter outlines the Telidon technical evaluation project which is reported in this volume. The Terms of Reference in relation to the status of the field trials is presented. "Telidon," "videotex," and "teletext" are defined.

2. TERMS OF REFERENCE

The purpose of this report is to foster the development of Telidon. The British (and, very likely, the French too) have shown the good wisdom of hiring psychologists to assist in the creation of their competing systems. Accordingly, the DOC has recognized the pitfall of developing communications, advanced office systems, and the like without professional behavioural help.

To that end, the DOC asked Behavioural Team to examine issues of applied psychology in the field trials of Telidon. Dr. Dorothy Phillips, head of the Behavioural Research group, supported this

contract. The work began in the summer of 1982 and ends with the issue of this report, March 31, 1983.

The topics of study under our Terms include:

** home experience with commercial equipment;

** learning to use the system, operating instructions, and manuals;

** operational likes and dislikes;

** perceptions of page display, readability and comprehension of text, time-related display parameters;

** searching, menus, cognitive organization of a database;

** ergonomics of hardware, comfort evaluations, and aesthetics.

3. METHODS OF STUDY

The conduct of this work involved several mutually-supporting activities. These were:

an examination of field trial self-studies,
review of lab research studies,
a national telephone sample of users,
behavioural observations at public terminals,
interviews with industry participants.

1. Field Trial Self-Studies

Each of the field trials was expected to perform evaluations of their own success. Some preliminary guidance was given to the trials by the DOC. However, the trials took divergent paths in fufilling their obligations.

In general, the reports were not professionally prepared. Various general purpose market-research houses and self-styled "communication consultants" undertook the work. The resulting research products were of varying quality, difficult to inter-relate, and did not always deal with essential issues. Taken together, they were an insufficient information base.

2. Review of Lab Studies

The lab studies of Telidon were carefully done. Remarkable to relate, they transcended the limitations of the "lab" environment and spoke relevantly to the real-world setting of Telidon.

It should be clear from our text below, that we hold great faith in the trustworthiness of this information.

In the "Ergonomics" chapter below, we cite anthropometric data. This information tends to be thoroughly reliable. However, please

remember the old joke, "Figures don't lie but liars figure." The reader of this report is therefore cautioned against simple-minded application of the figures we report.

3. A National Telephone Survey

Five field trials were involved in our survey: British Columbia Telephone, Elie, OECA, Vista, and New Brunswick Telephone. This selection of field trials provided a national cross-section of participants and types of trials. In total, 96 in-depth interviews were conducted. (See Appendix B for details of the survey.)

These one-hour interviews were conducted, as always, by our permanent professional staff They proved to be the source of much of the data on which this report is based. Even when field data existed, the survey added materially to the confidence of the analysts. (Please note, a professional French translator, not on our permanent staff, was hired to translate and to interview in that language.)

4. Behavioural Observations at Public Terminals

There are obvious methodological and practical problems in dealing with <u>public</u> Telidon. Moreover, we wanted a "microscope" for noting the natural behaviour of Telidon users. In addition, public

terminals allowed us to observe the behaviour of naive users. After all, users are naive only once! It is very difficult to reliably learn from user self-reports what it was like when they first tried Telidon.

Behavioural observations conducted by trained Observers - as was the case here - are reasonably reliable sources of information. Because users are so fascinated by the Telidon terminal, it was quite easy for us to conduct unobtrusive observerations from up close. At some sites, we were able to actually bring chairs and do our work sitting down!

The public's behaviour at Telidon terminals was observed at five locations across Canada and in the United States, for a total of 31 hours at 12 different terminals. (See Appendix C for details of the behavioural observations.)

These behavioural observations are discussed in the chapter, "Telidon in Public." One interesting conclusion we came to was that public terminals and the databases for them have requirements which are distinct from those serving homes or businesses.

5. Interviews with Industry Participants

A final approach to collecting information about the trials involved

interviewing industry participants. We thank all those who generously gave their time. Due to requirements to protect our sources, we have observed complete confidentiality in all instances where release of information collected would be to the detriment of the respondent.

Information about the industry players appears in a separate chapter below. There are four "players:"

NETWORK OPERATORS.....are organizations which transmit, carry, or broadcast the signals from the database to the Telidon terminal; they may or may not also be the Database Operator and they may or may not be assertive in their role.

DATABASE OPERATORS.....are organizations which manage the database computer, serve up the information, insert fresh pages, and, in general, are the soul of Telidon; they usually will also function as Page Creators.

PAGE CREATORS.....are large and small firms which create Telidon pages on behalf of Information Providers; the PC's take a larger role in the definition of Telidon than you might at first imagine.

INFORMATION PROVIDERS.....are a varied assortment of forward-looking public and private organizations who wish to expose their pages to the public; they include providers of public service information (weather), large commercial institutions (banks), and, for the future, other databases.

In-depth personal and telephone interviews were conducted with these key "players" involved in the major field trials across Canada and in the WETA trial in the United States. Additionally, information about the page creation process came from several sources. Behavioural Team reviewed the available literature on the process and problems of

making Telidon pages, including several manuals for Page Creator systems. We observed Page Creators at work for a total of 18 hours in five different settings. Also, Network Providers, Database Operators and Information Providers were asked about their views on page creation.

4. HOW ARE WE USING THE WORD "TELIDON?"

In this report, we are using "Telidon" to mean an information utility which uses the efficient Telidon data transmission code. That is, we are not referring to the code itself, to the general application of this code among computers, or to stand-alone devices (such as Cableshare's "Presentation Theatre"), or Telidon-like services for general purpose information utilities (such as The Source.)

What we do have in mind is roughly:

Telidon transmission
large, broadly appealing databases
selection or interaction by customers
access offered (or sold) to the general public

In the course of the this report, we do reflect on other members of the Telidon family. But, in general, the concern is with services

for which the present field trials are models and pre-cursors.

5. THE DIFFERENCE BETWEEN VIDEOTEX AND TELETEXT

"Videotex" is a term used to describe a communications service which allows users to access text and graphic information through the use of a two-way communication line between, say, a Telidon terminal and a central data bank.

The videotex variant of Telidon is analogous to the operations of a terminal (such as, say, the common "VT100") and a host (mainframe) computer. Today, videotex Telidon is primarily interactive page selection. Tomorrow, it can include tele-shopping, banking, sending messages, and, in fact, working with the Telidon host computer as if from a VT100 terminal.

The term "teletext" refers to a one-way broadcast system where pages or "frames" of information are transmitted to the user via the unused portion of a normal television signal. In this report, teletext using the Telidon code is assumed, of course.

A decoder attached to a television set allows the user to select the frames of information he or she chooses from the continuous cycle of pages being transmitted. Upon selection, the frame or page remains

on the television screen until the viewer selects another page, switches the set back to standard television, or turns the set off. The pages of information can be updated or changed weekly, daily or any number of times during a given day.

Unlike the two-way Videotex, broadcast teletext service does not allow the user to request that a specific page be sent from the database. Rather, the user requests the decoder to display a page from a continuously broadcast cycle of pages.

A possible future variant of teletext Telidon would be "user responsive" teletext. In this mode, the user would ask to have specific pages broadcast by first phoning the utility. These would be added to the great cycle of pages at an hour as per the arrangements negotiated.

2. User Satisfaction

1. ABSTRACT

User satisfaction with Telidon, as with any new service, is one of the key determinants of its future success or failure.

This section presents users' general reactions to Telidon based on surveys and interviews as reported from the various field trials, as well as from results of the telephone survey across trials conducted during this study. Additionally, some of the specific sources of satisfaction and dissatisfaction are discussed, along with recommendations, where appropriate, which would likely increase the satisfaction of the present and the future Telidon user.

2. GENERAL SATISFACTION

General user satisfaction can be assessed in a number of ways. There are direct questions which can be asked of respondents. Additionally, there are a number of indirect indicators, for instance, extent of use or willingness to pay for the service.

User reaction to Telidon was generally moderate. As an illustrative example, 50% of those surveyed for a large field trial were generally satisfied. They indicated that Vista "performed" as well as, or better than, they expected. However, the remaining 50% claimed that the system performed "not as well" or "nowhere near as well" as expected. Reports from other field trials present varied, but basically similar, results.

Participants in the Elie field trial were asked if they would be willing to pay for the service they had been receiving. Almost 59% responded "no," 5% answered "yes," and 36% indicated "maybe."

About 40% of the residential users of teletext said they would be willing to pay something for a television with teletext capability. Respondents who had used teletext in a public setting were quite favourable: it was given a rating of 4.2 on a five point scale. (The higher the number, the more teletext was liked.)

However, respondents involved in a survey about videotex in public settings (Cantel) were for the most part more negative than their teletext counterparts (WETA). Asked if they would ever come back and use the system again, 63% said "no," 34% responded with "yes," and 3% were undecided.

As an assessment of the degree of satisfaction among Telidon users,

respondents of the telephone survey conducted by Behavioural Team were asked if the use of Telidon caused them frustration or aggravation. Just over 35% answered "no, not at all" while 24% answered "yes, very much." These results are very similar to those from other surveys conducted on behalf of the individual field trials, again indicating users' mixed reactions.

(Note that the generic term "Telidon" is used when results of this study's telephone survey are presented and discussed. When conducting the survey, the term "Telidon" was replaced by the name of the specific field trial in question.)

The results outlined above point out the varied and mixed user reactions to Telidon. It is difficult to accurately assess an overall reaction since there are many factors which vary both within and between field trials. What is clear is that there are generally no strong feelings about Telidon. Users, on the average, tend to be somewhat "ho-hum" about it. Any suggestion of stronger reaction among users tends to point in the direction of dissatisfaction, as evidenced by the somewhat negative results outlined above.

In interpreting any survey, a baseline or anchoring concept is needed. Each year, the staff of Behavioural Team see many surveys related to public facilities. In general, new products or buildings, free trials, and "Canadian" products routinely receive uncritical high endorsement.

Our experience helps us know just how large a "grain of (professional) salt" is needed to evaluate the user reaction. For the material presented above, the reader ought to construe the results lower in approval than they nominally appear to be. It is possible, however, that users had negative experiences with the field trial personnel which coloured their evaluation of Telidon.

3. SATISFACTION AND USE

Intuitively there is an expectation of a relationship between satisfaction and use. Unless provided with no alternative, an individual would not be inclined to use a service (or system, or whatever) unless s/he were satisfied with that service. There is some evidence which is in line with these kinds of intuitive notions.

A study of teletext users found an indication of respondents' willingness to pay (an indication of satisfaction) and their level of teletext use (Alternate Media Center, Working Paper #6). Responses to the telephone survey of the present study suggest that satisfaction might be related to length of the viewing session. The results obtained, however, do not stand the rigours of statistical testing, and thus cannot be interpreted as conclusive. Further research is necessary to investigate the existence and nature of any

relationship between satisfaction and Telidon use.

4. TELIDON COMPARED TO ALTERNATIVES

Satisfaction with Telidon compared to alternate sources of information tends to be minimal. It is important to note that direct comparisons often can not be made. Users compare only a small aspect of Telidon with alternative means of getting the same information. With this context in mind, there are results which warrant mention.

A majority (61%) of the telephone survey respondents indicated that using Telidon to get information is less worthwhile than using the daily newspaper. Only 12% said it was more worthwhile. Similarly, in another field trial survey (Cantel), a majority (54%) indicated they preferred to use alternate sources of information to the use of Telidon. These results are illustrative of a number of reports which address this issue.

Comments made by those who prefer to use Telidon for at least some types of information reveal that their motives are related to the novelty of using the technology. This suggests that they might not continue to use Telidon for information once "the fun" has disappeared.

Clearly, the potential strength of "informational" Telidon lies in its ability to provide complementary information to that which people can get through more traditional sources, as well as providing information which is more timely. The evidence of our survey suggests that present Telidon should not compete head-to-head with existing alternate media.

Overall satisfaction or dissatisfaction is a composite of many specific likes and dislikes. Indeed, the lack of an enthusiastic reaction among field trial participants might be a general reflection of certain aspects which are well received combined with others which are negatively viewed. An analysis of users' satisfactions and dissatisfactions with the specific aspects of Telidon results in a fairly consistent picture across field trials.

5. SOURCES OF SATISFACTION

There are a number of aspects of Telidon which are a source of satisfaction. We have "saved the best for last." The following portion of this section examines what causes users' dissatisfaction. Staff of Behavioural Team feel that by emphasizing these points, we outline those aspects which require the most attention in order to contribute to the development of Telidon.

1. Roots of Dissatisfaction

The source of the greatest dissatisfaction among Telidon users tends to be the information in the databases. A number of aspects combine to make this a substantial irritant, if not deterrent, to users.

A summary of the information from specific field trials as well as the telephone survey indicate that users consider the content of many databases to be insufficient. There is simply not enough of a range of information and/or the information available lacks any significant depth. This latter criticism is especially the case where Telidon is used for educational purposes or is in locations which encourage use for research, as in reference sections in libraries.

Another database aspect which causes dissatisfaction and tends to discourage use is a lack of updated information. Updating information seems to be related to Telidon use, based on comments from field trial participants. "Use," of course, can be taken as an indication of satisfaction. Individuals who are generally receptive to using Telidon at first, lose interest when they find "stale" information time and time again. While they might not be extremely dissatisfied, they most certainly are not inclined to continue their use.

A third aspect is the lack of complete, detailed information. While

this does not contribute to dissatisfaction to the same degree as the two previously mentioned aspects, it is something which users react to quite negatively.

The solutions are obvious, while the means to the solutions might not be as straightforward. Whatever the effort required, staff of Behavioural Team recommend that the main thrust of developmental activities be directed towards improving all aspects of the databases used for Telidon. This is discussed in more detail in the "Recommendations."

Another major source of dissatisfaction has to do with the speed of the Telidon system. This was found in our telephone survey as well as in reports from the field trials themselves (for example, OECA and IDA). This aspect encompasses delays experienced in attempting to access the system as well as, to a lesser extent, delays in graphics page display. There is no evidence of system response time strictly defined (the delay between a keypress and the beginning of a page display), as a cause of dissatisfaction.

The main difficulty is the length of time required for a user to be connected to whatever database s/he is attempting to access. This tends to be even more acute when users require timely information or are using Telidon in a situation which limits their available time. The length of time taken for pages with graphics to be displayed also causes some irritation. Not only is the display time-consuming but

it contributes to boredom because the display of graphics may be continually repeated in many sections of the databases.

We recommend that efforts be directed to encourage users who are on the system, but are not actively using it, to log off, since this can contribute to system access delays. Additionally, research into the relationship between system usage and host computer capacity should be conducted to assess their impact on access time. Also, the extent of graphics displays should be reduced. Finally, graphics should be "advance downloaded" by some means, in order to be displayed more quickly. ("Advance downloading" applies only to teletext.)

There is one final specific aspect of Telidon which could be called a "main-line" source of dissatisfaction, although it is somewhat less important than those mentioned above. Users have expressed dissatisfaction with their ability to "move around" in the database. This encompasses getting to the specific information they want, as well as being able to retrace their steps and getting from one branch of the tree structure to another. Users can not do this easily, because the database structures are not behaviourally designed to support "mental mapmaking."

Many users find it quite tedious and restrictive to access information by the indexing system. There are too many levels for them to progress through. This is a <u>stronger</u> dissatisfaction with those who are experienced with Telidon. An alternative in many field

trials, direct page access, is also somewhat limiting because often users do not know the numbers of the pages they wish to access.

Many users would like to move around in the database. They want to retrace a few of their steps, or they might want to be able to get to a different branch of the tree structure. Yet they experience difficulty and frustration because they do not know how to go back a page, or how they can "jump" to another section of the database.

In the opinion of Behavioural Team, hard copy materials should be provided to users. These should help them to develop a better "mental map" of the database, resulting in less frustration. Also, pre-tested instructions displayed on the terminals would help.

2. Roots of Satisfaction

There are various aspects of Telidon which satisfy users.

The concept of Telidon and the convenience of being able to access information are aspects which many users like the best.

People tend to be satisfied by the entertainment aspect of Telidon. It is novel to use, the graphics are entertaining, and they enjoy the games available on the system.

Also, the interactive capability is something which is very appealing to users. This is also seen as something which can be developed even more in the future and would contribute to the satisfaction of future Telidon users, especially when coupled with large, up-to-date databases.

It is important to point out that satisfaction is relative to the expectations users have about Telidon. If they have come to believe that Telidon can offer far more than it actually delivers, then initial use is bound to result in disappointment. This initial negative experience can have a "halo" effect, colouring individuals' attitudes to subsequent experiences with Telidon. To avoid risking any unnecessary dissatisfaction, the capabilities and services offered by Telidon should be portrayed realistically in any promotional activities or materials.

3. Can a free trial be properly evaluated?

Another issue which bears on the topic of user satisfaction is that of the "free trial." Virtually all of the participants in the various field trials had the service and the equipment provided to them at no cost. The implication of this is that their expressions of dissatisfaction are very likely a mere whisper of what they would be in a situation where they pay for service. Consequently, the results concerning user reaction should be put into this "free trial"

context. We caution that user reaction would likely be much more extreme in a negative direction, in a pay-for-service situation.

6. SUMMARY

Users have mixed reactions to Telidon. While they are not particularly excited nor extremely satisfied by it, neither are they extremely dissatisfied. Efforts to improve those aspects which are the major sources of dissatisfaction for users should result in increased acceptance and use of Telidon in the future. AND THAT IS WHY BEHAVIOURAL TEAM HAVE BEEN ASKED TO PREPARE THE REPORT WHICH FOLLOWS.

3. Technical Reliability and Technical Problems

1. ABSTRACT

While the focus of this study is predominantly the interaction of man and machine - the human factors issues - the issue of technical reliability must also be addressed as the performance of the hardware clearly impacts on all aspects of Telidon use. In this section we discuss some of the specific technical problems reported from the various field trials. We also present related results from the telephone survey conducted for this study. Recommendations related to the specific problems discussed are made in the appropriate sections.

2. SPECIFIC TECHNICAL PROBLEMS

1. To what extent have users experienced technical problems?

One item in the telephone survey asked participants to respond to the question "Has your Telidon [generic term used here] equipment ever broken down?". Slightly over half (54%) of the respondents answered "yes." A breakdown of answers to this question by field trial revealed variation in responses based on the field trial in question. An indication of the variation is provided by the following results: in two of the trials, 80% and 62% of respondents reported no equipment breakdowns (the latter figure was based on a small number of respondents); in two other trials, 65% and 63% indicated their equipment had broken down. (See Appendix A - Field Trial Vignettes - for a listing of the equipment used in each field trial.)

2. Which components are involved in problems?

Some of the field trials used the Norpak Mark 1 dual mode decoders in the early stages of the trials. According to four reports, fewer than half of these decoders, designed to receive both teletext and videotex, received teletext. They are excessively fragile and

ideosyncratic, requiring individual adjustments at each installation. Additionally, they are susceptible to static, heat, and do not travel or handle well. (Note that these first generation decoders are no longer available, according to the Department of Communications.)

The Norpak Mark 3 dual mode decoders were used to replace the Mark 1 model part way through those trials which had used the older model initially. Other trials used the Mark 3 from the outset. Based on field trial reports, the Mark 3 decoder is very reliable, and provides good performance. For example, only 3 of 50 employed in one field trial had failed (OECA). The 3 breakdowns all occurred with the teletext mode. Apparently, the teletext board in the decoder is not quite as reliable as the videotex board. The main problem (which is not major) is static, which affects the performance of the Mark 3, regardless of which mode it is operating in.

There were no reports of any problems stemming from use of the Northern Telecom RF decoder.

Almost 18% of the respondents surveyed across field trials mentioned that they had experienced breakdowns with the decoders in use. This did not seem to be a major source of technical trouble.

Based on telephone survey results, technical problems with the various keypads or keyboards in use was also minor. Just under 9% of respondents had trouble with their keypads or keyboards.

The staff of Behavioural Team feel that the Norpak Mark 2 type of keypad is generally reliable and basically trouble-free. The only reported problems were with static, and the difference in function between the teletext and videotex modes. Many of the keypad functions in teletext mode do not operate as specified in videotex mode. No information was available about which specific functions cause problems. (According to the Department of Communications, these second generation decoders are no longer available.)

The Northern Telecom (numeric) keypad is also quite reliable. For example, study results from one field trial in which this keypad was used, indicated that 78% of 256 respondents reported "no problems" or problems "once" during the trial (Vista In-Trial Research, ABM Research Ltd., October, 1982).

Generally there were few problems reported by participants with the terminals used in the field trial as typified by the following results: fewer than 5% of the telephone survey respondents across field trials reported problems with their terminals; 60% of respondents indicated they had experienced problems either "once" or not at all during the Vista field trial. There was some mention of static causing problems, and the terminals generally tend to be sensitive to heat and moisture. Heat can age terminal components prematurely, and moisture causes short circuits. Anti-static mats, controlled humidity and the placement of terminals away from direct

sunlight or other sources of heat are recommended.

