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An Empirical Study of Peer Influence on User Attitudes, Behavior, and Performance

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AN EMPIRICAL STUDY OF PEER INFLUENCE ON USER ATTITUDES, BEHAVIOR, AND PERFORMANCE

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ABSTRACT

User attitudes, behavior, and performance have been studied by many researchers, yet we do not have a very complete understanding of their determinants. Word-of-mouth communication is described in this study as one potentially powerful influence on those outcomes. A deception experiment tested the effects of word-of-mouth communication on novices engaged in a learning task. It was hypothesized that negative communication would diminish attitudes, behaviors and behavioral intentions, and performance on material retention as well as task accuracy. The results provided evidence of the effects of word-of-mouth communication on attitudes, behavioral intentions, and software test performance, but failed to provide evidence that actual behavior or task performance are affected by such communication.

1. INTRODUCTION

Over the last several years, many MIS researchers have invested a substantial amount of time studying the attitudes, behavior, and performance of users. Such variables are chosen among the several possible outcome variables in MIS research and allow a "micro" view of information systems, most often at the unit of analysis of a single user. This level of analysis provides an important complement to "macro" studies of information systems outcomes such as those provided by Brynjolfsson (1993) and Cooper and Zmud (1990).

Although user attitudes, behavior, and performance have been studied for many years in the MIS literature, there has been relatively little work on simultaneous assessment of all three variables. Further, while many studies address relationships between some of the variables, few devote substantial theoretical and empirical attention to their origins.

The goal of this paper is to increase our understanding of peer influence on new information system users. We tap the Word-of-Mouth literature from Marketing, in conjunction with the Technology Acceptance Model from our literature and innovation-diffusion theory, to assess the extent to which user attitudes, behavior, and performance are manipulated by peers, rather than derived solely through direct experience. We report on a deception experiment that employed confederates in three experimental groups.

2. ATTITUDES, BEHAVIOR, AND PERFORMANCE

Major streams of research in MIS have investigated for some time user attitudes, behavior, and performance as surrogates to be used for measuring success.

2.1 User Attitudes

In the area of user attitudes, one of the most important surrogates for MIS success has been the study of user satisfaction (DeLone and McLean 1992; Ives and Olson 1984). Most satisfaction studies have addressed its measurement (e.g., see Miller 1989; Doll and Torkzadeh 1988; Rushinek and Rushinek 1986; Ives and Olson 1984; Ives, Olson and Baroudi 1983), its conceptual bases (e.g., see Melone 1990; Goodhue 1988; Iivari 1987), and its relationships with other variables (e.g., see Baroudi, Olson and Ives 1986).

Expectations have also appeared to be important for researchers to consider in attempting to identify sources of

user attitudes. Two competing theories can be used in explaining attitudes (Ginzberg 1981). The first theoretical perspective makes use of *contrast theory* (Sherif and Hovland 1961), focusing on the contrast between what a user expects and what is delivered. An opposing approach makes use of *cognitive dissonance theory* (Festinger 1957) and asserts that there will be some consistency between expectations and resultant attitudes. Dissonance theory was supported by Ginzberg's study, implying that users' exposure to positive, motivational messages will tend to improve attitudes, independent of the actual quality of the system.

2.2 Behavior

User behavior has been studied from two general perspectives: acceptance and usage. In general, the former is viewed as a prerequisite to the latter.

Acceptance of information technology has been studied from the point of view of the user's intentions to adopt, using the Technology Acceptance Model (TAM) (Davis 1989; Davis, Bagozzi and Warshaw 1989), the Theory of Planned Behavior (TPB) (Mathieson 1991), or the theory of innovation-diffusion (Rogers 1983).

TAM states that intentions can be predicted by assessing attitudes, which is in turn predicted by assessing perceptions of ease of use and usefulness. TPB states that intentions can be predicted by assessing attitudes, subjective norms, and perceived behavioral control. Both models were based on the Theory of Reasoned Action (Ajzen and Fishbein 1980) and appear to explain intentions to use a system very well. The empirical differences between the models are "not large enough to conclude that one model is better than the other on purely empirical grounds" (Mathieson 1991, p. 187). The studies by Davis, Bagozzi and Warshaw and by Mathieson support the assertion that perceived usefulness and perceived ease of use affect intentions to use technology. Davis found support for an assertion that perceived ease of use precedes usefulness in the causal chain, rather than working with it in parallel to influence behavior.

System usage, which presumably occurs after acceptance, has been long studied in the MIS literature. While the literature prior to the mid-1980s concentrated on relationships between variables such as user involvement, attitudes, and usage (e.g., Baroudi, Olson and Ives 1986; Robey 1979), the most recent work has employed TAM and TPB with their explicit inclusion of behavioral intentions leading to behavior.

Because TAM and TPB explicitly include behavioral intentions as an antecedent of actual use of technology, users of these models need to understand the relationships between those two variables. Driven by a great deal of evidence linking intentions to action in the TRA literature (Ajzen 1988), MIS researchers have found evidence for the same kind of link. For example, in their TAM study, Davis, Bagozzi and Warshaw found that behavioral intentions to adopt technology were significantly related to actual use after an interval of fourteen weeks following the measurement of intentions.

Usage has also been directly linked to perceived ease of use and usefulness, depending on the particular package under investigation (Adams, Nelson and Todd 1992). Davis found that usage was explained by both ease of use and usefulness; however, usefulness appears to be the more important and direct antecedent of use.

