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Toward an Understanding of the Behavioral Intention to Use a Groupware Application

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ABSTRACT

Groupware technologies have become an important part of the business computing and communicating infrastructure in many organizations. However, literature suggests that many groupware applications, especially those requiring significant collaboration and cooperation among users, are still not adequately used (Nunamaker, 1997; Orlikowski, 1993). Their potential benefits are far from being fully realized due to the lack of user acceptance. While there are studies that show the relevance and positive impact of group support systems on group work, very few have looked into users' perception of the groupware technologies and their motivation to participate (Nunamaker, 1997). Expectancy theory is considered one of the most promising models of individual motivation. This study examines the use of expectancy theory in explaining the behavioral intention (motivation) to use a groupware application. Data gathered from 86 student users in a judgment modeling exercise suggest that the model is a significant predictor of users' motivation. The successful use of expectancy theory also suggests that it is appropriate for assessing and understanding users' motivation to use a groupware application and, subsequently, its acceptance and success. Since user acceptance is an essential antecedent of a successful groupware application, the results of this study should be considered thoughtfully when a groupware application is designed, implemented, and operated.

Keywords: groupware application, expectancy theory, user acceptance

INTRODUCTION

Over the past decade, groupware technologies, such as e-mail, electronic bulletin boards, and group support systems, have become an important part of the business-computing infrastructure in many organizations. This evolving software category has captured the attention and imagination of information technology professionals, line of business managers and end users, not to mention software suppliers. Organizations adopt groupware applications to enhance communication, collaboration, and coordination among group members and thus improve group performance (*Lotus Development*, 1995). While some groupware applications, e.g., e-mail, have

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been commonly accepted, many other applications, especially those that require significant collaboration and cooperation among users, are not widely used in organizations and their potential benefits are far from being fully realized (Orlikowski, 1993). Although many laboratory and field studies have consistently shown the relevance and positive impact of group support systems on group work, more research is needed in understanding how to increase the rate of diffusion and adoption of the technology (Nunamaker, 1997).

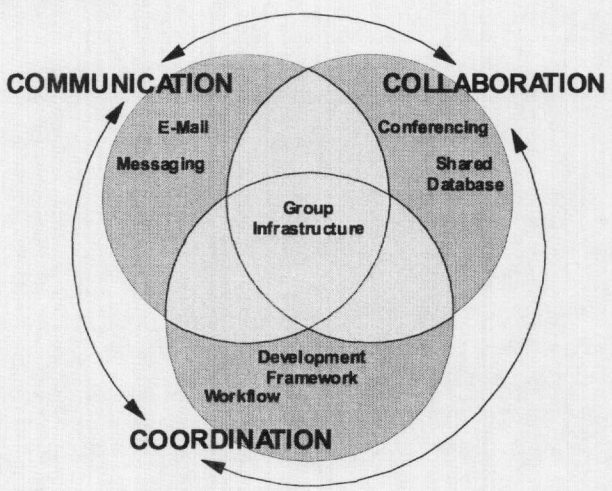
Behavioral-related elements (e.g., an individual's normative beliefs, attitude, and motivation), recognized by many, are the primary causes of users' resistance toward a newly implemented system or technology. Information technology (IT) research, however, tends to under-utilize existing knowledge in the behavioral science (Burton, Chen, Grover, & Stewart, 1993; Melone, 1990; DeSanctis, 1983; Turner, 1982). Expectancy theory has been recognized as one of the most promising conceptualizations of individual motivation (Snead & Harrell, 1995; Melone, 1990). Many researchers have proposed that expectancy theory can provide an appropriate theoretical framework for research that examines a user's acceptance of and intent to use a system (Melone, 1990; DeSanctis, 1983). This study uses expectancy theory as part of a student-based experiment to examine users' behavioral intention (motivation) to utilize a groupware application. The following section provides a review of prior research on groupware technology and a discussion of expectancy theory. The third section explains the research methodology and the fourth section presents the results of the experiment. Finally, limitations and implications are discussed.

