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The Effect of Positive Mood on Intention to Use Computerized Decision Aids

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Abstract

While psychology research indicates that positive mood enhances cognition and behavior, MIS researchers have largely ignored the potential effects of positive mood on user acceptance of new information technologies (IT). Using two cognitive theories about mood and memory, positive mood theory and the affect infusion model (AIM), this study develops hypotheses about users' acceptance of new IT under two mood conditions and two levels of uncertainty. These hypotheses are investigated via a lab experiment using a computerized decision aid. The lab experiment found that positive mood increased acceptance, as compared to a control group, under both levels of uncertainty. These results held for both induced and naturally occurring positive mood. The results for the high uncertainty condition along with results of two post-hoc tests are consistent with positive mood theory, but not with the AIM. These results indicate that mood is an

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important focus for future MIS acceptance research, which should be based on positive mood theory rather than the AIM.

Key Words: Mood, Affect, Uncertainty, Computerized decision aids, Behavioral intention, Technology acceptance, Human computer interaction

1. Introduction

A growing body of research suggests that positive mood enhances cognition and behavior [50]. Even small positive events occurring in everyday life, such as receiving a small gift, bring about significant changes in one's thought processes and behavior. Two prominent theories from the psychology literature have been developed to explain the effects of positive mood on cognitive processes and resulting behaviors: positive mood theory [52] and the affect infusion model (AIM) [31]. Based on these theories, experimental investigations have explored in detail the effects of positive mood in the areas of social behavior and cognition (for a review of this research see [51]).

The positive mood theory and the AIM as well as the growing body of research supporting them suggest that paying attention to the mood state of users may be particularly applicable for understanding users' initial acceptance of an IT. These two mood theories, however, have had little effect on the MIS literature.

MIS research has recognized the importance of some constructs that capture some form of the users' feelings. Examples of such constructs in MIS research include ***attitude***, "the degree to which a person likes or dislikes the object" [2], such as a computer [11]; ***computer playfulness***, "the degree of cognitive spontaneity in microcomputer interactions" [90], e.g., [13,40]; ***perceived enjoyment***, "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" [20], e.g., [67,94].

Mood is yet another construct in the continuum of human feelings. "Moods capture how people feel at work or when they are on the job, not necessarily how they feel about work, which entails more explicit cognitive evaluation" [39]. The difference between "how people feel" and "how people feel about an object" is an important difference in research studies. MIS research using affective constructs has primarily focused on the affective reactions toward the use of technology and not the affective state of users when they are introduced to IT. Our study involving mood investigates the feeling state of users at the time they first use a new IT, rather than their feelings toward using that new IT. Thus our study contributes to the MIS literature by examining positive mood – an affective construct that is shown to have a significant influence on behavior yet is rarely used in the MIS studies – and its influence on intention to use a new IT.

Based on the positive mood theory and the AIM, we develop a theoretical argument suggesting that positive mood can enhance the acceptance of an IT, even when uncertainty is high. We present our theoretical argument in the form of four hypotheses. Based on our theoretical argument and the hypotheses, we develop a lab experiment to test the effects of positive mood on acceptance of a computerized decision aid under two distinct levels of uncertainty. This lab experiment provides the necessary control to manipulate users' mood and the uncertainty of the information available to them.

Our experiment also examines the effects of both induced and naturally occurring positive mood on acceptance. Many investigations induce positive mood with simple methods, such as the one used in this study, that occur frequently in everyday life [49]. Given the evidence that naturally occurring positive moods are common [48], we argue that individuals' positive mood will increase acceptance regardless of whether it is induced or naturally occurring.

Our study of the potential effects of positive mood on technology acceptance has both theoretical and practical significance. Current MIS theories about IT acceptance have largely ignored the affective states of users as they interact with a new IT. Our research provides evidence that this could be a productive avenue for further research and theory development, not only in the acceptance studies but also in interface design investigations. Our study further contributes to research and theory development in IS by examining which one of the two mood theories is more applicable for studying IT acceptance. Moreover, our study contributes to IS literature by examining whether there is any difference between induced and naturally occurring moods in regards to intention to use a system.

Organizations continue to invest heavily in new IT and computerized decision aids, but these IT are often underutilized resulting in poor returns on organizational investments in IT [63,87]. Hence, examining factors that can increase IT acceptance has practical value, in addition to its theoretical value. In our laboratory experiment, positive mood affects acceptance. Since literature has found that the effects of positive mood on cognition and behavior are robust across many settings including organizations [56], these results suggest that organizations may be able to increase their IT acceptance by fostering positive mood when introducing a new system. Moreover, our findings that users' intention behavior increases regardless of whether positive mood is induced or naturally occurring suggest that companies may benefit from the effects of positive mood by merely sustaining, rather than inducing it. Finally investigating the effect of positive mood on acceptance under uncertainty is practically relevant because today's business environment is characterized by increasing levels of uncertainty [76].

2. Positive Mood Theories

Before reviewing the literature on positive mood, it is important to explain how the term mood is used in this article. First, although mood can be examined as a state or a trait variable [37,38], in the current study mood is investigated as a state variable because our investigation is grounded in psychological theories and studies that show one's feeling state is a significant influence on cognition and behavior [28]. Second, this article examines the mood of the subjects and not their emotions. Moods and emotions, although both affective states, differ on the dimensions of "pervasiveness", "intensity", and "specificity" [71]. Emotions generally denote short-lived strong reactions that most often have both a specific cause (as in a provocative act) and a target (as in the target of anger). Moods, on the other hand, usually refer to less intense, but more enduring and diffused affective states, which are not directed toward any particular object or behavior [66]. Third, this study focuses on positive mood states. Mood states (e.g., sadness, fear, happiness, joy, etc.) can be grouped into more general or global categories such as positive, neutral, and negative mood [14,77]. Choosing to focus on one mood category is important because the theoretical foundation for the effects of mood states differs by the various mood categories [47].

In this study we examine the effects of positive mood using two theories in the mood literature: the ***positive mood theory*** and the ***affect infusion model (AIM)***. Although these two theories take different approaches in explaining the effect of positive mood on cognitive processes, both theories suggest that positive mood acts as an effective retrieval cue for positive material in memory and argue that positive mood influences the evaluation of stimuli.