Finally, innovation-diffusion theory has investigated acceptance of technology by focusing on many variables, studies, and methods. Rogers discovered that innovations are adopted along a classic S-shaped curve (accelerating adoption, then decelerating adoption). The rate of adoption was found to be dependent on perceived attributes of innovations (relative advantage, compatibility, complexity, trialability, and observability), type of innovation-decision (optional, collective, authority), communication channels (mass media or word-of-mouth), nature of the social system, and extent of change agents' promotion efforts. Rogers outlines substantial evidence of the importance of word-of-mouth messages in adoption of technology.

Studies by Brancheau and Wetherbe (1990, 1989) provided evidence that the source of greatest influence in all stages of adoption decision making was from work colleagues. As the stages progress from initial knowledge to persuasion to the decision itself, the percentage of influence attributed to work colleagues rose steadily from 54% to 64% to 74%. Very little of the persuasion was attributed to computer specialists, consultants, vendors, mass media, teachers, and friends.

In summary, one might conclude that both acceptance of technology (measured via intentions) and usage of technology are behavioral variables that help us better understand information systems users. Further, word-of-mouth messages can be powerful determinants of the adoption of technology.

2.3 Performance

User performance is most often studied in the literature of Human-Computer Interaction (HCI). HCI is a confluence of several fields, among which are Psychology, Computer Science, and MIS. The literature gained substantial theoretical development in work by Card, Moran, and Newell (1983); principles set forth as a result of that research have

found their way into a large portion of the experiments conducted in the field. In general, their GOMS model provided a technique for modeling and predicting how much time it would take for an expert user to perform a task without errors. Such modeling has made it possible for other researchers to compare alternative interface designs without actually building them.

MIS researchers have traditionally not focused on design alternatives at or near the level of the keystroke, but have evaluated the relationships between performance and several other variables. Examples include data presentation alternatives (Vessey and Galletta 1991; Jarvenpaa 1989; DeSanctis and Jarvenpaa 1985), training approaches (Davis and Bostrom 1993; Olfman and Bostrom 1991; Bostrom, Olfman and Sein 1990; Sein, Bostrom and Olfman 1987), and users' backgrounds (Galletta et al. 1993; Mackay and Elam 1992).

In this study, we explore the potential relationship between the domain of affect (attitudes) and performance, working within the word-of-mouth paradigm.

3. WORD OF MOUTH

For many years, researchers in Marketing have explored the effects of information received by consumers on their purchasing behavior. Researchers have studied the role of word-of-mouth messages, how changed expectations affect behavior, and what factors affect the power of word-of-mouth messages.

Consumer expectations have been shown to be affected more by word-of-mouth messages than by any other factor overall (Webster 1991). Interestingly, such messages more strongly affect expectations than past personal experience, advertising, and sales promotion. One reason that consumers allow themselves to be influenced by others is to "learn about products or services by observing others and/or seeking information from others" (Bearden, Netemeyer and Teel 1989, p. 474).[1] Other reasons are identification with or enhancement of one's image among others, or willingness to conform to others' expectations.

Consistent with the work of Ginzberg in MIS described above, researchers in marketing have found that high expectations can lead to satisfaction, even when they are disconfirmed (Tse and Wilton 1988; Oliver and DeSarbo 1988; Churchill and Surprenant 1982; Oliver 1980; Olshavsky and Miller 1972). It is therefore important to make sure that the word-of-mouth message is highly effective.

Many researchers have attempted to understand more about the effectiveness of word-of-mouth messages. Several studies detect stronger effects when information about a product is unfavorable rather than favorable (e.g., Herr, Kardes and Kim 1991; Arndt 1967). Kisielius and Sternthal's "Availability-Valence Hypothesis" (1984, 1986) asserts that vividness alone is not enough, but that the message receiver would need to view the information favorably, and should perform additional cognitive processing for greatest influence on behavior. Herr, Kardes and Kim found that face-to-face word-of-mouth communication was more persuasive than written communication. Feick and colleagues (Feick and Higie 1992; Price, Feick and Higie 1989) show that preference heterogeneity (high differences between customer preferences) and lack of coorientation (similarity between the source of the information and the receiver[2]) can diminish the efficacy of word-of-mouth messages. Finally, an experienced source has more influence than an inexperienced source (Woodside and Davenport 1974; McGuire 1969).

In summary, face-to-face word of mouth messages have proven to be powerful influences in consumer attitudes and behavior.

3.1 Summary

The results of the MIS and marketing literature suggest that there is promise in attempting to merge the perspectives of both fields. One study that has examined the impacts of interpersonal word-of-mouth communication among MIS users concluded that this impact was indeed stronger than the impact of advertising in the diffusion of end-user computing technology (Brancheau and Wetherbe 1990, 1989). Our study continues the investigation into effects of such communication on users.

4. HYPOTHESES

Based on the findings from the literatures of MIS and Marketing described above, the model presented in Figure 1 is proposed. The model asserts that the relationship between a software package's ease of use and usefulness influence a user's perceptions of those variables. However, the relationship is moderated by word of mouth peer influence. The perceptions of ease of use and usefulness are likely to affect the user's attitudes, behavioral intentions, behavior, and performance.