There have been reports of difficulties arising because of the software used in teletext. One of the problems occurs when the teletext decoder has been set to inhibit the page number which is normally presented with the display of each page. The user's keyed-in page number (and error messages when appropriate) are also inhibited. Thus, the user is provided with no feedback about whether the page number keyed in is the desired one or not, until the page is displayed (OECA).

Another software problem is the lack of error messages for some single and double-digit "non-existent" pages (OECA). There was insufficient information from the field trial reports to determine which of the various decoders used in this field trial the problems mentioned relate to.

Users also can not branch from a four-digit page number of a five-digit page because of the type of software used in the decoder (OECA). Perhaps the capacity of the decoder could be increased to solve this problem.

With videotex, there is evidence of a problem of moderate degree with the pages. Almost 36% of the telephone survey respondents who mentioned specific technical problems reported that they had trouble with missing or partially missing pages. This problem had the

highest percentage of mentions. It is quite possible that this "technical" problem is not technical at all, but rather relates to missing pages in the database, and respondents could not perceive the difference.

Whether or not users confuse technical trouble related to the pages with gaps in the databases, they become increasingly irritated at discovering that some of the pages they have requested are blank, according to field trial reports. Non-existent pages should be listed as incomplete in the directory or on the most appropriate index pages, rather than allowing users to discover them after searching (perhaps extensively) through the database.

3. Which sets or combinations of equipment are most problematic?

Teletext

Generally, it seems that teletext equipment is very reliable and dependable. In one field trial, a slightly greater reception problem was reported for residential as opposed to publicly located terminals. Since the primary factor affecting reception is the quality of the broadcast signal received by the decoder, reception quality is highly dependent upon the mode of transmission.

Transmission of the teletext signal via the vertical blanking intervals of normal television signals provides good reception if the specific location favours this type of transmission. There needs to be very few "dead" spots in the reception area, for example. The disadvantages to reception of teletext "off-air" are that each specific terminal requires the use of an antenna and it must be properly placed since the reception it provides is highly sensitive to location. There are also problems with relay switching and signal boosting.

There has been some tendency for teletext transmission to move away from off-air to cable because of the convenience and increasingly widespread use or cable. According to reports from one field trial, the reception quality with the use of cable is dependent upon the quality of service provided by the specific cable company in question. One disadvantage to cable is that a signal which provides good video viewing according to cable TV standards might not be strong enough for good teletext reception. Also, reception in large exhibition areas tends to vary from outlet to outlet, which could be a problem in this specific type of application.

Reports from the only field trial to transmit teletext via satellite indicate that good reception was experienced (OECA).

Staff of Behavioural Team feel that in general, both cable and off-air provide comparable, acceptable service, depending entirely on

individual factors affecting the reception area in question. Because reception of teletext is so affected by environmental factors, it is an important issue for system designers and operators to address.

Videotex

There have been differing results reported about the quality of videotex service across the field trials. It seems that some trials have experienced more than their fair share of system breakdowns. These tend to discourage use of videotex by trial participants. For instance, those most directly involved in videotex use in educational institutions considered technical breakdowns the second most serious problem during the field trial period. According to reports, system unreliablity disrupted classroom use and instructors claimed they always had to have contingency plans when using videotex for classroom instruction (OECA).

However, participants in other field trials reported few, if any, technical problems. For instance, no technical problems were reported by the mid-point in one field trial (Vista). These results are corroborated by those of yet another field trial where 80% of respondents reported no ongoing problems with equipment or the system (IDA).

Since no detailed information about the nature of the system problems

experienced was reported, it is quite possible that some, if not many, of the difficulties might have been due to a somewhat inexperienced user facing an inept instruction manual. An instructor who uses videotex only occasionally would not be as familiar with the equipment and its use as someone who has a terminal in their home. Additionally, because classroom time is limited, it is important to be able to access the system immediately if videotex is being used for instructional purposes. Any delays experienced when attempting to log on (because of heavy demand or incorrect use) could easily cause an instructor to become frustrated and decide to use some other means of instruction, attributing the delay to "technical unreliability" of the system.

Transmission Mediums

Information about the effect of using different transmission media on the reliability of videotex service is very limited. Based on interviews with industry personnel, fibre optics transmission of videotex is thought to be less susceptible to breakdowns than conventional telephone cable since the latter is subject to more stress from extreme temperatures.

4. Does Telidon pose technical problems for other communication systems?

Industry personnel have some concern over the potential problem which the use of videotex might pose for normal telephone service. In small communities, especially, heavy simultaneous use of videotex which is transmitted via the telephone lines could effectively "tie up" the long distance networks passing through these communities.

Normal telephone service does not always resume automatically when Telidon users log off. In some instances, users must unplug their telephones and connect them to different "sockets" or plugs for regular telephone service. This seems to be a dumb inconvenience.

There is virtually no problem with Telidon interfering with normal television reception. This kind of problem was mentioned by only 2% of the telephone survey respondents who explained the specific types of technical problems they had.

5. How are the users' technical problems solved?

Based on reports from the various field trials and on interviews with industry personnel, it seems most field trial participants are provided with basic instructions about the system itself during the introductory phase of the field trial. The information they are given tends to focus on what the system can provide and how to operate the equipment rather than to emphasize or stress potential

problems and their solutions.

The initial hookup of the equipment is generally done by telephone personnel or other technical staff. Any problems with the use of the system or equipment-specific problems seems to be something which is left to the user to report. The system does not automatically identify faulty equipment.

An often used method is to provide field trial participants with a "hot line" number to call if they have any problems at all. This method was used by the overwhelming majority (87%) of respondents in the telephone survey. The people fielding these trouble calls then contact the appropriate help, be it Database Operators, Network Providers or technicians to repair or replace the equipment. This means that there is no onus on the field trial participant to assess the problem and decide who the appropriate party is to call. Users call only one number, regardless of the problem. Even with this method (which should result in more calls, since any problems are being reported), it seems that the number of reported trouble calls is small: of 256 participants in one field trial, 35% called the service centre once, and 40% didn't call at all to the mid-point of the field trial. The service was rated as "excellent" "extremely good" or "very good" by 66% of the respondents involved in the survey. Only 6% rated the service as "poor" (Vista - ABM Research Ltd., March 1982).

Other methods survey respondents used to deal with technical problems were minimal: 3.8% attempted to solve the problem themselves, and only 2% consulted the user manual for trouble shooting instructions.

6. What is the relation between technical problems/solutions and users' perception of system reliability?

Based on field trial data, it seems that some users interpret difficulties encountered when attempting to log on to the system as a reflection of system unreliability. It is interesting, and perhaps enlightening, that this situation was more evident in the field trial involving educational use of videotex. An explanation previously mentioned, but worthwhile repeating, is that the time factor involved in a classroom situation as well as a lack of familiarity with equipment use, might contribute to this perception of the system as unreliable.

3. SUMMARY

For the most part, judging from many field trial reports and the telephone survey results, maintenance and hardware problems were not a great concern to field trial participants. This must be understood as bearing only on free rental gear in a demonstration project with current levels of failure.

In the field trials, an exception to reliability tolerance seems to be when "time is of the essence." For instance, the instructor of a class has a limited amount of time to teach his/her students. There may be delays in logging on to the system because of heavy use, or difficulties encountered because of a lack of knowledge about equipment use. These problems can lead to impatience, frustration, and a resignation that the system is unreliable because it does not work immediately.

A major effect of a user pay system will be the increased numbers of situations where time <u>is</u> money to the user. Thus technical unreliability will become a more critical factor in acceptance.

4. Learning/Understanding

1. ABSTRACT

How individuals interact with Telidon is largely determined by the ease of learning and understanding its overall concept and use. This section presents findings about factors related to learning and understanding about Telidon. Detailed results and discussions about each specific aspect of Telidon use as well as specific recommendations are also presented.

2. DO USERS FIND TELIDON EASIER TO USE WITH PRACTICE?

connecting equipment

One trial reported that network service personnel were called in to resolve suspected problems with the modem and phone lines. The problems, however, were frequently related to noisy phone lines and to the host computer not working. This $40 house call is an

expensive waste. The issue of error detection by users is highlighted under "Recommendations."

identifying technical problems

Users also require instructions about identifying and interpreting various technical problems. For example, as usage increases, so does blockage of the host computer because of blocked ports. This causes short term crashes and slow response time of the system. These were interpreted as more serious failures and/or users blamed themselves for the problems. In this way, lack of understanding hurt user confidence.

accessing information

It was found that users had trouble using the ENTER key. Psychologically speaking, this key merits much more prominence than it has received. Instructions can support this action and make it routine.

2. Relative to equipment functions, how hard is it to learn to use the database?

Results suggest that users are relatively more reluctant to seek help about database problems.

The Behavioural Team staff believe that "floundering" and related failures must be interrupted as soon as possible. A program routine could be written to automatically return users to instructions or a previous index after two or three incorrect entries are made. Smart terminals are needed to handle this.

3. USER VARIABLES

1. How do user variables affect learning/understanding?

One survey found that 84 out of 119 users found videotex easy to use while 24 suggested that it required effort, 4 found it difficult, and 7 did not learn. Significantly, identified problems occurred far more frequently among adults than children.

Among the adult user group, the following things helped learning and understanding:

curiosity,
entertainment value,
relaxation value,
amount of credible, useful, easily accessible information, and
business uses.

The following things were reported to interfere with learning/understanding:

fears of new technology,
limited education,
limited instructions,
physical demands (eyesight, memory, etc.),
confusion about instructions,
fears of manipulations (gimmicks, sales promotions, etc.),
fears of breaking equipment,
confusion about computer terminology, and
jargon.

Clearly, there are many, many types of Telidon users. In the view of Behavioural Team staff, examining a few typical users by diary (or equivalent) techniques is a good way to address the issue of user

variables.

First consider some typical motives of older users. Curiosity, entertainment value, information needs, and potential applications may be high. Among the older group, there are some with previous training and experience with computers. Their learning/understanding would be superior, as existing skills would combine with the high motivation often found in adult learners. However, for most older users, fears, confusion, and other limits would slow down learning and understanding.

The typical younger user has many advantages - concentration, memory, confidence, and flexibility among them. It is also more likely that the younger user has had experience with computer technology, in an academic or recreational setting.

In our view, then, learning and understanding would generally increase with education and experience, but would decrease with age.

There are many handicaps which would interfere with using Telidon systems. Visual and memory handicaps would be particularly difficult to offset. In addition, much of the hardware would present barriers to physically handicapped individuals.

2. What do users' understanding and learning characteristics imply for system design, hardware and software?

In our view, problems with empty pages must be minimized. Users who search out a page, only to find no information, will be frustrated. To avoid this, empty pages should be deleted, blocked from access, or denoted "currently incomplete."

3. How successful have help-lines or help features been in learning different functions of the systems?

One trial reported on its help-line feature. It was found that simple operator errors and problem with modems/phone lines were readily corrected. Immediate solutions were also found for blockage of host computer ports, short term crashes, slow response time, and faults in the terminal hardware itself. In these cases, the helpline was able to correctly identify the problems (very reassuring in itself, it appears) and suggest appropriate action.

Based on this evidence, Behavioural Team staff advocate manned help-lines be available to users. The Compu-Serve utility growth has recently greatly outstripped its major competitor, The Source. Why? One reason might be the introduction of HUMANS into Compu-Servs user

services.

4. LEARNING ISSUES

1. Are the written instructions adequate?

Generally it seems that the written Telidon manuals used in the various field trials are read. Results of the telephone survey of field trial participants indicate almost 90% of respondents had written manuals, and that 84% had read them. An overwhelming majority of respondents (92%) found these written materials to be clear. In the experience of Behavioural Team staff, this type of affirmative answer tends not to be meaningful. In our judgment, the manuals (and the procedures they describe) do not meet contemporary professional standards.

2. Are the written instructions clear to various users? (by age, technical background, etc.)

Little clear "hard" data exists upon which to base any conclusions about the adequacy or clarity of written instructions for various users. A breakdown ("cross-tab") of the telephone results for clarity of written instructions by respondents' level of technological sophistication and age showed no pattern or trend.

Intuitively it seems that written instructions can not be adequate for all users simply by virtue of the range of user understanding and capabilities based on age and/or experience. Telidon users range in age from children not yet in their teens to those near or into retirement. The technical background of users in our survey encompasses experience with programming computers to virtually no experience with technology, not even the use of an adding machine! One cannot suppose that one set of written instructions can be easily or adequately understood by all.

While it would seem fruitless to attempt the production of written instructions which could be easily understood by each and every user, certainly some improvements could be achieved.

Instruction manuals could be divided according to the user's level of technological sophistication. This is "tracking." The absolute minimum of information for Telidon use could be presented in "plain" language for the inexperienced user. Increasingly sophisticated instructions could be in subsequent sections for those familiar with the basic use and terminology of Telidon. (For example, direct access to certain information for the sophisticated user versus an index search path for the novice. The issue of experienced and inexperienced Telidon users is discussed more fully below.)

3. Are the written instructions adequate for specific tasks?

It was found that the NORPAK instructions regarding the keypad were not basic enough. Concomitantly, there were difficulties in users' signing on.

The Cantel instructions did not prevent difficulty with indexing based on Alpha ranges. But the problem was not within the capable Cantel group. Greater subtlety of behavioural thought is needed to do alphabetic searches by use of numeric keypads.

4. Do users understand the written instructions?

Based on the telephone survey results, written instructions are generally understood by most of the field trial respondents. Almost 90% reported that the manual was "always easy" to understand and slightly over 10% reported problems "sometimes". Frankly, we find 90% to be on the low side and 10% to be unacceptably high.

Reports from the field trials indicate that the "How to Use Cantel" booklet was understandable, though viewed as long and involved.

Some specific things appear to interfere with understanding. Use of

the term "menu" is one. Using different colours to represent different databases is another. Certain graphics (such as ">" symbol for eastward, "(two vertical arrows)" meaning push twice, and the graphic representation denoting the keyboard were confusing as well. Inconsistencies interfered with the effectiveness of the instructions. The use of multiple symbols for a given procedure (e.g., accessing the next page) is confusing. Cases where the written instructions did not correspond to the screen instructions were also found troublesome.

The above findings are not surprising, and can be generalized to other instructional manuals which have similar weaknesses. A number of seemingly simple matters limited the effectiveness of otherwise largely satisfactory instructional materials. It is clear that all such instructions should be thoroughly pre-tested for understanding and retention, and revisions made in accordance with specific findings. Particular emphasis should be placed on clarity, simplicity, and consistency throughout the instructional packages. French-English versions must also be compatible. The use of colour to denote categories should be done with caution.

5. ACCESS EASE

1. Is signing on to the system easy and reliable?

Signing on to the system was a problem experienced by many participants in the various field trials. Reports revealed that the process of logging on - dialing the host computer and entering the appropriate identification numbers - was not the main area of difficulty at home. However, when Telidon was being used for instructional purposes, the logging-on process disrupted the flow of instruction, as did the delays accessing the system after the logging-on process was completed. Also, inexperienced users found the logging-on process complicated because of unclear instructions and the number of digits required for input.

The main difficulty related to logging on was accessing the host computer. This problem was reflected in many of the surveys and personal interviews conducted across field trials. For instance, participants involved in the OECA field trial considered system access as one of the more important impediments to Telidon use. In the Vista trial, 64% of respondents reported they had trouble accessing the system "frequently" or "occasionally" (18% said "frequently"). Over 62% of the Elie field trial participants

indicated that the length of time required to reach the database "must" or "could be" improved (just over 3% indicated "must").

These findings are very similar to the results of the telephone survey conducted as part of this study. Almost 65% of the respondents reported that using Telidon caused them frustration or aggravation. Of these, 50% mentioned delays accessing the system as the source of that frustration.

These types of results indicate that system access is somewhat of a problem on the average (a minority of respondents said access time "must" improve, or that difficulties were encountered "frequently"). The word "average," however, implies just that - a combination of various usage times and intents for use, from browsing to searching for specific, possibly important, information. Respondents' comments provide some insights into the nature of their difficulties, which are not evident from the numerical results alone.

The problem of system access can be acute when users attempt to log on to the system at peak periods. When the need for information at these times is important, then the problem is even greater. Difficulties accessing the system have some important potential implications .

If users with a strong desire to use the system have difficulty accessing it, then once they have been able to log on, they might be

tempted to stay logged on, even though they have no intention of using the system continually. Should many users decide to take this approach, it could effectively tie up the system, making it even more difficult, if not impossible, for others to log on within the span of human tolerance.

The difficulty of accessing the system could also be critical in another way. The frustration of not being able to log on easily (without delays which are perceived as lengthy), could discourage individuals from attempting to use the system. This could be especially important when certain segments of the user population are considered.

Those users who want timely information (stock prices, real-estate markets, the cost of grain, for instance) would likely become increasingly discouraged from using Telidon for their information needs if accessing the system takes a lengthy period of time. Staff of Behavioural Team think this is an important point for industry people to consider, since many of the future potential commercial uses of Telidon may indeed involve accessing timely information. (The subject of timely information and access is discussed more fully as a page creation bottleneck in "Recommendations.")

There are a number of possible "fixes" for the system access problem. The most obvious is to compile extensive data about usage information and then modify the system capacity (increase the number of ports on

the host computer) to accommodate peak periods. Another possible approach is to attempt to modify user behaviour so that use is more widely distributed throughout the day. This could be accomplished by offering incentives to use the system during off-peak periods (cheaper rates if and when people are paying for system use?), or by making certain interactions (playing games, for example) available only during specific hours. Likely some combination of the possible solutions mentioned would be the most effective. But, we are referring to sophisticated behavioural design, not engineering.

2. What factors are associated with database menu type and selection by user? How useful are printed directories, on-line menus, or key word searches?

Access to information in databases has predominately been restricted to use of searches involving tree-structure type databases, on-line menu, or index search techniques. This type of structure, some authorities say, provides the facility for a very large database, and makes the most effective use of computer processing time. This, in turn, keeps the system response time for users at a minimum, which is important for user satisfaction and continued system use.

We agree with the research findings of Dorothy Phillips' group. Namely, menu searching is very imperfect on a CRT. Telidon practice needs careful review, as follows.

Criticisms have sometimes been directed at this type of tree structure. For example, there is the possibility of users' getting lost in the database, simply because of its size coupled with the use of an on-line menu (index page) search only. A number of alternatives to this search technique and database have been investigated, and some have been employed in field trials.

The use of paper directories has been tried. These can be hard-copy versions of the database index pages, or alphabetic list types ("yellow pages"). The Bell Canada Vista field trial is making use of a paper directory. Results from field trial surveys indicate that most users would find some form of hard copy "reference" quite useful. (For example, almost 90% of respondents involved in the OECA trial felt that a printed index would be either "useful" or "very useful," and the absence of printed support material was considered a major impediment to Telidon use. The printed directory used in the Vista trial was considered quite favourably by 68% of respondents.)

Telephone survey results showed that almost half of the respondents (49%) wrote down page numbers which they had accessed for future reference. But there are curious differences between men and women in this regard. Women access pages directly less often than men do.

Hard copy materials, especially indices or other "reference" type material, would contribute to the ease of finding information, cut

down on search times, and reduce some of the dissatisfaction users feel. Studies by cognitive psychologists, (including Dr. Barkow during his tenure at Bell Labs in Murray Hill, New Jersey) have shown that scanning printed directories is exceedingly fast. Thus, multiple-indexed directories may be the most productive user-oriented technology.

The use of paper indices does have some disadvantages. It might be costly to provide them. They would also require periodic updating and distribution as the databases change, which has additional cost implications. These are, however, more economic and marketing considerations than human factors. From the Telidon user perspective, some form of printed reference material is extremely desirable.

Cross-referencing is a variation on the use of tree structures with strictly index-page search techniques. The terms used can direct users to lateral points in the database where similar information is stored, or might be of the hierarchical type, giving users an indication of where they have just come from (i.e., "Masonry" - Building Supplies). Cross-referencing is a viable technique to reduce user search errors, search times, and to allow users to develop a better "mental map" of the database in use. (Studies have shown that users prefer the inclusion of descriptors - see "Common Search Errors" - to a cross-referencing system, although they believe that cross-referencing can make searching for information much

easier.)

An approach which calls for the duplication of documents with the use of cross-referencing is not recommended. This is an uneconomical use of storage space with few benefits to the user.

Keyword search techniques have been used in some instances, although user response is less than enthusiastic (for example, 37% and 34% of voluntary and recruited Cantel users, respectively, preferred the use of keywords to the present index system; 11% of inexperienced and 36% of experienced Telidon users in an OECA survey preferred keywords.)

While this type of search might be of some help in accessing information more quickly, it is not without its pitfalls. Users must be aware of the proper keywords to use. This can be extremely difficult for an inexperienced user if a hard copy listing of the keywords is not provided.

