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Angry Reactions to Failure on a Cooperative Computer Game: The Effect of Trait Hostility, Behavioural Inhibition, and Behavioural Activation

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This study describes the use of a "cooperative" computer game in which the subject has to follow directions, supposedly sent from a partner, and steer a tank to avoid invisible mines. The tank is lost if it hits a mine or does not reach base within a set time limit. The game was designed so that the majority of trials would be lost. Affective (mood self-ratings), cognitive (attribution of blame questionnaire), and behavioural (feedback sent to the "partner") outcomes were assessed. The game significantly increased ratings of discontentedness and anger. Self-blame for task failure was correlated with the Guilt subscale of the Buss-Durkee Hostility Inventory (BDHI), and blaming the partner was correlated positively with the Motor Aggression subscale and negatively with the empathy scale of the I7, supporting the notion of hostile attributional bias in adults. The importance of individual differences in the strength of the behavioural inhibition system (BIS) and behavioural activation system (BAS) were explored using the BIS/BAS scales developed by Carver and White [1994]. Sending negative feedback to the partner was negatively correlated with scores on the BIS. Scores on BAS drive were positively correlated with increases in discontentedness and with sending negative feedback on trials when the tank was lost due to lack of time. These results are discussed in relation to Berkowitz's [1993] model of affective aggression. Aggr. Behav. 24:27–36, 1998. © 1998 Wiley-Liss, Inc.

Key words: cooperative task; BIS/BAS scales; anger; hostility; attribution of blame

INTRODUCTION

Aggression has been investigated using a variety of different methods. As in other areas of study, laboratory experiments have many advantages but also raise questions about ecological validity, the effect of demand characteristics, etc. Experimental work

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on aggression presents particular challenges, not least because of the practical and ethical difficulties involved in inducing people to behave aggressively toward each other in a laboratory setting. Nevertheless, some very valuable methods have been devised. The most well-known and widely used include the teacher/learner Aggression Machine [Buss, 1961], the Performance Evaluation Paradigm [Berkowitz, 1962, 1964], and the Competitive Reaction Time Task [Taylor, 1967]. Productive as these have proved, it has also been argued [e.g., Tedeschi and Quigley, 1996] that over-reliance on relatively few paradigms has meant that laboratory research has under-represented the construct of aggression. This then raises doubts about the extent to which results and theories derived from such research can be generalized to life outside the laboratory. To some extent, these criticisms have been answered by demonstrating that behaviour on laboratory tasks correlates with other measures of hostility and aggression and also by modifying the standard paradigms in various ways so that they represent more of the real-life situations in which aggression occurs [e.g., Gustafson, 1989; Lipetz and Ossorio, 1967]. However, the requirement for a wider variety of methods remains as results obtained with any single paradigm may be specific to its particular features.

Thus, a major aim of the research reported here was to develop a new method for eliciting and measuring anger and aggression in the laboratory. It represents situations in which people become angry with people with whom they are meant to be cooperating, such as when a driver blames his or her map-reader. The situation is cooperative, the potential elicitor of aggression is frustration caused by failure on the task, and the opportunities are for verbal rather than physical aggression. These features were chosen to complement some of the most widely used of the existing methods. The task is a computer game in which the subject has a limited time in which to steer a tank through mine-fields to its base. The mines are invisible to the subject and can only be avoided by following directions which are supposedly being sent by the partner. The task enables affective (change in self-rated mood), cognitive (attribution of blame questionnaire), and behavioural (feedback sent to the partner) components of angry reactions [Epps and Kendall, 1995] to be measured.

A second aim of this study was to explore some of the trait variables that may be important in affective aggression. Correlations of the outcome measures with trait measures of hostility, impulsivity, and empathy, which have previously been implicated in aggressive behaviour, will help validate the task. Gray [1981] proposes that two general motivational systems underlie behaviour and affect: the behavioural inhibition system (BIS) and the behavioural activation system (BAS). Carver and White [1994] have developed BIS/BAS scales to measure the sensitivity of these systems and point to the importance of further empirical evaluation of the applicability of the BIS/BAS model to human experience and behaviour. The BAS reflects sensitivity to signals of reward. Therefore, people scoring high on the BAS should respond strongly to frustration. Furthermore, Quay [1993] has argued that an overactive BAS underlies the development of conduct disorder. A weak BIS indicates weak inhibition of impulses and might therefore be associated with aggressive behaviour. Therefore, it is predicted that BAS scores will correlate positively and BIS scores negatively with angry reactions to failure on the game.

