Abstract
As organizations are adopting new structures such as the networked organization and the virtual organization, groupware is increasingly being used as a way of implementing these new organizational forms. Although user acceptance of groupware technology by the intended users is a prerequisite for realizing its full potential in organizations, there is no clear understanding about why people accept or reject groupware technology. Davis’ [5],[6] technology acceptance model (TAM) provides an useful basis in answering this question. It has been found that, with traditional end-user computing tools such as word processor and spreadsheet software, behavioral intention measured shortly after a brief training of the software can reasonably predict the usage behavior measured later in the system deployment process. Given the unique characteristics of groupware technology, particularly its social nature involving multiple users and its technical complexity, however, it is not clear whether traditional TAM can be still used in predicting groupware acceptance. In a longitudinal study with 108 senior executives, intentions to use a specific groupware system, measured two weeks after the training and initial introduction of the technology, were found not to be correlated with system use eight weeks later. As in previous IS research based on TAM, perceived usefulness and perceived ease of use were strongly correlated with contemporaneously measured behavioral intention and system use. These results suggest a possible existence of a social influence process in the groupware technology acceptance process. Managers need to be careful in trying to predict user acceptance using behavioral intention measured shortly after a short training or introduction of the technology to the intended users. Instead, managers may need to pay much closer attention to the social process of the groupware acceptance process in the workplace.

1. Introduction
Today’s organizations face unprecedented levels of competition. Globalization, technology development, deregulation, and an emergence of a new generation of customers who reject the notion of “mass” production, have forced organizations to search for new organizational structures [16]. Many different organizational structures, such as networked organizations [15], [18] and virtual organizations [17], are being proposed by organization scholars as candidates for replacing traditional hierarchical structures. Information technology (IT), including computers and communication networks, are being used qualitatively differently and quantitatively more as one such technique [4].

Groupware, software specifically designed to facilitate teamwork and information sharing among team members, is being proposed by many information systems (IS) scholars as an ideal IT for these types of new organizational structures [13]. Groupware represents a special form of IT in that its usage involves multi-person interaction and social processes. As the technology becomes more popular and matures, an increasing level of research activity has focused on the investigation of groupware effectiveness.
and its impact on group outcomes and productivity (e.g., [8]). As with any other IT, however, a prerequisite for a realization of the potential possibilities of groupware in the workplace is its acceptance by intended users [12], [19]. The objective of this paper is to test an existing model of IT acceptance, i.e., technology acceptance model (TAM) [6], in the context of a specific groupware environment, with the hope of gaining a better understanding of the fundamental behavioral and social processes of groupware technology acceptance.

Understanding why people accept or reject groupware is one of most important issues in groupware research in that, if we can build such a model, managers can predict user acceptance of any particular groupware which they intend to deploy in their organizations. Such predictions can be used as a guideline for design changes, development of implementation plans, and go/no-go decisions.

The following section provides the background and the research questions of the current study with a brief overview of TAM. This is followed by a description of research methods and findings. The final section presents a discussion of the findings and their implications for future research and practice.

2. Background and Research Questions

Drawing upon Fishbein and Ajzen’s [2] theory of reasoned action (TRA), Davis [5], [6] developed and tested the technology acceptance model (TAM) to explain IT acceptance behavior. TAM provides a comprehensive and parsimonious framework for understanding the IT user acceptance process. Key findings of empirical investigations based on TAM are [6]:

1. People’s computer use can be predicted reasonably well from their intentions;
2. Perceived usefulness is a major determinant of people’s intentions to use computers; and,
3. Perceived ease of use is a significant secondary determinant of people’s intention to use computers.

Despite the repeated replications of similar results by other researchers (e.g., [1], [14], [20]), several criticisms were raised against TAM. One such criticism is the model’s lack of attention to social processes (see [21]). By containing the IT acceptance as an “individual’s” decision, TAM excludes the organizational and social contextual factors from the IT acceptance process. Although this may not be a problem when TAM is used to predict the acceptance of individual oriented end-user computing tools such as word processor and spreadsheet software, this lack of attention to the social process of IT acceptance may limit the predictability of the model in groupware environments.

