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ABSTRACT

The social psychological phenomenon of alienation has been used to explain feelings of separation and estrangement with our increasingly technological society since it was first proposed by Marx. The present study represents an application of the theory of alienation to the attitudes of computer users in an attempt to explain their feelings, especially negative feelings, which have heretofore been vaguely referred to as "frustration," "dissatisfaction," etc. The result is a systematic decomposition of these attitudes into various components of alienation which are consistent with the already well-established theory of alienation. Several hypotheses are tested, including examination of the effect of education on computer alienation.

INTRODUCTION

The psychological, sociological, and organizational factors associated with humans using computers are of great importance in the design and use of management information systems. These factors affect the success and the essential viability of information systems in organizations. Because of this, a significant amount of effort has been expended studying the various effects of computing in organizations, a survey of which appears in Attewell and Rule (1984). One of the earliest theories in this area is attributed to Marx (1977) and pertains to the potential feelings of alienation workers feel in the face of automation. Marx and his followers proposed that the history of mankind is fraught with both increasing development and increasing feelings of separation from the self and the surrounding social structure.

Alienation is used in everyday parlance as a term meaning "to cause resentment" or "to estrange." In academic research, the term has been used to describe a variety of situations which include feelings of lack of power, lack of clarity, lack of ethics, lack of intrinsic satisfaction, and social rejection. These "components" of alienation, which will be more precisely defined later, can be applied to numerous fields of study.

Alienation has been treated both formally (Schraml, 1981; Shepard, 1971; Sheridan, 1980) and obliquely (Artandi, 1982; Cartwright, 1980; Morrison, 1983) by several authors as a means of explaining users' feelings of frustration with computers. Schraml (1981) describes users' perceptions of computers as representing vast, unfeeling technology over which they have no control. She also found a resentment stemming from the lack of human interaction when dealing with machines. Sheridan (1980) mentions that computers are perceived as making human operators remote from their task and causing our society to think that hard work is no longer the path to success. These authors are actually describing feelings of alienation, however no systematic attempt has been made by MIS researchers to integrate these descriptions of frustration with computers to alienation theory as it appears in social psychology.

ALIENATION DEFINED

Although alienation finds its roots in Marxist readings, Seeman (1959) is considered to be the father of modern alienation theory. His work represents the first systematic attempt to clarify the meaning of alienation, as used in the present, and to place it in a theoretical perspective (Lystad, 1972). Seeman (1975) listed several components of alienation: powerlessness, meaninglessness, normlessness, social isolation, self estrangement, and cultural estrangement. These components of alienation are briefly described as follows:

- powerlessness -- a sense of lack of control;

- normlessness -- high expectations for socially unapproved means for the attainment of goals;

- meaninglessness -- incomprehensibility of personal and social affairs;

- social isolation -- a sense of exclusion or rejection;

- self estrangement -- engagement in activities that are not intrinsically rewarding; and

- cultural estrangement -- an individual's rejection of commonly held values in a society.

Alienation, as consisting of these dimensions, has been studied in great depth, primarily relating to politics and the work environment. Recently, alienation has been used to explain certain marketing phenomenon (Allison, 1978; Ray, 1985).

Intuitively, computer alienation seems a reasonable explanation for users' frustration with computer use. Many authors have verbalized aspects of computer alienation. Table 1 lists many of the reported "frustrations" typically experienced by users and how these frustrations translate into alienation dimensions according to the Seeman descriptions. As can be seen from Table 1, these feelings may be mapped onto the various dimensions of alienation which then forms a useful construct that encompasses users' frustrations and fears with computer systems.

Possible Effects of Computer Alienation

Schraml (1981) lists some extreme results of computer alienation. These user reactions range from pouring honey into a terminal to running over a computer with a forklift truck, and represent examples where alienation results in resistance to computer implementation. Others have found that contextual alienation, such as with work or a marketing setting, results in lower levels of satisfaction, lower levels of perceived performance, lack of receptiveness to information about the source of one's alienation, and increased support of government regulation to "protect" the individual (Ray, 1985). In MIS, alienation may prove to be a valuable counterpart to the notion of user satisfaction (Ives, 1983) in that alienation and satisfaction are virtually antithetical constructs, although *dissatisfaction* and alienation are *not identical.* It is shown later that empirical results confirm a strong negative correlation. Derivatively, alienation may shed new light on persistent MIS implementation questions such as why information systems fail (Lucas, 1974).

