

Research report

Could mood state affect risk-taking decisions?

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Abstract

Background: Depressed patients are advised by clinicians to avoid making critical life decisions because their decision-making process might be influenced by their pathological mood states. In order to provide empirical support for this practice, we examined the influence of different mood states on risk-taking tendencies that govern one's decision during critical life decisions. *Method:* By means of viewing a happy, neutral or sad movie clip, participants were induced to a respective mood. Risk-taking tendencies were then measured with decision tasks modified from the Choice Dilemmas Questionnaire (Kogan N., Wallach, M.A., 1964. *Risk Taking: A Study in Cognition and Personality*, Holt, New York). *Results:* The findings ($SS = 54$) indicated varying risk-taking tendencies in different mood states: individuals in induced depress mood were significantly more conservative in taking risk than those who were in neutral mood, whilst people in induced elated mood did not differ significantly from those in neutral mood. Correlation between mood-ratings with risk-taking tendency was positive ($r = 0.319$, $P < 0.05$). *Conclusions:* People in induced depress mood would have a lower willingness to take risk than people in neutral and in positive mood. The manner in which decisions were influenced by negative mood was discussed. The asymmetry of influence of different mood states on risk-taking decisions was also discussed.

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1. Introduction

It is a common practice for clinicians to advise their clients not to make critical life decisions, like changing career or planning a marriage, during

episodes of clinical depression. There are several rationales for such practice, and one of which is that judgements and decisions made by patients during their depress episodes might become rigid and biased, thus affecting the quality of the decision. Self-doubt and self-blaming are common if such judgements bring out unsatisfied outcomes, and might affect the prognosis of the patient's clinical depression. Although the practice is common, little

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research has been done to verify the validity of this practice (see Kochansky, 1973; Nezu and Ronan, 1987). By examining the patterns of decision-making process among people in different mood states, we could obtain a better support for the stated common practice.

Among different factors guiding one's decision-making processes the willingness to take risk might be the most crucial one influencing one's overt behavior, as most judgements require us to deal with risky situations or dilemmas. Risk-taking decisions could be considered as the product of complex interactions of several cognitive factors, including availability of cognitive resources, memory processing, and the choice of decision strategies. Recent research has suggested that mood exerts its influence on all these factors (see Edell and Burke, 1987; Forgas, 1994, 1995; Natale and Hantas, 1982; Nygren et al., 1996; Petty et al., 1993; Pyszczynski et al., 1989; Teasdale, 1993).

Research findings of Drevets and Raichle (1998) provided strong evidence showing the effect of mood on neural activities. In their study, activation of different brain areas during experimental tasks was investigated by assessing the regional cerebral blood flow (rCBF) using PET. Their findings indicated that activities of several cortical areas for cognitive functioning (e.g. anterior cingulate and the dorsolateral prefrontal cortices) decrease during experimentally induced or pathological affective states. This suggests that change in brain activity accompanying intense emotional states may affect the quality of decision making. The effect of mood on memory processes is a bit more complex, as both the encoding and retrieval process could be influenced (Matthews et al., 1995; Natale and Hantas, 1982; Pyszczynski et al., 1989; Teasdale, 1993). In related to risk-taking decisions, researchers suggested that the affective states of an individual would activate information with similar affective meaning in one's memory, e.g. words describing emotional states or similar social conditions, for the retrieval. This mechanism allows the individual to retrieve relevant information from memory in a short time for decision making; but it would also biased the memory retrieval and distorted the cognitive processes during judgments (Schwarz and Bless, 1991). Research also addressed the influence of mood on our choice of

decision making strategies (e.g. Edell and Burke, 1987; Forgas, 1989, 1991, 1994, 1995; Forgas and Moylan, 1987; Isen, 1997; Jorgensen, 1998; Petty et al., 1993). The Elaboration Likelihood Model (ELM) by Petty and Cacioppo (1986) suggests that there are two routes to process persuasion messages: the central route and the peripheral route. The central route of persuasion represents the deep and elaborative processing of a persuasion message, whilst the peripheral route represents cue-dependent or heuristic processing. The present mood of an individual affect the choice of processing route; individual in a positive mood would choose a peripheral route while one in a negative mood would adopt a central route of processing (Tellis, 1998).