We will focus on the last four constructs in this study. Although a path model is suggested by the conceptual model in Figure 1, we choose to focus on the effect of word-of-mouth manipulation on the four constructs. A series of studies using a variety of techniques would be needed to provide evidence for the existence of a causal chain.
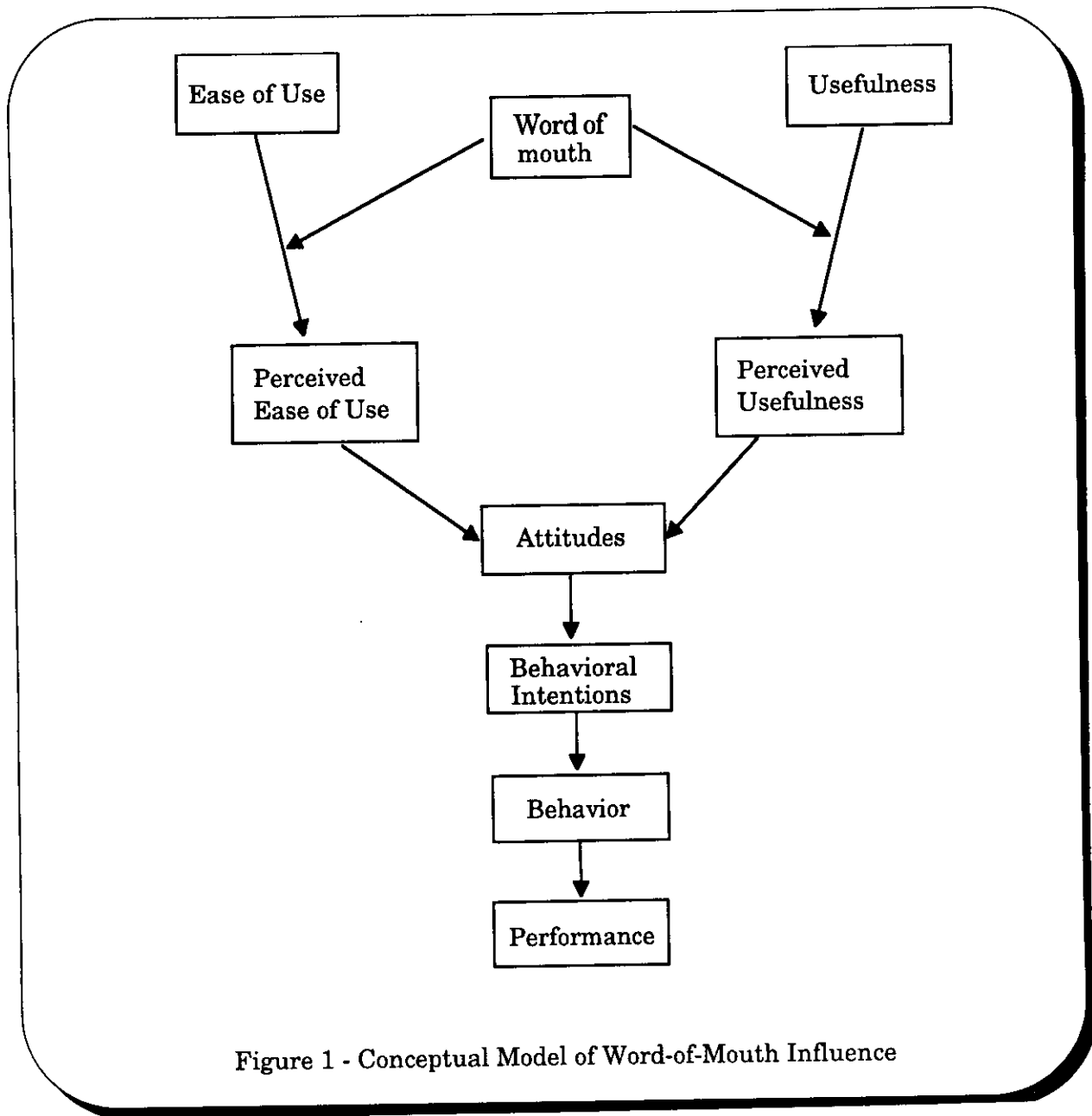
Figure 1 - Conceptual Model of Word-of-Mouth Influence

Based on the findings of previous research in Marketing and MIS, the first four hypotheses are offered. In general, word-of-mouth messages have been powerful determinants of consumer expectations (for example, see Webster 1991), attitudes (e.g., see Herr, Kardes and Kim 1991), and intentions to purchase (e.g., see Richins 1983).

H1:   Post-usage software product attitudes will be more favorable in the positive word-of-mouth condition than in the negative condition.

H2:   Intentions to purchase the software will be greater in the positive word-of-mouth condition than in the negative condition.

While the marketing literature focuses on the purchase decision, in the information systems setting, *usage* is often the only outcome variable that is appropriate. The purchaser of software is often a completely different party than the user; at issue in many cases is a *psychological*, rather than *economic*, purchase. Studies in TAM (Davis 1989), TBP (Mathieson 1991), and the Theory of Reasoned Action (Ajzen 1988; Ajzen and Fishbein 1980) demonstrate the importance of studying behavioral intentions as well as behavior. There is evidence to suggest high correlation between the two constructs (Ajzen and Fishbein 1980), however the intention must refer specifically to the behavior. Because our laboratory setting could not capture meaningfully an intention and an actual behavior, we have

chosen to investigate one intention (to use the software in the future) and a slightly different behavior (optional usage at the end of the experimental session). Both variables are of great potential importance in our context, although they might not correlate very highly. We therefore express them as two separate, but related, hypotheses.