If alienation has mostly negative consequences, one might want to know if it can be reduced by certain factors such as educational programs. Without external reductive forces, some evidence shows that feelings of alienation are fairly stable over time (Zeller, 1980). There is, however, substantial argument in the alienation literature concerning whether sociological alienation is of greater relevance than psychological alienation. If alienation is a psychological personality characteristic (referred to as general alienation) then very little can probably be done to reduce these feelings or lesson their impact. If, on the other hand, alienation is affected by sociological or organizational factors, then it may provide a valuable manifestation of computer user attitudes to be used for diagnostic and corrective purposes. The present study distinguishes between and examines both psychological and sociological alienation.

OBJECTIVES OF THE RESEARCH

The objectives of the present research lie in three principle areas. The first is to build upon the ideas of Schraml (1981), Sheridan (1980) and others who have suggested that many users

Table 1. Computer User Frustrations as Dimensions of Alienation.

User Frustration	Alienation Dimension
1. Computers invade our lives, making us dependent on them (Sheridan, 1980)	Powerlessness
2. Someday in the future, these machines may be running our lives for us (Morrison, 1983)	Powerlessness
3. People are being victimized by vast technology over which they have no control (Schram, 1981)	Powerlessness
4. Automatic control cannot be entrusted to computers (Artandi, 1982)	Normlessness
5. Users fear misuse of information stored in computers' files (e.g. invastion of privacy) (Schraml, 1981)	Normlessness
6. They (computers) can be used for evil purposes if they fall into the wrong hands (Morrison, 1983)	Normlessness
7. Computers are magical and not easily understood (Artandi, 1982; Sheridan, 1980)	Meaninglessness
8. Large computers are no longer understood by managers because of their complexity (Artandi, 1982)	Meaninglessness
9. Electronic brain machines are kind of strange and frightening (Morrison, 1983)	Meaninglessness
10. Users are used to working with other people and can have no human interaction with machines (Schraml, 1981)	Social isolation
11. With these machines, the individual person will not count for very much anymore (Morrison, 1983)	Social isolation
12. Computers make human operators remote from their jobs (Sheridan, 1980)	Self estrangement
13. Computers cause job stress (Schraml, 1981)	Self estrangement
14. Society no longer feels that hard work is the route to success because machines can do the work for us (Sheridan, 1980)	Cultural estrangement

are alienated from computers and that this feeling has a variety of negative consequences. Their work is largely informal and/or conceptual in nature -- not emphasizing the theoretical components of alienation or the empirical testing of these constructs. The second objective is to perform a re-analysis of computer attitudes along the lines of previous investigations (Morrison, 1983), but using the theory of alienation as a theoretical framework. This will involve the construction and testing of a new scale to measure alienation as it relates to computer usage. A third objective is to study computer alienation longitudinally as suggested by Goldstein and Rockart (1984, p. 114), particularly with respect to formal computer-related education of users. In addition, potential cause and effect relationships between measured components of alienation and various possible dependent variables (such as user satisfaction) are investigated. Note that the focus of this research concerns direct user interaction with computers in decision-making contexts not indirect or derivative uses involving persons whose only computer contact might be receiving computer-generated statements or working alongside numerically controlled machinery, etc. In the current paper, we chiefly address the development of tools with which to measure alienation and the results obtained from the first application of these tools to a group of subjects.

RESEARCH METHOD

The research method consists of the design, testing, and administration of a survey instrument (questionnaire), followed by an analysis of the responses in the context of the underlying theory. Data were collected from students in a university setting, about 90% of whom already had some significant computer experience. The following sections detail the steps involved.

Measures

The questionnaire, administered at the beginning and end of several computer-related university classes, consists of items pertaining to demographics, general alienation, computer

alienation, and past computer use, including the following specific measures.[1]

1. The general alienation scale of Middleton (1963) was used to measure the psychological alienation of each individual. Middleton's scale contains six questions that represent each of Seeman's (1975) dimensions of alienation.

