A PRELIMINARY STUDY OF SOME ATTITUDES TOWARDS COMPUTER TECHNOLOGY

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The Telecom strike in August, 1978, was a major industrial incident which directly brought before the community social and industrial issues raised by computerization in Australia (see, for example, The National Times, September 9, 1978, p. 25). The strike, precipitated by increasing automation of the telecommunications system, was over issues of job satisfaction, promotion, and employment opportunities for certain classes of technician. The national newspaper The Australian, ironically itself a highly computerized concern, addressed itself on many occasions in 1978 to the social impact and nature of the 'silicon chip revolution', commencing as early as May 9. In July, the paper suggested

> . . . we are entering the age of the computer holocaust. The computer is putting society's standards, as we have known them for generations, to the torch. Computer technology is taking over so many of the tasks done in the past by people, that we are entering an era in which there will not be enough work left for available human hands to do. (Editorial, The Australian, July 21, 1978.)

Later, in September, the paper ran a series of articles under the sensationalist banner "the computer holocaust" which purported to discuss the social impact of modern computer technology. Other areas of the media did not ignore the theme and, in the face of much adverse reaction to computerization, it was refreshing to find the authoritative "Four Corners" television programme drawing upon a current ERDC research project (Professor Kaneff's study of computer-aided skill acquisition by handicapped children at Woden Special School, ACT) to illustrate some positive aspects of computer technology when applied to education.

Perhaps it was predictable that at a time of high and rising unemployment, much of the attention given in the media to the impact of computer technology on society would be directed to the reduction of job opportunities. Elsewhere at the same period, however, it was possible to find rather positive statements of attitude to technological change. Kranzberg (1978) for example, argued that technology has always been related to human values, that the "march of civilization" has often been measured by technological advance, and, indeed, that technology is one of the chief factors which makes us distinctively human. He further suggested that not only is technology indispensable to our survival, but it is a major source of stimulus to art and to social justice. Such sentiments are in stark contrast to those evident in the Australian media during 1978.

The purpose of the present investigation was to conduct a small scale survey of current attitudes of the public to the issues raised by the application of computer technology in Australia. The authors were unable to locate any Australian investigation of public feelings about technology. The Social Research Centre of Canada conducted a survey in 1972 of public attitudes (reported in The Australian, May 9, 1978, and June 13, 1978). It was found at that time that areas of social concern in Canada, in order of importance, were unemployment, computer error, depersonalization, fair information reporting, and invasion of privacy. Other more general issues were involved as well. On the one hand, the computer was taken as a symbol of the technological life of twentieth century Canada, and people were aware of some of the benefits of technological progress, but, on the other hand, they were afraid and anxious about the effect of computer progress. These findings suggest an ambivalence of attitude in people to technological innovation.

Lee (1970) conducted a nationwide survey of some attitudes to the electronic computer in the United States, and suggested that the public views computer technology on two independent belief-attitude dimensions. In the first dimension, the computer is viewed as an instrument of man's purposes, helpful in science, industry, and space exploration especially. On the second dimension, however, the computer is portrayed as a relatively autonomous entity which can perform the functions of human thinking. Respondents indicated a sence of awe and inferiority in relation to this latter image of computers. There would appear to be some consistency between the American and Canadian findings regarding the ambivalence of people's thinking about computers.

The present investigation, then, was conducted as a pilot study with the following aims:

(1) to construct a Likert attitude instrument sampling major social concerns over the impact of computer technology obvious from previous research and from current public discussion in Australia;

(2) to analyse the factorial structure of the instrument in order to determine those dimensions which appear to deserve further development in a revised instrument; and

(3) to describe the characteristics of any discernible subgroups in the sample.

METHODOLOGY

The Instrument

Using the works of Lee (1970), Martin & Norman (1973), and Packard (1978) as a starting point, the investigators gathered as many statements of attitude about computers as possible. Forty statements were selected to cover a wide range of opinion and feeling about computers. An attempt was made to produce a bipolar unidimensional scale, but it became clear that the instrument had developed as a multidimensional instrument in which several useful subscales may emerge.

