Some Detrimental Effects of Negative Mood on Individuals' Ability to Solve Resource Dilemmas

Andreas Knapp
Johannes Gutenberg University, Germany
Margaret S. Clark
Carnegie Mellon University

This research examined the effects of induced mood on subjects' problem-solving behavior. In an initial study, an experimenter induced one of three emotions (happiness, sadness, or anger) or no emotion in subjects. Shortly thereafter a second experimenter asked each subject to solve a resource dilemma problem. Subjects in the sad and angry mood conditions were less successful (i.e., they were more likely to deplete limited resources, and they achieved less profit) than subjects in the happy or neutral mood condition. Performance of subjects in positive moods did not differ from that of subjects in neutral moods. In a second study, the effect of a sad mood leading to less success than a neutral mood was replicated. The effects observed across the two studies were attributed to a decrease in subjects' ability to delay gratification, found previously to be caused by negative, but not positive, moods.

Hardin's (1968) article "The Tragedy of the Commons" has served as the impetus to a series of studies examining the way in which groups of people can jointly maximize profits from a common resource pool over the long term. In certain situations, called resource dilemmas or social traps (Cross & Guyer, 1980; Platt, 1973), maximizing individual short-term profits interferes with long-term preservation of common property, thus proving detrimental to all participants (Hamburger, 1979; Parker et al., 1983).

A number of variables influencing success in multiperson collective resource dilemma experiments have been identified (Brewer & Kramer, 1986; Linder, 1982; Messick & Brewer, 1983; Samuelson & Messick, 1986). For instance, participants are more successful if they can communicate with one another (Dawes, 1980; Jorgenson & Papciak, 1981), if they have feedback about the amount remaining in the pool (Cass, 1975; Harper & Gold, 1978), if the resource is subdivided so that individuals exercise something like private ownership (Cass & Edney, 1978; Messick & McClelland, 1983), and if they have been given a cooperative, as opposed to a competitive, set (Harper, 1978).

Variables such as communication and subdivision of resources are clearly group variables, and their impact on a group process—that is, success on a *collective* resource dilemma—is what has been examined. In contrast, in the present study, we raised the question of how an *individual variable* might influence a *single* person's performance on the type of individual problem solving that should contribute importantly to one's ability to perform well in true joint resource dilemmas. In particular, we examined the influence of a person's mood state on his or her ability to withdraw resources from a limited pool of resources with a limited repropagation rate in such a manner as to be able to derive maximum profit over the long run. Although researchers in this area have tended to neglect looking at individual-level variables, we believe that doing so is important. Variables that influence individuals' performances on resource dilemma

Authors' Note: This research was supported by a Fulbright Grant from the Council for International Exchange of Scholars to the first author, by National Institute of Mental Health grant 1R01 40390 with Margaret Clark as the principal investigator, and by the authors' joint Collaborative Research Grant 86/0503 from NATO's Scientific Affairs Division. The authors thank Dean Pruitt for early guidance regarding relevant literature, Marilynn Brewer, Robyn Dawes, and Darwyn Linder for helpful comments on earlier versions of the article, Beth Muchant for help in running Study 1, and Beate Cartano for help in running Study 2. Requests for reprints should be sent to Andreas Knapp, Department of Psychology, Johannes Gutenberg University, Saarst. 21, 6500 Mainz, F.R. Germany.

PSPB, Vol. 17 No. 6, December 1991 678-688

tasks can obviously influence success in multiperson collective resource dilemmas as well.

Why did we suspect moods would influence performance on this type of problem solving? Effective management of one's own individual behavior while dealing with resource dilemmas involves taking resources from a pool in such a manner as to derive profit for oneself while not depleting the pool so that it cannot optimally replenish itself. This means one may often have to restrain oneself from taking too much from the pool early on. Past research suggests that moods may influence this process by influencing people's ability to exercise such restraint. We briefly review this work next.

EFFECTS OF MOOD ON DELAYING GRATIFICATION

As just noted, to perform optimally on a resource dilemma task, subjects must be able to limit the amount they withdraw from a pool during the early trials in order to maximize earnings over the long run. People who are feeling bad may be less able than others to do this, because they may have a special desire to alleviate their negative mood state (cf. Cialdini, Darby, & Vincent, 1973; Clark & Isen, 1982). One strategy available to them is to quickly derive profits from the pool in the hope that possession of these profits will make them feel good. The possibility of early depletion of the pool by subjects in negative moods is supported by prior research demonstrating that negative moods do indeed influence a person's ability to delay gratification (e.g., Fry, 1975; Mischel, Coates, & Raskoff, 1968; Schwarz & Pollack, 1977; Seeman & Schwarz, 1974). This research has shown that the more negative subjects' mood, the more likely they are to take available rewards in the present and to sacrifice larger gains over the long run.

On the basis of this reasoning, we predicted that, when faced with a resource dilemma, subjects in a negative state would be more prone than those in a neutral or positive state to take increased early profits and therefore should perform more poorly on the task. Accordingly, in our experiment we manipulated the moods of some subjects to be negative (either angry or sad) and compared the success of these subjects on a resource dilemma task with that of other subjects whose moods were not manipulated.