THEORETICAL BACKGROUND AND SUPPORTING LITERATURE

Groupware Acceptance and the Critical Mass Effect

Groupware refers to a class of computer technologies designed to support communication, collaboration, and cooperation among a group of knowledge workers. It

Figure 1: Groupware Definition



Source: Lotus Development Corporation, 1995

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covers a variety of technologies, ranging from simple e-mail systems to complex workflow applications. Lotus Development Corporation (1995) uses Figure 1 to define the contents and scope of groupware. Although the use of some groupware technologies, such as e-mail, has become ubiquitous, organizations have encountered many difficulties in adopting and utilizing more sophisticated groupware applications, such as group support systems and Lotus Notes (Nunamaker, 1997; Orlikowski, 1993).

While traditional technologies such as the telephone qualify as groupware, the term is ordinarily used to refer to a specific class of technologies relying on modern computer networks, such as e-mail, newsgroups, videophones, or chat. According to Johnson (1988), groupware technologies are typically categorized along two primary dimensions: time and place. Users of the groupware can work together at the same time (real-time or synchronous) or at different times (asynchronous). On the other dimension, users can work together at the same place (co-located or face-to-face) or at different places (non-co-located or distance). Table 1 provides a summary of the groupware categories. In this study, we focus on the groupware technologies, e.g., Domino Discussion or Lotus Notes, that are designed to be used at any time and any place.

Groupware applications are designed to support communication, cooperation, and collaboration among a group of users rather than to improve productivity of individuals. Therefore, usage and resulting benefits are only achieved if a majority of the users whose work is affected by a groupware application accept and use the system (Grudin, 1994). Otherwise, the application will not only fail to improve group performance, but will also create additional communication and coordination barriers. While many factors (e.g., users' background and commitment, organizations' reward systems, work norms, and policies and procedures) can contribute to the success of a groupware application, achieving a "critical mass" of users has been recognized as one of the keys for successful groupware acceptance (Ehrlich, 1987; Grudin, 1994; Markus, 1990; Markus & Connolly, 1990). The intrinsic value of a groupware technology increases and becomes more apparent as more and more users accept the technology. Consequently, more and more functions are available to adopters, which in turn reinforces their opinion about the technology and reaffirms their acceptance decisions.

Prior Implementation Research

A major stream of implementation research is the implementation factor research that involves the identification of factors or independent variables that directly or indirectly impact some dependent variables estimating implementation success (Ginzberg, 1980). Two commonly used measures of system success have been system usage (Barki & Huff, 1985) and user satisfaction (Brancheau &

Table 1: Groupware Classification

	Same time (synchronous)	**Different time** (asynchronous)
Same place (co-located)	GDSS, voting, presentation support	Shared computers
Different place (distance)	Videophones, chat	e-mail, discussion workflow

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Wetherbe, 1987; Hamilton & Chervany, 1981; Ives & Olson, 1984). Within this stream, positive user attitude (or user acceptance) is considered a critical factor that contributes to both proxies for implementation success. The relationship between attitudes and usage has been well documented (Barki & Huff, 1985; Maish, 1979; Robey, 1979). Similarly, user attitude toward an information system has been shown to influence user satisfaction (Lees, 1987; Rademacher, 1989; Robey, 1979).

Turner (1982) stressed that a continuing gap exists between the capabilities provided by new information systems and the extent to which these systems are accepted and used by individuals. This gap can be better explained by behavioral-related elements than by elements strictly related to technical system attributes. Although behavioral-related elements are seen as the primary causes of users' resistance toward a newly implemented system, implementation research has made little use of behavioral theory. Research in this area tends to under-utilize existing knowledge in the behavioral science and typically fails to tie implementation research to more general models of work behavior (Melone, 1990; Robey, 1979).

The theory of reasoned action, as proposed by Ajzen and Fishbein (1980), is a well-researched social behavioral model that has successfully predicted behavior in a variety of contexts. Davis (1986) adapted the theory of reasoned action to intentions to accept the information technology and formulated the technology acceptance model. The theory of reasoned action and the technology acceptance model both propose that attitudes and other variables (i.e., an individual's normative beliefs toward the system's usefulness and ease to use) do not directly influence actual behavior (e.g., actual system use) but are fully mediated through behavior intentions or the strength of one's intention to perform a specific behavior. This would imply that measurement of behavioral intentions (motivation) to participate in a system is a strong and more appropriate predictor (than just attitudes) of the system success. Though both models identify the relationships among users' attitude, behavioral intention, and actual behavior (system use), they do not look into the cognitive process of an individual user's attitude formation, which in turn affects his or her behavioral intention (motivation) and actual behavior.