The statements were randomly assigned as items in a six-point Likert scaling instrument. Choice points were labelled from 'strongly agree', 'agree', through two central categories labelled 'not sure but tend to agree' and 'not sure but tend to disagree', to the other extreme of 'strongly disagree'. To the extent that an undecided or 'don't know' category was not provided, the instrument was slightly forced, but according to Nunnally (1967, p. 522) should have mitigated against response styles. Items were scored in the direction of agreement. Some respondents did not mark all items; these were recorded as missing data and all available data included in analyses. Background data included sex, age category (5), level of secondary education (2), level of post-secondary education (5), amount of computer use and/or experience (4, often to never), and area of work or study (from 16 delineated).

Subjects

A 'pseudo-random' sample of convenience, large enough (N = 414) to suit the analytic purposes of the investigation was obtained. The sample was restricted entirely to the Newcastle metropolitan and suburban area. While respondents included unionists, housewives and registered unemployed persons, in fact there was a bias towards tertiary students, only some of whom were in part-time or full-time employment.

Wherever the anonymity of the individual was at risk unmarked envelopes were provided in which the respondent sealed their form, with the assurance that it would be processed only on a group basis.

Findings are therefore limited to an area characterized in late 1978 by one of the highest levels of registered unemployment in Australia. It is possible that any anxiety about the impact of computer technology on employment prospects obvious from the results may be higher than that which might be found elsewhere in Australia.

Statistical Analyses

All major analyses of the data were conducted with the aid of Youngman's (1976) PMMD suite of computer programs. Descriptive statistics of the sample were obtained from the background data supplied with the instrument form. The factor analytic procedures employed were principal components analysis followed by both Varimax orthogonal, and Little Jiffy Mark IV oblique, rotations, both of which were found to be helpful in interpretation. Cluster analysis was carried out on the data matrix. This procedure employed a relocation process at each grouping level to minimize differences between individual scores and group centroids. The clustering strategy was the 'error' or 'sum of squares' function (see Veldman, 1967).

RESULTS AND DISCUSSION

a) Sample Characteristics

As Table 1 shows, half of the sample was aged 20 - 29 years, and computer experience was largely restricted to this age group. The sample was split between persons engaged in tertiary education on the one hand and technically qualified persons on the other. On the whole, the sample was well educated, with 68 per cent graduating from high school at the Higher School Certificate level. Of this group, more than half were university staff or students.

The sample was slightly biassed in favour of men (245/410 - four respondents were unidentifiable with respect to sex). Of the total under-20 years group, 52 were women. In all other age groups men predominated, especially in the 20-24 and 25-29 age groups (92/144 and 39/56 respectively). Of the men, 58 (23.6%) were in business/trade employment, 90 (36.7%) were engaged in engineering occupations, and most of the remainder were science or education students. Of the women, 27 (16.4%) were in business/trade jobs, 29 (17.6%) were nursing, 14 (8.5%) were in science-related jobs, and the remainder were nearly all teacher trainees. Only a small number of people were sampled from the computer industry (10 or 2%), building industry (1%), agriculture (2 only), transportation (2 only), communications (1 only), and journalism (1 only), while one per cent claimed to be principally engaged in architecture and four per cent claimed to be involved in mathematical jobs. In the absence of greater detail, the latter two groups were assumed to be part of the educational bias in the sample. Of 80 young people under 20 years, 24 were employed in business/trade occupations, 20 in other jobs of assorted types, and the remainder were unemployed.

Turning to the matter of computer experience, it is of interest to note from Table 2 that university graduates are much more likely to have had, or be engaged in, frequent to occasional use of computers. Of the university graduates, 43.6 per cent often or sometimes used computers, with only 32.6 per cent never having used a computer. For technical or trades people, however, only 27.9 per cent at least sometimes used a computer, but 46.8 per cent had never used one. Men were much more likely to have had computer experience: 101/245 men (41.2%) at least sometimes used computers, whereas only 48/165 women (29%) did so. There was a not unexpected occupational bias in computer use. Computer science people often use a

TABLE 1

Age Group and Sex Frequencies by Educational Level and by Frequency of Computer Use

