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DOES AFFECT INFLUENCE JUDGMENT WHEN USING A DECISION SUPPORT SYSTEM?

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Abstract

Many of the current models of decision making in the Decision Support Systems (DSS) literature assume rational actors that make judgments in an emotional vacuum. The empirical investigations of the past three decades in psychology, however, have shown that every day feeling states can influence the thoughts that come to mind and thereby influence a judgment or decision that relies on those thoughts. Although such empirical investigations in psychology have explored the effects of mood in the areas of social behavior and cognition, little work has been done to examine these effects on managerial judgments that use a DSS. In this study, the existing theories of the influence of mood on memory and information processing were employed to expand current theories that investigate the role of DSS on decision making behavior. To do so, the effects of positive and neutral mood on effort and accuracy measures of a judgment that was made using a DSS were compared. The results show that the decision makers who were in a positive mood exhibited a greater degree of effort (used a greater number of informational cues that was provided by the DSS) and made more accurate judgments.

Keywords: Decision support systems, DSS, mood, decision making, judgments, accuracy, effort, information utilization

Motivation

The DSS studies that investigate the relationship between DSS usage and decision behavior have primarily focused on the measures of accuracy and effort in making decisions (e.g. Todd and Benbasat 1992; Benbasat and Todd 1996). These studies suggest that decision makers tend to pay more attention to effort reduction than to accuracy maximization when using a DSS. The assumption here is that the decision maker is a rational actor who determines the necessary amount of effort to reach a reasonably accurate decision by using a cognitive cost benefit analysis. In other words, these models assume a rational actor who makes judgments in an emotional vacuum. The psychological investigations of the past three decades, however, suggest that mundane everyday feeling states may play a great role in how decisions are made. This is because empirical investigations have shown that decisions and judgments may be influenced by thoughts that come to mind first or most easily (Tversky and Kahneman 1973) and what comes to mind first or most easily in turn have been shown to be influenced by how one feels (for a detailed review see Isen 1984). Consequently, investigating the role of mood in managerial judgments using a DSS is significant since as Venkatesh and Speier (1999) aptly put it, people are always in a "sort of mood." In other words, because one is always in a feeling state at any given moment, and because these feeling states can influence one's thought processes, it is reasonable to believe that how one feels at the time a judgment is being made may influence how one utilizes a DSS. The psychological investigations that examines the impact of mood on judgment and decision making can roughly be categorized into two main groups: the first group investigates the impact of feelings states on decisions that do not involve risk (Clark and Isen 1982, Isen 1984, Isen 1993) and the second group investigates the impact of feeling states on decisions that do involve risk (Mellers 2000, Lowenstein et al. 2001). The line of research that considers decisions without the involvement of risk generally concentrates on the effects of immediate feeling states only (Clark and Isen 1982, Isen 1984, Isen 1993). The line of research that investigates decision making under risk, on the other hand, usually focuses on the effects of anticipated feeling states on decisions (see the literature review in Lowenstein et al. 2001). This paper falls under the first category mentioned above. That is, this paper examines the impact of positive mood (immediate feeling state) on a judgment that does

not involve risk. Further, it investigates the impact of positive mood on a managerial judgment that is made using a DSS.

In the following pages of this article, first the literature on judgment and mood is reviewed. Then, some relevant hypotheses are formed. Finally, an experiment is conducted to investigate how the quantity of the used information provided by a DSS and the quality of judgments made using a DSS are influenced by one's mood.

Background

Judgment can be defined as a cognitive process in which a person draws a conclusion (a judgment) about something that he or she cannot see (a criterion) on the basis of a set of data (cues and or feedback) that he or she can see (Hammond 1975, Brehmer 1988). In other words, when making a judgment, one has to use the information provided by the cues to estimate the functional relationship between the cues and the criterion and combine the provided information into one single judgment. Obviously, one way to improve judgmental performance is to use all the available relevant information provided. Many decision making studies, however, suggest that human judges tend to use only a small subset of the cues or information available to them (e.g. Slovic et al. 1971, Brehmer and Brehmer 1987 cited in Brehmer and Brehmer 1988, p. 97). This seems to be the pattern even when decision makers are provided with computerized decision aids (Todd and Benbasat 1992, Benbasat and Todd 1996). Recent investigations of the impact of positive mood on cognition, however, give us reason to believe that positive mood may enhance judgmental performance and accuracy. For example, studies have shown that positive mood tend to promote a rich cognitive context (Isen et al. 1978, Isen and Daubman 1984), which in turn tends to facilitate efficient decision-making (Isen and Means 1983) and creative problem solving (Isen et al. 1987). Before discussing this literature, however, it is important to give a brief definition of the term mood and explain why this article concentrates on the effects of positive mood only.

