MODES OF CONFLICT RESOLUTION

AND STABLE OUTCOMES

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By

JOHN SANTA-BARBARA, B.A., M.A.

A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfilment of the Requirements

for the Degree

Doctor of Philosophy

McMaster University

(May) 1972

DOCTOR OF PHILOSOPHY (1971)
(Psychology)

MCMASTER UNIVERSITY
Hamilton, Ontario

TITLE: Modes of Conflict Resolution and Stable Outcomes

AUTHOR: John Santa-Barbara, B.A. (Boston College)

M.A. (McMaster University)

SUPERVISOR: Professor P. G. Swingle

NUMBER OF PAGES: xi, 255

ABSTRACT

An important issue in the study of conflict behavior concerns the manner in which one party involved in a conflict situation, can influence his protagonist to resolve the conflict in a way which is mutually rewarding (i.e. cooperative). The present thesis is addressed to this issue. In order to study the relationship between preasymptotic interaction patterns and stable states of cooperation and conflict, the data from a variety of two-person, mixed motive games are organized such that: a) criteria are established for defining stable states of cooperation and conflict; b) preasymptotic interaction patterns are clearly distinguished from these stable, asymptotic states; and c) the role of each dyad member is considered separately.

Organizing the data in the manner outlined above allows the description of strategies used by real subjects which lead to high levels of cooperation and conflict. Dyads who attain a high level of cooperation are found to use a cautious trust strategy. This strategy consists of two components, a cooperative signalling component and a firmness component. The cooperative signalling component is operationalized in terms of the difference in the proportion of cooperative choices between one dyad member and the other. The firmness component is operationalized in terms of the level of retaliation against an uncooperative action (D reciprocity). Dyads who attain a high level of conflict are characterized by an inappropriate signalling component, and/or the absence of a firmness component. Data are presented which indicate how the

requirements for a successful cooperative signalling component vary as a function of other variables.

The implications of focusing on stable outcomes in a conflict situation, and organizing the data in the manner developed here, are discussed in terms of notions current in the psychological literature on conflict behavior. Data from the present thesis are used to argue that strategic variables are relatively more important factors in determining stable outcomes in a particular conflict situation, than either predispositional or personality factors.

ACKNOWLEDGEMENTS

I would like to thank Mike Romano for introducing me to the work of Anatol Rapoport on conflict behavior. Dr. Rapoport's treatment of this subject is a continuing source of inspiration.

Dr. D. W. Carment is to be thanked for his support and encouragement of this project in its early stages. The freedom he offered me to develop my research interests is deeply appreciated.

Special thanks are given to Dr. P. G. Swingle for the many helpful suggestions and criticisms he contributed to this project. His assistance was invaluable to the final organization of this thesis. In addition, I would like to thank him for providing a stimulating introduction to the practical and theoretical intricacies of conflict behavior.

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Chapter I. INTRODUCTION

In the broadest sense, conflict may be defined as the coming together of incompatible forces. As such, conflict is an ubiquitous phenomenon in any complex system, whether biological or social. It is an assumption of the present thesis that conflict so defined is an inevitable occurrence of social interaction. Considering the number of different motives found within individuals, as well as between groups, it is little wonder that conflict is so frequently observed. This assumption, however, does not reflect a pessimistic view of man, implying for example that violence and wars are inevitable. Rather, the assumption reflects a belief that conflict resolution may result in the establishment of norms which serve to reconcile the incompatible forces, to one degree or another. In other words, conflicts are not necessarily situations to be avoided, they are situations to be resolved. At this point, an important distinction must be made between violent and nonviolent methods of conflict resolution. Conflict and violence are not synonymous. Many conflicts are resolved by means other than violence - by appeals to prevailing norms, or by the establishment of new norms.

Many other conflicts are not resolved at all. These conflicts may drain personal or national resources over long periods of time, and generally impede the establishment of satisfactory norms. The reasons for this lack of conflict resolution in some circumstances may be many and diverse. The conflict may not be accurately perceived, if at all. The protagonists in the conflict may not know which of several possible norms to appeal to. The norms appealed to may not be satisfactory to all parties concerned. Indeed, it may not be clear that any norms exist that might be appealed to. Resolution may also fail because one or both of the protagonists does not wish to resolve the conflict because its presence satisfies some other, perhaps psychopathic, needs of one of the protagonists. However, even in the absence of psychopathology, and in cases in which the best of intentions are in evidence, conflicts may continue.

What conditions give rise to satisfactory conflict resolution? What conditions impede such resolutions? Under what conditions do nonviolent attempts at resolution give way to violence? A theory of conflict behavior does not yet exist to completely answer these questions. Until very recently, the domain of conflict behavior was restricted to strategy theorists who dealt with large social forces such as military or labor-management conflicts (e.g. Kahn, 1960), or clinicians who dealt with intrapersonal conflicts in the tradition of Freud. The remainder of this introductory section will briefly describe a more recent, empirical approach to the study of conflict behavior. A justification of the use of the particular paradigm will be given, in addition to a description of the variables which have already been found to affect behavior in conflict situations using this paradigm.

A. The Theory of Games

The impetus for much contemporary research on conflict behavior is the theory of games introduced by v. Neumann and Morgenstern (1947).

These authors provided both a paradigm for studying conflicts of interests, and a model for prescribing how rational decision-makers should behave. What is a game? What are its characteristics? A game involves at least two decision-makers, each of whom has at least two distinct choices. A decision-maker may be an individual, a political party, or a nation. The distinguishing feature of each decision maker is that he has an objective which influences his activity in the game. Furthermore, a player's ability to attain his objective is dependent not only upon his own choices, but also upon the choices of the other player. In other words, the fates of the players (their respective outcomes) are interdependent. These outcomes, or payoffs, represent the utility to each decision-maker of being in any particular state of interaction with the other decision-maker. These utilities are represented on an ordinal scale, and game theory assumes that any monotonic transformation of the utilities in a particular game does not alter the structure of that game.

The structure of a particular game is defined by the relative rankings of each of the outcomes by each decision-maker. If one player's rankings of the possible outcomes is the inverse of the other player's preference ordering, it is clear that their objectives are irreconcilably opposed. The class of games defined as zero-sum games is such a case. In these games, one player's gain is another's loss. There is no provision for a mutually satisfactory outcome. Although the prescriptions of the game theory model are strongest for this class of games, the zero-sum structure does not provide an adequate description of most social conflict situations.

Before describing another class of games which are more germane to the study of social conflicts, let us briefly discuss the model that game theory prescribes. First, the game theory model is a normative one. Game theory prescribes how rational decision-makers should play a particular game. The objective of this theory is to devise rational, fool-proof strategies which should be used to maximize one's outcome, given a particular class of games. A strategy is defined here as a plan of action, a plan for making choices, which takes into account all contingencies and provides instructions concerning which choice should be made in each circumstance. The notion of "rationality" assumes that each decision-maker knows both his own and the other's utility for each of the outcomes. This model also assumes that each of the players is basically an economic man (i.e., his sole objective is to maximize his own gain and/or minimize his own loss).

One of the prescriptions which has emerged from game theory is the notion of a dominant strategy. A dominant strategy exists and is prescribed only in the case when by using it a player does no worse (and, in general, does better), regardless of the strategy chosen by the other player. In the game in Figure 1, Row player may choose A or B and Column player may choose X or Y; the payoff to Row is indicated by the number in the lower half of each quadrant, while Column player's payoff appears in the upper half of each quadrant. In this game, the dominant strategy for Row is to choose B, because B will produce 1 (the most preferred outcome) if Column chooses X, and 3 (more preferred than 4) if Column chooses Y. Similarly, the dominant strategy for Column player is to choose Y. Therefore, if both players follow the "rational" prescriptions of game theory, the interaction state BY will prevail, in which each player receives his third-most preferred outcome. From an examination of the game matrix, it is immediately obvious that both players may similtaneously do better than their third-most preferred outcome. If Row chose A and Column chose X, each player would receive his second-most preferred outcome. By being "irrational," each player may benefit more than by choosing the "rational" dominant strategy.

In what sense may the choices A or X be considered "irrational"? For one thing, these choices expose each of the players to his least desirable outcome (4) if the other player should simultaneously choose his dominant strategy. In such an event, not only will the "irrational" player be saddled with his least-preferred outcome, but the difference between his own and the "rational" player's outcome will be greatest.

This example is interesting for several reasons. First of all, it illustrates a condition in which the rational prescriptions of game theory may lead to absurd outcomes (the third-most preferred outcome rather than the second-most preferred outcome). Game theory is very persuasive in its prescriptions for the various classes of zero-sum games. However, in the case of non-zero sum games, the theory either prescribes strategies which lead to unnecessarily absurd outcomes, or makes no prescriptions at all. (For a thorough review of the strengths and weaknesses of game theory prescriptions, cf. Luce and Raiffa, 1957; Rapoport and Orwant, 1962; and Schelling, 1963). Secondly, this example serves to introduce the role of the gaming paradigm for studies of social motivation, and social interaction processes. Third, this example points out the need for descriptive as well as normative these studies were performed on trees growing in very wet environments. It was believed that trees growing in marsh, swamp, bog, or muskeg would show little if any variation in the widths of the growth rings. The presence of the high water table would prevent any possibility of drought conditions. It was assumed that water is the primary control of growth and that a high water table at a tree site provides an ample and available moisture supply for the tree.

One of the earliest growth ring studies made on bog trees did in fact conclude that water is the most important factor controlling diameter growth. Lyon (1949) reported that the water factor controlled diameter growth of white pine growing in a bog in New Hampshire and that crossdating was possible with trees growing on nearby upland mineral soil. He concluded that the shallow root systems of the bog trees were subject to the rise and fall of the water table in relation to amount of rainfall during the growing season and, hence, to shortages or abundance of water. No correlation was made between growth of either the bog trees or the upland trees with climatic data.

At the same time as the results and opinions on growth and environment summarized above were being expressed, two researchers tentatively considered other possibilities. In contrast to the widely held opinion that water control was probably responsible for diameter growth trends in wet environments, the independent investigations of Giddings and Hustich on growth rings in black spruce and other boreal trees concluded that mean summer temperatures controlled diameter growth. Working with black and white spruce and tamarack (Larix alaskensis Wight) in theories of conflict behavior. How do real players actually play such a game? Do they follow the economic prescriptions of game theory, or does the situation allow the expression of other social motives which must be incorporated into a theory of conflict behavior?