H3a: Intentions to use the software again will be greater in the positive word-of-mouth condition than in the negative condition.

H3b: The amount of optional use by subjects will be greater in the positive word-of-mouth condition than in the negative condition.

The final aspect we have discussed is a user's performance in using software. All other things being equal, a user with diminished intentions to use the software again is expected to be less motivated in accomplishing an experimental task, and perhaps less committed to learning. The importance of motivation for task performance has been discussed by Olfman and Bostrom (1991) and Moran (1981), among others. The following exploratory hypothesis formalizes the role of motivation and commitment to learning.

H4: Performance on experimental tasks will be higher in the positive word-of-mouth condition than in the negative condition.

5. METHOD

An experiment was conducted to identify the impact of peer influence on new users who learned to perform a task. There were several important guidelines in designing our study.

It was important to maximize the effects of word-of-mouth communication. That is, it was a necessity to (1) base the study on face-to-face communication with peers, (2) engage positive, negative, and control groups to permit detection of which valence is stronger, and (3) provide multiple opportunities for recipients of word-of-mouth communication to become cognitively engaged in the message.

One difficulty is the inability to control the level of preference heterogeneity inherent in affective evaluations of software. Price, Feick and Higie describe an evaluation of a cab ride as likely to exhibit low preference heterogeneity, while Feick and Higie (1992) describe an evaluation of a hair style as likely to exhibit high preference heterogeneity. It is indeed possible that computer software is perceived very differently by different people, and that it is more like a hair style than a cab ride in the level of agreement likely to be generated by its users. Feick and Higie found that the source's similarity to the recipient is very important

when high preference heterogeneity exists, and that the source's experience is very important when there is low preference heterogeneity.

Therefore, we added one final requirement: We needed to (4) make use of message sources that were perceived as experienced while having similar values as the recipients. Inclusion of both factors allowed us to mitigate the effects of high preference heterogeneity that might exist in evaluations of software.

5.1 Subjects and Incentives

The first author solicited subjects from several sections of a required MBA class at the University of Pittsburgh, presenting the opportunity to earn a flat $4 fee for participating. In addition to the flat fee, they were told that prizes would be awarded as follows: If they performed in the top half of the group, they would receive an additional $3. If they were one of the top five performers, they would receive an additional $18, $15, $13, $11, and $9, respectively.

All subjects in the sampling frame had received basic training in MS-DOS and Lotus 1-2-3[3] nine months earlier, and since that time had been assigned on frequent occasions to use PCs to complete assignments. Of the approximately 200 subjects we canvassed, 74 volunteered to participate in the study and signed up for a session.

Fifty-three subjects actually showed up for their designated sessions and participated in the study. We scheduled six subjects per group, but the large number of "no-shows" caused the actual groups to be irregularly sized, with slight variation in the number of empty seats per group. Three subjects were dropped from analysis because the background questionnaire revealed that they were already experienced with the somewhat rare integrated software package used in the study (described below).

Examination of all demographic measures revealed that the subjects represented remarkably well the sampling frame. The average age of the subjects was 27 (standard deviation 3.2) years, and 39 of the 50 subjects were males. The three largest majors represented were finance (42%), marketing (22%), and information systems (10%).

5.2 Experimental Design

Three separate types of experimental treatments were designed, termed as *positive*, *negative*, and *control*, named after the type of word-of-mouth stimuli presented to the subjects in each group. The control group subjects received no stimuli.