Mood: A Brief Definition

Mood and emotion, although both affective states, differ on the dimensions of "pervasiveness", "intensity", and "specificity" (Forgas 1991, Moore and Isen 1990). 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 enduring, less intense, and more diffused affective states, which are not directed toward any particular object or behavior (Moore and Ise 1990, Lazarus 1991, p. 48, Forgas 1991). Furthermore Clark and Isen (1982), Osgood and Suci (1955), and Schwartz and Clore (1988) argue that specific mood states (e.g. sadness, fear, etc.) can be grouped into more general or global categories such as positive, neutral, and negative mood. The literature suggests that positive mood exhibits more consistent effects than negative mood (Moore and Isen 1990). For this reason, this article concentrates on the effects of positive mood only and demonstrates its effects on decision making by contrasting it with those of neutral mood.

Mood Literature Review

Recent psychological research suggests that feeling states and memory are intimately linked (Forgas 2000, p. 11, Isen 2000, Isen 1993, Isen et al. 1992). For example, a number of theories have argued that cognition and feeling states both are parts of one single integrated cognitive representational system (Bower 1981, Clark and Isen 1982). According to these models, each event, concept, and feeling state is represented by a node in a large network of material in memory and is connected through associative relations to other nodes. Through learning, this collection of nodes becomes more complex and increasingly interconnected. Isen (1984), using a similar conceptualization, extends the above mentioned model by proposing a highly flexible organization for the network of material in memory, which may not have a permanent structure and may indeed change its organization depending on the retrieval cues such as a feeling state present at the time of recall. In the following paragraphs, some of the studies that are consistent with the above conceptualization (Isen 1984) and investigate the influence of mood on cognitive structure, organization, and information processing are briefly discussed. While a large number of empirical investigations suggest that positive mood can act as a fast and effective retrieval cue for the recall of positive memories (for a detailed listing of this literature see Isen 1985), numerous studies suggest that negative mood does not increase the recall of negative memories (Isen 1970, Mischel et al. 1976 cited in Moore and Isen 1990, p.13). Isen (1984, 1985, 1993, 2000) explains this asymmetry by suggesting that the network of positive material may be more interconnected than the network of negative material in one's cognitive system. Furthermore, literature reports that mood can influence one's cognitive organization and flexibility. That is, mood can influence the way cognitive elements in memory are grouped together (Murray et al. 1990, Isen 1993, Isen 2000). For example, it has been

shown that compared to their control counterparts, people in positive mood are able to perceive a greater number of similarities among stimuli when they are asked to find similarities (Isen and Daubman 1984) and can find a greater number of differences when they are asked to do so (Murray et al. 1990).

Positive mood can also influence one's information processing style (Forgas 2000, Isen 2000). For example, it has been shown that people in positive mood tend to make their selections without considering the same piece of information more than once (Isen and Means 1983) and tend to be thorough and efficient decision makers who exhibit significantly less confusion, greater integration of information, and better understanding of the issues at hand (Isen et al. 1991, Isen 2000). Isen (1993, 2000) argues that in the case of positive mood, efficiency or simplification seems to be facilitated through elaboration and thoroughness. That is, the rich cognitive context of people in positive mood enables them to discern more dimensions of a task, which in turn helps them to recognize more possibilities for combination and integration. According to Mednick (1962), creativity can be defined as the formation of unusual but useful associations. Isen et al. (1985) have shown that positive mood tends to facilitate perception of new and unusual but useful associations and promote creative problem solving (Isen et al. 1987).

Finally, Kahn and Isen (1993) have shown that people in positive mood tend to seek variety and enjoy exploring their options. They (Kahn and Isen 1993) argue that the explorative behavior of people in positive mood maybe due to their rich and elaborately connected cognitive context that gives them greater access to a diverse set of pleasant material, which in turn improves their expectation about neutral-to-positive stimuli. In short, the literature reports that people in positive mood tend to have a rich and flexibly organized cognitive context (Isen 1985, Isen 1993, Isen 2000, Murray et al. 1990), which enables them to be creative and efficient problem solvers (Isen et al. 1987, Isen et al. 1991, Isen 2000) who enjoy exploring their options and seek variety (Kahn and Isen 1993).

Hypothesis

Effort and accuracy are two measures of a decision that have been the focus of many studies in the DSS literature (e.g. Todd and Benbasat 1992, Bettman et al. 1990, Shugan 1980). Consistent with prior research, this study also examines effort and accuracy measures of a decision to investigate the role of mood in judgmental performance when using a DSS. Todd and Benbasat (1992) define decision accuracy as the deviation of a particular solution from the solution that would be provided by a normative strategy. Similarly, this study measures accuracy of a judgment through examining its deviation from the optimal judgment. To measure effort, Consistent with prior research (Todd and Benbasat 1992, Shugan 1980), the amount of information that was used to make a judgment is tracked.