Although our primary predictions had to do with the effects of negative moods on success at a resource dilemma, we also considered the possible effects of positive moods. Here our expectations were a bit less certain. On one hand, it has been suggested that happy people might have a desire to maintain their mood states (Clark & Isen, 1982), and research exists supporting this idea (Forest, Clark, Mills, & Isen, 1979; Isen & Levin, 1972; Isen & Simmonds, 1978). Therefore, relative to those in neutral moods, subjects in positive moods may also want to take increased early profits in order to be sure to maintain their mood. As a consequence, positive mood subjects also might harm their own chances for long-run success. On the other hand, precisely because they are already in positive moods, positive mood subjects may have less need than others to derive early profits to make themselves feel good. They might therefore be *better* able than others to delay gratification and so to solve resource dilemmas effectively. For these reasons, we made no specific predictions about the effects of positive moods on subjects' ability to solve a resource dilemma. Nonetheless, for exploratory purposes, in the experiment to be described shortly, we manipulated the moods of some of our subjects to be positive and compared their success on a resource dilemma with that of subjects whose moods were not manipulated.

THE RESOURCE DILEMMA: A FISHING ANALOG

The resource dilemma used in the present study was an analog of one developed by Brechner (1975, 1977). In Brechner's study, the subject's winnings consisted of any points harvested from a fictitious pool whose stock replenished itself at a rate dependent on the density of the pool. Brechner told his subjects that the points could be exchanged, at the end of the experimental session, for experimental credit. Our task paralleled Brechner's except that, instead of harvesting points, subjects imagined that they were catching fish, which propagated at a rate dependent on the number remaining.

In our study each subject took fish (profits) from a pool over a series of trials. During each trial the subject could take as many fish from the pool as he or she wanted. However, it was best in the long run to leave enough stock in the pool so that there would be maximum propagation. By doing so, the subject could draw the maximum number of fish from the pool over the course of all trials.

On each trial the subject was told how many fish were in the pool and drew out as many fish as he or she chose. Then the remaining stock was subjected to a propagation function, and the stock was increased accordingly. After the fish had been withdrawn and propagation had taken place, the subject was told the number of fish available in the pool, and the next trial began. To be successful on such a task, the subjects had to determine by trial and error how many fish could be taken from the pool while maintaining the maximum propagation rate. Thus, the task can be characterized as a structured sequence of

constantly changing pairs of numerical values representing harvest and propagation with a formula that subjects can estimate.

The propagation rate in our case was defined by a continuous inverted-U-shaped function. To succeed on the task, subjects needed to identify the functional relationship between the states of the pool before and after propagation of the stock. To avoid effects of forgetting data on performance, our subjects were allowed to keep complete written records of the amount of stock at the beginning of each trial, how much stock was taken, and the amount, following propagation, available on the next trial. Using this problem, we tested the following hypothesis: People experiencing a negative mood state will be less successful in solving a resource dilemma task than people in a neutral mood state. More specifically, we expected subjects in a negative mood to deplete the stock in early trials to a somewhat greater degree than subjects in neutral moods, thereby causing propagation to be suboptimal in later trials and eventually resulting in less overall profit. In addition, for exploratory purposes, we examined the impact of positive mood on performance of the task.

STUDY 1

Method

Subjects. Subjects were 64 students of psychology at Carnegie Mellon University. Each earned partial credit for a course requirement by participating.

Procedure. Subjects were led to believe they would be participating in two separate experiments. The mood induction was presented as a first experiment. The subjects were greeted by a first experimenter and told to read and memorize one of four stories. Each subject was randomly assigned to read either a happy, a neutral, a sad, or an angry story. The happy story begins with a description of a likable and artistically talented poor student who expects to be unable to go to art school. Through a series of fortunate events, she receives a scholarship and is able to go. The neutral story simply describes an average student applying to college and then finding an even number of pleasures and problems there. The sad and angry stories each begin like the happy one. In the sad story, the student is prevented from pursuing her goals by a serious illness; in the anger-inducing story, the student never receives the scholarship that is rightfully hers, because it is unfairly awarded to another student.

In order to encourage the mood to persist, the subjects were told that after the second experiment they would be asked some questions about the story they read. Some prior work (Isen, Clark, & Schwartz, 1978) has suggested that the effects of mood inductions may dissipate over the course of 20 min or so, and it was hoped this would encourage the subjects to continue thinking about the story and consequently to experience the accompanying affect during the entire experimental period.

At this point it should be mentioned that prior evidence for the effectiveness of our mood manipulations exists. Specifically, Erber (1985), who originally developed and used the same happy, sad, and neutral stories that we used in the present study, found that reading the sad story led to significantly greater ratings of sadness than reading the neutral story and that reading the happy story led to significantly greater reports of happiness than reading the neutral story. In addition, Milberg and Clark (1988) used the same happy, angry, and neutral stories as used in the present study. Like Erber (1985), they found that subjects who read the happy story reported feeling significantly happier than those who read the neutral story; they also found that subjects who read the angry story reported feeling significantly more angry than those who read the neutral story.

After reading the story appropriate to their condition, subjects went to a separate room and were greeted by a second experimenter unaware of the subject's mood condition. This experimenter introduced a supposedly unrelated experiment. He told the subject he or she would play a game in which the job was to maximize his or her takings from a fictitious pool of fish. The subject received the following specific introduction to this task:

> In this game we are simulating how a fisherman goes about fishing from a lake. You will be this fisherman and can catch tons of fish which you can exchange for cash when the experiment is over (1 ton = 1/4 cent).
>
> In each trial you are allowed to catch either nothing at all, or as many tons of fish as you like. However, the stock of fish is not unlimited. The amount of fish in the lake decreases whenever something is taken out. On the other hand the fish also propagate as long as there are enough of them in the lake.
>
> I will tell you when the game is over. However, if the stock drops to 0, the game is automatically over. In this case you will lose $1.00 of your total gains.
>
> Do you get the idea?
>
> Now try to maximize your own profits. You start with a current stock of fish in the lake of 120 tons.