confederate

confederate
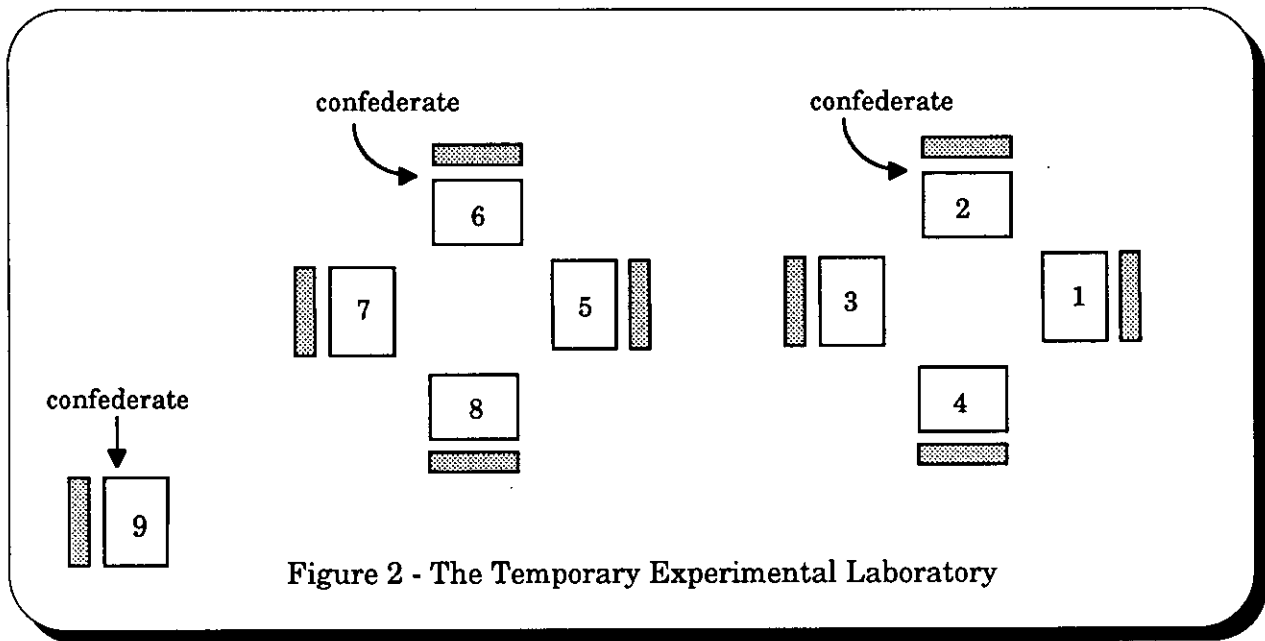
6

7   5

confederate

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9

2

3   1

4

Figure 2 - The Temporary Experimental Laboratory

Each treatment was administered in four separate sessions due to limitations in the size of the temporary computer lab we constructed for the study (see Figure 2). To accommodate their schedules, subjects could not be assigned to lab sessions randomly. However, we chose each group's treatment type randomly to ensure that every subject had an equal chance of being assigned to each treatment.

The laboratory contained seven 386sx PCs and two 8086 PCs. The 8086 PCs (stations 2 and 9) were restricted to confederates, to eliminate computer performance as an issue in measuring human performance or preference. The stations were arranged to reduce the ability of subjects to see the work of others.

5.3 Materials

Subjects were given three packets during the course of the experiment.[4] The first was distributed to subjects while giving them general instructions and included an informed consent form for their signature as well as a pre-experiment questionnaire. The questionnaire asked about their past experience with computing.

The second packet contained what was called a "Quick Tour" of using the integrated package Framework III.[5] The goal was for subjects to create a "frame" (similar to a window) that contained other frames, including text, a spreadsheet, and a graph tied to the spreadsheet (see Figure 3). Assumptions in the top right frame were to be manipulated and the results to be depicted in the new income numbers as well as the graph.

The first page of this self-paced training packet established the goals of the session, the time required, and other basic instructions, and eight pages of keystroke-by-keystroke instructions followed. At the end of this packet, subjects were asked to enter new numbers for a complete set of six assumptions at least twice. They were then invited to enter a new series of six assumptions up to eight more times as one measure of behavior (voluntary use, without financial incentive).

The third packet contained a post-experiment questionnaire, which assessed subjects' attitudes, behavioral intentions, and amount of retention. Most measures were created because there were no existing instruments allowing subjects to assess the particular package used. Subjects' overall reactions to the software were assessed by summing across seven 7-point semantic differential scales (see the appendix). Behavioral intentions were assessed by using two more scales that asked how likely subjects would be to use the software again and how likely they would be to purchase the software under the assumption they possessed adequate resources and need. A quiz consisted of eight multiple-choice questions (see the appendix).
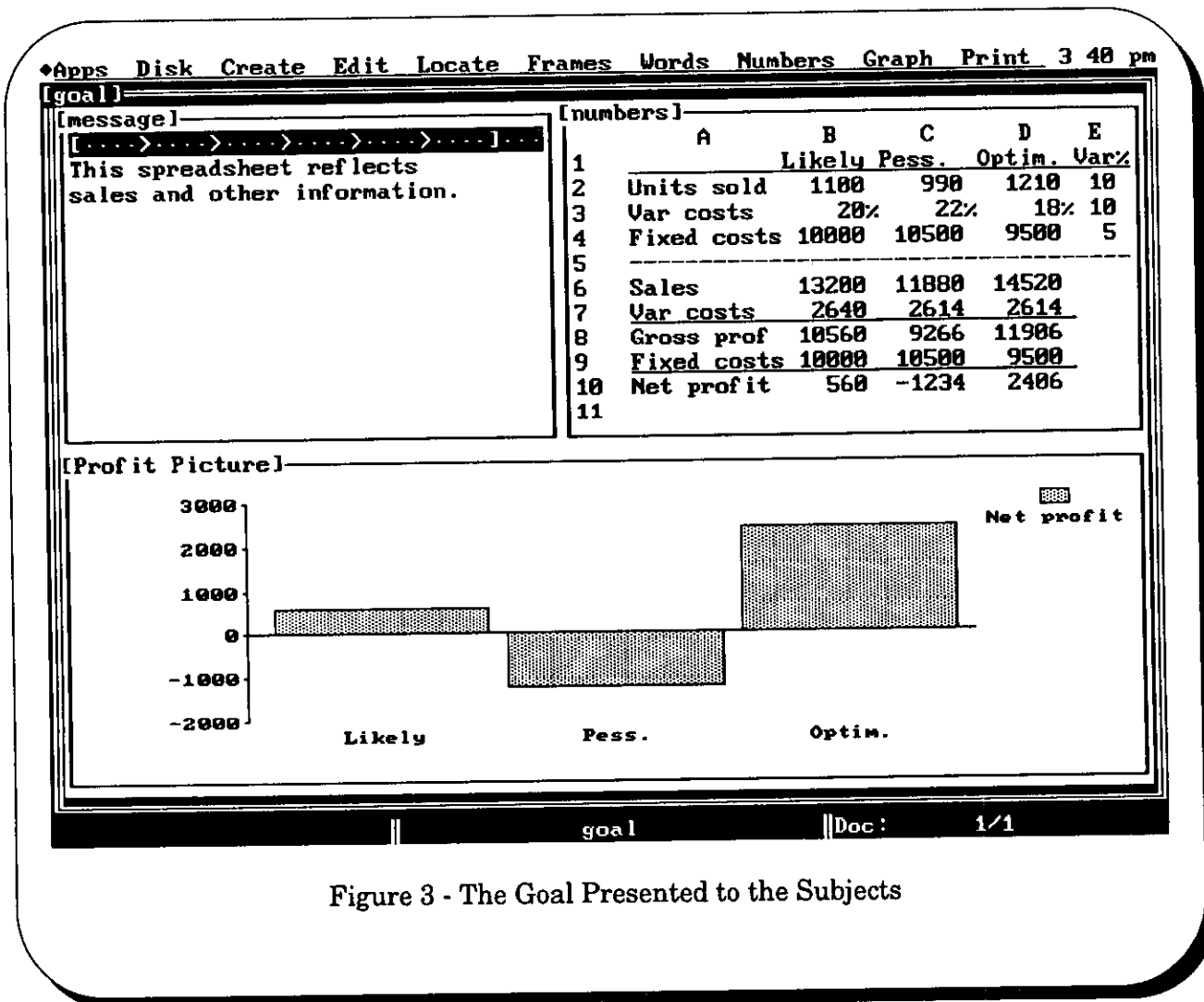
Figure 3 - The Goal Presented to the Subjects

