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A STUDY OF ATTITUDES TOWARD NEW COMMUNICATION TECHNOLOGIES

W. Lambert (Scot) Gardiner

INFORMATION SOCIETY PROGRAMME PAPER NO. I-14

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* This paper is the final report for Contract Number OST 80-00064 submitted to Dr. Dorothy Phillips, Director, Behavioural Research and Evaluation, Department of Communications, Ottawa on 31 March, 1981.

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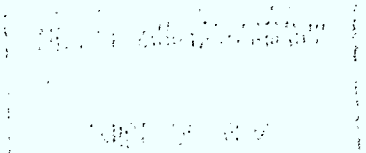

PREFACE

A study of attitudes toward new communication technologies is a report of research conducted by the author for the Department of Communications of the Canadian Federal Government. The purpose of the study is to develop two scales measuring respectively the thinking and feeling dimensions of attitudes to the new information technology, which could be used in field trials of Telidon, integrated office systems, or whatever related technology appears on the horizon.

The paper is part of GAMMA's ongoing Information Society Program (I.S.P.). The principal objectives of the I.S.P. are
(a) to promote a structural and strategic rather than a narrowly sectoral view of the information revolution,
(b) to alert Canada's decision-makers to the urgency of meeting the challenges and opportunities of this seminal event in the history of mankind, and
(c) to create a forum for successful consultation and concertation among Canada's principal economic actors namely the Federal and Provincial Governments, Business, and Labor.

The research strategy underlying the I.S.P. is to advance our knowledge of each of the topics within it through three phases. The first phase involves the drafting of an "issues-paper" defining the problématique of the topic in question. The second phase involves empirical research and the third the preparation of an integrating report usually in the form of a book covering the topic at hand. This paper is of the second phase, following up on the author's first-phase papers Public acceptance of the new information technologies: The role of attitudes, Psychological approaches to the person-machine interface, and Personal data banks: Invasion of privacy or erosion of autonomy? and my own paper Informediation and the quality of life: A conceptual framework for the assessment of the human implications of the information revolution.

The domain of research has been divided into two large foci. The first deals with Industrial and Technological strategy, in effect attempting to answer the question: "How can Canada be competitive and assume a leadership role in the emerging international information economy?". The second deals with the human and social impacts of the new technologies and their influence on life-styles, work and leisure, the condition of women, education, the political process, etc...

The working-papers to which this study belongs are designed as discussion drafts to stimulate discussion, comments and suggestions which should be directed directly to the author. More definitive publications will be in the form of articles and books and will come at later stages of the research after the feedback process has been completed.

K. Valaskakis
Director

EXECUTIVE SUMMARY

Attitudes toward New Telecommunications Technology

The future of Canadian society will be largely determined by the impact of new technologies upon it. To understand this process, it is useful to supplement broad studies of the impact of technology on society with more precise studies of the impact of specific machines (the elements of technology) on specific people (the elements of society). This study focuses on this relationship between people and machines. It focuses more precisely on the role of the attitudes of people to the new information-processing machines, based on innovations in computer and telecommunication technology, which are currently having a wide and deep impact on our society.

The purpose of the study is to develop two scales measuring respectively the thinking and feeling dimensions of attitudes to the new information technology, which can be used in field trials of Telidon, integrated office systems, or whatever related new technology appears on the horizon.

The measurement of attitudes is useful for those introducing the technology to discover the desires and concerns of the potential users and to gauge their reactions. It is useful too for those to whom the technology is being introduced since it helps them clarify their beliefs, desires, and concerns.

Previous Studies

A review of the literature on attitudes to technology suggests that public attitudes to technology tend to be positive. However, they are not simply toward the positive end of a single affective dimension. There is a second dimension of utility. People vary then between those who view it as a desirable necessity and those who view it as a regrettable necessity. The same ambivalence is found in attitudes to the computer - the machine which best embodies the emerging information society. On the one hand, it is appreciated for the useful functions it performs but, on the other hand, it is feared as an autonomous simulator of human functions.

Reactions to new technology may be as much a function of attitudes to the "new" as to the "technology". A preliminary exploration of attitudes to innovation suggests that this is a promising avenue for future exploration in the understanding of public resistance to new technology.

Current Study

A questionnaire was constructed and administered to 100 subjects. The questionnaire consisted of five sections:

Section A Familiarity with new information machines.
B Attitudes to new information machines (ANIM).
C Technophobia rating scale (TRS).
D Number of machines in your life.
E Personal history with machines.

Sections B and C were the basis of the two scales for measuring the cognitive and affective aspects of the attitude to the new information machines and Sections A, D and E were designed to check the construct validity of the scales. The ANIM scale is based on the Fishbein method in which attitude to the attitude object is measured in terms of the subjective desirability and subjective probability of various outcomes of that object. The TRS scale is designed by analogy with the Mathematics Anxiety Rating Scale, which has been very successful in measuring maths anxiety.

Both scales were found to be internally consistent. Split-half reliability scores were above .80 and most items correlated strongly with the total scores. Those which did not were eliminate to yield final tests which are even more consistent. A significant negative correlation between the ANIM and TRS scores verified, as anticipated, that people with technophobia tend to have negative attitudes to machines. However, neither ANIM nor TRS scores correlated significantly with either familiarity with new machines or number of machines in the subject's life. It is hoped that more precise measures of the conative dimension - for example, indices of usage in the field trials - will correlate with scores on those scales.

Even if they don't predict behavior, those scales serve to clarify our understanding of public attitudes to new information machines. The TRS scale demonstrates the pervasiveness of technophobia in our society and the ANIM scale documents the hopes and concerns people have with respect to the new information technologies which are threatening (or promising) to shape our futures.

ACKNOWLEDGEMENTS

Although only one name appears as "author" on the title page of this report, there are a number of covert "co-authors". It is not possible for any one person to have all the resources and skills required for a research project such as described here. One needs more than a little help from one's friends. The people listed on the following page contributed their various resources and skills. They are not, of course, responsible for any distortion of what they taught me as it passed through this medium to this paper.

The subjects helped too. Their contribution is seldom acknowledged but social scientists should erect a monument to The Unknown Subject.

The other name on the title page - Dorothy Phillips of the Department of Communications - should indeed appear as "co-author". She coaxed the author along, without ever nagging, with a constant stream of conventional and electronic "communications" - suggestions and encouragements, comments and criticisms, references and papers.

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1 INTRODUCTION

The research project described in this final report is only one of millions of possible projects. It can be introduced, therefore, by presenting the rationale for each of the series of decisions by which this research project was chosen from these millions of possible projects.

This strategy is peculiarly apt in this context, since it parallels the process by which a user of the Telidon system selects a particular page from the many pages offered by that system. The latter task is, of course, much easier. The set of options is well-defined (all the pages in the data bank to which the user has access) and the series of decisions is clearly stated (a push of a button displays the next "menu").

In both cases, the process in practice is not as neat as the process in theory. The theory is that the person zeroes in on the desired option by a series of decisions each of which narrows down the options from the many initially available to a smaller and smaller subset until there is only one option left. This process is usually represented by a tree diagram (typically with the tree uprooted and lying on its side or hanging upside down).

In practice, as we all know, people do not choose a tree, climb the trunk, and clamber in turn along a chosen branch, a sub-branch, a sub-sub-branch, until they reach the desired twig. Some tend to run to and fro in the forest, climb up and down trunks here and there, scurry from branch to branch, fall off and climb up again, and eventually reach a twig by some hit-and-miss process whereas others simply alight on a twig without any consideration of the logic by which they got there.

With those qualifications, an after-the-fact rationale by which the research project presented here was chosen is outlined in Figure 1. The argument for the succession of decisions to focus in turn on technology assessment, social impact, person/machine interface, and attitude is presented, respectively, in Sections 1.1, 1.2, 1.3, and 1.4.

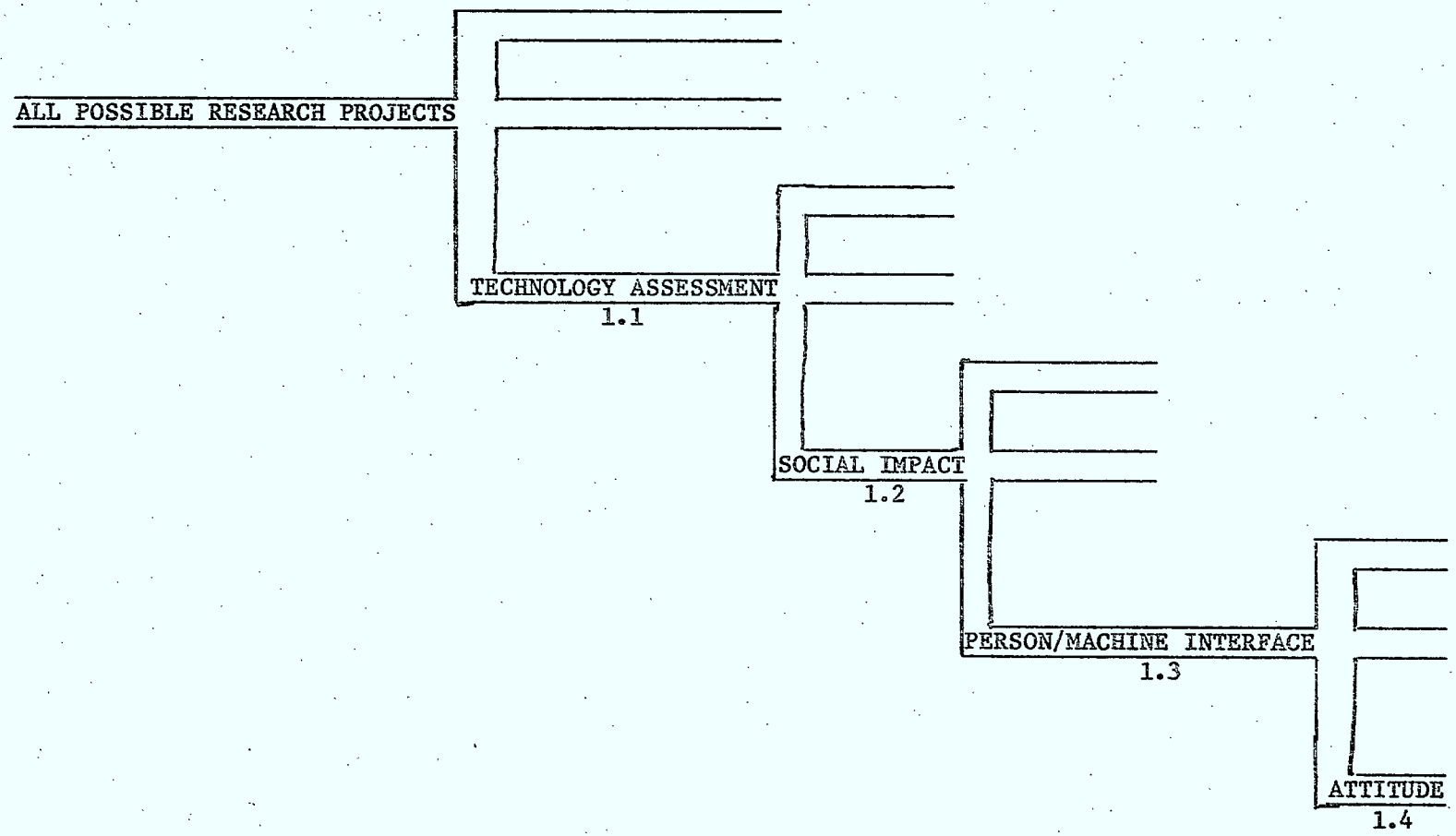


FIGURE 1 DECISION TREE UNDERLYING THIS RESEARCH PROJECT

1.1 Technology assessment

What distinguishes one era from another is not so much the nature of the person but the nature of the environment and, within the environment, not so much the natural environment or the social environment as the technological environment. People have changed little in historical times and will change little in essence in the future. During that time, the sun has continued to rise in the East and sink in the West and will continue to do so in the future (unless we blow ourselves out of orbit with technology). People will continue to live in families, however defined; attend schools, however improved, and do work, under whatever conditions.

The significant difference from era to era is the result of the introduction of technological innovations. The dramatic difference between your world and that of your grandparents is the technology available to you (my grandfather was a boy when the automobile was invented) and the dramatic difference between your world and that of your grandchildren will be the technology available to them. To understand the future, then, we must understand the technology which will define it.

In the 1960 census, there were about 180 million people in the United States of America and almost one billion machines (77). The fact that machines outnumbered people 5 to 1 (and have increased this ratio considerably in the two decades since) suggests how pervasive and powerful is the influence of machines on persons. Yet this important area is strangely neglected.

Whereas many university courses focus on the influence of literature, whose effect is minor at present and decreasing, few courses focus on the influence of technology, whose effect is major and increasing. Indeed, the only internationally-known organization for the study of the impact of technology in Canada - Marshall McLuhan's Centre for Culture and Technology at the University of Toronto - has been phased out.

One possible reason for the neglect of this important area is the very pervasiveness of the influence of technology. The ubiquitous is paradoxically elusive. A close look is not necessarily a clear look. The fish will be last to discover water. However, since technology is the "water" in which we are bathing and since it is seeping into our every pore, it is imperative that we understand its influence on us. Such an understanding may enable us to develop healthy attitudes to machines and synergetic relationships with them.

A second reason is suggested by a look at public opinion polling. This literature is generally frowned upon by research-

ers as a mere nose-counting exercise (or is it nos-counting?), as a periodic pragmatic taking of the public pulse. However, some percentage figures would be interesting as a rough indication of the vicissitudes of the public perception of technology over the years. The literature turns out to be more interesting, however, in what it does not contain. The last five years of the Gallup Opinion Index contain very little on public attitudes to technology or to science (a). There are some polls on energy (but mainly in a political-economic rather than a scientific-technological context), two polls on nuclear power, and one each on test-tube babies, astrology, and unidentified flying objects, the last two hardly the most important aspects of science and technology respectively (33).

By contrast, opinions about political and economic issues are being compulsively measured day by day, since it has been traditionally assumed that political and economic factors are most important in the world of today and will determine the world of tomorrow. However, many thoughtful people have argued that it is science and technology rather than economics and politics which determine the shape of today and the emerging shape of tomorrow. Buckminster Fuller has argued that science and technology have enabled so many of us to live this century as only kings lived last century (32). Nigel Calder has argued that the politics of tomorrow will be the battle for the control of science and technology (18). Most of us would agree that the world of our children will be dramatically affected by the form of the Canadian information system which emerges after the current transition period triggered by developments in the twin industries of computers and telecommunications just as our lives were dramatically affected by the penetration of the television and the telephone. On the other hand, whether the current occupant of 24 Sussex Drive is Joe Clark or Pierre Trudeau or even whether the current occupant of the White House is Jimmy Carter or Ronald Reagan will have little effect on their lives beyond providing different names in their history books (b).

Paralleling this shift in emphasis from political and economic factors to scientific and technological factors as the determining forces in society, is a shift in the power base from those who have economic power to those who have knowledge power. The dichotomy between the haves and the have-nots in the industrial society will be replaced by that between the knows and the know-nots in the information society. Christopher Evans predicts a polarization of attitudes about the new information-processing machines (26). If those with negative attitudes avoid the machines and thus do not learn to use them, then the knowledge they make available will go by default to those with positive attitudes who approach the machines and thus learn to use them. The polarization of attitudes could translate into a polarization of abilities. Such a polarization is a prerequisite to the

scenario presented by George Orwell in 1984 in which the world is controlled by a technological elite.

Increased public awareness of those issues is, therefore, important even if only to prevent misuse by others. One device for increasing awareness is the public poll. Pollsters could perhaps be encouraged to bring the balance between polling of scientific-technological and political-economic issues more in line with their importance in determining our future. The current imbalance contributes to an agenda-setting by the media which places politics and economics way above science and technology on our social agenda (61).

Tom Smith made a trend analysis of the public response to variants of the question "What do you think is the most important problem facing this country today?" in Gallup polls from 1946 through 1976 (96). The responses fluctuated widely (and wildly), reflecting the history of the United States during that period, but the problems were invariably seen as political and economic. The closest the responses veered toward technology was during the Arab oil embargo in January of 1974 when energy became a concern for a brief period. Though technology is both the cause and one possible solution to this problem, it was viewed within the context of economics. The discrepancy between lay and expert opinion on the importance of technology may be worth exploring.

During this period, however, happiness scales remained almost constant despite the dramatic ups and downs of economic and political concerns (40). Andrew Greeley argues that this is because happiness scales measure what is private and personal which is unaffected by what is public and impersonal. When asked what is the important problem, people will dutifully dash off the things the media is currently telling them are problems but will continue blissfully with their personal lives. Technology however threatens to affect happiness scales in the future because it is this very intimacy which could be destroyed.

Public opinion polling literature could be summed up perhaps as "street-lamp" research, after the Sufi story of the drunk who dropped his key while fumbling at the door and went to look for it under the street-lamp because the light was better there. The light is better because the public attitude to economic and political issues is more explicit than the public attitude to science and technology and the results of the polls can be clearly verified in the case of elections. However, it is not where the key is. The key to our future lies in the way in which we deal with science and technology.

1.2 Social impact

The United States Senate set up an Office of Technology Assessment in 1972 (66). This is an encouraging sign of our growing sensitivity to the impact of technology on our natural environment. However, this sensitivity should be extended from "nature" to "human nature". Information-processing machines may have less impact on our natural environment than energy-consuming machines but more impact on our social environment. Therefore, the focus here is on social impact studies within the field of technology assessment.

This could be rephrased more formally by considering technology assessment as the study of the interactions among three overlapping spheres - the biosphere, the sociosphere, and the technosphere (c). The focus here shifts from the intersection of the technosphere with the biosphere to the intersection of the technosphere with the sociosphere.

Since social impact studies deal with the impact of technology on society, they can be usefully classified in terms of the level of technology and the level of society at which the study is conducted. Figure 2 provides a list of such social impact studies by way of illustration. The various levels range all the way from broad essays about the impact of technology-in-general on society-in-general to precise statements of the impact of a particular machine (a dictaphone) on a particular person (Howard Gardner).