A hybrid design, combining the advantages of both index and keyword use techniques seems to be the most promising. This type of search involves the use of keywords to access certain sections of the database tree structure. The search is then completed by making choices from index pages.

Staff of Behavioural Team believe that search time would be improved

since users could "cut" to a certain section of the tree, avoiding the rigid process of going through all the index pages necessary to get to that point. Additionally, users might learn about which keywords to subsequently use by being exposed to the choices on index pages. Please note, these are recommendations for home users primarily.

A review of the literature indicates it is not clear which access methods are optimal for the typical user. It is conceivable that the best approach might be one which provides a moderate degree of flexibility. Users could select the access approach which best suits their level of experience or personal style. What is clear is that satisfaction and degree of Telidon use depend to a large extent on the speed and ease of information access.

3. What are the effects of an expanding database and directory updates?

Expanding the database can have implications for both Telidon users and those working to provide the service. Our discussion of page identification in the "User-Centred" section in "Recommendations" should be applied to the discussion which follows.

Database expansion means that not only are systems operators required to input the additional information, but also, they must work to

ensure that all choices provided on index pages reflect any expansions or deletions. If database expansion occurs frequently, this task could become time-consuming. There is also the need for an established sequence of accessing information to be maintained as much as possible, in the face of a database which is being expanded or deleted. This is important to minimize difficulties for the user. Alas, the methods used by Database Operators cannot support effective management activities such as these.

Users might find that their search for information takes longer. The expanded database will undoubtedly require them to look at more options on index pages or to view a greater number of index pages in order to access the information they are searching for. Search time might also be longer for previously accessed information. Users no doubt learn the sequence to information which they frequently access. If an expanded database has caused that sequence to change, search time will clearly be longer.

4. Are some access methods preferred by certain types of users? (e.g., direct page access versus menu search for business groups.)

No information from field trial reports or laboratory studies was available to effectively assess the answers to this question. New funding will permit further telephone survey cross-tabs which might further answer this question.

Perhaps keyword or direct page access approaches would be more beneficial to experienced users (many field trial participants commented that they found it tedious to go through all the levels to find information). Index search approaches might be best for inexperienced users. They might be more easily led through the search paths available and given a "sense" of the types of information and structures in the databases.

6. DATABASE SEARCHES

The degree of users' search success depends on a number of factors such as level of technological sophistication, experience with Telidon, clarity of index page choices, complexity of the database being accessed, and other factors. Of these, the biggest benefit, in our view, resides in researching the "cognitive mental map" which users hold.

In one exemplary laboratory study, naive Telidon users searching for information in a five-level database made an average of 1.0 mistakes on each search task. Each person made mistakes on about 49% of the tasks that s/he attempted, on average (Latremouille, S., Feb. 1980). Participants in another study had an average of 3.3 errors ("error" being defined as any choice which led the user <u>further</u> away from the information s/he was looking for) per problem and made mistakes on 59% of the search tasks attempted (McEwan, S.A., May, 1981).

It seems unlikely that any user will have an error-free search for information unless s/he has previously found the information and thus knows the correct search path to take. This is a sad conclusion.

Of course, the number of errors any user makes will vary depending upon the number of index pages (and thus levels of the database) involved in the search endeavour. Results from experimental studies estimated the probability of making one or more errors per index page in the range from .14 to .35 (Latremouille, S., Feb. 1980; McEwan, S.A., May 1981). Using these estimates, the probability of making one error (or more) during a search in a five-level database ranges from .53 or 53% to .88 or 88%; in a ten-level database from .78 or 78% to .99 or 99%!

2. How easy is it to find information you're looking for?

Generally, based on the telephone survey results, Telidon users experience a moderate degree of difficulty finding the information they look for. Slightly over 52% of respondents reported they had problems either "sometimes" or "always" (approximately 7% indicated "always").

Laboratory experiments have (eg., Whalen and Latremouille, May 1981; Whalen and Mason, May 1981) shown that the ease of finding information is related to certain points in the database design and to various human factors design aspects incorporated on index pages.

Research which led participants to believe that the existence of some

information in a simulated database was uncertain (a lab situation not unlike present ones in a residential or public setting) showed that many people make errors in their search for information, and furthermore, most errors occur with the first two levels of the database structure . (This was the case in situations where users returned to these levels after making errors, and where they were not allowed to return to the first two levels.)

Another very similar laboratory experiment had similar, yet more dramatic, results. With the use of an actual Telidon demonstrator database, the error rate among participants was higher than in the previously mentioned experiment. Again, most of the errors (53%) occurred with the first two levels of the database tree structure.

Based on results of trustworthy laboratory studies such as those mentioned above, it is evident that information becomes easier to find as a user progresses further down through the structure of the database. The specific reasons for this are presented and discussed in the section "Common Search Errors."

The ease of any user finding information can also be influenced by the type of approach s/he is required to take. Most field trials have employed a tree structure organization of database content coupled with a menu (index page) search approach. Generally, field trial participants found this easy to use, as illustrated by the following results:

-72% of Cantel users responding to a survey said they had no difficulty finding the information they wanted;

-84% of Elie participants surveyed indicated they found the index system "easy" for finding information;

-most OECA respondents indicated little difficulty with the use of the database;

-overall, Vista respondents praised the ease (and speed) of finding information.

While Telidon users generally regard the tree structure and index system as fairly easy to use in order to find information, they have also expressed some difficulties which are consistent across field trials.

The main problem is selecting the right choice from those listed on the index pages. (Specific index page problems are discussed in "Common Search Errors.") Additionally, although easy to use, the required progression through a number of database levels to get at information is perceived as quite tedious and somewhat annoying, especially when the information users finally arrive at is limited or quite superficial.

Another recurring problem is that users find it difficult to "go back", that is, to access pages previously seen. This might be due to lack of a "mental map" of the database and tree structure, or lack of knowledge about how to key in the appropriate commands.

To review a page, users tended to go back to the beginning of their search and start again, and some tried to find the desired page by a trial and error search. Both approaches are time-consuming and somewhat confusing for the user.

Solutions for index page problems are suggested in a subsequent section. To reduce the tedium of screening a large number of pages before finding information, frequently accessed topics could be moved to higher levels in the database. (Note that we refer to frequently accessed pages at lower levels in the database. For instance, suppose "Weather" was an often accessed bit of information at the, say, eighth database level. It could be moved up to the fourth or fifth level, thus saving the user the effort of going through three or four unnecessary levels.) Additionally, the number of choices at each level of the database could be increased. There is an effective range, however, beyond which user search times are disproportionately increased, based on laboratory results (see "Search Times and Paths").

Instructions about how to page back should appear not only in printed form but on the display screen as well. Printed reference materials

would assist users to develop a better sense of where they are located in the database at any point in their search. As well, these hard copy materials could also allow users to know the numbers of pages they could directly access.

Some trials have made direct access to pages available for users. They key in the page number associated with the content they wish to see. These directly keyed-in page numbers become increasingly longer (and hence, unmemorable) as the size of the database increases.

Laboratory research has shown that the probability of user error in entering a correct number increases with the length of the number being entered (Lee, E. January 1982). This experimental finding is supported by results from the field trials. Users found entering page numbers directly, especially long ones, somewhat tedious and error-prone to use.

Laboratory results suggest that the number of digits used should not exceed seven or eight. Additionally, the number of user errors could be decreased by 50% or more if the digits cueing users to enter numbers are grouped in three's (separated, of course, by blank spaces). This latter point applies to numbers on written directories and all displayed pages. Clearly any change which makes keying-in the numbers easier and reduces the probability of making errors makes finding information easier.

In theory, providing direct access to pages should make it easier for users to find the information they want. They do not have to follow a path through various database levels. In practice, finding information is not any easier when users do not know the page numbers corresponding to the desired information. This problem was expressed by many of the participants in field trials which provided direct page access. The solution is to provide a printed index of information and the corresponding page numbers.

As intuitively expected, the ease of finding information was related to use, in the results of our telephone survey.

Insert Table 4.1 Here

Table 4.1 shows a breakdown of how easy it was to find information by the average number of sessions users had per week. As can be seen, with increased use, respondents found information more easily. The implication is that anything which encourages system use will reduce the difficulty of finding information and the dissatisfaction which might result.

It is important to point out that regardless of the designs employed for indexing systems and tree structures, there is a need for standardization of the approach(es) taken. This need extends beyond

TABLE 4.1 Relationship Between Number of Sessions Per Week and Finding Information

Finding Information*	Number of Sessions Per Week: <5 (n=40)	5 - 10 (n=37)
Always Easy (40)	40% (16)	65% (24)
Sometimes a Problem (34)	53% (21)	35% (13)
Always Difficult (3)	7% (3)	—
TOTAL	100%	100%

* "How easy is it to find information you are looking for?"

$X^2 = 6.37$
$df = 2$
$p = .05$

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indexing systems and tree structures to user instructions, and other software and hardware aspects. Field trial participants have expressed the need for uniformity in page numbering, terminology, instructions, and various other aspects of Telidon use.

The staff of Behavioural Team are of the opinion that an emphasis on standardization throughout the Telidon industry would have many benefits, the most obvious being the encouragement of widespread use. This need might not be very evident or great at this stage of development, since, for the most part, many of the field trials have been operating in isolation from each other. However, if the Telidon concept is to become widely accepted for both commercial and public use in the future, then it is important that an emphasis be placed on standardization.

3. How easy is browsing with no particular item of information being sought?

Browsing seems to be virtually effortless when there is no task or end which the user wishes to accomplish. Based on behavioural observations, users simply log on to the system (which entails the same problems for both "browsing" and "non-browsing" users) and press whichever keys come to mind or they are prompted to press by the displayed information. Using the telephone survey results as a basis, staff of Behavioural Team estimate that browsing accounts for approximately 37% of field trial Telidon use.

Reports from the field trials indicate that users can experience frustration when they attempt to browse with a specific purpose in mind. (Unfortunately, no information was available to indicate what percentage of browsing is purposeful.) Browsing to find out about database expansions or updates tends to result in very limited satisfaction, if not frustration, since an overview is not possible unless browsing becomes an exhaustive look at the total database. Exhaustive browsing is a rather crude way of finding out about the most recent updates, additions or deletions. It could be eliminated by informing users of the latest changes via a regular bulletin or by displaying the information when the user first logs on.

7. WHAT DO THE DATA ON SEARCH TIMES AND PATHS TELL US ABOUT USERS' RESPONSE TO TELIDON?

1. Components of Search Time

Search time is a fundamental determinant of system appeal and satisfaction for the user. The shorter the search time, the higher user acceptance and satisfaction with system use will be (Lee, 1980).

Search time depends on a number of factors. It is influenced by the number of pages in the database, the number of levels in the database structure, the number of alternatives on each index page, system response time, the rate at which people read, the time taken to find and press the keys, and the search strategy used (Lee, 1980).

2. What is the average (and range) of search times?

Various laboratory studies have been conducted to assess how long users take to search for specific information. In one study, naive users took an average of 2.7 minutes per successful search task, with a range of 1.5 to 16 minutes (Van Ness et al., 1979). Experienced

users who were told that some of the information they were searching for did not exist in the database, took an average of 2.3 minutes to successfully complete search tasks (McEwan, 1980).

3. What are common search errors?

Results of laboratory experiments with naive Telidon users indicated that users had a number of related problems in their searches for information. In most cases, the majority of user errors (over 50%) were reported to occur on the first two levels of the database structure (Lee, E., May, 1981). While the reported figures for error rates (especially for the first few levels - see below) might be somewhat inflated, it is very evident that a large proportion of errors do occur on the first two levels.

The search paths users take when attempting to correct their errors usually require them to return to the first index page, or first level, of the database. Thus, there is more opportunity to make mistakes on this level since it is displayed to the users more often. This contributes to an over-estimate of the error rate. However, when this factor is controlled, error rates are still high on the first two levels (Lee and Latremouille, 1980).

On the first index page, errors occurred because the titles used were too general. The resultant ambiguity in users'

decision-making contributes to a trial and error approach: a "bit" of information could easily fit under a number of general categories, so users have no recourse but to arbitrarily choose a category.

Ambiguity is again evident in the problems experienced at the second level of the database structure. Participants in laboratory studies judged many of the index terms used as ambiguous. They also had problems because there was overlap between some of the content as implied by the index page words. Both types of problems contribute to decision-making difficulties. (Over-general, ambiguous index terms were a problem for 60% of naive users. - Latremouille, S., May, 1981)

Participants in the research mentioned above were told in advance of their search tasks, that the information they were looking for was in fact located somewhere in the database. It is easy to presume that had they not been told, they might have perceived the index terms used as even more ambiguous. (The uncertainty of information existence could likely contribute to the more general confusion of which category contains which information.)

Other laboratory results agree with those mentioned above. In one experiment, which used a simulated Telidon database, design defects were purposely introduced into the database. The defects were: miscategorization of information, use of two synonymous labels on pages, and vague category labels. Results showed that the

miscategorization of information was the most serious defect leading to longer search times. The other defects also impaired performance, though to a lesser degree (Whalen, T., May, 1981).

Many people's comments from the field trial surveys and the behavioural observations echo experimental findings. Index page terms were often misleading and vague. This contributed to search errors and increased the time required to find information.

As is evident from the results of laboratory studies and comments made by respondents of the field trial surveys, the error rate is dependent upon the level of generality or ambiguity of the index page. It seems that as the specificity of the page increases, the error rate decreases.

These types of results clearly point to the need for empirical testing of index pages and designs in an attempt to minimize user search times. Potential user difficulties might not always be obvious to systems designers. If research resources are limited, it is recommended that the indices used in the top two levels of the database structure receive the research focus, as the majority of errors are made there, and the number decreases as the user progresses down the tree.

The specific terms used on index pages should reflect the manner in which people tend to psychologically organize information, rather

than reflect the internal organization of the information or system providers. An example from a parallel situation can serve to illustrate this point:

> People used to have a great deal of difficulty using the Government listings in the telephone book. The way the listings were organized - by Government levels and departments - did not correspond to the manner in which people psychologically organized, and thus searched for, Government-related information.
>
> (Abstracted from a proprietary study.)

The use of very general or ambiguous index terms ("General Interest", for instance) should be avoided. As much as possible, the terms used should define mutually exclusive categories. If there is any risk of overlap in meaning, then qualifiers should accompany index page terms.

The use of descriptors on index pages is recommended especially on those pages in the first few levels of the database structure. Descriptors provide a brief explanation of the contents covered by each index term, and have been found to significantly reduce search times. Research has shown that index pages with descriptors had two

to three times fewer errors than index pages without descriptors (Latremouille, S., May, 1981). If space on the page is limited, abbreviated examples of terms covered by each index choice could be used. For some Telidon uses (educational, for example) descriptors which differentiate between games, information, and instruction should be used. (This type of distinction was preferred by almost 90% of respondents in an OECA field trial survey.)

Index terms which are approximately equivalent in their level of generality or specificity should be used on the same index page. (Under "Entertainment," for example, "Theatre," "Movies," and "Dancing" would be roughly equivalent. "Mime," "Movies," and "Polka Dancing" would not be appropriate.)

Some form of intra-page organization, perhaps alphabetical, should also be used. This refers to the organization of index terms within (or on) a given index page.

> There exists in the hearts of otherwise intelligent and educated people an irresistable impulse to use contracted sentences in signs. At its extreme, this impulse leads to ridiculous symbols and glyphs.
>
> We recommend the use of full, natural language sentences, as far as screen display limitations makes this possible.

Instead of having a menu item of "What's New?," we would prefer (as an extreme) "Press the 3 button to see a list of pages added since March 11, 1983." It takes cleverness to say things clearly but briefly. Being cryptic is no virtue.

8. WHAT AFFECTS SEARCH PATHS AND TIMES?

1. Printed Or On-line Directories

Although hard data about the exact effects are unavailable to date, the use of directories undoubtedly reduces search times since they remove any element of guesswork and allow users to know exactly which path to take to access desired information. Directories can also allow users to take a direct path to the desired information by keying in a page number (assuming this information is included in the directory), thus avoiding a search path through the various database levels. This very likely reduces search time and, probably, user dissatisfaction.

2. Key Word Search

As with directories, little hard data exists about the effects of key word searches on search times and paths. While one of the field

trials provided users with the option of keyword searches, there were no reported results addressing this aspect. Staff of Behavioural Team believe that, if properly implemented, the use of a keyword approach could reduce search times and minimize user effort. The key requirement for effective use is that users know the proper words to enter. Search times could be long and frustrating if inappropriate words are repeatedly keyed in resulting in unsuccessful searches.

3. Number of Choices per Page

Research has shown that the number of choices on index pages does have an effect of users' search times.

There seems to be an optimum range for the number of index page choices. This range tends to vary depending on whether teletext or videotex is being used.

According to theoretical models, in order to minimize search times, the optimum number of choices on videotex index pages should be less than ten. To accomodate a variety of conditions, the recommended range is from three or four up to about six to eight (Lee, E., May, 1980; and Phillips, D., May, 1980). Ten or more choices as well as two alternatives per index page should definitely be avoided, since both significantly increase search times.

The optimum number of choices on videotex index pages is not affected by the size of the database.

The recommended optimum number of choices for teletext index pages varies depending upon the mode of transmission as well as the size of the database.

For teletext with vertical blanking interval transmission, between seven and 13 choices should be displayed on each index page for small databases (approximately 100 pages). For larger databases (about 300 pages), 15 to 20 alternatives are recommended (Lee, E., February, 1980).

For teletext with full-channel transmission, the recommended optimum number of choices per index page fluctuates around ten, depending on various conditions such as transmission rate, exhaustive or self-terminating user search strategy, etc. Most search times with ten alternatives per page are within the 10% theoretical estimate of expected variation (Lee, E., February, 1980).

Further research should address the effects of varying the number of choices per index page, depending on the database level that the page is located on.

It has been suggested that users will have less trouble to follow a search path which involves a limited number of choice possibilities

through a greater number of database levels, than a large number of choices through fewer levels (Schabas, 1980). User preference based on participants' comments from the various field trials, however, tends to be in the opposite direction. Many users found it tedious to work through many levels of the database to find information. It seems user preference is to screen more choices on fewer index pages.

The development of index pages remains a very important aspect of Telidon. There is a need for further research which takes into account the optimal number of choices as suggested by laboratory studies and factors related to user preference, since user satisfaction is critically important for the encouragement of Telidon use. The evaluation of user satisfaction should form an integral component in the overall mix of research efforts contributing to the development of Telidon.

4. User Characteristics

None of the reports available from laboratory studies or from the field trials addressed the effect that user characteristics might have on search times or paths. Intuitively, it seems that the degree of user experience with computer-related technology would have an effect. Presumably, Telidon users with more technological experience would find searching for information easier. This presumption tends

to be supported by the telephone survey results from this study, although the results should be interpreted with caution because of the small number of respondents in each of the categories investigated.

A breakdown of the ease of finding information by the user's level of technological experience suggests a tendency for those with less technological experience to have more difficulty finding the information they are looking for. Perhaps because of their limited direct experience with analogous technology, they are more likely to be somewhat intimidated, and less apt to experiment. Thus, unless they definitely know what steps to take to find information (especially when they make errors), they may hesitate, and perceive the information difficult to find. This, of course, is speculation at this point, and the issue of why there might be these types of differences warrants further attention.

If the types of results outlined above are indeed supported by further research, then it seems important to assess the difficulties experienced by the "typical" user and to structure Telidon development, at least to a degree, to accomodate this typical user's level of technological sophistication.

Results of the telephone survey showed no relationship between age and the ease of finding information. Reports from the field trials indicate that younger users are more likely to browse the database.

This would increase their awareness of database content and the location of specific information, possibly increasing their ease of finding information.

9. WHAT RESULTS ARE THERE ABOUT UNSUCCESSFUL SEARCHES?

Some laboratory research has been conducted which provides information about unsuccessful searches. Participants in one experiment used a simulated database, and were informed that some of the information they were looking for did not exist. Results showed that they terminated searches if the information sought was not found after 8.8 pages, on the average (Whalen, May, 1981).

In another experiment, 28% of the participants terminated their searches prematurely. On the average, the search was given up after 3.4 minutes (McEwan, May, 1981).

Note that while both of these studies addressed the issue of unsuccessful searches, different dependent measures were used. The results of the studies are not comparable.

Researchers have also found that as users become more experienced, they give up searching after fewer pages. Staff of Behavioural Team believe that as users become more sophisticated, they are less likely

to think that their errors are contributing to unsuccessful searches, and are more inclined to think that the information does not exist. They therefore terminate their searches sooner.

10. DO USERS REMEMBER SEARCH PATHS, PROBLEMS, AND/OR THE INFORMATION THEY LOOK FOR?

In our view, users cannot quickly and reliably remember this kind of information. There is a certain futility in having keypad buttons for "go back one mode." If users can't conceptualize their location in cognitive space, then they can't figure out where is the previous "mode."