Formal game theory undergoes a qualitative change at the transition from zero-sum to non-zero-sum games. Zero-sum games are games of pure conflict, in which there is no room for compromise. The best one can do is to guarantee himself the best of the worst. Non-zero-sum games, on the other hand, allow for varying degrees of compromise, the extremes being complete cooperation and complete competition. Such situations more nearly simulate real-life types of conflicts in that in most conflict situations there are familial interests between the protagonists. In other words, it is usually not in the best interests of either protagonist to completely annihilate his opponent, for if he did he would be cutting off a source which provides resources for him.

A finite number of unique non-zero-sum games exists, and these have been classified according to the distribution of dominant strategies that their structures allow (Rapoport and Guyer, 1966). There are 78 such games, not all of which are psychologically interesting. Those which are not psychologically interesting are not so, for instance, because their dominant strategies lead to a stable realization of maximum outcome for each player. Many of those games which are psychologically interesting are so because they are mixed-motive games. A mixed-motive game, of which the above game matrix is an example, is one in which each player is motivated both to compete and to cooperate with the other player. The motivation to compete exists because the competitive strategy (B or Y) is the only one which can yield the most preferred outcome. The motivation to cooperate exists because, with full information concerning their own and the other's utility preferences, it is clear to both players that if they both compete simultaneously (BY), they will do worse than if they cooperate (AX). However, if one player cooperates while the other competes, the cooperative player is rewarded with his least preferred outcome (AY or BX). Thus, in order to realize a mutually beneficial interaction, each player must not only overcome his own temptation to compete, but also must trust the other player to do the same.

Mixed-motive situations involve not only a conflict of interests between protagonists, but also a conflict within each player concerning whether to cooperate or compete. This dual inter-, as well as intra-, personal conflict situation is one of the features that has attracted so much attention from social scientists. This does not mean that only mixed-motive games are psychologically interesting, as Marwell and Schmidt (1968) have noted. However, the game paradigm in general, and mixed-motive games in particular, have provided a great deal of interesting empirical data which may be used in the construction of a theory of conflict behavior. Let us briefly examine the reasons for the popularity of this paradigm.

The game paradigm itself has the advantage of providing a clearly defined situation, in which some element of conflict (the structural characteristics of the game) may be experimentally manipulated. It also provides a clearly defined measure of conflict (player's choice of strategy). The two-by-two choice situation outlined above is the simplest type; it should be clear, however, that such an interaction matrix may be expanded both in number of choices (n x n), and in number of players (n x n x n). The complexities of the 2 x 2 are sufficiently challenging so that restricting ourselves to this case is not unwarranted.

The relative clarity of the dependent and independent variables in game situations is in contrast to those used by social scientists who must rely on verbal responses to measure complex concepts such as trust or suspicion. Although it might seem that limiting players to only two responses each prohibits the study of such complex and interesting concepts, let us examine the two matrices in Figure 2, both to see how structural components may affect conflict behavior, and to explore the psychological complexities which can be studied in mixed-motive games. First, note that matrices I and II differ in structure by the definition above. The preference orderings, although the same for both players within each game, differ across games. The preference orderings for matrices I and II are represented in Figure 3 by matrices I' and II', respectively. The outcomes contained in I and II are simply the result of order-preserving transformations of I' and II'. Secondly, note that for game II, neither player has a dominant strategy, as they both do in game I which is simply a version of the game in Figure 1. Row's best response to Column's X is a B, and to Column's Y, an A. Similarly for Column, there is no dominant strategy. Matrix II has no dominant strategy because the outcome associated with the maximum gain (10) is also associated with the maximum loss (-20). Positive

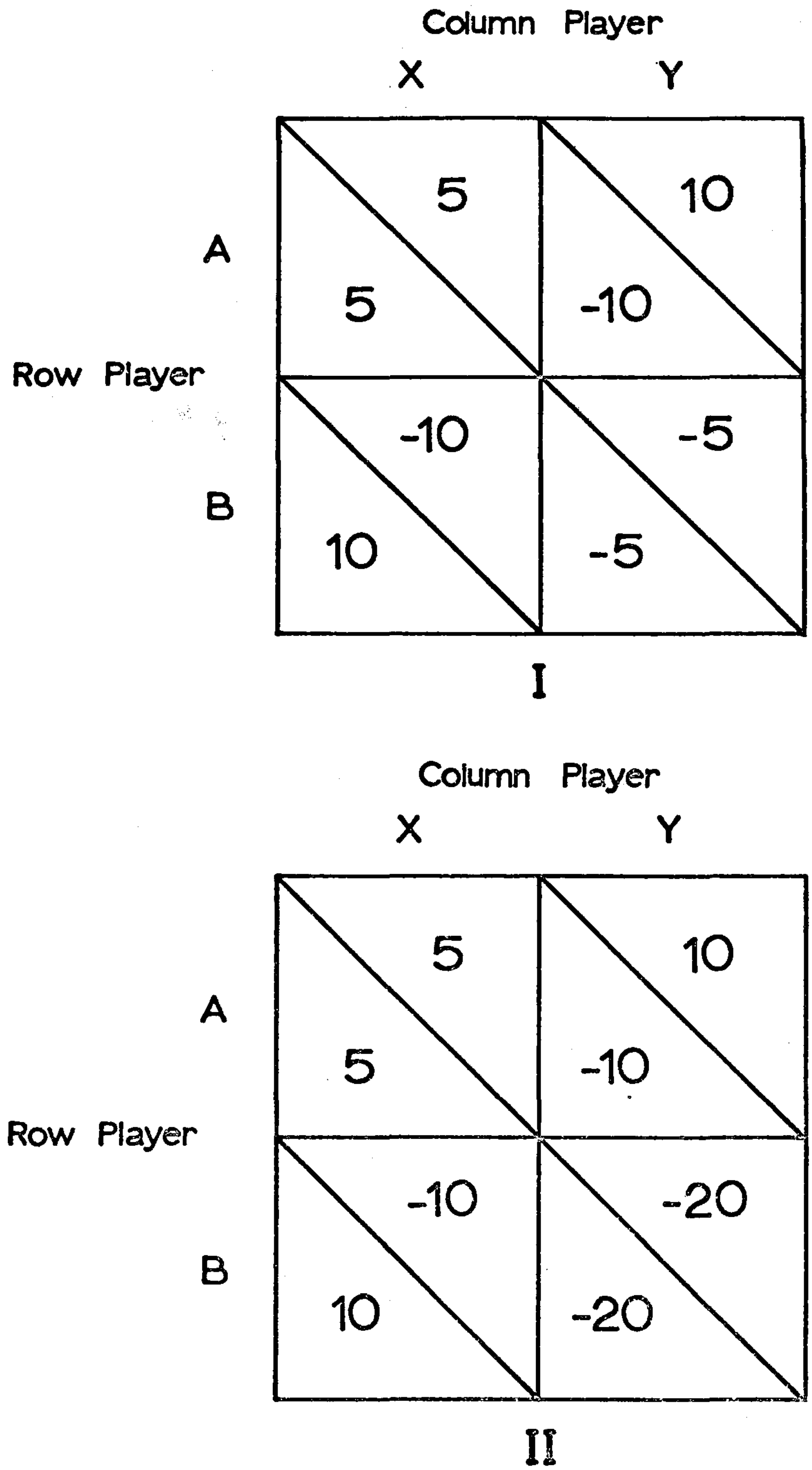
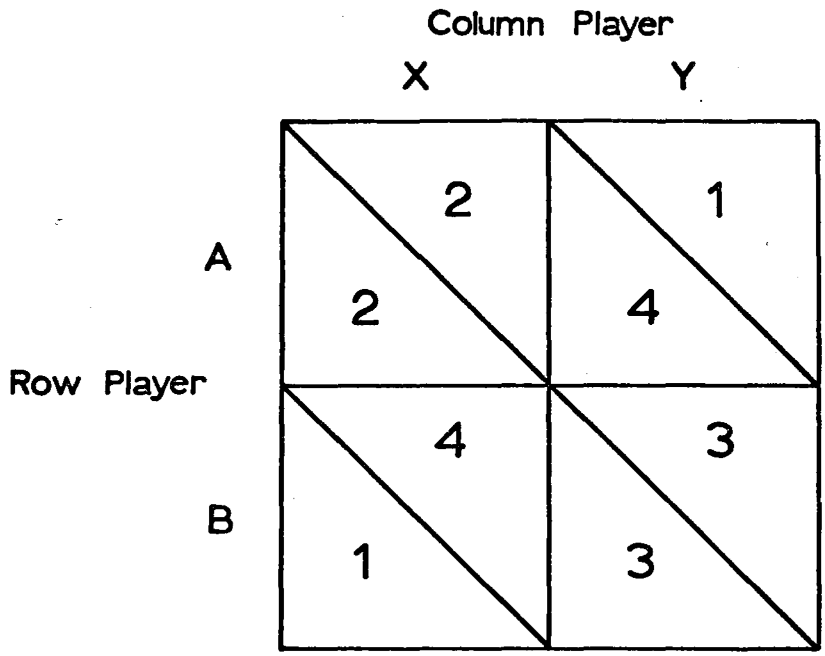
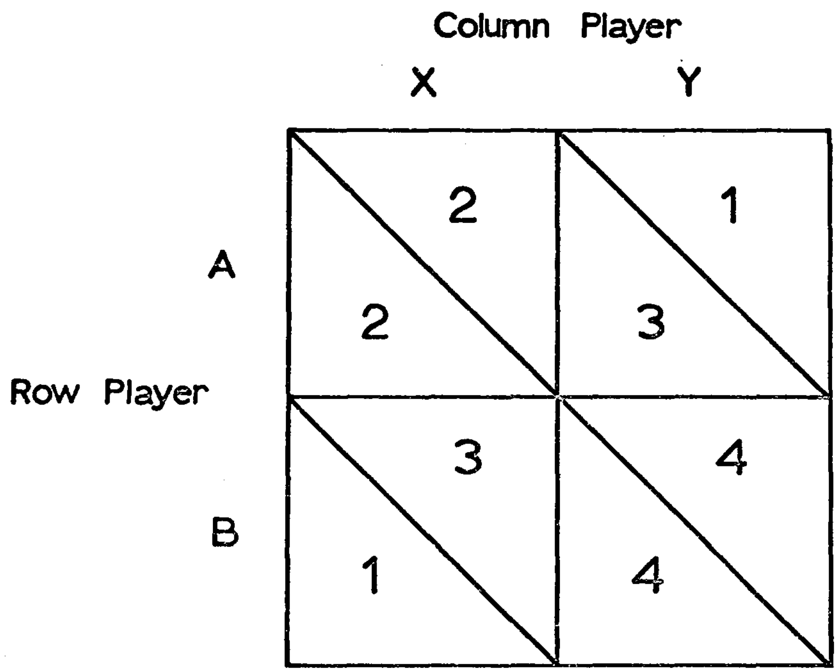


Fig. 2. Matrix representations of a Prisoner's Dilemma (I) and a Chicken (II) game showing the utilities for each player.