Social impact studies could be considered as an attempt to answer the conundrum "What happens when an irresistible force meets an immovable object?" - some people considering technology as an "irresistible force" and other people considering society as an "immovable object". One answer is that the force is sometimes not irresistible (society rejects the technology) and the object is sometimes not immovable (society accepts the technology). Total rejection and total acceptance could be considered as end-points on a scale of resistance. This resistance could be viewed as inertia if you are focussing on the "immovable object" and as friction if you are focussing on the "irresistible force". Total acceptance could be considered as the case in which friction is reduced to zero and total rejection as the case in which friction is enough to not only slow the technology but bring it to a halt (d). Christopher Evans argues that resistance affects the time scale of the development of a technology (26). Others have argued that resistance is a function of fashion, fluctuating up and down like the lengths of skirts, or swinging pendulum-like from acceptance to rejection as from liberalism to conservatism (to which dimension it is correlated).

TECHNOLOGY	SOCIETY	STUDY
technology-in-general	society-in-general	24, 32
social reform	bureaucrats in South America	116
introduction of CEGEPS	public in Quebec	21
new community mental health services	hospital staff	56
contraception	women in Malaysia	113
"love" marriages	public in Ankara	31
supersonic transport	public	83
telephone	public	82
technological innovations in mine	coal-miners	20
four-day work week	employees	30
computer-assisted instruction	college teachers	5, 80
curriculum innovations	elementary school teachers	38, 62, 98
bicycle	public in Nigerian	110
automative diagnostic centre	patrons of garage in Columbus, Ohio	25
dictaphone	Howard Gardner	36

FIGURE 2 LEVELS OF TECHNOLOGY AND SOCIETY IN SOME SOCIAL IMPACT STUDIES

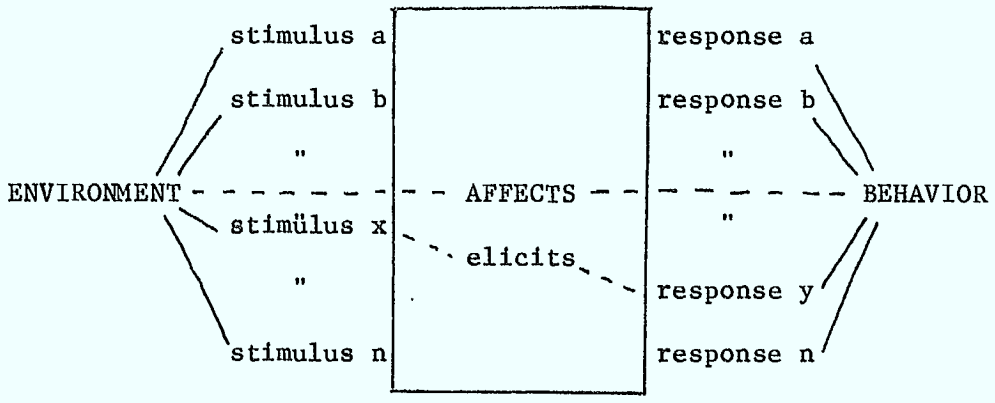
All social impact studies could be considered as involving public resistance to new technologies, if technologies are defined in their broad sense as ways of doing things and new is defined psychologically as new to the person involved rather than sociologically as new to the society. A technology may be composed of techniques as well as of things. Thus, a four-day week is a technology and, to someone who has not yet experienced it, it is a new technology.

1.3 Person/machine interface

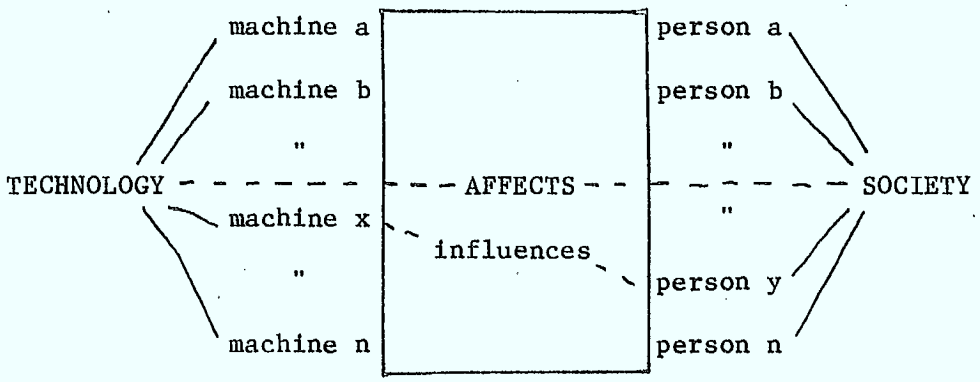
There have been many broad theoretical statements of the impact of technology on society, ranging from the thesis of the technological optimists - for example, Buckminster Fuller (32) - that the impact has been good in the past and will be better in the future to the thesis of the technological pessimists - for example, Jacques Ellul (24) - that the impact has been bad in the past and will be worse in the future. Fuller and Ellul and various others with intermediate positions have been nicely presented by William Kuhns as "post-industrial prophets" (52).

I have argued elsewhere that this analysis at a macro level should be supplemented by an analysis at a micro level to gain a fuller understanding of our technological society (34). This can be done by analysing technology into its elements (that is, individual machines), analysing society into its elements (that is, individual persons) and studying the influence of machines on persons as well as the impact of technology on society. This strategy mirrors that of the behaviorists who replace vague statements about the impact of the environment on behavior with precise statements about the relationship between a stimulus and a response (see Figure 3).

This figure is deliberately oversimplified for heuristic purposes. There are many levels between technology-in-general and specific machines, and between society-in-general and specific persons. The technology side of the figure ranges from technology-in-general through types of technology in terms of energy used (e.g. electronic), through functions performed by technology (e.g. electronic machines for information-processing), through locations in which machines are used (e.g. electronic machines for processing information in the office), through classes of machines (e.g. word-processors) right down to this particular AES-90 (Big Mac) on which I am composing this paper. The society side of the diagram ranges from society-in-general



(a) From environment-behavior to stimulus-response.



(b) From technology-society to machine-person.

FIGURE 3 PARALLEL ANALYSES OF ENVIRONMENT-BEHAVIOR AND TECHNOLOGY-SOCIETY.

through sectors of the society (e.g. academic community), through professions (e.g. university professors), through professional groups in a specific location (e.g. university professors in Montreal, Canada) right down to this particular individual who is composing this paper (see Figure 2).

The person/machine interface could be considered, somewhat whimsically, as the third interface of Adam. Presumably alone before Eve was manufactured out of his rib, he had to deal only with his physical environment - the biosphere. When Eve arrived and they multiplied, he had to deal in addition with his social environment - the sociosphere. As he and his progeny learned how to construct tools and machines, a third element emerged - the technosphere. Each of us, then, in our complex relationship with our environment, must deal with each of the three great spheres mentioned above in Section 1.1. The obvious analogy with The three faces of Eve is perhaps apt, since we may exhibit distinctly different personalities in each of these relationships.

The new information-processing technologies introduce a qualitative shift in this third interface. Since they simulate functions of the head rather than of the hand, they threaten white-collar workers rather than blue-collar workers. More dramatically, they threaten our image of our selves. A history of science and technology could be written in terms of progressive challenges to our human self-concept (103). Copernicus plucked us from the center of the universe and placed us on a broken-off fragment of one of a myriad stars; Darwin plucked us from our exclusive niche as the Divine creation and put us where we belong with the other animals; Freud taught us that we are not even rational animals - and now, a final insult to our dignity, we are told that we can be replaced by machines.

One small symptom of this identity crisis in our technological society is the recent publication of popular "survival manuals" (e.g. 105, 119) to help people deal with the emerging technologies.

The makers of public policy tend, understandably, to consult experts on institutions (sociologists, economists, political scientists), since such experts help clarify the "big picture" within which they must act. However, our various social, economic and political institutions are (or, should be?) simply tools for the satisfaction of the needs of individuals. Enlightened public policy, therefore, requires some understanding of the impact of that policy not only on our institutions but on the individuals who are served by those institutions. If the evolving information society is to be a humane society, then the technologies which characterize this society must be used to liberate rather than to oppress the individual.

Another reason for focussing on individuals as well as on institutions is that the rejection or acceptance of technological innovations ultimately depends on their rejection or acceptance by individuals rather than by institutions. This applies in the case when the consumer appears to be an institution (e.g when an individual in the role of purchasing agent buys X Telidon terminals on behalf of a company or another individual in the role of secretary in this company uses this terminal) as well as in the case in which the consumer is obviously an individual (e.g. a householder buys the terminal for the home).

If we assume that the emerging information society is an inevitable and positive development, then a coherent industrial strategy is crucial. One such strategy has been proposed by Kimon Valaskakis and Peter Sindell which is based on the concertation of the various actors on the Canadian communications stage (112). An important element of this (or any) strategy is an understanding of attitudes to technological innovations, since the information society depends on the acceptance by individuals of the technological devices which characterize it. Concertation of federal and provincial governments, of departments within each government, of government and industry, of labor and management, of company A and company B, of departments within each company to supply those devices is futile if there is no demand for them (e).

This point could be rephrased in terms of the various scenarios sketched during the first phase of the Information Society Project conducted at GAMMA (111). The télématique scenario implies complete adoptation of the new technologies, and maximum interconnection of computers and telecommunications in a national "central electronic highway". The privatique scenario is a decentralized option where stand-alone computers without interconnections predominate. In the rejection (pique?) scenario, public resistance to the new technologies forces the use of low and intermediate information technologies currently available.

Those "pure" scenarios are, of course, not mutually exclusive - the information society will emerge as some blend of those elements. The rejection scenario is an important ingredient in this blend since the paradigmatic shift in the modes of production and consumption implicit in the analysis of the information revolution rests on the assumption of public acceptance of the new technologies. "Acceptance" is a relative term, as argued above, and the mix of télématique and privatique which will emerge will depend on the relative public acceptance of each of those scenarios.

1.4 Attitude

Within the person-machine interface, the emphasis in this research project is on the person. Lip service is paid to the importance of the person (that is, everyone talks about it) but, in practice, the emphasis is usually on the machine. When a new technology is introduced, vastly more resources are devoted to the development of the machines than to the consideration of the effects on the people who will be influenced by them.

The new information-processing machines are no exception. Considerably more time, energy and money are being poured into providing the supply than on assessing the demand and, on the supply side of the equation, on hardware rather than on software. One way to avoid the frustration of finding ourselves with hardware without matching software and with supply without corresponding demand is to explore the demand for a technology before or, at least, concurrent with its development. In this way, commodities can be designed to satisfy needs rather than cynically sold as part of a need-and-commodity package deal.

The emphasis in this research report is, more precisely, on the attitude of the person to the machine. Understanding of attitudes to machines is of intrinsic value in itself. It is useful to those introducing a new technology to discover the desires and concerns of potential users and it is useful to the users to clarify those desires and concerns. It also has a more practical function. There is good reason to hypothesize that acceptance or rejection of a machine is determined to a large extend by the attitudes a person has toward it. Other things being equal (which, of course, they never are - this "ceteris paribus" qualification will be discussed at length later in the report), a person with a positive set of attitudes will tend to accept it, whereas a person with a negative set of attitudes will tend to reject it. Therefore, if one understands the attitudes to a particular technology, then one will be better able to predict its acceptance or rejection.

Such an understanding is of practical value, not only as a means of increasing the likelihood of acceptance by encouraging positive attitudes and of decreasing the likelihood of rejection by discouraging negative attitudes, but as a prerequisite to developing healthy attitudes to machines and synergetic relationships with them. A healthy attitude is not necessarily a positive attitude. It is an acceptance of the positive aspects of machines (those which enhance the quality of life) and a rejection of the negative aspects of machines (those which detract from the quality of life).

The importance of understanding attitudes is further illustrated by recognition of the phenomenological fact - that is, a person behaves with respect not to the objective world (world-as-it-is) but to his/her subjective map of the objective world (world-as-it-is-perceived). Pollyanna may perceive the word-processor being trundled into the office as a promise of reducing the mechanical chores she must perform; whereas Cassandra may perceive it as a threat since Pollyanna, with this machine, could replace her. It is the same machine, sitting innocently in the corner neither promising anything nor threatening anyone. However, it has opposite effects on behavior because of the different subjective maps of this common aspect of the same objective world. Pollyanna sees it as a promise and accepts it whereas Cassandra sees it as a threat and rejects it.

Within the same person, the same thing may change over time from a threat to a promise. A kiss is a threat to a pre-adolescent boy and a promise to an adolescent boy. This illustrates another advantage of attitude studies. Since attitudes can be changed over time, they represent a useful point of entry into a social system by those who aspire to change it.

Studies of attitudes to technology focus on the level of the individual person at the society side of the technology-society interface represented in Figure 2 (though results may be aggregated to represent the "attitude" of a specific group of people). They have a very special status within the complex study of the relationship between technology and society since they focus on the non-reciprocal aspect of this relationship. People have attitudes to machines but machines do not have attitudes to people. There is general agreement that the impact of technology on society has become increasingly more powerful than the impact of society on technology. Technology assessment represents only a very recent and very limited attempt by society at the social control of technology.

At the technology side of the figure, attitudes can be considered with respect to the whole range of levels from technology-in-general to specific machines. Most studies have been conducted at the general level. However, just as our attitudes to specific people and to certain groups of people may differ from our attitudes to people-in-general, so our attitudes to specific machines and to certain groups of machines may differ from our attitudes to machines-in-general (f). Most people, when pressed, will agree that their attitudes to technology are mixed. They are positive about some machines and negative about others (g). It would be useful then to supplement the studies of attitudes to technology with studies of attitudes to specific machines and to certain groups of machines.

Focussing down to the specific level reveals many dimensions of the person-machine interface which would not be considered at the general level. Just as people are more familiar with certain other people, so they are more familiar with certain machines. Thus an old typewriter which one has been pounding on for years is likely to be more benignly regarded than a strange new-fangled gadget which has just been wheeled into the office. Likewise, relationships toward different machines vary in intimacy. Attitudes to a mechanical arm, which is actually part of you, or to a kidney machine, on which you are dependent for your life, are likely to be very different from attitudes to atomic reactors or supersonic planes which seem, at least superficially, to be very peripheral to your life. Knowledge may also play a role. We know more about some machines than we do about others and this information will affect our attitudes to them.

Public resistance to new technologies, as described above, is a function of the attitudes of individuals, whether as private citizens or in their various roles. Thus, a technology which threatens jobs may be resisted by individuals holding those jobs, by trade unions representing those individuals, or by private citizen groups concerned about automation. Attitude studies, therefore, play a crucial role in social impact studies within technology assessment. They enable those responsible for public policy to understand the process of resistance to technological innovation and to provide a theoretical basis for initiating policies which will increase resistance to undesirable aspects of technology and decrease resistance to desirable aspects.

Public resistance should not be taken lightly by advocates of technology push. Marshall McLuhan predicts a backlash in the 80s from future-shocked consumers trying to curb runaway technology (64). Rather than dismissing those who reject technological innovations as "latter-day Luddites", we should seriously consider the basis of this rejection in order to discover how negative attitudes can be changed. There is appropriate <u>anti</u>-technology too.

In a previous paper (34), the author identified ten legitimate concerns about the new information technologies, which could contribute to its rejection:

The technology may replace me (obsolescence).
The technology may be used to exploit me (exploitation).
The technology may be used to invade my privacy (privacy).
The technology is vaguely threatening (technophobia).
The technology may involve me too deeply (technophilia).
The technology may become a "crutch" (dependence).
The technology may generate too much information (overload).
The technology may depersonalize me (informediation).
The technology may change me (media-as-message).
The technology may take too much time (opportunity-cost).

On the other hand, there are many desires for those new information technologies, which could contribute to its acceptance. Print technology has greatly expanded the amount of information which a culture can store and the ease to which any individual can gain access to it. The emergence of a set of machines in which information is powered by electricity considerably enhances this process. With them, we can do many things which we could do with print technology more efficiently and we can do some things which we could never do before.

2 ATTITUDE RESEARCH

Attitude research, like the attitudes it studies, has had its ups and downs. It was once "the most theoretically rich and empirically active area within social psychology", but went into a slump during the 1970s, and is now staging a recovery (23).

This chequered career may be partly due to the recognition by those in attitude research of the phenomenological fact, as mentioned above, that behavior is determined not by the environment as it is (the objective world) but by the environment as the subject perceives it (the subjective map of the objective world). An actual tree in your environment will not affect your behavior unless you become aware of it whereas an imagined mugger behind that tree will affect your behavior even if he is not there. The tree is part of the objective world but not of your subjective map whereas the mugger is part of your subjective map but not of the objective world. This fact is obvious but is being conceded only reluctantly and slowly by a science striving to be objective.

The past disenchantment with attitude research may be due to the fact that it attempts a very difficult task since such subjective phenomena do not yield easily to empirical research. It is being welcomed back because we are beginning to recognise that we have to expand the definition of our science of psychology to include such essentially important subjective phenomena. We certainly must assume the phenomenological fact in this study to explain why Pollyanna accepts and Cassandra rejects the same word-processor.

2.1 Attitudes to technology

"Technology got us into the environmental crisis and technology will get us out". In a study of four Minnesota communities, 83 percent of the sample agreed with this statement (106). Such technological optimism has been challenged by many recent studies including two sponsored by the Club of Rome (65, 67). Technological fixes may provide some temporary relief but only provide a breathing space for more permanent solutions, which involve changes in public attitudes (117).

Studies in the early seventies suggest that public attitudes to technology tend to be positive (54, 92, 104, 120). However, low correlations between responses to various statements indicate

that attitudes to technology do not fall along a single positive-negative scale, as typically used in opinion polls. They are multi-dimensional rather than uni-dimensional.