In an attempt of gaining a better understanding of the groupware acceptance process, therefore, we are testing TAM in the context of a specific groupware system. Given its exploratory nature, we did not specify any a priori hypotheses. However, if we find support of TAM with our data set, it may imply that managers can use TAM to predict user acceptance of groupware. If we find no support of TAM with our data set, it may suggest that TAM may need to be expanded by incorporating some new variables such as social influences and social norms.

3. Methods

The research methodology consisted of a field study conducted in an executive development program setting at a major state university. As a part of the executive development program, the participating executives were engaged in a 10-week long virtual team project (see below for a detailed description of the virtual team project).

3.1. Subjects

One hundred and eighteen executives from a large federal agency participated in the study. The sample comprised 65 males and 53 females. The average age was 49. Twenty-two subjects had a bachelor’s degree, 71 had master’s degrees, and 2 had Ph.Ds. Twenty-three individuals had other types of degrees, such as law and community college degrees.

3.2. Task

The task involved a complex community planning and development project for the city of Hagerstown in western Maryland (population 35,000). Each team was to assume the role of a consultant team to the mayor of Hagerstown and develop a specific strategy to increase the home ownership rate from the current rate of 38% to 51% (or greater) by the year 2006. At the conclusion of the 10-week project, each team was to submit a report to the mayor containing specific recommendations on the attributes of the customers (e.g., age and income mix), financing options, annual housing production levels (new construction and/or rehabilitation of old buildings), and other issues relevant to the project.
construction), as well as specification of resource levels, sponsors, and partners. All the teams were given census, demographic, and economic data for Hagerstown and the surrounding region. Other relevant data were provided by the mayor’s office, including statistics on employment, crime, education, and the town’s housing and community development profiles. The teams were free to use additional information from any other sources that they deemed useful in their project. The project data were made available to the virtual teams on a multimedia database of a groupware system.

3.3 Groupware Technology

Teams used an advanced groupware system referred to as the Alpha system in this paper. The Alpha system was an integrated groupware system that provided a set of functionality including e-mail, a media center (for storage and access of multimedia documents), threaded discussion capability, and workflow automation (features that allow implementing specific group interaction protocols). Participating executives were unfamiliar with the Alpha system. They were, therefore, extensively trained in its use during the two-week residential module of the program prior to the virtual team project. They were provided access to the Alpha system on a server at the university through a toll-free telephone number. Although the participants were encouraged to use the Alpha system for the completion of the project, the use of the system was voluntary. A post hoc analysis and interview revealed that teams also used a variety of alternative communication technologies to complete the project.

3.4. Procedures

Prior to the beginning of the virtual team project, the participating executives were assigned into a team of 8-9 individuals. If a team comprised members who were co-located in the same geographic office, an adjustment in the team composition was made to ensure a virtual team environment—i.e., that all interactions among the team members were computer-mediated, rather than face-to-face interaction, during the project.

Just prior to the beginning of the virtual team project, the mayor of Hagerstown and the same two staff members from his office met with each of the four cohorts to describe the project, discuss the issues the town faced, and answer questions posed by the participants. A faculty member who was very knowledgeable in the course contents and the Hagerstown project was assigned to play the role of the project facilitator. This faculty member, who was available to answer project-related questions and clarify task-related issues, also played the role of liaison between the teams and the mayor’s office; this reduced the frequency of contacts between the teams and the mayor’s office, cutting down on the interruptions in the work of the mayor and his staff.