Expectancy theory is considered one of the most promising conceptualizations of individual motivation. Several researchers have suggested that the adoption of an expectancy theory approach should enhance understanding of users' attitudes and behavior (DeSanctis, 1983; Robey, 1979; Zmud, 1980). Melone (1990) proposed that expectancy models have the advantage of presenting a theoretical framework for examining information system success via users' evaluation responses. She suggested that expectancy theory: (1) can integrate a "user's evaluation response with his or her behavioral intention"; (2) can be "easily implemented in field settings and relies on data that are available from users in most organizations"; (3) "permits integration of factors considered to be important in past studies examining information system success"; and (4) can change the focus of information system research from "describing to predicting and ultimately to influencing user evaluation responses" (Melone, 1990, p. 83). In response, this study examines the application of expectancy theory in measuring users' attitudes toward a groupware application and their behavioral intention (motivation) to use it. Figure 2 illustrates the relationship between users' attitude, behavioral intention, and system

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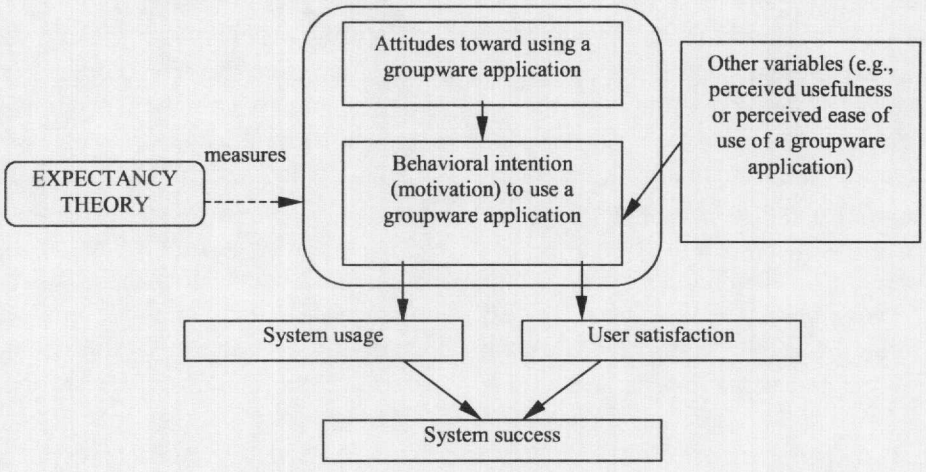
Figure 2: Use of Expectancy Theory in Measuring User Attitude and Behavior



success, as well as the use of expectancy theory in measuring this relationship in part.

Expectancy Theory

Expectancy theory was originally developed by Vroom (1964) and has served as a theoretical foundation for a large body of studies in psychology, education, organizational behavior, and management accounting (Harrell, Caldwell, & Doty, 1985; Brownell & McInnes, 1986; Hancock, 1995; Snead & Harrell, 1995; Geiger & Cooper, 1996). Expectancy models are cognitive explanations of human behavior that cast a person as an active, thinking, predicting creature in his or her environment. He or she continuously evaluates the outcomes of his or her behavior and subjectively assesses the likelihood that each of his or her possible actions will lead to various outcomes. The choice of the amount of effort he or she exerts is based on a systematic analysis of (1) the values of the rewards from these outcomes, (2) the likelihood that rewards will result from these outcomes, and (3) the likelihood of reaching these outcomes through his or her actions and efforts.

According to Vroom, expectancy theory is comprised of two related models: the valence model and the force model. In our application of the theory, the valence model shows that the overall attractiveness of a groupware application to a user (V_j) is the summation of the products of the attractiveness of those outcomes associated with the application (V_k) and the probability that the application will produce those outcomes (I_{jk}):

$$V_j = \sum_{k=1}^{n} (V_k I_{jk})$$

where: V_j = the valence, or attractiveness, of a groupware application (outcome j - first level outcome);
V_k = the valence, or attractiveness, of outcome k (second-level outcome); and
I_{jk} = the perceived probability that the groupware application will lead to outcome k.