One study which illustrates the multi-dimensionality of attitudes to technology was conducted by Richard Anderson and Mark Lipsey to determine the relationship between public attitudes to technology and public responses to the energy crisis (4). Their data consisted of responses to a 92-item questionnaire involving different facets of technology by a sample of residents in Claremont, California and students in Claremont colleges.

Semantic differential ratings of "technology" on five adjective pairs indicated a strong overall positive evaluation among both samples. A factor analysis suggested an evaluation of utility dimension ("useful-useless, "necessary-unnecessary") and an affective dimension ("exciting-boring", "good-bad"). Subjects high on both dimensions agreed that technology had changed life for the better, that the present rate of change was too slow, that technology would eventually solve all our problems, and that a variety of technologies (space exploration, atomic energy, computers, automation) were more beneficial than harmful. High enthusiasts also tended to rate household items as desirable, and favored technical solutions over behavioral solutions. However, they showed no difference in terms of conscious efforts to reduce consumption. This may have been due to the fact that the energy crisis tended to be viewed as a political rather than a technological problem - that is, there was no real energy shortage but only a manipulation by the oil companies (74, 115). Attitude studies tend to consider only the affective dimension. However, the second dimension of utility exposed in this study suggests that the affective dimension differentiates, not so much between those who are positive about technology and those who are negative, but rather between those who view technology as a regrettable necessity and those who view it as a desirable necessity. Those two dimensions were found to help predict public perception of technological issues and suggest possible public reactions to them.

Another example is a study by Todd LaPorte and Daniel Metlay, in which they interviewed a sample of adult Californians in their homes before and after the energy crisis in the Winter of 1973-74 (54). They reinterviewed 472 of the original sample of 980 (that is, 48 per cent) and made up the post-crisis sample by selecting 316 more using the same selection procedure. An open-ended question about perceived changes in society since 1945 yielded 40 kinds of change. Nearly a quarter of all changes cited had to do with technology or science. "The public as a whole assigns technological changes a more salient place than economic or political changes in the shaping of modern society." Both 1972 and 1974 samples showed a consistently positive

attitude toward existing technologies. However, they were ambivalent about the usefulness of technology in solving problems of public concern. They tended to view technology as an aid in the development of mass rapid transit, solving the energy crisis, protecting the environment, curbing population growth, and education. Less than half the respondents believed that technology could help in reducing the crime rate, reducing drug addiction, providing jobs, reducing cost of living, and protecting privacy of personal records. Indeed, with respect to the economic issues of providing jobs and reducing cost of living, almost a quarter of the subjects thought that further use of technology would only aggravate the problem. The "invasion of privacy" issue was the only one in which the public felt that the potential usefulness of technology is outweighed by its possible adverse effects.

Turning to future technologies, the subjects were asked to evaluate twelve potential technological capacities with respect to their beneficial or detrimental results and impact on their own life, and the lives of others. Responses ranged from a high positive response to urban rail transport to a high negative response to computerized data banks. Shifts from 1972 to 1974 reflected the effect of the media. Those technologies rated higher in 1974 had received much support by experts as credible solutions to social problems whereas those rated lower had been the subject of much controversy. Attitudes about present technologies strongly influenced attitudes about the social costs and benefits of future technologies (h).

The young, the poor, the uneducated, the liberal tend to support some technologies disproportionally but also to oppose other technologies disproportionally. "The growing polarization of judgments about technology on the basis of those demographic variables adds further evidence that technological matters are heading for the political arena. ---- The possibility of various design alternatives having different social effects, and thus being experienced differently by different segments of the population, should be thoroughly explored." (54, Page 397).

The privatique and télématique scenarios, sketched by Kimon Valaskakis (111), as the two major such design alternatives for the emerging new Canadian communication system, were presented above. It would be interesting to explore the differential attitudes of (and impacts on) each of those various demographic groups to each of those alternatives.

Irene Taviss describes a survey of public attitudes to technology conducted by the Harvard University Program on Technology and Society (104). The subjects were 201 persons interviewed in the Greater Boston area during the summer of 1970. Though the sample viewed technology as being generally more beneficial than

harmful, it seemed ambivalent about the subject. This was reflected in agreement with both positive statements ("machines have made life easier") and negative statements ("people today have become too dependent on machines"). This suggests that technology has many facets, some of which are viewed as positive and some of which are viewed as negative. Such ambivalence seems clearly on the rise reflecting perhaps increased public awareness of the social impacts of science and technology.

The study also included some items of the subjects' perception of others' perception of technology. "Is it your impression that a lot of people are critical of technology?" To this question, 50 percent said yes, 44 percent said no, and 6 percent were not sure. Those who answered yes were asked the further question, "Why do you think so?". To this question, 47 percent cited ignorance, 17 percent cited fears of various kinds, 12 percent mentioned ecological dangers, and 6 percent gave job-related reasons. That is, less than a third thought others had rational reasons for a critical view of technology.

Tae Woo and Carl Castore conducted a study of attitudes toward a nuclear power plant (118). Their method was based on the expectancy-value model of attitude formation proposed by Martin Fishbein and his colleagues (28). This theory is based on the premise that the lay person, like the professional doing a social impact study of a technology, conducts a cost-benefit analysis. Cost corresponds to the sum of the subjective probabilities that negative possibilities will occur weighted by the evaluation of those consequences; benefit corresponds to the sum of the subjective probabilities that positive consequences will occur weighted by the evaluation of those consequences. The attitude to the technology is the algebraic sum of those products of subjective probability and subjective desirability (positive or negative) of the various possible outcomes of the adoption of the technology, or, in shorthand,

$$A = \sum_{n}^{i=1} p_i \cdot d_i$$

where A is the attitude to object o
p is the subjective probability of an outcome the subject associates with o
d is the subjective desirability of that outcome.

A random sample was drawn from telephone books in an area within 30 miles of a proposed nuclear power plant site in northern Indiana. The 242 of the sample of 310 who agreed to participate were interviewed by telephone. The respondents were asked to recall any arguments for or against the nuclear plant that they were aware of. They were then asked to rate on 5-point bipolar scales the probability and desirability of each of the outcomes implied by those arguments. On the basis of their responses, the sample was divided into a Pro group (n of 82), an Anti group (n of 45), an Undecided group (n of 43), and a group

which could not be classified since they had never heard of the proposed nuclear plant despite several years of conflict about it (n of 72). The Pearson correlation between the utility scores (sum of products of probability and desirability scores) and the attitude score (also measured on a 5-point scale) was 0.61 ($p < .001$). Thus, understanding of the groups in this controversy requires two types of information - number of beliefs held by them and importance (probability times desirability) of those beliefs. All groups held an equal number of positive beliefs and, thus, would not have been differentiated with the earlier simpler methodology. However, the Pro group considered the positive outcomes as more important, the Anti group considered the negative outcomes as more important, and the Undecided group did not lack in relevant information or belief (the indifferent group was the one which had never heard of the issue) but were simply ambivalent about the outcomes.

The following two studies focus on attitudes to computers. Of all the myriad machines in our world, the computer seems to arouse the most extreme positive and negative attitudes. It has a very special status among machines. In the person-machine interface, computers are the Very Important Machines (VIMs) corresponding to the Very Important Persons (VIPs) on the other side of the interface. They have been described as a symbol of all that is good and evil in the modern world (104), as Satan or God (26), as the Fourth World (6), as a Rorschach (55, 109), as a metaphor (75) and so on through a list which is difficult to imagine as a description of any other machine.

Robert Lee developed a questionnaire of 20 statements to tap major themes, beliefs, and ideas about computers on the basis of 100 intensive interviews with a diverse sample of the general public and a psychological analysis of the humor in over 200 cartoons about computers in popular magazines (55). Data was collected in May 1963 on a modified area probability sample of 3,000 persons 18 years of age and older.

A factor analysis of the responses yielded two major factors. One was clearly favorable (heavily loaded on items such as "They make it possible to speed up scientific progress and achievements" and "They are becoming necessary to the efficient operation of large business companies") and the other was clearly unfavorable (heavily loaded on items such as "There is something strange and frightening about them" and "They help to create unemployment"). Superficially those factors look as if they should be labelled "positive" and "negative". However, a closer look reveals that the first factor is a positively toned set of beliefs around the notion that computers are beneficial instruments for our purposes, whereas the second factor is a negatively toned set of beliefs around the notion that computers are relatively autonomous machines which can perform the functions of

human thinking. Those two dimensions - computer-as-useful-tool--for-our-purposes and computer-as-autonomous-machine-which-thinks - correspond roughly to the utility and affect dimensions discovered by Taviss (as described above) and suggest again that a simple pro-con measure is not adequate to capture attitudes to technology.

James Orcutt and Ronald Anderson argue that Lee's concept of the computer as an abstract and ambiguous stimulus (and thus much like a Rorschach blot or TAT card in a projective test) applies only when the subjects have had little direct contact with a computer (79). They set up a situation in which their subjects had direct interactional experience with a computer. Subjects were invited to participate in a prisoner's dilemma game. In half of the games, they were led to believe their opponent was human and in the other half of the games that their opponent was a computer. They assumed that attitudes to computers would emerge through the person-computer interaction just as attitudes to persons emerge through the person-person interaction. The computer opponent was judged to be less responsive to his/her strategy, more depersonalizing, and more powerful than the human opponent. It also tended to be perceived as more insensitive, organized, skilful, interesting, unpredictable, and impersonal. Since there were no actual differences between the performances of the "computer" and "human" opponents, except in the minds of the subjects, those differences reflect their prejudged images of the computer.

Roy Goldman, Bruce Platt, and Robert Kaplan (39) conducted a factor analysis of responses to a questionnaire on mechanisation and extracted six independent dimensions underlying the responses, which they called

Global mechanism
Mechanical curiosity
Preference for handmade goods
Alienation
Spiritual benefits of technology
Human vitalism.

This study suggests that attitudes to technology are not uni-dimensional, as assumed in public polling research, or even bi-dimensional, as discovered in the studies by Taviss and by Lee described above, but have many dimensions. The potpourri of names required to describe the factors suggests further that we are dealing with a very complex phenomenon. Perhaps more dimensions emerged from this study than previous studies because it involved more test items of greater diversity. Just as our awe of the computer is diminished when we remember the GIGO principle (garbage in, garbage out), so our awe of the technology of factor analysis is reduced when we remember the LILO principle

(little in, little out). Or perhaps this study deals with a broader issue. "Mechanisation" involves "technology" but it is also associated with urbanisation, industrialisation, modernisation, and a complex of other "sations" which collectively characterize the technological society. Perhaps, then, this study is picking up not simply attitudes to technology but to the technological society of which technology is only an element.

In summary, the two major dimensions of attitudes to technology are utility and affect. That is, people tend to view it either as a desirable necessity or as a regrettable necessity. The same ambivalence is found with respect to attitudes to the computer, the machine which best embodies the emerging information society. On the one hand, it is appreciated for the useful functions it performs but, on the other hand, it is feared as an autonomous simulator of human functions.

2.2 Attitudes to innovation

Attitudes to new technology may be mainly determined by the "technology" (with the fact that it happens to be new quite incidental) or it may be mainly determined by the "new" (with the fact that it happens to be technology quite incidental). It is important to disentangle the relative contributions of attitudes to technology and attitudes to innovation and the interaction between them.

There is little formal psychometric work done within psychology in measuring attitudes to innovation. However, there are some theoretical traditions which suggest a personality dimension ranging from people who approach new things to people who avoid new things. Abraham Maslow argues that there is a constant see-saw battle within each of us between the need to know and the fear of knowing (59). People for whom the need to know tends to overcome the fear of knowing seek excitement; whereas people for whom the fear of knowing tends to overcome the need to know seek contentment. All of us, of course, try to maintain some optimal balance between contentment and excitement or, alternatively, walk a tightrope between boredom (the negative side of contentment) and fear (the negative side of excitement) (i). However, there are wide individual differences in tolerance for ambiguity, venturesomeness, etc.

One would assume little resistance to innovation within a scientific community, since the entire purpose of science is to discover new facts and invent new artifacts. Theoretically,

scientists are supposed to be delighted when a beautiful big theory is destroyed by an ugly little fact. However, in practice, it turns out that they are more delighted when it is their fact than when it is their theory. Even in science, attitudes are determined by vested interests. The resistance of a scientific community to new facts and theories is beautifully described by Thomas Kuhn (51). The content of a particular science is organized within a paradigm (a framework into which the various bits of information more or less fit). As more and more information accumulates which does not fit within this paradigm, a new framework emerges within which this information fits more comfortably. There has been a revolution. People committed to the old paradigm, however, resist the new paradigm and may never accept it.

Eileen McDonagh describes this paradigm shift in the language of attitude change, and suggests thereby that the acceptance of a new technology within a society as a whole could be usefully described in the same way as the acceptance of a new paradigm within a scientific community (63). One implication, for example, is that the new technology is more likely to be accepted by the young, since the old are more likely to have a vested interest in an old technology.

Although the major emphasis in this study is on attitudes to technology, a few items are included in each scale to try to get a preliminary glimpse of the possible role of attitudes to innovation, and their interaction with attitudes to technology in determining public resistance to new technologies.

3 AFFECTIVE, COGNITIVE AND CONATIVE DIMENSIONS

Every discussion of opinions, attitudes, or beliefs seems to begin with an attempt to distinguish the concept under consideration from the other two. They tend to be distinguished in terms of stability within a person from time to time - thus, a belief is seen as more stable than an attitude, which is more stable than an opinion. Or they are distinguished in terms of their centrality to the personality structure of the subject. Thus, Saul's conversion on the road to Damascus was a change of values whereas Sam's shift in preference from Coca-Cola to Pepsi-Cola is a matter of opinion. However, because of the phenomenological fact, one person's belief may be another person's attitude may be yet another person's opinion. In their state-of-the-science message, in which they tried to summarise the scientific findings on human behaviour, Bernard Berelson and Gary Steiner could not disentangle findings on opinions from findings on attitudes from findings on beliefs and lumped them altogether as opinions-attitudes-beliefs or OABs (13).

There is, however, more or less agreement that the three concepts refer to an intervening variable, which explains consistency within a person and differences from one person to another and which has three dimensions - affective (feeling), cognitive (thinking) and conative (doing). Although it is not possible to tell how stable and how central opinions-attitudes-beliefs with respect to technology are in a person, I have used the term attitude and have focussed on the attitude literature.

Whereas opinion research has tended to emphasize the affective dimension and belief research the cognitive dimension, attitude research has consistently struggled with all three dimensions. Indeed, much of the literature is a consideration of the relationships between those three dimensions. For example, the classical study by LaPiere (53) is a demonstration of inconsistency between the affective and conative dimensions (the subjects did not do what they said they would do) and the modern studies by Fishbein and his colleagues (28) suggest that actions can be predicted from measurements of attitudes which incorporate both the affective and cognitive dimensions.

The Technophobia Rating Scale (TRS) and the Attitudes to New Information Machines Scale (ANIM) proposed here are instruments to measure the affective and cognitive dimensions of the attitude to technology respectively. It is hoped that they will be consistent with the conative dimension. That is, those who score high on TRS and negative on ANIM will tend to avoid technology and those who score low on TRS and positive on ANIM will tend to approach technology.

The lay-person tends to think of attitudes with respect only to the feeling dimension ranging from love to hate. However, a deeper consideration which includes the actions determined by the attitudes, suggests that the important consideration is whether a person will approach the thing under study (love or hate) or avoid it (indifference or fear). The approach response may be either approach against (hate) or approach for (love). With respect to technology, the former is the familiar luddite response. The latter is what I will call here the technophilic response. The avoidance response may be active (fear) or passive (indifference). The former I will call here the technophobic response. The latter is of some importance in this context because indifference to a new technology constitutes rejection of it. When the end is involvement, indifference is rejection - a passive rejection but a rejection nevertheless, as all unrequited lovers know.

3.1 Affective dimension of attitude

3.11 The MARS scale - Suinn

Sheila Tobias was exploring the question of why women were so under-represented in the major professions (107). In good feminist fashion, she was searching for the answer in terms of sexual stereotypes and discrimination in a male-dominated society. However, she stumbled across a simple survey conducted by Lucy Sells, in which she discovered that 57 percent of the males but only 8 percent of the females entering the freshman class at the University of California in 1972 had taken four years of high school math (94). Since this was a prerequisite for 22 out of 24 majors, she had pinpointed the bottleneck which cut off most women from the major professions. Tracing the process backwards, Tobias did find her expected sexual stereotypes. Girls were doing as well in mathematics as boys until Junior High School. At that crucial time in their emotional development when they were anxious to be popular with males, they discovered that it was not feminine to excel in mathematics. Suddenly they became stupid.

Further studies have tended to support this version of the genesis of math phobia. Girls in grade 6 did <u>better</u> than boys in maths tests (78), and boys in grade 8 were <u>more</u> anxious about maths than girls (89). However, adult females consistently score higher than adult males on tests of mathematics anxiety (14, 15, 17, 71, 102) and admit to more mathematics anxiety (76). Strangely, whereas studies have been made before and after Junior High School, no one seems to have zeroed in on that crucial stage

to see more precisely what happens and how it can be prevented. There is, however, much anecdotal evidence from case histories given by victims of the process during math clinics designed to rectify the resultant damage.

This sex difference is attributed to myths about sex differences and to female attitudes which stem partly from those myths (58). That is, it is not simply the myth which does the damage but the belief in those myths which mediates between the myth and the math. Talented women are assumed to have exempted themselves from this socialisation process by refusing to accept the stereotypes, by not doing what they are supposed to do (99). However, attrition among girls in a program for talented students was higher than for boys (46). It takes more than talent apparently for women to leap this hurdle. However, even those with more than talent have failed to jump further hurdles and become significantly represented among the upper echelons of mathematicians.

The principal tool for measuring math phobia is the Mathematics Anxiety Rating Scale (MARS). It consists of 98 items each of which describes a situation involving mathematics. Subjects are invited to indicate how frightening each situation is to them by checking one of five levels of anxiety from "not at all" to "very much". It is a Likert scale in which the weighted scores for each item are added to produce a single score of mathematics anxiety (see Appendix A).