5.4 Pilot-Tests

The materials (and procedures) were pilot-tested in several iterations, resulting in many changes and refinements to all items. The Quick Tour document presented many interesting problems. First, subjects sometimes became confused and needed to backtrack when setting up the screen layout. Instructions and macros were added to allow backtracking; the material was subdivided into what became eight independent small steps. If a subject became lost, he or she could return to the beginning of that particular step by pressing an ALT sequence.

Another interesting problem was that some pilot subjects sometimes forgot to pay attention to the screen, merely following the keystrokes listed on the paper. On the bottom of each page, a prominent message was added to promote attentiveness.

5.5 Experimental Procedures

The main part of the study was intended to furnish the positive or negative cues both *before and during* the training. This timing was chosen because of the potentially opposing effects of cognitive dissonance theory and contrast theory, described earlier. The former would predict that pre-training cues would facilitate development of attitudes consistent with those cues. However, contrast theory would predict that some subjects might then become surprised in the opposite direction, because they might raise or lower their expectations excessively. Therefore, additional cues

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given during training were thought likely to reinforce the initial cues, strengthening the overall manipulation.

Upon the arrival of all subjects in a group, the experimenter began to describe in general what was to be accomplished and passed out packet one for subjects to complete. In his explanation, he gave the name of the software package that was to be used. One of the confederates immediately raised his hand, asked for verification of the package to be used, and then stated that he was already very familiar with Framework III. In the positive (negative) group, the confederate then expressed his favorable (unfavorable) perceptions of the package according to a prepared script. He also mentioned the high market share Framework holds in Europe (poor market performance in the U.S.) In the control group, the confederate expressed no opinions but merely told of his familiarity with the package. The confederate was then excused from the session and the experiment continued.

The remaining subjects were given the second packet and were asked to sit at "any computer they wished." The remaining two confederates were always seated closest to the computers and were easily able to position themselves at stations 2 and 6. The experimenter stood in the way of station 9, which was completely unable to run the software due to the lack of a hard drive.[6]

Macros were used for unobtrusive measurements. Several macros were invoked at certain places to capture and save the current system time. One macro captured the number of times users changed assumptions, as well as the amount of time spent doing so. Another macro saved each subject's results at the end of the exercise. Finally, other macros presented a title and exit screen summarizing the experimenter's verbal instructions.

On average, subjects worked on the task for 28 minutes (standard deviation 7.7). While the subjects worked, confederates in the positive (negative) groups made positive (negative) comments even though subjects were instructed to keep as silent as possible. For example, positive comments included several different loudly-whispered expressions of excitement, while negative comments included groans, sighs, and loudly-whispered expressions of how painful the exercise seemed. These scripted outbursts were timed at about five to six minute intervals to ensure a proper balance of salience and realism. The experimenter reacted to the first outburst, asking if there was a question or problem, then reminded subjects to be as quiet as possible. Just before the second outburst (involving obviously sympathetic interaction between the two confederates), the experimenter walked out to the hall for a moment and returned as if he was not aware of the outburst. Just before

the third (large) outburst, the experimenter walked quickly to the door as if there was an urgent message and seemed to miss it once again. Depending on timing, the fourth or fifth (minor) outburst was scheduled to occur at about the time when the experimenter was preoccupied distributing packet three to the first real subject who indicated that he or she was ready for it. The experimenter again admonished subjects lightly for talking. Minor outbursts continued as subjects continued completing their tasks.

We considered it necessary to introduce the outbursts as unsanctioned behavior because we needed to control the setting as much as possible. If real subjects were allowed to speak out loud, then each group would be different; our level of analysis would then be at the *group* rather than at our target, the *individual* level. Therefore, the risk of making subjects uncomfortable with outbursts was considered to be outweighed by the added control from ensuring that all groups within a treatment were exposed to identical messages.