3.5. Measurements

We measured perceived usefulness (U), perceived ease of use (EOU), behavioral intention (BI), and self-reported usage (USE). The questions were adapted from the original instrument developed by Davis [7]. Extensive pretests and replications [1], [6], [7], [14], [20], [22] have led to confidence in these scales. EOU and U were measured twice, at the end of the second and the tenth weeks, using four items. BI was measured once at the end of the second week, using two items. USE was measured once at the end of the tenth week, using two items.

4. Results

Table 1 summarizes the correlations among measured variables along with their means and standard deviations. Table 2 summarizes the results of the regression analyses.

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1 Team members were provided with 3.5 hours of in-class hands-on training with the Alpha system. An hour long one-on-one help session was also provided to the participants, who were also free to practice in a lab during their off hours. Finally a two-hour Alpha system question and answer session was held before the participants’ departure from the university campus at the conclusion of the first residential segment of the program.
### Table 1. Correlations, means and standard deviations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std Dev</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>BI₁</td>
<td>3.9206</td>
<td>0.7839</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USE₂</td>
<td>1.7010</td>
<td>0.9592</td>
<td>0.1923</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOU₁</td>
<td>3.2037</td>
<td>0.8833</td>
<td>0.4197**</td>
<td>0.0266</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U₁</td>
<td>3.1429</td>
<td>0.9458</td>
<td>0.5473***</td>
<td>0.0614</td>
<td>0.5227***</td>
<td>1.0000</td>
<td></td>
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<tr>
<td>EOU₂</td>
<td>2.4064</td>
<td>1.1222</td>
<td>0.3804**</td>
<td>0.4487***</td>
<td>0.4578**</td>
<td>0.3452*</td>
<td>1.0000</td>
</tr>
<tr>
<td>U₂</td>
<td>1.7706</td>
<td>1.0907</td>
<td>0.2352</td>
<td>0.5511***</td>
<td>0.1914</td>
<td>0.2297</td>
<td>0.5228***</td>
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</tbody>
</table>

* p < 0.05; ** p < 0.01; *** p < 0.001 (two-tailed)

### Table 2. Results of regression analyses

<table>
<thead>
<tr>
<th>Equation</th>
<th>Adjusted-$R^2$</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI₁ = EOU₁ + U₁</td>
<td>0.29***</td>
<td>EOU₁ 0.17*</td>
</tr>
<tr>
<td>USE₂ = BI₁ + EOU₁ + U₁ + EOU₂ + U₂</td>
<td>0.32***</td>
<td>BI₁ 0.06</td>
</tr>
<tr>
<td>EOU₂ = BI₁ + EOU₁ + U₁ + U₂</td>
<td>0.31***</td>
<td>BI₁ 0.10</td>
</tr>
<tr>
<td>U₂ = BI₁ + EOU₁ + U₁ + EOU₂</td>
<td>0.26***</td>
<td>BI₁ 0.09</td>
</tr>
</tbody>
</table>

*p < 0.05; ** p < 0.01; *** p < 0.001 (two-tailed)
The first regression model tests the role of U and EOU in predicting BI during the same time period. As expected, $U_1$ and $EOU_1$ had strong significant influences on $BI_1$ measured contemporaneously at the end of second week.

The second regression model examines whether $BI_1$ measured in phase 1 predicts $USE_2$ measured in phase 2. Contrary to TAM’s prediction, $BI_1$ did not predict $USE_2$ at all. However, as expected, $U_2$ and $EOU_2$ were both significant in predicting $USE_2$.

To gain better insight on how users’ beliefs change over time, we formed the third and fourth regression models. In the third equation, we regressed $EOU_2$ on $BI_1$, $EOU_1$, $U_1$ and $U_2$. As expected, $EOU_2$ was highly correlated with contemporaneously measured $U_2$. $EOU_2$ was also highly correlated with $EOU_1$. In the fourth equation, we regressed $U_2$ on $BI_1$, $EOU_1$, $U_1$ and $EOU_2$. Unlike $EOU_2$, however, it was found that $U_1$ and $U_2$ were not correlated with each other. Taken together, it was found that $EOU$ showed a rather stable pattern over time while $U$ showed a significant change between the two data collection points. (This will be discussed in the next section.) Figure 1 summarizes the results of the regression analyses in a path model.