According to the positive mood theory, positive material in one's cognitive system is diverse, rich and flexible, and positive mood cues positive material in memory. Thus, when in a positive mood one has access to a rich and elaborately connected network of cognitive positive material. Consistent with this view, a growing body of research has shown that positive mood can significantly enhance one's cognitive ability and behavior [3,35]. Positive mood promotes an explorative behavior or an increase in willingness to try new products [62]. When in a positive mood, people tend to integrate new information more efficiently, be less confused or overwhelmed by the task, and exhibit a better understanding of the issues at hand [25]. These effects are supported by a neuropsychological study proposing the "dopaminergic" theory of positive affect, which suggests that the release of dopamine into the anterior cingulated region of the brain may underlie the relationship between positive affect and the above discussed enhanced cognitive processes.

The AIM also argues that mood and memory are intimately connected. According to this theory, mood states are directly linked to cognition within a single associative network of mental representations. These mood states cue thoughts as they selectively activate memory nodes to which they are connected [7,30]. Thus, similar to positive mood theory, the AIM suggests that positive mood cues positive material in one's memory.

Both theories argue that moods are common and can be induced with ordinary events that are likely to occur in one's everyday life. In particular, positive mood can be successfully induced by simple things such as viewing short clips of non-aggressive comedy films [54], finding a coin in a public phone [58], thinking positive thoughts [55], success on an unrelated task [60], receiving a small gift [24], or working in a room with a pleasant atmosphere [4].

A point of departure between the two theories is in their explanation of the effect of positive mood on processing style. AIM predicts that positive mood promotes a processing style that relies on internal schemas and data to respond to a situation. The positive mood theory argues that positive mood facilitates a processing style that is responsive to both internal and external information.

Another point of disagreement between these two theories is the role of uncertainty on mood effects. AIM suggests that affect congruent effects take place when tasks require creative processing and active generation of new information, e.g., when "people face uncertain and unpredictable social encounters" for which they will need to interpret indeterminate cues [29]. That is, AIM predicts that positive mood effects are more likely to take place in the presence of uncertainty. Moreover, AIM predicts that the effects of positive mood on cognition and behavior are intensified when more extensive processing is required, such as situations when we need to deal with a more demanding, complex, or uncertain task. For example, when in a positive mood, an individual performing a more uncertain task produces a more positive evaluation of stimuli. Although the positive mood theory also suggests that the nature of the task can mediate the effects of positive mood on behavior, this theory does not suggest that a more demanding, complex or uncertain task results in intensified mood congruent behavior.

In summary, both positive mood and the AIM theories posit that positive mood significantly influences cognition and behavior. Both theories agree that positive mood primes positive thoughts in memory, which then lead to evaluations that are more positive. These two theories, however, provide different explanations for how positive mood influences cognitive processing. In addition, the AIM suggests that more demanding, complex or uncertain tasks can intensify the effects of positive mood on behavior – a view not shared by the positive mood theory. This study investigates the effects of positive mood on acceptance, which is supported by both theories. It also investigates which one of these two theories' predictions are verified regarding the mood effects under high uncertainty. In other words, we examine whether the positive mood effects are stronger under more uncertain tasks (an effect supported by the AIM) or stay the same (an effect supported by the positive mood theory).

3. Research Model and Hypotheses

Our research develops a basic model of the effects of positive mood on intention to use a new computerized decision aid, and tests this model via a lab experiment that involves two levels of uncertainty. Our basic research model and the hypotheses investigated in this study are shown in Figure 1.

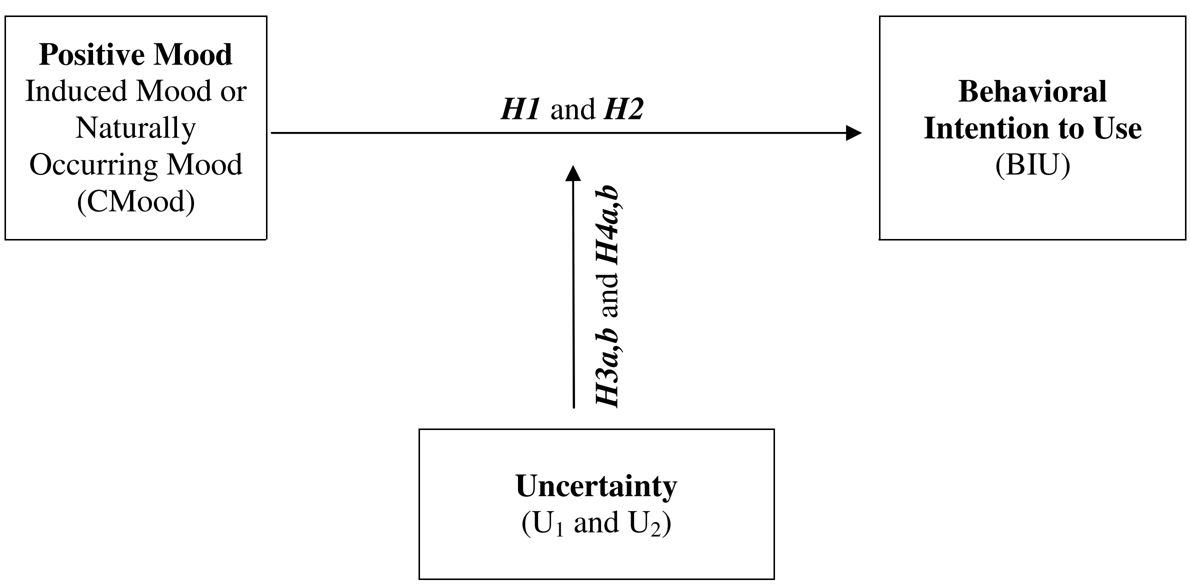

Figure 1: Research Model

3.1 Effect of Positive Mood

The main objective of MIS research on IT acceptance is to examine why individuals adopt a new information system and what can be done to improve the acceptance of a new IT. This objective is accomplished by examining various antecedents to users' intention to use an IT, since intention is closely linked to actual behaviors. These antecedents, including usefulness [86], ease of use [70], playfulness, security [26], risk, cost [93], fashion involvement [78], and task support satisfaction [36], are often chosen by tailoring theories in the psychology literature to examine individuals' reactions and behavior to a new system IT. These antecedents are sometimes investigated with regression or ANOVA [85], as in this study, and sometimes with Structural Equation Modeling (SEM) using LISREL, AMOS, or PLS [45].