In this study, we examine four poten-

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tial outcomes (i.e., k=4) of groupware applications. They are: 1) enhancing communications among coworkers; 2) increasing ability to coordinate activities; 3) facilitating collaboration among coworkers; and 4) improving competence in performing a job. Among the four outcomes, the first three are specifically proclaimed by groupware application designers, which emphasize the improvement of group performance (Lotus Development, 1995). The last one addresses the personal competence aspect. All four, however, have been proposed by prior studies as expected outcomes of groupware applications (Ehrlich, 1987; Grudin, 1994; Nunamaker, 1997; Orlikowski, 1993).

The force model shows that a user's motivation to exert effort into using a groupware application (F_i) is the summation of the products of the attractiveness of the application (V_j) and the probability that a certain level of effort will result in successfully using the application (E_{ij}):

$$F_i = \sum_{j=1}^{n} (E_{ij} V_j)$$

where: F_i = the motivational force to participate in a groupware application at some level i;

E_{ij} = the expectancy that a particular level of participation (or effort) will result in successfully using the application; and

V_j = the valence, or attractiveness, of the groupware application; derived in the previous equation of the valence model.

In summary, each user first uses the valence model and then the force model. In the valence model, each user of a groupware application evaluates the application's outcomes (e.g., enhanced communication, increased ability to coordinate, better collaboration, and improved competence) and subjectively assesses the likelihood that these outcomes will occur. Next, by placing his or her own intrinsic values (or weights) on the various outcomes, each user evaluates the overall attractiveness of the groupware application. Finally, the user uses the force model to determine the amount of effort he or she is willing to exert to use the application. This effort level is determined by the product of the attractiveness generated by the valence model and the likelihood that his or her effort will result in a successful use of the application. Based on this systematic analysis, the user will determine how much effort he or she would like to exert in using the groupware application.

Research Objectives

The general research question examined by the this study is: "Can the valence and force models of expectancy theory explain the motivation of a user to use a groupware application?" Specifically, under the valence model, we investigate the impact of the potential outcomes of a groupware application upon users' motivation to use such an application. The four outcomes of groupware applications examined by this study are: 1) enhancing communications among coworkers; 2) increasing ability to coordinate activities; 3) facilitating collaboration among coworkers; and 4) improving competence of job performance. Under the force model, we investigate the extent that the difficulty of using a groupware application will affect users' motivation to actually use the application. Based on the above research objectives,

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two research propositions are developed:

Proposition 1: The valence model can explain a user's perception of the attractiveness of using a new groupware application.

Proposition 2: The force model can explain a user's motivation to use a new groupware application.

RESEARCH METHOD

Subjects

The subjects are 86 undergraduate students[1] enrolled in five business courses taught by three different professors at a middle sized (15,000 to 20,000 total enrollment), mid-west university. Most of them have a junior or senior rank with a mean age of 21.5. The number of female and male are 44 and 42 respectively and 38 of them have used a groupware application in a prior course or other occasions. The instrument was administered before the intersession break of a regularly scheduled class around the middle of the quarter to all the students who were present on that particular day. We explained the use of the instrument, went over the instruction with the students, and then asked them to complete the instrument. The entire process took between 15 and 20 minutes. Though no incentive was given, it is our observation that the majority of the students took reasonable effort in completing the instrument.

These student subjects are appropriate for this study because: 1) they have classroom exposure to a groupware application; 2) they are actual users since a groupware application is made available for their use in class activities; and 3) they are potential users of groupware applications in their future employment. While the use of students has been criticized, satisfactory results using student subjects have been achieved (DeSanctis, 1983; Harrell & Stahl, 1984). Based on a review of research in psychology, organizational behavior, marketing, and accounting, Ashton and Kramer (1980) concluded that students can be adequate surrogates for business people when the research is focused on certain types of decision making.

Judgment Exercise

The within-person or individual focus of expectancy theory suggests that appropriate tests of this theory should involve comparing measurements of the same individual's motivation under different circumstances (Harrell, Caldwell, & Doty, 1985; Murray & Frazier, 1986). In response to this suggestion, this study adapts a well-established within-person methodology originally developed by Stahl and Harrell (1981) and later proven to be valid by other studies in various circumstances (e.g., Burton, Chen, Grover, & Stewart, 1993; Snead & Harrell, 1995; Geiger & Cooper, 1996). This methodology uses a judgment modeling decision exercise that provides a set of cues, which an individual uses in arriving at a particular judgment or decision. Multiple sets of these cues are presented with each representing a unique combination of strengths or values associated with the cues. A separate judgment is required from the individual for each unique combination of cues presented.

