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ABSTRACT

This paper begins by reviewing previous research concerning the external validity of mixed-motive games as models of international conflict, interpersonal behavior, and behavior in large-scale social dilemmas. Two further experiments are then described, both of which cast further doubt upon the usefulness of such games as models of any real-world reference system. The author cites the large number of publications existing in this area, and compares it to the small number of validation attempts, suggesting that such studies are worth carrying out only if a correspondence can be established between behavior in the game nad behavior in an external reference system. Because of the difficulty of establishing such a correspondence, the author suggests redirecting validation attempts away from individual analysis, to focus more on situational variables in games and real-world dilemmas. (Author/BP)

Is Game Behavior Related to Behavior in Any Other Situation?

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Running Head: Is Game Behavior Related to Any Other Situation

(Rough Draft: Comments and Criticism appreciated.)

Abstract

Previous research concerning the external validity of mixed-motive games as models of international conflict, interpersonal behavior, and behavior in large-scale social dilemmas is reviewed. The relative scarcity of validation attempts in comparison to the number of publications is pointed out. Two experiments which cast further doubt upon the usefulness of such games as models of any real-world reference system are briefly described.

Is Game Behavior Related to Behavior in Any Other Situation?

Game research is interesting, relatively inexpensive and easy to do, but is it meaningful? Are psychologists merely creating an elaborate system of predicting behavior in artificial systems of their own creation? Despite the multitude of published studies of game behavior, the evidence for the external validity of such studies is still unsatisfactory. This paper will review evidence relating to the external validity of mixed-motive games and briefly present research casting some doubt upon the external validity of N-person mixed-motive games which have recently been proposed as tools for the study of behavior in social dilemmas such as pollution and overpopulation.

In discussing the problems of validating games, Hermann (1967) pointed out that the criteria for validation vary according to the purposes for which the game was developed. The study of mixed-motive games has been primarily directed toward hypothesis and theory construction concerning cooperative behavior in a variety of real-world situations. The task of establishing the external validity of mixed-motive games in social psychology is to establish some correspondence between behavior in the game and behavior in the refernce system to which one wishes to generalize.

Different game researchers have appeared to have at least three different reference systems in mind in their study of game behavior. The behavior of players in such games as Prisoner's Dilemma and Chicken has been compared to the behavior of nations in the area of nuclear deterrence (e.g., Gallo, 1972; Rapoport, 1962). Other researchers have attempted to generalize to cooperation in face-to-face interaction (Kelley & Stahelski, 1970; Sermat, 1970; Speer, 1972). Still others have attempted to generalize from behavior in N-person mixed-motive games to cooperation in large-scale

social dilemmas such as pollution and overpopulation where cooperation must occur in groups too large for face-to-face interaction (Meux, 1973; Dawes, McTavish & Shaklee, Note 1). Each of these three reference systems will be discussed as external validation efforts are reviewed.

Game Behavior and International Conflict

Although many writers have promoted mixed-motive games as models of international arms races, no empirical evidence has been presented which demonstrates that variables studied in game research operate the same way in conflict between nations. Gallo (1972) noted that increasing the stakes in a game appears to increase the probability of cooperation. He then suggested the Cuban Missile Crisis as an example from the reference system where raised stakes resulted in conflict resolution. He also suggested that the Vietnam War might continue until the stakes were raised to the point of a nuclear showdown. Since the publication of his speculations, the United States has withdrawn before the stakes became that extreme. What, then, can we conclude about the correspondence between game behavior and international conflict? The answer is, of course, nothing. But would the conclusion have been any different if events had occurred as Gallo suggested they might? No, we would then have had two positive instances of an increase in stakes to the level of nuclear threats leading to conflict resolution. But before drawing conclusions we would want information about the relative likelihood of conflict resolution under conditions of increased versus reduced stakes. We would also want information about the incidence of raised stakes failing to produce conflict resolution. Of course, no one is likely to be around to record or draw conclusions from failures in conflict resolution under conditions of the ultimate stakes involved in nuclear deterrence.

It is no surprise then that no social psychologist has presented evidence showing a correspondence between game behavior and international conflict.

A mutually exclusive and exhaustive categorization of historical conflicts regarding their levels of stakes and their outcomes, conflict resolution versus war, would be required. The problem is even more intractable when one considers the scarcity of well established findings concerning the effects of particular variables on cooperation in games. Gallo's example of a finding from the laboratory which might generalize to international conflict is still being disputed at the level of laboratory findings (cf. Wrightsman, O'Connor & Baker, 1972).