Psychological theories also suggest that behavior is influenced by the thoughts that come to mind first or most easily [84], which in turn are shaped according to our mood [30]. While mood represents only one of many constructs developed to capture some aspects of human feelings, the mood literature suggests that positive mood is likely to be as helpful in refining our understanding of acceptance behavior as are other human feelings (such as playfulness, enjoyment, etc.). The mood literature provides compelling theories and empirical evidence for the enhancing effects of positive mood on cognition and behavior. This literature suggests that positive mood primes positive thoughts in one's cognitive system. Positive mood promotes explorative behavior and influences one's evaluation of stimuli [32]. For a detailed review of this literature see [46].

MIS research and model development, however, has largely ignored positive mood as an antecedent to acceptance of an IT. We found only two studies that examined the effect of mood on IT acceptance indicators [89,92]. The Woodroof and Burg study examines the effect of negative affect (as a trait variable not a state variable) on user satisfaction of an information system. Thus, it focuses on negative moods, a different mood category with different theories, while our study focuses on positive mood. The Venkatesh and Speier study examines the effect of mood on motivation during training. Similar to our study, the study by Venkatesh and Speier measures positive mood as a state variable and examines its effect on intention to use a system. Theoretically, because their study focuses on training, it induces positive mood before training. Our study focuses on acceptance and thus induces positive mood immediately before the experimental use of the system for a task, which provides a more direct test of positive mood effects on acceptance. Our first hypothesis both replicates the results obtained by Venkatesh and Speier and extends it by providing a more direct test of mood effects on acceptance.

H1. *Individuals in the positive mood treatment will have greater intention to use the computerized decision aid as compared to individuals in the control group.*

The literature suggests that positive moods are common and that the effects of positive mood on cognition are robust and independent of the mood inducement method [33]. Thus, it is reasonable to expect that positive mood, regardless of whether it is naturally occurring (induced by a naturally occurring positive event) or induced by the experimenter (a surprise gift of candy), will have a similar increasing effect on intention to use as described in H1. Thus, we test the effects of naturally occurring mood by testing the effects of mood within the control group as follows:

H2. *For individuals in the control group, the higher the mood scores, the greater their intention to use the computerized decision aid.*

3.2 Effect of Uncertainty

In this study, we use a judgment task to test the effects of positive mood on acceptance. A judgment is defined as a cognitive process in which a person makes a judgment about an unobservable event (a criterion) on the basis of a set of observable data [8]. Judgments, as defined here, are fundamental cognitive processes involved in many decisions. Hence, many decision making and decision support studies use judgment tasks to study human decision behavior [12,27]. For example, the task used in this study has been used in several prior decision support systems studies [75] including a study examining acceptance decisions [22]. When making a judgment, one has to estimate the relationship between the available information and the criterion and combine the provided information into one single judgment. Judgment tasks are inherently uncertain because they require decision makers to interpret indeterminate information [80].

While both positive mood theory and the affect infusion model suggest that positive mood affects cognition and behavior, the affect infusion model also suggests that the effects of mood are intensified under more uncertain tasks. In other words, more uncertain tasks produce stronger effects of positive mood on intention to use the decision aid. To examine AIM's predictions that acceptance will be enhanced when uncertainty is higher, we created two levels of uncertainty in our judgment task. Consistent with AIM, it is reasonable to argue that intention to use is more favorable for individuals in the positive mood treatment who complete the more uncertain task.

H3a. *For individuals in the positive mood treatment, those with the more uncertain task will have greater intention to use the computerized decision aid as compared to those with the less uncertain task.*

Although positive mood theory agrees with AIM in that the nature of the task can influence the effects of positive mood on behavior (e.g., whether mood effects take place or not), it does not suggest that higher levels of uncertainty will results in stronger mood effects. Nor does it suggest that the mood effects will be less strong for more uncertain tasks. Thus, consistent with positive mood theory, we also test a no differences version of hypothesis 3 in the form of H3b.

H3b. *For individuals in the positive mood treatment, there will be no significant difference in intention to use the computerized decision aid between those with the more uncertain task and those with the less uncertain task.*

Hypotheses H3a and H3b examine the effects of uncertainty on the effect that induced positive mood can have on intention to use a computerized decision aid. Since positive mood effects on cognition are robust regardless of the mood inducement method [57], it is reasonable to expect that these uncertainty effects (as predicted by the AIM and positive mood theory) also extend to naturally occurring positive moods. Thus, the following hypotheses (H4a and H4b) are tested within the control group only. Consistent with the AIM, H4a asserts that the mood congruent effects of naturally occurring positive mood on intention to use a computerized decision aid (i.e., the higher the mood scores of the subjects, the higher their intention scores) is stronger under the more uncertain task. Grounded in the positive mood theory, H4b posits that there will be no significant difference between the effects of naturally occurring positive moods on intention to use a computerized decision aid under different levels of uncertainty.

H4a. *For individuals in the control group, the mood congruent effect on intention to use (i.e., the higher the mood scores, the greater the intention to use the computerized decision aid) will be significantly stronger for those with the more uncertain task as compared to those with the less uncertain task.*

H4b. *For individuals in the control group, the mood congruent effect on intention to use (i.e., the higher the mood scores, the greater the intention to use the computerized decision aid) will not be significantly different for those with the more uncertain task as compared to those with the less uncertain task.*

4. Research Method

4.1 Design of the Laboratory Experiment

The hypotheses developed in the previous section were tested using a laboratory experiment because a laboratory experiment provides the necessary control over the task, uncertainty, and mood [79]. The task used in this study is a judgment task requiring multiple judgments over time. Judgment tasks such as the one used in this experiment require interpretation of information because of the probabilistic and uncertain nature of task information [9]. The task was embedded in a computerized decision aid that was new to the subjects, thus providing a context for measuring intention to use.

