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1-1-1971

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Nonstructural determinants of behavior
in the replicated prisoner's dilemma game*

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The present research examined three factors that were thought to affect cooperation in the replicated prisoner's dilemma game: (1) motivation for participating, (2) understanding of the game, and (3) reward level. Results indicated that both high-understanding instructions and recruiting Ss to participate for money (rather than research credit) promoted cooperation, while reward level had no significant effect. These findings were used to argue that past studies, which tended to show low levels of cooperation for less than 50 replications, generated results that do not validly model real-life conflict.

It has been argued a number of times (e.g., Howard, 1966) that when confronted with a replicated prisoner's dilemma game (PD), persons should cooperate and choose their nondominant alternative.[1] However, past research has indicated that Ss do not behave as these models prescribe. For example, in their review of the literature, Gallo & McClintock (1965) conclude: "In general the percentage of cooperative responses [in the replicated PD] tends to be well below 50 percent... [p. 74]."

That detrimental conflict does, in fact, exist in the replicated PD, though in theory it should not, was the starting point for the present research. We reasoned that since Ss do not behave as they "should," factors independent of the basic structure of the game are responsible for the typically high level of conflict which is manifested in the PD. Past research (e.g., Komorita, 1965; Messé & Sawyer, 1965) suggested two factors: motivation and understanding.

Motivation was examined in the present research through the manipulation of two variables: the inducement used to recruit Ss and the reward level of the matrix. Most PD studies have used Ss whose primary purpose for participating in the experiment was something other than the money that could be won in the game; usually they were induced to participate by the promise of research credit that was of benefit to them in their introductory psychology course. Given this inducement, it is reasonable to assume that Ss in these studies were less than optimally motivated to earn money. On the other hand, Ss recruited to participate by the promise of money should be more highly motivated to behave rationally, and their level of cooperation should be high.

Reward level has been manipulated in a number of studies, with mixed results; for example, Gumpert, Deutsch, & Epstein (1969) found no difference in behavior as a function of differences in real money rewards, while Gallo, Funk, & Levine (1969) found greater reward levels generated greater cooperation (in a six-choice nonmatrix form of the game). Still it seemed reasonable that the greater the money potentially available in the game, the more Ss should be motivated to behave rationally and cooperate.

Understanding was examined in the present research through the manipulation of instructions. Most past studies have used very brief instructions that merely pointed out the alternatives available to the Ss. It seems reasonable that Ss would not completely understand the nature of the game with just a brief introduction to it, since payoff matrices should be totally unfamiliar and, like tables and quantitative concepts generally, not easily grasped. Radlow (1965) has shown that instructions which emphasized the nonzero-sum nature of the PD generated greater cooperation than did a more typically brief form.

In summary, the present research manipulated three variables—inducement for participating, reward level, and instructions—that are independent of the structure of the PD but hypothesized to affect choice behavior in the game. If these variables were found to affect the level of conflict manifested in the PD, the results of past studies could be interpreted as irrelevant to the models that prescribe cooperation, since these theories assume enlightened, motivated Ss.

SUBJECTS AND RECRUITMENT

The Ss were 160 male undergraduates enrolled in introductory psychology courses at Michigan State University. In half of the classes, sign-up sheets informed potential Ss that one research credit (the usual inducement) used at Michigan State) would be awarded for participation; in the remaining classes, they stated that no research credit would be given, but instead, Ss would be paid for their time.

It should be emphasized that Ss in both conditions were volunteers; only the reason for volunteering differed. Students in introductory courses are not required to serve as Ss. They earn extra credit by doing so, but they can earn the same amount of credit by performing some alternate task, such as writing a short paper.

INSTRUCTIONS[2]

Two sets of instructions were used. Half the pairs of Ss were given instructions that were typical of most PD experiments: they briefly described the two alternative choices available to each S and the resulting four cells of the PD matrix. The remaining pairs of Ss were given more detailed information. These instructions first presented the payoffs available in a nonmatrix decomposed (Pruitt, 1967) form so that the Ss could more easily realize the interdependency inherent in the game. Then they described the matrix and suggested, in a neutral manner, different strategies that might be adopted in making choices.

Since there was the possibility that the two sets of instructions differed in the degree and direction of bias potentially present in them, a pretest was performed. Two samples of five Ss each read one form of the instructions, and they were asked if they thought the E was trying to get them to respond in a certain way and, if so, how. Results indicated that neither set of instructions was biased in favor of cooperation or conflict.

REWARDS

Two sets of matrix values were used, with one set having payoffs that were 10 times as great as the other (see Table 1). Half the pairs of Ss were presented with one form of the matrix, the remainder with the other form.

DESIGN AND PROCEDURE

The manipulation of the three variables described above provided a 2 (inducement to participate) by 2

Table 1
High and Low Reward PD Matrices

Player A's Choices	Player B's Choices	
	Cooperate	Conflict
	High Reward Matrix (in Cents)	
Cooperate	50, 50	10, 70
Conflict	70, 10	30, 30
	Low Reward Matrix (in Cents)	
Cooperate	5, 5	1, 7
Conflict	7, 1	3, 3

Note—The first entry in each cell is the payoff to Player A.

