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THE IMPACT OF THE COMPUTER ON THE CHOICE ACTIVITY OF DECISION MAKERS: A REPLICATION WITH ACTUAL USERS OF COMPUTERIZED MIS

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A previous study on the impact of computer generated information on the choice activity of student subjects found that those with computer experience were less influenced by computer generated information than they were by information presented in a more traditional mimeograph format. Subjects who had little, if any, computer experience were more influenced in their choice activity by computer generated information than by the identical information presented in the more traditional mimeograph format (Luthans & Koester, 1976). The results of that study seemed to have definite implications for users of computerized information systems, suggesting that computer generated information per se may bias users. Those with a great deal of computer experience may be overly skeptical of computer generated information, and those with little or no computer experience may be in awe of the computer and place too much credibility and reliance on the information that it generates. These possibilities seem sufficiently significant and intriguing to be tested in a field study with actual management information systems (MIS) users.

Computerized information is playing an increasingly significant role in all aspects of managerial decision making. Unfortunately, there is too little research evaluating its impact (e.g., Lucas, 1975; Mason & Mitroff, 1973; Schewe, 1976; Swanson, 1974). Although over two decades ago Weinwurm (1957) warned about the need for better understanding of human factors in management science, there still is very little known about important areas such as the impact that computers have on human decision making (Tomeski, 1976). On the one hand, some computer experts are making the plea that "The computer must *support* the manager but not *replace* his judgment. It should not try to provide the 'answer,' not impose a predefined sequence of analysis" (Keen, 1976, p. 2). Yet the laboratory study suggested that those users with little computer expertise may actually be letting the computer make the decisions for them. It is the syndrome that says: "If the computer says this is the answer, then it must be right. Who am I to question the big, blinking, magical box?" On the other hand, there is some evidence that humans are not as effective as are computers in making decisions (e.g., Dawes, 1973). Based on this, the

argument becomes: "Essentially a man should 'tell' the computer *how* he wants decisions made, and then let the machine make the decision for him" (Zeleny, 1975, p. 38). From this latter perspective, the laboratory study suggests that those with a great deal of computer expertise may be underselling the value of the computer in making decisions.

In either case, a replication with actual users as subjects should be able to shed important new light on the impact that computers have on the managerial decision making process. In addition, the present study represents the orderly progression of scientific inquiry by moving from the laboratory to the field setting in the search for generalizability and the more effective practice of management.

Background and Subjects

The present study utilized members of the professional finance and accounting staff of the production division of a large oil company. This company has one of the largest concentrations ($N = 450$) of practicing accountants in the country. It contains one of the most sophisticated nonmilitary computerized information systems in the world. Within the last decade this division has experienced two major mergers so that most of the present staff have a wide range of experience with three large petroleum companies.

The accountants are invited to attend monthly technical, professional meetings sponsored by the company. The day the study was conducted, 220 accountants attended the meeting. This represented the biggest turnout in the 18 months the program was in effect. All but 17 of the accountants (they participated in the planning and/or administration of the study) took part in the study ($N = 203$).

Virtually all the subjects are heavy users of the computerized information system. They retrieve, manipulate, and display information from the computerized system on a daily basis, although some are more experienced, especially in the input/programming and system development aspects, than are others. Because previous computer experience had such an important moderating effect in the original study by the present authors, the subjects were classified as experienced or nonexperienced. In consultation with the appropriate company representatives three questions were developed to determine the degree of computer experience: (1) Have you ever attended the in-house computer programming school? (2) Do you have six months or more of programming experience in any of the languages? (3) Have you ever served as the primary user representative in the development of a computer system? Subjects who answered yes to one or more of these three questions were classified as computer experienced. If all three questions were answered no, the subjects were classified as nonexperienced. During the data analysis phase of the study the subjects were assigned to the experienced and nonexperienced experimental groups according to these criteria.