Age	Sex M	Sex F	Sex O*	Educational Level: Trade course	Trade cert.	Dip	Degree	Post grad	Mult. degree		Computer Use: Other	Sometimes	Rarely	Never	Total
16-19	27	52	1	1	25	0	22	0	29	80	4	14	24	37	80
20-24	92	50	2	3	46	3	70	16	4	144	15	59	35	33	144
25-29	39	17		7	27	4	10	6	2	56	10	13	11	22	56
30-34	31	13		6	16	5	8	6	3	44	2	10	11	21	44
35-39	26	15		6	6	9	9	7	4	41	5	10	7	18	41
40-44	4	6		1	2	2	2	2	1	10	1	0	2	7	10
45-49	8	4		2	2	1	3	2	1	12	1	2	2	7	12
50+	18	7		3	9	3	1	0	9	25	1	2	3	19	25
0*	0	1													
Totals M F O*	245	165	4	26 3 1	87 45 1	8 19	79 45 1	26 13	17 36 1	412 +2*	28 11 4	73 37	62 31 1	81 83 1	412 +2*
	414			30	133	27	125	39	54	414	40	110	96	165	414

* omitted this data

computer and a high proportion of mathematical, commercial and engineering people at least sometimes use one. Of the other occupations sampled, only small minorities had sometimes or often used a computer at some stage. Forty per cent (165) or the total sample had never acquired experience with computers.

Future research in this area should be much more carefully planned with respect to sampling on the one hand, and background data on the other: it would appear that the cross-tabulations possible from the results of a carefully planned study would be illuminating on certain trends in society regarding the differential impact of computer technology, and interactions with education and related variables.

b) Analysis of the Instrument

Sample responses to the 40 Likert items of the instrument were factor analysed in order to determine whether constructs would emerge which appeared to deserve attention in the drafting of a revised

TABLE 2

Education Level by Frequency of Computer Use

Educ Level	Computer Use				Total
	Often	Sometimes	Rarely	Never	
Trade Course	2	4	7	16	30
Trade Certif	9	36	35	53	133
Diploma	1	1	5	20	27
Degree	15	47	35	26	125
Post-gr	10	16	5	7	39
Several Quals	1	6	9	38	54
Total	39	110	96	165	414*

* 6 gave no Educational Level response,
4 gave no Computer Use response.

instrument. This is not necessarily the same issue as determining viable subscales within the instrument. Since this was a pilot scale, it was quite possible that meaningful psychological constructs might emerge with poor internal consistency coefficients.

Items were scored uniformly in the direction of agreement, even though some items could be viewed as negative in direction. An examination of item-total score correlation coefficients revealed that although several items had near-zero correlation with total score, only one item was in fact (slightly) negatively correlated: "I think computers should be used as much as possible". An examination of some items having relatively high correlation with total score suggested that the scale, taken as a unity, is best described as assessing as unfavourable attitude towards computer technology.

The alpha coefficient of internal consistency for the total instrument was calculated at 0.6704. This indicates that underlying any more complex structure in the instrument is a moderate degree of homogeneity in the attributes being sampled by items.

The product-moment correlations among the 40 items were typical of such scales: low correlations with some moderate coefficients for a few item pairs. In the interests of economy the matrix is not reproduced here. Nearly all coefficients were statistically significantly different from zero, given the large sample size of 414 or a ratio of subjects to items greater than 10:1.

The principal components analysis revealed 12 eigenvalues in excess of unity (Table 3). All 12 factors accounted for only 57.8 per cent of variance, suggesting a moderate degree of item specificity. This is not inconsistent with the moderate value of the internal reliability coefficient (0.67).

TABLE 3
Principal Components Analysis of the Correlations Among the 40 Items - First Twelve Factors

Factor	Eigenvalue	Percentage trace	Cumulative Percentage
1	7.0654	17.6634	17.6634
2	2.9088	7.2721	24.9356
3	2.1040	5.2600	30.1956
4	1.4776	3.6941	33.8897
5	1.4079	3.5198	37.4095
6	1.3436	3.3590	40.7685
7	1.2774	3.1935	43.9620
8	1.2260	3.0651	47.0271
9	1.1477	2.8694	49.8964
10	1.0934	2.7335	52.6299
11	1.0577	2.6442	55.2741
12	1.0184	2.5460	57.8201

In interpretation, a factor loading of less than 0.40 was not generally considered unless the item was salient in the oblique rotation or unless, in the Varimax solution, the item aided the interpretation of the factor. In the latter case, no loading below 0.30 was used.