(instructions) by 2 (levels of reward) factorial design, with 10 pairs of Ss per cell.

Members of a pair were brought separately into the experimental room and seated on opposite sides of a table which was divided in half by a screen 4 ft high; this screen prevented an S from seeing the other person. On the table in front of each person was a pad of paper with sheets numbered from 1 to 30. The letters "A" and "B" appeared on each sheet.

The E, who stood at the middle of the table between the Ss, presented the appropriate instructions and answered any questions. Each person then made his first choice by circling the appropriate letter on the first sheet of his pad. After both Ss had chosen, the sheets of paper were collected, and each person was given his respective payoff.

This procedure was followed for 10 trials. When the 10 trials had been run, persons who were induced to come for research credit were given, in addition to the money that they made in the game, a credit slip. Ss who were induced to come for money but who were assigned to the low reward level conditions were, without prior notification, given an extra dollar at the end of the session. Before they left, Ss were pledged to secrecy.

RESULTS

The percentage of cooperative choices per pair over the 10 trials was computed; the means of these percentages for each condition of the three variables are presented in Table 2. Arcsin transformations were performed on the data to stabilize the variance, and these scores were subjected to an ANOVA (df = 1/72). Further, as Winer (1962, p. 208) suggests, individual comparisons were performed on the main effects of the three variables, since hypotheses were directional (money as an inducement, high-understanding instructions, and high reward level were all expected to generate more cooperation).

Table 2 indicates that two of the three variables affected the level of

cooperation in the predicted direction, and the ANOVA revealed both effects to be significant: money as an inducement produced significantly more cooperation (t = 2.53, p < .01) than did research credit; high-understanding instructions yielded significantly greater cooperation (t = 1.68, p < .05) than did the low-understanding instructions. The results for reward level were in the opposite direction from that predicted, but the difference was not significant (t = −1.48). Further, no interactions approached significance (highest F = 0.98).

DISCUSSION

The findings for reward level, as with most negative results, are difficult to interpret. Since the studies that have examined this variable, including the present research, have differed on a number of dimensions, the reasons for the disparate findings are not readily apparent. However, for the most part, the studies that produced negative results used a simple PD with a small number of trials (≤ 20). Most research that has found greater cooperation with greater reward level has tended to use more complicated situations (e.g., the six-choice PD of Gallo et al, 1969) or more trials (e.g., McClintock & McNeel, 1968, ran Ss for 100 trials).[3] It could be that the potential for some "easy money" that was present in the studies using the more simple procedures generated in Ss feelings of suspicion about being allowed to keep their rewards and/or guilt about being inequitably overpaid (Adams, 1965). Either feeling, if present, would tend to lower cooperation. Such an interpretation is, of course, highly speculative, but it does account for the disparate results and, therefore, merits further investigation.

Whatever the reasons why reward level failed to produce the expected effect, the fact remains that the results did support two of the three hypotheses. These findings confirm the general proposition that the low level of cooperation typically found in the replicated PD is a function of factors which are independent of the structure of the game. Most prior research implicitly assumed that Ss both understood the nature of the game and were motivated to play it well (i.e., wanted to make as much money as possible). The present results seriously call into question these assumptions. The deception of many PD experiments is that, by producing conflict, they appear to model those real-life situations where rational, motivated persons find cooperation difficult to attain. But, as the present research indicates, they model only the result, not the process; they

Table 2
Mean Percent Cooperation for Conditions of Inducement to Participate, Instructions, and Reward Level

Conditions	Percent Cooperation
	Inducement to Participate
Money	72
Research Credit	55
	Instructions
High Understanding	69
Low Understanding	58
	Reward Level
High	59
Low	68

produce conflict for the wrong reasons—for lack of understanding and motivation.

The question becomes, what are the factors which determine real-life conflict? The answer obviously must await future research, but a number of variables, such as imperfect information, asymmetric power and threats, and numerous alternative choices, seem likely candidates. In any event, it is clear that the typical PD situation is somewhat too simple to yield relevant findings and that answers to questions of real-life conflict must be sought elsewhere.

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NOTES

1. The PD is a two-person two-choice game in which each person independently chooses a dominant ("conflict") or nondominant ("cooperative") alternative. The structure of the game is described in detail elsewhere (e.g., Rapoport & Chammah, 1965), and it is assumed that the reader is familiar with its essential features.

2. Verbatim presentation of the instructions is beyond the scope of this report. However, copies of the instructions can be obtained upon request to the first author.

3. An exception to this conclusion is the recent study by Gallo & Sheposh (1971) which found that Ss who played 20 trials of a PD for real money were more cooperative than were Ss who played for imaginary money. However, the conclusion is congruent with the results of most studies.

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