We employed a one-half fractional factorial design[2] using the four second-level outcomes. This resulted in eight different combinations of the second-level outcomes ($2^4 \times \frac{1}{2} = 8$ combinations). Each of the

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resulting eight combinations is then presented at two levels (10% and 90%) of expectancy to obtain 16 unique cases (8 combinations x 2 levels of expectancy = 16 cases). This furnishes each participant with multiple cases that, in turn, provide multiple measures of each individual's behavioral intentions under varied circumstances[3]. The multiple-case measurement is a prerequisite for the within-person application of expectancy theory (Snead & Harrell, 1995).

In each of the 16 cases, the participants are asked to make two decisions. The first decision, Decision A, corresponds to the V_j in the valence model and represents the overall attractiveness of using the groupware application, given the likelihood (10% or 90%) that the four second-level outcomes (I_{jk}) would result from the use. The instructions and a sample case are provided in Appendix A. As mentioned earlier, the four second-level outcomes are: 1) enhancing communications among coworkers; 2) increasing ability to coordinate activities; 3) facilitating collaboration among coworkers; and 4) improving competence in job performance. The second decision, Decision B, corresponds to F_i in the force model and reflects the strength of a participant's motivation to use the groupware application, using: 1) the attractiveness of the application (V_j) obtained from Decision A, and 2) the expectancy (E_{ij}, 10% or 90%) that, if the user exerts a great deal of effort, he or she would be successful in using the application. We adopt an 11-point response scale with a range of -5 to 5 for Decision A and 0 to 10 for Decision B. Negative five represents "very unattractive" for Decision A and positive five represents "very attractive". For Decision B, zero represents "zero effort" and ten represents a "great deal of effort".

Experimental Controls

We use Pearson's correlation coefficients between R^2 values of valence and force models and selected demographic information (rank, gender, age, GPA, prior experience using groupware) to test the associations between the empirical results and users' background. Appendix B shows the questions asked at the end of the survey for the demographic information.

The users are asked to evaluate the 16 hypothetical cases (groupware applications) presented to them instead of the groupware applications they have experienced before. Therefore, the users' background should not affect their responses to these individual cases. Non-significant correlation between participants' background (i.e., rank, gender, age, GPA, prior experience using groupware) and R^2 values of valence and force models would indicate that the subjects are able to evaluate the proposed applications objectively without bias, thus would support our argument that the subjects we use are appropriate for this study.

RESULTS

Valence Model

The first proposition predicts that the valence model of expectancy theory can explain a user's perception of the attractiveness of using a groupware application. Through the use of multiple regression analysis, we seek to explain each participant's perception of the attractiveness of using a groupware application. Decision A (V_j) serves as the dependent variable, and the four second-level outcome instruments (I_{jk}) serve as the independent variables. The resulting standardized re-

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gression coefficients represent the relative importance (attractiveness) of each of the second-level outcomes to each user in arriving at Decision A. The mean adjusted-R^2 of the regressions and the mean standardized betas of each outcome are presented in Table 2. Detailed regression results for each participant are not presented, but they are available from the authors.

As indicated in Table 2, the mean R^2 of the individual regression models is .6876. The mean R^2 represents the percentage of total variation in users' response that is explained by the multiple regression. Thus, the relatively high mean R^2 indicates that the valence model of expectancy theory explains much of the variation in users' perception of the attractiveness of using a groupware application. Among the 86 individual regression models, 79 are significant at the level of .05. These results support the first proposition.

The standardized betas of V1, V2, V3, and V4 are significant, at the level of .05, for more than half of the individuals. This implies that all four of the secondary outcomes are important factors to a majority of the individuals in determining the attractiveness of a groupware application. Although all four factors are important, some factors are more important than others. It is the *mean* of these standardized betas that explains how users, on average, assess the attractiveness of potential outcomes resulting from a groupware application. The users, on average, place the highest valence on the outcome V4. The other valences, in descending order of their strength, are V1, V2, and V3. These results imply that the users believe improving job competence (V4) is the most attractive outcome of a groupware application and improving collaboration among coworkers (V3) is the least attractive outcome. In the middle is the enhanced communication (V1) and increased coordination (V2).