I'



II'

Fig.3. Matrix representations of a Prisoner's Dilemma (I) and a Chicken (II) game showing the preference orderings for each player.

and negative goal-directed behavior is cojoined in the single strategy choice of B or Y.

Let us consider what effect this seemingly simple structural change has on the psychology of the players. In game I we noted earlier that trust might be necessary for a cooperative (AX) outcome to be realized. Each player would have to trust the other to forego his maximum gain, before he would be willing to expose himself to his maximum loss by making a cooperative choice. Trusting the other player, however, might prove to be very difficult. If the other is indeed trustworthy (i.e., will make a cooperative choice), either player is better off making his competitive choice. And if the other is not trustworthy (i.e., makes a competitive choice), either player will obtain his worst possible outcome by being trusting.

It might be argued, on a priori grounds, that less trust is required for an AX outcome to be realized in game II than in I. Since the worst possible outcome is cojoined with the best outcome in II, it would seem to make sense for each player to assume that the other will make a cooperative choice, each thinking the other will surely avoid the possibility of obtaining the worst outcome (-20). But one player may then assume that since the other will surely avoid the large loss associated with his competitive choice, why should he not make his competitive choice and obtain the maximum outcome at the other's expense. In this case, one player is assuming that he can take advantage of the other's fear.

This sketch of the player's psychology illustrates a number of points. Slight structural changes may have important psychological ramifications. In the case above, the transition from game I to II suggests a transition from a trust-suspicion dimension to one of "brinksmanship," in which threats and counterthreats are foremost. This sketch also illustrates the complex social issues which may be dealt with in a simple game paradigm. Game I' types have in fact been used to study various aspects of trust and suspicion. (This literature will be reviewed in a later section.) The game matrix may represent any variety of real-life situations with the same structural characteristics. Game I is an example of a Prisoner's Dilemma (PD) game. This situation is one in which two prisoners, held incommunicado, are faced with the choices of confessing (B or Y) to a crime they are both accused of, or not confessing (A or X). They can be convicted only if either confesses. If one confesses he is set free for turning state's evidence and is also given a reward. If the other player does not confess, he is not only convicted by the other's testimony, but is also given a more severe penalty for withholding evidence. If both players confess together, they are given a lighter sentence than if they had withheld evidence. However, if neither confesses, they are both set free. Obviously, the cooperative choice is not to confess, but one must trust the other prisoner to do the same, and to forego the reward for turning state's evidence.

Game II' types have been labelled games of chicken (Ck). This type of structure also fits a variety of real-life situations, from teenagers playing with their automobiles to statesmen playing with their armies. Using the teenagers' situation, the A or X choice is a choice to swerve one's car. The B or Y choice is a choice not to swerve, but to continue on the narrow roadway, hoping the threat of mutual disaster will deter the other driver.

It should be clearly stated at this point that these game structures are not viewed as models of these real-life situations. The structures do seem to contain some elements of the real-life situations, but surely there are so many differences that any simple analogy would be absurd. However, these games do permit operational definitions of such variables as trust, threat, and many other social variables to be discussed below, whose study may help us to understand other, more realistic conflict situations. Games have the advantage of simplicity and flexibility, but we cannot attempt to directly extrapolate game findings to applied problems of conflict resolution. Games, worthy of study in their own right, may only provide hints for a more "rational" approach to conflict.

Some recent investigations have been addressed to this issue of the generality of game findings to more realistic conflict situations. Kelley and Stahelski (1970) for example, report a number of studies which indicate that individuals who tend to be cooperative in a conflict situation also tend to have very different interpersonal perceptions and beliefs about their opponents, than do competitive individuals. The latter tend to believe others are homogeneously competitive whereas the cooperators express a greater variability in their beliefs about others. Evidence is presented which indicates that this relationship holds not only in laboratory gaming and bargaining situations drawn from many countries, but there is also survey data available concerning student-administration confrontations in universities which indicate the same pattern. Orwant and Orwant

(1970) have investigated the relationship between abstract (i.e. matrix) versions of mixed-motive games and interpreted versions of the same games, in which the conflict is described in terms of a real-life situation. They found subjects to be more cooperative when playing the real-life versions. The only other study to date which compares behavior in a game and non-game situation (the latter being a picture interpretation task involving story writing and discussion in dyads) found few differences between cooperators and competitors in the non-game situation. The cooperators and competitors were defined by their behavior in a game situation. In a different game situation, the Paddle Game (cf. Sermat, 1970), most subjects behaved cooperatively although there were some subtle differences in the way cooperators and competitors behaved in this situation. Sermat concludes that broad generalizations from behavior in experimental games to other interpersonal situations is not justified. One of the major problems in comparing such situations involves determining the structural characteristics of the non-game situations. Until reliable techniques are developed for determining the structure of a non-game situation, it is impossible to determine the validity of the game paradigm as a description of real-life conflicts. The structure of the situation has an important bearing on the subjects' behavior, as will be indicated below.

Let us now turn to a description of the variables which have been found to influence conflict behavior. First we will discuss the primary dependent variable used in many studies and introduce some basic characteristics of the data. Then we will explore the independent variables, divided into structural and situational determinants. Finally, the issue most relevant to the present work, strategies, will be examined in some depth.

Chapter II. EMPIRICAL STUDIES STIMULATED BY GAME THEORY

A. Dependent Variables

A variety of indices have been used to measure various aspects of conflict behavior in PD games, the most common of which is a "cooperative" strategy choice. In terms of the examples above, this choice would be A or X, for only by making such a choice will a mutually satisfactory interaction result. What are the characteristics of the data using this index of conflict?

Games may be played for one, two or any number of trials. We will now consider the one- and 300-trial cases, taking data from Rapoport and Chammah (1965). On the very first trial, after each player independently makes a strategy choice without any knowledge of the other player, the proportion of cooperative (A or X) and competitive (B or Y) responses is usually about 50%. In other words, about half of the players choose cooperatively and half competitively. As the game continues, a decrease of about 10% in cooperative strategy choices occurs until about 40 trials have been played. After this initial drop, there is an increase in cooperation which levels off after 150 trials, and remains fairly stable. The particular value of this asymptotic level of cooperative responding is not characteristic of the entire subject population. Most dyads "lock-in" at either the mutually cooperative (AX) or mutually competitive (BY) outcome. The unilateral response states (AY or BX), in which one player cooperates while the other competes, tend to drop out almost entirely after a large number of trials.

This "lock-in" effect is evident in both the number of dyads who persist in one of the mutual outcome response states (AX or BY), and in the correlation coefficients between the cooperative strategy choices by members of a dyad. These correlations are typically very high (i.e., >.90), and seem to suggest that individual differences between members of a dyad are "washed out." The explanation offered for this wash-out effect is that after repeated plays of the game, the structural aspects of the situation dominate any personality differences between dyad members (Rapoport & Chammah, 1965; Tedeschi et al., 1968a).

It is often the case when several hundred trials are played that play is stopped after each 25-trial block so that players may calculate their scores. "Start" and "end" effects have been found with this procedure (Rapoport & Dale, 1966). The probability of a cooperative choice is typically highest at the beginning and lowest at the end of such blocks. The start effect is interpreted as an attempt by each player to "try cooperating" at the start of each 25-trial block, and the end effect is viewed as a last try for the lion's share, since no immediate retaliation can follow.

These measures indicate the basic types of data used by most game researchers. A variety of other measures will be discussed below. Let us now see what types of variables have been found to influence these measures.

B. Structural Variables

One of the primary advantages of representing conflicts in a game format is that the structure of the conflict may be manipulated quite easily. Much of the research on game conflict centers on the relationship between an index of cooperation and the particular structure of the conflict, defined by the payoff matrix.

It is a useful convention to describe each of the payoffs in a game according to its assumed impact on the players. The matrices in Figure 3 may be rewritten in more abstract form, as in Figure 4. R stands for the Reward for cooperation (i.e., after making a C response); T stands for the Temptation to defect (i.e., choosing a D response); S stands for the Sucker's payoff obtained after unilateral cooperation; and P stands for the Punishment associated with defection. This terminology is convenient for some, but not all, mixed-motive games. The structure is defined by some simple restraints placed on the relationship between the varicus payoffs. For example, a PD game (I in Figure 2) occurs if the following relations prevail: $T_i > R_i > P_i > S_i$; and $S_i + T_i < 2R_i$; where $(i = c,r)$. The first restraint is simply a re-statement of the utility ordering mentioned earlier. The second restraint is necessary so that only one mutually cooperative response sequence is possible. The need for such a restraint is obvious. The essential difference between a PD and Ck game (II in Figure 2) is that in the latter, $S_i > P_i$. Another convention is to label the choice associated with an R outcome as cooperative (C), and the other choice as a defection (D). These conventions will be adhered to throughout this review, without implying an endorsement of these labels.