The system design must be strengthened to assist users. There are many possibilities for useful features. Users should be able to access brief instructions simply. When finished with the instructions, the users should then be able to very simply return to the last frame used before accessing the instructions, or to the main index frame.

11. WOULD USERS LIKE HARD-COPY MATERIALS?

It was found that there is a clear need for hard-copy materials, especially references (such as directories or "maps" of the database) and instructions. In one trial where the official booklet was not widely used, contact people prepared other materials for distribution. Users also prepared their own reference materials about database content and page numbers. There were also numerous requests for multiple copies of materials.

Users also reported that the written manual was their preferred method of learning, followed by demonstrations, a combination of manual and demonstration, minimal instructions, no guidance, and Telidon courses.

There are many benefits with "old fashioned" hard copy materials. Reading the instructions prior to accessing the system may speed up user learning, especially if the hard-copy instructions are the same as, or close to, the machine-based instructions. Indeed, there are some users who would require written instructions just to approach the machine and access the machine-based instructions. Hard-copy instructions could then reduce the time required by users, thereby making the hardware more accessible to others. Personal copies can be kept for easy reference and note-taking.

Considering the benefits, the staff of Behavioural Team believe that the hard-copy instructions should be viewed as a useful supplement to the computer-based instructions and be made available in quantity.

We feel that the hostility to providing printed materials for users among some members of the Telidon industry has harmed the Canadian field trials.

Hard copy reference materials encourage Telidon use by making it easier to know how to directly access certain information as well as to know the database content. As well, materials such as journal articles, papers, updates, database additions and deletions, and so forth are readily available for distribution.

12. WHEN ARE THERE MOST OR LEAST USERS ON THE SYSTEM?

Based on reports from the various field trials, peak Telidon use occurs during the late afternoon and early evening. Some trials (Weta and Vista) reported evidence of a peak during the morning hours (between nine and ten o'clock for Weta), although use during this period was substantially less than during the evening peak. Late afternoon use tends to be predominately by children, and adults tend to use Telidon more during the early evening.

Telephone survey results from this study corroborate those reported from the field trials. Almost 60% of the respondents reported that they normally used the system in the afternoon or evening, while less than 5% indicated their usual time of day for Telidon use was in the

morning.

13. WHAT IS THE RELATIONSHIP BETWEEN NUMBER OF USERS AND SYSTEM RESPONSE TIME?

Although there is no available evidence of the direct relationship between system response times (defined as the length of time between user request and the time the page begins to be displayed) and number of users on the system, there is information about the effect that heavy use has on system access.

While the exact numerical relationship remains the domain of engineering research, it is very clear from field trial reports that an increase in the number of users at any given time results in longer delays for other users attempting to access the system. These delays seem to be longer in practice than in theory. (System access has been discussed in the section which deals with problems users have encountered with logging on.) This in turn frustrates users. (Delays accessing the system were cited by 50% of the telephone survey respondents as one of the causes of their aggravation with Telidon.)

14. HOW LONG DO USERS GENERALLY STAY ON THE SYSTEM?

Session length tends to vary depending on the nature of the information available for access, the location of the terminal, the type of terminal setting (residential versus public), and the specific field trial in question. The following examples will illustrate the variation in session lengths.

The average session length for Cantel (public terminals) was about 17 minutes. However, session length for Cantel terminals located in shopping malls averaged to be approximately 10 minutes; in libraries, just under one hour. We timed viewing sessions for publically located terminals in the Weta field trial. They averaged 4 minutes, 21 seconds in length. The average length of viewing sessions for Vista was approximately 20 to 25 minutes.

Results of this study's telephone survey, which was conducted across field trials, indicated that 63% (58) of the respondents typically viewed Telidon for 20 minutes or more. Just over 21% (26) had session lengths from 10 to 19 minutes. A minority of just over 8% (8) used the system for under 10 minutes per session, on the average. These results are very similar to those of the Vista field trial.

15. WHAT IS INVOLVED WITH USERS TERMINATING A SESSION?

1. Ease of Logging On

First of all, it is important to mention that the difficulty of logging on might have an effect on users' willingness, or lack of it, to log off for brief times. As mentioned in a previous section, if users experience long delays accessing the system, (logging on), then once they have been successful, there is the strong temptation for them to stay logged on regardless of whether they intend to continuously use the system or not. There might be even more of a tendency for this to occur if users are searching for specific information, as opposed to just browsing.

2. Does the system give any on-line message requesting log off to inactive terminals?

To date, there are no messages requesting the user to log off displayed on the screen or communicated through audio channels in circumstances where users have logged on but are not using the system. Consequently, there are no prompts (or incentives) to make efficient use of Telidon. Perhaps paying for connect time, as well as for the number of pages accessed, will be a deterrent to "inactive use" of the system. This in turn, has it's implications, as mentioned above, for other users attempting to access the system.

3. Can one log off from any point in database?

While most points in a database allow the user to log off, there are some which require that the user "back up" at least one page, if not more, before the terminal will accept the log off command. While it would be extremely time-consuming to check all of the database points, attempts to log off from randomly selected points revealed that a user cannot exit directly from the complaint/compliment pages of some databases.

Staff of Behavioural Team feel that this is not a major problem, unless it is more widespread than our unsystematic trial indicated. At most, based on our experience, it would cause some minor irritation to users.

4. Does the system give feedback regarding success or failure of log off?

Based on the experience of Behavioural Team staff, most systems extend a "courtesy" message to the user when s/he has logged off. The repeated display of the last page accessed is a passive indication of failure to log off, by default, since this tends to happen when the user has not successfully logged off. Telephone survey results indicated that logging off was considered "always easy" by 99% of the respondents.

It seems that feedback about the success of logging off, or lack of it, is not important in the field trials. But, if you paid for connect time, and if you left your terminal connected over a long weekend ....

SUMMARY

Telidon hardware, software, and written instructions must all combine to assist learning/understanding among a wide variety of people.

This section has outlined what is known about users' strengths, weaknesses, experiences, potential problems, and so on. Building on this knowledge, a variety of methods can be employed to assist the learning. Some examples follow.

Machines suitable for public use can be placed in public places. This would allow for casual observing of others. Observation is a powerful but unthreatening way to learn. Seeing others so engaged is also comforting and would make it easier to approach the machine and begin experimenting.

Observing a more structured demonstration would also serve some of the same purposes. The "serial" character of present Telidon (discussed later) limits the instructional potential.

Trial and error learning, whether casual "browsing" or more active experimentation, also needs to be encouraged, through attractive hardware and ongoing displays on the screen.

A variety of instructional materials, users' guides, learning aids, promotional packages and so on could be utilized. These should be prepared by appropriate behavioural professionals and, definitely, pre-tested.

More active learning methods can be used. Learners could practice under supervision or even be involved in activities such as developing pages of Telidon text.

Backup support (helplines and so forth) and peer contact would complement these methods as well.

Instructions serve many functions. They promote simple approaches and can encourage initial experimentation among new users. For experienced users instructions explain features, outline applications, and clarify infrequently used procedures. Information about applications could include news items such as new developments and uses, a descriptive catalogue of available sequences, objectives for educational/business/personal applications, and other suggestions for use. Information about features and technical operational procedures could include directions about how to log on, how to

access pages, how to troubleshoot emerging problems, installation and operation of terminal, how to access assistance, and so forth.

In all instances, instructions must be flexible to meet many different needs. The instructions will cover a wide range of information, ranging in difficulty. They must be arranged such that user can access appropriate sections (eg., users would request beginning, intermediate, or advanced instructions). These selections will change as the users' knowledge and skills grow. Instructional packages must be adaptable, since the systems and applications are ever-changing. Above all, instructions must be simple and clear.

Terminating sessions is not difficult for users, and since the method of logging off ("proper" log off, or telephone disconnection, etc.) seems to have no important implications for the Telidon system, there is only one recommendation to be made. Users who are logged in to the system, but are not actively using their terminals, should, by some manner, be motivated to log off. This would reduce the system access delays, and likely some of the frustration of other individuals wanting to use Telidon.

5. Page Display and User Reactions

1. ABSTRACT

This chapter examines issues related to page display. Page display is considered both in terms of its visual elements (such as spacing) but also in terms of page display time. The chapter begins by defining optimum standards for each of 10 elements, including typeface, type size, number of colours, sequence of graphics and text, proportion of graphics and text, spacing and layout, number of choices per index page, amount of information, characters per line and lines per page, and equipment characteristics.

A number of psychological outputs, such as legibility, are then discussed with a view towards how the features of page display affect them. The outputs discussed include: legibility and perceptual quality, aesthetic acceptability, efficiency of information retrieval, understandability, user response and search times, information overload, and visual comfort.

Lags in display time are also addressed. How these lags affect the user in terms of irritation and frustration is one key area examined.

Finally, a number of solutions to these problems are considered.

2. PAGE DISPLAY

Given the constraints of video displays and technical standards, what is the optimum ....

1. Typeface?

The telephone survey data support our belief that typefaces used in the field trials were acceptable. Only four people found the pages difficult to read, and of 50 criticisms made about readability, none involved the typeface.

Treurniet (May, 1981) also recommends a set of typeface styles. These were designed, we assume, by professional graphic artists. Two sizes (on 5 X 8 and 7 X 11 matrices), consistent with Telidon specifications, are included. So too are double-size versions (requiring special designs, rather than a simple doubling of elements). Treurniet notes these typefaces would be recommended for picture tubes with a shadow mask, like that in Electrohome's Model C40-852 television receiver. Samples of various typefaces and data on their acceptability is included in his report, to which the interested reader is directed.

Treurniet (1981) has also suggested "established convention" can be used in the choice of case, since case (upper/lower) did not affect reading speed.

On the basis of the limited information available, current practices do not seem unreasonable.

2. Typesize?

In one trial, 91.6% of users stated no improvements were needed to the type itself. However, six people interviewed in the telephone survey stated that type size was troublesome. Although not large, in our experience in designing public facilities, this level of criticism is borderline unacceptable. Adjustments are necessary and should be made on the basis of further human research.

Generally, research to date (Snyder and Maddox, 1978) has found that decreasing the type size will increase reading speed. However, larger type size speeds up the search times, when users are skimming or scanning the text. These two findings create conflicting demands on designers. To resolve this dilemma, perhaps two type sizes should be used, one for headings and a smaller size for the body of the text.

3. Number of Colours?

Telidon currently offers eight colours (including black and white) and six shades of grey. Users clearly appreciate the use of the colour on the Telidon services. Yet there are serious problems.

In one trial, 50% found the colours excellent or very good. Among the 30% who saw problems, colour combinations were seen as the problem, rather than individual colours themselves. Generally, too bright, contrasting colours were troublesome, such as Red on Blue or Yellow on Black.

When asked about ease of reading pages, 17 people (in our telephone survey) identified the colours as a problem, while 11 mentioned the contrast among colours. Only one person found the pages unattractive, but three persons criticized the colours and the contrast.

Studies have also been made of colour combinations and their wide-ranging effects. Contrasts make the best combinations, while combining complementary colours (such as blue and yellow) should be avoided. Dull colours (such as blue) are most appropriate for the background, while bright colours (such as white) are appropriate for the text.

In the view of Behavioural Team staff, no more than three colours should generally be used on a given page. A proliferation of colours does not appear helpful (Phillips, 1980). Further, the choice of colours and their combinations should follow the research findings outlined previously (Phillips, 1980). For the present, we must cautiously rely on research done with other media, principally hard copy.

In time, with increasing use of Telidon and its wonderful potential and flexibility, much new knowledge could become available. However, given the low level of management skills of the present Canadian Telidon establishment, as we document below, we are not optimistic about the speed with which learning will occur.

4. Sequence of Graphics and Text?

Telidon frames generally incorporate graphics for the following purposes:

1) to draw attention to parts or all of the text;
2) to decorate the page;
3) to provide a consistent style;
4) to provide information and meaning where graphics were judged more informative, interesting, satisfying, and/or easy to understand than descriptions.

As an example, graphics such as boxes and arrows can accompany visual text to outline complex and dynamic processes. A time series of graphics illustrating changes in a given process is another powerful learning tool. This is a form of slow-motion animation which has been used with great success by Cantel.

Field trials and research studies have found graphics to be useful and entertaining. However, graphics cost system designers time, money, and effort in producing them. Indeed, page creation is something of a bottleneck, as discussed later on. Users also require time and effort to review them. For graphics, like text, there are also costs involved in storage. Further, graphic effects are <u>not</u> always helpful.

We strongly advocate that graphics and text be viewed as complementary media, where one can not replace the other. Pictures can provide a conceptual base to assist verbal comprehension, and language can assist the interpretation of the pictures.

The most appropriate sequence of graphics and text must be determined for each situation. Consistency and relevance are essential in determining such sequences.

5. Proportion of Graphics and Text?

As noted earlier, graphics can certainly be useful and entertaining. However, use of graphics must be strictly controlled. Logos and other graphics are useful when specific and relevant, but harmful when general and incidental to the main points at hand. In one trial, 18% of users felt there was "too much emphasis on graphics," a factor which was the second greatest dislike. In another trial, only 75% were satisfied with the proportion of graphics and text. Findings, however, varied depending on the subject matter.

The telephone survey presented some interesting findings about the graphics. Of 97 people interviewed, only one found the pages unattractive. Six people made criticisms, one citing the graphics and three citing "clutter." These results show how successful page designers have been in satisfying users. It should also be noted that graphics was one of the features eleven users liked best, while five users said slow graphics were what they liked least.

Graphics may not always be necessary. Research (Champness and de Alberdi, September 1981) has shown that using paragraphs and colour-coded keywords alone provided maximum clarity. Participants' own reports and their performance in memory tests were used to measure clarity.

Of course, audience characteristics must also be taken into account in assessing the proper proportion of graphics and text. Graphics

are essential to maintain interest among young children, but could interfere with adults' reviewing detailed information. Similarly, a high proportion of graphics may serve to attract and hold the interest of a naive user, but may interfere with an experienced user who wants hard information. The interested reader is referred to the "Recommendations" chapter of this report, which discusses types of users in greater detail.

Another factor is frequency of use. When the graphic is repeated throughout the page(s), or the page(s) is/are heavily accessed, change or elimination of the graphics is desired by users.

Graphics should be used where essential to maintain interest and enhance the meaning of the text. In our view, though, there is danger in trying to apply all the traditional (i.e., printed text) uses of graphics to Telidon procedures. The situation is clearly different in a number of important ways, including technical limitations on the types of images that can be produced and on the costs involved in developing more complex graphics. For instance, as a rule, photographs are more "believable" than drawings. However, Telidon users may lower their evaluations of finely detailed drawings, recognizing the delays involved in producing them.

A paper by Mills, part of the Telidon Behavioural Research series, is particularly useful background reading. In addition to presenting valuable information about various applications of graphics, this

paper outlines many potential areas of applied research. Not only will basic research in fields such as cognition, perception and communication assist Telidon development, but Telidon can help to identify and test new theories. The tradeoffs and interplay among the type of task, equipment, user, and graphics must be considered.

It is clear that the proper sequencing and proportion of graphics can not be determined from a single vantage point; the graphic artist, the copy editor, or the corporate comptroller can each take some of the relevant factors into mind. But the reaction of the user counts in a special way that must be carefully anticipated, pre-tested, and monitored throughout. This bears on two issues - - responsibilities of the various parties (Who is the publisher?) and page creation. Both of these issues are discussed in "Recommendations."

Of course, the graphics ability of the Telidon instuctions (the Picture Description Instructions, "PDI's" for short) are one of its major advantages over other media and other videotex or teletext systems. The technology allows for many useful applications - outlines, cartoons, graphics, animation, and so forth, as well as bit-by-bit presentations of photographic type materials. Furthermore, the use of PDI's is relatively economical. The position of Telidon relative to other services in the marketplace is discussed later in this report.

6. Spacing and Layout?

Spacing did not appear to be a problem, based on telephone survey data. Three questions related to this, and only seven criticisms were made about spacing.

Studies (Treurniet, 1979) support a standard of 3 pixels (picture elements) between lines, 2 pixels between adjacent characters, and descenders for lower case letters at least one pixel below the line. The total area occupied by a 5 X 7 character thus grows to a 7 X 11 matrix. Reducing inter-row spacing to 2 pixels will allow 20 lines of 40 characters each to be presented. This spacing will also accommodate French language accents.

For 7 X 9 characters, descenders should be at least 2 pixels, letters should be separated by 3 pixels, and space between lines can be as little as one pixel. This extends the area required by one character to 10 X 12 pixels, allowing 18 lines of 28 characters each to be presented.

Legibility experiments (Treurniet, 1981) suggest spacing between letters and lines on a text should vary according to the typeset in use. He also advocates proportional spacing be used whenever possible (that is, vary the widths of the space allowed for different

letters by removing unused columns). This will also affect the spacing between words (a spacing of 2 pixels between letters and 6 pixels between words worked well in his readability experiments).

These suggestions appear reasonable and are also consistent with other standards being recommended. This spacing conforms, for instance to the number of characters per line often found in practice.

Careful "chunking" of material, using categories and/or paragraphs, will increase the value of the information transmitted. Experience also suggests that paragraphs be about 3 to 6 lines in length. These are not graphic arts questions, but applied psychology issues.

In previous studies, Behavioural Team have found texts which measure low on the Fog Index yet are inpenetrable to human understanding. Due to the constraints of Telidon, prose should be prepared by skilled writers. It should be carefully tested, too.

7. Number of Choices per Index Page?

Staff of the Behavioural Research Group, Department of Communications (Lee, 1980) made the following recommendations. These apply to videotex systems:

> Alternatives per index page should be kept under 10, with a range of 4 to 8 alternatives being optimal under most situations. Two choices per index page increases search times. In summary, the numerically paged tree index with a maximum of 10 choices is preferable to an alphabetically paged tree using up to 26 choices per index page.

The same method was also used to consider full-channel transmissions of broadcast Telidon. In this situation:

> Alternatives per page could be kept to 10 without significantly increasing search times. At least 6 choices (and as many as possible) should be displayed. Lee predicted that search time would be less than 2 minutes on the average, even for a database as large as 15,000 pages.

Lee (1979) made the following recommendations for broadcast Telidon, using the Vertical Blanking Interval (VBI):

> 7 to 13 alternatives per page, for small databases (roughly 100 document pages)
>
> 15 to 20 alternatives per page, for large databases (roughly 300 document pages)
>
> the use of very few alternatives (e.g., 2 or 3) should

definitely be discouraged

if the number of alternatives per page is limited to a maximum of 10, then, (a) as many alternatives as possible should be displayed on each page and, (b) at least 6 alternatives should be displayed on each page to minimize search time.

It should be noted that these recommendations are based largely on the work of Eric Lee, of the Department of Communications' Behavioural Research group. Lee's work is predicated on mathematical models of response time. That is, given a fixed number of document pages, different index stuctures were devised. One could increase the number of choices on an index page and thus reduce the number of index menu pages (i.e., levels in the decision tree), or vice versa. Using set parameters (such as reading speed, strategy, response time, waiting time, etc.), the overall search times were predicted.

We have no quarrel with this methodology nor its findings, but do wish to point out its limits. It does not consider the effects of errors. Actual trials with subjects attempting to find certain information (Lee and Latremouille, 1980) revealed disturbing levels of errors. Ways to reduce errors must be taken into account. So too, user preference can upset the model. Whether using an exhaustive or self-terminating search strategy, there are preferences which reflect people's comfort in making decisions. Moreover, indexing choices must also consider the actual subject matter at hand

- too few choices could make the selections too general and ambiguous and result in the infamous Telidon plague: "Menu Proliferation!" Too many choices might frustrate users.

Different types of users may prefer to make different choices and/or numbers of choices. Naive users may prefer fewer choices and could thus use a strategy in which they study all alternatives. Experienced users might prefer a large number of more specific choices, and fewer index pages. A number of the better human-factored word processor programs have separate modes of operation depending on the user's level of experience.

These types of relationships are not known at this time, yet obviously require attention. These and similar issues, relating to different user types, are discussed in the "Recommendations" chapter of this report.

8. Amount of information per information page?

About 150 words is the maximum amount of information which can be put on a given page. Assuming spacing for paragraphs, headlines, user instructions, and perhaps a graphic, 74 words appears to be a more practical upper limit.

Experience to date, of course, rests on trials conducted at no cost

to the user. Depending on the amount and type of fee, users may well want more information on the page. The matter of free trials complicates this particular research question.

9. Characters per line, lines per page?

The number of lines per page was troublesome to 12 users interviewed in the telephone survey. This is a non-negligible problem, and is at odds with the Telidon lab research literature.

Treurniet has pursued a line of research and literature review on these topics. His research measures users' performance and preferences. In a May, 1981, report, he advocates the current standard of 20 lines per page be maintained. In making this recommendation, he considered international practices, technical requirements, viewing distance, overscan, length of descenders on lower case fonts, position of French language accents, and spacing between lines. To accommodate accents on capital letters, a character height of 15 pixels would be needed, limiting the number of rows to 13.