Force Model

The second proposition proposes that the force model can explain a user's motivation to use a newly implemented groupware application. We again use multiple regression analysis to examine the

*Table 2: Valence Model Regression Results**

	N	Mean	Standard Deviation	Range	Frequency of Significance at .05 Level
Adjusted R^2	86	.6876	.2034	-.0267 to .9388	79/86
Standardized Beta Weight					
V1	86	.3748	.1745	-.4423 to .7646	62/86
V2	86	.3320	.1619	-.1506 to .6129	53/86
V3	86	.3190	.1830	-.5897 to .6803	51/86
V4	86	.5197	.2444	-.3965 to .9197	73/86

* Results (i.e. mean, standard deviation, range, and frequency of significance at .05) of individual within-person regression models are reported in this table.
V1: valence of communication enhanced
V2: valence of coordination ability increased
V3: valence of collaboration improvement
V4: valence of competence improvement

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*Table 3: Force Model Regression Results**

	N	Mean	Standard Deviation	Range	Frequency of Significance at .05 Level
Adjusted R^2	86	.7205	.2301	-.1141 to .9999	75/86
Standardized Beta Weight					
B1	86	.5997	.2530	-.1960 to 1.00	72/86
B2	86	.4976	.3110	-.2302 to .9763	64/86

* Results (i.e. mean, standard deviation, range, and frequency of significant at .05) of individual within-person regression models are reported in this table.
B1: weight placed on attractiveness of the groupware application
B2: weight placed on the expectancy of successfully using the system

force model (Decision B) in the experiment. The dependent variable is the individual's level of effort to use the groupware application (F_i). The two independent variables are (1) each user's perception about the attractiveness of the application (V_j) from Decision A, and (2) the expectancy information (E_{ij} =10% or 90%) which is provided by the "Further Information" sentence of the test instrument (see Appendix A). The force model results are summarized in Table 3.

The mean R^2 (.7205) supports the second proposition and indicates that the force model sufficiently explains the users' motivation of using a groupware application[4]. The mean standardized regression coefficient B1 (.5997) indicates the impact of the overall attractiveness of the groupware application (V_j), while B2 (.4976) indicates the impact of the expectation that a certain level of effort leads to successfully using the application. These results imply that both factors, the attractiveness of the groupware application (B1) and the likelihood that the user's efforts will lead to a successful use (B2), are of similar importance to the user's motivation.

Experimental Controls

Appendix B presents Pearson's correlation coefficients between R^2 values of valence and force models and selected demographic information (i.e., rank, gender, age, GPA, and prior experience using groupware applications). There is no significant correlation (at the .05 significance level) between either of the users' R^2 values and their rank, gender, age, GPA, and prior experience. These results suggest that neither the users' perception of the attractiveness of groupware application nor their motivation to participate is correlated with their background or with their prior experience of the groupware application. These results also support our argument that the subjects we use are appropriate for this study because neither their background nor their prior experience with groupware applications affects their evaluation of the hypothetical groupware applications tested in the questionnaire.[5]

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DISCUSSION AND IMPLICATIONS

Some limitations of this study need to be discussed. First, the selection of subjects is not a random process. Students become subjects by virtue of being present the day their class is surveyed and the selection of classes is arbitrary. Consequently, caution should be used in generalizing the results to other groups and settings. Second, an experimental task is used in this study and the subjects' responses are gathered in a controlled environment rather than in a real world setting. Third, users are not given the opportunity for input on the outcomes that motivate them to use the groupware application. In the instrument, four possible outcomes are given to the users. Fourth, the extreme levels of instrumentality and expectancy (10 percent and 90 percent) are used in the cases. This does not allow us to test for the full range within the extremes. In another sense, such extremes may not exist in actual practice. Fifth, all subjects are students and come from only one institution. It is likely that students are more concerned with their individual performance and less on group collaboration compared to users in a business environment. Thus, extrapolation of the findings of this study into a business environment should be made with caution. The findings of this study, however, can be useful for faculty members who are currently using or intend to use groupware applications for classroom purposes.