The above-stated factors interact during decision-making and in turn play an important role in risk assessment. The intensity of mood correlated with a change in neural activities, which may impact on the choice of processing strategies adopted in decision-making. One mediating factor linking the influence of mood on risk-taking tendency is the perception and preference of risk in a decision outcome. When the individual is in a positive mood, more favorable assumptions and expectations on the environment and related people would be generated and the case is opposite in negative mood. The evaluation process of these expectations and assumptions might be biased by mood and mood-relevant interpretations would be formed.

On the basis of previous research, positive mood was expected to increase the risk-taking tendency (Isen, 1997; Isen et al., 1982; Nygren et al., 1996). According to the Affect Infusion Model (AIM), heuristic processing would be adopted by participants in positive mood (Forgas, 1995). They would rely on cues to make judgements. With the mood priming effect, they would be more vulnerable to access thoughts about the positive aspects of the risky situations than does those in neutral mood (e.g. Forgas, 1982, 1989, 1994; Isen, 1997; Nygren et al., 1996). With the bias in information and in the way of evaluating the situation, people would perceive the outcome of risky choices as more favorable and more possible, in turn they would be more willing to take risk. On the other hand, people in negative mood would be more conservative and less willing to take risk. People in a negative mood are more likely

to perceive the world as a threatening place and thus would be more likely to carefully process information in order to avoid potential loss (Jorgensen, 1998). Together with the mood priming and the use of substantive processing, more negative evaluation on the risky choice would be generated and people would be more likely to have a conservative choice on the situation.

Recent research gave very good support to the expectation that positive mood would increase one's risk-taking tendency (e.g. Isen, 1997; Isen et al., 1982; Mittal and Ross, 1998; Nygren et al., 1996), yet there are relatively few research in the literature addressing the influence of negative mood on risk-taking tendency, and some of the findings contradicted the expectation stated above (see Hockey et al., 2000; Leith and Baumeister, 1996; Mano, 1992; Pietromonaco and Rook, 1987). It is arguable whether there really exists a contradiction of findings in the literature, as research that showed an increase in risk-taking tendency with negative mood usually adopt a different operationalization of either negative mood or risk-taking tendency (see Hockey et al., 2000). However we should not deny the possibility that negative mood might influence risk-taking tendency via other mechanisms because researchers suggested that it is quite plausible that positive and negative mood are mediated by independent neural pathways (Ashby et al., 1999). The current study attempts to compare the influence of induced elate and depressed mood and to examine the influence of negative mood state so that we might establish a basis for clinician's practice to advice patients to be careful with their decisions during their depressed episodes. Healthy subjects were recruited to participate in the current research to provide a basis for comparison between the influence of both positive and negative mood states. Previous studies suggested that experimentally induced mood states could be used as a model in explaining the cognitive processes in depression (for example, see Bouhuys et al., 1995; Kwiakowski and Parkinson, 1994; Lecci and Wirth, 2000). Furthermore, employing healthy participants in our research provide us with strong internal validity via the use of mood induction paradigm as proposed by Hockey et al. (2000); better control of mood states could be achieved and the influence of mood states could be better observed. According to

the previous review on the influence of positive and negative mood states on different cognitive processes, the current study hypothesized that risk-taking tendency would be the highest in participants who are in positive mood, moderate in neutral mood and the lowest in negative mood.

2. Method

2.1. Participants

All participants for the study were healthy Chinese undergraduate students at the University of Hong Kong. Totally there were 54 participants (18 male and 36 female) in the study. The age of participants ranged from 18 to 20 years old. Prior studies on risk-taking tendencies suggested that age, gender, personality construct and time pressure have significant impacts on the risk-taking tendency of an individual (see Byrnes et al., 1999; Kohler, 1996; Moore et al., 1997; Salminen, 1995; Trimpop, 1994; Trimpop et al., 1997). In order to control for the personal factors affecting risk-taking tendency (age group difference, gender difference and personality difference), participants were in the same age group; and balanced ratio of male and female participants were randomly assigned to one of the three groups to control for individual difference in risk-taking personality as well as the gender difference in risk-taking tendency.