At this point the subject began the game. In each trial the subject recorded the amount of fish he or she took and his or her prediction about the amount of stock after propagation. (These predictions provided a measure of the subject's ability to perceive the true propagation function.) After the subject had made his or her predictions, the experimenter told the subject the actual amount of

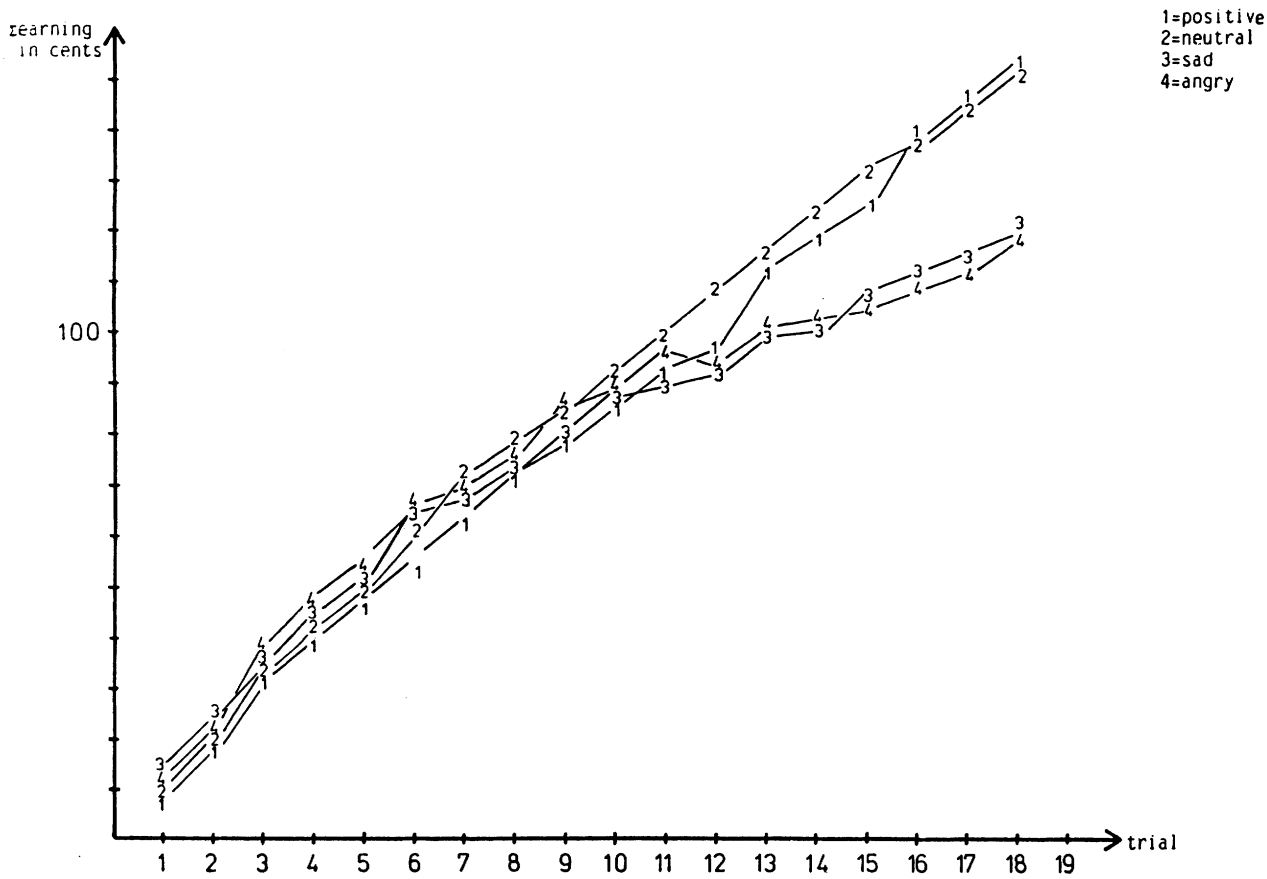

Figure 1 Cumulative profits over trials by treatment variable, Study 1.

stock left in the pool following propagation. Without giving prior notice, the experimenter ended the game after the 18th trial. Afterward the experimenter checked the effectiveness of the mood induction. The subjects were asked to note four important events of the story and to rate how the story had made them feel. Only then was the subject informed of the overall profit earned, checked for suspicion, paid, debriefed, and thanked. No subject expressed suspicion about the two studies being connected.

Results

Manipulation check. As just noted, the efficacy of the mood induction was evaluated by having subjects check a rating scale indicating how reading the story had made them feel. The scale ranged from –5 (indicating feeling depressed) to +5 (indicating feeling uplifted). As intended, the happy story induced a mainly positive mood ($\bar{x} = 2.8$), whereas both the sad ($\bar{x} = -2.0$) and the angry ($\bar{x} = -2.3$) stories induced a mainly negative mood. The neutral story was rated in the middle of the scale ($\bar{x} = 0.3$) and did not appear to induce any particular mood. A one-way analysis of variance revealed that the ratings of the four stories were significantly different from one another, $F(3, 60) = 31.14$, $p < .0001$. Planned comparisons indicated that the happy story induced more positive moods than the neutral story, $t(60) = 4.23$, $p < .0001$, and that the angry and sad stories induced more negative moods than the neutral story, $t(60) = 4.22$ and 3.81, respectively, $ps < .0001$.

We realize that it would have been better to use a rating scheme sensitive to the differentiation between anger and sadness. In future work that will be done. Nonetheless, we are confident from the present manipulation check results that the two negative manipulations produced more negative feelings than the neutral or positive manipulation and that the happy manipulation produced more positive feelings than the neutral or negative manipulation. Further, as already mentioned, manipulation checks reported by Erber (1985) and by Milberg and Clark (1988) had previously indicated the efficacy of the sad story for producing sadness and of the angry story for producing anger.