Hypothesis One

Using the mood literature, one can argue that there are at least three good reasons for why the subjects with positive mood in this study would exhibit a greater degree of effort (i.e. base their decision upon a greater number of cues that is provided by the DSS) than their control counterparts. First, studies have shown that positive mood tends to promote variety seeking and exploration (Kahn and Isen 1993). Thus, it is reasonable to believe that the subjects in positive mood will be more inclined to examine a greater number of cues. Second, studies have shown that positive mood tends to promote efficiency. That is, people with positive mood tend to be able to process more information (Isen and Means 1983). Because of their enhanced information processing capability, it is reasonable to expect that subjects in positive mood to gather more information (i.e. cues) to base their judgments upon. Finally, studies have shown that positive mood tends to facilitate elaboration (Isen et al. 1991). Thus, it is reasonable to expect the subjects in positive mood to be more thorough and use a greater number of cues when making a judgment. Therefore, it is expected that the null hypothesis will be rejected in favor of this alternative:

H1) Subjects in a positive mood will exhibit a greater degree of effort than their control counterparts. That is, they use a greater number of cues that is provided by the DSS to base their decision upon than their neutral mood control counterparts.

Hypothesis Two

As mentioned before, studies have shown that people in positive mood tend to have a rich cognitive context (Isen 1985), tend to be able to discern more relationships among stimuli (Isen et al. 1984, Murray et al. 1990), tend to be creative problem solvers (Isen et al. 1987) who are able to recognize unusual but useful associations among stimuli (Isen et al. 1985), and finally, tend to be less overwhelmed by the task and show less confusion and greater understanding and integration of the issues during the decision making process (Isen et al. 1991, Isen 2000). Such

enhanced cognitive capability is of great importance when it comes to making good judgments where the decision maker must use the available information, learn the functional relationship between each provided cue and the criterion, and integrate the provided information into one single judgment. Therefore, it is reasonable to believe that people in positive mood will be able to combine the provided information into more accurate judgments. Thus, it is expected that the null hypothesis will be rejected in favor of this alternative:

H2) Subjects in a positive mood will make more accurate judgments. That is, the mean absolute error of the judgments for the subjects in the positive mood group will be significantly lower than those of the control group.

Method

Participants

The participants were 49 male and female undergraduate business students from two sections of a third year statistics course of a major land grant university.

Design

First, participants were randomly assigned to two groups. The treatments (experimental and control) were then randomly assigned to these groups. The subjects in the experimental group were induced with positive mood. The subjects' mood in the control group was not manipulated.

Task

The task used in this experiment is an important manufacturing problem. The task was to use the DSS that provided five statistically independent informational cues and an outcome feedback to estimate the production volume for a manufacturing company. The scheduling decision used in this study is based on the Holt et al. (1960) model of the production-scheduling problem. The problem in this model is to decide how many units to produce given uncertain future demand and the knowledge of current work force size, productivity, and inventory level. The DSS used in this experiment displayed the informational cues as numbers, an outcome feedback after each judgment, and a short history of previous judgments that included the informational cues, the subject's judgment, and the optimal answer. The judgments were entered to the system using a scrollbar that was used to adjust a displayed judgment value. All information was displayed in labeled boxes and the command buttons were clearly marked to help the subjects to navigate through the judgments.

Mood Manipulation

Consistent with prior research (Isen et al. 1978, Isen et al. 1987, Isen et al. 1992) subjects in the experimental group (positive mood) received a surprise gift of chocolate and candy wrapped in colorful paper prior to performing the task.

Mood Measurement

Consistent with prior research (Isen and Gorgolione 1983, Kraiger et al. 1989, Elsbach and Barr 1999) a self-report survey to measure the feeling state of the subjects was used.

Procedure

On the day of the experiment, the participants gathered in their classroom and were given a short tutorial of the task and how to use the DSS. After the tutorial, the subjects in the experimental group received a surprise gift of candy whereas the subjects in the control group did not receive a gift. The subjects were then asked to go to their designated randomly assigned computers in the computer lab. To ensure consistency, instructions were read from a previously prepared script and were given by the same person to both the experimental and control groups. In the computer lab, the subjects activated the software package that included the practice trials, the mood survey, and the DSS. The software was designed in a way that participants had to complete the mood manipulation survey followed by practice trials before they could start the actual task embedded in the DSS portion of the software. After finishing the task, the subjects were debriefed and asked to leave the room. The entire procedure did not exceed one hour.

Results

Mood Manipulation Check

We found that the mean of the mood scores in our positive mood group (mean = 11.24) was significantly higher ($t=1.959$, $df=47$, $p=0.028$) than the mean of the mood scores in our control group (mean = 10.00). In other words, we found that positive mood was successfully induced.