There is considerable evidence that the attributions people make for success and failure are important influences on how they feel and behave, and Weiner [1982] has argued that blaming others for negative self-related outcomes is associated with anger.

However, there has been relatively little work on the attributions associated with anger and aggression in adults, and most of this has been concerned with the attributions made for others' behaviour and been investigated using hypothetical scenarios [e.g., Blackburn and Lee-Evans, 1985; Epps and Kendall, 1995]. The study reported here extends previous research in looking at attribution of blame for a self-related outcome in a real, as opposed to hypothetical, situation. If trait-related differences in the tendency to blame the partner for failure are found, this will support the existence of hostile attributional bias in adults.

METHOD

Design

The design was correlational. The study investigated the correlation between measures of personality and responses to a task designed to produce frustration and anger.

Subjects

Six male and 17 female subjects, mean age 22.22 ± 5.48, were recruited from "A" level psychology classes at Lambeth College.

Procedure

Approval from the Institutional Ethics Committee was obtained, and the subjects gave written informed consent. Subjects completed the trait questionnaires during one of their regular classes and then made appointments to visit the laboratory in pairs. On arrival, they were individually taken to a small room with a computer where they completed the mood scales. Standard instructions were read to them. They were lead to believe that another student, their partner for the task, was in an adjacent room. They were told that they were going to play a cooperative computer game and would be working with their partners to achieve as high a score as possible. The game was demonstrated to them, and they practised steering the tank before playing the game. Immediately following the game they completed the mood scales again and the Attribution Questionnaire. They were then thanked and debriefed. They were asked if they had any suspicions about the things they had been told. All the subjects had believed that they had been playing with a partner.

The Task

The task was a computer game especially designed for this study. It involved using the left and right mouse buttons to steer an image of a tank on the computer screen through fields to its base, which would appear at the top of the screen. The tank would be destroyed if it did not reach the base within a time limit of 70 sec. The time elapsed and remaining were displayed visually as a clock face in a corner of the screen. The subjects were told that the fields contained mines which they could not see but which could be seen by their partners in an adjacent room who were also able to follow joint progress in the game. If a tank hit a mine, then it was blown up and lost. The subjects were told that their partners would send them directions to help them avoid the mines. These directions (Right, Left, or Straight) appeared at the top of the screen. To make the task credible, ignoring the directions resulted in immediate destruction of the tank. Twenty trials were used, i.e., there were 20 tanks to be returned to base. After each trial,

the score so far (i.e., the numbers of tanks won, lost, and still to be played) appeared on the screen. The task was designed to be difficult and to result in failure on the majority of trials. After seeing the 'score so far' after each trial, the subjects were asked to send a rating message to their partners by pressing a number between 1 and 6 on their keyboards. There were three possible outcomes for each trial: win by getting the tank back to base, lose by hitting a mine, and lose by running out of time.

Response Measures

Three types of response were measured:

Affective: changes in mood. These were measured with two sets of visual analogue scales, the Anger Rating Scale (ARS) [Bond and Lader, 1986] and the Mood Rating Scale (MRS) [Bond and Lader, 1974], completed immediately before and after the tanks game.

Cognitive: attribution of blame for failure. This was assessed using a 25-item questionnaire. Each item was a possible reason for failure, and the subject was asked to state whether it was "not a reason," "a minor reason," or a "major reason" for failure on the task. These responses were scored "0," "1," and "2," respectively. Nine of the reasons concerned the partner (e.g., "my partner did not try hard enough"), nine concerned the self (e.g., "my reactions were too slow"), and the remaining seven concerned the task or chance (e.g., "the equipment was poor" and "it was bad luck").

Behavioural: ratings sent to the partner after each trial. These were on a 6-point scale with "1" indicating "excellent help"; "2," "very helpful"; "3," "fairly helpful"; "4," "OK"; "5," "not at all helpful"; and "6," "absolutely useless."

Personality Measures

The I7 [Eysenck et al., 1985] was used to measure impulsiveness, venturesomeness, and empathy. The Buss-Durkee Hostility Inventory (BDHI) [Buss and Durkee, 1957] was used to give scores on Guilt, Motor Aggression, and Attitudinal Hostility subscales. Four BIS/BAS scales—BIS, BAS drive, BAS reward responsiveness, and BAS fun-seeking [Carver and White, 1994]—were used to assess the strength of these systems.

RESULTS

Student's t-tests were used to look at differences in mood before and after the tanks game, and Spearman's rho was used to measure correlations among trait variables and reactions to the game.