Effects of mood on successful solution of the resource dilemma. Our measure of performance on the task was the accu-

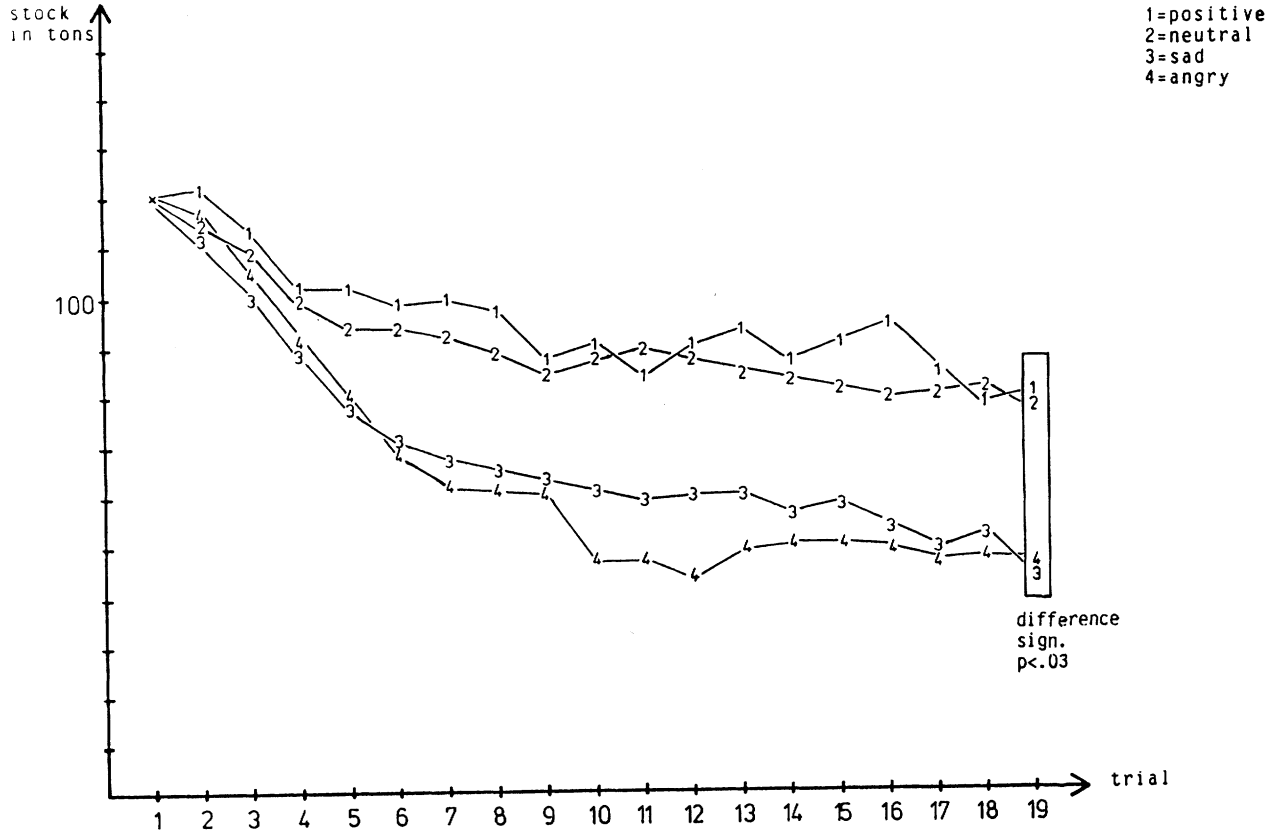

Figure 2 Amount of stock over trials by treatment variable, Study 1.

mulated profit taken over the course of trials. The higher this sum, the more the subjects were paid in cash. The pattern of results for this variable in each mood condition across all trials is shown in Figure 1. From the initial trials, subjects in the sad and angry conditions withdrew slightly more stock than subjects in the other two conditions. They continued to take increased harvests until the 6th trial, after which their harvests (profits) gradually declined until, at the end of the 12th trial, their profits were less than those gained by subjects in the happy and neutral conditions. The slopes of the two pairs of lines after the crossover in the 11th trial show that from this point subjects in the happy and neutral mood conditions reaped greater profits than those in the sad and angry conditions. Moreover, the longer the experiment continued, the wider the gap between the profits made by the treatment groups became.

A one-way analysis of variance revealed that the differences in mean accumulated profits on the last trial among the different treatment groups approached significance, $F(3, 60) = 2.26$, $p = .09$. In addition, to test whether the apparent interaction between the effects of moods and trials on profit taken on each trial was significant, a 4 (Mood: happy, sad, angry, neutral) × 18 (Trials: 1-18) analysis of variance with mood as a between-subjects variable and trials as a within-subject variable was performed. The interaction effect between moods and trials approached significance, $F(51, 1020) = 1.29$, $p = .08$.