2. Likert scale items were constructed to relate computers to each of the alienation dimensions: powerlessness, normlessness, meaninglessness, social isolation, self estrangement, and cultural estrangement. These dimensions and the number of questions related to each are: powerlessness (5), normlessness (5), meaninglessness (5), social isolation (6), self estrangement (4), and cultural estrangement (4). The questions are presented in a randomized order, with approximately half the questions for each dimension, and for the questionnaire as a whole, worded in the positive sense (the remainder worded in the negative sense). This was done to control for acquiescence bias. Each of the alienation questions consists of a statement followed by five choices ranging from "strongly agree" to "strongly disagree." Representative questions that appear in the final scale can be seen in Table 3, which will be discussed later. The measurement of each dimension of alienation consists of a summative score for each dimension, after properly recoding those questions which are worded in the negative sense. These items were generated from alienation items that have appeared on previous scales outside the field of MIS, discussions with MIS professionals and students, and personal experience. Since the major thrust of this research is scale development, more items were generated than would be expected to appear in the final scale.

3. Questions related to potentially important variables such as a person's receptiveness to information about computers, their primary source of computer information, their personal satisfaction working with computers, and their propensity to support legislation regulating the use of computers were asked. Since the subjects were students (discussed later), information about the student's grades in past computer classes and the grade they expected in the current class was collected, as was general information such as whether the person currently

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[1]A copy of the questionnaire is available upon request.

owned a computer and (if not) how soon he or she anticipated owning one. The use of dependent measures such as these in both alienation and MIS research has been suggested by other researchers (Butcher and Muth, 1985; Goldstein and Rockart, 1984; Moyer and Motta, 1982; Ray, 1985; Sanders, 1984).

Pretesting

Because one of the major thrusts of the present research is the development of a computer alienation scale, pretesting before initial administration was minimal. The questionnaire would be modified at a later date based on the final version of the alienation scale, therefore this phase of the research itself served as a pretest. However, the preliminary computer alienation items were presented to several MIS professionals and pretesting was informally conducted by the debriefing method. This method asks that a pretest respondent answer all items on a questionnaire and then report on any problems found with the survey itself (Hunt, *et al.*, 1982).

Subjects and Procedures

The initial collected data consist of 257 responses obtained from student volunteers. A second administration of the questionnaire surveyed approximately half the original subjects after the sixteen week semester.[2] Since the questionnaire was administered during a regularly scheduled class, the response rate was virtually 100% and nonresponse bias would not be a problem. Demographic information for the original 257 respondents is summarized in Table 2. The majority of the subjects were students in an graduate level introductory MIS class at a large university. The remainder were undergraduate students at a small liberal arts college. In both cases, the survey instrument was administered on the first day of class before any instruction began and again during the last week of classes.

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[2]The second survey was a convenience sample subset of the original group consisting of graduate students only. Before and after responses were matched by unique identifiers, permitting meaningful examination of the education effect on the latter group of subjects.

Scale Development

Of the thirty-five questions related to alienation, six were intended to measure the psychological personality trait of general alienation. The remaining twenty-nine relate to the sociological or organizational aspects of alienation with respect to computers. Responses to these twenty-nine were examined with regard to their appropriateness in measuring their respective dimension of alienation. This was done by considering each item's correlation with the summed score for that dimension, its effect on Cronbach's alpha for its dimension, the commonalities obtained from preliminary factor analysis, and its correlation with the total of all computer alienation items from the first survey administration. Five questions were eliminated during this stage. The remaining twenty-four items were then factor analyzed. A varimax rotation was scrutinized for two, three, four, five, and six factors. The analysis that resulted in the most interpretable loadings was the two-factor model, therefore six factors corresponding to the theorized dimensions of alienation were *not* judged to materialize at this point. Instead, what was apparent was a division between those items that addressed a *personal* or *hands-on* relationship with computers (e.g. "I like to use computers") and an impersonal relationships (e.g. "Computers encourage unethical practices"). In referring back to the twenty-four questions, it was noted that each question could (independently of the factor analysis) also be classified into a personal or impersonal category based on its wording in this regard. At this time items with extremely low factor loadings (less than .20) were deleted, leaving twenty-two computer alienation scale items. Table 3 lists the two-factor analysis of these twenty-two final items.