2.2. Instruments

2.2.1. Mood induction

Data showed that unexpected gifts, music, self-recall of affective states, bogus feedback of participants' performance, hypnosis, story completion tasks and movie clips were successful in manipulating participants' mood (Forgas, 1989, 1994; Natale and Hantas, 1982; Niedental et al., 1997; Nygren et al., 1996; Mittal and Ross, 1998; Siemer and Reisenzein, 1998). In this study, movie clips were used because they provided a direct and effective way to induce a certain mood (Forgas and Moylan, 1987). With the help of ten independent judges, three movie clips categorized as 'happy', 'neutral' and 'sad' were selected for mood induction. The three clips were of

similar length, ranges from 22 to 26 min. The clips were validated by the judges to ensure that such length would not increase participants' tedium level, which may influence participants' mood. The content of the movie clips was examined by the judges to make sure that situations portraying in the clips would not resemble any of the cases presented in the decision tasks. This is to ensure that the movie clips would have minimal effect on the judgements made during the decision tasks.

The mood induction procedure of the experiment was checked by repeated measures of a self-reported mood questionnaire administered before and after the three decision tasks. The self-reported mood questionnaire measures three dimensions of an individual's mood suggested by Matthews et al. (1995): unpleasant–pleasant, tense–relax, tiresome–energetic. One more dimension, the anxious–calm dimension, was added. According to the Diagnostic and Statistical Manual of Mental Disorders (4th Edition, DSM-IV) published by the American Psychiatric Association (1994), depressed patients in general were characterized by persistent feelings of sadness, increased irritability, and lack of energy. In light of these characteristics, the unpleasant–pleasant dimension could be a measurement for the feeling of sadness, the tiresome–energetic dimension could be a measurement for lack of energy, and both the tense–relax and the anxious–calm dimensions could be a measurement for irritability. The use of these four dimensions could give us information on whether the mood induction procedure could mimic these conditions of depressed patients, that is, to induce a depressed mood. In the questionnaire each of the four dimensions was rated by an 11-point Likert scale anchored between -5 and $+5$. For a better comparison of positive and negative mood with neutral mood, a 11-point Likert scale was used to increase the sensitivity of the measurement. The overall mood rating was obtained by averaging the scores of the four dimensions.

2.2.2. *Validation of decision tasks*

Participants' risk-taking tendencies were measured by decision tasks. Each decision task consisted of a case describing a 'life dilemma' and two opposing scales measuring the willingness of participants to perform one in two acts of the dilemma. The

descriptions of the life dilemmas used were constructed according to the format of the Choice Dilemmas Questionnaire developed by Kogan and Wallach (1964). The decision tasks were based on the Choice Dilemmas Questionnaire because it includes realistic and detailed descriptions of common, everyday life dilemmas. It has been widely used in research on risk-taking and it was a well-accepted means to operationalize the concept of risk-taking tendency (Forgas, 1982).

Three cases applicable to Chinese culture were adopted from the Choice Dilemmas Questionnaire and seven more dilemmas were constructed following the format and style of the Choice Dilemmas Questionnaire for the pretest. In the course of case construction the novelty of the dilemmas were carefully adjusted to minimize the presence of decision schema inducing a direct access processing strategy.

In each case, two options were available for the situation, one predictable but less rewarding act and a highly rewarding but risky alternative. The risk-taking tendencies of the participants were then assessed by measuring the willingness to choose the risky act obtained from the mean score of two opposing scales. The first scale required participants to indicate their willingness to perform the risky act by means of probability estimation. The other scale counter-checked the first scale by asking participants to rate their willingness to choose the conservative act on an 11-point Likert scale anchored between -5 and $+5$. The 11-point scale was then rescaled and the mean of the two scales represents participants' willingness to take risk, that is, the risk-taking tendency. Cases that yielded a mean score around the middle of the scale, i.e. participants had the same chance to perform any one of the acts, were selected for the use in the experiment. Furthermore, the cases described should be free from judgements that would be confounded by cultural values and religious beliefs. The ten cases in random sequence were pretested by 20 independent judges (in neutral mood) and three cases were chosen for the experiment finally. Questionnaire sets containing the self-report mood questionnaires and the three cases were prepared, with the two self-report mood questionnaires presented at the beginning and the end. The three cases in the middle were arranged in

sequences following a 3×3 Latin square so as to eliminate order effect of different arrangements.