Test-retest reliability was .78 for a sample of 119 college students (100). High test-retest and internal consistency reliability was also found for a sample of 369 undergraduates (84).

It is reasonable to assume that mathematics anxiety would be less for those who have done well in mathematics courses in the past, who are currently involved in activities requiring mathematics, and who have undergone therapy to reduce it. Such relationships have indeed all been demonstrated using MARS, thereby contributing to confidence in the validity of the instrument.

In a study of 2 groups of 109 and 80 undergraduates, humanities majors scored higher in MARS than social science majors who, in turn, scored higher than physical science majors (17).

The same study provided further validation of MARS by demonstrating an inverse relationship between scores on the test and (a) number of years of high school mathematics, (b) number of years of calculus, and (c) grades achieved in high school mathematics. Another study of 52 psychology students and 54 mathematics students found that MARS scores were higher for the psychology students than for the mathematics students and were

inversely related to performance in mathematics for the psychology students (72). The scores also predicted worry (cognitive concern about test performance) and emotionality (physiological and affective arousal). An inverse relationship was found between scores on MARS and scores on the mathematics section of the Differential Aptitude Tests for 119 college students (100). Further evidence for validity comes from a study in which MARS scores decreased after behavior therapy for mathematics anxiety (85).

3.12 The technophobia rating scale (TRS)

The above evidence for the reliability and validity of the MARS scale in measuring math phobia suggests that it may be possible to develop a parallel instrument to measure technophobia, which would also be reliable and valid. Such an instrument could be created by simply substituting situations involving machines for those in MARS involving mathematics.

Math phobia has captured the attention of researchers because it excludes many people, especially women, from most prestigious professions. However, technophobia may be as widespread as math phobia and even more debilitating since technophobes must live in an environment which is becoming increasingly alien and alienating as more and more machines come into our lives (j). Though math phobia does indeed shut off many career paths, it is not very disruptive of day-by-day life. Most of us can manage the four basic arithmetic operations which is all that is normally required. If not, then we are able to resort to the ancient technology of our fingers or the modern technology of hand calculators. However, if we have a phobia about using such calculators - or slide projectors or elevators or automobiles or whatever subset of the myriad machines in our technological society, then our lives are thereby very much limited.

The two phenomena have enough in common to make it fruitful to develop methods of diagnosis and amelioration of technophobia by analogy with those already successfully developed for math phobia. The testing of the important findings on math phobia in the domain of technophobia would be an important contribution to our understanding of public resistance to technology.

On the other hand, they are sufficiently different to yield interesting findings beyond those discovered in the investigation of math phobia. For example, since machines are not "taught" in school, people with technophobia cannot be described as curriculum-disabled, a term applied to math phobics. Some interesting

differences in the distribution of people with technophobia as opposed to people with math phobia may emerge (for example, whereas women tend to suffer more from math phobia than men, people with many years of schooling may suffer more from technophobia than people with few years of schooling, since one thing we learn in the informal curriculum of school is that educated people do not make their living working with machines). Since mathematics are discoveries and machines are inventions, further differences may emerge between those who are apprehensive about their capacity to understand our discoveries and those who are apprehensive about using our inventions.

3.2 Cognitive dimension of attitude

3.21 The expectancy-value scale - Fishbein

The original aspiration of attitude studies was to predict action from attitude. Traditional studies of attitude experienced considerable difficulty in doing so. One explanation for this is that the first generation of scales (e.g. those devised by Likert, Thurstone, Guttman, etc.) were uni-dimensional scales. They assumed that attitude could be measured in terms of perceived desirability of the attitude object. How do you feel about X?

A spate of multi-dimensional scales have subsequently evolved in response to this limitation. This is one of the major reasons why the field of attitude studies is experiencing a revival. Perhaps the most successful of those scales is that developed by Martin Fishbein (27) and later presented in a more extensive and somewhat modified form by Martin Fishbein and Icek Ajzen (28).

Although it appears in the literature under a bewildering variety of names (k), it will be called the expectancy-value scale here, since this serves as a heuristic to remind us of the two major dimensions. The "value" dimension corresponds roughly to the perceived desirability of traditional uni-dimensional scales. However, it asks the subject to judge the perceived desirability of an outcome of the attitude object. How do you feel about outcome Y of X? The "expectancy" dimension is a measure of the perceived probability of that outcome. How likely do you think outcome Y of X is? The Fishbein scale could be considered then as a refinement of the Likert scale. It does not measure the perceived desirability of an attitude object directly

but measures the perceived desirability of various outcomes of the attitude object with each outcome being weighted by the perceived probability of that outcome.

Or, more succinctly, as indicated above in Section 2.2,

$$A = \sum_{i=1}^{n} p_i \cdot \alpha_i$$

where A is the attitude to object o
p is the subjective probability of an outcome the subject associates with o
d is the subjective desirability of that outcome.

It is a rational model of behavior. Fishbein assumes that the lay person is not dramatically different from the professional person in dealing with the social impact of new technologies. They consider, as we are doing in this research project, the various possible outcomes of the introduction of the technology with respect to the desirability and probability of each outcome. Such a scaling technique avoids the usual contradiction in psychological studies which portray the experimenter as rational and the subject as irrational. It provides an interesting contrast to the TRS scale which assumes that behavior with respect to machines will be determined by an irrational fear of them. One purpose of this research project is to determine which of those scales best predicts behavior with respect to machines.

Fishbein's scale, with its emphasis on the evaluation of outcomes of an attitude object, is peculiarly appropriate as a means of assessing the social impact of new technologies. It is appropriate also because of its demonstrated past success in the prediction of behaviour and stated attitude. Of 34 tests of the model published between January 1976 and January 1981 inclusive, 23 were judged to have predicted behaviour and stated attitude. They are listed in Figure 4 to indicate the wide range of behaviours and stated attitudes which have been predicted by the scale.

3.22 The attitudes to new information machines scale (ANIM)

The Attitudes to New Information Machines Scale (ANIM) is based on the Fishbein scaling technique. This technique, with its focus on the subjective desirability and subjective probability of possible future outcomes of the attitude object, lends itself beautifully to attitudes to new technologies.

The original intention was to assess the pervasiveness of the various concerns listed by the author in a previous paper (34). Items expressing each of those concerns are, indeed,

Having a child and using oral contraceptives (22).
Female occupational choice (41).
Attitudes toward religion (7).
Turnover in National Guard members (45).
Perception of positive arousal (11).
Voter decision on an energy ballot proposal in Oregon's 1976 general election and public reaction to future energy proposals (16).
Second language acquisition (37).
Use of marijuana (9, 10)
Drinking behaviour (49).
Job satisfaction in university employees (87).
Weight reduction (93).
Attitudes to family planning (113).
Donation of blood (121).
Participation in speech workshop (48).
Beliefs about people with speech disorders (29).
Behaviour (73).
Job-relevant attitudes (3).
Drinking of alcohol by adolescents (91).
Responses to persuasive communications (57).
Attitude ratings of 10 countries (68).
Effect of exposure to positive and negative words (42).
Behaviour (2).
Attitudes to nuclear plants (118).

FIGURE 4 BEHAVIOURS AND ATTITUDES PREDICTED BY FISHBEIN SCALE.

included. Figure 5 lists the concerns (except for "technophobia" which is qualitatively different and covered by the TRS above and "technophilia" which is its mirror image) and the items which express each concern. However, it was decided to extend the scale to include positive as well as negative items to capture the full range of attitudes. Those were constructed by phrasing the issues under concerns in a positive way and by adding items reflecting other predictions made by experts in this area. Since it was not feasible to include items to complete a full concern-machine matrix, it was decided to include one item testing each concern containing the word "computer", since this is the central machine permeating the information revolution. Those items are also indicated in Figure 5.

For each item, the subject is invited to indicate subjective probability on the following five-point scale:

very improbable (0)	improbable (.25)	don't know (.50)	probable (.75)	very probable (1)

and subjective desirability on the following five-point scale:

very negative (-2)	negative (-1)	don't care (0)	positive (1)	very positive (2)

The score on each item is the product of the two scores, as indicated. The subjective probability score could be viewed as a multiplier of the traditional social desirability score. If the subject thinks this outcome is "very probable", then the desirability score is given full weight. As indeed it should, since the subject believes that this (positive or negative) outcome will come to pass. However, if the subject thinks this outcome is "very improbable", then the desirability score is cancelled. As indeed it should, since it does not matter how positive or negative the outcome, it does not contribute to the attitude since the subject does not believe it is going to happen anyway.

Positive and negative attitudes will be picked up by this scale using neutral items. People with positive attitudes will judge them as positive and people with negative attitudes will judge them as negative. Thus, for example, some people will judge the outcome "Computers will be used more and more in education" as positive and some will judge it as negative. This parallels the case of the optimist seeing a glass as half-full and the pessimist seeing the same glass as half-empty.

The subjective-probability multiplier, however, permits the use of positive and negative statements. Most people would judge the outcome "Computers will reduce unemployment" as positive and

CONCERN TESTED BY ITEM	ITEMS MENTIONING COMPUTER	ITEMS MENTIONING INFORMATION MACHINES IN GENERAL	
	a		
Obsolescence	5	11	
Exploitation	25	15	
Privacy	27	2	24
Dependence	8	14	
Overload	16		
Informediation	31	22	
Media-as-message	23		
Opportunity-cost	21	19	

a Numbers refer to items in the original ANIM scale (See section B of Appendix B Attitudes to Machines questionnaire).

FIGURE 5 ITEMS IN ANIM SCALE TESTING EACH OF THE CONCERNS ABOUT TECHNOLOGY AND THE ATTITUDE TO COMPUTERS

the outcome "People will become too dependent on machines" as negative. Such items would therefore not differentiate between those with positive attitudes and those with negative attitudes. However, the Fishbein scale does differentiate them. Whereas a person with a positive attitude and a person with a negative attitude will both judge the former outcome to be positive and the latter outcome to be negative, the positive person will tend to judge the positive outcome as probable and the negative outcome as improbable and the negative person will tend to judge the positive outcome as improbable and the negative outcome as probable. Continuing the analogy in the above paragraph, the optimist and the pessimist both see one glass as half-full of whiskey and another glass as half-full of poison, but the optimist assumes that he/ she will be able to drink the former and will not be required to drink the latter, whereas the pessimist assumes that he/she will not be able to drink the former and will be required to drink the latter.

Since each item is judged on two five-point scales, there are 25 different possible patterns of responses to each predicted outcome. The distribution of all possible scores for each item is presented in Figure 6. The "meanings" of the extreme scores and the two alternative "meanings" of the middle zero scores are indicated. The intermediate positive scores represent positive desirability weighted by probability and the intermediate negative scores represent negative desirability weighted by probability. This makes some subjective sense.

The original items were chosen to measure the various concerns about new information technologies listed in Section 1.4 above. In order to pick up the whole range of attitudes, some of those concerns were phrased in a positive way and some items were added which embodied some positive outcomes of the technology as predicted by various experts in the field. Those items were tested informally with pilot groups and, on the basis of the feedback, refined over six successive versions of the questionnaire into the form which appears as Appendix B.

F	p.d	INTERPRETATION
1	2.00	very desirable and very probable
1	1.50	
2	1.00	
1	0.75	
2	0.50	
1	0.25	very improbable (desirability therefore irrelevant)
9	0.00	
1	-0.25	neither desirable or undesirable (probability
2	-0.50	therefore irrelevant)
1	-0.75	
2	-1.00	
1	-1.50	
1	-2.00	very undesirable and very probable

where F is frequency

p is subjective probability

d is subjective desirability

FIGURE 6 DISTRIBUTION OF ALL POSSIBLE SCORES FOR EACH ITEM IN THE ANIM SCALE

4 RESEARCH STUDY

4.1 Method

The Technophobia Rating Scale (TRS) and the Attitudes to New Information Machines Scale (ANIM), described above in Sections 3.12 and 3.22 respectively, were incorporated into a questionnaire along with other sections designed to test their construct validity. The 20-page questionnaire (see Appendix B) consists of 5 sections:

Section	
A	Familiarity with new information machines
B	Attitudes to new information machines (ANIM)
C	Technophobia rating scale (TRS)
D	Number of machines in your life
E	Personal history with machines

The questionnaire was administered to 100 subjects broken down as follows:

19	Students in a calculus class at Vanier College.
8	Staff members of McGill Library.
11	Office employees at Transport Canada.
14	Students in a Science and Society day class at Concordia University.
15	Students in a Science and Society evening class at Concordia University.
23	Students in an introductory sociology class at Concordia University.
10	Members and friends of staff at GAMMA.
100	

Administration of the questionnaire was preceded by the following statement:
"I'm Scot Gardiner and this is my colleague, Maureen Jue. We are trying to understand something about the relationship between people and machines, and would appreciate your help by sharing your experiences with machines.
First, to acquire some concrete data and to prime you to think about your personal experience with machines, would you kindly complete this questionnaire?
Try to fill in all the items (just guess, as you do in examinations, if you are not sure). Feel free to write rude remarks in the margin if there are items which you think are unclear or ambiguous.
If you want information about the results of this research, make sure you copy down my name, address, and telephone number so that you can write or call.
If you want to know how your scores compare to the average, jot down a pseudonym or some sign so that I can identify your copy of the questionnaire."

In the classes, the administration of the questionnaire was followed by a 10-minute slide-and-tape presentation on the person/machine interface and a discussion in which the principle investigator answered any questions raised by the subjects. The same follow-up was provided for the McGill Library group later at a departmental meeting. Each subject to whom the questionnaire was administered individually was invited to discuss the questionnaire afterwards.

Each scale will be analysed internally to determine if it is homogeneous and reliable. A scale is homogeneous if each item within it measures whatever the whole scale measures. An item analysis, in which scores on each item are correlated with scores on the test as a whole, will reveal which items do not measure what the scale is measuring. Those items will be eliminated. A scale is reliable if it is consistent in measuring whatever it is measuring from one administration to another. Since it was not possible to administer the scales a second time, two administrations are simulated by dividing each scale randomly into two equal parts and calculating the correlation between the two halves.

This internal analysis of each scale will be followed by an external analysis. A mere consistency is not enough. The scales must not only measure whatever they measure consistently but they must measure what they are designed to measure. That is, they must be valid as well as reliable.

Since TRS is designed to measure the emotional component of the attitude to machines and ANIM is designed to measure the cognitive component, it is assumed that they will be correlated. That is, those with a high score in the technophobia scale will tend to have a negative attitude toward machines. Both scales will, in turn, be expected to correlate with measures of the third component of attitude - the conative dimension. That is, those high in TRS and negative in ANIM will tend to reject the new technologies whereas those low in TRS and positive in ANIM will tend to accept the new technologies. Those conducting field trials will presumably be devising indices of rejection and acceptance, and thus be able to contribute to evidence of such predictive validity of the scales.

It will be possible, in the context of this study, to establish only construct validity. Evidence for such construct validity of the tests in sections B and C will be sought using the other sections of the questionnaire. That is, it is hypothesized that those high in TRS and negative in ANIM will tend (a) to be less aware of the new information-processing machines (section A) and (b) to have less contact with machines in their everyday lives (section D).

A positive correlation between awareness and attitude would contribute to the construct validity of the ANIM test. It confirms the common-sense notion that familiarity breeds content. It is not clear, however, what breeds what. Perhaps content is the mother of familiarity. That is, because one has a positive attitude to new technologies then one becomes familiar with them just as our positive attitude toward blondes leads to the same end. Or perhaps awareness and attitude are both symptoms of some third underlying variable. Whatever the causal relationship, a positive correlation would contribute to construct validity.

A negative correlation between awareness and technophobia would contribute to the construct validity of the TRS. That is, the higher the irrational fear of technology the lower the awareness of new technology. A significant negative correlation would suggest the operation of the phenomenon of selective non-perception.

Subjects high on TRS and negative on ANIM will presumably have less contact with machines - that is, will have used fewer machines, will have fewer machines in their homes, will be able to operated fewer machines.

The demographic information in section E may contribute to the construct validity by providing evidence with respect to the following hypotheses:

1 Women will score higher on TRS and be more negative on ANIM than men.

2 Older people will score higher on TRS and be more negative on ANIM than younger people.

3 People with much formal schooling will score higher on TRS and be more negative on ANIM than people with little formal schooling.

4 People whose interest and competence is in the humanities will score higher on TRS and be more negative on ANIM than people whose interest and competence is in the social sciences and those in social sciences will, in turn, score higher on TRS and be more negative on ANIM than those whose interest and competence is in the natural sciences.

Hypothesis 1 is based on the commonly-held assumption that men are more at home with machines (except perhaps home machines) than women. Hypothesis 2 is based on the frequent observation that young people respond positively to information machines because of their familiarity with electronic games. Hypothesis 3 is based on the argument, expounded above, that more educated people work with their heads rather than with their hands. Hypothesis 4 is based on the fact that machines are associated more with the natural sciences than with the social sciences than, in turn, the humanities.

4.2 Results

Although no effort was made to ensure a random sample of subjects, the distributions of scores in each section of the questionnaire is of some interest as an indication of the relative order of items within each set. In each case, those numbers can be read as percentages, since there were (by a well-designed stroke of good fortune) 100 subjects.

The distribution of responses in Section A, Familiarity with new information machines, is presented in Figure 7. The average score for each machine was calculated, assigning 1 to "heard", 2 to "seen", 3 to "used", 4 to "own/rent", and 0 to no response (that is, this is interpreted as "never even heard of it"). The machines are listed in order of familiarity.

The means and standard deviations of responses in Section B, Attitudes to new information machines, are presented in Figure 8. The score for each subject on each item is the product of the subjective desirability and the subjective probability of the outcome expressed in each item. The scores assigned to each response and the distribution of desirability-probability products are indicated above in Section 3.22. The items are listed from most positive to most negative. Correlations of score on each item with the total ANIM scare is also indicated on the right of the figure.

The distribution of responses in Section C, Technophobia rating scale, is presented in Figure 9. Averages and standard deviations are calculated, assigning 0 to "not at all", 1 to "a little", 2 to "a fair amount", 3 to "much", and 4 to "very much". Correlations of score on each item with the total TRS score is also indicated on the right of the figure. The items are listed in order to "frighteningness".