The restraints which define either a PD or Ck game allow the investigation of a wide range of parameters within their particular structure. For example, in order to examine the effects of various levels of mutual punishment on the occurrence of C responses in Ck games, one may vary P while keeping all other payoff entries constant. Rapoport and Chammah (1966) performed such a study and found a non-monotonic relationship between the level of punishment and the level of C responses. Cooperation was least at an intermediate level, rather than at the lowest level of P. At low levels of P, the punishment is not sufficient to deter defection choices. At the highest levels of P, the risks associated with a DD outcome are too great for either player. However, at some intermediate level of P, each player may assume that the other will surely avoid the risk involved, and he, therefore, may safely take the largest payoff. At the same level of P that produces the most defections, there is also an increase in the number of unilateral response states (CD and DC). This event may indicate that some players attempt to preempt their opponents (DC), while others are more willing to appease (CD) such "brinksmanship." The implications of these and related discoveries to notions of military "deterrence" have been discussed by Swingle (1970).

For the PD game, a broad range of parameters may also be varied without violating the restraints that define the game. Rapoport and Chammah (1965) systematically varied each of the entries in a PD game, and found that the level of cooperation increases as R and P increases, and cooperation decreases as T increases. A large number of trials is often required to produce these effects, as indicated by Morehouse (1966). She found no difference in level of cooperation after 50 trials for two values of T.

Several investigators have not been content to vary a single parameter at a time, but have attempted to devise indices which capture

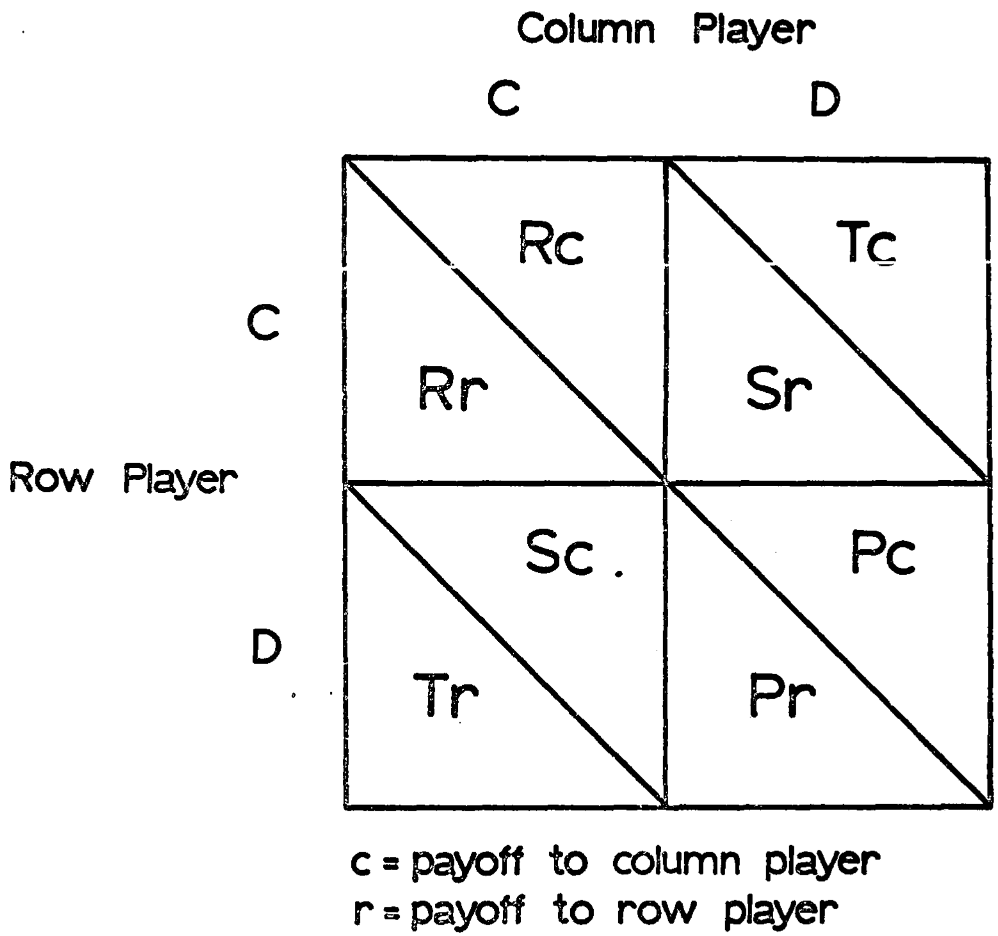


Fig.4. Matrix representation of a mixed-motive game.

the relationship between the various payoff entries. The rationale for this approach rests on the assumption that two motives dominate the PD - one to cooperate and one to compete. If the relative strengths of these motives can be expressed by the relationship of payoffs to each other, an index will be produced that should hold for any linear transformation of a particular game. Rapoport and Chammah (1965) and Steele and Tedeschi (1967) have investigated over 200 possible indices to describe the structure of a PD game. Rapoport and Chammah found that as the ratio (R-P)/(T-S) increases, the level of cooperation increases. Steele and Tedeschi found essentially the same relationship, using 42 different matrices. The Pearson r calculated in the latter study was .64, indicating that a fair proportion of the variance in level of C responses was accounted for by the matrix values of the games.

In the Steele and Tedeschi (1967) study, not all of the matrices satisfied the constraints of the PD game. To eliminate any possible confounding, and to investigate some further dimensions of the payoff structure, Jones et al. (1968) used only PD matrices. Three different values of the index (R-P)/(T-S) were used, and for each value of the index, three different payoff matrices were used, two of which were linear transforms of the first. In addition, the effects of negative and non-negative payoffs were examined. The relationship between the ratio and level of cooperation was found to be logarithmic, and there was no significant effect of the absolute value of the payoffs. In those matrices which contained negative values, there was a significant trend toward more cooperation.

Although more difficult, it is also possible to compare games with similar payoffs but different structures. Rapoport and Chammah (1966) compared several PD and Ck games in which the ratios of R, T and S were equal, but P varied from PD to Ck status. Cooperative responses were more frequent in the Ck games, although the level of CC outcomes was almost identical for both sets of games. The increased levels of C responses in the Ck games almost all resulted in unilateral response states.

A C response in a Ck game may have a different meaning than a C response in a PD game. In a Ck game, a C may be an appeasing response. The greater proportion of unilateral outcomes in the Ck game were at the expense of the DD outcomes, which were more frequent in the PD games. The time course of these measures is also different in the two games. The higher proportion of Cs in the Ck games occurs primarily during the first 200 trials; at this point the level of Cs in the PD game becomes equal.

In summary, this set of results indicates that differences in payoff values do make a difference to players, and in a manner that makes some intuitive sense. At the same time, some not so obvious relationships have been found to indicate the usefulness of an empirical approach. The U-shaped relation between proportion of Cs and amount of punishment was not predictable, a priori, from common sense. Although it is clear from these studies that the structural variable is very powerful, it is equally clear that other variables must also have a potent effect. The finding that negative payoffs induce more cooperation than positive payoffs, strictly speaking, relates to a situational rather than a structural variable. Let us now examine some other situational variables.

C. Situational Variables

For the purposes of this discussion, situational variables are those which describe the environmental circumstances of the interaction situation. Excluded from this category are the structural variables inherent to conflict, and personality variables inherent to the players. Under this rubric, strategy might be considered a situational variable. However, since strategic considerations are central to the present study, they will be treated more thoroughly in a separate section.

Since one of the basic requirements of a conflict situation is the interdependence of outcomes, it would appear obvious that protagonists must be aware of their interdependence for the conflict to be resolved. That awareness is not necessary for cooperation was demonstrated by Sidowski et al. (1956). In this study, each subject was instructed to make as many points as he could by pushing one of two buttons. Each time the subject pushed the left button, another subject operating under the same instructions, but whose existence was unknown to the first, would receive a point. Each time the subject pushed the right button, his partner received an electric shock. Thus, each subject had complete control over his partner's payoff, and only indirect control over his own payoff. Given a free-responding schedule, subjects in this "minimal social situation" learned to cooperate (provide points for each other) in a very few minutes. Even after establishing cooperation, subjects were still unaware that their payoffs were interdependent with those of another subject.

Although awareness may not be necessary for cooperation, it certainly affects the development of cooperation. Kelley et al. (1962)

demonstrated that in a minimal social situation, subjects informed of their interdependencies cooperated more rapidly than those who were naive in this respect. However, some subjects in the naive condition did cooperate if they were forced to respond simultaneously.

It is not terribly surprising that cooperation develops without awareness in this situation. Structurally, the game is one of pure coordination. It would be interesting to pursue the reasons for some dyads not reaching this solution, and what the effects would be of a more conflicting situation.

Two protagonists may realize their mutual dependencies, but be unaware of the actual utilities for themselves or the other player regarding a particular interaction. Given that the interaction situation structurally represents a conflict, Rapoport and Chammah (1965) hypothesized that the absence of information concerning the utilities of each player would result in more cooperation than if the utilities were known. To test this hypothesis, several PD games were played in which the matrix values were either displayed or not displayed. Contrary to predictions, those dyads in the no-display condition cooperated less than those in the display condition. The ability to see the payoffs of the situation, even in a conflict situation, seems to help players realize that tacit collusion is possible.

Withholding the entire payoff structure is, of course, an extreme case. Innumerable subtleties can be explored with respect to the effects of selectively withholding certain aspects of the payoff structure. Swensson (1967), for example, studied the effects of informing only one subject of both payoff structures, while the other knew only her own payoffs. Furthermore, the informed player realized she had more information than the other. Rather than exploiting their less-informed partners, the complete-information subjects tended to make more cooperative moves than the other in a PD game. However, there was a general decline in cooperative choices over the 30 trials, and it is impossible to know whether such unilaterally informed dyads would reach cooperative solutions more often than bilaterally informed dyads. The data suggest, at least, that having more information, and knowing you have more information, may activate a norm of responsibility rather than exploitation. Undoubtedly, if this effect does exist it would interact with many other variables. Swensson (1967), for example, found that this result tended to occur only when communication between subjects was not permitted. The reverse effect occurred when subjects communicated.