Scores on Personality Questionnaires (Table I)

The means and standard deviations for the BDHI and the I7 are broadly similar to those reported in previous studies [e.g., Buss and Durkee, 1957; Eysenck et al., 1985; Luengo et al., 1991, respectively]. The means and standard deviations of the BIS and BAS reward responsiveness scores are very similar to those reported by Carver and White [1994] for undergraduates at the University of Miami (BIS mean, 20.30 Lambeth vs. 20.28 Miami; BAS reward responsiveness mean, 17.40 Lambeth vs. 17.97 Miami). The mean scores on BAS drive and BAS fun-seeking, however, are somewhat lower (10.92 and 10.72 Lambeth vs. 12.03 and 12.62 Miami).

TABLE I. Means and Standard Deviations of Scores on Trait Questionnaires

	Mean	Standard deviation
BDHI		
Guilt	4.02	1.89
Attitudinal hostility	7.93	3.23
Motor aggression	23.70	9.80
Total	**38.85**	**9.80**
17		
Impulsiveness	6.20	3.71
Venturesomeness	7.98	3.29
Empathy	11.93	4.48
BIS/BAS		
BIS	20.30	4.06
BAS reward responsiveness	17.40	1.75
BAS drive	10.92	3.20
BAS fun-seeking	10.72	2.88

Performance on the Game

There were three possible outcomes on each of the 20 trials: win by getting the tank back to its base, lose by hitting a mine, or lose by running out of time. Overall, the subjects found the game difficult. All subjects lost at least eighteen tanks, and for all but two subjects these included both types of losing trial.

Affective Response to the Game (Table II)

The ARS showed significant increases in self-rated anger after the game. The MRS showed significant increases on the factors "discontentedness" and "anxiety" but no significant change in sedation-alertness. Changes on the items "happy–sad" and "relaxed–tense" were not significant.

Cognitive Response to the Game

The mean score on the items attributing blame to the self was 0.55 ± 0.34. For items attributing blame to the partner the mean was 0.67 ± 0.40, and for items attributing blame to chance or the task the mean was 0.49 ± 0.38. Thus, on average, subjects endorsed about half the items blaming themselves, the task, or chance, and about two-thirds of the items blaming their partner as a "minor reason" for failure. These figures suggest that the scores can be meaningfully correlated with trait variables and other task outcomes.

TABLE II. Means and Standard Deviations of Changes in Mood Ratings (Post-Tank Game Minus Pre-Tank Game)

	Mean	Standard deviation	t	$P <$
Mean ARS	15.39	16.67	4.33	0.0003
MRS factors				
Sedation alertness	3.43	12.45	1.32	ns
Discontentedness	9.22	13.95	3.17	0.0044
Anxiety	11.30	16.38	3.31	0.032

Behavioural Response to the Game

The rating messages sent to the partner tended to get more negative as the game progressed. Thirty-eight percent of the variance in the median rating can be explained by trial number. Winning trials were invariably followed by the most positive rating of "1." The mean rating message sent after being blown up was 3.6, and the mean rating message after running out of time was 2.9. A matched pairs *t*-test found this difference to be near statistical significance ($t_{20} = 2.07$, $P = 0.052$, two-tailed). Thus, it seems there was a tendency for subjects to send more negative messages when they had lost by hitting a mine than when they had lost by running out of time.

Correlations Between Personality Measures and Responses to the Game (Table III)

Affective response. Increased discontentedness was positively correlated with BAS reward responsiveness and BAS drive and negatively correlated with the empathy scale of the I7 and the BIS. The Attitudinal Hostility and Motor Aggression subscales of the BDHI were significantly correlated with increases in ratings 'aggressive' and 'belligerent' but not with increases in discontentedness.

Cognitive response. Self-blame was correlated with the Guilt subscale of the BDHI. Attributing blame to the partner was correlated positively with the Motor Aggression subscale of the BDHI and negatively with the Empathy scale of the I7.