When each subject completed the task, he or she was given packet three. After collecting packet three, each subject was thanked, paid, and followed out into the hallway. As a manipulation check, the experimenter asked each subject if the outbursts distracted him or her. He then reminded the subject not to discuss any aspect of the experiment (including the outbursts) with anyone else until the experiment was completed (in three days).

The manipulation check was not very effective, because subjects seemed reluctant to disclose that they heard the outbursts. About a third of the subjects said they heard nothing, but when the experimenter pointed in the general direction of machines 2 and 6, all but five subjects suddenly acknowledged that they were aware of the outbursts, acting as if they had at first misunderstood the question. This conflict between their initial and revised answers was puzzling to the experimenters, who speculated that the subjects might have indeed been made a bit uncomfortable by the outbursts. Most of the subjects quickly assured the experimenter that the outbursts did not affect their performance.

The procedure met the goals described earlier. Face-to-face word of mouth statements were provided by using confederates. Cognitive engagement was maximized through consistent and repetitive outbursts. Source experience and peer similarity were simultaneously achieved by using multiple confederates.

Due to the small number of subjects, univariate T-tests comparing only the positive and negative groups were used to test each hypothesis. This is appropriate because no non-hypothesized relationships were explored.

6. RESULTS

Results will be discussed in three sections, covering user attitudes, behavioral intentions, and performance.

6.1 Attitudes

Cell means for the custom-made 7-item attitude scale (alpha = .89) are shown in Table 1. As Hypothesis 1 predicts, the negative group is significantly lower than the positive group.

6.2 Behavior and Behavioral Intentions

Behavior was examined using conventional behavioral intentions surrogates and also using a new approach: counting the number of voluntary "what-if analysis" iterations performed by subjects.

Subjects were asked if they would use the software again and if they would purchase the software. Cell means (see Table 2) both differed as predicted by Hypotheses 2 and 3a. Once again, the control group appears to be more similar to the positive group than to the negative group.

In accordance with Hypothesis 3b, a second type of behavior measure was employed to determine whether actual behavior would be affected by the treatment. Subjects in the two groups appeared to perform about the same number of additional, voluntary "what if" analysis iterations (see Table 3). Although the control group mean appears to be larger than either of the experimental group means, even the most liberal of testing failed to indicate a significant difference, as did the appropriate, conservative post-hoc comparisons (Hays 1988).

We also investigated the degree to which the optional iterations correlated with intentions to purchase or use the software. Both correlations were non-significant and only 1% of the variation in the number of optional iterations would be explainable by knowing each of the intentions if the correlations had been significant.

6.3 Performance

The final, exploratory hypothesis was examined by measuring two performance variables: a 10-point quiz score and a 10-point task score. As Table 4 illustrates, mixed results were obtained for Hypothesis 4. Means for the quiz scores for negative and positive group subjects differed significantly in the hypothesized direction, but not the means for the task score.

7. DISCUSSION

There were significant findings in each of the three categories we examined. These findings appear to support the assertion that word-of-mouth communication can be a powerful determinant of attitudes, behavior, and performance. Along with a short discussion of each of the major findings, we discuss some of the limitations of the study.

7.1 Major Findings

Our subjects who were exposed to unfavorable word-of-mouth statements appeared to adopt unfavorable attitudes toward the software, in comparison to the subjects exposed to positive statements. Interestingly, the control group mean appears to be virtually equivalent to the positive group, which would suggest that negative word of mouth comments are more potent than positive comments. This finding is consistent with that of much of the marketing literature (e.g., Herr, Kardes and Kim 1991; Arndt 1967). This might be explained by a higher degree of cognitive availability caused by a greater degree of salience (Kisielius and Sternthal 1984, 1986) or by the fact that "negative information tends to be more diagnostic or informative than positive or neutral information" (Herr, Kardes and Kim 1991, p. 460). Of course, an alternative explanation is that our positive treatment was simply not as convincing as our negative treatment.

Both of the measures of behavioral intentions appeared to differ as a result of the negative word-of-mouth communication. However, actual behavior (voluntary iterations in "what if analysis") did not differ between groups. Several alternative explanations can account for this unexpected finding. One possible reason is that subjects lacked a task they needed to perform to make the additional work meaningful for them. Another reason is that time pressure might have become an issue for certain subjects regardless of their treatment. Another is the skewness of the results; nearly half of the subjects performed none of the optional iterations, and almost 10% performed only one of the two required iterations. Finally, subjects might have possessed several different types of motivations for continuing the iterations. Experimental artifacts such as subjects who attempt to please the experimenters (or *not* to please the experimenters) might have influenced subject behavior to a greater degree than did the treatment.

Performance results were also mixed. The quiz score appeared to be significantly different between the positive and negative groups, but not the actual task score. A likely explanation for the lack of a significant difference in task score was the lack of variability of the task score. Over half of the subjects (31) received perfect scores on the task.