Another dimension of the information variable concerns the protagonists' awareness of how they stand relative to their opponent. Several studies have investigated the effect of various types of feedback regarding own and other's gains. For these studies, a "maximizing difference game" (MDG) has been used. This game differs from the PD in that the motive for "defecting" is not to increase one's own gain (since mutual cooperation is the dominant strategy), but to increase the difference between one's own and the other's score. The defecting player actually must take a loss in absolute number of points when he defects. Messick and Thorngate (1967) provided feedback which either informed both subjects only of their own cumulative scores, or of their own and the other's cumulative scores. The results indicate that subjects who knew their opponent's score tried to maximize the difference between their own and the other's score. McClintock and McNeel (1966a) found similar results with Belgian students in a MDG in a low-reward condition. Even when the reward level was high and cooperation profitable, subjects who knew the other's score would defect frequently.

These studies indicate that the desire to do better than an opponent may be more potent than the desire to simply maximize one's own economic gain. Although the extent to which a maximizing difference motive might be active in a PD game has not been investigated, the effects of various motivational sets have been studied. Deutsch (1958, 1960a) gave his subjects three instructional sets in a one-trial PD game. Subjects were instructed to either do as well for themselves as possible and better than the other (competitive set), or to consider the welfare of the other (cooperative set), or to do as well for themselves as possible without regard to the other's welfare (individualistic set). In the cooperative condition, 89% of the subjects cooperated; 36% cooperated in the individualistic condition; and 13% cooperated in the competitive condition. The same results occurred when subjects played a ten-trial game. Kanouse and Wiest (1967) instructed subjects to either "cooperate as a team," or to consider only their own welfare. The proportion of cooperative choices in a one-trial PD game was 63 and 37%, respectively. Such studies give some indication of the effectiveness of various instructions. As a result of these data, most game researchers use individualistic instructions, and avoid such terms as "opponent," "partner," "game," etc., which might establish undesirable demand characteristics.

A more sophisticated approach to the motivational bases of choice in games is being developed by Messick and McClintock (1968). These authors assume that three possible motives may be operating in a conflict game: maximization of joint gain, maximization of own gain, and maximization of relative gain. They then go on to develop a series of matrices to isolate each motive that might lead a subject to make a cooperative or competitive choice. Using six different games, they found a significant effect across game conditions, indicating that they could discriminate the various motives they wished to study. Furthermore, they found significant interactions between game matrices and various feedback conditions, indicating that the effect of having information about own, joint and relative gain were dependent upon whether the corresponding motives were elicited by the structure of the interaction situation.

Related to the question of motivation in a game situation is the issue of motivational level. This variable has been manipulated in a number of ways. Gallo and McClintock (1965), using a trucking game which is conceptually similar to a PD game, asked their subjects to either play for imaginary money or for real money, with fairly high stakes for a college population. In the imaginary money condition, only 2 out of 16 dyads showed a profit. In the real money condition, however, 14 out of 16 dyads showed a profit. Using the same MDG, but two different exchange rates, McClintock and McNeel (1966b) found more cooperation in the high-reward condition. Radlow (1965) used a PD game of 98 trials. On one randomly selected trial, the exchange rate changed 100-fold, from cents to dollars. The level of cooperation obtained was relatively high (>70%).

Electric shock has also been used as a payoff by Bixenstine and O'Reiley (1966). In this within-group design, each dyad played two PD games, one for money and the other for electric shock. For the latter condition, it was assumed that the avoidance of shock would be considered a gain. The results indicated no difference between the money and shock games, although more cooperative responses were made in both situations than in similar money-only games.

More recent studies (Gallo et al., 1969; & Oskamp & Kleinke, 1970) have indicated that the relationship between the amount of reward and game behavior is related in complex ways to several situational and structural variables.

The effects of these manipulations of motivational level are actually difficult to assess. Experimenters often fail to include control conditions and choose matrix values which may account for their results. Some experimenters pay their subjects an hourly rate, to which their game earnings are added. Other investigators give each subject a stake at the beginning of the experiment, and the subjects' earnings in the game are added to or subtracted from this stake. Some researchers engage in the dubious practice of making participation compulsory for a passing course grade. Thus, an obviously important and easily manipulable variable has not been investigated properly in its own right. A particularly interesting study would be one employing relatively large sums of money as positive payoffs, and electric shocks as negative ones.

Noting that few studies report relatively high (i.e., > 60%) levels of cooperative choices, several investigators introduced a number of variables which they thought might increase the level of cooperation. One such variable is communication between the protagonists. Scodel et al. (1959) had subjects play 50 trials of a PD game under either a no-communication or communication condition. The communication condition consisted of a two-minute interval during which subjects were free to talk, after 25 trials had already occurred. In the no-communication group, only 2 out of 22 dyads reached a cooperative solution. In the communication group, more dyads reached a cooperative solution, but such dyads were still in the minority.

Using a PD game, Loomis (1959) divided his subjects into note-senders and note-receivers, and provided them with five communication levels, ranging from expectation and intent, to retaliation and absolution. All subjects played against a cooperative stooge. Loomis reported that as communication became more explicit (more levels of communication were sent), cooperation increased. However, he found that note-receivers tended to exploit the other more often than did note-senders. Apparently, sending the note elicited some commitment to adhere to the note's content, while receiving such a note implied no such commitment.

In a one-trial PD game, Deutsch (1958) found that communication affected all three instructional sets given to the subjects. Both the individualistic and competitive set groups produced twice as many cooperative responses when allowed to communicate (71 and 29%, respectively), compared to the no-communication condition. A slight increase in the number of subjects cooperating also occurred if they were allowed to reverse their choices after mutual announcement of what they would choose (77 and 36%, respectively). In a later study, Deutsch and Krauss (1962) investigated three aspects of communication in a trucking game: no communication, permissible communication and compulsory communication. The highest payoffs were obtained by those subjects in the compulsory communication condition, and the lowest in the permissible communication condition. The authors noted that the communications were often used to threaten or to express one's adamancy, rather than to induce cooperation. Whether or not cummunication increases the level of cooperation is influenced by the structure of the conflict situation, as well as the structure of the communication condition, e.g. whether it is forced, or optional (Swingle & Santi, 1971).

It is clear that the effects of communication are not simple. The above studies have given rise to the investigation of several other variables, including the enforceability of communication (Evans, 1964), the credibility of promises (Gahagan & Tedeschi, 1968), and specific types of communications such as threats and promises (Tedeschi, 1970).

Another variable which has been experimentally manipulated to elicit high levels of cooperation is the strategy of the "other" player.

Chapter III INTERACTION PROCESSES

Strategy may be defined as a plan of action which takes into account all contingencies and provides instructions concerning which choice should be made in each case (Shubik, 1964). One of the assumptions implied by such a definition is that the plan of action is directed towards a specified goal. Formal game theory assumes that "rational" men develop strategies aimed at the goal of maximizing their economic gain and/or minimizing their economic loss. The findings that at least some real players are more concerned with maximizing the difference between their own and another's score indicates that this game theory assumption is not generally tenable for a descriptive theory of conflict. Other subjects choose the exact opposite of the game theory prescription by cooperating. These findings also suggest that a number of different goals may exist for the players in a real game situation. What are these goals, and what strategies must be used by players if they are to realize their goals?

We have already indicated that a C response in Figure 2 is considered to be a cooperative choice. This description implies that the goal of choosing C is to enjoy mutual cooperation or the maximization of joint gain. Conversely, the D response is considered to be a defecting or competitive move, indicating that the player's goal is either to do better than his opponent or to maximize his own gain, regardless of the other's outcome (Deutsch, 1958, 1960b; Rapoport & Chammah, 1965).

Given these possible goals, each player's task would seem to involve three general processes. Each player must decide which of these possible goals will be his own, then he must take into account all contingencies, and finally provide instruction concerning which choice should be made in each circumstance. But how is this to be accomplished? Should a player first decide upon his goal, and then consider what the other player's goal might be? Or should he first try to guess the other's goal, and then make his decision? Even if a player accurately guesses the other's goal before any interaction begins, and has decided upon his own goal, he still must decide what choices he should make so that he may reach his goal. The difficulty of this latter decision should vary greatly, depending upon which goals the players actually settle on for themselves, and how accurately they perceive each other's goals. Some contingencies which must be considered in this process are the accuracy of the other's guess about one's own goal, and one's perception of how accurate the other perceives one to be in guessing his goal. Such considerations would seem to leave our players very much in the position of the centipede who was asked how he managed to walk so well with so many legs.

Fortunately for our species, we are not very often immobilized by rational considerations of this type. What then is the basis of players' actions in such a game? Might not players use the early trials of a game to both sample the other's behavior and to experiment with various plans of action? Sampling the other's behavior may narrow the range of contingencies which must be considered, and indicate what the other's goal might be. Experimenting with various choice patterns could give a player invaluable information about which goal he might reasonably set for himself. But would such a sampling procedure really unravel our Gordian centipede? Might not the early interaction patterns set the stage for the latter interactions, influencing the tenability of holding various goals and the efficacy of using different choice patterns? Negotiation teams are usually loathe to make the first concession toward a compromise solution, lest the concession appear to be a weakness (Siegel & Fouraker, 1960). Thus, even if a player were to use such a sampling procedure, he would still have to decide on what his own choice pattern should be during the sampling period, and all of the same contingencies would have to be considered.

Although a sampling procedure does not eliminate the infinite regression involved in considering contingencies of the sort outlined, the notion does have some intuitive appeal and suggests that behavior during the early stages of interaction may be qualitatively different from later behavior patterns. The above discussion suggests that attempting to go about choosing a strategy on totally rational or logical grounds would very quickly tax the capacity of the human cognitive system. When taxed in such a manner, emotional considerations often influence behavior. Needs influence the perceptions of others and their motives (Tagiuri, 1969), and having expectations confirmed has a different effect than having expectations disconfirmed (Carlsmith & Freedman, 1968; Watts, 1968). Being exploited when one is attempting to cooperate may precipitate a more intense conflict spiral than when two parties are trying to outwit each other. In the former case, the frustration and anger aroused from having one's good intentions and admirable gestures shoved down one's throat may be too intense to overcome. In the latter case, the emotional reactions of the players may be a mutual admiration and/or respect that leads to an equitable outcome. Although we might hope that negotiators in real-life situations would weigh such emotional contingencies very coolly and carefully, we should not be surprised if this is not the case. In any event, emotional as well as "rational" issues must enter our discussion.