A major strength of this study is the use of a within-person approach to examine the two expectancy theory models. In addition, subjects' background factors are controlled, little method bias is involved, and a relatively large sample size is used. The expectancy model used in this study provides a good overall explanation of a user's motivation to use a groupware application. The valence model significantly explains a user's assessment of the attractiveness of a groupware application. Further, the force model provides a good explanation of a user's motivation to use a groupware application. By the successful application of expectancy theory, this study provides a better understanding of the behavioral intention (motivation) of using a groupware application. The results of this study also support the proposal of prior literature that expectancy theory provides an appropriate conceptual framework for system implementation research. Given the validation of expectancy theory model established in the area of groupware applications, replication of this study in a business setting should be beneficial and logical.

Implications for Practice

The study described in this paper provides a successful illustration of expectancy theory, using the case of a groupware application. In practical terms, this study shows that expectancy can be applied early in the design phase of system development to provide a better indication of users' intention in using a groupware application. In order to maximize system success (e.g., system usage and user acceptance), system developers and designers may incorporate and stress the favorable attributes (second-level outcomes) identified in this study into their groupware application. Further, system developers may gauge their own effort to achieve these outcomes according to each outcome's relative importance as generated from this study.

Our empirical results show that users have strong preferences for the uses of a groupware application and these preferences are remarkably consistent across individuals. To users, the most attractive

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outcome of a groupware application is the improvement of their job competence, while the enhancement of communications among coworkers is the second strongest outcome. Thus, users who believe that their participation and use of the groupware application will improve their competence or enhance communications should be highly motivated to use the application. In contrast, users who experience significant downgrade on their personal performance will not be persuaded to use groupware unless the situation changes radically. These results explain, in part, the underutilization of some sophisticated groupware applications where stress has been placed on group collaboration and coordination rather than on individual productivity and performance. The new understanding of users' motivation obtained from this study can be used to redirect designers of groupware applications to expand or emphasize the individual performance dimension of their products in order to gain user acceptance and satisfaction.

Towards the goal of motivating users to use an implemented groupware application, we make the following practical suggestions. First, declare prominently the outcomes and benefits of the groupware application in the users' training sessions, forums, and instruction manuals. If these outcomes are consistent with the outcomes that users' prefer (and they believe that the application will truly be used for these purposes), the users will assign a high valence to the groupware application. The next step is to show users that their efforts in using the application can actually lead to the perceived benefits. Accomplishing this will increase users' subjective probabilities of the secondary outcomes. It would also increase their subjective probabilities that they will be successful in using the application. Thus, their force or motivation to use the application will be high. One way of showing users that the application has been used successfully is to ask users to share in newsletters or users' meetings some recent examples of how the groupware application has helped them accomplish a particular task or improve their job performance. This seems like a low cost, but highly visible way to show users the benefits of the application. It may also have the salutary effect of encouraging users to ponder and evaluate the benefits of the application, which in turn reinforces their opinion about the technology and reaffirms their acceptance decisions.

Implications for Research

This study successfully applies a behavioral theory, expectancy theory, to a system implementation area. This application: 1) helps close the gap between the capabilities of a groupware application and the extent to which it is used, and 2) responds to the claim of previous research that the gap can be better explained by behavioral elements rather than by technical attributes.

Future research should revalidate the application of expectancy theory in different contexts. Various factors such as social norms, one's job requirements, and an organization's reward system can be examined for their impact on the valence and force models. Along with the direction of several recent studies (Lucas & Spitler, 1999; Szajna & Scamell, 1993), the relationship among attitude (i.e., perceived system quality, perceived usefulness, and perceived ease of use), intention, and actual use needs to be further validated. The ultimate goal of this line of research is to gain more rigorous and consistent insight into understanding the effectiveness of groupware applications and our ability to

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explain or predict user acceptance to a groupware application.

APPENDIX A

Assume that you are employed by a company and consistently involved in group projects and assignments. A groupware application (e.g., Domino Discussion or Lotus Notes) is introduced to you and is available for your use. Various outcomes may result from using the application, such as: enhancing communications with your colleagues; coordinating job-related activities; facilitating collaboration among coworkers; and increasing competence in performing your job. Use of this application is voluntary; your use could range from minimum to maximum. Minimum use essentially implies that you will continue to perform your job as you have been without Lotus Notes. Maximum use means that you will rely on the groupware application to a great extent in performing your job.