Whereas Figures 8 and 9 present the results of the internal analysis of the ANIM and TRS scales respectively, Figure 10 summarizes the external analysis. It indicates the inter-correlations between those scales and the various other indices derived to test their construct validity.

	NEVER HEARD OF IT	HEARD OF IT	SEEN IT	USED IT	OWN/RENT IT	AVERAGE SCORE
Pocket calculator	01	00	04	32	63	3.76
Digital clock	02	01	24	19	54	3.14
Digital watch	00	01	39	28	32	2.91
Other electronic games	02	07	23	54	14	2.71
Computer terminal with print-out	08	06	37	49	00	2.27
Telephone-answering machine	03	12	47	32	06	2.26
Computer terminal with screen	05	12	38	45	00	2.23
Electronic cash register	06	06	62	24	02	2.06
Chess-playing machine	08	27	48	16	01	1.75
Automatic bank teller	19	16	43	22	00	1.68
Home computer	11	33	38	15	03	1.66
Video-disc	11	33	41	13	02	1.62
Robot	07	33	60	00	00	1.53
TELETEXT RECEIVER	27	22	33	18	00	1.42
Word processor	26	30	26	17	01	1.37
Micro-computer	27	30	25	17	01	1.35
Language translator	15	48	25	11	01	1.35
Computerized camera	32	29	22	07	10	1.34
TWO-WAY TELEVISION	21	39	33	06	01	1.27
Facsimile machine	60	15	06	19	00	0.84
"Smart" photocopier	54	28	05	13	00	0.77
VIDEOTEX RECEIVER	38	21	17	04	00	0.67
"Smart" telephone	65	23	10	02	00	0.59
Optical character scanner	64	23	11	02	00	0.51
TELIDON	59	32	09	00	00	0.50
PRESTEL	78	15	07	00	00	0.29
ANTIOPE	89	07	03	01	00	0.16

FIGURE 7 DISTRIBUTION OF RESPONSES IN SECTION A FAMILIARITY WITH NEW INFORMATION MACHINES

R	N		MEAN	S.D.	C	p
01	33	New electronic home services will help those who are house-bound (handicapped, old) lead more productive lives.	1.31	0.67	.26	.005
02	12	Individuals will have more access to information.	1.13	0.74	.28	.002
03	18	Computers will enable business and government to provide more efficient services	0.90	0.77	.33	.001
04	29	Work schedules will become more flexible since people can work when and where they like.	0.78	0.74	.37	.001
05	07	Computers will give us more leisure time.	0.77	0.77	.14	.084
06	03	Computers will be used more and more in education.	0.74	1.10	.20	.024
07	04	People living in the country will not have to go to the city for information.	0.59	0.74	.26	.004
08	01	Home computers will enable people to work more at home.	0.47	1.20	.34	.001
09	13	Traditional mail delivery will be largely replaced by electronic mail in which messages are sent directly from one terminal to another.	0.39	0.90	.40	.001
10	26	All information will be available in all places at all times.	0.35	0.76	.26	.006
11	31	Personal relationships will improve since computers will be doing the slave work leaving us more time to spend with one another.	0.33	0.67	.16	.063
12	10	Polls and referendums on political issues will be conducted through home computers.	0.19	0.83	.29	.002
13	11	Robots will take over much of the mechanical work.	0.18	1.00	.44	.001
14	15	People will have more personal power because they have access to all information in all places at all times.	0.16	0.78	.41	.001
15	05	Computers will reduce unemployment.	0.14	1.06	.09	.199
16	20	Traditional shopping will be replaced by teleshopping in which one previews goods presented on the television screen and orders them by telephone.	0.11	0.84	.38	.001

R is the rank order of the items.
N is the number of the item in the original ANIM scale (see section B of Appendix B Attitudes to machines scale).
MEAN is the average score on the item for the 100 subjects (see Figure 6 for range of possible scores).
S. D. is the standard deviation of the average scores for the 100 subjects.
C is the correlation between score on the item and score on the total ANIM test.
p is the probability that such a correlation can be attributed to chance.

FIGURE 8 DISTRIBUTION OF RESPONSES IN SECTION B, ATTITUDES TO INFORMATION MACHINES SCALE

R	N		MEAN	S.D.	C	p
17	02	Records will be kept about what information is requested from electronic home information systems.	-0.14	1.06	.24	.012
18	21	Computers will be too expensive - most people won't be able to afford them.	-0.15	0.69	.14	.082
19	23	Human nature will be changed because computers entend the functions of our minds.	-0.17	0.76	.42	.001
20	30	Electronic devices will replace books, newspapers, and other print media.	-0.23	0.89	.58	.001
21	06	Much of the content of information machines will come from the United States.	-0.27	0.81	.23	.010
22	19	The information machines will take up a large part of each day.	-0.30	0.76	.45	.001
23	16	Computers will overload people with information.	-0.41	0.79	.38	.001
24	22	People will communicate mostly through machines rather than face-to-face.	-0.47	0.70	.46	.001
25	32	Society will be polarized around those who love the new machines and those who fear them.	-0.49	0.77	.51	.001
26	24	A National Data Bank will be established to keep records of all citizens.	-0.50	1.06	.44	.001
27	08	People will become addicted to computers.	-0.55	1.02	.46	.001
28	17	People will not have to learn to do things for themselves because computers will do things for them at the push of a button.	-0.56	0.89	.51	.001
29	34	Computers will get out of human control and control our lives.	-0.58	0.87	.56	.001
30	14	People will become too dependent on information machines.	-0.63	1.06	.61	.001
31	25	Power will be in the hands of the few people who understand computers.	-0.66	0.89	.55	.001
32	09	Information machines will turn us into passive consumers of information.	-0.69	0.88	.55	.001
33	28	Computer terminals with screens will damage the eyes of frequent users.	-0.73	0.84	.45	.001
34	27	Other people will use computers to invade our privacy.	-0.94	0.93	.59	.001

R is the rank order of the items.
N is the number of the item in the original ANIM scale (see section B of Appendix B Attitudes to machines scale).
MEAN is the average score on the item for the 100 subjects (see Figure 6 for range of possible scores).
S. D. is the standard deviation of the average scores for the 100 subjects.
C is the correlation between score on the item and score on the total ANIM test.
p is the probability that such a correlation can be attributed to chance.

FIGURE 8 DISTRIBUTION OF RESPONSES IN SECTION B, ATTITUDES TO INFORMATION MACHINES SCALE (CONTINUED)

R	N		0	1	2	3	4	5	MEAN	S.D.	C	p
01	41	Watching an operation.	27	23	26	08	14	02	1.58	1.35	.45	.001
02	33	Cutting down a tree with a chain saw.	27	28	18	07	14	06	1.50	1.37	.52	.001
03	42	Seeing a dentist's drill.	33	25	19	08	15	00	1.47	1.41	.45	.001
04	12	Listening to someone explain how something works and finding you do not understand.	26	36	22	10	05	01	1.31	1.12	.46	.001
05	21	Using a chain saw.	30	29	23	10	05	03	1.29	1.16	.42	.001
06	37	Using a machine that you have never used before.	22	53	19	03	02	01	1.09	0.85	.64	.001
07	17	Firing a rifle.	31	26	16	08	15	04	1.05	1.42	.49	.001
08	49	Driving in rush-hour traffic.	41	31	14	05	07	02	1.04	1.19	.63	.001
09	16	Going up on a ski tow.	42	31	12	07	06	02	1.02	1.18	.38	.001
10	01	Taking a driving test.	39	38	12	04	05	02	0.96	1.07	.34	.001
11	38	Using an automatic bank teller with people waiting in line behind you.	39	37	08	02	05	09	0.87	1.05	.62	.001
12	15	Thinking about taking a driving test.	43	37	10	02	05	03	0.86	1.04	.48	.001
13	07	Seeing a complicated diagram of a machine.	45	34	14	02	03	02	0.81	0.97	.41	.001
14	18	Flying.	48	35	09	01	05	02	0.78	1.02	.34	.001
15	31	Driving a skidoo.	51	21	11	04	03	10	0.74	1.06	.55	.001
16	05	Having a mechanic explain what is wrong with your car.	53	30	07	04	03	03	0.70	0.99	.32	.001
17	14	Taking a photograph with a complicated camera.	58	34	10	04	00	02	0.67	0.82	.52	.001
18	11	Changing a tire.	59	23	10	04	01	03	0.61	1.91	.45	.001
19	44	Talking to a telephone-answering machine.	57	29	06	03	01	04	0.56	0.83	.47	.001
20	45	Checking your restaurant bill with a calculator.	65	18	07	02	03	05	0.53	0.95	.34	.001
21	23	Using a computer.	58	29	07	01	01	04	0.52	0.77	.50	.001
22	39	Brushing your teeth with a electric tooth-brush.	65	19	04	05	01	06	0.49	0.89	.37	.001
23	29	Asking a mechanic to explain what is wrong with your car.	63	24	08	01	01	03	0.48	0.78	.42	.001
24	13	Reading instruction manual for a radio you have bought.	70	17	08	02	02	01	0.47	0.88	.56	.001
25	09	Watching a science fiction movie.	66	19	07	00	03	05	0.47	0.86	.40	.001

R is the rank order of the items.
N is the number of the item in the original TRS scale (see section C of Appendix B Attitudes to Machines Scale).
MEAN is the average score on the item for the 100 subjects (range of scores from 0 to 4).
S. D. is the standard deviation of the average scores for the 100 subjects.
C is the correlation between score on the item and score on the total TRS test.
p is the probability that such a correlation can be attributed to chance.

FIGURE 9 DISTRIBUTION OF RESPONSES IN SECTION C, TECHNOPHOBIA RATING SCALE

R	N		0	1	2	3	4	5	MEAN	S.D.	C	p
26	40	Taking a class in auto mechanics.	66	19	06	03	01	05	0.46	0.84	.56	.001
27	48	Driving under an electronic garage door.	63	29	05	01	00	02	0.43	0.64	.34	.001
28	30	Visiting an assembly-line factory.	70	19	02	01	03	05	0.40	0.86	.48	.001
29	35	Listening to a vacuum cleaner salesperson explain technical details of the product.	71	18	03	02	02	04	0.40	0.83	.45	.001
30	03	Listening to someone explain how something works.	71	22	03	01	02	01	0.39	0.78	.33	.001
31	20	Travelling alone in an elevator.	76	12	06	02	02	02	0.39	0.86	.44	.001
32	28	Visiting the cockpit of a plane you are flying in.	74	15	06	01	02	02	0.39	0.82	.42	.001
33	27	Putting a roll of film into a 35mm. camera.	71	19	04	00	01	05	0.33	0.66	.43	.001
34	10	Reading How Things Work.	71	16	03	01	01	08	0.32	0.69	.36	.001
35	50	Stepping on and off an escalator.	79	13	05	01	00	02	0.27	0.60	.24	.006
36	22	Playing an electronic game in an amusement arcade.	76	14	01	01	01	07	0.25	0.64	.39	.001
37	19	Explaining how something works to a child.	80	15	03	01	00	01	0.24	0.55	.45	.001
38	36	Projecting a movie in your home for friends.	78	17	01	00	01	03	0.24	0.57	.37	.001
39	06	Changing the ribbon in a typewriter.	82	13	03	00	01	01	0.23	0.60	.32	.001
40	24	Helping a child construct a machine with a Meccano set	78	16	01	01	00	04	0.22	0.51	.36	.001
41	47	Making a long-distance telephone call.	80	15	02	01	00	02	0.22	0.53	.43	.001
42	34	Using an electric can-opener.	84	11	03	00	01	01	0.21	0.59	.38	.001
43	25	Replacing a light bulb.	87	08	02	00	02	01	0.20	0.67	.34	.001
44	46	Adjusting the controls on a television set.	87	08	01	00	02	02	0.18	0.65	.25	.006
45	43	Getting cigarettes from a vending machine.	84	08	00	01	01	06	0.16	0.57	.42	.001
46	02	Setting an alarm clock.	94	04	01	00	01	00	0.10	0.48	.20	.012
47	04	Using a pocket calculator.	92	07	00	01	00	00	0.10	0.39	.27	.004
48	26	Using a telephone in a telephone booth.	94	03	01	00	01	01	0.09	0.48	.26	.005
49	32	Loading a dish washer.	92	02	00	00	01	05	0.06	0.43	.24	.009
50	08	Setting a thermostat.	94	03	00	00	00	03	0.03	0.17	.21	.016

R is the rank order of the items.
N is the number of the item in the original TRS scale (see section C of Appendix B Attitudes to Machines Scale).
MEAN is the average score on the item for the 100 subjects (range of scores from 0 to 4).
S. D. is the standard deviation of the average scores for the 100 subjects.
C is the correlation between score on the item and score on the total TRS test.
p is the probability that such a correlation can be attributed to chance.

FIGURE 9 DISTRIBUTION OF RESPONSES IN SECTION C, TECHNOPHOBIA RATING SCALE (CONTINUED)

	FAMILIARITY	ATTITUDE	TECHNOPHOBIA	MACHINES	SEX	AGE	SCHOOLING	INTEREST
FAMILIARITY (A)		.02	-.04	.40 (.001)	-.13	.15 (.071)	.44 (.001)	-.11
ATTITUDE (B)			-.26 (.004)	.12	-.10	-.04	-.07	-.05
TECHNOPHOBIA (C)				.00	.18 (.035)	.04	.05	.15 (.071)
MACHINES (D)					.13 (.097)	-.12	-.04	.25 (.006)
SEX (E1)						-.10	-.12	.10
AGE (E2)							.45 (.001)	.02
SCHOOLING (E3)								-.26 (.004)
INTEREST (E4)								

The numbers in parentheses refer to the probability that the correlation above is significant.

FIGURE 10 MATRIX OF INTERCORRELATIONS AMONG TOTAL SCORES IN SECTIONS A, B, C, D OF QUESTIONNAIRE AND DEMOGRAPHIC VARIABLES IN SECTION E

4.3 Discussion

Figures 7 through 10, summarizing the results of the research, are designed to speak for themselves. Some commentary on each figure will, however, help to clarify the results. Let us look at each figure in turn.

In Figure 7 - summarizing the responses to Section A of the questionnaire, Familiarity with new information machines - Telidon and related concepts are written in upper case to highlight their relative position among those new information machines. Their relatively low position is partly an artifact of the measuring instrument - they are not yet generally available and thus a subject can score 3 only if he/she has participated in a demonstration and can not score 4 at all. However, it is interesting to note that almost 60% of a college-educated sample have never even heard of Telidon. It is heartening though to supporters of this Canadian version of videotex to see that almost 80% have never even heard of the British equivalent (Prestel) and almost 90% have never even heard of the French equivalent (Antiope).

At the other end of the scale, the over 60% penetration of pocket calculators in such a short period since they became available suggests that there will be significant shifts up this scale over the next few years. It will be interesting to use this scale over those years to monitor the "penetration" of those concepts into public awareness.

Figure 8 summarizes the responses to Section B of the questionnaire - Attitudes to new information machines. Of the 16 items with positive means (listed on the first page of the figure), only 7 correlate with the total ANIM score at the .001 level of significance; whereas, of the 18 items with negative means (listed on the second page of the figure), 15 correlate with the total ANIM score at this level of significance. This suggests that positive attitudes to those new information machines are more differentiated than negative attitudes. That is, they tend to be rejected because of a vague general apprehension about them but accepted because of the subjects' perception of two or more positive impacts on our society.

A formal procedure has been suggested for eliminating items based on an item analysis (76a). However, it is suggested that the items with lowest correlations be successively dropped until a reliability score of .80 is obtained. The split-half reliability cofficient of this test as-is is already .81. However, correlations with probabilities less than .005 are dropped to tighten up the scale. The final ANIM scale is found in Appendix D. It contains 26 items; 8 items were dropped from the original scale.

Figure 9 summarizes the responses to Section C of the questionnaire - Technophobia rating scale. The most frightening items tend to be those involving scalpels, chain saws, drills, and rifles, confirming the suggestion above that technophobia differs from math phobia in that machines are physically dangerous. However, two items ranked in the first six ("Listening to someone explain how something works and finding you do not understand" and "using a machine that you have never used before") point to the same sort of psychic dangers involved in math phobia. Such psychic dangers - of failing, of feeling stupid, etc. - may play a larger role with respect to information machines since their threat is more psychical than physical.

Once again the split-half correlation coefficient is greater than .80 (.84 to be precise) but the items which correlate with the total TRS score at a level less than .001 are arbitrarily eliminated. The items which fail to discriminate tend to be those for which the vast majority of subjects indcate that they were not at all afraid. Elimination of such items, however, still leaves items like "making a long-distance telephone call", "using an electric can-opener", "replacing a light bulb", and "getting cigarettes from a vending machine". Ten per cent or more of a sophisticated sample admitted to some fear in performing such apparently innocuous tasks. There is little doubt then that technophobia is widespread in our technological society. The final TRS scale is found in Appendix E. It contains 43 items; 7 items were dropped from the original scale.

The ANIM and TRS scales appear to be measuring something and, in their revised forms, will measure their respective "somethings" more consistently. It is necessary to turn to Figure 10 to determine if there is any evidence that those somethings are the things which the scales were designed to measure.

A significant negative correlation between scores on the ANIM and TRS scales (-0.26, p less than .004) is encouraging. This confirms the predicted relationship between affective and cognitive dimensions of attitudes to machines. However, the attempt to demonstrate a further link between those two dimensions and the third conative dimension failed miserably. There was no correlation between the scales and either familiarity with new information machines (Section A of questionnaire) or number of machines in your life (Section D of questionnaire). The fact that those two scales correlate significantly with one another (0.40, p less than .001) suggests that they are both picking up some other factor. However, this factor is not related, as anticipated, to our feelings or thoughts about machines. Perhaps in our machine-saturated society, we are forced to use established machines (Section D) and to be aware of emerging machines (Section A) regardless of our feelings and thoughts about them.