Given the difficulty of establishing the external validity of games as tools for the study of international conflict, how is one to evaluate the more than 15 years which social psychology has devoted to the study of cooperation in games? Surely this work has not proceeded without demonstrating generalization to some interesting reference system? Unfortunately, very few attempts have been made to establish external validity and most of the attempts have failed to produce evidence of a correspondence between cooperation in the game and the reference system.

Most of the published studies concerning mixed-motive games and their external validity have not made direct comparisons of behavior in the game and in a reference system. Instead, they have relied upon a model which proposes that cooperation in any situation including games, face-to-face interaction in small groups, and anonymous choices in large-scale social dilemmas, is at least in part a function of the personality and attitudes of the people involved. There is a fairly large body of research devoted to demonstrating a relation between attitudes or personality and game cooperation. Such research appears to assume that the personality and attitudinal variables will have the same effects upon cooperation in non-game situations. In this regard, the external validity of the game appears to be an assumed property of such research. Perhaps, the only reason for including such research in an attempt to evaluate progress in establishing

the external validity of games is that the personality and attitudinal variables are measured outside the game situation and in the case of the well-established measuring instruments for personality and attitudes, the measures themselves have already shown some form of construct or predictive validity.

Game Behavior, Personality, and Attitudes

In this section, personality and attitudinal variables will be discussed in order from those least promising as predictors of game cooperation to those most promising in that regard.

Several personality factors have been tested for relationships in only one experiment and have yielded no relationship to game cooperation. Wrightsman (1966) tested the following factors and found negative results relating to trusting or trustworthy choices in a two-trial sequential choice Prisoner's Dilemma game: (a) Chein's anti-police attitudes scale, (b) Chein's personal optimism scale, (c) Agger's political cynicism scales (also negative results in Uejio & Wrightsman, 1967), (d) Rehfisch Rigidity Scale, (e) Berkowitz's Social Responsibility Scale.

Other investigators have tested the following variables with negative results: (a) Pilisuk, Potter, Rapoport, & Winter (1965) found no relationship between self acceptance and cooperative play in a disarmament game; (b) MacDonald, Kessel & Fuller (1972) found no relationship between scores on the Rotter Interpersonal Trust Scale and cooperative behavior in a sequntial choice Prisoner's Dilemma game; (c) A measure of altruism showed no relationship to cooperation in four mixed-motive games (Bixenstine & Blundell, 1966) or to cooperation in a six-person Prisoner's Dilemma game (Bixenstine, Levitt, & Wilson, 1966).

Other personality factors have been tested at least twice with mixed findings. Relationships have been found but failed to replicate for the following variables: (a) The Radicalism/Conservatism Factor of the

Sixteen Personality Factor Questionnaire (16PF) was positively related to cooperative behavior in a version of the Trucking game (Mack, 1972), but failed to show a relationship to cooperation in the Prisoner's Dilemma game (Gillis & Woods, 1971); (b) the Emotional Stability Factor of the 16PF showed the same findings as above, i.e., positive findings by Mack and negative findings by Gillis and Woods; (c) the personality variables aggression has also shown mixed results. Aggression as measured by the Gough Adjective Check List was positively related to defection in a Prisoner's Dilemma game (Marlowe, 1963) in one study, but failed to replicate in another (Noland & Catron, 1969). Aggression as measured by the Buss-Durkee Verbal Hostility Scale showed no relation to cooperation in a sequential choice Prisoner's Dilemma game (Wrightsman, 1966).

Theoretical values as measured by the Allport-Vernon-Lindzey Study of Values might be expected to correlate with cooperative choice in a Prisoner's Dilemma game because cooperation is the riskier choice and several studies have found theoretical values to be related to a preference for risk taking (Conger, Gaskill, Glad, Rainey, Sawrey, & Turrell, 1957; Scodel, 1961; Scodel, Ratoosh, & Minas, 1959; Sherman, 1968). However, Mack (1972) is the only investigator reporting a positive relationship between theoretical values and cooperation in a mixed-motive game (a variety of the Trucking game). Two other studies failed to find any relation between theoretical values and cooperative choices in Prisoner's Dilemma games (Bixenstine & Blundell, 1966; Bixenstine, et al, 1966). And more directly, Dolbear and Lave (1966) failed to find a relation between risk preference and cooperation in a Prisoner's Dilemma game.

Because failure to replicate findings of research relating personality to game behavior is quite common, those factors which have shown relationships but have only appeared in one study should be viewed with considerable skepticism. Such factors include: (a) cooperativeness as measured by a

test of social insight was positively related to cooperation in a Trucking game (Mack, 1972); (b) the need for power as measured by the Thematic Apperception Test was related to defection in a one-trial Prisoner's Dilemma game (Terhune, 1968); (c) personal relations as measured by the Guilford Zimmerman Temperament Survey was related to cooperation in a Trucking game (Mack, 1972); (d) self disclosure as measured by the Jourard scale was related to cooperation in a Prisoner's Dilemma game (MacDonald et al, 1972); (e) exhibition as measured by the Edwards Personal Preference Schedule was related to behavior in a Trucking game (Mack, 1972).