The experiment is a 2 X 2 design with two levels for mood (positive and control) and two levels for uncertainty (low and high). Each subject was randomly assigned to one of the four conditions. The subjects were 134 (60 male and 74 female) undergraduate business students from four sections of a third year business statistics course of a major land grant university. The results of the power analysis [16] showed that with this sample size (n=134), medium effects can be detected with a power of 0.95 and small effects can be detected with a power of 0.80.

4.1.1 Mood Treatment

The subjects in the positive mood treatment were induced with positive mood. Consistent with prior research [59], subjects in the positive mood treatment received a surprise gift of chocolate and candy wrapped in colorful paper a few minutes prior to performing the task. Once again, consistent with prior research [61], mood manipulation was disguised by presenting the surprise gift as a small token of appreciation. The participants in the control group did not receive a surprise gift, that is, subjects' mood in the control group was not manipulated.

4.1.2 Mood Measurement

As in prior research [10], a self-report survey was used to measure the subjects' mood. Subjects were asked to rate on a seven-point scale (with 1 denoting "strongly disagree", 4 denoting "neutral", and 7 "strongly agree") how each of the words "glad", "happy", "pleased" described their current mood. These words were used to measure positive mood. The same words were used on a mood manipulation survey created by Elsbach and Barr [23]. To measure mood Elsbach and Barr employed words from the "Dictionary of Affect" [91]. These words described feeling states that were high on the dimension of pleasantness.

The items on Elsbach and Barr survey were strongly related (alpha= 0.893). We verified the internal reliability of the items on the survey. Our test of reliability also showed a strong relationship among the items on the survey (alpha= 0.89). Consistent with prior research [65], for each subject a composite mood score (CMood) was calculated. In other words, the ratings for the items happy, glad, and pleased on the survey were averaged to calculate a single CMood for each subject.

4.1.3 Task Description

The task used in this experiment is a manufacturing problem based on Holt, Modigliani, Muth, and Simon's [44] model of the production-scheduling problem. This problem has been used in many previous laboratory experiments [64]. The problem in the task was to decide how many units to produce given uncertain future demand and the knowledge of the current work force size, productivity, and inventory level.

This production-scheduling problem was selected because it is a managerially relevant problem appropriate for the subjects used in the experiment. Judgment tasks, like the one used in our study, are often used to measure how judges learn to improve their judgments [69]. Thus, this type of task is appropriate for subjects who have no prior experience with the task such as students [19,83]. Furthermore, this task has been calibrated with actual data for the production-scheduling decision at Pittsburgh Plate Glass [43].

The production-scheduling decision is modeled through the following equation:

$$\text{Production Decision} = b_{10} + b_{11} * (\text{work force last month}) - b_{12} * (\text{inventory on hand}) + b_{13} * (\text{the current month's demand}) + b_{14} * (\text{the demand for next month}) + b_{15} * (\text{the demand for two months ahead}) \quad (1)$$

Where the coefficients values are b_{10}=148.5, b_{11}=1.005, b_{12}=0.464, b_{13}=0.464, b_{14}=0.239, and b_{15}=0.113.

The decision rule in Equation 1 describes a perfect world with no uncertainties. To mimic the real world with its uncertainties in an experimental setting, an error term is generally added to the above equation:

$$\text{Production Decision} = b_{10} + b_{11} * (\text{work force last month}) - b_{12} * (\text{inventory on hand}) + b_{13} * (\text{the current month's demand}) + b_{14} * (\text{the demand for next month}) + b_{15} * (\text{the demand for two months ahead}) + e \tag{2}$$

The computerized decision aid in which this production scheduling task was embedded provided subjects with scheduling information (e.g., demand, inventory, etc.). While the decision aid is tailored to this particular experimental task, it provides information and computations typical of a decision aid designed to support operational-level decisions. The subjects entered their judgments (production scheduling decision) by adjusting a slider or using a scrollbar to set their desired value. A small window on the bottom right corner of the screen displayed a message to motivate subjects to do their best. A judgment was submitted by clicking the button "I am satisfied with my current decision." Once this button was pushed the subject's judgment (the production value entered by the subject), the actual judgment (the production value generated by the model in Equation 2), and the percentage error of the subject's judgment (outcome feedback) was displayed in a dedicated section of the screen. A short history of the subject's five most recent judgments along with the actual judgments and the percentage error were also displayed. At the same time, the window that displayed the motivational message was replaced by another window displaying the value of the actual judgment (the production value generated by the model in Equation 2) in a large font. A button labeled as "OK to Continue" was also displayed. This button was used to start a new trial (i.e., a new set of randomly determined and statistically independent cue values).

The production scheduling task consisted of 35 trials. The lower limit for the number of trials in a judgment task with low to zero cue correlation (such as the task in this study) is determined by the number of cues in the task. The literature suggests a "5 to 1" ratio (five trials for each cue) for the minimum number of trials. The upper limit for the number of trials is often determined by the available time [81]. Many studies (including ours) select the number of trials by starting with the minimum and adding some extra trials [74]. We provided 10 extra trials in addition to the required minimum (5 trials for each of the 5 cues+ 10 extra trials=35 trials).

4.1.4 Uncertainty Treatment and Measurement

Uncertainty in a judgment task, which is referred to as environmental predictability (Re), is calculated through the correlation between the optimal criterion (production decision in Equation 1) and the actual criterion (production decision in Equation 2) [18]. Thus, the level of uncertainty in the task is controlled through the error term added to the task in Equation 2 [68].

In this study we used two different error terms to generate two distinct uncertainty levels U_1 and U_2 ($U_1 < U_2$). To create these uncertainty levels, a set of error terms and their corresponding predictabilities (e, Re) were generated through a simulation study. Then from this set, the error term e=100 with its corresponding predictability level Re=0.75 was selected to generate the uncertainty level U_1. Because the error term, e=100, has been used in many prior studies [73], this uncertainty level served as a useful point of reference.