After a number of rotations were performed, a five factor solution was accepted as most useful in considering a revised instrument. The first three factors accounted for 30 per cent of trace, while the remaining two factors accounted for only 3.5 per cent of trace each. The accepted five factor Varimax solution produced scales with 13, 18, 5, 5, and 5 items, and alpha internal consistency coefficients of 0.87, 0.59, 0.59, 0.32 and 0.28 respectively. The total scale reliability for retained items was 0.73. Table 4 presents the Varimax factor loadings and indicates the oblique salients for the five factors.

Factor 1 Table 4 presents the Varimax factor loadings and item content for the first factor, as well as the salient variables in the corresponding oblique factor. There was high agreement between the orthogonal and oblique rotations for the factor. The factor strongly suggests concern and apprehension over the impact of computers with special reference to employment opportunities. The high loading items stress threat to individual worth (15), personal freedom (4), and to privacy (21). These are associated with items which are also salients in the oblique factor, and which stress the 'hardship' that computers bring to the worker (39), who will be thrown out of work (33). Computer technology, in fact, should not be introduced if it means displacing workers (37), we would be better off without computers (17), business is

Table 4

Varimax Factor Loading (numeric) and Oblique Salients (*) for a Five-factor Solution

	FACTOR						FACTOR				
Item	1	2	3	4	5	Item	1	2	3	4	5
1		54 *				21	61			*	
2						22	*			63-*	
3				32		23				-43 *	
4	69			*	*	24					
5	60				*	25			66 *		
6	55 *					26		39 *			*
7				-*		27				33	*
8					45	28			*		44 *
9	-55	*				29	48	-*		*	
10	60			*		30					46
11	*		-*	50		31			41 *		
12	65					32			-*		
13		55 *		*		33	67 *				*
14			*		51*	34			-65-*		
15	70			*	*	35		*			
16		66 *				36	-*	*	-39		
17	62 *	-*				37	61 *				
18			*	-*		38	*		54 *		
19				*	-32	39	67 *				
20		49 *				40		38 *	*		

too dependent on them (12), and not only will further computerization cause loss of jobs (6), but it will not contribute to the betterment of society (29). Associated with this theme is an element of alienation and unrealistic assessment of the powers of computers, which emerges more strongly in other factors. Varimax items suggest that people fear the power of the machine: they may one day run people's lives (5), and they are getting to know too much (10). In a similar vein, oblique salients suggest that computers are too complex for the ordinary person (38), and, consistent with the major emphasis in the area of loss of jobs, computers will lead to more leisure (11) and we should be prepared to share jobs in order to reduce unemployment (22). In both rotations there is a suggestion of bi-polarity in that, in the Varimax case, computers should not be used as much as possible (9), and in the oblique case, knowledge about computers should not be taught in schools (36). Although the context of most items loading in both rotations is employment and work, there is evidence that the construct being sampled is wider than work alone. The factor is labelled as "concern and apprehension for the individual" over the impact of computer technology.

Factor 2 The second factor was similarly identified in both rotations. The factor is considered to represent a "positive acceptance" of society's dependence on computers for its standard of living. The higher loadings demonstrate some support for the notion that computers are necessary in modern society (13), they will make a positive contribution to the education of children (16, 1), and they will make life easier for everyone (20). The weaker loading items add to this interpretation: computers will make a positive contribution to medical care (26), and, most interestingly, computers are tied in with the notion that society is dependent on permanent growth (4). The oblique factor, which includes all the loading items of the Varimax factor, enhances this interpretation. The negatively loading items (29, 17) obviously support the idea that the factor represents positive support for computer technology. There is, however, a hint of resignation in the suggestion (35) that the development of computers was somehow inevitable and out of the hands of ordinary people. This oblique factor is quite strongly negatively correlated (-.64) with the first, so that there would appear to be the basis of a "positive acceptance/apprehensive rejection" scale in these factors.