A final category of personality and attitudinal variables includes seven variables which have been most extensively explored, and while yielding some mixed results, show the most promise of being significantly related to game behavior. These seven factors are discussed below.

1. One of the earliest and most widely quoted findings in this area is Deutsch's finding (1960) that authoritarians (California F Scale) are less trusting than non-authoritarians. Subjects played a sequential choice Prisoner's Dilemma game. They were classified as trusting if they made a cooperative choice when responding first. Deutsch found a point biserial correlation of .50 $p < .001$, between authoritarianism and lack of trust. Two studies using the sequential choice method have replicated Deutsch's findings (MacDonald, et al, 1972; Wrightsman, 1966). Nevertheless, using a regular Prisoner's Dilemma paradigm, three unpublished studies (see Baxter, 1970) and one published study (McKeown, Gahagan, & Tedeschi, 1967) failed to find a relationship between authoritarianism and defecting choices. Two studies using other game measures of cooperation also report negative results. Fry (1965) also failed to find a relation between authoritarianism and defection in a three-choice, tacit coordination game, and Wood, Pilisuk, and Uren (1973) failed to find a relation between authoritarianism and reactions to martyr behavior in a modified three-person Prisoner's Dilemma game. Klein

and Solomon (1966) failed to find a relationship between F scale scores and defection by schizophrenics in a Prisoner's Dilemma game.

2. Another early and widely quoted finding is that people with internationalist attitudes are more cooperative in games than are people with isolationist views. Lutzker (1960) administered a scale of internationalism to 484 subjects and paired the extreme scoring subjects in homogeneous and heterogeneous pairs for a thirty-trial game of Chicken. He found that internationalist pairs made more cooperative choices, and were more likely to both cooperate at once than were isolationist pairs. Competition did not increase over trials in internationalist pairs as it did in other pairs. Similar findings are reported by McClintock, Harrison, Strand, and Gallo (1963) for a Chicken game played by homogeneous pairs of extreme internationalists and extreme isolationists. McClintock, Gallo, and Harrison (1965) found that internationalists were more cooperative to a cooperative strategy, but isolationists were uniformly competitive to either cooperative or competitive strategies when playing an asymmetric Prisoner's Dilemma game. Sermat (1968) found a significant correlation between internationalism and cooperation in a Chicken game.

Using games other than Chicken, three studies have failed to find a relationship between internationalism and tendency to cooperate in mixed motive games. Sherman (1968) compared choices among game matrices and did not find any tendency for internationalists to choose less competitive matrices. Pilisuk, et al (1965) did not find any relation between internationalism and cooperation in a disarmement game. Bixenstine, et al (1966) found no relation between internationalism and cooperative play in a six-person Prisoner's Dilemma game. The three failures to replicate all differ from Lutzker's study in not preselecting extreme internationalists and isolationists and in using different games.

3. A third variable, need for achievement, has shown a relationship

to cooperative game play by male subjects. Chaney and Vinacke (1960), using the Edwards Personal Preference Schedule, created male triads consisting of one subject high on need for achievement, one high on nurturance and one intermediate. The high achievement subjects took an active role in initiating cooperative play in a board game allowing the formation of coalitions. Amidjaja and Vinacke (1965), using the French Test of Insight, replicated this finding for male subjects, but not for females. Terhune (1968), using only male subjects, found that high-need achievement subjects (measured by the Thematic Apperception Test) played one-trial Prisoner's Dilemma games more cooperatively. No failures to replicate have been reported and the relationship has been found for two different games and for three different measures of need for achievement.

4. Cognitive complexity, as a personality factor, has been found to be positively related to cooperation in two non-zero sum games (Phelan & Richardson, 1969; Baxter, 1970). The related concept of tolerance for ambiguity, however, has shown no relationship to cooperation in a disarmament game (Pilisuk, et al, 1965), reactions to martyr behavior in a modified three-person Prisoner's Dilemma game (Wood, et al, 1973), or preference for less competitive Prisoner's Dilemma matrices (Sherman, 1968).