Behavioural response. Sending negative feedback (over all trials) to the partner was negatively correlated with the Empathy and BIS scales. Sending negative

TABLE III. Correlations Between Outcome Variables and Trait Measures

	Buss-Durkee subscale				BIS/BAS scales		
	Guilt	Attitudinal hostility	Motor aggression	17 Empathy	BIS	BAS reward responsiveness	BAS drive
Increases on anger scales							
Angry	–0.12	0.14	0.17	–0.24	–0.07	0.05	0.13
Quarrelsome	–0.16	0.22	0.33	–0.24	–0.17	0.42*	0.36
Furious	–0.25	0.17	0.16	–0.20	–0.02	0.35	0.08
Aggressive	0.08	0.46*	0.46*	–0.16	0.13	0.27	0.12
Belligerent	–0.14	0.43*	0.57*	–0.43*	–0.17	0.28	0.33
Resentful	0.04	0.39	0.51*	–0.32	–0.20	0.49*	0.34
Hostile	–0.06	0.05	0.19	–0.03	–0.01	0.36	0.42*
Spiteful	0.02	0.15	0.29	–0.21	–0.08	0.34	0.27
Annoyed	–0.06	0.01	0.27	–0.34	0.07	0.23	0.14
Disgusted	0.06	–0.05	0.27	–0.39	–0.22	0.45*	0.36
Increase on mood factor							
Discontent	–0.14	0.07	0.25	–0.43*	–0.45*	0.46*	0.43*
Attribution of blame to							
Self	0.46*	–0.26	–0.30	0.18	0.39	–0.16	–0.18
Partner	–0.10	0.26	0.52*	–0.45*	–0.36	0.37	0.37
Task/chance	0.11	0.15	–0.31	0.00	0.13	0.15	–0.21
Rating measure sent when							
Blown up	–0.27	0.16	0.17	–0.51*	–0.48*	–0.02	0.21
Out of time	–0.26	0.21	0.22	–0.33	–0.47*	0.32	0.44*
All trials	–0.25	0.17	0.15	–0.52*	–0.54*	0.03	0.28

*$P < 0.05$.

messages after losing by running out of time was positively correlated with scores on BAS drive.

Correlations Between the Outcome Variables (Table IV)

Increased anger, anxiety, and discontentedness were all positively correlated. Increased anger was positively correlated with attributing blame to the other person and negatively correlated with attributing blame to the self. Increased discontentedness was positively correlated with sending negative messages.

DISCUSSION

The results indicate that a cooperative computer game in which the subjects believe they are being sent directions by another subject may be a useful way of inducing anger and related behaviour in the laboratory. The game increased self-rated anger and general negative affect (mood factor "discontentedness"), and although ratings on the mood factor "anxiety" also increased, subjects did not rate themselves as significantly more tense or sad. It therefore seems reasonable to conclude that the primary mood induced was anger. The game appears to be successful in this respect, particularly given that it is often difficult to induce "pure" anger in the laboratory [cf. van Goozen et al., 1994]. Furthermore, the credibility of the cooperative nature of the game appeared to be high. This was apparent in the debriefing and is also supported by the results of the Attribution Questionnaire in which subjects, on average, endorsed more than half of the items blaming the partner for failure. The game may be a useful complement to existing laboratory methods for inducing anger and aggression. Unlike the Competitive Reaction Time Task and some versions of the Performance Evaluation Paradigm, the subject is not attacked either verbally or physically and so their response is not retaliation in kind. Consequently, the subject is neither behaving defensively nor conforming to what they believe to be another's behaviour, as may sometimes be the case in these alternative methods.

Behaviour on the game was measured on three different types of outcome trial: those which result in a win (i.e., the tank reaches base), those in which the tank hits a mine, and those in which the subject runs out of time. Subjects tended to send less negative messages when they had run out of time, when indeed it does seem less reasonable to blame the partner, than when they hit a mine. Thus, cognitions about the cause of the frustration are clearly important, as demonstrated in previous research [e.g., Kulik and Brown, 1979;

TABLE IV. Correlations Between the Outcome Variables

	Increase in mood rating	Attribution of blame			
	Anger	Self	Other	Chance/ task	Ratings sent to partner
Increase in mood rating					
Discontent	0.68	–0.16	0.38	0.15	0.43
Anger		–0.43	0.50	0.34	0.37
Attribution of blame					
Self			–0.45	–0.12	–0.04
Other				0.01	0.37
Chance/task					–0.14

Worchel, 1974]. Sending negative messages after running out of time was positively correlated with BAS drive, suggesting that cognitions had less effect on behaviour in high BAS drive scorers, possibly due to higher levels of arousal. Zillman [1988] argues that the cognitive processes which inhibit aggression are less available when arousal is high.

One criticism that has been made of some laboratory methods for inducing aggression is that the behaviour displayed by the subjects may not be genuine aggression insofar as they believe they are acting to help the person to whom they are sending electric shocks, bursts of noise, or negative feedback. This has been investigated in relation to the Buss Aggression Machine by Baron and Eggleston [1972]. In the task reported here it might be argued that the subjects send negative feedback to help their partners. While this is a possible interpretation of the situation, its plausibility is reduced by the significant negative correlation between trait empathy and sending negative feedback.