Factor 3 In the oblique rotation, the third and fifth factors were reversed with respect to the corresponding Varimax factor. The factor is considered to represent "misconceptions and ambivalence of feeling" about the current role and performance of computers, and, in both rotations, there is a hint of alienation to the technology. Computers are seen to be too large, too expensive (25) and too complex (38) for the average person; computers are not widely used in business (31), they will not become regularly used in the home (34), and, importantly, schools should not be teaching about them (24, 36). At the same time, data banks of personal information are desirable (18)! The oblique factor, would appear to allude more strongly to an ambivalence in people's thinking about computers. Both the higher loading positively-signed items and the negatively-signed items are consistent with the interpretation of the Varimax factor. It is interesting, however, that computers will not lead to more leisure time (11), they are tied in with the necessity for continuous growth in society (40), data banks of personal information are desirable (18), and further, computers are somewhat superior to people (14, 28). Although an analysis of the meaning of the factor is not quite as clear from a juxtaposition of the two rotations as for the first two factors, it is considered to suggest that ignorance about the state of the technological art is related to some antipathy to computers. There is some support for this in that the oblique factor is positively correlated (.64) with the first factor but negatively correlated (-.64) with the second oblique factor.

Factor 4 This factor shows the most substantial and interesting difference between the two rotations. The Varimax factor suggests a "warm response" to the introduction of computers. Computers are not 'heartless machines' (23), and they will lead to more leisure time (11), but to offset this, we should be prepared to accept less pay (3) and to share our jobs with others (22). There is just a hint of unrealistic belief in the power of computers in the suggestion that computers can learn (27). In contrast, the oblique factor very much reflects a negative attitude towards computers characterized by the 'heartlessness' and power of computers and their threat to the individual (21, 4. 15). Computers 'know too much' (10), they can be used for evil in the wrong hands (19), they cannot be made 'trustworthy' and secure (7), data banks are undesirable (18), and business is already too dependent on them (12). We should not have to share our jobs because of computers (22), and the further introduction of computers will be counterproductive (29). Not surprisingly, this oblique factor is highly correlated with the first (.77) and with the last factor (.61) discussed below, but negatively correlated with the second oblique factor (-.67).

Factor 5 Again in this factor, the two rotations lead to the same interpretation. The factor concerns the "perceived superiority" of computers. They can think better than humans (14), they do not waste time like people (30), and one day they will surpass humans in intelligence (28). The Varimax factor has a suggestion of unrealistic support for the introduction of computers in so far as there is some belief that computers cannot be used for evil (19). Workers made surplus by computer technology should be sacked (8).

The oblique factor supports the interpretation of the factor as revealing a "perceived superiority" of computers construct, but once again this is tinged with a negative perspective involving items relating to the individual (5, 15, 33, 4). Not a great deal can be made of this factor, since it accounted for so little of the trace (Table 3) and loadings were, at best, moderate. Nevertheless, it was an aspect of the instrument which persistently arose in various rotations.

c) Cluster Analysis on the Sample

Sample responses to all items of the instrument were cluster analysed in order to explore any emergent characteristics of person groupings. Standardized background variables were included in the analysis to facilitate group description. Other detailed analyses need to be carried out and followed up by multiple discriminant analysis, although such analyses could fruitfully be held over for the data produced by a more carefully planned study.

Commencing from a random allocation of respondents to nine groups, relocation analysis and 'sum of squares' clustering suggested that 5 subgroups existed in the sample. Discriminant analysis to test the significance of the grouping separation was not carried out. In order of size, the groups consisted of 106, 99, 84, 71 and 54 persons. Table 5 presents the group centroids of the standardized data on all variables.

The largest group of 109 persons would appear to be characterized as a group of 'older' men (over sample average age of 25-29 years) who have had below average secondary and post-secondary educational qualifications. The figure for post-secondary qualifications suggests that people in this group have or are completing trade certificates. This group is characterized by little contact with computers in their work, but variation on this variable is high. Occupational groups represented include people employed in business, engineering occupations, laboratory work and nursing, as well as students. The group has close to average responses to all items, and therefore, given the overall negative slant of the items, can be described as mildly negative towards computer technology and in their reactions to the social impact issues canvassed.