5. The personality variable dominance-submission has quite consistently shown a relationship to cooperative behavior in Prisoner's Dilemma and Chicken games. Marlowe (1963) found that deference and abasement on the Gough Adjective Check List were positively related to extreme cooperation in a Prisoner's Dilemma game. Noland and Catron (1969) report a failure to replicate, but while Marlowe used only male subjects and selected extreme cooperators and defectors for comparison, Noland and Catron used only female subjects and did not select extremes. Measuring dominance with the A-S Reaction Study of Allport and Allport, Fry (1965) found that pairs who were heterogeneous on dominance played a tacit coordination game

more cooperatively than did homogeneous pairs. Moore and Mack (1972), using the A-S Reaction Study, found that pairs of dominant subjects playing a Prisoner's Dilemma game locked into double defection sooner than submissive or mixed pairs and that the proportion of defecting choices began and stayed highest in dominant pairs and lowest in mixed pairs. Two studies have shown that high scores on the dominance scale of the Minnesota Multiphasic Personality Inventory are negatively related to cooperation in Chicken games (Sermat, 1968; Sermat & Gregovich, 1966). For Prisoner's Dilemma, the dominance-submission factor of the 16PF accounted for 11 to 14% of the variance in cooperative behavior (Gillis & Woods, 1971). A failure to replicate this finding is reported by Mack (1972) using a Trucking game.

6. Two measures of concern with moral principles have been studied in relation to cooperative game behavior, with mixed results. Bixenstine's Flexible Ethicality scale showed a relationship to cooperation in a Prisoner's Dilemma game (Bixenstine, Potash, & Wilson, 1953; Bixenstine & Wilson, 1963), but not in an asymmetric non-zero sum game (Bixenstine, Chambers, & Wilson, 1964). Factor G of the 16PF, reflecting concern with moral values, was related to cooperation in one Prisoner's Dilemma study (Gillis & Woods, 1971), but failed to replicate in a Trucking game study (Mack, 1972).

7. One attitudinal factor which might be expected to relate to one's choice in a mixed-motive situation is how trusting or favorable an attitude one has toward mankind in general. Wrightsman's Philosophies of Human Nature (PHN) scale was related to a trusting, cooperative response in a sequential Prisoner's Dilemma game (Wrightsman, 1966). Uejio and Wrightsman (1967) found similar results for Caucasion and Japanese subjects playing a regular Prisoner's Dilemma game against a 76% cooperative strategy, but only when subjects believed their opponent was Caucasion. However, three unpublished studies (see Baxter, 1970) found mixed, mostly negative results. Only some of the earlier findings were repeated, and not at statistically

significant levels. Richman (1971) reports finding no relation between PHN scores and cooperation in either of two regular Prisoner's Dilemma games or in a sequential play Prisoner's Dilemma.

In summary, relationships between personality and attitudes and tendency to cooperate in games have not been found consistently, although a few variables such as authoritarianism, internationalism, dominance, flexible ethicality, PHN, and need achievement have shown replicable effects. Even for these variables occasional negative results [redacted] and positive findings are often questionable since subjects are selected as being extreme and results of analysis of variance are ambiguous in the sense that causal interpretations are open to the same criticism as causal interpretations of correlational findings. Subjects in the extreme groups may differ on unmeasured dimensions because assignment to groups is not random.

Even if a relationship between game playing behavior and certain personality and attitudinal variables could be established, it would only be one step in the direction of establishing correspondence between games and the real-world situations they are developed to study. A more direct approach would be to compare game behavior directly to the analogous real-world behaviors. Only a few investigators have taken such an approach.

Game Behavior and Other Interpersonal Behavior

Sermat (1970) first tested the correspondence between subjects' behavior in a Prisoner's Dilemma or Chicken game and their behavior in another laboratory analogue of cooperation, the Paddle game. The second game was played from one to several months later and care was taken that subjects saw no connection between the two experiments. Pairs of like-sexed subjects consisting of one member who had previously played consistently cooperatively and one member who had played consistently competitively were assigned the task of developing alternating use of a single channel. As predicted, subjects who had previously played Prisoner's Dilemma or

Chicken very competitively succeeded in using the channel first in almost every pair.

In another experiment in the same series (Sermat, 1970) both Chicken and the Paddle game were played by pairs of subjects in the same experimental session. Considerable consistency of behavior was found; subjects who behaved competitively in one game situation tended to behave competitively in the other.

In the last experiment of this study (Sermat, 1970) extreme competitive or cooperative behavior in earlier Chicken or Prisoner's Dilemma games was tested for relations to behavior of a less game-like nature. Subjects first wrote stories under instructions stating that the experiment was designed to determine how well people use their imaginations. Subjects then read one another's stories and discussed them for 20 minutes under no pressure to reach agreement but with instructions saying the discussion was an opportunity to exchange ideas. Interaction was coded by observers using Bales' interaction categories. No significant difference was found between the behavior of previously cooperative and previously competitive subjects. Observers were asked to guess the game-playing strategy of the discussants and were unable to do so. After the discussion subjects were again asked to write their interpretations of the pictures. The amount of agreement in stories of pairs with similar game-playing behavior was higher than that shown in stories of dissimilar pairs.