The most general point to be made from these considerations is that an empirical approach is essential to understanding the interaction processes of conflict behavior. But is it possible that a strictly experimental approach can preserve the complexities and important subtleties so germane to real conflict behavior? The remainder of this section will examine some of the complexities that the empirical approach, stimulated by game theory, allows us to study. First we shall consider what types of measures are useful for investigating strategies by introducing several new dependent variables. Next we will present a critical review of studies primarily concerned with strategy as an independent variable. And finally, we shall consider measures which tell us how the players in a mixed-motive game perceive each other.

A. Measures of Strategy

The dependent variable mentioned above, the frequency of a C response, may be considered a strategy of the simplest kind. A player might, for example, decide on a competitive strategy in a PD game and play C 0% of the time. On the other hand, he might set himself the goal of joint maximization and play C 100% of the time. A player who sets himself the goal of maximizing his own gain might guess that his opponent is aiming at joint maximization, and he should therefore play C about 75% of the time. His rationale might be something as follows: "Too few Cs will cause the other to retaliate, which would result in a big loss for me; therefore, if I reward him sufficiently by playing a high percentage of Cs, I may be able to get away with the lion's share quite often." Many investigators have varied the % C as an independent strategy variable; these studies will be discussed below.

Another set of variables which provides some important information concerning the interaction process is the response state measures. With a 2 x 2 PD game, there are only four possible outcomes: both players win (CC), both lose (DD), or one wins and the other loses (CD and DC). Row's choice is indicated first and column's second, in each case. While the proportion of CCs and DDs must necessarily be the same for both players, the unilateral states (CD and DC) have no such constraints and may yield important information about the effects of asymmetric outcomes. If one player enjoys a high proportion of DC outcomes, in which he obtains the lion's share at the expense of the other, will he feel guilty and switch to a C response? Will the initial loser then demand his share of DC outcomes before tacitly agreeing on a CC outcome?

The response states have been manipulated in a number of experiments to be described. The most common manipulation has involved the use of a "matching strategy," in which a stooge matches the responses of the real subject on each trial. This reduces the game to a two-outcome situation (CC or DD), but this restraint is unnecessary if probabilistic matching strategies are used.

A related strategy manipulation which has been used frequently is known as the "delayed matching strategy." In this procedure the stooge chooses on trial n + 1 what the real player chose on trial n. The stooge reciprocates the player's move in a tit-for-tat fashion. The overall reciprocity variable may be broken down into a cooperative (Cn+1/Cn) and competitive (Dn+1/Dn) measure. These measures are mathematically independent of one another and thus may be combined in any proportion. For instance, a player might decide that a combination of high cooperative reciprocity and moderate competitive reciprocity should lead to a state of joint maximization. The Dn+1/Dn measure might better be labelled punitive rather than competitive in such a case. (Again, this strategy may be probabilistic rather than all or none.) This measure is also used as a dependent variable to evaluate how subjects reciprocate each other's moves.

This measure of reciprocity or reactance may be broken down further into a series of first-order conditional probabilities. These stochastic measures take into account not only what the other player did on trial n, as do the reactance measures, but also what one's own choice was on trial n. In other words, these measures are concerned with the proportion of C responses on trial n+1, given the occurrence of a particular response state on trial n. Each player has four such measures and since they are identical for each player, they are presented only from Row's point of view:

Symbol	Measure		Interpretation
$x =$	$Pr\ (Cn+1/CCn)$	-	trustworthiness
$y =$	$Pr\ (Cn+1/CDn)$	-	forgiveness
$z =$	$Pr\ (Cn+1/DCn)$	-	repentance
$w =$	$Pr\ (Cn+1/DDn)$	-	trust

Although these measures may be described in an identical fashion from Column's point of view, the measures for Row are mathematically independent of those for Column. While Row may have a high value of x, Column's x may be quite low.

These first-order conditional, or stochastic, variables have been interpreted by Rapoport and Chammah (1965) in the following manner: x is considered a measure of "trustworthiness" in that it indicates a willingness to continue the tacit collusion obtained in trial n; y indicates a willingness to persist in cooperating even though one has sustained a considerable loss while the other gained. This variable is considered to be a measure of "forgiveness." The variable z indicates a willingness to not continue a successful exploitation, and is therefore considered to be a measure of "repentance." The variable w indicates a willingness to break a deadlock, and is considered to be a measure of "trust" in that one trusts the other not to continue defecting.

The interpretations given above for these measures apply to a PD game but not all of them apply to a Ck game. In a Ck game, y is considered to be an "appeasing" response in that it is the fear of a DD outcome which prevents the player from retaliating. As the matrix structure changes to other types of interaction situations, these variables may provide measures of a number of complex psychological concepts (e.g. cf. Guyer and Rapoport's (1969) discussion of the Hero and Leader games and Marwell and Schmidt's (1968) discussion of single-motive games).

Two other issues are relevant to a discussion of dependent variables. One is the question of the difference in choice patterns between one player and the other, and the second involves changes in any of the above-mentioned variables over time. The issue of asymmetry in the behavior of dyadic members has been approached in two ways. Messick and McClintock (1967) have developed measures of homogeneity both within and between dyads. They are able to tell how similar members of a dyad are on any particular measure, and how similar one dyad from a group is to the others in the group. Rapoport and Chammah (1965) have used correlational procedures for the same purpose. The difference between members of a dyad has also been used as an independent variable in those studies, for example, that programme stooges to reciprocate or match the real player's move with some probability between 0 and 1.0. Changes over time have been investigated by all those studies using more than 1 trial.

There are other dependent variables, but those presented above are the major ones. Their number and sophistication suggest that a variety of complexities inherent in conflict situations may be investigated in the simple 2 x 2 game paradigm. Let us see if this hope is fulfilled by the data. In the following review, data will first be presented on the strategy measures as dependent variables.

Then the studies using these strategy measures as independent variables will be reviewed.

B. Studies of Strategy

Strategy as a Dependent Variable

The major work on this topic has been carried out by Anatol Rapoport. His data on the PD game will be summarized in this section (Rapoport & Chammah, 1965). These authors investigated the effects of changes in matrix values in a variety of conditions. In reporting their data they often collapse a variable across these different matrix conditions, obscuring the effects of a particular game, but allowing more general statements to be made about a particular variable under a certain condition in PD games. In the present review we shall restrict our discussion to the Pure Matrix condition, in which a particular dyad played a single PD game with full information about each other's outcomes. Data on the time course of the four response states have already been presented in a previous section. The most striking feature of these data is the lock-in effect in which most of the outcomes are either CC or DD by the end of the game. Apparently, the distribution of lock-ins is bimodal, some dyads settling on CC and others on DD. Although the actual distribution of dyads in these response states is not reported as such, data from Amnon Rapoport and Mowshowitz (1966) indirectly indicate that the majority of lock-ins are CC outcomes. Of their 38 subjects, 14 made between 80 and 100% C responses, while only 5 subjects made between 0 and 20% Cs, in a 300-trial PD game. It is somewhat unfortunate that this interesting finding regarding the bimodal distribution of outcomes has not been reported more fully. Considerably more will be said about the implications of this finding later.

Rapoport and Chammah (1966) have also investigated the characteristics of the response state measures in a variety of Ck games. In this study, R, T and S were held constant (at 1, 2 and -2, respectively), as P varied from -3 to -40. Compared to the results from the PD games, these Ck games reveal a higher level of CC and unilateral outcomes, and fewer DD outcomes. The DD outcomes show an interesting reversal from the P = -3 to the P = -40 game for both sexes. At intermediate values of P, there were more DD and fewer CC outcomes than at either extremes. At intermediate levels of P, the temptation to preempt appears to be maximal, since retaliation is considered to be less likely than at low levels of P, and less risky than at high levels of P.

With respect to the reactance measures, it has been shown that they are sensitive to both the matrix values of a game and the time course of the interaction. Cooperative reactance is highest (80-90%) when T-R is a minimum, or when P is large. Competitive reactance is highest (80-85%) when T-R is a maximum and P is small. The tendency to reciprocate cooperativeness, or to retaliate against defection, is influenced both by the magnitude of the reward for defecting and the loss associated with mutual defection. These dual controls indicate, for instance, that the desired effects of deterrence might be accomplished not only by increasing the value of P, but also by minimizing the difference between T and R. This could be accomplished, for example, by helping an opponent increase his R to a point close to or equal with his value of T. The relative effectiveness of these dual controls has not been extensively investigated.

The reactance measures increase in value over trials as lock-ins occur. Using the correlational procedure mentioned earlier, Rapoport and Chammah (1965) report that the cooperative reactance measures for dyad members have a higher correlation than the competitive reactance measures. The authors interpret this finding as indicating that cooperative reciprocity has a stronger interaction effect than competitive reciprocity. By interaction effect they mean that the dyad members become like each other after prolonged interaction because the structure of the game, and the other's choices, dominate the choice each must make. Thus, the interaction tends to wash out any initial differences between the behavior patterns of the pair members. This finding also indicates that dyad members are less alike on competitive reciprocity than on cooperative reciprocity. This might indicate that randomly matched subject pairs are less likely to share notions of the effectiveness of punishment, or vengefulness, than they are to share notions of conditional cooperativeness. It would be interesting to investigate the possibility that there is greater variability in the subject populations' reaction to the potential use of punishment, than in their reaction to a cooperative gesture. In their comparison of male and female populations, Rapoport and Chammah (1965) report that males playing against males produce higher values of cooperative reciprocity than competitive reciprocity. Females playing against females show just the opposite effect. However, no data are presented regarding the correlations of these reciprocity measures within pairs across these different populations.

A further refinement of these stochastic reactance measures is provided by the first-order conditional probabilities x, y, z and w defined above. The trustworthiness response, x, is usually the highest value, again indicating the predominance of CC lock-ins. In both PD and Ck games, x increases over trials (300) to 80-90%. The rate of increase is greater in PD than in Ck games, primarily because the initial value of x in Ck games is higher.