Hypothesis Testing

The task in this study consisted of 30 trials (30 judgments). All the results discussed below are based on the actual trials (trials 11-30). The learning period data (trials 1-10) was not included. Regression analysis was used to capture the subject's judgmental policy.

Hypothesis One

Hypothesis one proposes that the subjects in the positive mood group will use a greater number of cues provided by the DSS. Consistent with prior research (Tuttle and Burton 1999, Chewing and Harrell 1990) cue utilization was obtained by counting the number of statistically significant ($\alpha=0.05$) beta weights in the subject's captured policy. The results show that the number of subjects in the positive mood group who used two or more cues (21 out of 25 subjects) was significantly higher ($z=-2.265$, $p=0.012$) than the number of subjects who used the same number of cues in the control group (13 out of 24 subjects). Similarly, the results show that significantly ($z=-1.729$, $p=0.042$) more subjects in the positive mood group (11 out of 25 subjects) used three or more cues than their control counterparts (5 out of 24 subjects). In other words, as predicted, the subjects in the positive mood group used a greater number of cues.

Hypothesis Two

Hypothesis two proposes that the subjects in the positive mood group will make more accurate judgments. The t-test revealed that the mean of the absolute error in the positive mood group ($MAE=112.23$) was significantly lower ($t=2.246$, $df=40$, $p=0.015$) than the mean of the absolute error in the neutral mood group ($MAE=127.16$). In other words, the results show that people in positive mood delivered significantly more accurate decisions than their control counterparts.

Discussion

This study examined the influence of positive mood on the effort and accuracy measures of a judgment that is made using a DSS. The results showed that people in positive mood exhibited a greater level of effort as well as a greater degree of accuracy when making judgments using a DSS. That is, the results show that significantly more subjects in the positive mood group utilized a greater number of informational cues provided by the DSS and significantly more subjects in the positive mood group made more accurate judgments using a DSS. These results are consistent with the theories discussed in the mood literature review section of this paper.

The results of this study have important theoretical implications for theories that investigate the relationship between decision making and DSS usage. First, the results show a significant improvement in the measures of effort and accuracy, which are the primary focus of DSS usage in the literature. Second, these results help to establish mood as a mediating variable in existing decision making theories. Janis and Mann (1977, p. 46) suggest that people are "programmed" with emotions and are not able to make decisions in an emotional vacuum or, as they put it, in a state of "detached affectlessness." Since this study clearly shows that mood matters when it comes to making a judgment using a DSS, it becomes crucial to include the feeling states of the actors in the theories that investigate the relationship between decision making and DSS usage.

The results have also important implications for the design of a DSS. Isen (1984) argues that positive affect is very common: "compare the number of times that you laughed today, with the number of times you cried" (Isen 1984, p. 187). Thus, paying attention to how the system's interface may interact with users' feeling state (e.g. whether it diminishes or sustains a positive mood) can potentially lead to building more effective systems.

This study has important practical implications as well. As discussed previously, this study shows that decision makers, under the influence of positive mood, can use a DSS more effectively and deliver significantly better judgments. Thus, organizations can benefit from such improved performance by paying attention to the feeling states of their decision makers. One may argue, however, that it is not practical to manage individuals' moods in an organization. After all, moods are malleable and can easily be affected. An individual's mood can even be affected by events outside the control of an organization (e.g. stress at home, traffic, etc.). However, Isen and Daubman

(1984) have shown in an experimental setting that simple accommodations, such as providing comfortable chairs and refreshments, can successfully induce positive mood. Thus, it is reasonable to believe that through a positive organizational climate, it is possible to create an environment where employees tend to find themselves in a positive mood, which in turn enables them to use their DSS more effectively and deliver more accurate decisions.

It is important to note that the generalizability of the current study is limited by the laboratory setting and the task used. Nevertheless, this study attempted to reduce the threat to external validity by designing the experimental setting to capture relevant aspects of real decision tasks and calibrated the task by real world data. However, as in all laboratory experiments, care must be taken when generalizing the results. With the caution of these limitations in mind, this study can be extended to examine the effects of negative mood on decision behaviors using a DSS. Given the importance and complexity of managerial decision making combined with the fact that people are always in a "sort of mood", it is crucial to investigate whether negative mood can influence such processes. One may naturally assume that since positive mood tends to lead to more enhanced judgmental performance, negative mood would lead to opposite results. However, this assumption may not necessarily be true since the literature reveals that the effects of positive mood are not always the opposite of those of negative mood (Moore and Isen 1990). Thus, further research is needed to closely examine the impact of negative mood on managerial judgments that use a DSS.

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