Procedure

All subjects were led to believe that they were participating in a study to determine their aptitude for the analysis and utilization of various kinds of data. They then were given a packet of materials and were told to follow instructions carefully. They were warned not to turn to any page in the packet until told to do so. Then they were asked to fill out the first page which asked for their name and various biographical information. Included were several items designed to stimulate the competitiveness and interest of the subjects. For example, subjects were asked to identify their organization unit, immediate supervisor, and the college from which they were graduated. (This latter point was deemed to be significant because the majority of the company's accountants came from a concentration of regional, highly competitive universities.) The first page also contained items to determine the degree of experience the subjects had with the computer.

After filling out the first page, the subjects were told that they would be taking a 10 minute, 20-item multiple choice test. They were told that it was a difficult test, but there was no penalty for guessing. They were told to answer all questions, to keep their answers to themselves, and not to look at the remaining materials in the packet until told to do so. This multiple choice examination consisted of 10 aptitude-type questions. Two dealt with general logic, two with vocabulary, one with spelling, two with general mathematical exercises, and two with numerical progressions. There was one general information question. Five of the questions dealt with technical aspects of finance and accounting. The remaining five consisted of a tax question, a question on the security and exchange commission, and three questions on internal company data. The key aspect of this test is that there is no one best answer. Of the 20 questions, 14 list possible answers, all of which are incorrect, and the remaining 6 questions list possible answers, all of which are correct. The role of this test is essentially that of a placebo. This procedure is commonly used in all projective instrumentation in personality analysis and in the use of many no-answer tests in creativity research. The objective was to prohibit the test items per se from influencing the subject's choice activity. Therefore, each item was carefully designed and pilot tested. Examples of a couple of the questions are:

What is the next number in the progression 17, 12, 43, 22? (a) 6 (b) 95 (c) 30 (d) 29.

Differential calculus is to integral calculas as algebra is to: (a) factor analysis (b) exponentiation (c) probability theory (d) derivative extraction.

As the above indicates, these questions were very difficult, and post-study interviews with participants indicated that they did not suspect that there was no one best answer.

After completing the 20-item test, the subjects were told that, because the test was so difficult, they would have a five minute review period in which they could change answers if they so desired. They were told to turn to the last two pages of their packet for this review.

When the packets were randomly passed out to the subjects, in about 30 percent of the packets the last two pages contained irrelevant data from the company's annual report. The subjects receiving the latter packets became the control subjects. They received no suggested answers to the exam. During the data analysis phase of the study, when it could be determined from the first page of the packet what the subjects' experience with the computer had been, there turned out to be 31 in the computer experienced control group and 30 in the nonexperienced control group. The remainder of the packets that were handed out contained a last page that had either a computer printout list of suggested answers or a mimeograph list of suggested answers. When assigned according to the experience criteria, the four experimental groups were as follows:

Experimental Group I ($N = 29$). Computer experienced subjects were given the same page (the page following the twenty-question exam in the packet) of irrelevant data as was received by the control subjects, but a last page having a computer *printout* list of suggested answers.

Experimental Group II ($N = 28$). Computer experienced subjects were given the same page of irrelevant data as received by the control subjects, but a last page having a standard *mimeographed* list of suggested answers.

Experimental Group III ($N = 46$). Nonexperienced subjects were given the same page of irrelevant data as received by the control subjects, but a last page having a computer *printout* list of suggested answers.

Experimental Group IV ($N = 39$). Nonexperienced subjects were given the same page of irrelevant data as received by the control subjects, but a last page having a standard *mimeographed* list of suggested answers.