The two factors representing personal and impersonal dimensions do not by themselves decompose alienation into the six dimensions of interest. Upon closer inspection of the factors in Table 3, however, one notices that all powerlessness and meaningless items load on the personal factor, while the majority of normlessness and social isolation items load on the impersonal factor. Self estrangement and cultural estrangement items are equally divided between the two factors. Note that Seeman (1967) discusses internal vs. external sense of control as being directly relevant to alienation through powerlessness.

Table 2. Summary Statistics for Respondents.

Variable	Mean	Category	Percentage
Sex		Female	37%
		Male	63%
Age	22.7	< 20	15%
		20–25	67%
		> 25	18%
Number of years of computer-related job experience	0.6	0	73%
		1	11%
		2	8%
		3	5%
		> 3	3%
Number of college-level classes taken which make significant use of the computer	3.1	0	20%
		1	18%
		2	19%
		3-5	23%
		> 5	20%
Number of programming languages known	2.1	0	6%
		1	37%
		2	24%
		3	15%
		4	9%
		> 4	8%
Number of non-language software packages familiar with	1.1	0	30%
		1	33%
		2	17%
		3	10%
		> 3	9%
Number of different computers used	2.2	0	8%
		1	33%
		2	25%
		3	16%
		> 3	17%
Student classification		Freshman	9%
		Sophomore	7%
		Junior	13%
		Senior	11%
		Masters	60%

Table 3. Twenty-two Item, Two Factor Varimax Rotation.

Question	Item #	Personal Factor Loadings[1]	Impersonal Factor Loadings
Questions dealing with hands-on computer use:			
I clearly understand what input computers want. (M+)[2]	11	<u>.72</u>	.05
I don't understand computer output. (M-)	5	<u>.70</u>	.06
I don't understand how computers work. (M-)	15	<u>.69</u>	-.03
Working with computers is so complicated it is difficult to understand what is going on. (M-)	7	<u>.69</u>	.25
I don't feel helpless when using the computer. (P+)	10	<u>.68</u>	.13
I don't get along with computers. (SI-)	19	<u>.64</u>	.26
I like to use computers. (SE+)	24	<u>.59</u>	.29
I feel that I control computers rather than computers control me. (P+)	8	<u>.55</u>	.07
I don't care what other people say, computers are not for me. (CE-)	30	<u>.49</u>[3]	.49
I would use computers even if it were not expected of me. (CE+)	26	.39	<u>.41</u>[3]
I usually have to make my work fit the computer rather than the computer fit my work. (P-)	32	<u>.40</u>	.20
I'd rather do things by hand than use a computer. (SE-)	3	<u>.37</u>	.32
I trust computers. (N+)	9	<u>.31</u>	.15
Questions about impersonal computer feeling:			
The computer has made us lazy. (SE-)[2]	29	.03	<u>.56</u>
The computer interferes with professional relationships among people. (SI-)	20	.11	<u>.54</u>
The computer interferes with my work. (SE-)	27	.22	<u>.54</u>
Computers encourage unethical practices. (N-)	33	.03	<u>.50</u>
Computers are robbing people of their jobs. (N-)	14	.02	<u>.45</u>
Society values computers too highly. (CE-)	4	.08	<u>.43</u>
The computer doesn't interfere with my personal relationships with people. (SI+)	35	<u>.37</u>[3]	.32
I get along well with people who work with computers. (SI+)	21	.23	<u>.35</u>
Modern day communications would be impossible without the computer. (SI+)	23	.11	<u>.30</u>

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Question	Item #	Personal Factor Loadings[1]	Impersonal Factor Loadings
Eigenvalues (22 total items):		4.44	2.67