The correlation of x between dyad members is fairly high across PD games (average 0.79). The correlation of x between dyad members is generally lower (.30-.60) when P is low relative to R and T. These findings suggest that the value of P has an effect on both the initial level of x (which is highest in Ck where P is lower than in PD), and the interaction effect (when P is low relative to R and T, dyad members are less like each other). The initial level of x over PD games is about 65%, which means that defections from a cooperative interaction are fairly frequent (about 35%) on the early trials. It would be interesting to know what the distribution of x is like on the early trials and the relation of x to the bimodal distribution of response states on later trials. Such data are not available.

The value of the trust measure, w, is generally the lowest of the first-order conditional probabilities in a PD game. The value of w is lowest (5%) when T-R is a maximum and P is high. It is higher (30%) when either T-R is a minimum or when P is low. Trust is generally stable over trials in PD games. Unlike x, the value of w is very different in PD and Ck games. In Ck games w is much higher (50%) and indicates a gradual decrease over trials. Since the DD outcome is more costly to both players in a Ck game, willingness to avoid repetitions of this outcome is not surprising, especially since switching to a C on the next trial must produce less of a loss. The decrease over trials may indicate a lack of trust, either because it is unnecessary or intolerable if a CC lock-in has occurred, or because it is unwarranted if a DD lock-in has occurred. The correlation of w between dyad members is generally lower (.48) than that for x, indicating that w is less susceptible to interaction effects than x. This may mean that players are less likely to respond to a double defection in a similar manner, as they do to mutual cooperation. What role this individual difference has in determining various modes of conflict resolution is not clear.

The forgiveness response, y, is usually intermediate between the values of x and w. In PD games y is high (45%) when T-R is a minimum and P is small. It is lower (28%) when T-R is a maximum and P is small. In all of the matrices used, S has a value inversely related to T, which may be more relevant to consideration of y. The forgiveness response is relatively high when S is low compared to R, and low when S is high compared to R. It is easier to forgive a mild transgression than one involving a large loss.

In a Ck game, the statistic y has a different meaning than in a PD game. In Ck y is more appropriately considered an appeasing response, allowing the other to continue defecting without retaliating oneself. Since retaliation is more costly in Ck, y is higher than in the PD, as one might expect. In Ck, y may show values as high as 66% when P is very large. The time course of y is similar in both PD and Ck games, except that y is generally higher and more stable in Ck. In PD games, y shows an increase over the last block of trials, perhaps indicating that occasional defections from CC lock-ins are tolerated.

In PD games, y is less susceptible to interaction effects than either x or w. In many games, the correlation between dyad members' y values are negative, indicating that one player's sacrifice does not necessarily induce the other to reciprocate. The y measure is therefore one which might provide some information about characteristics of the players, rather than the structure of the game.

The measure of repentance, z, is generally very similar to that of y in PD games, both in magnitude and in its time course. Like y, z often shows a negative correlation between pair values, again indicating its relative independence from interaction effects. In Ck games, z shows a slow increase over trials from an initially high level (50%). The higher value of z in Ck than in PD is to be expected because of the fear of retaliation after making a successful defection.

These various measures of strategy or interaction variables have proven to be sensitive to a number of major independent variables. The matrix values, the number of trials, whether or not the matrix is displayed, and the sex of the subject population affect these various measures to one degree or another. It has also been demonstrated that the initial response state on trial 1, if it is CC or DD, has an effect on the nature of the final lock-in. If the initial response state is a CC, the probability is greater than chance that the final lock-in will be a CC; similarly for a DD on trial 1 which leads to a DD lock-in.

Given the sensitivity of these measures demonstrated by Rapoport and Chammah (1965, 1966), it is somewhat surprising that these measures have not been used more extensively as dependent variables. The great majority of gaming studies using PD or Ck games have focused solely on the probability of a C response as the major dependent variable. One reason for the paucity of data on the stochastic measures may very well be the large number of trials and/or subjects required to provide stable estimates of these variables. Many gaming studies have used no more than 50-60 trials, and often less than 10 subjects per condition.

Although a stooge was used to simulate the behavior of the "other player," a study by Swingle (1969) indicates the utility of these stochastic measures for investigating some interesting relationships between protagonists in a conflict situation. In this study, the real subjects were led to believe that the "other player" was an English Canadian (EC) or a French Canadian (FC). This study was carried out in the city of Montreal, which has a long history of English-French conflict and mutual prejudice. The simulated other used a delayed matching strategy (with probability 0.90) after an initially cooperative response on trial 1 of a 100-trial PD game. The results indicate a significant opponent x trials interaction. When either an EC or FC played against a French "opponent," there was an increase in the proportion of forgiveness (C_{n+1}/CD_n) responses from the first to second 50-trial blocks. When the "opponent" was English, there was a decrease in forgiveness over trials, or conversely, an increased tendency to retaliate against a unilateral defection. These results support the author's hypothesis that retaliation in ethnically heterogeneous dyads is delayed when the other is disliked.

Many other interesting relationships were found in this study. FC subjects are more trustworthy (Cn+1/CCn) when their opponent is also FC than when the other is EC, suggesting that FC subjects expect to be exploited by ECs but not by fellow FCs; or, that FCs are more likely to try and exploit ECs than fellow FCs. The repentance measure, Cn+1/DCn, is generally higher when the subject is guaranteed anonymity from his opponent after the game, suggesting it is easier to repent if one can do so and "save face" at the same time. The one exception to this relationship is interesting. FC subjects playing against an EC opponent are most repenting when they expect future interaction with the other, and least repenting when anonymity is assured. The FC subjects seemed to "know their place" and to comply to what they perceived as proper behavior in such a situation. When subsequent interaction was prohibited by guaranteeing anonymity, the compliance was absent.

Given the richness of these data, it is somewhat difficult to understand why there have been so few studies focusing on the stochastic measures as dependent variables. The above findings are even more interesting in view of the fact that Swingle found no differences between groups in the proportion of C responses.

The measures of homogeneity developed by Messick and McClintock (1967) have not been used extensively. The authors report on the use of this technique with data from a maximizing difference game. Looking at the response which produces the greatest own or joint maximization, the variance between dyads is several times greater than the variance within dyads, indicating a strong interaction effect. Unpublished data of the present author indicate the same relationship for the probability of a C response in a PD game. In general, very few investigators have addressed themselves to the issue of asymmetric response proportions between dyad members. Formal game theory assumes that both players are equally rational and therefore, individual differences should not be an important consideration. Although psychology has a long history of studying individual differences, very few investigators have looked at differences in the behavior of dyad members in a real game. Investigators have been more prone to examine either structural effects or other non-game behavior variables such as anonymity, etc. (Marlowe et al., 1966). Those investigators who have looked at individual differences in game behavior have related these differences to non-game measures such as F-scale scores (Deutsch, 1960a; Terhune, 1968), rather than comparing the difference between members, for example, to the response states dyads lock in on. Rapoport and Chammah (1965) do not report directly on changes in the correlation coefficients over time, but it is clear that the interaction effect develops gradually as CC and DD lock-ins occur. The author's unpublished data indicate that the within-dyad variance decreases over trials in a PD game. If dyad members are not necessarily alike in their choice patterns early in their interaction, how do they become alike as trials progress? What is the social influence process by which dyad members shape one another's behavior within the structure of a particular game? There are several ways to approach this issue, about which more will be said later. Many investigators have provided some insight into these questions by using strategies as independent variables.

C. Strategy as an Independent Variable

Although strategy manipulations might be considered as attempts to investigate interaction patterns and social influence processes in a very broad sense, many studies have been concerned with a much more specific goal. Noting the relatively low levels of cooperation, P(C), observed in several studies, investigators set out to demonstrate that high levels of cooperation could be produced in a PD game. Strategy manipulations were often used for this purpose. Many types of strategy manipulations may be performed by an experimenter. For our purposes, these types will be classified according to a single criterion, i.e., whether the strategy used as an independent variable is reactive to the real player's behavior. If a strategy is fixed and unresponsive to changes in the subjects' behavior, that strategy will be referred to as non-contingent. If a strategy leads to changes in the stooge's choice pattern as a function of the subjects' behavior, it will be referred to as a contingent strategy. First we shall review the simpler non-contingent strategy studies.

There are several different types of non-contingent strategies. Controlling the proportion of C responses made by the stooge is the simplest type. This type of strategy can be made dynamic, while remaining nonreactive, by altering the proportion of C responses in a predetermined fashion over trials. Non-contingent strategies can also be made more dynamic by using various types of pretreatments before the strategy is introduced. In many cases, the data reported below do not represent an entire experiment, but simply one of several experimental groups used in a study. Data pertaining to each type of strategy manipulation will be presented before a comparison of various strategies is made.

Extreme strategies have been used by several investigators. Minas et al. (1960), Solomon (1960), Oskamp and Perlman (1965), Scodel (1962), Lave (1965), and Wilson (1969) have all used stooges programmed to play 100% cooperatively. Solomon (1960), Lave (1965), and Wilson (1969) also used a 0% cooperative strategy. With the exception of the work of Lave and Wilson, all other studies used 50 or fewer trials. The results are unanimous, if not surprising; the range of proportions of C responses produced by 100% cooperative strategies is from 39 to 56% in these PD games. The 0% cooperative strategies used by Solomon and Wilson produced 21 and 6% Cs, respectively. Lave does not report his data in % Cs, but indicates that the 100% D strategy produced the fewest Cs of any of his experimental groups. Several other studies have used less extreme values for the stooge to play, or have compared several values in the same study. Bixenstine et al. (1963) pitted their subjects against either 83% Cs or 83% Ds for 30 trials in a PD game. These strategies produced 33 and 29% Cs, respectively. Similar results were obtained by Wrightsman et al. (1968), Phelan and Richardson (1969), McClintock et al. (1963) and McKeown et al. (1967). These authors who also included a totally random response pattern (50% C) report observed levels of cooperation which are the same as those obtained by their cooperative and competitive strategies (Phelan & Richardson, 1969; McClintock et al., 1963; & McKeown et al., 1967).

