Information on the nature of the game as a determinant of behavior in the prisoner's dilemma

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Fifty male and 50 female Ss played single trials of six prisoner's dilemma games (PDGs) in each of two experimental conditions (ECs). In EC1, Ss read a descriptive matrix prior to playing. In EC2, no descriptive matrix was presented. Within each EC, two forms of matrix were employed: (A) where strategies were explicitly labeled COOPERATION and COMPETITION and (B) where strategies were identified by letters only. No significant sex differences were found. Significant differences were found in competitive behavior: EC1A > EC1B and EC1A > EC2A. The findings indicate that increased information results in increased competition.

There is now an extensive body of literature in experimental games with well-established findings related in particular to the PDG. By and large, the major finding has been that most experiments employing the reiterated PDG result in a high overall percentage of cooperative behavior on the part of Ss, even though it is to their joint benefit¹ to cooperate on a series of plays. Much of the completed research has concentrated on the level of cooperation observed, and many factors have been researched. Bixenstine et al (1963) and Gallo et al (1966) have reported that the level of cooperation is influenced by strategy choices of the other player, while other Es have shown the level of cooperation to be in part dependent on other factors such as (1) the personality of the players (Sermat, 1968); (2) the magnitude of the payoffs (McClintock & McNeel, 1966); and (3) the information available concerning the other player's characteristics (Mack et al, 1971). Additional studies have been conducted in attempts to elicit increased levels of cooperation (Scodel, 1962).

When we look at the format of the PDG, however, we may well ask why cooperative behavior is exhibited at all—the "partial reinforcement effect" inherent in the game, together with the game-theoretic outcome, both point to a "rational" choice (in the game theory sense) of the competitive strategy, D², on every play. It can be argued that each cooperative choice is an irrational one on the part of the S who makes it. Why then does it occur? It is the conviction of the present authors that the reason lies in the total abstraction of the game form usually employed and the resultant lack of understanding about the situation exhibited by Ss at the beginning of play. [In the majority of studies reported, the amount of observed

cooperation decreases over time (cf. Rapoport & Chammah, 1965), indicating that as players become more aware of their own choices in relation to those of the other and as they begin to understand the consequences of their actions, they begin to change their pattern of play in the direction of a more rational choice.] In short, while information effects with regard to many variables have been investigated in the past, little attention has been paid to the provision of explicit information regarding the nature of the game itself, beyond an abstract presentation of the payoff matrix and the values it contains. It has long been held that in some way information influences the decision-making process—i.e., that there is some measure of information quality to which one can relate a measure of quality of decision. Our general hypothesis holds that the relationship of behavior in a choice situation is some function of the amount, quality, and comprehensibility of information in the possession of the decision maker. Within the PDG situation, the present experiment was designed to consider the possible effects of providing Ss

with more complete and more comprehensible information regarding the nature of the game and the consequences associated with each strategy choice. The narrowed hypothesis relevant to this study states that increased quantity and quality of information about the nature of the game will tend to increase the number of rational choice (i.e., competitive) decisions made by Ss during play.

METHOD

Two hundred Ss taken from an introductory psychology course played one trial of each of six PDGs under one of two experimental conditions (ECs): EC1, where Ss were presented with a descriptive form of the general PDG payoff matrix prior to playing the PDGs, and EC2, where no such descriptive matrix was presented. The descriptive matrix used was as follows (using the convention established by Pilisuk & Rapoport, 1964): R, R—both WIN the same amount; T, S—you WIN MORE, the other player LOSES; S, T—you LOSE, the other player WINS MORE; and P, P—both LOSE the same amount. Within each EC, two forms of the matrices were employed for the six PDGs played: (A) where the strategies were explicitly labeled COOPERATION and COMPETITION, and (B) where the strategies were identified by letter only (see Fig. 1).

Matrix Form A was judged to give more information about the nature of the game than Matrix Form B. Four subgroups (N = 50 in each) were employed. Within each subgroup, Ss were segregated by sex. The payoff matrices used in the six PDGs employed in the experiment can be specified by the parameters listed in Table 1 (again using the convention of Pilisuk & Rapoport, 1964).