Figure 1. Path model of groupware acceptance

5. Discussion

5.1. Predicting Groupware Usage

One of the most important practical contributions of TAM is that, by measuring users’ behavioral intentions after a short training or mockup prototype presentation, organizations can make an early go/no-go decision regarding the system deployment. This is based on the finding that people’s computer use can be reasonably well predicted from their intention measured after short exposure to the system [6:997]. However, as noted in the previous section, we found that, in a complex groupware environment such as the Alpha system, users’ behavioral intentions measured shortly after the initial training and introduction of the technology are not good predictors of usage behaviors in a much later period of system deployment.

Davis et al. [6] found that the intention-behavior correlation diminished with increased elapsed time. He further states that people’s intentions shortly after the initial training and introduction of the technology may not be extremely well-informed and stable. We found that this diminishing intention-behavior relationship is even more amplified in groupware environments to such a degree that behavioral intention in an early stage of technology deployment does not predict the usage behavior later in the deployment process.

We believe that this is not idiosyncratic to this particular data set, and that this insignificant (or much reduced) intention-behavior relationship is in fact a
general phenomenon that can be found in other groupware implementation processes. This observation is based on two characteristics of the groupware technology: its social nature and complexity.

First, groupware is a social technology. Unlike word processor or spreadsheet software which have been typically used to test TAM in previous research, groupware is specifically designed and developed to support groups working together to achieve common goals. As such, use and acceptance of groupware are not only dependent on what an individual user thinks and believes, but also on what other group members think and believe. Thus, one would expect that, as the group members interact more with each other and with groupware technology, they will not only form their own individual beliefs of the groupware technology, but also share their own beliefs with others. This will lead to the formation of a shared belief of the technology that in turn affects an individual’s own beliefs of technology. Therefore, an individual’s early behavioral intention, which are based on his or her own beliefs and experiences with the technology, may change as he or she interacts with other members of the group.

Although it is difficult to disentangle this complex reciprocal dyadic relationship between individual-group beliefs, there is some empirical evidence of this relationship. First, in this data set, an individual’s perceived usefulness measured in phase 1 is not significantly correlated with that measured in phase 2, while an individual’s perceived ease of use shows a stable pattern over time. Previous IS research on user belief showed that, while an individual’s perceived ease of use is more directly related to intrinsic factors such as computer self-efficacy, an individual’s perceived usefulness is influenced by external factors [22]. Therefore we believe that since perceived ease of use is more directly linked to intrinsic factors, an individual’s perceived ease of use would not change dramatically as a result of group interactions. On the other hand, we believe that an individual’s perceived usefulness is more susceptible to social influence. Thus, one can argue that the changes in perceived usefulness between phase 1 and 2, were in part due to the influence of social interactions taking place among group members.

Also, in a recent longitudinal study involving fifty-seven MBA students from two universities working on a project over a period of six weeks, Alavi and Yoo [3] found that other group members’ perceptions and usage behaviors affect an individual’s perceived ease of use and usefulness through a social influence process. They found that, in the early stages of group development when the cohesiveness among group members was relatively low, group members show similar usage behavior albeit they have different perceptions of the groupware. However, they also found that in the later stages of group development when the group cohesiveness among group members was relatively high, group members showed a convergence in their perceptions on technology as well as their usage behavior.