2.3. Procedure

The experiments were carried out in experiment cubicle on one-to-one basis. The participant was first seated and consented, followed by the presentation of standard instructions. For the sake of avoiding confirmatory bias, participants were told as a disguise that the purpose of the experiment was to examine the effect of movie on the comprehension of reading and judgement. The assigned movie clip was presented to the participant for the induction of the designated mood. Participant was left alone in the experiment cubicle and was instructed by the experimenter to view the movie clip as if they were watching it at home or in a movie theatre; the mood manipulation procedure was administered in an unobtrusive manner. The experimenter returned into the cubicle and started the decision tasks when the clip ends. Then prepared questionnaires containing the self-reported mood questionnaires and the three decision tasks were presented to the participant and they were asked to complete it page by page so that the experimenter could record their reading and decision time. During the decision tasks participants were instructed to ignore the time keeping and work in their own suitable pace; time pressure which may influence risk-taking tendency and processing strategies of the dilemmas could be eliminated by the instruction. Time for reading and completing the questionnaire was recorded and finally participants were debriefed, thanked and the experiment was completed.

3. Results

3.1. Validation of mood manipulation

The mood manipulation procedure was checked by the two-way analysis of variance (ANOVA) of the repeated measures of the self-reported mood rating. The mood manipulation procedure was effective as there was significant main effect of mood induction procedure, $F(2,51) = 13.76$, $P < 0.01$. Post-hoc comparison using Tukey's HSD revealed that self-

ported ratings in positive mood induction (mean = 0.81, S.D. = 0.88) were significantly more positive than that in neutral mood induction (mean = 0.10, S.D. = 0.61), and negative mood induction (mean = -0.70, S.D. = 1.06) significantly more negative than neutral mood induction, with all P -values < 0.05 . Furthermore, effect of the mood manipulation procedure lasted throughout the experiment; results revealed that there was no significant difference between the repeated measure of self-reported mood ratings, $F(1,51) = 0.14$, $P = 0.71$. The reliability coefficient was computed to validate the repeated measures of self-reported mood ratings, results indicate that the repeated measures of self-reported mood is reliable (Cronbach's alpha = 0.77). The above statistics showed that the mood manipulation procedure was successful in inducing participants to the designated mood.

3.2. Effect of mood on risk-taking tendency

The two scales measuring participants' willingness to take risk in the decision tasks were rescaled into a risk score that lies between zero and 100: the higher the score, the higher the risk-taking tendency it represents. The overall risk-taking tendency was obtained by averaging the risk scores of the three decision cases. With a one-way analysis of variance (ANOVA), the risk-taking tendencies of the three groups were compared. A significant difference was observed between the risk-taking tendency of the three conditions, $F(2,51) = 8.19$, $P = 0.01$, with the risk-taking tendency in positive mood induction (mean = 53.56, S.D. = 12.26) higher than that of neutral mood induction (mean = 48.61, S.D. = 9.90) and negative mood induction (mean = 37.64, S.D. = 13.77). Post-hoc comparison was performed to check for the significance of difference between the risk-taking tendencies of the conditions (see Table 1).

Table 1

Post-hoc comparison between risk-taking tendencies in different groups of mood induction

Mood induction	Mean difference	S.D.	Significance
Positive–Neutral	4.95	4.03	0.44
Neutral–Negative	10.97	4.03	0.02
Positive–Negative	15.93	4.03	0.01

The differences in risk-taking tendencies are significant between positive mood and negative mood induction ($P = 0.01$), negative and neutral mood induction ($P = 0.02$). Yet the risk-taking tendency between positive and neutral mood induction group fail to show significant difference ($P = 0.44$). To further check for the influence of mood, the risk-taking tendency was correlated with the overall mood ratings and a significant result was obtained. There is a positive correlation between risk-taking mood and risk-taking tendency ($r = 0.319$, $P = 0.019$), that is, the more positive the mood, the higher the risk-taking tendency an individual is.

4. Discussion

4.1. Overview

Findings from the current study indicated that healthy subjects' risk-taking tendencies vary under the induction of different mood states. Although the risk-taking tendencies between neutral and positive mood induction groups failed to show any significant difference, there existed significant difference between the positive and negative, and between the neutral and negative group; the trend of the risk-taking tendencies in these three groups satisfied the expectation brought out by the hypothesis partially. Moreover, the moderate but significant positive correlation between mood and risk-taking tendency indeed indicated a greater tendency to take risk in positive mood and vice versa in negative mood.