In his view, a display with 22 rows of text would create problems and is not needed. The 24-row system advocated by European proponents of videotex can not be implemented (given the parameters of ordinary North American TV receivers) without violating acceptable standards

(e.g., a minimum character size equal to a 5 X 7 dot-matrix).

The implications of these discrepancies in the proposed standards must be pursued in order to guarantee the acceptability of current standards. Telidon users in the field trials would not have used the equipment in optimal environments. Real life factors such as crowds, improper facilities and so on may have great impact. In light of the number of criticisms, further study is warranted.

For some years - and for many reasons - there has been a race to perfect alternative technologies to the CRT. Much of the discussion of type format is based on contemporary levels of performance of TV receivers using shadow mask color CRT's. As new display technologies are perfected, new and higher standards will become possible.

3. DISPLAY PARAMETERS AND USER PERCEPTIONS

1. Legibility and Perceptual Quality?

It has been found that the best colour combinations are those which provide the greatest contrast (Phillips, February 1980). For example, white on blue or white on black help legibility and perceptual quality. Yellow and white, blue and yellow, or red and green should be avoided in combination (Champness and de Alberdi,

September 1981). As noted earlier, a large number of telephone survey (17) participants criticized the colour.

In the views of Behavioural Team, occasional use of bold face type also helps perception.

Data from our telephone survey strongly suggest that legibility and perceptual quality is satisfactory, with 71.9% of those surveyed reporting pages were easy to read.

Ease of Reading	N	%
Easy	69	72%
Average	23	24%
Difficult	4	4%

(Based on 96 of 97 respondents ... 100%)

This is tempered by the number of criticisms made:

Specific Reading Difficulty	N
colour	17
too many lines	12
contrast	11
type size	6
other	4

(Based on criticisms held by 28 of 97 respondents.)

In our view, improvements to legibility and perceptual quality are not urgently required. Any improvement for the sake of legibility may have costs which exceed the value of the improvement. At the same time, experience to date has identified a number of troublesome matters.

2. Aesthetic Acceptability?

Users find colours and graphics cheerful, interesting and exciting. Comments such as "excellent," "fantastic," and "unbelievable" have been reported (Champness and de Alberdi, September 1981). Animation and zoom capabilities build interest, according to two trials. Both teachers and student users report that these features increased motivation to use Telidon. Significantly, users then find the materials more useful. As expected, reactions vary among user groups; one trial suggested graphics hold less appeal for middle age male managers, as opposed to many teenagers, women, and some minority groups.

The telephone interview sample of users in the field trials clearly found the pages attractive. Of those interviewed, 28 found them average, one believed the pages were unattractive, but most (66 or 69.5%) called pages attractive. Nonetheless, it would be important to identify problems for the sake of future improvements.

Users were asked to name problems. The "attractiveness" figures closely correspond to the "ease of reading" figures above! The people who found the pages unattractive gave the following reasons.

Specific Page Aesthetic Difficulty	N
colour	3
contrast	3
clutter	3
other	2

(Based on 6 of 97 respondents.)

Aesthetic acceptability is a unique dimension of user response. However, it is clearly related to other factors such as user satisfaction and comfort. For this reason, system designers should maximize the aesthetic appeal of the page display. This should be done by establishing rules of good display, not (as at present) by having artists independently craft each page without guidelines.

3. Efficiency of Information Retrieval?

In order to measure the efficiency of information retrieval, users were asked to comment on the worthwhileness of the system, compared to reading a daily newspaper. Results were as follows:

Telidon *	N	%
more worthwhile	11	12%
just as worthwhile	26	27%
less worthwhile	58	61%

* "In comparison to your daily newspaper as a way of getting information, is what you gain from Telidon worth the time and effort spent?"

Page display, however, does not appear responsible for the problems. Many people mentioned the speed of content, and/or the information content itself as features they liked least.

Professor Buxton of the University of Toronto has summarized the problem this way in a recent talk (Buxton, 1983):

> "Who would want to access this data <Telidon> if it is presented at one-quarter of reading speed?"

Studies have identified a number of psycho-perceptual procedures which increase efficiency, including:

** paragraphs, which make materials more meaningful, significant, and useful

** colour-coded key phrases

** "bullets" and other typographical markers

** symbols and other graphics

However, it has also been found that some graphics - such as excesses of colour - can interfere with the clarity of a page. Also, the sometimes slow process of producing graphics on the screen interferes with the flow of meaning between pages (not to mention the emotional composure of the patron).

Organizing the material into meaningful paragraphs is an essential step, and one with no harmful consequences. As pointed out above, more skillful writing is needed to survive the constraints of Telidon. In our view, colour coding can help, provided only a few colours are used and in a reasonable number of cases. Symbols and other graphics should be used only as necessary.

Efficiency depends not only on the page display, instructions, and the hardware, but on the users themselves. Experience, for instance, is a major variable. Differences between experienced and naive users, and the implications of this difference, are discussed below.

4. Understandability

In the overall scheme of page display elements, understandability should easily be considered the most important issue of all. To use the current cliche, it is the "bottom line" of Telidon communications. Visual comfort, legibility and attractiveness are desirable and necessary. The proper flow of information (to avoid boredom or, at the other extreme, information overload) and its timely delivery are also necessary for user satisfaction. Yet even with all these in place, there would be no assurance the material is understood.

Very little information is available about the understandability of the Telidon material. Nor can we determine what elements of page display enhance understanding, and which might interfere. This absence of comprehension testing is especially poignant to the staff of Behavioural Team. Comprehension measurement has been a specialty of this firm for several years.

It seems reasonable to assume that typeface, type size, and textual components do not have major impact on understanding. The use of colours, graphics, and text/graphics (in particular the prose) sequences are more likely to be major determinants of understandability.

There are many unique elements to the Telidon situation - users control the pace of presentation, they can select materials as desired, and so forth. These can enhance understanding. At the same time, factors such as discomfort with the new medium would interfere. Clearly, further study must be given to determine the effectiveness of Telidon in terms of presenting materials. Such work would also carefully consider the variations connected with different users and types of materials.

As a cautionary note, Behavioural Team recently reviewed nuclear power plant control rooms. Increasingly, information reaches operators through CRT's. The present generation of monochrome CRT displays is, alas, far inferior to "brass instrument" readouts and annunciators in terms of human cognition. However, we feel that the future generation of displays (which, like Telidon, include colour) can be far more effective (Behavioural Team, 1982, confidential).

The staff of Behavioural Team believe that the CRT is not an effective medium of communication without careful applied psychology. Indeed, we devoted an entire report to Bell-Vista on this subject (1981, confidential). There <u>are</u> visual techniques (e.g., apparent movement) available to enhance the effectiveness of text on CRT screens but these are not developed in Telidon today.

5. User Response and Search Times

The timing involved in using Telidon was a key point of interest to us in the telephone survey. Respondents were asked how often they feel it takes "too long" for pages to begin to be drawn on the screen. Thirty-nine (42.4%) said "often," 32 (34.8%) "sometimes," and 21 (22.8%) "never."

Page display time itself is more of a problem, and 76 (79.2%) said they had found this boring at times. When asked to recall a particularly slow page, graphics pages accounted for 85.7% of the answers.

It is generally agreed that such delays do have serious consequences. Speed is important to the user and the overall system. Users are often unaware of what is causing the delay. They may wonder whether they have made mistakes or damaged the equipment. These types of uncertainty and fear make any delays all the more irritating. Location of such causes and their effects are explored in more detail in "Intelligence in Users and Terminals" later in this report.

These reactions as well as the response and search times themselves will change as users become more experienced.

User response time and search time factors are very powerful.

Therefore, it is very important that the optimum standards (outlined earlier in this report) be followed to ensure maximum performance. Some other relationships between page display features and response/search times, include:

use of paragraphs leads to a 14 to 16% increase in reading speed

headlines, colours and "bullets" help skimming and scanning, but not exhaustive reading

optimum spacing affects reading speed, but not accuracy

smaller type size increases reading speed, while larger type size reduces search time

A limit of 10 choices per index page will not significantly increase search times. For example, researchers have reported that even for a database as large as 15,000 pages (on full-channel broadcast Telidon), fewer than two minutes on the average should be required for a user to search through the database index and find the desired information. (Lee, February, 1980)

6. Feeling of Information Overload

Amount of information per page is clearly important. While a feeling of information overload is apparently not widespread among present users any such reactions would clearly have bad effects on Telidon success. An examination of best and least liked features is quite illuminating. By far, the largest (anticipated) attraction of Telidon in the field trials is access to information.

But it was also previously noted that most users found Telidon less worthwhile than reading a newspaper, in terms of effort and time.

Determining the appropriate kind and amount of information is a matter for empirical testing. At the same time, the research literature has provided some clear directions about appropriate types and amount of material.

> Compact, specific, appropriate information should be selected. Sports scores, news briefs, and personal horoscopes are good examples. Extended news documents and prose have not been viewed as suited to the Telidon medium. In our view, the mix and sequencing of graphics and text would also have a major impact on preventing information overload, as would spacing and layout.
>
> A very important determinant of that vague feeling of information overload is not <u>in</u> the information itself. Rather, it is a feeling of being lost among the information. Helping people form effective cognitive maps is one of the greatest challenges to Telidon and to all computer systems.

The effects of these (and other) features on information overload should be carefully studied.

7. Level of Visual Comfort (e.g., eye strain)

Users were asked to report physical problems such as eyestrain, headache, and fatigue. These problems present as reported below.

Problems	N
eyestrain	26
fatigue	6
headache	3
other	1

(Based on complaints from 27 of 97 respondents.)

In all, 27 people reported at least one physical problem. Our cross-tab shows these individuals also found Telidon frustrating and far from worthwhile (and to a greater degree than users as a whole).

In addition to user variables, there may be limits on comfortable use, depending on the type of application and length of use.

Without doubt, most of the page display variables affect visual comfort. As an example, page displays with 24 lines per page, it has

been reported, require greater effort and lead to fatigue. Long paragraphs (greater than the recommended 3 to 6 lines) and poor colour combinations are also bad. Since physical problems are common and quite irritating to users, more time and effort are needed to explore these relationships.

8. What are the advantages of animation? Of zoom capabilities?

Animation and zoom capabilities clearly play a useful role in creating interest and motivation. However, there are costs involved in producing, transmitting, and viewing these features, just like other graphic features. Therefore, they must be used with caution.

4. IS PAGE DISPLAY TIME A PROBLEM FOR USERS?

1. What is the relation of lags in page display to irritation, distraction, or loss of patience?

Many field trial findings speak to this matter. There is wide agreement that this is a significant problem. Indeed, one trial (IDA) concluded that lags in page display overshadowed problems related to the quality of the display. Similarly, lags were the main criticism of another user group (WETA).

Dissatisfaction was widespread among users. Trials described the effects of lags in display time in similar ways. Frustration, irritation, and boredom were reported frequently. 83% of one user group felt frustrated even after significant improvements were made. In a large field trial, findings were virtually all negative on this point:

22% of users asked that the system be "speeded up,"
13% wanted quicker graphics displays,
9% an improved index,
8% better routing,
72% found the graphics "a little too slow" or "much too slow."

Some latencies were more frustrating than others. Users were irritated by having to view logos on every page. Parenthetically, some graphics of some consecutive pages do not need to be redrawn.

It is a sad comment on the ineffectiveness of the page creation system that many technicians do not realize that portions of a page can be carried over to the next page without the need for boring re-transmission. Unfortunately, most Telidon pages are created on a particular brand of page creation terminal. This PC terminal can not be readily mastered by ordinary humans. As a consequence, many pages are created by technicians who simply do not have a mastery of their tools. Elsewhere we have argued that Norpak who sell this awful page creation terminal should not receive further DOC support.

The telephone survey revealed that graphics were also frustrating in many instances. Complex (and/or detailed) graphics were particularly annoying because of the length of time needed for display. Graphics that were shown repeatedly also frustrated the users. Graphics can interfere with the user's expectations for hard information from the text. In our behavioural observation of Telidon users, children were observed to skip ahead to new pages, instead of waiting for the graphics to be fully displayed.

Users likely desire an instant display. Short of that (presently) impossible ideal, there may be a time range which would be minimally acceptable. WETA concludes their 6 to 7 second lag time (achieved after mid-trial adjustments) was near tolerable. 83% of their user group still felt frustrated, but continued to use the system. OECA suggested a five-second wait time would be reasonable.

Lag in page display time is a major problem. Current procedures have not eliminated the frustration caused by delays. Since the amount of information per page is already limited, any delay is particularly irritating to the user. However, the field trials served to identify specific problems, which can be acted upon.

The telephone survey also contains data which helps to consider the size of this problem, and the types of situations (or pages) it occurs in. Respondents were asked whether or not they felt that the pages took too long to finish being completed. Those who answered "yes" were asked to specify the type of page which they felt took too long to be displayed. Results are presented below.

Too long to finish drawing, ever	N	%
yes	76	79%
no	20	21%
	96	100%

A type of particularly slow page	N
graphics	66
game	8
information	5
index	2
other	9

(Based on 77 of 97 respondents.)

Sixteen users who responded to the telephone survey said "speed of information" was the worst feature about Telidon. Speed of response is likely to be more troublesome for some users and certain types of applications.

Problems with page display time were also noted in the behavioural observations conducted during our site visits. Again, most problems were related to waiting for graphics. Impatience was noted, as people waited for artwork to be completed. In one case, a user pressed the key before artwork was finished, and ended up with the next page superimposed on the first!

One can well imagine users would be much more upset about waiting time if they were paying for the service by the minute. So the type of frustration already found would likely increase in a fee for service operation.

Reactions to lags in page display time may well differ from user to user. An experienced user will probably have greater expectations and stricter requirements for the equipment and may become frustrated much more easily and quickly. New computer users are often suprised about how dumb computers (and computer programmers) are. If naive Telidon users are frustrated, they may simply give up.

2. How can the problems be lessened?

There are many ways to proceed. The following suggestions are based on experience in the field trials, and have been categorized:

a) Graphics

use graphics only when appropriate; avoid superfluous graphics,

do not repeat graphics needlessly,

put text on the screen first, so users can read the text while the graphic is being produced,

utilize graphics built on complex commands such as PDI's. This reduces the overall digital stream, saving time and money,

avoid the alphaphotographic or "bit map" display process.

b) Reduce cycle time (broadcast Telidon)

reduce the page size,

reduce the number of pages per cycle, until the system can allow reasonable display time ("reasonable" to be defined by further study).

The WETA trial reduced the cycle from 20-27 seconds to 13-14, using these methods.

c) Decoder

improvements in the data-capturing potential in the decoder may allow a much larger acceptable cycle time, thus allowing for more pages and programming options

d) Host terminal

improve software,

increase number of ports, relative to number of users.

A dedicated-line access system should be generally faster. However, increasing numbers of users have created significant slowdowns, and

60-second response times have been experienced. Software ought to be developed to decrease response time to at least under 15 seconds. Failing that, broadcast may be viewed as the more responsive medium. Currently, response time for 100 page broadcast cycle is within 18-20 seconds and averages nine seconds (assuming no errors, which would cause delays).

> Page display time is a major consideration, and the best role for graphics requires urgent attention. It clearly offers great potential (including new areas such as teaching computer art), and can serve to arouse and hold user interest. At the same time, a number of problems occur.
>
> Further research is required to study these trade-offs. A variety of applications should be studied, each using a different proportion and sequence of text and graphics. Subjective responses should be carefully reviewed, along with factors like cost, page display time, and so on. Clearer guidelines should emerge from this process.

5. SUMMARY

This section has reviewed major aspects of page display. Optimum standards have been recommended, based on research findings, observations, and user surveys.

Seven consequences of page display were also reviewed. Causes for various outcomes were identified. A great number of interrelationships are obvious, even though each consequence is unique.

Lags in display time was discussed in terms of (a) users' reaction, principally frustration, and (b) possible solutions.

Some highlights of our conclusions are:

1. Current choices of typeface are not unreasonable.

2. Many colour combinations used to date were troublesome; however, there are many practical guidelines which could be followed. (The number of colours used should be limited to about three. Colours which are complementary to one another - blue and yellow, or red and green - should not be used in combination.)

3. The amount and uses of graphics are critical areas for study. While graphics is one of the best user-endorsed features of Telidon, there are risks involved. These include irritating users with the same repetitive graphics display. Future directions toward improved, efficient use of graphics will be complex, and must take a number of variables, such as frequency of displays, user reactions, and interests of the information providers, into account.

4. A consensus has emerged governing spacing, characters per line, amount of information per page, and so forth. Current practices do not appear unreasonable. Present practice is an acceptable

technical/behavioural compromise.

5. The number of choices per index page is a complex issue. For the time being, standards based on limited experimental trials and mathematical simulations appear satisfactory.

6. Most of the known user reactions are generally favourable - e.g., pages are legible and attractive.

7. Users are concerned about response times and efficiency of information retrieval. Lags in display time are a source of irritation. There are many possible ways to reduce this problem, however. (Please see the comments at the end of this section.)

8. Understandability of materials accessed through Telidon is unknown at this time, and is another potentially valuable area of future enquiry.

Much of the knowledge about page display has been borrowed from knowledge about other media, such as printed text. This "borrowing" should be done with caution. Much remains unknown, and only a careful research strategy can solve the problems caused by an inadequate behavioural database. How can the features and consequences be properly measured? What are the relationships among

them? Do these relationships occur with different types of people and in different situations? These are only some of the questions that must be answered.

"Reliability" and "Speed" are two concepts which must be kept distinct. It is almost universal for behavioural designers to have to deal with them in connection with services to the public.

"Reliability" should be thought of as the variation of "Speed." It is more common, in our experience, to find people valuing reliability more than speed (within a certain range of values). This fact sometimes surprises engineers.

In the behavioural design of systems - such as Telidon - reliability and speed are generally mutual trade-offs. In fact, we often advocate that some speed be traded-off in order to gain reliability, predictability, or simply to fulfil orderly expectations.

For the moment, Behavioural Team do not have sufficient grasp of the details of database management to offer specific suggestions to achieve the proper balance. Our purpose here is merely to caution readers to avoid sacrificing predictability in order to gain quickness.

6. Ergonomics and Aesthetics of Hardware

1. ABSTRACT

Much of applied psychology deals with questions of the physical ease of use, in ergonomic terms, of equipment. Telidon field trials include a variety of user equipment, a very broad range of users, and various settings and purposes for using the equipment. The human factors considerations of equipment and its design require analyzing the ease of use of the components, and the sets of components, for different users, for different purposes, in different situations.

This chapter deals first with the physical ease of use of the video display and decoder, the keypad, and the cables and connections. Behavioural Team have noted several areas needing improvements. These include a) size and portability, b) cords and connections, and c) keying devices. Information on typical viewing conditions is also reviewed.

Evidence of potential health or safety hazards from radiation is not convincing. Most of the problems seem to result from lighting, glare, seating, and other environmental factors. However, users'

feelings and perceptions are entirely legitimate even though they may not be based on the latest evidence. Health and safety hazards are addressed in the second part of the chapter.

Finally, the limited information on users' aesthetic preferences regarding the equipment is summarized.

2. Ergonomics of Equipment

1. Video Display and Decoder

The terminals in the different trials range from home television sets with decoders to single units housing modem, decoder and "RGB"-type display. The equipment is fairly bulky. Users do not think of it as portable. This lack of portability limits the usefulness of Telidon. If someone wants to follow step by step procedures provided on Telidon for cooking or fixing something, they must either move the Telidon to the place where they are working, or copy the information. The ability to produce a hard copy of selected pages would overcome much of the portability problem.

In most cases, the components are connected when they are delivered. The degree of explanation of the connections, provided at the time of installation, varies. Users rarely disconnect, reconnect or move

their Telidon equipment. Lifting or moving one of the larger units would pose serious difficulties for a large portion of the population. However, if the visual display itself is to be moved, Behavioural Team recommend its weight should not exceed 14 kg if adolescents and small women are to be able to lift the unit to a shelf height of one meter.

The table below lists maximum weights for different subsets of the population lifting an object to a one meter height. Of course, this will vary somewhat depending on the exact shape and grasp of the object and the shelf height and location.

Group (with population percentile)	Weight in kg
large man (97.5 %)	67
average man (50%) or large woman (97.5%)	43
average woman (50%) or small man (2.5%)	23
small woman (2.5%)	14

(Adapted from "Humanscale," Dreyfuss Associates, 1981.)

The power switches and other controls also vary from trial to trial. On most public terminals, these controls are not accessible. When they are, we have observed that the equipment is too often turned off or switched to television reception. (On the other hand, given the present state of public terminal software, access to the plug is valuable. Momentarily unplugging the unit may be the only expeditious user approach to removing a system hang-up.)

In home installations, however, the switches were sometimes not accessible enough. Power switches located at the back of the unit are not compatible with shelf or cabinet installation. Most users prefer to have the power switch located on the front of the device.