The demographic data collected in Section E was designed to supply further construct validity by showing consistent group differences on scores in the ANIM and TRS scales. The first variable, sex, correlated negatively with the ANIM scale (-.10) and positively with the TRS scale (.18). Though not impressive, those correlations are encouraging, since they suggest, as anticipated, that women tend to have more negative attitudes to machines and to be more technophobic. The second and third variables - age and schooling - do not correlate with either scale. The sample was too homogeneous with respect to those variables to provide an adequate test of the hypotheses. The fourth variable, interest-competence, correlated negatively with ANIM (-.05) and positively with TRS (.15). Both correlations are in the right direction but are discouragingly low. The variable is clumsily measured, however. Most subjects found it very difficult to put themselves in one category and many subjects chose a fourth category - practical skills, which was added in a fit of absentmindedness and which does not contribute to the hypothesis. Comparisons of groups enrolled in natural science, social science, and humanities classes or, better, of students majoring in those areas or, even better yet, of professional groups would constitute a much better test of the hypothesis.

4.4 Proposal for phase II

The two scales developed in this project are designed to provide uniform instruments to be administered in a number of field trials of Telidon, of integrated office systems, and of whatever technological innovation appears on the horizon. The large amount of data so generated will provide some understanding of attitudes to new technology and their role in public resistance to new technology. This first section of a proposal for phase II is designed to realize the potential of the scales by orchestrating their administration.

It involves the following steps:

(a) Prepare a supply of the final versions of the ANIM and TRS scales.

(b) Inform field trial operators that they are available.

(c) Distribute copies to field trial operators on request, with instructions for administration, suggestions about their possible role within the field trial design, and a request that the data be made available for analysis.

(d) Analyse the data and present the results of the analysis to the field trial operators and to the Department of Communications.

(e) Integrate the data from each successive field trial with the data from previous trials and, in an iterative manner, devise more and more precise hypotheses to test in subsequent trials.

(f) In the light of the theoretical findings, provide practical suggestions for improving the person-machine interface to reduce negative attitudes and technophobia with respect to whatever new technology is being introduced.

Here are some tentative hypotheses to be tested in the early field trials:

(a) People with negative attitudes to technology (as indicated by the ANIM scale) will tend to suffer from technophobia (as indicated by the TRS scale). This is an attempt to confirm the finding here with a larger and more heterogeneous population.

(b) Technophobia will tend to "run in families". This hypothesis is based on the assumption that, whereas math phobia is "learned" mainly in school, technophobia is learned mainly in the home.

(c) People with negative scores in ANIM and high scores in TRS will tend to reject new technologies. "Rejection" and "acceptance" will be defined as end-points on a dimension of public resistance, which will be operationalized in the field trials by usage scores. This hypothesis is another attempt at testing the hypothesis which failed in this project - i.e. that the cognitive and affective dimensions of attitudes to technology (as measured, respectively, by the ANIM and TRS scales) will be correlated with the conative dimension. Perhaps precise measures of the conative dimension using usage scores will pick up a phase in the process of penetration of a new technology between its penetration into a person's awareness (as measured by Section A of the questionnaire, familiarity with new information machines) and its penetration into that person's everyday life (as measured by Section D of the questionnaire, number of machines in your life). It is during this transitional phase, perhaps, that people with negative attitudes and technophobia reject a new technology before grudgingly accepting it as another regrettable but inevitable part of the technological environment.

(d) Scores will be more negative in the ANIM scale and higher on the TRS scale for women as opposed to men, for older people as opposed to younger people, for people with many years of schooling as opposed to people with few years of schooling, for people interested in sciences as opposed to people interested in arts. Those hypotheses are attempts to retest hypotheses which failed in this project in a larger and more heterogeneous sample.

Public resistance to new technology could be a major theme of the "electronic eighties". Like most important topics, it is a complex phenomenon. This second section of phase II is designed to gain a better conceptual grasp of it. One important element is attitudes to technology, as explored in this project. Another possible important element is attitudes to innovation, as discussed briefly in Section 2.2.

A tentative attempt to consider the role of this second "actor" and its dialogue with the first was made by including three items in ANIM which reflect attitudes to innovation as well as attitudes to technology (items 13, 20, 30) and two items in TRS which reflect fear of newness as well as fear of technology (items 12, 37). The items did not distinguish themselves - they all correlated at the .001 level of significance with the relevant total scores. The ANIM items were all phrased in terms of electronic analogues replacing traditional systems. Their rankings possibly reflect attitudes to those systems - replacing mail delivery (ranked 9 of the 34 items), replacing shopping (ranked 16), and replacing print media (ranked 19). The TRS items were ranked 4 and 6 of the 50 items, way up there among the chain saws, drills, and rifles, suggesting that newness may be an important component of technophobia.

This second section of phase II (conducted concurrently with the first section) would involve the following steps:

(a) Review of psychological literature on attitudes to innovation, starting with the on-line search already provided by the Department of Communications.

(b) Review of psychometric literature to determine which extant test could best measure attitudes to innovation.

(c) Incorporation of this test into the testing program within field trials as presented in the first section of Phase II.

(d) Analysis of variance in usage scores with respect to the new technology to determine how much of the variance is due to the "new" and how much is due to the "technology" and how much is due to the interaction between them.

(e) Final report describing both the theoretical analysis and empirical results.

FOOTNOTES

a Though the emphasis here is on attitudes to technology, I include attitudes to science, since it is becoming increasingly difficult to disentangle them. Despite our protests about our purity, the public is becoming more aware that science and technology are intimately intertwined. Thus, as would be predicted by consistency theories, attitudes to science are moving closer to attitudes to technology. This introduces another practical implication of this study. Public support for Research and Development funding is a function of public attitudes to science and technology. Fred Knelman (50) has argued that increasing sophistication of the public is generating an insistance that R & D becomes R & D & D (Dissemination).

b Nevertheless, the ups and downs of Canadian Prime Ministers and United States Presidents are compulsively polled. The style of a Kennedy makes better theater than that of a Ford but the events continue relatively independent of their interventions. Now that the U. S. public has cancelled the Carter show because of poor ratings and cast the Reagans to play First Family to liven up their televiewing, we finally have a professional actor playing President of the United States, and may become more aware of the extent to which it is a role and it does not really matter very much who plays the part (which offers some consolation to those apprehensive about the current incumbent in the White House). The large percentage of the voters who chose the fourth category on the ballot - none of the above - perhaps reflects increasing public awareness of this fact.

c I am indebted to Fred Knelman of Concordia University for this terminology and this conception of technology assessment.

d However, in practice, acceptance or rejection are rarely total. Even the machines which have achieved very high penetration in industrialized countries (automobile, telephone, television, etc.) are rejected by some people who choose not to use them or, at least, not to own them. What seems like rejection of a technology may be simply a temporary resistance which is subsequently overcome. To continue the friction metaphor, it is as if the public is riding the brake of the technological juggarnaut - hard enough sometimes to stop it but subsequently easing up. The study of the acceptance and the rejection of technology is therefore

the same study from two different points of view - they are both studying resistance to new technology with rejection and acceptance being theoretical end-points of the resistance dimension.

e The image of people representing each of those "actors" crowded on to a stage giving their "concert" with no one in the "audience" may help make this point more vivid.

f Though we tend to study attitudes to technology-in-general, we do not tend to study attitudes to people-in-general. This could be interesting. I have always been fascinated by how people answer the telephone. Since all they know as they pick it up is that there is some other person on the other end, their typical tone would reflect their attitude to people-in-general. As the tone shifts when they identify you (from gruff to pleasant or from pleasant to gruff), you find out where you stand with respect to people-in-general. On the other hand, studies of attitudes to technology-in-general may not predict behavior with respect to specific machines, since our attitudes to the myriads of machines in our environment may be almost as complex as our attitudes to the myriads of people, especially since, as mentioned above, the number of machines is increasingly outpacing the number of people.

g If pressed further, they will say that they are positive about good machines and negative about bad machines. It is in the definitions of good and bad that they begin to be differentiated. Good machines are those that they personally find useful and bad machines are those they find threatening. A friend who owns a translating business was praising the word-processor, which facilitates translation within his organization. However, when I mentioned my translating machine, which would facilitate translation outside his organization, he dismissed it as a useless toy. Another friend loves Beethoven but hates machines. When confronted with the fact that Beethoven came to him courtesy of machines, whether record-players or orchestral instruments, he decided that those were not "really machines". Carol Taviss (104) describes a subject who was anti-technology but admitted whimsically that she did not know how she would survive without her car. Appropriate technology, it seems, is <u>my</u> technology.

h It is not clear from the article whether attitudes to old technologies influence attitudes to new technologies which

are associated with them. This, however, would make sense. One practical implication for the marketing of Telidon is the description of the company it keeps. It is being presented as two-way television and thus linked to the established technology of television. However, it could equally well be presented as an extension of the telephone - that is, it enables you to use your telephone to talk not only to other people but also to machines which can give you a lot of useful information. The television screen is merely a device for displaying this information to you. If the telephone has a better "press" than the television, then this would be a better way of marketing Telidon. Or perhaps one population (those of lower socio-economic status?) would more willingly accept it as an extension of the television whereas another population (those of higher socio-economic status?) would more willingly accept it as an extension of the telephone. By the same logic, whether you would want to emphasize that the machine one can talk to is a computer would depend on public attitudes to the computer.

i This conflict is seen in its most blatant form in the child venturing away from the mother but rushing back when threatened. As we get older, we get further and further away for longer and longer periods. Neil Armstrong got all the way to the moon without his mother. However, many of us never venture very far from our suburban castle, corner bar, tenured position or whatever symbolic equivalent we have established for our mothers' skirts.

j The terms "technophobia" and "technophilia" provide an interesting comment on how quickly those phenomena are shifting from the periphery to the core of our consciousness (or perhaps simply an illustration of selective perception). When I started thinking about those phenomena early in 1980, I thought I had invented the terms. An on-line computer search of the Psychological Abstracts database, however, yielded one reference in an obscure Iron Curtain journal in which capitalist thinkers were accused of either overenthusiastic acceptance of technology (technophilia - though the term was not used) or technophobia. In May, I was told that Francois Hetman had used both terms in his Society and the Assessment of Technology (44). By July, at the World Future Society meeting in Toronto, the words were suddenly everywhere. There was a session entitled Mental Health: Technophobia or Technophilia? A special interest group was formed to study the phenomena. A Globe and Mail article included "technophobia" in a list of buzz words, and Alvin Toffler included it in a list of fads in The Third Wave. I'm in future shock to see terms moving from discovery to fad in

six months. However, faddish or not, the terms have not yet percolated into the professional literature. An on-line search in March 1981 of Infomart's Data Base Index (which provides a ranking of frequency of terms within the various data bases in the System Development Corporation computer) reveals that none of those data bases contain more than two postings of either "technophobia" or "technophilia".

k A sampling from various articles testing the model - "behavioral intervention model", "behavioral intentions model", "Fishbein 67", "Fishbein & Ajzen 75", Fishbein's extended model", "extended behavioral intention model", "theory of attitudinal antecedents", "relevance-expectancy model", "expectancy-evaluation attitude model", "behavior prediction model", "behavioral intention model", "linearity index", "linear model", "regression model", "behavior intentions". It will be nice when - like the Likert scale and the Thurstone scale and the Guttman scale - it settles down as the Fishbein scale.

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NAME _____ Total Score _____

MATHEMATICS ANXIETY RATING SCALE (MARS)

The items in the questionnaire refer to things and experiences that may cause fear or apprehension. For each item, place a check (✓) in the box under the column that describes how much you are frightened by it nowadays. Work quickly but be sure to consider each item individually.

	Not at all	A little	A fair amount	Much	Very much
1. Determining the amount of change you should get back from a purchase involving several items.	☐	☐	☐	☐	☐
2. Having someone watch you as you total up a column of figures.	☐	☐	☐	☐	☐
3. Having someone watch you as you divide a five digit number by a two digit number.	☐	☐	☐	☐	☐
4. Being asked to add up 976 + 777 in your head.	☐	☐	☐	☐	☐
5. Dividing a five digit number by a two digit number in private with pencil and paper.	☐	☐	☐	☐	☐
6. Calculating a simple percentage, e. g., the sales tax on a purchase.	☐	☐	☐	☐	☐
7. Listening to a salesman show you how you would save money by buying his higher priced product because it reduces long term expenses.	☐	☐	☐	☐	☐
8. Listening to a person explain how he figured out your share of expenses on a trip, including meals, transportation, housing, etc.	☐	☐	☐	☐	☐
9. Having to figure out how much it will cost to buy a product on credit (figuring in the interest rates).	☐	☐	☐	☐	☐
10. Totaling up a dinner bill that you think overcharged you.	☐	☐	☐	☐	☐
11. Telling the cashier that you think the dinner bill was incorrect and watching the cashier total up the bill.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
12. Being treasurer for a club.	☐	☐	☐	☐	☐
13. Totaling up the dues received and the expenses of a club you belong to.	☐	☐	☐	☐	☐
14. Adding up 976 + 777 on paper.	☐	☐	☐	☐	☐
15. Doing a word problem in algebra.	☐	☐	☐	☐	☐
16. Solving a problem such as: If x = 11, and y = 3, then the results of x/y is equal to_____?	☐	☐	☐	☐	☐
17. Solving the problem such as: If x = 12, and y = 4, then the ratio of x to y is equal to_____?	☐	☐	☐	☐	☐
18. Determining the grade point average for your last term.	☐	☐	☐	☐	☐
19. Reading an article on the basketball team, showing what percentage of free throws each player made, the percentage of field goals made, the total number attempted, etc.	☐	☐	☐	☐	☐
20. Reading an historical novel with many dates in it.	☐	☐	☐	☐	☐
21. Counting the number of pages left in a novel you are engrossed in.	☐	☐	☐	☐	☐
22. Guessing at the number of people attending a dance you're at.	☐	☐	☐	☐	☐
23. Buying a math textbook.	☐	☐	☐	☐	☐
24. Watching someone work with a slide rule.	☐	☐	☐	☐	☐
25. Watching a teacher work an algebraic equation on the blackboard.	☐	☐	☐	☐	☐
26. Signing up for a math course.	☐	☐	☐	☐	☐
27. Listening to another student explain a math formula.	☐	☐	☐	☐	☐
28. Walking into a math class.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
29. Having to compute the miles/gallon on your car.	☐	☐	☐	☐	☐
30. Watching someone work with a calculator.	☐	☐	☐	☐	☐
31. Looking through the pages of a math text.	☐	☐	☐	☐	☐
32. Working on an income tax form.	☐	☐	☐	☐	☐
33. Reading your W-2 form (or other statement showing your annual earning and taxes).	☐	☐	☐	☐	☐
34. Studying for a math test.	☐	☐	☐	☐	☐
35. Starting a new chapter in a math book.	☐	☐	☐	☐	☐
36. Walking on campus and thinking about a math course.	☐	☐	☐	☐	☐
37. Meeting your math teacher while walking on campus.	☐	☐	☐	☐	☐
38. Reading the word "Statistics."	☐	☐	☐	☐	☐
39. Sitting in a math class and waiting for the instructor to arrive.	☐	☐	☐	☐	☐
40. Solving a square root problem.	☐	☐	☐	☐	☐
41. Signing up for a course in Statistics.	☐	☐	☐	☐	☐
42. Checking over your monthly bank statement.	☐	☐	☐	☐	☐
43. Taking the math section of a college entrance exam.	☐	☐	☐	☐	☐
44. Having someone explain bank interest rates as you decide on a savings account.	☐	☐	☐	☐	☐
45. Raising your hand in a math class to ask a question.	☐	☐	☐	☐	☐
46. Reading and interpreting graphs or charts.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
47. Reading a cash register receipt after your purchase.	☐	☐	☐	☐	☐
48. Figuring the sales tax on a purchase that costs more than $1.00.	☐	☐	☐	☐	☐
49. Having a person illustrate to you the best way to divide your money into a savings and a checking account.	☐	☐	☐	☐	☐
50. Figuring out which of two summer job offers is the most lucrative: where one involves a lower salary, room and board, and travel, while the other one involves a higher salary but no other benefits.	☐	☐	☐	☐	☐
51. Reading a formula in chemistry.	☐	☐	☐	☐	☐
52. Hearing a lecture in a social science class where the instructor is commenting on some figures, e. g., the percentage of each socio-economic group who voted Republican.	☐	☐	☐	☐	☐
53. Taking an examination (quiz) in a math course.	☐	☐	☐	☐	☐
54. Taking an examination (final) in a math course.	☐	☐	☐	☐	☐
55. Hearing two of your friends exchanging opinions on the best way to calculate the cost of a product.	☐	☐	☐	☐	☐
56. Having someone ask you to recheck his figures in a simple calculation, such as division, or addition.	☐	☐	☐	☐	☐
57. Being asked by a friend to answer the question: how long will it take to get to Denver if I drive at 30 miles per hour?	☐	☐	☐	☐	☐
58. Studying for a driver's license test and memorizing the figures involved, such as the distances it takes to stop a car going at differing speeds.	☐	☐	☐	☐	☐
59. Hearing friends make bets on a game as they quote the odds.	☐	☐	☐	☐	☐
60. Playing cards where numbers are involved, e. g., bridge or poker.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