Group 3, consisting of 84 persons, is another cluster characterized by mild responses, but in this case group preferences indicate a clear tendency to feel positively about computer technology. The group is mostly male, of average age (25-29 years), better educated than the first group at post-secondary level and with slightly above average post-secondary qualifications. Experience with computers is limited but tends towards occasional use. Vocational areas represented suggest that this is a group of teachers and other professionals with a first degree. This group is nevertheless quite strongly of the opinion (items 4, 15) that individual freedom is not jeopardized by increasing computerization, computers will not run our lives for us in the future, and they tend to disagree with the idea that computerization leads to loss of jobs (6, 11, 33, 38). At the same time, the group holds no great faith in better learning via computer assisted learning (16) or in better medical diagnosis using computers (26), they tend to think that computers cannot be used for evil purposes, that personal privacy will not be affected (21), and that computers won't surpass human intelligence (28). There is a suggestion, though, of a lack of knowledge about computer technology in this group, in that group responses tended to disagree with statements relating to computers entering the home (34), that computer knowledge should be taught in schools (36), and that

Table 5

Standardized Group Centroids for Five Clusters on Six Background Variables and 40 Likert Items

Item	SAMPLE Mean (cat)	SAMPLE S.D.	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
Sex	1.41	0.52	-.18	-.35	.07	.17	.78
Age	3.05	1.96	24	01	-29	-02	-01
2ndy Ed	1.72	0.56	-12	17	22	27	-77
Post 2ndy	3.37	1.57	-20	-14	13	01	44
Compr.Exper.	2.92	1.06	39	-53	-19	-05	57
Fld of Wk	6.07	5.38	-18	-22	-10	0.00	91
1	3.94	1.41	12	64	-33	-02	-86
2	4.22	1.42	08	08	-26	36	-38
3	2.11	1.41	-09	03	-14	50	-33
4	3.05	1.68	15	-64	-56	92	54
5	3.03	1.71	20	-57	-59	96	32
6	4.46	1.50	14	-65	-34	59	67
7	3.54	1.53	30	34	-13	-32	-58
8	2.65	1.47	-19	29	-12	35	-43
9	3.67	1.51	26	80	-04	-70	-1.00
10	2.62	1.61	-03	-55	-39	60	88
11	4.35	1.37	24	-10	-20	0.00	-35
12	3.62	1.66	16	-86	-26	61	85
13	3.81	1.58	12	63	-31	-08	-82
14	2.05	1.37	02	-08	-22	27	09
15	2.59	1.65	-17	-66	-51	1.05	95
16	3.53	1.47	19	66	-60	05	-71
17	2.22	1.27	-22	-75	-21	50	1.49
18	2.42	1.50	11	29	-29	-26	05
19	4.61	1.51	07	-04	-41	22	27
20	3.99	1.35	28	68	-32	-50	-62
21	3.94	1.50	30	-59	-57	69	47
22	3.89	1.58	16	-09	-15	09	-03
23	4.76	1.56	-10	-23	-02	21	38
24	3.05	1.61	-02	39	-32	19	-43
25	2.66	1.58	-16	-59	-05	24	1.14
26	3.19	1.50	30	09	-54	35	-38
27	2.89	1.64	-01	-02	-18	26	0.00
28	2.10	1.40	-06	-23	-40	39	64
29	3.14	1.53	-22	-65	0.00	64	78
30	4.40	1.42	12	19	-39	01	03
31	2.32	1.19	29	-34	-09	-07	29
32	4.22	1.36	02	14	-16	16	-26
33	2.99	1.53	05	-66	-49	72	91
34	4.06	1.44	12	59	-54	07	-57
35	3.03	1.61	25	05	-50	18	-03
36	4.72	1.27	23	54	-29	08	-1.09
37	2.90	1.52	-15	-52	-42	64	1.08
38	2.37	1.32	14	-53	-32	34	74
39	2.66	1.50	0.00	-74	-44	79	1.00
40	3.41	1.74	30	18	-51	-23	19

computers are too complex for ordinary people to use (38).

Group 4, of 71 persons, is the group most representative of the average (mildly negative) response in the sample: of average age, education, and mixed in occupational background, with some computer experience but with more women in the group than average. The group is negative in attitude overall and displays a somewhat fearful outlook towards the technology. The group quite strongly agrees with negatively stated items pertaining to computer threat to individual privacy and freedom, and strongly disagrees with positively stated items (eg., 9). In general terms the group holds much stronger opinions than Group 1 and tends to score in an inverse pattern to Group 3, which was mildly positive. The position of Group 4 is summed up by the content of some of the items agreed with most firmly: the individual will not count for much anymore (15), as computerization increases personal privacy will decrease (21), computerization will not improve society (29), computers will throw us out of work (33), computers should not displace workers (37), and will only bring hardship to workers in the future (39).