Other user comments indicate that the screen sizes used in the field trials are generally about right. A small proportion would like the screen to be larger or smaller. Larger screens would be preferable for group viewing, particularly in educational applications for groups.

Those involved in the various field trials indicate few problems with the video displays. The decoders malfunction or break down occasionally. Sometimes they can be repaired on site, but more often a replacement is provided while the unit is being repaired elsewhere.

Problems with reception are more common in the teletext mode.

Receivers operating in this mode frequently require tuning by a service engineer with a waveform monitor to ensure optimal reception. Unfortunately no hard data is available from the field trials with respect to opinions regarding display and decoder.

The staff of Behavioural Team feel that decoders and video display units should be smaller and more portable. All user controls should be clearly labelled and located on the front of the display. It should be easy to move the decoder, modem, etc. to another video display and make the appropriate connections. This would enhance flexibility for the users.

2. Keyboard or Keypad?

Equipment for keying responses and requests ranges from small numeric keypads to full alphanumeric keyboards. There are various factors involved in determining an optimum keying device. Different devices may be more appropriate, depending on the location and users. The numeric keypads can be held in the hand, but the keys are rather small for anyone with limited vision or coordination. Individuals with cerebral palsy are especially frustrated by small keypads (Kellerman, 1983).

The small keypads which have letters, numbers and functions are even more demanding on users. One has 45 keys in a 9 X 6 cm area and

another has 63 keys in a 8 X 16 cm area. In some trials, public terminals have been set up using fewer and larger keys (numbers and basic functions such as enter and delete.) This arrangement is easy for most people, including those with limited dexterity.

The alphanumeric keypads and keyboards permit the use of additional features such as key word indexing. This feature increases possible search cues. It is also viewed as very important for educational uses of Telidon. This permits learners to provide answers, rather than just recognize them. A larger keyboard is easier to use than a full keypad but it takes up more space and can not be hand held. However, larger keyboards are already in use on home and business computers to access other databases and as specialized, expanded keyboards for use by the physically disabled.

In various questionnaires and interviews across the different field trials, 66 to 87% of respondents reported that the keypads were "very easy" to use or caused "no problems." A figure of about 90% acceptance would be preferred as a standard. These figures may be overly optimistic due to various biasing factors (e.g., self-selection of satisfied respondents.) The complaints that were recorded are consistent with design recommendations of Hearty (1982) and Behavioural Team (1981).

The keys were generally too small and too close together. Our

recommended size is approximately 1.3 cm wide and 1.1 cm long. The protrusion and displacement should be about 0.3 cm with a resistance of about 170 gm. Separation of the keys should be a minimum of 0.65 cm from edge to edge. Typical Telidon keypads have a separation of only about 0.3 cm.

Needless to add, there are many other qualities to consider besides size. These qualities include physical and sound feedback, positive feel, contour, angling, etc.

Those with labels printed between the rows of keys were more confusing than those with labels printed directly on the keys. For both types the labels were too small. Symbols and letters should be 0.3 to 0.4 cm high, and in black on white keys (Hearty, 1982). Symbols, like words, must be pre-tested for user comprehension (Barkow, 1981).

A great deal of confusion is generated by keys whose function is unknown. This was sometimes the result of inexperience but several keypads have keys that have no function.

Labelling of the keys often contributed to the confusion. The symbols used did not always bear any relation to the functions performed. In some cases they do not even correspond to the visual feedback provided on the screen. For instance, sometimes the caret symbol [^] appears on the screen, while the keypad has arrows to indicate the

same function. On occasion messages on the screen used the word "Go", while the keypad was labelled with the word "Enter" (or vice-versa).

Users also experienced some problems with the mechanical properties of the keypad because of too much or too little force was required to activate the keys, lack of kinesthetic or auditory feedback, or the decoder's inability to transmit rapid sequences of keystrokes. To prevent misinterpretation of accidental keystrokes, Hearty (1982) suggests a key-lockout period of 50 to 70 msec. This would permit a keypress rate of 12 to 20 per second, certainly fast enough for most users.

Today's better computer keyboards also have numerous software enhancements. These include type-ahead, macro inputting, synthesized auditory feedback, n-key, rollover, user definable special function keys, etc. In general, the Telidon user keyboard falls far short of acceptable contemporary software.

The keypads are generally larger than the suggested size for hand-held devices (6.4 cm wide and 1.9 cm thick.) Of course, these dimensions are too small to accommodate an alphanumeric system without making the keys too small or too close together. Some newly designed keypads for microcomputers have solved this problem by assigning several characters, or even character strings, to each key. The different sets are selected by other "function" keys.

In cases where the equipment is used to access more than one database (Gatewaying), problems of keypad compatiblity arise. The same function may have a different label on different keypads, or keys with the same label may have different functions. In addition, different databases use different cues for users' responses.

The keypad problems are worst in public terminals. Users are unfamiliar with the system and usually have no guidance other than written instructions. Sometimes the instructions are poorly written, vandalized or missing. Given the present user interaction protocols, novice users are unlikely to be successful without clear instructions and simple keying devices.

An additional factor in keyboard problems seems to be experience with similar equipment. People with no computer experience are easily intimidated. Those who have used only one similar device, like a calculator or typewriter, expect the keying device to be similar. The people who are most likely to learn quickly have more extensive experience with a variety of key operated devices.

It is our opinion at Behavioural Team that the keying equipment is most crucial. It is the link from user to database, just as the video display is the link from database to user. For public applications, large, simple keypads and pre-tested instructions are essential. For settings where more capability is

required and more instruction is possible, a full keyboard with consistent and clear pre-tested function labels is needed.

Attempts should be made to permit use of common small computers to access Telidon information. Since many homes and offices have some sort of terminal or computer, keyboard compatability would reduce system costs for users.

3. Touchscreens

Although touchscreens have not been used in the field trials described in this report, they offer many advantages in some situations. They are in use in several commercial applications of Telidon (The Bank of Montreal, Videopress, etc.) The cognitive tasks involved in menu choices are simplified and the user feels more "in touch" with the action. Touchscreens could be particularly useful in public sites where learning about the system needs to be fast and easy.

Touchscreens are somewhat more demanding in terms of ergonomics since different size users need to see and touch the screen. They simplify the situation, though, since a keyboard or keypad is not required. Perhaps most important of all, they oblige the system designer to be "user centered" in his/her approach. This is discussed in "Recommendations" below.

4. Keyboard Layout (QWERTY versus ABC versus "?")

As mentioned above, persons who have used ordinary (QWERTY) keyboards expect the arrangement of the Telidon keys to be similar. (Unfortunately no data were available on experienced versus novice users of keyboards.) Various alternative designs have been suggested and some of these are in use on other computer systems. There are Dvorak's invisibly tucked away in the keyboard ROM's of several computers. They sit there, patiently awaiting the Millennium.

Although these other keyboard arrangements - such as Dvorak - may have some advantage when considered on their own, the QWERTY arrangement is so common today that, with some regret, Behavioural Team advocate that it should be the standard arrangement for full keyboards. Of course, this would not preclude the use of other keyboards. The code sent to the decoder or host computer is not limited to one spatial arrangement of the keyboard.

5. Cables and Connectors

The cables were a common source of complaints. Users thought the cords were unattractive, inconvenient, and even dangerous. The cables connecting the modem, decoder and video display to each other and to electrical power cause a jumble of wires around most home installations. The cords provide temptation to wandering toddlers, playful kittens, and teething puppies.

These wires could be wrapped up or tucked away using a variety of proprietary devices. But better design would also help. Retractable cords might provide some benefit. Although these mechanisms have proven unreliable in many situations, this may be due to continuous reeling and unreeling. Most Telidon sets would rarely require rearrangement, so the cord length would not be reset very frequently.

In more "dedicated" arrangements, the videotex equipment should be configured as a single unit including decoder, modem or receiver, and video display. The only connections required would be to power and, for "twisted-pair" videotex, to a phone jack. Teletext applications usually require 300 ohm antenna connections or 75 ohm coaxial cable.

The cord to the keypad poses problems of its own. In one of the

trials the keypad was cordless. Users liked this arrangement, except for one feature. The keypad had to be "aimed" at the receiver in order to work properly virtually all of the time.

For those keypads with a cord, users complained that the cord was too short. They didn't like their children sitting so close to the television. One otherwise excellent integrated unit, for example, had a coiled 50 cm cord that reached a maximum extension of 2.2 meters. However, the coil pulled the keypad back toward the terminal whenever the keypad was set down. On a flat tabletop the friction of the keypad's rubber feet balanced the spring of the coil at a length of less than one meter, as established by our measurement. If the keypad was not resting on its rubber feet the cord pulled it back to 50 cm from the video display. It was sometimes amusing to see users trying to deal with this loaded spring cord effect. They would back up to their preferred distance of about two meters and begin to press keys and look at pages. If they wanted to write something down, or put the keypad down for some other reason, the cord would pull the keypad off of their laps and onto the floor beneath the video display. Who says Telidon isn't fun?

Except for mental telepathy, a cordless keypad is obviously the best applied psychology solution for a handheld unit. Larger keyboards that remain stationary, such as home computer keyboards, usually have connecting cables. Their length should allow users to position the keyboard up to approximately three meters away for viewing the video

displays.

This seems a reasonable distance which takes into account that, on some occasions, a group of individuals might be viewing the display at the same time. This situation would mean the group would likely have to sit somewhat further away from the screen, compared to only one individual viewing it. (Our survey discovered the importance of group Telidon use in homes. This is discussed later in this chapter.)

The cords on the various pieces of equipment are rarely labelled. People recognize power plugs and place them into outlets reliably. The same is becoming true for "modular" phone jacks. Other connections, such as the "RS232" are unfamiliar to most people, but are designed so that they can't be connected incorrectly. It is good human-factors to use "D" plugs. However, the plug sockets on certain pieces of Telidon equipment are incompatible with some commercially available RS232 connectors because of the small profile required for the connector to fit into the video unit. Much more ergonomic attention is needed in the choice of connectors.

Cord and connection issues have not been fully tested in the field trials. Most sets required little or no disconnecting and reconnecting, since users didn't view them as portable. As Telidon becomes a part of more variable and flexible home and office equipment arrangements, these cord and connection problems will

require more attention. If someone wants to use a video display for television, Telidon, as a remote terminal for other computers, as a microcomputer screen, videotape playback unit, pay TV receiver or game display, disconnecting and reconnecting (or switching) become greater tasks. Issues of compatibility between connections, signal protocols, labelling, and ease of connection will require further research.

3. TYPICAL VIEWING CONDITIONS AND SPACE CONSTRAINTS

The typical viewing position varies from one location to another. The public terminals are generally designed for a tall standing adult. Occasionally, there is seating near the terminal. But this should usually not be provided in order to discourage groups of users from monopolizing the equipment. We observed one user in Vancouver who whiled away an hour while others queued up.

At a children's museum, the public terminal was placed at a lower height to accommodate sub-adult stature. At all locations, the height (and of course the angle) was fixed so that it was bound to be too high for some people and too low for others.

The following table shows eye height and suggested work height for standing people of different sizes.

GROUP	EYE HEIGHT	COUNTER HEIGHT
average 7 year old	113 cm	66 cm
average 10 year old	131	79
average 14 year old	153	94
small woman	143	90
small man or average woman	155	96
average man or large woman	167	104
large man	179	113

(Adapted from "Humanscale," Dreyfuss Associates, 1981.)

As can be inferred from the figures presented in the table, the

optimum counter height varies, depending on the user's physical characteristics. There needs to be some identification of who the "typical" user is likely to be before the best counter height can be suggested.

Behavioural Team favour adjustable equipment. But adjustment can be as simple as providing a little step for short people to stand on.

A seating position accommodates a larger range of user sizes. Appropriate seat heights for the groups listed above range from 29 cm for the average seven year old to 48 cm for a large man (ibid.)

Most home use seems to involve a sitting position. Since the keying devices are movable and separate from the video display, the possible range of seating positions is quite variable. Thus, individuals are free to change their position to avoid any discomfort. For this very reason, separate and movable keypads have been recommended for any work situation involving VDTs and key entry devices.

The length and spring of connecting cables poses some limitations on optimal seating (see Cables and Connections, above.) Some users may recline while using Telidon. This may cause some difficulty in terms of angle and orientation of view.

In general, Telidon does not constrain the user's position as much as does text or data entry on a VDT system. The user is relatively free

to move around or to try different positions to achieve comfort. The ability to vary the angle of the screen would enhance user comfort.

The amount of reliable information on other details of the viewing environment in homes is quite limited. There are no reports of Telidon use outdoors.

The levels of illumination, glare, noise, and heat are assumed to be similar to those encountered in television watching. If a user is writing down information from the pages displayed, the level of background illumination needs to be somewhat higher. This does not pose a problem in terms of contrast glare since the Telidon screen is usually fairly bright, even for TV receiver screens.

An important but unexpected finding arose in the course of our national telephone survey. The users surveyed report that Telidon viewing was often a social situation. Entertainment <u>on</u> Telidon or searching for entertainment was frequently a family activity. The family also invited friends and neighbours to come and watch. The screens are as appropriate for group viewing of Telidon as they are for television. However, the size of print may limit the range of distance and angle from which Telidon information can be easily read.

The decisions concerning paths and pages is generally left to the person holding the keying device. This is similar to the implicit social ettiquette Behavioural Team discovered in our studies of

carpooling. The social protocol for such decisions has not been investigated.

But particularly germane to this discussion is cord length. Put geometrically, the keypad cord often turns out to be shorter than the radius of the circle formed by the social group. This disrupts the natural social setting and puts strain on the group (and on the cord).

4. POTENTIAL HEALTH AND SAFETY HAZARDS

In the past few years there has been much research on the health and safety issues arising from increased use of video display terminals (VDT's.) This work was reviewed by Treurniet (1982), who provides a summary of the results and an extensively annotated bibliography. Several recent publications from the Centre for Occupational Health and Safety have brought this literature up to date.

Information from Telidon users indicates low amounts of average daily viewing. Few people used a Telidon terminal for more than 2 hours at a time. Other CRT research involves work situations with many hours of concentrated effort every day. Although Telidon users are not likely to experience such extreme effects, they do report a rather high rate of physical complaints. Offices tend to use monochrome

CRT's while Telidon uses high voltage colour tubes.

The research on VDT exposure provides guidance for optimum viewing conditions, and steps that can help avoid user discomfort. Many issues of natural and artificial daylight and VDT's are discussed in "An Investigation of the Effects of Windows and Lighting in Offices," (Behavioural Team, 1982). These are discussed in the light of office productivity and worker morale.

Most of the complaints from those who work with VDT's are related to visual fatigue or muscle fatigue. These, in turn, come from specific features of the workplace or the display, not from radiation. Modern VDT's emit levels of non-visible radiation that are well below official standards. Some difficulties may be caused by the static electric field between the screen and the operator's face, but this factor has not been subject to extensive investigation. The Centre for Occupational Health and Safety has recently re-examined the radiation problem. They are not concerned about high but <u>low frequency</u> radiation from yokes and flyback transformers. They advise caution in length of exposure.

The staff of Behavioural Team have no direct research experience in the physiology of radiation. Therefore, we neither support nor doubt current standards. Likewise, we are neutral about the ability of physical measurement devices to detect (and to re-detect on an on-going basis) excessive radiation doses.

However, it should be pointed out that the problem is user reaction, not physical impingement. This is a problem and should not be discounted. Fear of radiation effects can be addressed by a variety of hardware and software approaches and should not be further neglected.

The main environmental causes of complaint and discomfort are glare and reflections on the screen, poor display quality, and improperly designed workstations. Visual deficiencies of the operators account for many other reported problems. Minor, undiagnosed problems in the visual or ocular-motor systems may lead to eyestrain with extended VDT use.

From our sample of Telidon users in the field trials, 28% reported physical problems. The majority of those (96%) experienced eyestrain. Physical fatigue was reported by about 6% of the total sample of 99 and headache by about 3%. Some users had more than one physical complaint.

Our cross-tabs were interesting. The physical complaints of fatigue and eyestrain were clearly more prevalent from those who had longer sessions. The number of sessions per week did not relate to the probability of a physical symptom. Two-thirds of the reports of eyestrain came from those who usually used Telidon for more than 20 minutes at a time. Further research is required to analyze the

effects of viewing time and environment on users' experience of eyestrain and fatigue. However, the new information reported here offers some immediate design directives.

Eyestrain can result from a number of factors. The actual symptoms include discomfort, tiring, or irritation of the eyes, problems with visual clarity, and headaches. All of these problems can be avoided by proper design of the display, its illumination, the viewing environment, and the mental orientation of the user.

Someone should simply write a little guidebook, "How to Enjoy Viewing Teldion." It should contain the distilled wisdom of the applied psychology of perception.

Reflections cause glare and induce the eyes to focus on the plane of the reflected objects rather than the screen. Anti-glare coatings and screens are helpful if they don't reduce illumination too much. The screen should be positioned perpendicular to strong light sources such as windows or flourescent lights. The keyboard or keypad and other visible surfaces of the equipment should also use a matt finish to reduce reflections.

Touchscreens represent certain riddles of glare reduction, sanitation, durability, and maintenance. The best area, in this light, for touchscreen development may be in opto-sensor technology.

Glare is more of a problem in text and data entry situations where bright characters are presented on a dark screen. Since Telidon pages generally have a bright background, the user's light adaptation system is not stressed under normal lighting conditions. However, the industrial designers who developed the handsome terminals seem quite ignorant of the psychology of vision.

Individuals having even minor visual disabilities may experience problems with extended viewing of a VDT. Irregularities in accommodation (focus), convergence (binocular vision), or eye movements are likely to lead to discomfort. In our industrial consulting practice, we urge our clients to send their staff to the opthalmologist before sending them to the VDT!

Fatigue is usually related to maintaining improper posture for long periods of time. Telidon users are less constrained in this regard than other VDT users. The fact that some users still complain indicates that some study of users' typical posture is needed.

It is accepted by ergonomists today that screens should be adjustable in several directions (pitch, yaw, etc.). Screens which lack adjustment ability often lead to physical and morale problems. Our experience with adjustable equipment has not been too positive. Few users are prepared to make the needed effort to understand and to perform the adjustments. That is why compressed gas assisted chairs are worth the cost penalty; they "support" easy user interaction.

The design considerations described above require further elaboration as an ongoing process. Care and continued consultation are required to deal effectively with implications of ergonomics on a complex and evolving system such as Telidon. The interactions between ergonomics and other features, such as display characteristics, also require careful interpretation in specific cases. Many valuable details concerning the design and use of information processing systems and video display terminals can also be found in recent documents prepared by the Lockheed Missiles and Space Company (Brown, Burkleo, Mangelsdorf, Olsen and Williams, 1981; Olsen, 1981.)

5. USERS' AESTHETIC PREFERENCES

In Behavioural Team's national telephone survey of users, about 22% of those asked had specific complaints about the physical design of the equipment. The majority of these complaints dealt with the size of the units or the number of pieces. These issues have been addressed above in discussions of portability and the number of cables required to connect the pieces.

Complaints actually dealing with aesthetics, per se, were less common. Curiously, there seemed to be more complaints about aesthetics from men than from women. All of the complaints about

colour or shape of the equipment were made by men. Their complaints about colour were twice as frequent as those about shape. However, only about 6% of the total sample complained about colour or shape.

Most people were neutral in the extreme when asked about equipment "attractiveness." Only a few found it actually attractive. There is an obvious need for further research on aesthetic preferences of users. The system could be made more attractive. The options required to make it look good in different settings (home, school, office, public space) could be defined by more in depth study. Testing sample users with mock-ups of different styles would be very informative. For a discussion of mock-up testing see the Spring, 1983, issue of The Behavioural Goods, published by Behavioural Team. People have a hard time reacting to questions of aesthetics without something real to judge.

6.SUMMARY

In reviewing the available literature, visiting field sites and talking to users, Behavioural Team found much need for improvement in the ergonomics of Telidon equipment. The aesthetic requirements for the next generation of Telidon hardware are less clear. Both areas definitely require some concentrated effort. The equipment must be attractive and easy to use if it is to achieve wide popularity. Some of these issues may become relevant to many equipment manufacturers as more and more systems are made compatible with Telidon technology.

7. Telidon In Public

1. ABSTRACT

Without a discussion of information acquired from public terminal usage this report would be incomplete. That's because public Telidon appears to have different requirements from those of residential Telidon. Our focus in this chapter is to provide a discussion of terminal usage issues based on behavioural observations. The findings are presented in a straightforward manner and deal with specific public terminal issues.

Section 2. discusses the use of observational methods.
Section 3. deals with the setting observed.
Section 4. looks at user characteristics, in particular, age and sex.
Section 5. provides information on length of viewing sessions across the field trials.
Section 6. considers length of display time in particular types of pages that took a long time to display.
Section 7. looks at the selection of topic groups.
Section 8. analyzes user difficulties in relation to the machine as a unit, the instructions provided, and the absence of an attendant.
Section 9. treats problems encountered with the equipment design and function.
Section 10. outlines six elements that affect system usage.
Section 11. concludes with a summary of these findings.