Although our primary measure of success on the task was the profit taken out of the pool, a second reasonable measure of success is the stock of fish remaining in the pool after the unexpected end of the experiment in the 18th trial. An effective solution to the dilemma involves conserving the initial stock so that an appropriate amount of stock for propagation is left over the course of trials. Therefore, the amount of fish remaining at the end of the experiment was used as a measure of successful conservation. The pattern of the dependent variable "amount of stock" from the first through the last trial is shown in Figure 2. As can be seen there, although all subjects started with the same amount of stock, subjects in the sad and angry conditions had depleted the stock more by the end of the 3rd and 4th trials than subjects in the happy and neutral conditions. The disproportional depletion of the stock by subjects in the sad and angry conditions continued through the 7th trial, after

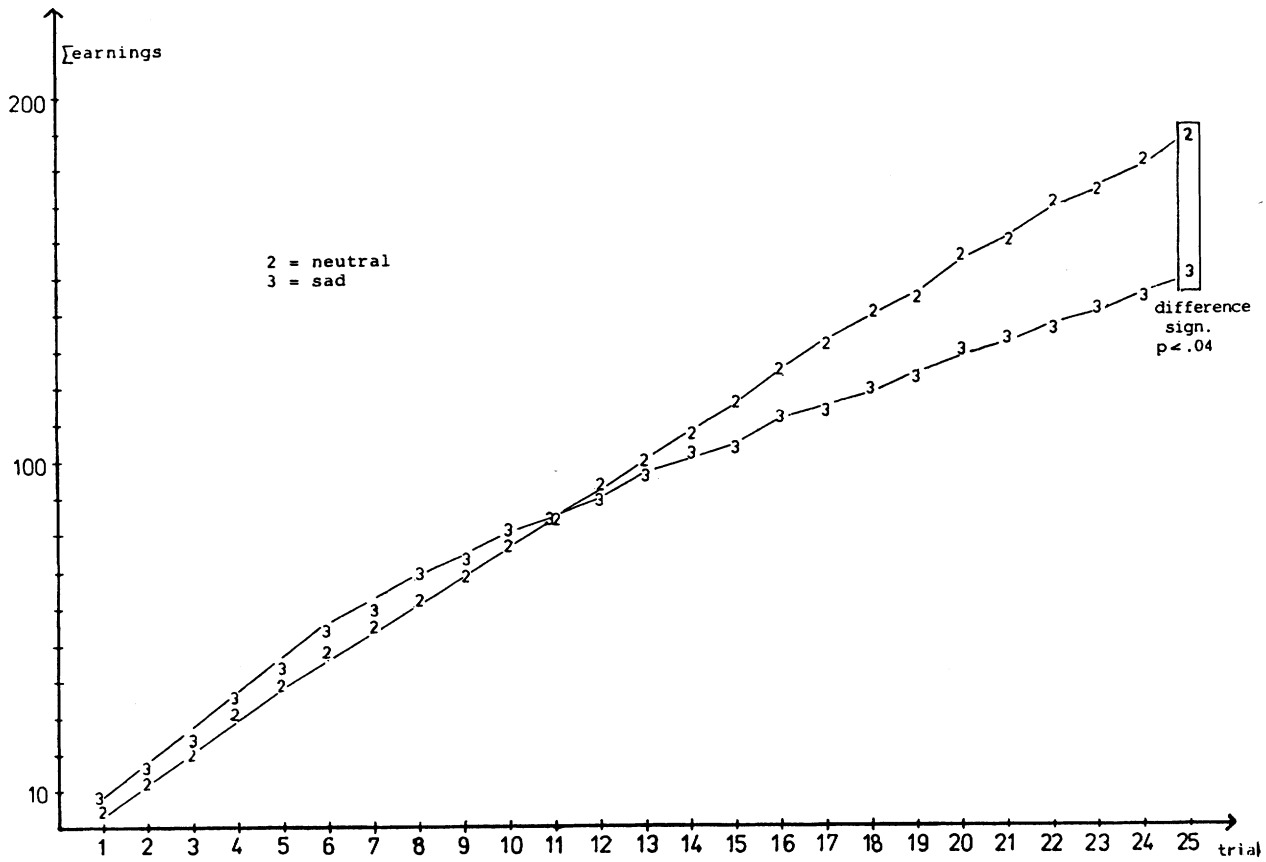

Figure 3 Cumulative profits over trials by treatment variable, Study 2.

which the differences in the level of depletion between subjects in these and other conditions remained approximately constant. A one-way analysis of variance revealed that the final stock left after the 18th trial did differ significantly between conditions, $F(3, 60) = 3.12$, $p = .032$. The amount left was lower in both the sad and angry conditions than in the happy and neutral conditions. This analysis of variance also showed a significant interaction effect between moods and trials on amount of stock left, $F(51, 1020) = 1.47$, $p = .02$, such that whereas there was little difference in depletion in the early trials, there was a difference in the later trials.

Accuracy of estimates. After each trial subjects estimated what the stock would be on the next trial given the amount they had just taken and subsequent propagation. The accuracy of each subject's estimate after each trial is indicated by the difference between that estimate and the true amount of fish left in the pool on the next trial. This difference can be considered a measure of the subject's ability to perceive the true structure underlying the sequences of harvests and propagation.

To determine whether there were any effects of mood on understanding of the task itself, a 4 (Mood: angry, sad, happy, neutral) × 18 (Trials: 1-18) analysis of variance with trials as a within-subject variable and mood as a between-subjects variable was performed. As would be expected, this analysis indicated a significant main effect of trials, $F(17, 1020) = 13.3$, $p < .001$, suggesting that subjects did increasingly come to understand the underlying function as they participated in more and more trials. However, there was no significant main effect of mood, $F(3, 60) = 0.8$, $p = .48$, and no significant interaction between trials and mood, $F(51, 1020) = 1.2$, $p = .08$.

STUDY 2: REPLICATION STUDY

It seemed to us that the effects on accumulated profits observed in Study 1 might have achieved significance had the number of trials been greater. We therefore decided to replicate the study with an extended number of trials.