All subjects were told that they could change as many answers as they desired during the review period. They were told that the two additional pages of information for the review session were generated from a variety of sources and may or may not be correct. This also was stated at the top of the last page for the experimental subjects. Because there was no single best answer to the questions on the test, there also was no single best answer suggested by the answer lists given to the experimental subjects. For example, the answer listed corresponding to each question stated that, "THE ANSWER TO QUESTION 1 is E," etc. These suggested answers were randomly assigned on the lists. In other words, the suggested answers were not the key, but rather the key was the type of format (i.e., mimeograph or computer printout) on which the suggested answers were presented. The suggested answers for the printout subjects were printed by the computer on regular computer printout paper. The suggested answers for the mimeograph subjects were mimeographed on standard white paper. The two lists of answers were identical in every other respect (content, size, form, capitalization, punctuation, spacing, and quality of paper).

The answer sheet used by the subjects contained two columns. The subjects were instructed to place their answers to the questions during the regular time period in column A and during the review period to place any answers they wished to change in column B. Thus, the exact number of changes could be accurately recorded.

Results and Conclusions

The mean number of answer changes during the review sessions by members of each of the six groups (two control and four experimental) is summarized in Table 1. Analysis of variance found a statistically significant difference between each of the subgroups (control, printout, and mimeograph) *within* each of the two major classifications (experienced and nonexperienced). [$F(2, 85) = 4.18$, $p < .05$ for the computer experienced group, and $F(2, 112) = 3.84$, $p < .05$ for the nonexperienced group.]

TABLE 1
Number of Changes in Answers for Computer Experienced and Nonexperienced Subjects

Group	*N*	*Mean Number of Changes*	*Standard Deviation*
Experienced			
Control	31	0.419	0.84
Printout	29	1.483	2.16
Mimeograph	28	2.679	4.53
Nonexperienced			
Control	30	0.333	0.83
Printout	46	1.783	2.88
Mimeograph	39	1.487	2.16

Other than the analysis of variance within the two major classifications, no significant difference [$t(59) = .396$] at any acceptable alpha level was found between the means of the experienced and nonexperienced control groups. This result is evidence of the homogeneity of the subjects in the study. In addition, because both control groups had mean changes that were significantly smaller than the means of either the printout or mimeograph experimental groups, the lists of suggested answers does seem to have had a significant influence on the choices of the subjects.

As was found in the original laboratory study, the key finding of this replication is that highly experienced computer users are less influenced by information that is computer generated than they are by information presented in mimeograph form, and relatively inexperienced computer users are more influenced by computer generated information than they are by identical information presented in mimeograph form. The mimeograph group of computer experienced users changed significantly more answers than did the computer-experienced printout group. The reverse

was true of the relatively nonexperienced users. The printout group of nonexperienced users changed significantly more answers than did the mimeograph group of relatively nonexperienced users.

The implications that the original study had for actual users of computerized information systems were supported by this replication. The choice activities of actual users of MIS seemed to be affected by the computer per se. Also similar to the original study was the type of impact the computer had on the subjects. As in the first study, those users with relatively little computer knowledge, background, or experience were more influenced by the computer than they were by more traditional forms of information. A case could be made that those who know nothing about the computer may try to put it down and discount the data that are computer generated. An example may be a judge who has no computer experience and may discredit evidence that is computer generated. In today's organizations, however, most managers realize the growing importance of computers. The stereotyped version of the manager with no computer experience holding the computer in awe and being overly influenced by it seemed to be the case in this study. The results would suggest that users with little computer background should recognize and be cautioned that computer generated information is not necessarily equal to or superior to more traditional forms of information. By the same token, the finding that the computer experienced users may be overly pessimistic about computer generated data also has implications for practice. Some writers on systems analysis already have suggested that they have falsely assumed that past experiences with the computer have been pleasant and productive (Gibson, 1977). This study would indicate that this is true. Knowledgeable, experienced users were not as influenced by computer generated information as they were by more traditional forms of data. These knowledgeable users should recognize that they may be unfairly biased against the computer. They should recognize that their past experience may affect their present judgment in using computerized information systems. In either case, with the increasing use of MIS, the users themselves, as well as their peers, superiors, and subordinates, should be aware that the computer per se may influence the decision making process.

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