In summary, Sermat found similarities between Prisoner's Dilemma and Chicken game behavior and behavior in another mixed-motive game, but important behavioral differences between cooperators and defectors were not found in a more natural social interaction.

Kelley and Stahelski (1970) found evidence for a pattern of behavioral and perceptual differences in cooperators and competitors in a wide variety of game situations and in survey responses concerning how they would

act and expect others to act in a student protest situation. Their triangle hypothesis may be briefly summarized as follows:

1. People differ in their dispositions to cooperate or compete.

2. Cooperators in interaction with competitors tend to become behaviorally assimilated, i.e., they respond to competition by becoming competitive, although in interaction with another cooperator they maintain cooperative behavior.

3. Cooperators are aware of their behavioral assimilation, but competitors do not realize the influence they are having over interaction.

4. Cooperators, therefore, develop a world view that others are heterogeneous with regard to cooperation and competition, but because competitors are unaware of the influence they are having in establishing competitive interactions, they come to regard the world as homogeneously competitive.

Evidence supporting the triangle hypothesis has been found in four different experimental games: Prisoner's Dilemma, Chicken, and two complex negotiation games, played in eight different laboratories including three in Europe. Two studies using survey responses concerning how one would react and how one would expect others to react in a student protest situation also support the triangle hypothesis. Several studies concerning the social perceptions of high and low authoritarians also support the hypothesis (see Kelley & Stahelski, 1970). Some of these studies involved judgments made after actual observation or participation in relatively natural social interactions. Although no studies regarding the triangle hypothesis compare the behavior of the same people in both games and natural interactions, the patterns of behavior or behavioral intentions and social perceptions do correspond between settings.

Speer (1972) found considerable correlational evidence that the way married couples play Prisoner's Dilemma games is related to the quality of communica-

tion between them (Primary Communication Inventory) and their marital satisfaction (Marital Adjustment Test) as measured with self-report scales.

In summary, some effort has been made to assess the correspondence between game behavior and other interpersonal behavior. Sermat (1970) found no relation between game playing behavior and behavior observed in a discussion. Speer (1972) found some evidence for correspondence between subjects' game behavior and their self reports on questionnaires concerning behavior in other situations. Kelley and Stahelski (1970) found a consistent pattern of behavior and perception across several games and within questionnaire responses concerning a student protest situation. Nevertheless, considering the amount of research on mixed-motive games there is very little evidence for their generalizability to other interpersonal situations.

Behavior in Games and in Large-Scale Social Dilemmas

The third reference system to which mixed-motive games have been compared is the social dilemma situation in which cooperation is an issue in a group too large for face-to-face interaction. The Kelley and Stahelski surveys discussed above could be regarded as referring to large-scale social dilemmas, but the wording of their questions was more suggestive of face-to-face confrontations between student leaders and university administrators.

A social dilemma is defined as a situation in which an action which is in each group member's best interest to pursue, results in a collective cost to the group such that everyone in the group would be better off if they all refrained from such action. For example, during pollution alerts, people are requested to refrain from using their cars. Reduced driving is socially beneficial (it may shorten the alert) but involves personal costs in terms of delays in getting to work or greater exposure to air pollution if one decides to ride a bicycle or walk. To phrase the dilemma in economic terms, individual's self interests dictate couses of action involving

external costs. The problem of providing collective goods is also a social dilemma, although here self interest dictates refraining from action, and when all members make that decision, the collective goods go unprovided. The remainder of this paper will be concerned with the empirical evidence regarding the correspondence between behavior in social dilemmas and behavior in mixed-motive games.

N-Person Chicken

Meux (1973) compared college students' behavior in an N-person Chicken game with their self reports about how they would behave in the following four social dilemmas: (a) Giving up the use of one's car in Los Angeles, (b) complying with a Presidential request to delay expenditures to fight inflation, (c) refraining from taking a paper clip from one's office because money being used to replace paper clips could be used to provide a fellowship, (d) limiting one's family size to avoid overpopulation.

Subjects whose self reports were intermediate in cooperativeness were eliminated. Twelve-person groups were then composed with each group containing three men who predicted they would behave cooperatively in those four situations and three men who said they would behave uncooperatively in those situations, and two comparable groups of women. The dependent measure was frequency of cooperative choices in 50 trials of a 12-person Chicken game. Subjects were not told how many trials to expect and were not allowed to communicate with one another, although they sat in a row and groups reported some prior acquaintance.