	Not at all	A little	A fair amount	Much	Very much
61. Hearing a friend try to teach you a math procedure and finding that you cannot understand what he is telling you.	☐	☐	☐	☐	☐
62. Scheduling my daily routine to allocate set times for classes, for study time, for meals, for recreation, etc.	☐	☐	☐	☐	☐
63. Juggling class times around at registration to determine the best schedule.	☐	☐	☐	☐	☐
64. Deciding which courses to take in order to come out with the proper number of credit hours for full time enrollment.	☐	☐	☐	☐	☐
65. Working a concrete, everyday application of mathematics that has meaning to me, e. g., figuring out how much I can spend on recreational purposes after paying other bills.	☐	☐	☐	☐	☐
66. Working on an abstract mathematical problem, such as: "If x = outstanding bills, and y = total income, calculate how much you have left for recreational expenditures."	☐	☐	☐	☐	☐
67. Being given a set of numerical problems involving addition to solve on paper.	☐	☐	☐	☐	☐
68. Being given a set of subtraction problems to solve.	☐	☐	☐	☐	☐
69. Being given a set of multiplication problems to solve.	☐	☐	☐	☐	☐
70. Being given a set of division problems to solve.	☐	☐	☐	☐	☐
71. Picking up the math text book to begin working on a homework assignment.	☐	☐	☐	☐	☐
72. Being given a homework assignment of many difficult problems which is due the next class meeting.	☐	☐	☐	☐	☐
73. Thinking about an upcoming math test one week before.	☐	☐	☐	☐	☐
74. Thinking about an upcoming math test one day before.	☐	☐	☐	☐	☐
TOTAL	___	___	___	___	___

	Not at all	A little	A fair amount	Much	Very much
75. Thinking about an upcoming math test one hour before.	☐	☐	☐	☐	☐
76. Thinking about an upcoming math test five minutes before.	☐	☐	☐	☐	☐
77. Talking to someone in your class who does well about a problem and not being able to understand what he is explaining.	☐	☐	☐	☐	☐
78. Waiting to get a math test returned in which you expected to do well.	☐	☐	☐	☐	☐
79. Waiting to get a math test returned in which you expected to do poorly.	☐	☐	☐	☐	☐
80. Walking to math class.	☐	☐	☐	☐	☐
81. Realizing that you have to take a certain number of math classes to fulfill the requirements in your major.	☐	☐	☐	☐	☐
82. Picking up a math textbook to begin a difficult reading assignment.	☐	☐	☐	☐	☐
83. Being called upon to recite in a math class when you are prepared.	☐	☐	☐	☐	☐
84. Not knowing the formula needed to solve a particular problem.	☐	☐	☐	☐	☐
85. Receiving your final math grade in the mail.	☐	☐	☐	☐	☐
86. Opening a math or stat book and seeing a page full of problems.	☐	☐	☐	☐	☐
87. Being responsible for collecting dues for an organization and keeping track of the amount.	☐	☐	☐	☐	☐
88. Getting ready to study for a math test.	☐	☐	☐	☐	☐
89. Listening to a lecture in a math class.	☐	☐	☐	☐	☐
90. Figuring out your monthly budget.	☐	☐	☐	☐	☐
TOTAL	___	___	___	___	___

	Not at all	A little	A fair amount	Much	Very much
91. Being given a "pop" quiz in a math class.	☐	☐	☐	☐	☐
92. Seeing a computer printout.	☐	☐	☐	☐	☐
93. Having to use the tables in the back of a math book.	☐	☐	☐	☐	☐
94. Being told how to interpret probability statements.	☐	☐	☐	☐	☐
95. Asking your math instructor to help you with a problem that you don't understand.	☐	☐	☐	☐	☐
96. Being asked to explain how you arrived at a particular solution for a problem.	☐	☐	☐	☐	☐
97. Tallying up the results of a survey or poll.	☐	☐	☐	☐	☐
98. Acting as secretary, keeping track of the number of people signing up for an event.	☐	☐	☐	☐	☐
TOTAL	____	____	____	____	____

Total Score _____

APPENDIX B

ATTITUDES TO MACHINES

In the 1960 U. S. census, there were five times as many machines as there were people. Since then, the "population" of machines in industrialized countries has increased more rapidly than the population of people. Whatever your attitude to machines, you will probably agree that your relationship to machines is an increasingly important aspect of your life.

This survey is conducted by Gamma Research Services (an independent consulting company) for the Behavioural Research Group at the Federal Government's Department of Communications. It is designed to give us some understanding of our attitudes to machines and, at the same time, to give you some insight into the role of machines in your life.

Could you please complete the attached questionnaire. It should require only about 30 minutes of your time. It is not a "test". There are no right or wrong answers. We are interested in your opinion. Just take a guess if you are not sure about any answer.

Please do not write your name on the questionnaire. Your name will not be used or released to anyone under any circumstances. Your completed questionnaire will be considered as a confidential document in accordance with the Human Rights Act, which prohibits disclosure of individual responses. The questionnaire will be used for research purposes only. All data made public will be averaged across groups to guarantee your anonymity.

If you are interested in the results of this research, please write or call Scot Gardiner at

GAMMA
3535 Queen Mary, Suite 210,
Montreal, P. Q. H3V 1H8
(514) 343-6385

Thank you for your help.

RESEARCH STUDY NUMBER TB/CT REG.- B2001

SECTION A

A new generation of machines are becoming available which are based on recent technical innovations in the telecommunication and computer industries. Many experts argue that these information-processing machines will make important changes in the way we will live in the future. Here is a list of some of these machines.

If you have heard of this machine, check "heard".
If you have seen this machine, check "seen".
If you have used this machine, check "used".
If you own or rent this machine, check "own/rent".

(If you have read about this machine, check "heard".
If you have seen a photograph or diagram of the machine, check "seen".
If you have not heard of, seen, used or owned/rented this machine, leave the line blank.)

	heard	seen	used	own/ rent
Digital watch	___	___	___	___
Digital clock	___	___	___	___
Chess-playing machine	___	___	___	___
Other electronic games	___	___	___	___
Computerized camera	___	___	___	___
Language translator	___	___	___	___
Video-disc	___	___	___	___
Home computer	___	___	___	___
Two-way television	___	___	___	___
Word processor	___	___	___	___
Telidon	___	___	___	___
Videotex receiver	___	___	___	___
Automatic bank teller	___	___	___	___
Robot	___	___	___	___

	heard	seen	used	own/ rent
Prestel	___	___	___	___
Facsimile machine	___	___	___	___
"Smart" photocopier	___	___	___	___
Optical character scanner	___	___	___	___
Video taperecorder (VTR)	___	___	___	___
"Smart" telephone	___	___	___	___
Antiope	___	___	___	___
Computer terminal with screen	___	___	___	___
Computer terminal with print-out	___	___	___	___
Teletext receiver	___	___	___	___
Electronic cash register	___	___	___	___
Pocket calculator	___	___	___	___
Telephone-answering machine	___	___	___	___
Micro-computer	___	___	___	___

Other information machines?

_____	___	___	___	___
_____	___	___	___	___
_____	___	___	___	___
_____	___	___	___	___
_____	___	___	___	___
_____	___	___	___	___
_____	___	___	___	___
_____	___	___	___	___

SECTION B

Whereas experts tend to agree that the social impact of those information machines listed in Section A above will be profound, they differ about whether this impact will be positive or negative. Here is a list of predictions that have been made about possible social impacts of those machines during the next 10 years. Do you think those outcomes are probable or improbable? Check the appropriate column.

		VERY PROBABLE	IMPROBABLE	DON'T KNOW	PROBABLE	VERY PROBABLE
1	Home computers will enable people to work more at home.	___	___	___	___	___
2	Records will be kept about what information is requested from electronic home information systems.	___	___	___	___	___
3	Computers will be used more and more in education.	___	___	___	___	___
4	People living in the country will not have to go to the city for information.	___	___	___	___	___
5	Computers will reduce unemployment.	___	___	___	___	___
6	Much of the content of information machines will come from the United States.	___	___	___	___	___
7	Computers will give us more leisure time.	___	___	___	___	___
8	People will become addicted to computers.	___	___	___	___	___
9	Information machines will turn us into passive consumers of information.	___	___	___	___	___
10	Polls and referendums on political issues will be conducted through home computers.	___	___	___	___	___
11	Robots will take over much of the mechanical work.	___	___	___	___	___

		VERY IMPROBABLE	IMPROBABLE	DON'T KNOW	PROBABLE	VERY PROBABLE
12	Individuals will have access to more information.	___	___	___	___	___
13	Traditional mail delivery will be largely replaced by electronic mail in which messages are sent directly from one terminal to another.	___	___	___	___	___
14	People will become too dependent on information machines.	___	___	___	___	___
15	People will have more personal power because they have access to all information in all places at all times.	___	___	___	___	___
16	Computers will overload people with information.	___	___	___	___	___
17	People will not need to learn to do things for themselves because computers will do everything for them at the press of a button.	___	___	___	___	___
18	Computers will enable business and government to provide more efficient services.	___	___	___	___	___
19	The information machines will take up a large part of each day.	___	___	___	___	___
20	Traditional shopping will be replaced by teleshopping in which one previews goods presented on the television screen and orders them by telephone.	___	___	___	___	___
21	Computers will be too expensive - most people won't be able to afford them.	___	___	___	___	___
22	People will communicate mostly through machines rather than face-to-face.	___	___	___	___	___

		VERY IMPROBABLE	IMPROBABLE	DON'T KNOW	PROBABLE	VERY PROBABLE
23	Human nature will be changed because computers extend the functions of our minds.	___	___	___	___	___
24	A National Data Bank will be established to keep records of all citizens.	___	___	___	___	___
25	Power will be in the hands of the few people who understand computers.	___	___	___	___	___
26	All information will be available in all places at all times.	___	___	___	___	___
27	Other people will use computers to invade our privacy.	___	___	___	___	___
28	Computer terminals with screens will damage the eyes of frequent users.	___	___	___	___	___
29	Work schedules will become more flexible since people can work when and where they like.	___	___	___	___	___
30	Electronic devices will replace books, newspapers, and other print media.	___	___	___	___	___
31	Personal relationships will improve since computers will be doing the slave work leaving us more time to spend with one another.	___	___	___	___	___
32	Society will be polarized around those who love the new machines and those who fear them.	___	___	___	___	___
33	New electronic home services will help those who are house-bound (handicapped, old) lead more productive lives.	___	___	___	___	___
34	Computers will get out of human control and control our lives.	___	___	___	___	___

Here is the same list of predictions. This time, let us assume that each of them has come true. Some of the outcomes are positive and some are negative. Show how you feel about each prediction coming true by checking the appropriate column.

		VERY NEGATIVE	QUITE NEGATIVE	DON'T CARE	QUITE POSITIVE	VERY POSITIVE
1	Home computers will enable people to work more at home.	___	___	___	___	___
2	Records will be kept about what information is requested from electronic home information systems.	___	___	___	___	___
3	Computers will be used more and more in education.	___	___	___	___	___
4	People living in the country will not have to go to the city for information.	___	___	___	___	___
5	Computers will reduce unemployment.	___	___	___	___	___
6	Much of the content of information machines will come from the United States.	___	___	___	___	___
7	Computers will give us more leisure time.	___	___	___	___	___
8	People will become addicted to computers.	___	___	___	___	___
9	Information machines will turn us into passive consumers of information.	___	___	___	___	___
10	Polls and referendums on political issues will be conducted through home computers.	___	___	___	___	___
11	Robots will take over much of the mechanical work.	___	___	___	___	___

		VERY NEGATIVE	QUITE NEGATIVE	DON'T CARE	QUITE POSITIVE	VERY POSITIVE
12	Individuals will have access to more information.	___	___	___	___	___
13	Traditional mail delivery will be largely replaced by electronic mail in which messages are sent directly from one terminal to another.	___	___	___	___	___
14	People will become too dependent on information machines.	___	___	___	___	___
15	People will have more personal power because they have access to all information in all places at all times.	___	___	___	___	___
16	Computers will overload people with information.	___	___	___	___	___
17	People will not need to learn to do things for themselves because computers will do everything for them at the press of a button.	___	___	___	___	___
18	Computers will enable business and government to provide more efficient services.	___	___	___	___	___
19	The information machines will take up a large part of each day.	___	___	___	___	___
20	Traditional shopping will be replaced by teleshopping in which one previews goods presented on the television screen and orders them by telephone.	___	___	___	___	___
21	Computers will be too expensive - most people won't be able to afford them.	___	___	___	___	___
22	People will communicate mostly through machines rather than face-to-face.	___	___	___	___	___

		VERY NEGATIVE	QUITE NEGATIVE	DON'T CARE	QUITE POSITIVE	VERY POSITIVE
23	Human nature will be changed because computers extend the functions of our minds.	___	___	___	___	___
24	A National Data Bank will be established to keep records of all citizens.	___	___	___	___	___
25	Power will be in the hands of the few people who understand computers.	___	___	___	___	___
26	All information will be available in all places at all times.	___	___	___	___	___
27	Other people will use computers to invade our privacy.	___	___	___	___	___
28	Computer terminals with screens will damage the eyes of frequent users.	___	___	___	___	___
29	Work schedules will become more flexible since people can work when and where they like.	___	___	___	___	___
30	Electronic devices will replace books, newspapers, and other print media.	___	___	___	___	___
31	Personal relationships will improve since computers will be doing the slave work leaving us more time to spend with one another.	___	___	___	___	___
32	Society will be polarized around those who love the new machines and those who fear them.	___	___	___	___	___
33	New electronic home services will help those who are house-bound (handicapped, old) lead more productive lives.	___	___	___	___	___
34	Computers will get out of human control and control our lives.	___	___	___	___	___

SECTION C

The items in the following list describe things and experiences that may cause fear or apprehension.
For each item, check off the column that best describes how much you are frightened by it nowadays.
Work quickly but be sure to consider each item individually.

		not at all	a little	a fair amount	much	very much
1	Taking a driving test.	___	___	___	___	___
2	Setting an alarm clock.	___	___	___	___	___
3	Listening to someone explain how something works.	___	___	___	___	___
4	Using a pocket calculator.	___	___	___	___	___
5	Having a mechanic explain what is wrong with your car.	___	___	___	___	___
6	Changing the ribbon in a typewriter.	___	___	___	___	___
7	Seeing a complicated diagram of a machine.	___	___	___	___	___
8	Setting a thermostat.	___	___	___	___	___
9	Watching a science fiction movie.	___	___	___	___	___
10	Reading How Things Work.	___	___	___	___	___
11	Changing a tire.	___	___	___	___	___
12	Listening to someone explain how something works and finding you do not understand.	___	___	___	___	___
13	Reading instruction manual for a radio you have bought.	___	___	___	___	___
14	Taking a photograph with a complicated camera.	___	___	___	___	___

		not at all	a little	a fair amount	much	very much
15	Thinking about taking a driving test.	___	___	___	___	___
16	Going up on a ski tow.	___	___	___	___	___
17	Firing a rifle.	___	___	___	___	___
18	Flying.	___	___	___	___	___
19	Explaining how something works to a child.	___	___	___	___	___
20	Travelling alone in an elevator.	___	___	___	___	___
21	Using a chain saw.	___	___	___	___	___
22	Playing an electronic game in an amusement arcade.	___	___	___	___	___
23	Using a computer.	___	___	___	___	___
24	Helping a child construct a machine with a Meccano set.	___	___	___	___	___
25	Replacing a light bulb.	___	___	___	___	___
26	Using the telephone in a telephone booth.	___	___	___	___	___
27	Putting a roll of film into a 35 mm. camera.	___	___	___	___	___
28	Visiting the cockpit of a plane you are flying in.	___	___	___	___	___
29	Asking a mechanic to explain what is wrong with your car.	___	___	___	___	___
30	Visiting an assembly-line factory.	___	___	___	___	___
31	Driving a skidoo.	___	___	___	___	___
32	Loading a dish washer.	___	___	___	___	___
33	Cutting down a tree with a chain saw.	___	___	___	___	___

		not at all	a little	a fair amount	much	very much
34	Using an electric can-opener.	___	___	___	___	___
35	Listening to a vacuum cleaner salesperson explain technical details of the product.	___	___	___	___	___
36	Projecting a movie in your home for friends.	___	___	___	___	___
37	Using a machine that you have never used before.	___	___	___	___	___
38	Using an automatic bank teller with people waiting in line behind you.	___	___	___	___	___
39	Brushing your teeth with an electric tooth-brush.	___	___	___	___	___
40	Taking a class in auto mechanics.	___	___	___	___	___
41	Watching an operation.	___	___	___	___	___
42	Seeing a dentist's drill.	___	___	___	___	___
43	Getting cigarettes from a vending machine.	___	___	___	___	___
44	Talking to a telephone-answering machine.	___	___	___	___	___
45	Checking your restaurant bill with a calculator.	___	___	___	___	___
46	Adjusting the controls on a television set.	___	___	___	___	___
47	Making a long-distance telephone call.	___	___	___	___	___
48	Driving under an electronic garage door.	___	___	___	___	___
49	Driving in rush-hour traffic.	___	___	___	___	___
50	Stepping on and off an escalator.	___	___	___	___	___

SECTION D

In answering each of the following questions, do not try to count the number of machines.
Just make a rough guess and circle the nearest number.

How many machines did you use yesterday?

0 1 3 6 10 15 20 25 30 40 50 60 70 80 90 100 200

How many machines are there in your home?

0 1 3 6 10 15 20 25 30 40 50 60 70 80 90 100 200

How many machines have you ever used?

0 1 3 6 10 15 20 25 30 40 50 60 70 80 90 100 200

Here is a list of familiar machines.

In the first column, check off the machines which you used yesterday.

In the second column, check off the machines which you have in your home (Ignoring, of course, machines like trains and planes which you are unlikely to have at home.)

In the third column, check off the machines which you have ever used.