Using the mood induction paradigm could help us to gain insight into the influence of intense pathological mood on the clinical population. The lower risk-taking tendency of subjects in the induced depress mood indeed provide us insight into the overly pessimistic thinking style of depressed patients. The intense negative mood influences patients' perception of risk as well as risk-taking tendency. As the perceived environment and the perceived outcome become more risky under the influence of intense depressed mood, depressed patient becomes pessimistic and the willingness to take risk decreases. In terms of patient management, the current study indeed provide some preliminary data to support the common practice among clini-

cians: advise patients to be careful with critical life decisions during depress episodes, and even to avoid making the decision on their own if not necessary. Because depressed patients' willingness to take risk decrease with their pathological negative mood state, they may regret their decisions made and blame themselves. Such self-blaming and self-doubt would be an obstacle to their recovery.

The literature has already provided us with a good account for the influence of positive and negative mood on social judgements. The explanations could also be applied to judgements concerning risk-taking. People in positive mood would perceive the environment as a rather safe place and they would adopt a heuristic processing to make judgements (Forgas, 1982, 1989, 1994; Isen, 1997; Nygren et al., 1996). More positive material would be available in their working memory for their reference in making the judgements. In the judgement processes the mood would act as an indicator for them to judge the positivity of the outcome; they would perceive the choice as less risky and the outcome as more favorable: they are more willing to take risk (Isen, 1997; Nygren et al., 1996). Alternatively, the presence of negative mood would signify a dangerous environment; individuals would be more cautious. Together with the priming of negative materials, the substantive processing of negative materials would result in a more conservative decision.

4.2. Asymmetry of affective influence

Comparing the risk-taking tendencies between positive, neutral and negative mood, the influence of negative mood induction was found to be greater than that of positive mood induction. The manipulation check of the mood induction procedure revealed that the magnitude of induction of positive and negative mood is more or less the same with respect to the neutral mood condition. With reference to the risk-taking tendency in neutral mood, the dispute in mean differences of risk-taking tendencies between positive vs. neutral ($= 4.95$, $P > 0.05$, insignificant) and neutral vs. negative ($= 10.97$, $P > 0.05$, significant) mood induction depicted an asymmetry of influence existing between positive and negative mood. In the literature there exists some evidence indicating that the influence of mood on judgement is

asymmetrical (Forgas, 1995). Yet some researchers suggested that the influence of positive mood would be more significant; the current finding is indeed in contradiction to the literature. Though the manipulation check for the mood induction procedure showed that the positive and negative mood induction was similar in magnitude (but opposite in sign) with reference to the neutral point, the mechanism for the influence of positive mood may differ from that of negative mood. As stated in the affect infusion model, affect infusion is a multiple process; individual in positive and negative mood would adopt a different mechanism to make social judgements (Forgas, 1995). For such reasons the effect of positive and negative mood may not follow a linear relationship, but two or more independent relationships might coexist to account for the difference between positive and negative mood on risk-taking tendency. Recent literature also suggested that the influence of positive and negative mood depends on two separate or even unrelated neural systems (Ashby et al., 1999). Ashby and colleagues 1999 proposed that positive mood is mediated by the neurotransmitter dopamine, while the neural mechanism for negative mood is still under research. Findings from the current study also suggested that there might exist an asymmetry on the mechanisms which positive and negative mood influences our risk-taking decisions. Recent literature provides us with a very good account for the influence of positive mood; yet research on the impact of negative mood is relatively few. Hence new research could address the problem on such asymmetry of influence as well as the mechanism of influence of negative mood.

The current study addressed the influence of mood on only the outcome, risk-taking tendency, of cognitive processing. The question about the underlying mechanisms influencing mood (especially negative mood) remains unanswered. Although several hypotheses were proposed in the literature to account for the influence of mood on different facets of cognitive processing, a systemic way to look at the influence is lacking. The complex interactions between cognitive resources, memory encoding and retrieval, choice of processing strategies, as well as the perception and preference of risk in the environment and the decision outcome should be clarified;

the influence on mood on each aspect of cognitive function, plus the overall impact of mood in their interactions also worth our further investigation.

5. Conclusions

The current study tried to address the effects of positive and negative mood on risk-taking decisions. With our hypothesis partially fulfilled, people in induced depress mood were more conservative in making risky choices than those who were in neutral mood whilst the risk-taking tendency of people in induced elated mood did not differ significantly than people in neutral mood. An asymmetrical effect between positive mood and negative mood was observed, signifying a possibility for the existence of different mechanisms in which positive mood and negative mood influence risk-taking judgements. This observation is in contrast to some previous data, indicating a need for further research on the asymmetry of influence of positive and negative mood. In general, it appears that future research on the application of the current findings might be beneficial to professionals working in high-risk fields.

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