The second uncertainty level (U_2) was selected in a way to make the task information less predictable than the task information in the first uncertainty level (U_1). We used the error term e=188 with its corresponding predictability level Re=0.55 to represent this uncertainty level (U_2). Naylor and Schenk [72] have shown that decision makers' achievement significantly decreased when their task predictability decreased from 0.9 to 0.7 to 0.5. Since these predictability levels differ by 0.2 points, the predictability of the more uncertain task in this study was selected so that it was 0.2 points lower (Re=0.55) than the predictability of the less uncertain task (Re=0.75). Hence the predictably level 0.55, which was generated by adding the error term e=188 to the task equation, was used to represent the uncertainty level U_2.

A pretest was conducted to establish that the two uncertainty levels were significantly different. Evidence of significant differences in the two uncertainty levels is whether there is significantly lower judgment quality for the more uncertain task [82]. To verify that the uncertainty levels were significantly different, we compared subjects' task achievement, i.e., their judgment quality [6]. Judgment tasks such as the one used in this experiment require the task doer to make a prediction (judgment) about the likelihood of a future event (criterion). Achievement reflects how closely subjects' judgments and the criterion values match [42], the closer the matches between subjects' judgments and the criterion values, the higher their achievement.

The pretest involved 43 subjects who were randomly assigned to either uncertainty level U_1 or uncertainty level U_2. Subjects' achievement was measured through the correlation between subjects' judgments (decision values entered into the computerized decision aid by the subjects) and the actual criterion (production decisions calculated by the linear model in Equation 2) [41]. The results of this pretest showed that the subjects' achievement was significantly lower under the more uncertain task (Mean_{U1} =0.58, Mean_{U2} =0.34, t= 2.97, p=0.002). Thus, the results of the pretest showed that the uncertainty levels U_1 and U_2 were significantly different. The results of the pretest also showed that all the subjects completed the task (35 trials) within the allocated time of less than one hour.

4.1.5 Behavioral Intention Measurement

Behavioral intention to use the computerized decision aid was measured using the validated scale from Venkatesh and Morris [88]. This scale has been used in many prior research studies [1,21]. The test for internal reliability of these items confirmed previous findings and showed a strong relationship among the items of the survey (alpha=0.98).

To ensure validity of BIU in this context, subjects were told that the decision aid used in this study was designed to be used in business courses (including the very course they were attending) for the purpose of practicing decision making. The questions on the survey asked the subjects to rate their intention to use this software assuming they had access to it.

4.2 Procedure

4.2.1 Assigning Subjects to Treatments

Each subject was randomly assigned to one of the four conditions. Subjects were first randomly assigned to one of the two mood groups (positive mood treatment and mood control group). The subjects in each of these groups were then randomly assigned either to the low task uncertainty U_1 or to the high task uncertainty U_2.

The 134 subjects were from four sections of the same course. Two of these sections met on Tuesdays and Thursdays every week and the other two sections met on Wednesdays and Fridays. Thus, this experiment was conducted over four days (Tuesday, Wednesday, Thursday, and Friday) of the same week. The subjects were randomly assigned to these four days in a way that each of the four sections of the business course was equally represented in the positive and control mood groups. Subjects attended only the session that they were assigned. In other words, subjects had no actual class sessions during that week; they went to their classroom only one day during the week and that was when the experiment was conducted.

The mood of the subjects who were assigned to the Tuesday and Wednesday groups was not manipulated. Thus, the subjects in these two days served as the control group. The mood of the subjects who were assigned to the Thursday and Friday groups was manipulated by giving the subjects a surprise gift of chocolate and candy wrapped in colorful paper. Thus, the subjects in these two days served as the positive mood group. The mood manipulation was conducted in the last two days of the experiment to control for the possibility of mood contamination (i.e., the subjects on Thursday or Friday learned about the surprise gift given on Tuesday or Wednesday). All subjects were instructed not to talk about the experiment to anyone until the following week after the experiment was completed.

We examined our data to ensure that there were no systematic differences within the positive mood intervention sessions and within the control group sessions. The results of the t-test showed that there was no significant difference between the two sessions in the positive mood treatment (sessions conducted on Thursday and Friday). Similarly, no significant difference between the two sessions in the control group was found (sessions conducted on Tuesday and Wednesday). Thus, we pooled the data gathered from the two sessions for the positive mood treatment (data from Thursday and Friday sessions). Likewise we pooled the data within the control group sessions (data from Tuesday and Wednesday sessions).

4.2.2 Running the Experiment

On the day of the experiment, the participants gathered in their classroom. Upon arrival, the subjects received a card with a randomly assigned seat number typed on it. The random seat numbers were used to eliminate situations that might have possibly affected the mood of our subjects (e.g., sitting near a friend or in a favorite spot).

The same person gave the instructions to all of the groups. To ensure consistency, the instructions were read from a written script. Subjects were informed that this experiment investigated managerial decision making. They were told that the software package that they were about to use was designed to assist business students in learning and practicing managerial judgments and that it was being considered for use in their current or other business courses.

The subjects were given a short tutorial on the task. After the tutorial, the subjects in the positive mood treatment received a surprise gift of candy and chocolate. The subjects in the control group did not receive a gift. The subjects were then asked to go to their designated computers in the computer lab (subjects were randomly pre-assigned to computers). The embedded task in the computerized decision aid had either uncertainty level U_1 or the level U_2. Thus, half of the subjects in each mood treatment completed a task with uncertainty level U_1 and the other half completed a task with uncertainty level U_2.

In the computer lab, the subjects activated the software package that included the mood survey, two practice trials, and the actual task that consisted of 35 trials. The software was designed so that participants had to complete the mood survey followed by practice trials before they could start the actual task. After finishing the task, the subjects were debriefed and asked to leave the room. The entire procedure did not exceed one hour.

4.3. Analysis

We used SPSS to perform our analyses. For the two hypotheses about differences between two treatment groups, we used t-tests to compare behavioral intention to use (BIU) between the two treatments, e.g., between positive and control mood treatment in H1 and between the two uncertainty treatments in H3. We used regression to analyze the effect of mood scores, a continuous variable, on intention to use the computerized decision aid (H2). To test whether uncertainty moderates the relationship between mood and intention to use, as predicted by H4, we followed the method suggested by Baron and Kenny [5]. Since mood (CMood) and Intention to use (BIU) are represented by continuous variables and uncertainty (U) by a dichotomous variable, this method involves running two separate regressions (i.e., regressing the mood scores, CMood, against the intention scores, BIU, using one regression for uncertainty level U_1 and another regression for U_2), and comparing the slopes, i.e., testing whether the unstandardized regression coefficients are significantly different [17].