2. OBSERVATIONAL METHODS

Because of the paucity of trustworthy data from the field trials, Behavioural Team requested permission from the DOC to conduct behavioural observations of Telidon use. This chapter presents the main findings. However the knowledge we gained during the observation experience is distributed in all the chapters.

In using observational methods the specific cooperation of the person being observed is not needed. The study is conducted in public and does not infringe on the privacy of the individual. Because the person is not aware of the data being recorded, there is no participant bias since no one influences their own actions to be more "acceptable" to the Observer. An Observer, standing or sitting, say, three meters away from the individual engrossed in using the terminal, is not obtrusive in any way.

Observational methods at public terminals were used to gain a greater understanding of naive user needs. Various public terminal locations were visited by Behavioural Team Observers. B.C. Tel, Elie, WETA, Cantel and Vista field trials were observed for varied lengths of time.

Insert Table 7.1 Here

A total of 12 different terminals were observed. Ten were public terminals, one was a business/office terminal and the other was a home terminal. A total of 31 hours of observations were manually recorded. Both general findings and those specific to locations are provided.

All Observers were full-time permanent staff of Behavioural Team. All were experienced in behavioural observation methods.

The complete details of the behavioural observations appear in Appendix C. Some of the information is also presented in the text of the report.

Note that the information in all of the tables appearing in this section is only descriptive of what was observed. The reader is cautioned against drawing inferential conclusions based solely on this data, since it will not stand the rigours of statistical testing.

TABLE 7.1 Number of Terminals Observed and Length of Observation Time for Five Field Trials

Field Trial	Terminals Observed	Observation Time
BC Tel (British Columbia)	3 Public Terminals	6 hours
Elie (Winnipeg)	1 Public Terminal	2 hours
WETA (Washington D.C.)	3 Public Terminals	5 hours
Cantel (Toronto)	1 Public Terminal	6 hours
Vista (Toronto)	2 Public Terminals	1.5 hours
	1 Business/Office Terminal	6 hours
	1 Home Terminal	4.5 hours
TOTAL 5 Field Trials	12 Terminals	31 Hours

3. THE SETTING

The public terminals were located in shopping malls, libraries, museums, galleries, and information centers. The specific location of the terminals varied from site to site.

Information provided in a field trial report by WETA indicates that location sites influenced usage of the units. When the terminal complemented or supported the activity that occurred in the location where it was placed, it was used more heavily. This finding is supported by our behavioural observations as well.

For instance, the Cantel terminals located in Canada Service Bureaus are part of a service provided by the government. In the shopping malls they were in areas where passersby could easily access them to check the weather or look at entertainment information. By contrast, the Vista terminal did not seem to "fit in" with the activities in the bank (although it contains some banking pages).

Users often made comments about Telidon to staff employed in the vicinities of the public terminals. Based on information provided by these individuals, users perceived that terminals placed in the lobbies of the libraries were helpful aids to the overall available

information in the libraries. However, their opinion of the worth of the system decreased when the terminal was located in the reference section of the library. In the latter case, user expectation of available information and functioning of the system was likely far greater than in the former situation. As a plausible consequence, the discrepancy between "real" and "expected" was larger.

For the most part, the public terminals consisted of stand-alone units for which the user remained standing to use the system. Depending on the height of the individual, the terminal may cause some difficulty to the user. The unit provided in one shopping centre was noted to be above eye height for many. (30% [12] of those observed were less than 14 years old; another 30% were aged 14 to 17).

These stand-alone units were not reconceptualized from the home units. For this reason, the public user can not be faulted for the home user type of difficulties that were experienced. In future, it would be advisable to build the units to accommodate the needs of the public user.

The system provided in one location in Toronto was placed on a desk top, encouraging the users to sit down on a nearby sofa to use the terminal. There is a disadvantage with this setup. Since the terminal is not presented at standing eye level, it does not encourage passersby to browse through the available information.

The settings, hours of observation, weather conditions, etc. influenced the observations. All that can be attested to is that the behavioural observations are unbiased records of actual real-world conditions of use. In most of the settings, the distribution of ages of people observed did not appear materially different from the distribution normal for such places.

4. USER CHARACTERISTICS

The users generally came in pairs, or groups ranging from two to four people. Only when the individual was there to obtain specific personal information (e.g., job search) were they ordinarily alone.

1. Age of the Individual

In several of our sites we collected information on individuals other than direct users. Table 7.2 presents three situations: the users, those who paid attention to the users, and those who glanced at the terminal and walked away. Also shown are the general age groups of these individuals. We can report distinct differences in the different age groups.

Insert Table 7.2 Here

Over half of the users (54% of 109) fall into the less than 18 years of age group. This figure is broken down further with 37% of the users being between 13 and 17 and 17% being between the age of 9 to 12. This suggests a need for attention to age-specific requirements and behaviours.

Of the remaining users, 37% are individuals between the ages of 25 to 44. The figures for the other two age groups of users (18 to 24 and 45 to 64 years) are quite small (7% and 2%, respectively).

Across the various field trials the Observers noted that there was a tendency for older adults near the Telidon terminal to simply pass by and they did not "try their hand." They were often observed not even glancing at the system. The predominant age group who glanced at the system and walked away during our observations were those individuals between 25 and 44 years (64% or 14). In particular, no individual in the group 65+ years was observed using, paying attention to a user, or even glancing at the system and walking away.

These findings suggest that there is less interest in Telidon for older individuals. (This is not meant to be taken in a longitudinal time sense. There is no indication that as a given individual grows

TABLE 7.2 Distribution of Observed Individuals by Interest and Age

AGE	Users	Paid Attention To Users	Glanced at Terminal and Walked Away	
Pre-teens (9-12)	17% (19)	3% (2)	0% (0)	
Teens (13-17)	37% (40)	32% (19)	23% (5)	
Σ<18	54% (59)	35% (21)	23% (5)	
18-24	7% (8)	3% (2)	9% (2)	
25-44	37% (40)	60% (36)	64% (14)	
45-64	2% (2)	2% (1)	4% (1)	
65+	0% (0)	0% (0)	0% (0)	
	100% (109)	100% (60)	100% (22)	TOTAL (N=191)

older, his/her interest in Telidon will fade.) While our observations did not reveal the reasons for this finding, we believe it may be that older individuals tend to be less oriented to the new technology and thus more hesitant about approaching it and thinking about its usefulness.

In one case an older individual sat on a couch as far away from the terminal as possible. He then picked up the instruction leaflet that was resting beside him. He read through the information and then put it down. After looking around at his surroundings for a while he picked up the leaflet again. He then leaned over and picked up the code manual that was on the shelf. He then put both down but never picked up the keypad to operate the system. Instead he sat there and then picked up the newspaper and started reading it.

The process described in the preceding paragraph although not complete, gives us some insight into familiarizing people. That is the key to making this new technology appeal to users. Alas, it also indicates that, in the end, this person was below the threshold for action after reviewing the texts.

The location of the terminal partly defined the age of those observed. For instance, the terminal located in the Children's Museum in Washington D.C. had lots of younger children viewing or using the terminal. This is not surprising! The attendant at this location, by the way, noted that children between the ages of 6 and 7

were the youngest group who succeeded with the system.

A system placed in the Canada Service Bureau in Toronto drew individuals who were specifically interested in the highly seductive National Job Search Bank. These individuals were between 20 and 30 years. Of those observed at this location, 43% (9) used the system, 19% (4) stood by observing someone else use it, and 38% (8) glanced at the terminal, but did nothing else.

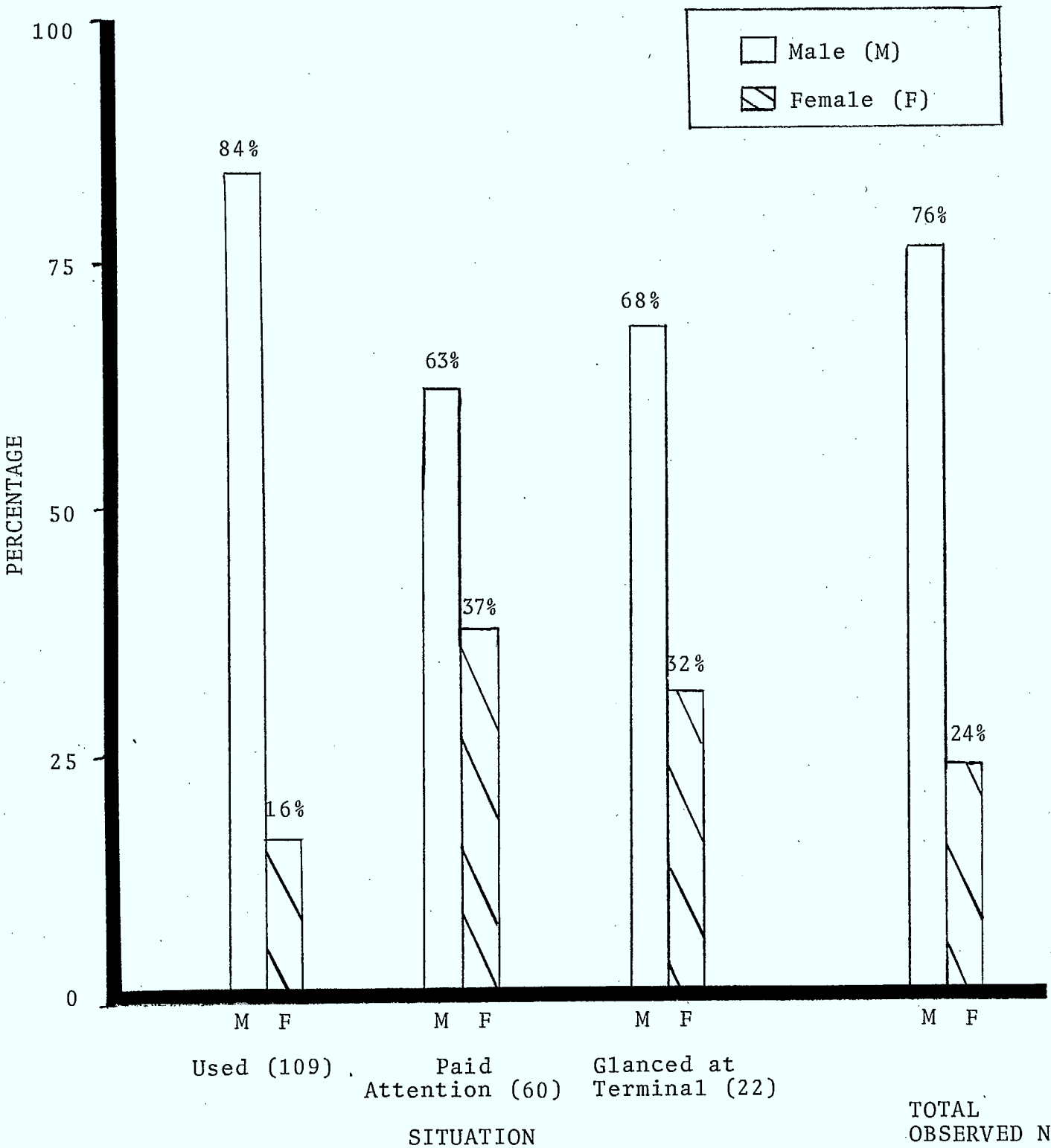
2. Sex of the Individual

Of the total group observed, whether using the system, watching someone use it, or glancing at the terminal and walking away, 76% were male, and 24% were female. Although seemingly an equal number of men and women walked by the terminals, 84% of the people who stopped to use the system were male.

Insert Figure 7.1 Here

Females represent only 16% of the users (N = 109). This is a substantial difference between the sexes. These findings were consistent across the public field trial.

FIGURE 7.1 Percentage of Observed People By Sex In Three Situations (Used, Paid Attention to Users, and Glanced at Terminal and Walked Away) and Total Observed



We noted more males than females (63% and 37% respectively) when we observed those who "paid attention to a user" (N = 60).

A difference between the sexes also is apparent for the data from the "glanced at the terminal and walked away" group (N = 22). Males comprised 68% of this group whereas women comprised less than half of this percentage (32%).

By combining the figures for the "user" group and the "paid attention" group, we arrive at the percentages of males and females interested in the new technology. Only 23% of those interested in the new technology (N = 169) were females. This figure was much higher for the males (77% - see Table 7.7 for the actual figures).

Note that in our presentation of the material, we have interpreted an individual who observes others using the system as someone who is expressing (however indirectly) a degree of interest in Telidon.

3. Age by Sex and by Situation

Tables 7.3, 7.4, and 7.5 present the findings from the three groups observed: user, paid attention to a user, glanced at the terminal and walked away. Each table provides a category breakdown by age and by sex for the observed individual. Looking at the three tables together is the equivalent of viewing the results of a three-way

table: Age x Sex x Level of Interest.

First of all, it is important to keep in mind that the overall ratio of males to females in the sample was approximately 3 to 1. This ratio changed considerably for each of the levels of interest presented in Tables 7.3 to 7.5. Males to females were in the ratio of about 5 to 1 in the "user group", 1.7 to 1 in the "paid attention" group, and 2.1 to 1 in the "glanced and walked away" group.

Of the total number of users observed (N=109), 84% were male and 16% were female. The largest group of all users is represented by males less than 18 years of age (50% or N=92). Males in the 25 to 44 group represent the second largest group with 27% (N=29) of the users.

Women are grossly underrepresented in the users category. Given the overall ratio of men to women in the sample, one would expect approximately one-third of the users to be women. Only 16% of the users are women. Those in the 25 to 44 age group represent the largest female users group. It is sad to note that women in the less than 18 years of age group only represent 5% of the users. We can only suggest that when groups of teens approach the terminals there seems to be some sex-role stereotyping.

Insert Table 7.3 Here

Of the total group who watched others use the system (N = 60), there were more males (63%) than females (37%). This is to be expected, given the higher proportion of males to females in the overall sample. The ratio within this group, however, is less than 2 to 1, while the sample ratio is about 3 men to 1 woman. This indicates that there are proportionately more women in the "paid attention to users" group.

In considering a specific age group by sex we find that males and females are equally represented (37%) for the age group 25-44. They are both equally interested in watching someone else use the system.

By contrast, there is a large difference between males less than 18 (22%) and females less than 18 (9%). The girls are less interested in watching how it is being done than the boys are. In addition, we note that the older group (25 to 44) is much more interested in watching than the younger group is.

Insert Table 7.4 Here

TABLE 7.3 Users of Public Terminals by Age and Sex

	USERS (109)	
AGE	Male	Female
Pre-teens	17% (18)	1% (1)
Teens	33% (36)	4% (4)
Σ <18	50% (54)	5% (5)
18-24	6% (7)	1% (1)
25-44	27% (29)	10% (11)
45-64	2% (2)	0% (0)
65+	0% (0)	0% (0)
	84% (92)	16% (17) TOTAL

TABLE 7.4 Individuals who Paid Attention to Users of Public Terminals by Age and Sex

	PAID ATTENTION TO USERS (60)		
	Male	Female	
AGE			
Pre-teens	2% (1)	2% (1)	
Teens	23% (14)	8% (5)	
$\Sigma <18$	25% (15)	10% (6)	
18-24	2% (1)	2% (1)	
25-44	37% (22)	37% (14)	
45-64	0% (0)	2% (1)	
65+	0% (0)	0% (0)	
	63% (38)	37% (22)	TOTAL

Females less than 18 years of age comprised 23% of all of the individuals observed who glanced at the system and walked away (N = 22). For this same age group not one male was observed. The younger men (less than 18) are less apt to glance at Telidon and walk away from it without "trying their hand!"

Insert Table 7.5 Here

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4. Other Age Effects

Table 7.6 shows that 59% of the male users were less than 18 years. Teenage boys from the ages of 13 to 17 comprised 39% of all the male users. They seemed to be enthusiastic about exploring the new technology rather than obtaining specific information.

Thirty-two percent of all the male users were between 25 and 44 years old. The other three age groups for male users are: 18 to 24 (8%), 45 to 64 (2%), and 65+ (0%).

For the female users, the descending order of usage based on age groups is somewhat different. The highest group of female users were those between 25 and 44 (65%). In descending order the other groups are: less than 18 (29%), 18 to 24 (6%), 45 to 64 (0%), and 65+ (0%).

TABLE 7.5 Individuals who Glanced at the Terminals and Walked Away by Age and Sex

	GLANCED AT TERMINAL AND WALKED AWAY (22)		
	Male	Female	
AGE			
Pre-teens	0% (0)	0% (0)	
Teens	0% (0)	23% (5)	
Σ<18	0% (0)	23% (5)	
18-24	5% (1)	5% (1)	
25-44	59% (13)	5% (1)	
45-64	5% (1)	0% (0)	
65+	0% (0)	0% (0)	
	68% (15)	32% (7)	TOTAL

Behavioural Team

It is interesting that for males and females, the two age groups which used public Telidon the most were those under 18, and the 25 to 44 year age group, although most male users were under 18, while most female users were aged 25 to 44.

Insert Table 7.6 Here

To highlight some of the sex differences, Table 7.7 presents the percentages of all females, and the percentages of all males, who were in the various groups.

Insert Table 7.7 Here

There are approximately twice as many male users (63%) as there are female users (37%). On the other hand, almost twice as many females paid attention to users (48%) than did males (26%).

These two situations represent opposites for the sexes. Of the males, "users" comprise the largest group (63%), whereas for females the largest group is "paid attention to users" (48%).

TABLE 7.6 Percentage of Male Users and Female Users By Age

(N=109)

	Male Users (92)	Female Users (17)	
AGE			
Pre-teens	20% (18)	6% (1)	
Teens	39% (36)	24% (4)	
$\Sigma <18$	59% (54)	29% (5)	
18-24	8% (7)	6% (1)	
25-44	32% (29)	65% (11)	
45-64	2% (2)	0% (0)	
65+	0% (0)	0% (0)	
	100% (92)	100% (17)	TOTAL

TABLE 7.7 Percentage of Males vs Females who Used, Paid Attention to a User, Glanced at the Terminal and Walked Away (Males = 145) (Females = 46)

USERS		PAID ATTENTION TO USERS		GLANCED AT TERMINAL AND WALKED AWAY	
Males	Females	Males	Females	Males	Females
63% (92)	37% (17)	26% (38)	48% (22)	10% (15)	15% (7)

For various reasons women where not as active in using the public service which Telidon provided. At this point we can only offer some suggestions as to why this may have been the case.

A terminal located in a shopping mall competes with the task of "getting the shopping done."

Its location in the public eye offers no protection from the possible embarrassment that might be experienced as a first-time user.

It is very possible that women may feel more intimidated by new technology.

There is possibly less loitering in the malls by teenage girls than by teenage boys.

Teenage girls are less likely to participate when they are in a mixed group once again because of the possible embarrassment.

The new technology is truly in need of an approach directed at <u>women users</u>. Telidon in homes requires lots of female participation for commercial success. For example, electronic funds transfer will rely on having user demand from many childcaring, homebound women. They should be drawn to <u>want</u> to use the system. We offer no clever solutions at this point in time. However, we do caution against simple-minded designer approaches such as painting the terminals pink!

Curiously, the situation at home appears to be rather different. There is some evidence in our telephone study that women are keen games players <u>at home</u> on Telidon. Our interviewer warns this should not be taken at face value, but that their game playing may likely be

a means of entertaining and interacting with their children.

5. LENGTH OF VIEWING SESSIONS

The length of the viewing sessions at public terminals varied greatly with each user and terminal location. The many factors which potentially come into play, become apparant with an analysis of the environmental and psychological aspects of using Telidon.

The length of time one spends at a Telidon terminal is likely influenced by such factors as intent of use, time available, range and type of information available and sought, the presence of others (the total social setting - caring for young children, with peers, etc.), and the physical setting (library, shopping mall, government office, etc.). Operational factors also play a part: level of the user's technological experience, clarity of instructions, whether or not the system is ready for use, or requires logging on, and so on.

Precise figures for viewing time are not available, nor, in our opinion, is their presentation appropriate within this kind of research context. There is the risk of an overly precise interpretation of times which are only descriptive estimates, and subject to the influence of many potentially biasing factors. Suffice it to say that there was extreme variation in the viewing session length, and, although not a rigourous measurement in itself,

observers noted that there was an increase of about four to seven minutes in the length of the viewing session when the user had to log on to the system.

Logging off is a request of users on certain systems. Oddly, there were certain situations where the user was presented with the instructions on how to log-off the system before s/he was told how to start. (This was the case at public terminal locations in the B.C. Telephone field trial. Presumably, these instructions were an attempt at encouraging users to log off when they had finished.) Presenting the user with this information before s/he starts using the system might convince them that it isn't worth the trouble to get involved because they'll have to go through "all of this" to get off the system.