A three-way analysis of variance (Sex x Self Report x Group) showed a significant effect for the variable self report of cooperativeness in the four large-scale dilemmas described in the questionnaire. Further analysis of simple effects suggested that the effect held only for women. Women who predicted that they would be extremely cooperative in the social dilemmas actually behaved more cooperatively in the N-person Chicken game. Although

an analysis of variance was used in discussing the results, the evidence is actually correlational in nature. Extreme scoring groups on the questionnaire may differ systematically from one another on other variables as well as cooperativeness in social dilemmas; i.e., assignment to groups was non-random.

Is N-Person Chicken a Social Dilemma?

In discussing formal models of social dilemmas, Dawes (1975) has pointed out that the two essential characteristics of social dilemmas are that defection is the dominating strategy for each individual, and the choice of dominating strategies results in a deficient equilibrium. In order for defection to be the dominating strategy, the following condition must be met: Let $D(m)$ be the player's payoff for a defecting choice when m players cooperate, and let $C(m)$ be the payoff for a cooperative choice when m players cooperate; at every choice point the following inequality must hold: $D(m) > C(m + 1)$. That is, whenever any number m of other people cooperate, each player is better off defecting than becoming the $m + 1$st cooperator (Dawes, 1975).

In the 12-person Chicken game used by Meux, $D(0) = -100$, and $C(1) = -99$. Thus, when a player is faced with the choice of whether or not to become the only cooperator, defection is no longer the dominating strategy. For all other choice points, however, defection is a dominating strategy which results in a deficient equilibrium, i.e., the result of everyone defecting is less favorable than universal cooperation. Thus, although there is one choice point for which defection is not the dominating strategy, the dilemma exists at every other choice point and one might expect that the decision making within such a game would resemble that in other formal models of social dilemmas and in the real-world large-scale dilemmas.

The other way in which Meux's game departs from an ideal formal model of a social dilemma has far greater implications for the expected external

validity of the game as an analogue to social dilemmas. As Amnon Rapoport (1967) noted in discussing Prisoner's Dilemma, and as Dawes (1975) has pointed out in discussing social dilemmas, a game involving repeated plays may not be a dilemma at all. If players feel that their responses on one trial can influence their opponents' responses on subsequent trials, players no longer face only the dilemma of whether to act in their own best interests or to act according to some concept of collective rationality. Instead, they face the problem of trying to respond in a way which will control or influence the choices which other players will make in the future. Because Meux's subjects were acquainted and all seated in one room, they are especially likely to have been involved in attempting to solve the influence problem. The large-scale social dilemmas to which Meux attempted to generalize do not contain the same possibilities for influence. It is true that individual decisions about whether to pollute are repeated many times, but it is doubtful that their own decisions would have the same potential for influencing the decisions of other people. One or two people who give up their cars in Los Angeles are not likely to have the same effect upon other city residents that one or two staunch cooperators might have on ten other players in an experimental setting. Nor do the residents of Los Angeles have the same power to punish one another for defecting choices.

The next section describes another laboratory analogue which is believed to be more representative of large-scale social dilemmas. Attempts at external validation are briefly described.

N-Person Commons Dilemma

On the basis of Hardin's analysis of the "tragedy of the commons", (1968), Dawes (1974) devised a simple single-play game to be used to model the decision making in social dilemmas. Hardin pointed out that the tragedy of the commons arose because the profit to be gained from adding additional animals to his herd always outweighed the individual's share of the losses resulting

from reduced grazing for each animal. In the Commons Dilemma game proposed by Dawes (1974, 1975) each player faces a choice between defecting and cooperating. A defecting choice results in profits to the individual which outweigh his individual share of a group fine which is spread out over all members of the group. The Commons Dilemma game is defined by the following three conditions:

1. Each player who defects has his payoff incremented by an amount $\underline{d} > 0$ above the payoff $\underline{C}(\underline{N})$ for total cooperation.

2. Players are collectively fined $\underline{d} + \lambda (\lambda \geq 0)$ for each defecting choice, each player's share of the fine being $(\underline{d} + \lambda)/\underline{N}$.

3. $\underline{d} < \lambda/(\underline{N} - 1)$.

The definition guarantees that defection is a dominating strategy (Condition 1) which results in a deficient equilibrium (Condition 2). That is, if all players defect they are worse off than if all cooperate, but no player is motivated to change his decision. Furthermore, everyone is better off the more people cooperate, because the amount gained by an individual defecting is less than the amount lost by the group for his defection (Condition 3).

Extensive efforts to establish the external validity of the Commons Dilemma game have now been made (McTavish, Note 2). A brief discussion of failure to replicate Meux's findings and failure of more extensive efforts to demonstrate external validity will conclude this section, but first arguments will be presented to suggest that these attempts at validation were an adequate test of the external validity of mixed-motive games as analogues of large-scale social dilemmas.