5. Results

In the following sections the results of this study are reported. First, an uncertainty manipulation check was conducted to verify that the uncertainty levels in this study were significantly different. Then, a mood manipulation check was carried out to test whether positive mood was successfully induced. Next, descriptive statistics were run for each treatment. Finally the hypotheses were tested.

5.1 Uncertainty Manipulation Check

The pre-test check of significant differences between the two uncertainty levels was repeated with the experimental subjects. Like the pre-test, we compared subjects' achievement under the uncertainty levels U_1 and U_2. To exclude possible mood effects, this comparison was done for the subjects in the control group only (n=63).

The results of the one tail t-test for achievement, measured as the correlation between actual criterion (decision values calculated using the model in Equation 2) and subjects' decisions (decision values entered into the computerized decision aid by the subjects), showed that the achievement of the subjects with the lower uncertainty level was significantly higher than the achievement of the subjects with the more uncertain task (Mean $_{U1}$ =0.53, Mean $_{U2}$ =0.33, t=3.73, p<0.01), see Table 1. That is, subjects' achievement was significantly worse under the more uncertain task. Thus, consistent with the results of the pretest, these results confirmed that uncertainty was successfully manipulated.

Table 1: Uncertainty Manipulation Check

Uncertainty level	Achievement	
	Mean	Std. Dev.
U_1 (low)	0.52	0.20
U_2 (high)	0.35	0.20

df= 61, t Stat= 3.46, p<0.001

5.2 Mood Manipulation Check

The results of the mood manipulation check show that positive mood was successfully induced. The one tailed t-test showed that the mean of the composite mood scores, CMood, of the subjects in the positive mood treatment was significantly higher than the mean of the CMood of the subjects in the control group (Mean $_{\text{Positive Mood Treatment}}$=5.04, Mean $_{\text{Control Group}}$=4.65, t=1.99, p=0.02), see Table 2.

Table 2: Mood Manipulation Check

	CMood	
Treatment	Mean	Std. Dev.
Positive mood group	5.04	1.08
Control group	4.65	1.11

df= 132, t Stat= 1.98, p=0.02

5.3 Descriptive Statistics

Before presenting the results of testing the four hypotheses, we provide the basic descriptive statistics for the composite mood scores (CMood) and for the dependent variable, behavioral intention to use (BIU), broken down by treatment condition, see Table 3.

Table 3: Descriptive Statistics by Treatment

	Control Group		**Positive Mood Treatment**		**Total**	
	CMood	BIU	CMood	BIU	CMood	BIU
Uncertainty U_1	4.76 (1.15)	4.73 (1.11)	4.95 (0.94)	4.96 (1.09)	4.86 (1.04)	4.85 (1.10)
	N=31		N=35		N=66	
Uncertainty U_2	4.55 (1.07)	4.30 (1.22)	5.11 (1.21)	4.76 (1.33)	4.84 (1.18)	4.54 (1.28)
	N=32		N=36		N=68	
Total	4.65 (1.11)	4.51 (1.17)	5.04 (1.08)	4.86 (1.21)	4.86 (1.11)	4.69 (1.21)
	N=63		N=71		N=134	

Statistics in each cell are Mean, (Std. Dev.), Number of Subjects

5.4 Positive Mood Hypotheses

Hypothesis 1 asserts that individuals in the positive mood treatment will have greater intention to use (BIU) their computerized decision aid as compared to those in the control group. The results of the one tail t-test showed that the mean of the variable BIU was significantly higher in the treatment group, see Table 4. These results support hypothesis H1.

Table 4: Results of Hypothesis 1

	BIU	
Treatment	**Mean**	**Std. Dev.**
Positive mood group	4.86	1.21
Control group	4.51	1.17

df= 132, t Stat= 1.72, p=0.04

Hypothesis 2 asserts that the effects of positive mood as predicted in hypothesis 1 will hold regardless of whether positive mood is induced or naturally occurring. In other words, H2 asserts that naturally occurring positive moods will have the same enhancing effect on intention to use a computerized decision aid as was observed for the induced positive mood. Since this hypothesis pertains to naturally occurring positive moods, it was tested for the subjects whose mood was not manipulated by the experimenter, i.e., the subjects in the control group (n=63). According to this hypothesis, the higher the mood scores of the subjects the higher their BIU scores. To test this assertion, a regression model in the form of Equation 3 was used.

$$BIU=b_0 + b_1 * CMood \quad (3)$$

In the above equation, *BIU* represents the self reported intention to use scores. The variable *CMood* in Equation 3 captures the composite mood scores of the subjects in the control group, i.e., it represents subjects' naturally occurring moods. Note that the CMood is a continuous variable, that is, it takes on a range of values.

The results show that 20% (R^2=0.20) of the variation in *BIU* is explained by the regression equation. Moreover, there was a significant effect for the variable *CMood*

(b_1=0.44, t=3.86, p<0.001 one tail), see Table 5. These results indicate that the higher the mood scores of the subjects (the more positive the moods) the higher their BIU scores. These results are consistent with H1, which predicts that individuals in the positive mood treatment (who have high mood scores due to the positive mood treatment), compared to individuals in the control group (whose mood score is not as high as people in the positive mood treatment), will have higher BIU scores. The results of H1 and H2 together indicate that there are no discrepancies between the effects of induced and naturally occurring positive mood.

Table 5: Results of Hypothesis 2

Variable	***b*-value**	***t*-value**	***p*-value**
CMOOD	0.44	3.86	0.000
R^2 = 0.20; adj. R^2 = 0.18; $F_{1, 62}$=14.91; *p*-value=0.000			

5.5 Uncertainty Hypotheses

Hypothesis 3a, consistent with the AIM, asserts that the individuals in the positive mood treatment who complete the more uncertain task will have greater intention to use the computerized decision aid as compared to their counterparts in the positive mood treatment who completed the less uncertain task. Hypothesis 3b, consistent with the positive mood theory, asserts that there is no significant difference between the BIU scores of individuals in the positive mood treatment who complete the more uncertain task and their counterparts in the positive mood treatment who completed the less uncertain task.