Performing separate factor analyses on only the personal items and only the impersonal items produced valuable results. With the personal items, three clear factors were produced relating to the following alienation dimensions: (1) powerlessness and one normlessness item; (2) meaninglessness items; and (3) a combination of social isolation and the estrangement items. Table 4 presents these results. Factor analysis of only the impersonal items produced no particularly meaningful divisions with two, three, four, five, or six factors rotated. Therefore, it appears that computer alienation may be initially decomposed into two "first-order" factors -- personal feelings toward computer use and feelings about computers in general. Subsequently, the first of these factors may be further broken down into clear dimensions of powerlessness/normlessness, meaninglessness, and social isolation/estrangement "second-order" factors. To summarize: the items were partitioned into two categories based on a preliminary two-factor factor analysis and the question orientations (personal or impersonal). This results in the partitions shown in Table 3. Each partition was then factor analyzed to iso-
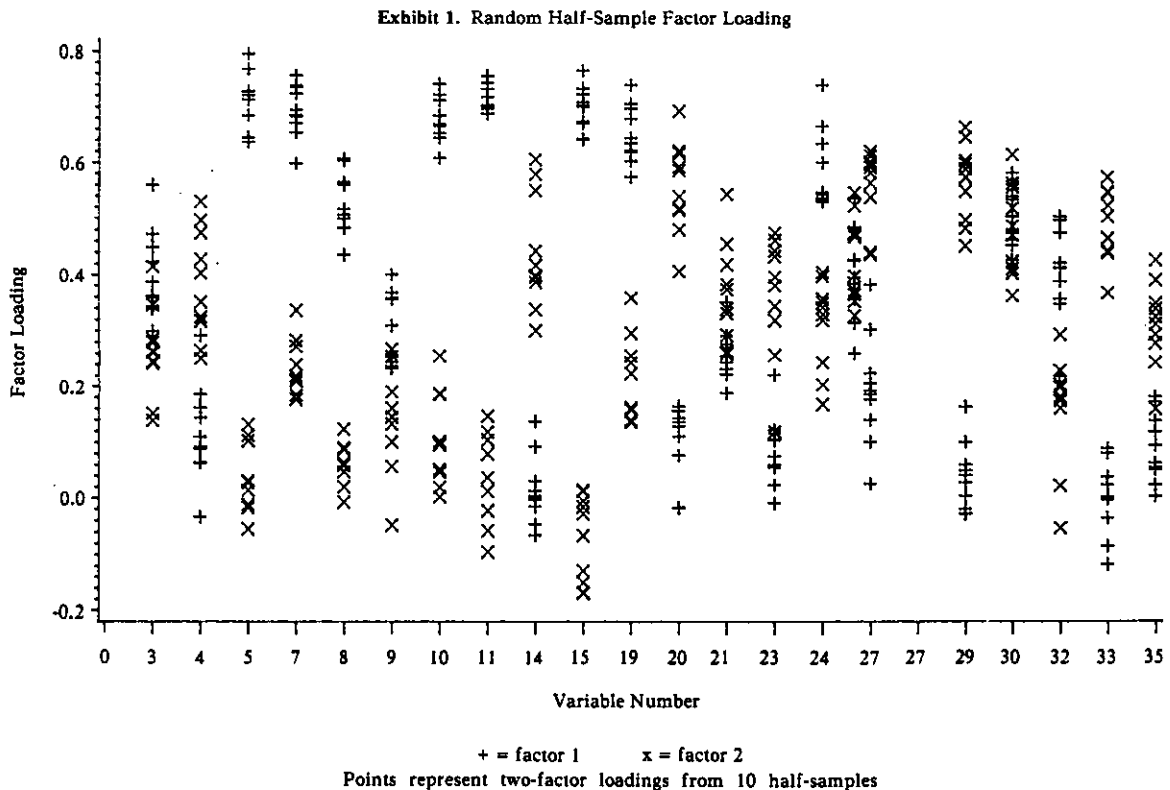
late relevant components of alienation. The result is three alienation dimensions contained in one first-order factor and a fourth dimension representing an amalgamation of remaining alienation components contained in the other first-order factor. As an extension to the present research a formal hierarchial factor analysis as suggested in Parsons and Hulin, (1982) and Schmid and Leiman, (1957) will be undertaken in the future.