As the first study had indicated that responses of subjects in positive and neutral moods did not differ and that responses of subjects in angry and sad moods did

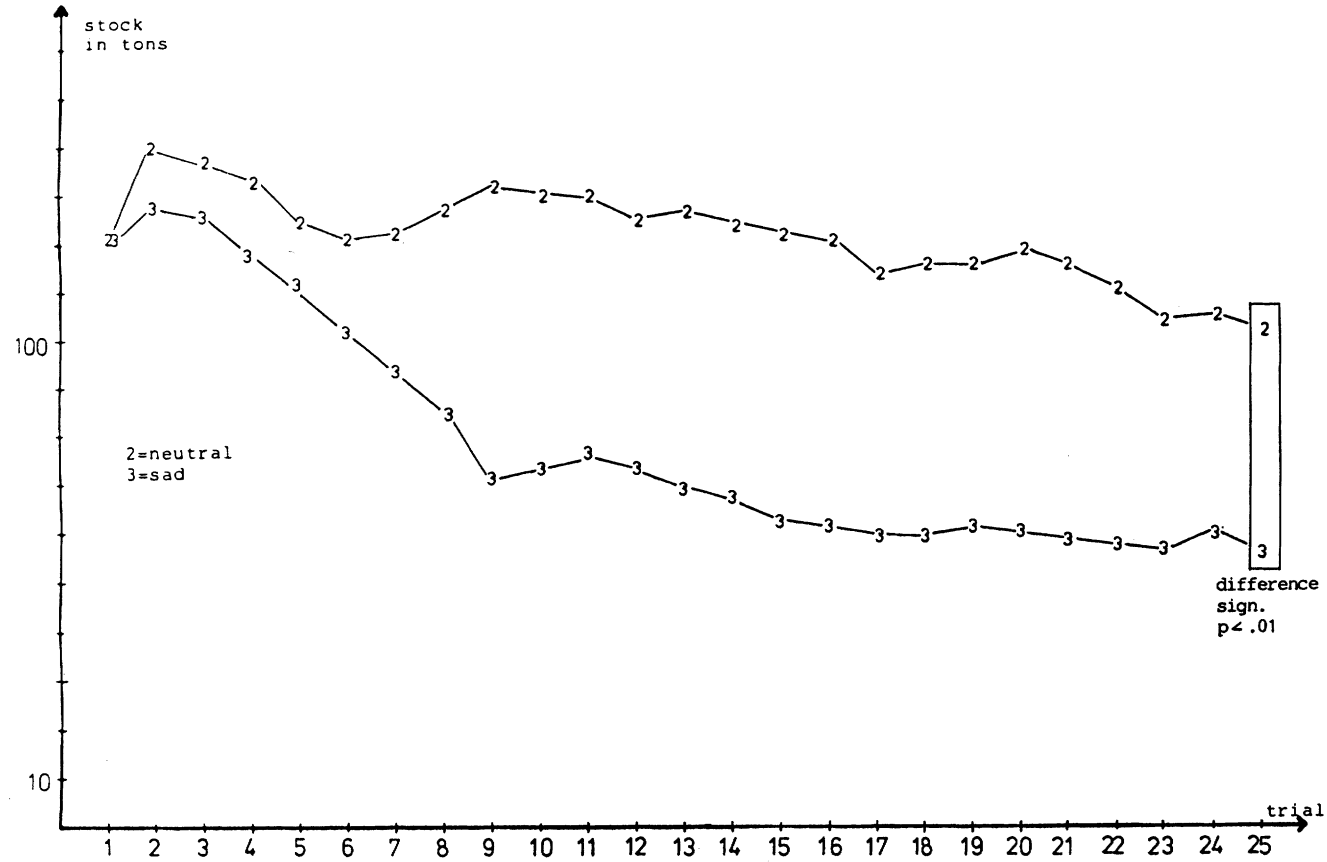

Figure 4 Amount of stock over trials by treatment variable, Study 2.

not differ, only neutral and sad moods were induced in the replication study.

Method

Subjects. Thirty-two students from Johannes Gutenberg University served as subjects in the second study. They were randomly assigned to either a sad or a neutral mood condition.

Procedure. The procedure for the second study followed that for the first study exactly, with two exceptions: The number of trials was extended from 18 to 25, and subjects were informed at the start that there would be 25 trials.

Results

Manipulation check. As in the first study, subjects in the replication study had indicated how reading the story given to them had made them feel by checking a scale identical to that used in the first study. The mean ratings were consistent with those found in the first study. Subjects in the neutral mood condition rated themselves as having feelings that fell in the middle of the scale ($\bar{x}$ = –.03), whereas subjects who read the sad story rated themselves as having mainly negative feelings ($\bar{x}$ = –2.7). These ratings differed significantly from each other, $F(1, 30) = 8.15$, $p = .008$.

Effects of mood on successful solution of the resource dilemma. Figure 3 shows the cumulative profits of subjects in the sad and neutral treatment conditions. Initially, subjects in whom a sad mood was induced take slightly greater profits than subjects in the neutral mood condition. This difference increases through the 6th trial and then gradually declines. By the end of the 11th trial, profits accumulated by those in a sad mood are actually smaller than the profits accumulated by those in neutral moods. The slopes of the two lines after the crossover in the 11th trial show that from this point subjects in the neutral mood condition reap greater profits than subjects in the sad mood condition.

A one-way analysis of variance revealed that the means of the accumulated profit on the last trial differed significantly between the two treatment groups, $F(91, 30) = 4.45$, $p = .04$. A second 2 × 25 analysis of variance with mood (neutral, sad) as a between-subjects factor and

trials (1-25) as a within-subject factor also revealed that the expected interaction effect between mood and trials on noncumulative profit was significant, $F(924, 720) = 2.14$, $p = .001$.

Our assumption that the effect of mood on cumulative profit, insignificant in the first study, would achieve significance when the number of trials was extended to 25 was justified. Although we told subjects in the replication study that the game would end after the 25th trial, this advance knowledge of the exact number of trials appears not to have had any effect on their strategies.