As well, the user has not had a chance to store all of this new information before s/he is faced with more new information. It is likely that the user will not remember "what to do" once s/he has finished. If logging off is truly essential, then the instructions on what to do should be presented when the user has indicated s/he is ready to log off.

This leads to the question of "Why log off?" It seems so much simpler just to walk away. The user must be provided with a good reason why s/he should spend some extra time and do this procedure. What are the benefits to them? An answer to these questions must be

provided.

Logging off is an issue since only one person logged off the system during the entire length of the observation period, at two public terminals. After briefly looking at the various categories ("What's New", weather, jobs, taxes, and the inflation rate) the user easily carried out the "bye" process. The familiarity with which she carried out the process suggested that she had had a lot of practice with the system.

Viewing time seemed to be a function of usage intent. (Assumptions about intent were made based on the setting and the information which was seen to be accessed during use. Intent could not be directly surmised from observations). Rough estimates of the viewing time tended to be higher for those individuals who were interested in accessing personally important information (for example, the National Job Search Bank). As well, for this example, there were instances when it was necessary for the bureau attendant to limit the usage time per individual once a lineup had formed. For example, in the Calgary office of the Canada Service Bureau a time limit of ten minutes per user was imposed. No such lineups were observed at other locations, shopping malls for instance, where users likely view Telidon with a different intent.

It is interesting to note that it was necessary to obtain a second unit for the Calgary office of the Canada Service Bureau in Alberta.

The need to access the National Job Bank was so great that time limitations and long lineups were becoming a serious problem. For the months of December (a slow month) and January the service officers of this Cantel location reported client usage to be 978 and 1,180 respectively. The acquisition of a second terminal was therefore a worthwhile investment.

Viewing time also seemed to be a function of comprehensive and timely information. Users who found outdated material (as observed on the screen after the viewing session) often left the terminal making comments typified by the following:

> "I can't believe it! With all of this fantastic technology you'd think there would be some way they can make sure we get up-to-date stuff."

The issue of timely, up-to-date information is truly important to encourage and sustain Telidon use. This is discussed more fully in "Recommendations."

6. LENGTH OF DISPLAY TIME

The weather graphics took a long time to be completed on the screen. Users were heard saying that these "colourful pieces" were often irrelevant to the basic message sought. In order to proceed to the next page (to learn the code) it was necessary for the artwork to be completed. When using a public terminal, one user got a page superimposed onto the previous one when he pressed the key before the graphics page had been fully displayed. Two examples of pieces of artwork which took a long time to finish being displayed were: "Stouffers' Lean Cuisine" and the graphics for the "Weather."

A serious problem identified both by the users and the terminal attendants was "system slowness." The user had completed reading the page and was ready to proceed but could not do so because the system was not yet ready.

7. SELECTION OF TOPIC GROUPS

The popularity of a topic group was influenced to a large degree by the building in which the terminal was located.

The Canada Service Bureau in Toronto had a large group of users who were between the ages of 20 and 30 and who were interested solely in the National Job Bank.

Staff at the D.C. library reported that users were primarily interested in the categories of jobs, arts, weather, sports, and education.

The categories "What's New" and "Weather" were particulary popular with the users who accessed the terminals located in shopping malls, such as the Harbour Centre in Vancouver, and the Bay in Winnipeg.

Tourist-specific information (restaurants) was the only category accessed by an Australian couple visiting B.C.

8. USER DIFFICULTIES

1. The Machine

When an "out of order" sign has been placed in front of the machine users do not face the frustration of having to find out for themselves that this machine is not in service. In certain cases, the Observers (and users) found no sign on an out-of-order machine.

In one particular instance, the system was not working well. The TV sound was available but there appeared to be no way to switch onto the TV. The only thing that did come up on the screen was the colour bar chart which enabled the colours to be calibrated. Some people proceeded to read the instructions at this point, and tried again but soon gave up saying, "It doesn't do anything!" In this case an individual, possibly a first time user (but potentially a regular user) is left with a negative impression about the "worth" of the system.

Frustration also results when the user has travelled a long way to use the system and finds out upon arrival that it doesn't work. The library staff in D.C. reported this observation. This situation might be resolved with some effective advertising. Perhaps the user must be encouraged to "call <u>before</u> he comes."

Finding the machine on arrival can sometimes be a frustrating experience. In one instance, the Observer spent 15 minutes trying to find the terminal, with assistance from the information desk.

2. The Instructions

Observers noted that users found some instructions ambiguous and confusing. Often this was a result of vagueness and a lack of consistency within the instructions. For example, one set of directions read as follows:

Step A "To Begin: Press START"
Step B "To see Next Choice: Press NUMBER"
Step C "Then: Press GO"

Each of the words START, NUMBER, and GO were capitalized and placed in a box. Since there was a key for START, the implication of the instructions is that keys exist for NUMBER and GO. In looking for the NUMBER key the user is perplexed to find that one doesn't exist. How do you proceed from here? The user wants to know what this command means. S/he looks for the NUMBER key for a period of time before realizing something else needs to be done. "What number do

they want me to press?" Not all users are patient people and, with instructions like these, the individual may be more apt to "kick the bloody thing" than to try to figure things out.

Likewise, confusion results when the instruction appearing on the screen reads "press ?" and there is no "?" key. The user may attempt to resolve this problem by choosing an alternative key (possibly one that accidentally turns off the system) or by walking away from the unit.

Using the same symbol to represent two different functions may make it difficult for the user to keep track of what is happening. This was noted when a missing page was identified by a square box and a square box was also used to define the ENTER button.

Observers noted that quotation marks were poorly used. In places where they would have been appropriate they were absent, and in places where they were inappropriate they appeared.

Often the error being made is so difficult to detect that the user has a hard time deciding what s/he is doing wrong. The user of a Vista Terminal was observed entering the number "13" and receiving the message "Page as requested does not exist" on the screen. He had done two full exercises by means of going through each page individually when he realized that it was ".13" that had to be entered in order for him to advance to that point automatically.

In most cases individuals who are unfamiliar with the system would not have persevered in the same way as this particular user did.

Users were seen going up to the machine and "trying their hand at it." It was not until they ran into some kind of trouble that they would read the instructions provided. In one specific instance the user approaced the Vista Terminal and began pressing some numbers in order to access information. The screen prompted the user with "press NEXT." Having done this the user waited for something to happen. When nothing happened the user looked down to read the instructions in front of him on the upright stand. He then noted that you had to press both NEXT and SEND in order to proceed.

In general, full prompts (eg. Press NEXT, then Press SEND) should appear on the screen, especially since most users do not read the instructions fully, if at all, before use.

Observers found that the instructions were not well thought out. Good cognitive structure was not adhered to.

The amount of information presented, the rapid sequence in which it appears, and the unmemorableness of CRT's make it difficult for the user to form "mental maps." Without the aid of a mental map the user must inevitably go back to the menu if they've made an error anywhere along the way. This error correction method is awkward and it can become particularly bothersome to the user. An alternative approach

would be a straightforward coherent structure which would allow the user to form a mental map, and would simplify the error correction process. Perhaps users could request a "trace" of their last five entries if they felt lost, for instance.

Please note, the logical sequence is for the database operator to begin by arranging the database in a psychologically meaningful way. This contrasts with the incorrect (but common) assumption that philosophic or library categories are helpful. This whole area of database organization in terms of human understanding will be followed up in the "Recommendations" section.

3. No Attendant Present

At those locations where attendants were present any queries or problems were directed to them. Under these circumstances very few users were seen reading through the instructions. In one instance the user experienced a page jam. The line appearing on the bottom of the screen read: "Try another number." After she had tried a few numbers with no success her first instinct was to go to the attendant and not to read through the manual.

Confusion resulted for a user who had gotten himself into the upper case by using the shift key, and then couldn't get out of it. Having a person rather than a written manual instruct you on the use of this

new piece of technology was clearly the preferred alternative.

For example, the statistics collected by the Canada Service Bureau officers in Calgary (Cantel Public Terminal) show that about 1/2 to 1/3 of all users require assistance. These ratios translate to 397 of the 978 clients in December and 382 of the 1,180 clients in January requiring assistance. Providing one or more knowledgeable attendants for terminal sites, especially very busy ones, could be an approach to alleviating user frustrations quickly, as well as a more human introduction to the use of Telidon for those who might be somewhat hesitant about it.

9. EQUIPMENT DESIGN AND FUNCTION

1. The Keypad

The keypads used in the various trials differed in size and in number of keys available. The standup units had keypads which were not removable from the top of the unit. The user did not have to hold the keypad in their hand. The difficulty with this setup was that the keypads were very small, making the pressing of the keys rather difficult. It was primarily difficult for people who have large hands or for those who experience arthritis in their hands. This group has trouble touching <u>one</u> key at a time.

Using a keypad with very small entry buttons is also difficult for women who have long nails since they can not help but hit adjacent buttons at the same time.

The hand-held keypad, although somewhat larger in size, had the problem of extra keys which served no function. Curiosity leads us to explore. When users did explore, they often found that the machine wasn't doing anything. And this caused some people to be puzzled and to walk away.

Common sense would suggest that being at ease with calculators, adding machines and typewriters makes it easier for the user to operate the keypad. This may be one more reason why older individuals feel uncomfortable using the system.

Difficulties also arise when the keypad is worn and the characters are no longer readable. It then becomes far easier to make an error. For example, to enter information on the Cantel terminal a dot (which is easily removed) is used. A worn keypad also requires the user to check the screen after each use to ensure that s/he has pressed the right key.

Using an abbreviation that is difficult to decipher can create unnecessary problems. The words delete and command appear on the keypad keys as "DEL" and "CMND." Particularly for first-time users,

a short synonym or a clearer abbreviation is needed.

The keypad style fitted into one of three formats. For certain locations it was embedded onto the top of a standup unit. This setup provided the user with the convenience of not having to hold this equipment in their hand. The difficulties were the small size of the keys on the keypad and the size of the pad itself.

Other observation sites had hand-held (or desk-top) keypads which were attached to the screen via a cord. These cords were sometimes troublesome. Cord length interfered with passersby when the terminal and the bench were separated by some distance.

Providing cordless hand-held keypads for public terminals proved both difficult and costly. The keypad needed to be aimed at a certain spot in order for the "connection" to be made. This required that the user be standing on axis. In addition, individuals working at, or near, the public observation sites where the keypads weren't "bolted down" reported them to have mysteriously disappeared. They became collectors' items, no doubt!

2. The Screen

One Observer identified up to seven colours on the screen at one time. Comments overheard by Observers suggest that many of the colours used were hard on some users' eyes. Others seemed to find the particularly colourful graphics sensational and not disturbing in the least, judging by the comments they made.

Glare on or from the screen was identified. People wearing eyeglasses may be especially bothered by this glare, as it can add to the glare they might already be experiencing from their glasses.

Size of the screen is important when considering the number of individuals who are associated with a user. In the opinion of Behavioural Team, in circumstances where demonstrations are being made at the terminal, the size of the screen should be larger. A smaller screen size is benefical when the user is seated and plans to gain access to information that is of personal interest to them and may take a long time to work on.

10. ELEMENTS AFFECTING SYSTEM USAGE

1. In what building is it located?

The building in which the terminal is located affects usage. For instance, Behavioural Team are of the opinion that it is not a good idea to place a terminal in a retail store. People who go to the store are often on a very tight time schedule and have a specific personal task to accomplish. This leaves very little time for browsing and for using equipment that will not accomplish the specific end that they had in mind. Of course, the situation is quite different if the database is associated with the store goods.

On the other hand, bank employees observed some Telidon uses during those times when lineups were exceedingly long. Also, people who had gone to the bank to accompany a friend were likely to approach the system.

Telidon is hard to access for most people today. It is not yet a "household" word or concept, and it would seem that most people would be hard-pressed to locate a terminal they could access, assuming they wanted to use it. Thus for most of the general public today, public terminals can not really serve as anything but a brief diversion

while a friend waits on line at a bank, for instance. Even this "diversion," however, can present useful information - specifically related to banking - to the individual waiting in the bank for a friend.

2. How difficult to find is the terminal?

In most cases the Observers had little trouble finding the public terminals. They were often located in a "high traffic" area. This was good strategy in terms of attracting users.

When something is new and technologically-oriented, people prefer to be confronted with it head on. At a few of the observation sites the Observer spent some time trying to find the system. It was felt that this terminal wouldn't get too much public use since it was placed at a rather inconspicuous place. (A breakdown of location by site observed is not necessary to be able to make the suggestion that the specific location strategy for public terminals borrow from the field of marketing: if you want exposure for a product or service, and with it the likelihood that it will be used, situate it in a high traffic location, not in some obscure corner. Fortunately, this seemed to be part of the strategy used in locating most of the terminals where observations were made.)

Circumstances do exist when a public terminal located in a quiet,

isolated spot away from the "flow of traffic" might be the best location. In this case the users would be able to access specific, personal information without crowd interference. Perhaps if users are more likely to access somewhat confidential information (banking, for instance), or they are about to embark on an educational endeavour, the quiet offerred by a slightly isolated location would be conducive for Telidon use. In determining the location for specific terminals, the nature of the information people are likely to access should be a factor in the final decision.

3. Is it free?

As children we are brought up with the notion that nothing is free. It is quite possible that passersby may not have stopped to explore the system because they felt that there was a cost involved. If they did stop and were unable to operate it they might assume that it was because the system was not free. A couple in their thirties were observed using the system and being unable to get anywhere with it. Even after checking the instructions they were still unable to access any pages. Finally one commented to the other, "You can't use it unless you have an account."

4. What's on the screen?

The extent to which passersby are encouraged to approach the system and use it depends very much on what information has been left on the screen.

The highest rate of approach was noted when the previous user had left the main menu page on the screen. This intrigued the passerby to find out what was under a category that interested them. It gives them a chance to participate in high technology.

If the menu from a certain sub-category of the main menu is left on the screen and the individual is interested in that topic, for example "What's new!," the passerby may approach the system. The likelihood is lower than when the main menu page is still on the screen.

Leaving a page from the middle of a file on the screen does not encourage people who are new to the system to approach the screen.

From the above results it becomes evident that it is extremely important for the screen to be returned to the main menu page once a user has finished with the system. The page contents are set up so that the main menu can be readily seen by the passerby. Curiously,

Behavioural Team employed a similar bit of behavioural design at the CN Tower ten years ago.

This finding offers an interesting point of discussion. Out of necessity the main menu page has to be short. This poses the problem of the magnetism (attracting potential users) of the category names. The subtly of the words and the sequence of presentation were particulary important in making a choice. Observers found that users, particularly those who were browsing, chose categories based on the "quality" of the menu names! A good example of a very appealing category name is "What's New." This topic group was particularly popular. It would seem that whoever controls category titling has a lot of power over popular access. Thus a seemingly minor issue of cognitive psychology is actually of central importance in the debate over Telidon as a legitimate public utility. Need we say more ....

The question of whether or not there is a natural browsing course needs to be looked at more carefully. Do people pick the last item (or first item) on the menu more than any other item? If so, what implications does this have? How often should the menu titles be rotated?

Often a user will look for a listing under a title that seems the most appropriate to them. For example, we look for information on the weather under the title "weather." But this title may not be the

one chosen by the naive IP. (Hint. Look under "Environment Canada.") Providing the user with multiple alternate categories (cross-referencing) is a system which ought to be adopted. This whole question is being discussed more fully later in this report.

Although the category title should intrigue the user to explore that file, it should not misrepresent the contents of that file. User expectations should be met. When a title provides the correct contents, users develop a positive impression of the system. They feel that they are being provided with information that they have asked for.

5. Is the system being used?

Use seems to be influenced by a number of factors, including the users' needs, awareness, and how knowledgeable they are about the system. Apparently, it is also influenced by what might be available time: Our behavioural observations showed that individuals who were waiting their turn to use a terminal would wait no longer than a few minutes before leaving. Some few returned after a while.

But perhaps a browser who is fearful or inexperienced with the "new" technology might feel more comfortable watching someone else using the machine. By learning through example, this person can then avoid the possible embarrassments and frustrations that a novice who <u>is</u>

being watched experiences. At the same time s/he is enjoying watching a demonstration that is interesting.

6. Will I be able to cope?

Not everyone in the population has good eyesight, good reading skills, and computer knowledge. A person who wears eyeglasses or who has poor eyesight may be especially bothered by glare on or from the screen. The colour graphics may be bothersome to some people whereas for others this does not pose a problem.

Anyone can make a spelling error. In accessing information by keywords it is important that the words are spelled correctly. For example, does accommodation have two "c"'s and two "m"'s or is it one "m"? How do you spell "restaurant?" As well, which form of the word "labour" will the machine accept, "our" or "or?" Individuals whose spelling is poor may find it especially difficult to cope. These are issues which require professional psychological judgment and should not be left to the de facto decision of just any individual responsible for creating keywords.

Good reading skills are primarily determined by level of education and practice. Not all Canadians have been fortunate enough to go to school to acquire these skills. Immigrants in particular, have difficulty with speaking English, let alone with reading or writing

it. The Canadian Mosaic is a reality for Telidon success.

It is common knowledge that just the word "computer" or "technology" frightens certain people. Like these words, "Telidon" is new and we have to learn about it. Because the machine looks complicated the potential user assumes that it is difficult to learn. Perhaps it is not worth their time and effort. Computer knowledge is not second nature. Until people become more comfortable with the products of "computer" and "technology" they will be unable to cope successfully. One potential user was overheard saying, "I'm afraid to touch it!"

11. SUMMARY

Observational methods provided us with information that could not be tapped through other methods of study (phone questionnaire or existing literature). BC Tel, Elie, WETA, Cantel, and Vista field trials received observation time totalling 31 hours.

The public terminals were located in shopping malls, libraries, galleries, and information centres. Overall, the terminals were easy to find although at times difficult to operate.

Approximately 85% of the people who stopped to use the systems were male. Teenage boys between the ages of 13-17 comprised 40% of the

male users.

Both the elderly and women were seen as "Telidon shy." The question becomes "How do we make these two groups fit into the whole scheme of things?"

The ratio of men to women using the Telidon system was established at approximately 9:1. Consequently, determining if there exists a difference in user difficulty between the sexes will require future study.

The location of the terminal (eg. Children's Museum, Canada Service Bureau) influenced to a large degree the age of the users which in turn affected their interests.

Viewing session lengths for any one particular user were affected by three factors:

a) user interest, which averaged between two to three minutes
b) the necessity to log-on the system, which added from four to seven minutes to the total viewing time.
c) the constraints imposed by the attending information officer when a lineup had formed (in one case ten minutes).

The users felt that display time may have been too slow, particularly where graphics were involved.

Users seemed to experience difficulty in three areas:

the machine
the instructions
the absence of an attendant.

To avoid leaving a potential user with a negative impression about the "worth" of the system, an "out of service" or "not functioning properly" sign should be posted as quickly as possible on any non-operable machine.

Observers found that instructions were not well thought out. Vagueness and ambiguity resulted in a confused user. For example, the presentation of full prompts would provide greater clarity. In addition, the instructions did not always match the keys to be pressed.

Having a knowledgeable attendant at the terminal to help you or to quickly point out an error was far superior to having a written instruction manual.

The design for the public terminals of the keypad took one of three forms:

a hand-held keypad
a desk-top keypad
a keypad embedded onto the top of a standup unit.

The function of each of these styles of keypads proved problematic in certain instances. Women who have long nails, individuals who have large hands and those who experience arthritis in their hands had difficulty when the small hand-held keypads had very small entry buttons. Larger keypads solved this problem although they often contained extra keys which served no visible function.

Observers reported certain terminals having worn keypads. The characters on the keypads were no longer readable. In addition, it was noted that providing abbreviations for certain words appearing on the keys often made it difficult for first time users to decipher. Two good examples of this occurrence are:

command = cmnd
delete = del

The colour graphics and the glare on or from the screen were particularly bothersome to some of the individuals observed.

Six elements were found to affect system use.

1. In what building is it located?

   System use will be less when it is placed in a bank than when it is placed in a service centre or in a library.

2. How difficult to find is the terminal?

   Placing a terminal in a "high traffic" area will ensure that it is being used to full capacity. Under certain circumstances it might be best to locate the terminal in a "quiet" area so that users can access personal information with some level of privacy.

3. Is it free?

One possible reason why some users were not drawn to try the systems was the belief that they may have to pay for this service.

4. What's on the screen?

A passerby was more likely to approach the unit if the main menu was displayed on the screen rather than a category menu or a page from a file.

5. Is the system being used?

A user who is intent on exploring the system for himself will not wait in line for longer than two or three minutes. The exception is the National Job Search Bank.

6. Will I be able to cope?

Good eyesight, reading skills, spelling skills and computer knowledge are influencing factors in determining if the user will be able to cope with the new technology.

TELIDON FIELD TRIAL EVALUATION:
TECHNICAL ISSUES