The results of one tail t-test show that the BIU scores of the subjects in the positive mood treatment with the high uncertainty task, compared to the BIU scores of the subjects in the positive mood treatment with the low uncertainty task, are not significantly different (see Table 6). Thus, these results support Hypothesis 3b, rather than Hypothesis 3a.

Table 6: Results of Hypothesis 3a and 3b

	BIU	
Uncertainty level	**Mean**	**Std. Dev.**
U_1 (low)	4.96	1.09
U_2 (high)	4.76	1.33

df= 69, *t Stat*= 0.70, *p*=0.24(one tail)

Hypothesis 4 predicts that the same pattern of behavior as predicted in hypothesis 3 holds for naturally occurring positive mood. Hypothesis 4a, consistent with the AIM, predicts that the effect of positive mood on intention to use the computerized decision aid is intensified under the more uncertain task. Hypothesis 4b, consistent with positive mood theory, predicts that there is no significant difference due to level of uncertainty. Once again, since these hypotheses pertain to naturally occurring positive moods, we tested them using the subjects in the control group only (n=63).

Hypothesis 4 examines the moderating effect of uncertainty (a dichotomous variable) on the relationship between mood and BIU (continuous variables). Since the moderator is a dichotomous variable we need to examine the effect of mood (CMood) on intention to use (BIU), using a linear model similar to the one in Equation 3, separately for the uncertainty levels U_1 and U_2. The test of difference between the unstandardized regression coefficients recommended by Cohen and Cohen showed that there was no significant difference between the regression coefficients (b_{U1}=0.49, b_{U2}=0.44, t= 0.20, p=0.84). These results support hypothesis 4b but not 4a, which is consistent with the results of Hypothesis 3. Thus, these results indicate that there is no discrepancy between the effects of induced and naturally occurring positive mood.

Table 7: Results of Hypothesis 4

BIU = b_0+ b_1 * CMood

Uncertainty Level	*b*-value	*t*-value	*p*-value
U_1 (low)	0.49	3.18	0.004
U_2 (high)	0.44	2 20	0.036

t = 0.20; p-value=0.84

6. Discussion and Conclusion

The results of this study show that positive mood had an influence on intention to use a computerized decision aid and that the effects of positive mood did not depend on whether the positive mood was induced by the experimenter (Hypothesis 1) or naturally occurring (Hypothesis 2). Contrary to what was expected by the AIM, the result did not show more favorable acceptance under higher levels of uncertainty, both when positive mood was induced by the experimenter (Hypothesis 3a) and when it was naturally occurring (Hypothesis 4a). Consistent with what was expected by the positive mood theory, the positive mood effects did not differ across uncertainty levels, that is, the effects were also not less favorable, both when positive mood was induced by the experimenter (Hypothesis 3b) and when it was naturally occurring (Hypothesis 4b).

We first examine these findings in light of the two models of positive mood: the positive mood theory and the AIM. Both the positive mood theory and the AIM argue that affective and content information are stored on linked nodes. Our results are consistent with this view supported by both theories. AIM proposes that people in positive mood rely on the information stored in their internal cognitive structure to respond to a situation, while the positive mood theory argues that individuals in positive mood use both internal and external data. Viewed through the AIM theoretical lens, individuals in positive mood in this study evaluated their computerized decision aid more favorably because they created their response by accessing their internal positive cognitive structure without paying much attention to the external data. Viewed through the positive mood theory's lens, subjects in positive mood made their evaluations based on the information in their internal cognitive structures (internal data) as well as the information they gathered through their interactions with the computerized decision aid (external data).

To assess further which theoretical lens best explains our results, we compared the positive mood treatment with the control group using two post hoc analyses. The post hoc analysis of the time used to complete the task showed that subjects in the positive mood treatment did not differ from the control group in time to complete the task. While no difference in completion time between the mood treatments indicates that people in the positive mood group spent as much time as their control counterparts did, it does not reveal whether they differ from the control counterparts in their effective use of the decision aid to learn the task. Hence we conducted a second post hoc analysis. This second post hoc analysis showed that there was no significant difference between the G value for the mood treatment and the G value for the control group, where G captures the knowledge of the requirements of the task and the ability to apply that knowledge to predicting the criteria[2].

These results together suggest that subjects in the positive mood treatment made use of the external data at least as much as their control group counterpart – a result more

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[2] As Cooksey recommends, G is measured as the correlation between the values predicted by the optimal model of the ecology (production values produced by Equation 1 using the b values that were calibrated with real data from Pittsburgh Plate Glass) and the judgment values predicted by the subject's policy equation (production values produced by Equation 1 using the b values that were determined by regressing subjects' decision values- the values they entered into the decision aid- against the provided cues).

aligned with the argument of the positive mood theory than with the AIM. The lack of support for the hypotheses of stronger effects for higher uncertainty levels, which were developed from the AIM, also indicates better alignment of our results with positive mood theory.

Thus, we conclude that our findings are consistent with positive mood theory, but do not support the use of AIM for studying the effect of positive mood on IT acceptance. For IT researchers, these clear results allow us to focus on a single mood theory, the positive mood theory, which should increase the likelihood of successful future IT research examining the effect of positive mood in IT related models. For psychologists doing mood research, the implications are different. Our results show that the AIM prediction regarding the effects of mood under increased levels of uncertainty does not extend to technology acceptance. Thus, this study extends existing mood research by providing a context in which the AIM prediction regarding the mood-congruent effects of positive mood under increased uncertainty does not apply. For AIM researchers, further research should investigate why this AIM prediction does not hold in the IT context.

Using positive mood theory, the interpretation of our results is that people in positive mood are cognitively better able to scale the initial hurdles involved in technology adoption. Our findings and this theoretical interpretation of them have significant theoretical and practical implications.