Hermann (1967) has pointed out that the first criterion for establishing a correspondence between a game and its reference system is the internal validity of the game. Do replications of the game yield similar results? In two separate experiments, involving 60 groups of approximately eight

members each, consistent results concerning the effects of communication and assumptions about other people have emerged (Dawes et al, Note 1).

The second criterion is that of face validity: The initial impression of the game's realism. During extensive pretesting of the Commons Dilemma game, experimenters were deeply impressed by the seriousness with which subjects approached the game situation. When one set of subjects played the Commons Dilemma game in a classroom for sizable real money payoffs, the only two defecting subjects were later unwilling or unable to keep their ill-gotten gains of $14.00 each. Responses were completely anonymous, yet both defectors insisted upon volunteering public confessions. One subject announced that he had regretted his choice and donated the money to a church charity and the other defector returned the money to the other members of his group, each of whom had suffered some reduction in his winnings due to the defector's choice. In conditions where subjects were allowed to discuss their decisions, discussions were usually serious, often tense, and almost always included subjects' spontaneous comments regarding analogous real-world dilemmas and the ethical implications of choices.

Hermann (1967) also discusses validity questions directly related to the use of human participants in a game designed to model a real behavioral system. First, do the participants in the game differ in any systematic way from actors in the reference system? By using sizable monetary payoffs and recruiting subjects through newspaper advertisements in both the local daily newspaper and the student newspaper, an effort was made to reduce the usual bias of research which depends upon student volunteers. The use of real payoffs varying from losing $8.00 to gaining $10.50 also helped to ensure that players would experience motivations in the game which are similar to those of actors in the reference system. The monetary consequences of decisions made in the group were immediate and fairly substantial. As noted in the discussion of face validity, participants appeared very highly

involved in the game situation.

In discussing the current disappointing lack of demonstrated relations between real-world behavior and game behavior, Wrightsman et al (1972) listed three properties which a game should have in order to increase its likelihood of showing a correspondence to other situations. The first was that there be opportunity for interaction. In the validation efforts to be described below, 50 out of the total of 60 groups (ranging in size from five to eight members each) were allowed a 10-minute discussion period. The second and third properties Wrightsman, et al recommended were that there be the opportunity for improvisation. Even in the 10 noncommunicating groups subjects were run in face-to-face groups where these properties did exist. The version of the Commons Dilemma game which was examined for external validity was, therefore, a game situation including the conditions under which one would be most optimistic of finding a correspondence with reference system behavior.

As part of a larger research project investigating the effects of communication and assumptions about other people in commons dilemma situations, two experiments were run in which subjects participated in a single-play Commons Dilemma game and also filled out extensive questionnaires concerning their past, present, and future behavior in a wide variety of real-world commons dilemma situations. A complete discussion of procedures and results for communication and assumptions about other people is presented by Dawes et al (Note 1) and a complete discussion of the questionnaires and efforts to test the external validity of the game is presented by McTavish (Note 2).

Subjects in these experiments met in eight-person groups and were faced with a single play of the Commons Dilemma game. Each player made an anonymous choice between a defecting choice and a cooperative choice, and the payoffs to each subject depended upon the total number of cooperative

and defecting choices in his group. A cooperative choice earned $2.50 with no fine to anyone; a defecting choice earned $12.00 with a fine of $1.50 to each group member, including both defectors and cooperators. Defection dominated cooperation by $8.00 but if all defected, fines exactly balanced payoffs and no one won anything. Subjects made their choices privately and were paid and dismissed privately to maintain the anonymity of their choices. In the first experiment, 40 groups were run, and in the second experiment 20 groups were run.

After playing the game, but before discovering the results for his group (i.e., before learning the amount he had won) each subject filled out an extensive questionnaire concerning his behavior in many different real-world situations, including the four questions used in Meux's research (1973). In the first experiment the Behavior Checklist included 90 items measuring three kinds of behavior in everyday situations that were expected to relate to cooperative or defecting choices in the game. Items tapped prosocial behavior, antisocial behavior, and tendency to cooperate in large-scale social dilemmas. Prosocial items tapped a subject's tendency to make his contribution in everyday situations analogous to the problem of providing public goods; ie., situations in which reacting prosocially involves bearing some private cost in order to promote the general welfare. Examples of the kinds of behavior include contributing to charities, aiding stranded motorists, voting, serving on ad hoc community service committees, and writing to public officials. Antisocial items tapped a subjects' tendency to engage in the kinds of everyday antisocial acts which benefit an individual at some social cost. Examples include shoplifting, cheating on taxes and exams, driving while intoxicated, or padding insurance claims. The last category of items consisted primarily of personal efforts to avoid contributing to pollution. Examples include recycling, reducing driving during fuel shortages or pollution alerts, conserving paper, and changing one's

personal habits in order to avoid contributing to pollution. Included within the checklist were the four items used by Meux (1973). The checklist and the Meux items were measures of the subjects' behavior in the reference system which the game attempts to model. In addition, in the first experiment, each subject was rated by three friends for his general tendency to cooperate in situations in which his individual interests conflict with the interests of a larger group to which he belongs.