As can be seen in Figure 4, the pattern of results for the stock variable corresponded closely to the results of Study 1. The final amount of stock was significantly lower for subjects in the sad condition, $F(1, 30) = 7.03$, $p = .01$, than for subjects in the neutral condition. In addition, a 2 (Mood: neutral, sad) × 25 (Trials: 1-25) ANOVA with mood as a between-subjects variable and trials as a within-subject variable revealed a significant interaction effect between moods and trials on stock, $F(24, 720) = 4.72$, $p = .0001$.

Accuracy of estimates. In the replication study, as in the original study, after each trial subjects estimated what the amount of stock on the next trial would be given the amount removed from the pool and the estimated subsequent propagation. Again, the difference between the estimate for each trial and the amount of fish actually available on that trial served as an indication of the subject's understanding of the true function underlying the sequence of harvests and propagation.

To determine whether mood had an impact on subjects' understanding of the underlying function, a 2 (Mood: neutral, sad) × 25 (Trials: 1-25) analysis of variance with mood as a between-subjects variable and trials as a within-subject variable was conducted. As would be expected, this analysis revealed a main effect of trials, $F(24, 72) = 3.9$, $p < .0001$, indicating that subjects increasingly came to understand the function over trials. There was no main effect for mood, $F(1, 30) = 1.4$, $p = .24$, and no interaction between mood and trials, $F(24, 720) = 0.8$, $p = .64$.

GENERAL DISCUSSION

Our research was designed to test the hypothesis that being in a negative mood would cause individuals' performance on a resource dilemma task to deteriorate. The results from the two studies were consistent and clearly supported our predictions. Subjects in negative moods were less successful on the task than subjects in a neutral mood. In contrast, the results of Study 1 revealed that the success of subjects in positive moods and subjects in neutral moods did not differ.

Why did negative moods interfere with success on the task? Examination of the pattern of taking profits revealed, as expected, that subjects in negative moods took disproportionately high profits during the early trials relative to subjects in the positive and neutral mood conditions. This left a less-than-optimal amount of stock in the pool for purposes of propagation, which, in turn, interfered with later success on the task. After the early trials, the disproportionate profit taking by subjects in negative moods decreased, but not to the extent necessary for the stock in the pool to remain constant or to increase (although this would have been theoretically possible). Instead, these subjects continued to appear unable or unwilling to allow stock to increase by taking smaller profits. In other words, the behavior of subjects in negative moods supported Platt's (1973) assertion that, like fish in a trap, "men or organizations or whole societies get themselves started in some direction . . . that later proves to be lethal and they see no easy way to back out" (p. 641). In contrast, subjects in whom a positive mood had been induced and subjects in neutral moods delayed reaping of the somewhat larger profits early, thus allowing themselves greater eventual success on the task.

As discussed earlier in this article, we believe the reason that negative moods led subjects to deplete the pool was that, owing to a desire to repair their moods, subjects in negative moods were less able than subjects in a neutral mood to delay gratification. This idea is supported by the results of prior studies showing that people in negative moods have difficulty delaying self-gratification (Fry, 1975; Mischel et al., 1968; Schwarz & Pollack, 1977; Seeman & Schwarz, 1974). Interestingly, in our study, unlike much prior work, the immediate effects of negative mood on gratification were quite small. That is, in the very first trials negative mood subjects took only slightly more profits than neutral or positive mood subjects. However, over trials the higher profit taking of the negative mood subjects did produce considerable drops in the size of the pool, and later on it made these subjects unable to continue to draw larger profits than other subjects and eventually resulted in statistically significantly lower overall profits. One can say that the small initial effects were considerably magnified over the course of trials, with serious long-term consequences. This occurred even though it would have been theoretically possible for the negative mood subjects to reverse this magnification process by taking especially small profits later. In other words, they could have returned the pool to optimal size and then started taking optimal amounts from the pool, but they chose to continue to deplete the pool.

Alternative Explanations?

Three explanations for the effects of negative moods

on success other than the "mood repair" one offered here might be raised. First, it might be suggested that it is not mood improvement that produced our results but, rather, that subjects in negative moods were less interested in the game than subjects in positive or neutral moods. After all, recall that our negative mood manipulations consisted in leading subjects to think about an injustice that had happened to another person (anger) or about another person's serious illness (sadness). When compared with such serious matters, our "fishing game" may have seemed unimportant or even silly.

Although at first such an explanation seems plausible, a careful consideration of our findings suggests it is not correct. Even though decreased interest in the task is consistent with performing poorly in general, it cannot easily explain the early high profit taking by subjects in negative moods compared with other subjects. Is it not just as plausible that uninterested subjects should pay less, rather than more, attention to profits? Because they did appear to attend to profits, we would argue that they *were* interested in the task. Furthermore, a lack of interest in the task would suggest that the negative mood subjects would concentrate less on the task and therefore show less discernment of the underlying function. Yet, subjects in the negative mood conditions were *not* worse at discerning that function than others. For these reasons, an alternative explanation based on less interest in the task among subjects in negative moods than among other subjects seems unlikely to us.

Second, some might propose that negative moods increase willingness to take risks. Subjects in negative moods might therefore take bigger profits initially when they do not yet know the long-term consequences of doing so. After all, when one already feels bad, one may feel one has little to lose by performing poorly on a task. Although this also seems plausible initially, we believe that it too is an unlikely explanation. It seems to us at least equally plausible that negative moods would cause people to be *less* willing to take risks so that they will not be made to feel any worse. More important, research by Isen, Means, Patrick, and Nowicki (1982) has shown that positive moods lead to greater risk taking. Therefore, even if negative as well as positive moods increased willingness to take risks (which is a logical possibility), it would be expected that both positive and negative mood subjects would show increased early profit taking and subsequent long-term poor performance on the task relative to subjects in a neutral mood. Because this clearly did not occur in Study 1, we believe that our results cannot be explained by assuming that negative mood increases risk taking.