From the perspective of MIS technology acceptance research, the results of this study provide support for establishing positive mood as a variable that influences technology acceptance. Because positive mood can influence user's intention to use a computerized decision aid, MIS researchers doing acceptance studies should, at a minimum, measure and thereby statistically control for the mood of subjects. This is especially important because our results show that positive mood leads to the same pattern of behavior, regardless of whether it is induced or naturally occurring. Thus, positive mood effects are present whether or not they are induced as part of the research. Statistically controlling for subjects' mood could reduce the error variance and thus generate more precise results in acceptance studies. In addition, our results suggest that new theoretical models of acceptance are needed that combine positive mood theory with the theories such as the theory of reasoned action that were used to develop existing MIS models of technology acceptance.

Although we did not observe intensified mood effects under higher levels of uncertainty, the favorable effects of positive mood on acceptance persisted under more uncertainty. The acceptance level of people in the positive mood treatment was significantly higher than those in the control group regardless of uncertainty levels, that is, positive mood had a significant main effect on intention to use regardless of uncertainty levels. These experimental results suggest that a significant increase in uncertainty does not diminish the enhancing effects of positive mood on acceptance. Since today's business environment is characterized by uncertainty [15], this result suggests that organizations may benefit from the presence of positive mood when introducing a new IT. Although these initial results are good news for designing and using computerized decision aids in today's organizations, future research is needed to investigate whether further increases in uncertainty can weaken these mood effects.

This study also has implications for the measurement of mood. One method for examining the effect of positive mood on behavior is to compare subjects' behavior in different mood treatments, e.g., our positive mood treatment and control groups. Such a method, although valuable in determining differences, uses only a dichotomous indicator of the mood treatment; it does not fully take advantage of the richness in the variation of mood within each group that is available from a continuous measure of mood, e.g., CMood. In addition to examining the effect of mood by comparing behavior under different mood treatments, we examined the relationship between individual mood scores (CMood) and their corresponding intention scores (BIU) for people whose mood was not manipulated in this experiment. This method not only revealed that naturally occurring positive moods had enhancing effects on acceptance, but also provided a more refined way of analyzing the effect of positive mood on behavior. For example, the results of the estimated model in Equations 3 (which employ the continuous mood variable, CMood) not only show that positive mood had a significant effect on intention to use the computerized decision aid, but also that the more positive the mood of the subjects (the higher the values for CMood), the more likely they were to use the computerized decision aid (the higher the values for intention scores). The additional information revealed by this method of analysis can potentially help to advance our understating of mood and its effects on behavior. Furthermore, this method of measurement can more easily be added to MIS research studies, especially when focusing on naturally occurring positive mood, as compared to requiring separate treatment conditions. It provides a mood measure that can more easily be incorporated into regression or structural equation modeling with other variables. Moreover, the use of the CMood variable provides a new way of examining the effect of naturally occurring mood on intention to use a system and thus testing possible discrepancies between the effect of induced and naturally occurring positive mood. Finally, our analysis of effect size showed a moderate effect (f^2=0.25) on BIU for the CMood variable (mood as continuous variable) in the regression model estimated by Equation 3 while it showed only a small effect on BIU (d=0.40)[3] for the t-test comparing mood treatments (mood as a dichotomous variable). The larger effect size found for the CMood mood variable (compared to the effect sizes found for the dichotomous variable representing the mood treatment) provides further support for using a more refined measure of mood in future studies.

This study has practical implications as well. The results show a significant improvement in intention to use, a key factor in technology usage, from positive mood. This study provides managers with additional information for increasing acceptance of a new system in their organizations by paying attention to the feeling states of their employees. One may argue that it is not practical to manage individuals' mood in an organization. Organizations, however, can manage their employees' mood in several ways such as providing a pleasant work environment or fostering a positive organizational climate [34,53]. Since positive mood is common (individuals' baseline mood tends to be positive), organizations may merely need to sustain the natural positive mood of their employees, rather than attempting to induce positive mood.

The results also have implications for the design of computerized decision aids. Because sustaining the naturally occurring positive mood may lead to the same enhanced behavior as from inducing positive mood, paying attention to the effect of the system's

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[3] Effect size refers to the degree to which the phenomenon is present in the population. Effect size calculations depend on the statistical tests, e.g., they differ for regression (measured as f^2) and t-tests (measured as d). As a result the breakpoints between small and medium effects differ between regression and t-tests. For example, Cohen considers the effect size of a regression as medium if it is between 0.1 and 0.33. For a t-test, however, Cohen considers an effect size to be medium if its value is between 0.5 and 0.8. Although the values for medium and small effect sizes are different for different tests, the concept of small vs. medium serves as a suitable measure to compare effect sizes across tests.

interface on users' feeling state in terms of diminishing or sustaining a positive mood could potentially lead to building systems that are accepted more easily. Investigating how interface designs affect users' feeling states may provide another avenue for future research.

The generalizability of the current study is limited by the laboratory setting and the task used. The threat to external validity was reduced by designing the experimental setting to capture relevant aspects of real decision tasks and by using a task calibrated with real world data. As with all laboratory experiments, however, care must be taken when generalizing the results. For example, because our laboratory experiment involved one decision aid designed to support an individual user performing a single function, generalizing the results to IT acceptance in a broader sense requires more experiments examining the effects of positive mood on the acceptance of different types of IT. In particular, future research is needed to examine the effects of positive mood on the acceptance of large multi-functional systems, such as enterprise systems.

Although mood theories have been instrumental in advancing our understanding of cognition and behavior, they are rare in the MIS literature. Using two influential and current mood theories, this study provides a rationale and direction for future studies to extend the mood literature and the MIS acceptance literature, as described above. In this study, the effect of negative mood on acceptance was not investigated. Since the literature suggests that the effects of positive and negative mood are not necessarily asymmetrical, this study could be extended to examine the effects of negative mood on acceptance. To do this, the theoretical arguments must be re-developed since they are not necessarily the same.

The objective of this study was to uncover whether positive mood influences acceptance. Hence, in this study we examined the role of positive mood as a possible antecedent of behavioral intention. While our results provide support for including positive mood in the set of antecedents of acceptance, more studies are needed to examine the relationship (e.g., moderating, mediating, or none) between positive mood and other affective states and dispositions such as emotions and attitudes, as well as their combined effect on acceptance.

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