As a way of validating the task, subjects' scores on the BDHI were correlated with their responses to the game. The motor aggression subscale was correlated with the affective and cognitive, but not the behavioural, response to the game. Impulsivity, often associated with affective aggression, was not significantly correlated with any of the outcome variables. Empathy, on the other hand, was negatively correlated with affective, cognitive, and behavioural responses to the game.

As predicted, individual differences in BIS and BAS sensitivity correlated with reactions to the game. The negative affect induced was negatively correlated with BIS scores and positively correlated with BAS drive and BAS reward responsiveness. BIS and BAS drive were also correlated with the behavioural response to the game. Figure 1 summarizes some of these results as they might relate to a simple and partial model of affective aggression in response to frustration. To the extent that behavioural inhibition reflects concern or anxiety about the reactions of others, the BIS results are consistent with previous research showing high need for approval to be associated with lower levels of aggression [Taylor, 1970]. Of course, individual differences in BAS sensitivity may only be important in situations where aggression is triggered by frustration rather than, say, insult, when other traits may have more influence. The person × situation interaction has been found to account for more variance than the situation alone in explaining reported hostile behaviour according to responses on a situation-response inventory [Endler and Hunt, 1968].

The current results are consistent with Berkowitz's [1990, 1993] model, in which affective aggression is primarily generated by negative affect rather than specifically

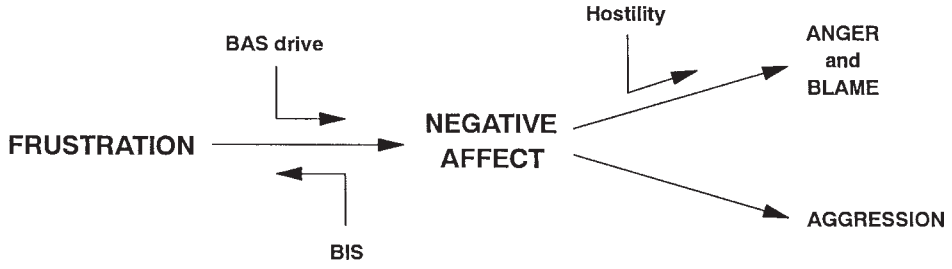

Fig. 1. Schematic representation of effects of BIS, BAS drive, and trait hostility on processes in affective aggression.

by anger. Sending negative feedback was correlated with increased discontent but not with increases on the anger rating scale. Obviously, conclusions from the correlations reported here are limited by the validity of the measures and the small number of subjects involved; nevertheless, they do appear to be more consistent with Berkowitz's position than with the more cognitive models of, for example, Geen [1990] and Anderson et al. [1995], who see interpretation or appraisal leading to anger as an integral part of the pathway to aggressive behaviour. However, increased anger, but not increased discontent, was correlated with blaming the partner. This again is consistent with Berkowitz's view about the parallel generation of anger and aggression from negative affect. The results reported here suggest that the route from frustration to aggression is influenced by the strength of the BAS and BIS whereas the route to anger and blame is influenced by hostility (see Figure 1).

Turning to the results obtained with the Attribution Questionnaire, it was found, as would be predicted by Weiner [1982], that becoming angry in response to task failure was correlated with blaming the partner. Guerra et al. [1993], using hypothetical scenarios, also found that an angry response to failure was associated with making external attributions. Individual differences in the perception and interpretation of aversive events and how these relate to anger and aggression has been investigated in children by Dodge and colleagues [see, e.g., Dodge and Crick, 1990], but there has been relatively little similar work with adults. However, Epps and Kendall [1995] found that subjects high on trait measures of anger and hostility attributed more hostility to protagonists in hypothetical situations, and other studies have shown that trait hostility is related to interpretation of ambiguously hostile verbal or visual stimuli (e.g., Copello and Tata, 1990; Petzel and Michaels, 1973; Watson et al., 1955). Here, blaming the partner correlated positively with trait hostility (Motor Aggression subscale of BDHI) and negatively with empathy. Self-blame correlated positively with the Guilt subscale of the BDHI. Therefore, guilt, empathy, and hostility all appear to be important in how blame for failure is placed. Thus, this study extends previous work by showing that trait hostility is correlated with attribution of blame in a real, as opposed to hypothetical, situation and therefore supports the notion of hostile attributional bias.

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