To investigate the stability of factor loadings some researchers have performed separate split-half factor analyses to compare the resulting loadings (Morrison, 1983). This technique has been extended in this study to a bootstrapping-like method whereby multiple samples of size n/2 are drawn from the original n observations. The distributions of the resulting factor loadings computed from these samples may then be examined. Exhibit 1 shows the results when ten subsamples were used to investigate the original two-factor model. In this graphical display it can be seen that all variables whose highest loading is .5 or above are also characterized by

Table 4. Factor Analysis of Personal Dimension.

Dimension	Item #	Factor 1	Factor 2	Factor 3
Powerlessness	8	.16	.18	.60
Powerlessness	10	.32	.37	.52
Powerlessness	32	20	.21	.38
Normlessness	9	.03	.05	.56
Meaninglessness	5	.30	.69	.14
Meaninglessness	1	.22	.66	.20
Meaninglessness	7	.36	.58	.30
Meaninglessness	11	.27	.52	.42
Social isolation	19	.52	.40	.27
Self estrangement	24	.66	.24	.20
Self estrangement	3	.45	.20	.12
Cultural estrangement	30	.62	.20	.10
Cultural estrangement	26	.61	.11	.12
Eigenvalues (13 total items):		2.18	2.11	1.56

Note: The largest factor loading for each item is underlined.

Exhibit 1. Random Half-Sample Factor Loading

Variable Number

+ = factor 1   x = factor 2
Points represent two-factor loadings from 10 half-samples

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loadings sufficiently different in magnitude so that no combination of loadings from samples overlap. The probability of this result by chance alone is $1/(2K!/(K!*K!))$ for K subsamples with two factors each, or $1/184,756$ for $K=10$, suggesting that the loadings for these variables are relatively distinct and stable.

Reliability and Validity

Internal consistency reliability is indicated by Cronbach's alpha for the four dimensions. They are: powerlessness/ normlessness, .65; meaninglessness, .82; personal social and estrangement items, .77; and all impersonal computer items, .71. While not as high as might be hoped, the alphas of > .7 or greater meet the criteria proposed by Nunnally (1978) for preliminary research.

Convergent validity may be indicated by correlating "maximally different methods of measuring the same construct" (Peter, 1981, p. 136). Although dissatisfaction and alienation are not identical constructs, the relationship between the two has been used to establish validity in the past (Ray, 1985). Therefore, the summative score of the twenty-two alienation items was correlated with the single item measuring computer satisfaction. The computed correlation coefficient of -.40 is significant at the > .0001 level, lending support to convergent validity. In some studies (Schacht, 1970), results have shown that alienation in a specific context may be related to general alienation. In the present study, we found a correlation coefficient of +.31, which is significant at the .0003 level, again supporting the validity claim.

Predictive validity can be established if in fact students' alienation scores could be successfully used to predict success in a computer related class. The correlation between computer alienation and a performance measure in a computer class is -.35, which is significant at the .0001 level, indicating that alienation has predictive capabilities. These relationships will be investigated more fully in the Hypotheses and Results section.

Effect of Education on Computer Alienation

A question of major importance related to both general alienation and computer alienation concerns the stability of alienation over time and over various treatments. Zeller, Neal, and Groat (1980) found that all general alienation dimensions remained stable over a eight-year time period. However, in this period there was no attempt at changing the levels of alienation, such as through an educational program. The choice of student subjects makes it possible to study a particularly important relationship--that of education or training on alienation. To do this a second questionnaire identical to the first was administered to about half the original sample group, with the responses being matched to allow paired comparisons before and after a formal course in MIS. This course involved both learning about information systems in general and hands-on use of software such as Lotus 1-2-3, IFPS, etc.

HYPOTHESES AND RESULTS

From a total of twenty-nine original computer alienation items, a final scale materialized that appears to have dimensions of high internal consistency and validity. Using this scale, it is possible to test the following hypotheses using Pearson product-moment correlations and an alpha level of .05. All hypotheses stated are in the alternate form, reflecting the expected state of nature.