In the spaces provided at the end of each subsection, add the names of any machines which we have missed and check off the appropriate columns.

	used yesterday	in my home	ever used
BEDROOM/BATHROOM MACHINES			
alarm clock	___	___	___
electric tooth-brush	___	___	___
hair dryer	___	___	___
flush toilet	___	___	___
faucet	___	___	___
shower	___	___	___
_____	___	___	___
_____	___	___	___
KITCHEN MACHINES			
stove	___	___	___
refrigerator	___	___	___
dish washer	___	___	___
electric kettle	___	___	___
electric toaster	___	___	___
blender	___	___	___

	used yesterday	in my home	ever used
coffee grinder	___	___	___
electric can-opener	___	___	___
_____	___	___	___
_____	___	___	___
OTHER HOME MACHINES			
vacuum cleaner	___	___	___
washing machine	___	___	___
clothes dryer	___	___	___
central heater	___	___	___
air conditioner	___	___	___
thermostat	___	___	___
fire alarm	___	___	___
security alarm	___	___	___
lock and key	___	___	___
lawn mower	___	___	___
lawn sprinkler	___	___	___
fire extinguisher	___	___	___
_____	___	___	___
_____	___	___	___
PERSONAL MACHINES			
watch	___	___	___
pocket calculator	___	___	___
cigarette lighter	___	___	___
hearing aid	___	___	___
field glasses	___	___	___

	used yesterday	in my home	ever used
gun	___	___	___
fishing rod	___	___	___
_____	___	___	___
_____	___	___	___
ENTERTAINMENT MACHINES			
radio	___	___	___
television	___	___	___
record-player	___	___	___
cassette recorder	___	___	___
camera	___	___	___
movie camera	___	___	___
movie projector	___	___	___
slide projector	___	___	___
overhead projector	___	___	___
chess-playing machine	___	___	___
other electronic games	___	___	___
piano	___	___	___
guitar	___	___	___
_____	___	___	___
_____	___	___	___
OFFICE MACHINES			
telephone	___	___	___
telephone-answering machine	___	___	___
typewriter	___	___	___
dictaphone	___	___	___

	used yesterday	in my home	ever used
electric pencil sharpener	___	___	___
cash register	___	___	___
duplicator	___	___	___
stapler	___	___	___
word processor	___	___	___
computer terminal with screen	___	___	___
computer terminal with print-out	___	___	___
computer	___	___	___
_____	___	___	___
_____	___	___	___
TRANSPORTATION MACHINES			
elevator	___	___	___
escalator	___	___	___
bicycle	___	___	___
car	___	___	___
bus	___	___	___
train	___	___	___
plane	___	___	___
roller skates	___	___	___
jack for car	___	___	___
air pump	___	___	___
taxi-meter	___	___	___
electric garage door	___	___	___
electronic door	___	___	___
traffic light	___	___	___

	used yesterday	in my home	ever used
parking meter	___	___	___
_____	___	___	___
_____	___	___	___
OTHER MACHINES			
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
_____	___	___	___
TOTAL (please add check marks)	/___/	/___/	/___/
ESTIMATE (from page D - 1)	___	___	___
DIFFERENCE	___	___	___

Did you tend to over-estimate or under-estimate the number of machines in your life?
If so, would you like to comment on why you think you did so?

SECTION E

Thinking back on your experience with machines, how do you feel about machines in general?
(Continue on back of page if there is not enough room here.)

Could you describe the best experience you have had with a machine?

Could you describe the worst experience you have had with a machine?

Do you remember any particular machine with which you had a very good relationship?

Do you remember any particular machine with which you had a very bad relationship?

Have you noticed any change in your feelings about machines?

To help us understanding individual differences in attitudes to machines, could you please give us a little information about yourself by circling one category in each of the following.

1	SEX	a	male
		b	female
2	AGE	a	under 20
		b	20 to 29
		c	30 to 39
		d	40 to 49
		e	50 to 59
		f	over 59
3	FORMAL SCHOOLING	a	none
		b	some elementary school
		c	finished elementary school
		d	some high school
		e	finished high school
		f	some college
		g	bachelor degree
		h	some graduate or professional school
		i	graduate or professional degree
4	MAJOR INTEREST AND COMPETENCE	a	natural sciences (physics, biology, etc.)
		b	social sciences (psychology, economics, etc.)
		c	humanities (art, literature, etc.)
		d	practical skills (carpentry, weaving, etc.)

APPENDIX C

RAW DATA

CODE	SUBJECT NUMBER
FAM (A)	TOTAL SCORE ON FAMILIARITY WITH NEW INFORMATION MACHINES (SECTION A OF QUESTIONNAIRE)
ANIM (B)	TOTAL SCORE ON ATTITUDES TO NEW INFORMATION MACHINES (SECTION B OF QUESTIONNAIRE)
TRS (C)	TOTAL SCORE ON TECHNOPHOBIA RATING SCALE (SECTION C OF QUESTIONNAIRE)
MACH (D)	TOTAL NUMBER OF MACHINES IN YOUR LIFE (SECTION D OF QUESTIONNAIRE)
S	SEX
A	AGE
C	YEARS OF SCHOOLING
I	FIELD OF INTEREST/COMPETENCE (SECTION E OF QUESTIONNAIRE)

CODE	FAM	ANIM	TRS	MACH	S	A	C	I
___	(A)	(B)	(C)	(D)	_	_ (E)	_	_
001	33	14.25	078	097	2	3	6	3
002	58	28.54	010	122	1	2	6	1
003	47	-14.25	049	120	1	2	6	2
004	55	06.75	005	137	1	2	6	-
005	23	01.47	039	055	2	2	6	-
006	43	12.75	002	128	1	1	6	3
007	41	-04.12	104	---	1	2	7	1
008	34	07.00	021	122	2	2	6	1
009	50	10.75	012	073	1	1	6	-
010	55	02.25	002	112	1	2	9	2
011	41	14.25	020	102	1	2	6	-
012	37	19.25	014	075	1	2	6	2
013	35	18.50	031	102	1	1	6	2
014	51	38.25	013	050	1	2	7	1
015	37	-20.50	020	081	2	1	6	2
016	36	52.65	---	070	2	2	6	2
017	47	-13.50	062	055	1	1	6	1
018	44	-05.15	036	092	1	2	6	2
019	52	-07.50	067	067	1	2	9	1
020	16	00.00	013	027	2	1	6	2
021	54	01.50	024	100	1	3	9	2
022	53	00.26	032	106	2	3	7	2
023	41	-13.28	048	115	2	4	8	2
024	40	-03.75	016	103	1	3	9	3
025	44	-14.50	042	078	2	3	9	3

CODE	FAM	ANIM	TRS	MACH	S	A	C	I
___	(A	(B)	(C)	(D)	_	_ (E)	_	_
026	47	-09.00	014	099	1	3	9	3
027	41	01.29	041	111	2	3	9	2
028	46	-00.50	016	114	2	2	9	-
029	52	15.00	003	112	1	3	8	1
030	46	10.89	024	125	2	2	5	-
031	53	02.50	023	116	1	3	8	1
032	60	09.75	037	087	1	4	9	1
033	59	13.25	018	168	2	2	6	3
034	56	03.18	029	112	1	4	9	2
035	38	15.07	013	123	2	2	8	4
036	47	01.00	004	114	1	6	9	1
037	41	06.44	013	109	2	2	5	1
038	54	-17.00	025	113	1	3	7	2
039	52	00.25	063	177	2	2	7	3
040	50	07.50	020	108	2	3	8	-
041	59	-09.75	014	132	1	1	6	1
042	36	-23.50	037	092	1	2	6	3
043	58	-18.50	056	122	2	2	6	-
044	62	-06.50	029	111	1	2	7	1
045	52	-11.25	010	108	1	2	6	2
046	18	-16.50	018	047	2	3	7	-
047	35	03.98	039	056	2	3	6	3
048	28	-09.00	040	100	2	2	6	2
049	72	11.25	029	116	1	2	6	4
050	48	-10.25	034	101	1	2	7	4

CODE	FAM	ANIM	TRS	MACH	S	A	C	I
___	(A)	(B)	(C)	(D)	_	_ (E)	_	_
051	58	04.00	014	096	1	2	7	1
052	35	-10.30	014	101	1	2	8	-
053	25	-08.25	030	082	2	1	6	1
054	57	-00.50	018	104	1	2	8	1
055	40	11.77	011	042	2	3	6	-
056	36	15.23	013	081	2	1	7	2
057	36	10.00	038	064	2	1	6	2
058	47	-01.80	065	136	2	2	6	4
059	48	-12.88	067	109	1	2	7	2
060	38	-08.25	025	088	1	2	6	-
061	39	-01.75	033	108	1	1	6	2
062	25	-11.75	060	090	2	2	6	2
063	57	27.00	004	118	1	1	6	3
064	36	00.75	013	121	2	1	6	2
065	41	06.44	003	101	2	2	6	2
066	35	-10.00	016	109	2	2	7	3
067	47	08.25	005	101	2	2	6	2
068	50	12.11	032	122	1	2	6	2
069	35	04.00	040	125	2	2	6	2
070	65	-02.58	004	134	2	3	7	1
071	42	-04.25	012	124	1	4	7	3
072	48	06.75	029	048	1	2	7	2
073	29	-02.06	027	057	1	3	8	2
074	50	-08.00	020	066	2	2	6	2
075	48	-05.05	042	111	2	2	6	3

CODE	FAM	ANIM	TRS	MACH	S	A	C	I
___	(A)	(B)	(C)	(D)	_	_ (E)	_	_
076	33	07.05	019	035	1	-	6	-
077	48	-16.21	009	095	2	1	6	2
078	51	-05.75	013	141	1	2	6	3
079	37	01.00	006	085	1	2	7	1
080	49	00.00	004	103	1	2	7	-
081	15	-25.25	072	078	2	1	6	-
082	42	-43.50	008	073	1	2	8	1
083	51	-02.75	036	113	1	2	6	1
084	48	-------	004	060	2	3	7	-
085	43	-16.00	076	100	1	2	6	4
086	26	-13.22	010	142	1	1	6	-
087	29	-07.71	043	062	-	-	-	-
088	47	-18.00	030	088	2	3	6	3
089	37	26.25	046	096	1	2	6	3
090	56	-01.03	011	124	1	2	7	1
091	42	-09.43	020	095	2	2	6	1
092	42	-07.96	023	107	2	3	6	2
093	24	-12.50	072	077	2	6	6	2
094	61	-09.50	034	110	2	3	7	3
095	49	-12.75	024	116	2	2	7	3
096	56	01.50	043	114	1	3	9	2
097	43	04.50	029	087	1	3	9	2
098	56	03.25	032	097	1	3	8	2
099	48	-17.54	042	059	2	3	8	-
100	60	06.90	010	097	2	2	8	-

ATTITUDES TO NEW INFORMATION MACHINES SCALE (ANIM)

Whereas experts tend to agree that the social impact of information machines will be profound, they differ about whether this impact will be positive or negative. Here is a list of predictions that have been made about possible social impacts of those machines during the next 10 years.
Do you think those outcomes are probable or improbable?
Check the appropriate column.

		VERY LIKELY	IMPROBABLE	DON'T KNOW	PROBABLE	VERY PROBABLE
1	Home computers will enable people to work more at home.	___	___	___	___	___
2	People living in the country will not have to go to the city for information.	___	___	___	___	___
3	People will become addicted to computers.	___	___	___	___	___
4	Information machines will turn us into passive consumers of information.	___	___	___	___	___
5	Polls and referendums on political issues will be conducted through home computers.	___	___	___	___	___
6	Robots will take over much of the mechanical work.	___	___	___	___	___
7	Individuals will have access to more information.	___	___	___	___	___
8	Traditional mail delivery will be largely replaced by electronic mail in which messages are sent directly from one terminal to another.	___	___	___	___	___
9	People will become too dependent on information machines.	___	___	___	___	___
10	People will have more personal power because they have access to all information in all places at all times.	___	___	___	___	___
11	Computers will overload people with information.	___	___	___	___	___

12	People will not need to learn to do things for themselves because computers will do everything for them at the press of a button.	___	___	___	___	___
13	Computers will enable business and government to provide more efficient services.	___	___	___	___	___
14	The information machines will take up a large part of each day.	___	___	___	___	___
15	Traditional shopping will be replaced by teleshopping in which one previews goods presented on the television screen and orders them by telephone.	___	___	___	___	___
16	People will communicate mostly through machines rather than face-to-face.	___	___	___	___	___
17	Human nature will be changed because computers extend the functions of our minds.	___	___	___	___	___
18	A National Data Bank will be established to keep records of all citizens.	___	___	___	___	___
19	Power will be in the hands of the few people who understand computers.	___	___	___	___	___
20	Other people will use computers to invade our privacy.	___	___	___	___	___
21	Computer terminals with screens will damage the eyes of frequent users.	___	___	___	___	___
22	Work schedules will become more flexible since people can work when and where they like.	___	___	___	___	___
23	Electronic devices will replace books, newspapers, and other print media.	___	___	___	___	___
24	Society will be polarized around those who love the new machines and those who fear them.	___	___	___	___	___
25	New electronic home services will help those who are house-bound (handicapped, old) lead more productive lives.	___	___	___	___	___
26	Computers will get out of human control and control our lives.	___	___	___	___	___

Here is the same list of predictions. This time, let us assume that each of them has come true. Some of the outcomes are positive and some are negative. Show how you feel about each prediction coming true by checking the appropriate column.

		VERY NEGATIVE	NEGATIVE QUITE A BIT	DON'T CARE	POSITIVE QUITE A BIT	VERY POSITIVE
1	Home computers will enable people to work more at home.	___	___	___	___	___
2	People living in the country will not have to go to the city for information.	___	___	___	___	___
3	People will become addicted to computers.	___	___	___	___	___
4	Information machines will turn us into passive consumers of information.	___	___	___	___	___
5	Polls and referendums on political issues will be conducted through home computers.	___	___	___	___	___
6	Robots will take over much of the mechanical work.	___	___	___	___	___
7	Individuals will have access to more information.	___	___	___	___	___
8	Traditional mail delivery will be largely replaced by electronic mail in which messages are sent directly from one terminal to another.	___	___	___	___	___
9	People will become too dependent on information machines.	___	___	___	___	___
10	People will have more personal power because they have access to all information in all places at all times.	___	___	___	___	___
11	Computers will overload people with information.	___	___	___	___	___

12	People will not need to learn to do things for themselves because computers will do everything for them at the press of a button.	___	___	___	___	___
13	Computers will enable business and government to provide more efficient services.	___	___	___	___	___
14	The information machines will take up a large part of each day.	___	___	___	___	___
15	Traditional shopping will be replaced by teleshopping in which one previews goods presented on the television screen and orders them by telephone.	___	___	___	___	___
16	People will communicate mostly through machines rather than face-to-face.	___	___	___	___	___
17	Human nature will be changed because computers extend the functions of our minds.	___	___	___	___	___
18	A National Data Bank will be established to keep records of all citizens.	___	___	___	___	___
19	Power will be in the hands of the few people who understand computers.	___	___	___	___	___
20	Other people will use computers to invade our privacy.	___	___	___	___	___
21	Computer terminals with screens will damage the eyes of frequent users.	___	___	___	___	___
22	Work schedules will become more flexible since people can work when and where they like.	___	___	___	___	___
23	Electronic devices will replace books, newspapers, and other print media.	___	___	___	___	___
24	Society will be polarized around those who love the new machines and those who fear them.	___	___	___	___	___
25	New electronic home services will help those who are house-bound (handicapped, old) lead more productive lives.	___	___	___	___	___
26	Computers will get out of human control and control our lives.	___	___	___	___	___

TECHNOPHOBIA RATING SCALE (TRS)

The items in the following list describe things and experiences that may cause fear or apprehension.
For each item, check off the column that best describes how much you are frightened by it nowadays.
Work quickly but be sure to consider each item individually.

		not at all	a little	a fair amount	much	very much
1	Taking a driving test.	___	___	___	___	___
2	Listening to someone explain how something works.	___	___	___	___	___
3	Having a mechanic explain what is wrong with your car.	___	___	___	___	___
4	Changing the ribbon in a typewriter.	___	___	___	___	___
5	Seeing a complicated diagram of a machine.	___	___	___	___	___
6	Watching a science fiction movie.	___	___	___	___	___
7	Reading How Things Work.	___	___	___	___	___
8	Changing a tire.	___	___	___	___	___
9	Listening to someone explain how something works and finding you do not understand.	___	___	___	___	___
10	Reading instruction manual for a radio you have bought.	___	___	___	___	___
11	Taking a photograph with a complicated camera.	___	___	___	___	___
12	Thinking about taking a driving test.	___	___	___	___	___
13	Going up on a ski tow.	___	___	___	___	___
14	Firing a rifle.	___	___	___	___	___
15	Flying.	___	___	___	___	___
16	Explaining how something works to a child.	___	___	___	___	___

		not at all	a little	a fair amount	much	very much
17	Travelling alone in an elevator.	___	___	___	___	___
18	Using a chain saw.	___	___	___	___	___
19	Playing an electronic game in an amusement arcade.	___	___	___	___	___
20	Using a computer.	___	___	___	___	___
21	Helping a child construct a machine with a Meccano set.	___	___	___	___	___
22	Replacing a light bulb.	___	___	___	___	___
23	Putting a roll of film into a 35 mm. camera.	___	___	___	___	___
24	Visiting the cockpit of a plane you are flying in.	___	___	___	___	___
25	Asking a mechanic to explain what is wrong with your car.	___	___	___	___	___
26	Visiting an assembly-line factory.	___	___	___	___	___
27	Driving a skidoo.	___	___	___	___	___
28	Cutting down a tree with a chain saw.	___	___	___	___	___
29	Using an electric can-opener.	___	___	___	___	___
30	Listening to a vacuum cleaner salesperson explain technical details of the product.	___	___	___	___	___
31	Projecting a movie in your home for friends.	___	___	___	___	___
32	Using a machine that you have never used before.	___	___	___	___	___

		not at all	a little	a fair amount	much	very much
33	Using an automatic bank teller with people waiting in line behind you.	___	___	___	___	___
34	Brushing your teeth with an electric tooth-brush.	___	___	___	___	___
35	Taking a class in auto mechanics.	___	___	___	___	___
36	Watching an operation.	___	___	___	___	___
37	Seeing a dentist's drill.	___	___	___	___	___
38	Getting cigarettes from a vending machine.	___	___	___	___	___
39	Talking to a telephone-answering machine.	___	___	___	___	___
40	Checking your restaurant bill with a calculator.	___	___	___	___	___
41	Making a long-distance telephone call.	___	___	___	___	___
42	Driving under an electronic garage door.	___	___	___	___	___
43	Driving in rush-hour traffic.	___	___	___	___	___

GARDINER, SCOT.
--A study of attitudes toward new communication technologies.

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