Groups 2 and 5 provide the most interesting insights, however, into potential education implications of the interaction among opinion patterns and background variables. Group 2 is a substantially male group of average age (25 - 29 years), moderately well educated, and most importantly, who use or have used computers often. Occupations in this group represent the technical sciences, psychology, medicine, engineering and selected private industry posts. This group is strongly positive towards computers, knowledgeable about the technology, and holds no fears for the negative social impact of computers. In fact, computers should be used as much as possible (9). Computer technology will improve education and society in general in the future (1, 16, 29), they strongly feel that freedom, privacy and employment are not threatened by computers, believe that computers are necessary in modern society (12, 13, 17), that computers can be made trustworthy and secure (7), and strongly disagree that computers are "heartless machines without feeling" (23). The group believes knowledge of the technology should be taught in schools (36). That the group is knowledgeable about computer developments can be inferred from items relating to the entry of computers into the home (34) and the demystification of computers (38).

Group 5, by contrast, holds very strongly opposite opinions to Group 2 on every major issue. Figure 1 presents a diagrammatic representation of the orientation of these two groups in relation to sample mean responses, for the Varimax factors presented in Table 4. Group 5 is a mostly female group, of average age, and generally the most highly educated subgroup in the sample. Significantly, this group has virtually no computer experience. Occupations represent the teaching and humanities areas (eg. graduate English/History teacher trainees) and under represented groups such as journalists, architects and other non-technical professions.

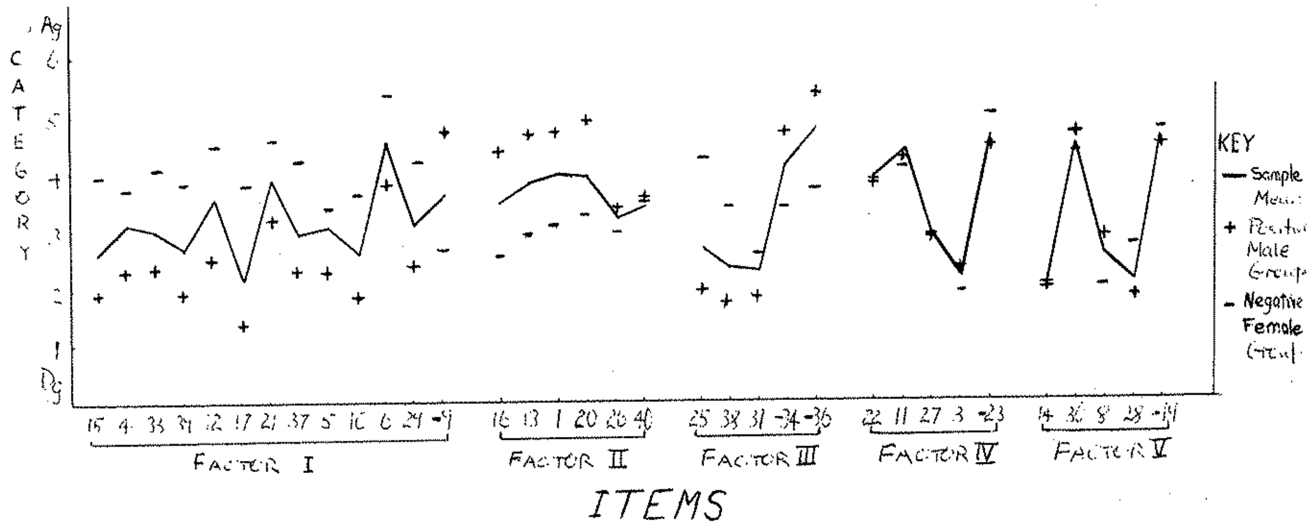

Figure 1: Mean sample and mean cluster response patterns for positive Group 2 and negative Group 5 on items loading on the Varimax five factor solution.

Group 5 holds a strongly negative view of the impact of computer technology on society and would appear to be highly threatened and alienated by the technology. In brief, this group very strongly believes that computers will not contribute to society or education (1, 13, 16, 20, 29), and individual freedom and privacy and employment are strongly threatened (4, 6, 15, 21, 29, 33, 37, 39). In contrast to Group 2, this group strongly opposes teaching about computers (24, 36), and further alienation is suggested by the apparent refusal to recognize that computers are already widely used (12, 13) and that strike action in the computer industry could cause national chaos (2).