Seeman (1967) found that alienation is often negatively related to propensity to pay attention to information sources about the topic related to the alienation.

> H1: Computer alienation is related to the propensity to pay attention to information sources about computers (supported; $r = -.30$, $P(|R| > r) = .0006$).

This is consistent with the Seeman findings, and indicates that individuals alienated from computers tend to ignore news about them.

Intuitively, one's satisfaction with his work, political affiliation, or even computer ex-

periences would be affected by his feelings of alienation. Past research has found this relationship to consistently be upheld, and it is tested again here.

> H2: Computer alienation is related to overall satisfaction with computer experiences (supported; r = -.40, P(IRI > .40) > .0001).

As mentioned earlier, this relationship provides some evidence for convergent validity.

It may be suggested that a person's computer alienation may be related to the wish for additional government protection from the effects of computerization. Allison (1978) and Ray (1985) found a relationship between alienation and support of government protection.

> H3: Computer alienation is related to the belief that more laws are needed to protect people from computers (not supported; r = .096, P(IRI > .15) = .096).

It appears that even though one may feel alienated from computers, there is not a belief that increased government regulation is the answer. The current study cannot answer the question of whether the respondents feel government intervention is not desirable, would not be effective, or both.

Predictive capabilities of alienation would be evident if the computer alienation of the respondents is highly correlated with computer performance as measured by classroom grades.

> H4: Computer alienation is related to performance in a computer related class, as measured by percentage of possible points achieved at the end of the class (supported; r = -.35, P(IRI > .35) > .0001).

Although the direction of any cause and effect relationship is not determined by the significant correlation or even the temporal sequentiality of alienation measurement followed by later class performance, it appears plausible that reducing a student's alienation towards computers may lead to better classroom performance.

The following hypotheses were tested using separate paired T-tests to investigate the effects

of the computer class on computer alienation, powerlessness, and meaninglessness. The latter two alienation components were isolated for investigation because of the *a priori* expectation that they will be affected by education. As anticipated, general alienation was found not to change significantly over the course of the semester. Table 5 shows the paired T-test results for the above one-sided T-tests.

> H5: Computer alienation will lessen after students receive education concerning computers (supported at alpha=.05).

> H6: Powerlessness will lessen after students receive education concerning computers (supported at alpha=.05).

> H7: Meaninglessness will lessen after students receive education concerning computers (supported at alpha=.05).

The results found above represent important relationships between education and computer alienation. The reduction in aggregate computer alienation seems primarily due to the strong powerlessness effect and the extremely strong meaninglessness effect. Because meaninglessness involves a sense of incomprehensibility with affairs at hand, it is quite reasonable to assume that computer related education may reduce computer alienation. Similarly, feelings of powerlessness may be reduced by successful hands-on computer experience associated with coursework.

Table 5. T-Test Results

Variable	n	t*	P(T<t)
Computer alienation	95	-1.83	.0349
Powerlessness	102	-2.68	.0042
Meaninglessness	101	-5.67	.0001

* Negative values of t indicate a reduction in the score between the first and second questionnaire administration.

SUMMARY AND CONCLUSIONS

The current research represents an initial attempt to relate computer users' attitudes with alienation theory. As such, it can only be considered exploratory. Students were used as subjects, and should not be necessarily considered representative of all computer users. However, the data collected do show that alienation theory is meaningful in an MIS context and can help to explain certain performance related measures.

Limitations of the current research should be noted. One is that some demographic characteristics shown to relate to other types of alienation were not investigated (for instance, race, sex, and age). Authors, including Moyer and Motta (1892) found that while no difference between whites and blacks may exist, alienation has more negative influences on blacks than whites. It would also be desirable to control for subjects' varied technical backgrounds and experience, an omission for which previous alienation studies (Shepard, 1971) have been criticized (Attewell, 1984). Methodologically, many of the dependent measures used are single-item measures against which Nunnally (1978) warns.

Ideally, dependent measures with additional psychometric strength would be employed. Future research will be undertaken to address these and other issues and to apply the developed instrument to a more general class of computer users in business and industry to ultimately help explain how to make information system implementations more successful.

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