Third, it might be proposed that the results were due to differences in subjects' ability to understand the function underlying the problem rather than to negative mood subjects' desire to alleviate their state. After all, several authors have suggested and found evidence for the idea that mood states, both positive and negative, take up capacity in working memory (e.g., Ellis, Thomas, McFarland, & Lane, 1985; Ellis, Thomas, & Rodriguez, 1984; Isen et al., 1982; Mackie & Worth, 1989; Worth & Mackie, 1987). Negative mood, then, may interfere with a person's ability to discern important relationships between behavior and outcomes and thus with the person's ability to solve a resource dilemma. However, there are at least two arguments against this interpretation. First and more important, our studies did include a measure of subjects' ability to understand the function underlying the problem (i.e., the difference between their estimates of what the stock would be on the subsequent trial and the actual amount of stock on that trial). Analyses indicated no significant effects of mood on these estimates. That is, in neither study were there any significant or marginal main effects of mood on accuracy of estimates, and even though in Study 1 the interactive effect of mood and trials on estimates approached significance, in Study 2, in which the effects of being in a negative mood were again observed, the analogous interaction did not come close to significance. Further, one cannot argue that the lack of effects of mood on the measure of estimates of stock left was due simply to having an insensitive measure of understanding the function underlying the task, because, just as one would expect, in both studies estimates did improve significantly over trials. Second, the past literature provides no reason to think that positive mood should interfere with problem solving less than negative mood should. Yet, positive mood did not interfere with success on the task, and negative mood did.

Before dismissing this last possible alternative explanation entirely, though, we would note that under somewhat different circumstances than obtained in our present studies, moods might well affect performance on resource dilemmas through interfering with capacity for information processing. For instance, had our subjects not been allowed to keep written records of profits taken and of subsequent levels of stock, greater cognitive capacity would have been required to perform adequately on the task. Under such circumstances whatever capacity positive or negative moods do take up might well have interfered with performance.

Lack of Effects for Positive Mood

We included a positive mood manipulation in Study 1 for exploratory purposes. We suspected that *if* subjects in a positive mood had strong desires to maintain their mood state, they too might deplete the pool early on and be less successful in the long run. It also seemed possible, however, that precisely because they were in a positive

mood, they might have less reason than others to make themselves feel good by quickly acquiring profits and might therefore be more successful in the long run. In fact, in Study 1, positive mood had no apparent effect on success on the task. The behavior of subjects in the positive mood condition was very similar to that of subjects in the neutral mood condition. Thus, we have no evidence that positive mood subjects are especially desirous of performing behaviors to maintain their mood or evidence to suggest they are especially invulnerable to reaping big rewards quickly.

Limitations on the Generalizability of the Results

Clearly, the optimal level of trial-to-trial profit taking on a task such as that used in the present study is dependent on the function underlying the task. Because we were attempting to make our problem relevant to resource dilemmas in which resources are quite scarce, we kept our optimal level of profit taking low. All our subjects actually took more-than-optimal amounts, and negative mood subjects took even more than neutral or positive mood subjects, thereby lowering their overall success on the task. On other tasks, similar to the one we used in all ways except that resources are more plentiful, the optimal level of profit taking might be considerably higher. It could actually exceed the amounts our subjects, including our negative mood subjects, took. In such a case, if negative mood subjects took more profits trial-to-trial than neutral subjects, they might actually experience *more* success on the task. It should therefore be noted that our results may not generalize to other tasks in which resources are not so scarce.

However, because level of profit taking may depend not only on mood but also on whatever knowledge (however incomplete) the subject has of the function underlying the problem, we cannot be sure of this potential limitation on the generalizability of our findings. It remains possible that as the level of resources available changes together with the level of optimal profit taking, all subjects will adjust their profit taking upward. If they do so, all subjects may surpass the optimal level, and the negative mood subjects may surpass it to a greater extent (as they did in our studies). Alternatively, neutral and positive mood subjects may approach the optimal level while the negative mood subjects surpass that level. In either case the detrimental effect of negative moods on overall success observed in the present studies might still obtain.

Some Implications for the Commons Dilemma Literature

The present findings are important for at least two reasons. First, most prior research in this area has investigated factors influencing how pairs or groups of people behave when faced with resource dilemmas. Such research is important. However, our research emphasizes that a complete understanding of behavior in the face of joint resource dilemmas will also require taking factors that influence each *individual's* behavior into account, and we have identified negative mood as one specific factor having important effects on individuals' performance. Second, we feel that mood may, at least to some extent, mediate the effects of other variables that have been shown to influence group performance on commons dilemmas. For example, the observed positive effects of communication (Dawes, 1980; Jorgenson & Papciak, 1981), feedback about remaining resources (Cass, 1975; Harper & Gold, 1978), and subdividing of resources so that individuals can exercise something like private ownership (Cass & Edney, 1978; Messick & McClelland, 1983) may be due, at least in part, to a reduction of subjects' negative affect (in these cases, perhaps fear). The reduction in negative affect, in turn, may lead to more optimal individual performance and therefore more successful group performance. We can easily think of other variables of potential importance to solving commons dilemmas—for example, intragroup attraction—whose effects might also be mediated, at least in part, by mood. In particular, the less intragroup attraction, the more anger and sadness group members may feel, and the less success on resource dilemmas they may experience. In our future research we intend to pursue the question whether mood might mediate some of the effects that other variables have been shown to have on groups' ability to cope successfully with commons dilemmas.

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