This exercise presents 16 situations. Each situation is different with respect to how the groupware application is likely to be used. We want to know how attractive using the groupware application is to you in each given situation.

You are asked to make two decisions. You must first decide how ***attractive*** it would be for you to use the groupware application (DECISION A). Next you must decide how much ***effort*** to exert in using the groupware application (DECISION B). Use the information provided in each situation to reach your decisions. There are no "right" or "wrong" responses, so express your opinions freely. A sample situation is provided below.

Example Questionnaire

If you use the groupware application (e.g., Domino Discussion or Lotus Notes) to the MAXIMUM extent in your job, the likelihood that:

You will enhance your communications with your coworkers is ..... HIGH (90%)

You will improve your ability to coordinate job-related activities is ..... HIGH (90%)

You will achieve a better collaboration among your coworkers is ..... HIGH (90%)

You will increase your general level of competence in performing your job is ..... LOW (10%)

DECISION A: With the above outcomes and associated likelihood levels in mind, indicate the ***attractiveness*** to you of using the groupware application in your job.

-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
Very Unattractive ... Very Attractive

FURTHER INFORMATION:
If you exert a great deal of effort to use Lotus Notes in your job, the likelihood that you will be successful in doing so is LOW (10%)

DECISION B: Keeping in mind your attractiveness decision (DECISION A) and the FURTHER INFORMATION, indicate the level of ***effort*** you would exert to use the groupware application.

0 1 2 3 4 5 6 7 8 9 10
Zero Effort ... Great Deal of Effort

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APPENDIX B

Demographic Information

Please answer the following questions about yourself. Your answers will help to analyze the data collected.

1. Rank: Freshman Sophomore Junior Senior Graduate
2. Gender: Female Male
3. Age: _____
4. Major: _____
5. What is your GPA? _____
6. Did you use a groupware application (e.g., Lotus Notes or LearningSpace) in a prior course or other occasions? (Circle one) Yes No

Pearson's Correlation Coefficients / P-Values

	Rank	Gender	Age	GPA	Experience
Adj-R^2 Force	0.1327 (0.2233)	-0.2085 (0.0541)	0.1427 (0.1894)	0.0663 (0.5440)	- 0.0768 -(0.4822)
Adj-R^2 Valence	0.1497 (0.1690)	-0.1266 (0.2453)	0.1378 (0.2057)	0.0607 (0.5791)	-0.0205 (0.8516)

ENDNOTES

1. This study adopts a within-person methodology that does not have sample size requirement for making statistical inference. Prior studies (e.g., Burton, Chen, Grover, & Stewart, 1993; Geiger & Cooper, 1996), however, had a sample size between 80 and 100.
2. According to Montgomery (1984, p. 325), "If the experimenter can reasonably assume that certain high-order interactions are negligible, then information on main effects and low-order interactions may be obtained by running only a fraction of the complete factorial experiment." A one-half fraction of the 2^4 design can be found in Montgomery (pp. 331-334). Prior expectancy theory studies (e.g., Burton, Chen, Grover, & Stewart, 1993; Snead & Harrell, 1995) also used one-half fractional factorial design.
3. In a pilot test, we tested two different instruments; each had the order of the cases determined at random. The two instruments were distributed to every other student. We compared the average R^2s from the two random-order versions and found no significant difference between them. This result implies that there is no order effect in our experimental design.
4. A hierarchical regression analysis is conducted to compare the appropriateness of the full multiplicative model and the additive model. The only difference of the multiplicative model from the additive model is that the former incorporates not only the two independent variables but also their interaction term. The results indicate that the average incremental explanatory power of the interaction term over the additive model is

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not significant. Thus, the additive model appears to be adequate in explaining the effort decisions made by most users.

5. It is reasonable to expect an association between someone's prior experience with a groupware application and his or her motivation to participate in that particular application. However, the participants are asked to evaluate the 16 proposed cases (groupware applications) but not the application they have experienced before. Therefore, the non-significant correlation coefficients indicate that the subjects are able to evaluate the proposed applications objectively without bias, thus supporting our argument that the subjects we use are appropriate for this study.

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