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Table 1. Attitude Scores

Mean Scores on Semantic Differential Item
Indicating Overall Attitudes About the Software
(sum of 7 items; 7 = positive; 1 = negative)

	Negative Group	Control Group	Positive Group	Negative versus Positive (1-tailed)
Mean Score (std dev)	31.6 (7.8)	36.3 (6.5)	37.1 (8.6)	t = 1.87; p = 0.35*

*significant at the p = .05 level

Table 2. Behavioral Intentions Scores

Mean Scores on Semantic Differential Items
(7 = positive; 1 = negative)

	Negative Group	Control Group	Positive Group	Negative versus Positive (1-tailed)
Likelihood of using again	4.0 (1.6)	5.1 (1.9)	5.4 (1.8)	t = 2.40; p = 0.12*
Likelihood of purchasing	3.4 (2.0)	4.4 (2.0)	4.8 (2.0)	t = 1.94; p = 0.31*

*significant at the p = .05 level

Table 3. Behavior Scores

Mean Number of Times Subject Performed Optional Task
(minimum of 0; maximum of 8)

	Negative Group	Control Group	Positive Group	Negative versus Positive (1-tailed)
Number of times	.9 (1.4)	1.9 (2.2)	.9 (1.2)	t = .01; ns

*not significant at the p = .05 level

Table 4. Performance Scores

Mean Scores on Quiz and Task
(higher score indicates better performance)

	Negative Group	Control Group	Positive Group	Negative versus Positive (1-tailed)
Score on 10-item quiz	8.1 (1.3)	8.8 (1.0)	8.8 (.9)	t = 1.85; p = 0.38*
Score on 10-point task	9.7 (.6)	9.2 (1.4)	9.2 (1.3)	t = 1.42; ns

*significant at the p = .05 level

Only six subjects made more than one error on the task. There was much more variation in the quiz scores (although quiz scores were also quite high). Our pilot testing failed to reveal this lack of discrimination of the task score and future studies should be conducted with more difficult tasks and testing.

While most of the hypotheses were fully or partially supported by the data, there are several other limitations of this study. First, we did not examine software users in an actual organization who attempted to perform tasks required for their jobs. Also, the time period of the study was extremely short; the entire cycle from the word-of-mouth communication to task performance was completed in under an hour. It would be important for future researchers to assess long-term impacts in an organizational setting. However, such assessment will be difficult without the strong controls that are available in an experimental setting.

7.2 Implications

Both researchers and practitioners can benefit from several implications of this experiment. In general, this study has provided evidence that researchers should consider word-of-mouth communication as one possible important determinant of attitudes, behavior, and even performance. Also, there are many unanswered questions pertaining to the preference heterogeneity of software.

Although software would appear on the surface to be quite heterogeneous in how it is perceived by users, and thus less susceptible to word-of-mouth effects, perhaps another factor could explain the strength of our results. Many of the items offered as examples in the definitions by marketing researchers (e.g., hair styles, restaurant dinners) are highly heterogeneous in the extent to which different people react to the same treatment, and therefore word-of-mouth communications are not as valuable in predicting a given person's reaction.

Interestingly, highly complex computer software is likely to be even higher in preference heterogeneity; software opinions tend to be passionate and highly varied. What, then could possibly explain the value of word-of-mouth communication? The answer is likely to be related to the high amount of effort involved in personally experiencing software. This effort raises the value of others' opinions; a bad report could save a person significant installation and learning time.

Practitioners can gain from this study if they pay more attention to detecting any rumor and gossip that takes place before new software is introduced. The potential effects of negative word-of-mouth communications on attitudes, behavior, and performance should be of great concern. This study's new evidence of a performance effect can be

important to consider when designing training programs; some time should probably be spent conveying accurate information to users before beginning the sessions, perhaps including videos of peer testimonials. It might be very valuable to maintain active, open, and honest communication with users to detect negative sentiment early enough to correct any misunderstandings and perhaps take the opportunity to make favorable changes where the negative communications are correct.

User attitudes, behavior, and performance are important but elusive information systems outcomes. By extending our understanding of these variables and their interrelationships, we might avoid needless difficulties when introducing new systems.

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9. ENDNOTES

1. Also see comments by Rogers on the role of such influence as an uncertainty-reduction mechanism.

2. Also see a discussion by Rogers about the positive and negative effects of "homophily" (individuals who are alike in some way). Diffusion is accelerated within homophilic groups, but actually decelerated overall because of barriers between heterophilic groups.

3. MS-DOS and Lotus 1-2-3 are trademarks of Microsoft Corp. and Lotus Development, Inc., respectively.

4. All packets can be obtained by contacting the first author.

5. Framework is a trademark of Borland, Inc.

6. Workstation 9 was never intended to be used, but the lack of a ninth station might have raised subjects' suspicions.

APPENDIX

QUESTIONNAIRE ITEMS

Software Evaluation

Overall reactions to the software:

terrible			neutral			wonderful
1	2	3	4	5	6	7

frustrating			neutral			satisfying
1	2	3	4	5	6	7

dull			neutral			stimulating
1	2	3	4	5	6	7

difficult			neutral			easy
1	2	3	4	5	6	7

inadequate power			neutral			adequate power
1	2	3	4	5	6	7

rigid			neutral			flexible
1	2	3	4	5	6	7

not useful			neutral			useful
1	2	3	4	5	6	7

Future Use

How likely are you to use this software again if given the opportunity?

never			neutral			definitely
1	2	3	4	5	6	7

Assuming you have the resources and need, would you purchase this software?

never			neutral			definitely
1	2	3	4	5	6	7

Quiz items

Ten mulitiple-choice questions asked subjects how to:

1. combine spreadsheets, text, and graphics
2. size frames
3. "jump" inside a frame
4. create a graph
5. set margin width
6. underline cells
7. perform "what-if" analysis
8. select more than one cell
9. cancel a selection
10. describe its overall features available