The five clusters are rank ordered from most favourable towards computers to least favourable towards computers, on the basis of (a) frequency of computer use, and (b) educational qualifications in the post-secondary area. There is also a suggestion of a sex interaction with computer experience and negative attitude. The correlation between tertiary study and less negative attitudes regarding computers may be explained by the fact that most teaching involving the use of computers is carried out in tertiary institutions. More significant for educational planning, however, is the strong suggestion in the data that as the frequency of use of computers increases, alienation and fear of the technology decreases. This hypothesis should be subject to further research. It is also interesting to note that the more positively disposed groups believe that knowledge about computers should be taught in schools and have a positive role to play in improving teaching effectiveness, whereas the negatively disposed groups strongly oppose both these opinions. This latter observation is interpreted as being symptomatic of alienation to the technology, and is seen as supporting the notion that frequent use of computers is correlated with more positive attitudes towards them and their impact on society. One possible educational implication is that teaching about computers in school would do much to reduce fear of the technology and negative responses to its applications in society.

CONCLUSION

The purpose of the present study was to construct a pilot attitude instrument surveying some major concerns about the impact of computer technology, to analyse the factor structure of the instrument with a view to providing a basis for the drafting of discriminating subscales, and to describe the characteristics of any discernible subgroups in the sample. A forty item Likert instrument was constructed and administered to a moderately large sample of 414 taken from institutions of higher education and from the community of Newcastle. The instrument proved to have only moderate internal consistency and it was not surprising that the principal components analysis showed that there were 12 factors with eigenvalues greater than unity accounting for only 57.8 per cent of variance. After a series of rotations, a five factor solution was accepted as being the most helpful in interpretation, although a three factor solution gave technically better subscales. Both a Varimax orthogonal rotation and a Little Jiffy Mark IV oblique rotation were found to be of assistance in interpreting the factor structure of the instrument.

Although the five factors were not necessarily simple in the concepts represented, there is some hope that balanced, positive/negative subscales can be produced from them. The two rotational procedures showed considerable agreement on three of the five factors. Two of the factors, Factor 3 and Factor 4, showed evidence of bipolarity and therefore indicate the possibility of deriving discriminating subscales. The five areas deserving further attention in a revised instrument are summarised below.

1) Apprehension over the impact of computer technology in several areas of society, with items relating to employment/loss of jobs and to personal freedoms/privacy indicating particular areas of concern.

2) An acceptance of society's dependence on computer technology already and that society's living

standards have, and will, result from technological advances.

3) An ambivalence, perhaps even alienation, in thinking about computers. Tied in with this factor was a lack of knowledge and certain misconceptions about the powers of computers. There was a negative acceptance of the involvement of computers in continued growth in living standards, but at the same time computer technology was seen as being necessary to growth.

4) Warm support for the further introduction of computer technology as opposed to the threat computers pose to the ideal of individuality and privacy, best captured by the item which referred to the 'heartless machine'.

5) The superiority of the computer in certain areas over people. In the oblique rotation, this factor stressed the threat to the individual and is obviously related to the first and the third factors.

Cluster analysis of the sample responses with background variables suggested that the sample was composed of five subgroups with reasonably clear attitude profiles. These included:

1) a group of 99 mostly male persons of average to below average age and well educated, who used computers often and who were strongly positive in their attitudes towards the technology;
2) a group of 84 persons of average age and good education, with some experience of computers and who felt mildly positive towards them;
3) a group of 109 persons of above average age and below average education, who had some experience with computers and who felt mildly negative towards computers;
4) a group of 71 persons, mostly female, of average age and education, who felt quite negatively towards computers and their impact on the individual as well as society; and
5) a substantially female group of 54 persons, of average age but highly educated, who had virtually no contact with computers, and who were strongly negative and alienated.

A perfect rank order relationship was observed between strength of negative response in the cluster and experience with computers. It was suggested that non-threatening (educational) experiences with computers may significantly alter strongly negative and alienated orientations towards a more benign or even a positive perspective of the technology and its impact on society. This hypothesis should be tested.

Further research in the immediate future should concentrate on the development of a more carefully constructed and discriminating attitude instrument in the areas suggested above, and its use in exploring interactions with background variables.

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