Although Alavi and Yoo [3] did not measure the behavioral intention, their results explain in part why behavioral intention measured in the early stage of group development is not a good predictor of usage behavior in the later stage of group development for the following reasons. First, as demonstrated by previous empirical tests of TAM [7], [14], [20], [21] and replicated in this study, perceived ease of use and perceived usefulness are strong predictors of behavioral intention and/or usage behavior measured contemporaneously. And, as discussed earlier, Alavi and Yoo [3] found that an individual’s beliefs and perceptions of groupware technology changes significantly as a group becomes more cohesive over time. As such, one can expect that behavioral intention measured in the early stage of group development may not be a reliable predictor of usage behavior in the later stage of group development. This explains in part why \( B_I \) did not predict \( U_E \) at all in this data set.

The second characteristic of groupware systems is their complexity. Most groupware systems are developed to become a “platform” rather than to become an “application.” What this means is that these systems are extremely flexible allowing a variety of different implementation strategies and application development possibilities. However, the flexibility of these emerging groupware software systems comes with complexity. Previous IS research inspired by Giddens’ structuration theory [9],[10] shows that people’s perception and belief of complex information technology changes over time as they interact with the system and find out more about the functionality of the system. Unlike simple end-user computing tools such as word processor or spreadsheet software that can be trained in a fairly short amount of time, most groupware technology require an extensive level of training followed by on-going technical support. Even with an extensive level of training, a user may find “new” features or problems of the system as they try to use the system in the context of their project, which may alter the user’s beliefs of the technology.

This structural aspect of the users’ beliefs formation process due to the technical complexity of the groupware is not conceptually independent from the...
social influence process that we discussed above. In fact, we believe the social influence process is an integral part of the structurational process. That is, we think that people reformulate their beliefs of groupware technology as they find new features of the system. As they change their beliefs, group members will try to share their “new” beliefs with other people that in turn affect others’ beliefs and their intention to use and actual usage of the system.

5.2. Implications for Future Research

There are several limitations of the current research which need to be addressed by follow-up research. First, we measured the behavioral intention only in phase 1 and the self-reported usage only in phase 2. This was done because we expected that behavioral intention measured in phase 1 would significantly predict usage measured in phase 2. Contrary to our expectation, as we discussed above, behavioral intention measured in phase 1 did not significantly predict the usage measured in phase 2 and we speculated that this finding was due to the groupware technology’s social nature and complexity which make the behavioral intention unstable in groupware environments. To empirically show that the behavioral intention is indeed unstable in groupware environments, however, we need to measure it twice and see the correlation between those two. If indeed we find they are highly correlated, it provides an empirical support to our speculation. This suggests a replication of the current study with a research design in which behavioral intention is measured twice in both phases 1 and 2.

Another interesting research venue from here would be to disentangle the complex reciprocal dyadic relationship between individual and group beliefs of technology and how that affects the way people accept groupware technology. Taylor and Todd [21] incorporated subjective norms in their Theory of Planned Behavior (TPB). Alavi and Yoo [3] used directly measured other members’ perceptions and usage behavior in their social influence model of groupware acceptance. Whichever method of capturing social influence is used, it seems very important to better understand how social and group interactions among the users affect they way groupware technology is accepted for more successful deployments of groupware technology in organizations.

5.3. Practical Implications

The practical implication of this research is quite clear: Do not rely on behavioral intention measured after a short training or prototype presentation to predict usage of groupware. Groupware is a social, complex technology and predicting the acceptance and usage of it is much more complex than predicting simple end-user computing technology. IS managers should not be misguided by blind applications of theoretical models developed and validated with other kinds of information systems. A successful implementation of groupware requires an organization-wide commitment and deployment of the technology. This requires vast amounts of financial and technical resources committed to the technology. If one makes such a big commitment based on an ill-advised interpretation of behavioral intention measured early on in the deployment process, the organization may later find that the groupware technology is not utilized as much as they expected. Certainly, as Ginzberg [11] pointed out, “early-warning” techniques can improve the possibility of successful groupware implementation in organizations and it is greatly needed. However, until we grasp a better and much clearer understanding of the user acceptance of groupware technology, IS managers need to pay close attention to the social dynamics of the groupware acceptance process throughout the deployment process.
REFERENCES