The experiment was conducted in a group setting, with all Ss receiving the standard PDG instructions simultaneously. Play on the six PDGs was then completed, with Ss receiving

		COOP- ERATION	COMP- ETITION
COOP- ERATION	3, 3	-5, 5	
COMP- ETITION	5, -5	-1, -1	

A

		A	B
A	3, 3	-5, 5	
B	5, -5	-1, -1	

B

Fig. 1. Matrix forms employed showing (1) explicit and (2) nonexplicit labeling of strategy choices.

Table 1
Values for the Six Payoff Matrices Employed

Matrix	T	R	P	S
1	5	3	-1	-5
2	40	30	20	10
3	-1	-2	-3	-4
4	4	3	2	1
5	-10	-20	-30	-40
6	50	30	-10	-50

no feedback as to the outcomes on the individual plays.

RESULTS

The primary measure employed was the percentage of C responses made by Ss over the series of six plays. The findings are summarized briefly in Table 2, which shows the mean percentage cooperation found in each group. A Kruskal-Wallis one-way analysis of variance indicated significant differences (at $\alpha = 0.05$) within the eight experimental subgroups. Using the Mann-Whitney U test, no significant differences were found between the sexes within the matrix-form subgroups of either EC. The results for M and F Ss were therefore combined.

In an attempt to verify our hypothesis that increased information will tend to increase rational choice behavior, the chi-square test was employed to test for differences between the following groups: EC1A vs EC1B, EC1A vs EC2A, EC2A vs EC2B, and EC1B vs EC2B. The chi-square test indicated significant differences (at $\alpha = 0.01$) for the following comparisons: EC1A vs EC1B, and EC1A vs EC2A. (In terms of competitive—i.e., rational—choice behavior: EC1A > EC1B and EC1A > EC2A.) No other statistically significant differences were found.

DISCUSSION

The most significant finding was that the addition of information about the nature of the game and about the consequences of the strategy choices resulted in a greater degree of competitive behavior on the part of Ss, thus giving support to our hypothesis. This finding may be viewed as supportive of the work of Cangelosi,

Robinson, & Schkade (1968), who, using a more general decision-making task, found that information about the task significantly altered the choices made by Ss in the direction of greater rationality. (In the PDG, the competitive choice, D, is also the game-theoretic rational outcome.) It is to be noted that, in the present study, increased rationality is exhibited only when additional information is presented regarding both the nature of the game and the consequences of strategy choice (EC1A). Information regarding either the nature of the game or the strategy-choice consequences, when presented alone, appears insufficient to alter behavior in the direction of rational choice (EC1B $\approx$ EC2B and EC2A $\approx$ EC2B).

At first glance, the present findings, while in accord with those of Cangelosi et al, may appear to be at odds with the work of Orwant & Orwant (1970), who reported that information, in the form of "interpreted" matrices, resulted in significantly less competitive behavior. Closer examination, however, indicates that the information provided by the interpreted matrices (called "real-life" situations by the authors) was of a different sort to that provided Ss in the present study. While the Orwant and Orwant experiment attempted to provide situational information to which Ss could relate as persons participating in real-life decision-making tasks, the information provided in the present study was of a clarifying nature, concerning the underlying nature of the game itself and its outcomes—information which could be directly related to the numerical values assigned to the abstract payoff matrices. The two studies are not therefore directly comparable, and the apparently opposite findings should not be seen as necessarily conflicting. It is concluded, therefore, that the hypothesis was substantiated by the results and that increased information regarding the nature of the game and the consequences of the strategy choices does indeed lead to increased rational choice behavior.

Table 2
Mean Percentage Cooperation Found for Each Experimental Group

Experimental Condition	Percent Cooperative Response
EC1AM	21
EC1AF	36
EC1BM	41
EC1BF	36
EC2AM	48
EC2AF	36
EC2BM	44
EC2BF	33

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NOTES

1. It is to be noted that "maximization of joint benefit" is not necessarily the same as "maximization of self-interest" and should not therefore be automatically equated with rationality.
2. The following symbols are used throughout for the PDG: C for cooperative and D for defecting (competitive) choices.