Results of these extensive efforts at external validation are extremely discouraging for those of us who would like to be able to study large-scale social dilemmas in a laboratory setting. Meux's findings were not replicated. Subjects who scored extremely cooperatively on Meux's items were not more likely to cooperate in the game. In accordance with Meux's analysis procedure, extreme scoring males and females were identified and a two-way analysis of variance (Sex x Cooperativeness on Meux's items) was performed with game cooperation as the dependent variable. Neither main effects nor interactions were significant. When subjects were not allowed to communicate the results were in the opposite direction from Meux's. In the communicating conditions, there was no effect for cooperativeness on the Meux items (F (1, 58) = .89, p < .35). The interaction between sex and cooperativeness on the Meux items also failed to replicate (F (1, 58) = .23, p < .63). Even for female subjects, those who rated themselves most likely to cooperate in the situations Meux described were not more likely to make a cooperative response in the game. Correlational analysis of the checklist items was equally discouraging. Although some correlations from the first experiment were statistically significant, the way a person reported himself behaving in real-world dilemmas accounted for very little of the variance in game cooperation. Furthermore, the way a person's friends rated his general tendency to cooperate in social dilemmas did not relate to that person's cooperation in the game.

Fishbein and Ajzen (1974) have demonstrated that behavioral items can be scaled with the measurement techniques normally applied to items in attitude scales and that such scaling procedures result in multiple-item criteria which correlate more highly with attitudes than do single items of behavior. The 90-item checklist was refined using such scaling procedures, including the creation of two forms of a Thurstone scale of behavior in social dilemmas, and the improved multiple-item behavioral criteria were examined for a relationship to game behavior. A second analysis of the results of the first experiment showed improvements in ability to predict game cooperation from cooperation in everyday social dilemmas, but an attempt to cross validate these results in the second experiment was unsuccessful, suggesting that the improved predictability in the first experiment was due mainly to the capitalization on chance involved in such a post hoc analysis.

Conclusion

The experiments briefly summarized above describe an N-person mixed-motive game which has high face validity as an analogue of social dilemmas. The experiments included most of the conditions which other investigators have suggested would be most likely to yield evidence of external validity. Yet extensive efforts to demonstrate external validity have failed. Encouraging correlational results from the first experiment failed to cross validate, suggesting that any efforts to establish external validity on the basis of correlational findings should be viewed with considerable skepticism unless cross validation is included.

Investigators involved in attempts to understand the determinants of behavior in mixed-motive games have proposed that the games can serve as models of three different reference systems. Yet there is, as yet, little evidence that such games have external validity as models of any reference system of interest. Considering the amount of energy psychologists have expended in discovering the laws of behavior in mixed-motive games, it is

indeed distressing that so little attention has been given to the external validity of such games.

The many difficulties involved in demonstrating a correspondence between games and international conflict may explain the lack of validation attempts directed at that reference system. Previous research on interpersonal behavior and on large-scale social dilemmas also shows little evidence for external validity. What may be needed is a redirection of validation attempts.

Previous research has been primarily directed at showing individual consistency. Researchers have attempted to show that those individuals who behave most competitively in games also behave competitively in interpersonal encounters or in large-scale social dilemmas. Individual consistency of behavior has not been satisfactorily demonstrated. Individual differences in game behavior do not seem to be consistently related to individual differences in reference system behavior.

Perhaps, we need to redirect our efforts so that the individual is no longer the focus of investigation. In the study of obedience, individual differences have accounted for very little of the variance in behavior when compared to situational variables. Current research with games as models of large-scale social dilemmas shows promise of establishing consistant findings concerning such variables as communication and assumptions about other people (Dawes, et al, Note 1) and future validation efforts could move away from individual analysis to compare the effects of situational variables in games to the situational variations in real-world dilemmas. For instance, does the kind of media attention to social dilemmas such as pollution have any effects on our assumptions about other people that can be studied in laboratory analogues? We can conclude that individual differences in game behavior do not relate to individual differences in behavior in the reference systems. However, we have not yet made the kinds of validation efforts necessary to know whether the games are good models on a more aggregate level.

Reference Notes

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