Unconditionally cooperative strategies are similar to pacifist strategies in some ways, but dissimilar in others. High levels of unconditional cooperation are indeed the behavior pattern one would expect from a pacifist. However, pacifists hold such a position because of a moral repudiation of violence; pacifists not only cooperate, but they also appeal to others to refrain from retaliating in the face of threat by reference to a moral norm which holds that violence is illegitimate. In the studies reported to this point, the cooperative stooge did not make known his pacifist position to the subject, he did not clearly relinquish his ability to retaliate, and he did not make it clear to the subject that he was sustaining a loss for moral reasons. Shure et al. (1965) included these relevant features of pacifism in a mixed-motive bargaining game. The pacifist stooge not only cooperated with the real player, but also gave up his option of delivering electric shock to the player and clearly indicated that his demand for equity was based on moral grounds. The pacifist did not back down when the subject attempted to dominate him, leading the subject to use his shock option and force his domination over the pacifist stooge. This occurred even when the pacifist made known to the subject that he was a Quaker and morally committed to nonviolence.

Another variation on this simple theme of programming a fixed percentage of cooperative responses is to alter the percent Cs played by the stooge in a predetermined manner, regardless of the real players' actual choice patterns. Within this variation, one can investigate either a particular sequence of changes, or the effects of a particular percent of Cs, viewed as a pretreatment, on a later percent C strategy manipulation. In a 50-trial PD game, Scodel (1962) used a 10-trial 100% D pretreatment followed by 40 trials of 100% Cs. On the first 10 trials the subjects played C 34% of the time. After the stooge shifted to a cooperative strategy, the subjects seemed to respond more cooperatively, but it is impossible to tell from Scodel's presentation exactly what level of cooperation was reached. Apparently half of the subjects cooperated with the stooge, and the other half did not.

Bixenstine and Wilson (1963) investigated the effects of two different sequences of predetermined changes in percent C responses. In one sequence the 200 trials were unequally divided into five sections, within which the percent C started at 95%, dropped to 5% for the middle 80 trials, and rose again to a final level of 95%. In a second sequence, the opposite percent C values were used, starting at 5%, rising to 95% and dropping again to 5%. The authors suggest that these changes from high to low C choices might represent to the subject the other's "benevolence" or "malevolence." The results for the low-high-low C sequence indicate that the subjects were sensitive to the changes in the "other's" strategy and tended to mimic the other's behavior. However, even when the stooge played C 95% of the time, the observed level of C was less than 50%. For the high-low-high sequence, the results indicate that the real subjects exploited the initially cooperative stooge until the stooge "retaliated" by playing 5% Cs. On the final high C trials, the subjects increased their level of C, but again this was below 50%.

A somewhat similar study was performed by Sermat (1964), who studied the effects of four levels of percent C pretreatment on two levels of cooperative strategy. For the first 50 trials of a Ck game, subjects received either 20, 40, 60, or 80% Cs from the stooge, and were then switched to either a 90 or 10% C strategy for an additional 60 trials. The only difference among the pretreatment effects is that the 20% group showed a greater decrease in C played than the other groups, all of whom indicated decreases from an initial 50% C response level. When the stooge shifted to either 90 or 10% Cs, the effects upon the various pretreatment groups was apparently the same. Both groups showed a further decrease in level of Cs to about 30%. No further breakdown of the data is provided, indicating, for example, the effects of the 90% Cs upon the 40% pretreatment group.

Swingle and Coady (1967) used both a 96 and 4% C pretreatment condition for 50 trials, each of which was followed by 50 trials of either 4, 25, or 96% Cs. In line with earlier findings, there was no effect of these abrupt strategy changes in level of C responses after either pretreatment conditions. The final level of Cs made by the subjects was between 20 and 30%. However, these authors did note that the variability of the subjects' responses showed a significant increase as a function of the "partner's" final strategy. The abrupt strategy changes apparently affected different subjects in very different ways.

Swingle (1968) also studied the effects of various pretreatment types and durations on abrupt strategy changes in a second study. He used either 0, 5, 10, 20 or 40 pretreatment trials of either 5 or 95% Cs. These conditions were followed by 60 trials in which the stooge shifted his strategy from either 5% C to 95% C, or vice-versa. If the "partner's" final strategy was highly cooperative (after an initially uncooperative pretreatment), the pretreatment conditions had the effect of suppressing noncooperative responding. In general, the longer the pretreatment, the greater the suppression of the noncooperative responses. If the "partner's" final strategy was uncooperative (only 5% Cs), all pretreatment conditions had the effect of increasing noncooperative responding. In no case did a group produce more than 50% cooperation.

Using the absolute difference between subjects' last 10 pretraining and first 10 final strategy responses as an index of change, Swingle found a significant effect of duration of pretraining, and a sequence (5-95% or vice-versa) by pretraining duration interaction. Collapsing across sequence there was also a significant difference between each of the pretraining conditions, and the control groups (zero pretraining trials).

In summary, the noncontingent strategies do not seem to be generally effective methods of controlling subjects' behavior, unless one wants to produce low levels of cooperation, in which case cooperatively programmed strategies are almost as effective as defecting strategies. These results occurred even though the actual matrix values used in most of the above studies were not predisposed to noncooperation, i.e., the difference between T and R was small in most cases. Strategy changes seem to elicit more behavioral changes than fixed levels of C. However, different subjects react very differently to these changes.

What happens when the strategy is allowed to fluctuate as a function of the subjects' behavior? Several types of strategy manipulations allow this question to be investigated. The simplest contingent strategy is a matching strategy, in which the stooge has full knowledge of the subject's move on a particular trial, and simply duplicates that move, essentially reducing the game to a two-outcome situation (CC or DD). The subject can win only if he chooses a C, and he is always punished for choosing a D. This strategy allows for no unilateral defections or cooperation. This simple strategy may be modified in several ways; matching may occur with some probability between 0 and 1, or Cs may be matched with a different probability than Ds. These same modifications may be made on a simple delayed matching strategy, in which the stooge reciprocates the subject's response from the previous trial. Various contingent and noncontingent sequences may be studied, as well as the juxtaposition of different pretreatments.

Simple matching strategies have been studied by Solomon (1960), Oskamp and Perlman (1965), Tedeschi et al. (1968c), and Wrightsman et al. (1968). The level of cooperation induced by such strategies ranges from 59 to 88%. Tedeschi et al. (1968c) also studied the effects of matching Cs and Ds with different probabilities. Although their paper does not contain any data, they report a significant difference between a 100% matching condition, and one in which both

Cs and Ds are matched only 50% of the time. Perhaps the reason that more studies varying the % matching have not been made is that such designs are hopelessly confounded with other strategies such as % C, and various stochastic measures.

The effects of various pretreatments were investigated by Bixenstine et al. (1963), who used two pretreatment conditions: 83% Cs or 83% Ds for 30 trials, followed by an 83% matching strategy. Since their pretreatment conditions produced similar levels of C, it is no surprise that the subjects' behavior on the 60 matching trials was not affected by the pretreatment. Unfortunately, the authors do not provide any data on the actual results of the matching strategy. They do note, however, that the change to a matching strategy increased the variability of the subject's behavior. Bixenstine and Blundell (1966) used a pretreatment of 80% matching for 10 trials, followed by 100% matching for 20 trials, and finally a matching plus 20% more Cs than the subject on the last 10 trials. This schedule produced a decrease in Cs from 50 to 40% in a PD game.

Some of the most interesting strategy studies have used delayed matching techniques, or some variant of them. Komorita (1965) used a 100% delayed matching strategy after matching the subject's response on trial one. Presenting data on the last 20 trials only, the author notes a significant sex difference; males produced 56% Cs and females, 47%. He noted that 20% of his subjects alternated between the unilateral response states, and reported later that they thought they were cooperating, although maximum joint gain required a mutually cooperative outcome. Unfortunately, data on the time course are not presented, nor are data available regarding the behavior of two real subjects under the conditions used. Crumbaugh and Evans (1967) also used a delayed matching strategy in an 80-trial PD game, but after an initially cooperative move on the part of the stooge. Their results indicated a slightly higher level of C (65% over the last 30 trials), but it is difficult to determine if this is due to the initial cooperative response, or because they used a more cooperative matrix than Komorita. Wilson (1969) used matrix values more similar to those of Komorita (1965), and a similar strategy to that of Crumbaugh and Evans (1967). Wilson's results indicate an average of 52% Cs over 120 trials.

Several studies have used delayed matching strategies which have some probability between 0 and 1. Komorita (1965) used three levels of conditional cooperation (.25, .50 and .75) in an 80-trial PD game. The results indicate that males were relatively insensitive to this manipulation, producing about 10% Cs on the last 20 trials in each condition. Female subjects, on the other hand, increased their level of cooperation as a direct function of the conditional cooperation of the stooge. The more cooperative the stooge, the higher the level of their cooperation. But even when the stooge was conditionally cooperative, with probability .75, the females produced only 40% Cs on the last 20 trials. Pilisuk and Skolnick (1968) employed a similar strategy in an extended PD game which was phrased in terms of an arms race. A "concilatory" strategy was used in which the stooge played one missile less than the subject played on the previous trial. This strategy produced about 60% cooperation, which was higher than that between real pairs, but about the same as a straight delayed matching strategy.

A further variant of the delayed matching routine was used by Wilson (1969). His stooge used a "coaxing" strategy, which was essentially a delayed matching strategy with the restriction that the stooge would never make more than two Ds in a row. In a 120-trial PD game, this strategy produced only 56% Cs, which was almost identical to both a straight delayed matching and a 100% cooperative strategy.

One of the most extensive probabilistic delayed matching strategy experiments (Gaebelein & Bixenstine, 1968) included some of the above variants, plus others. There were five experimental conditions, each of which reciprocated cooperative and competitive choices differentially. The "cautious" strategy reciprocated one C move by the subject with a probability of .60, two Cs with a probability of .80, and three or more Cs with a probability of 1.0. The same number of Ds were reciprocated with a D with identical probabilities. The "suspicious" strategy used these same probabilities for reciprocating cooperation, but reciprocated all Ds with a probability of 1.0. The "trusting" strategy used just the reverse probabilities, answering each C with a C, but increasing the probability of a D slowly, as the subject made more Ds. The "exploit" strategy used the same pattern for responding to Ds, and just the reverse for responding to Cs. The more Cs the subject made, the lower the probability that the stooge would reciprocate a C. The "impulsive" strategy was a straight delayed matching one.

Over 150 trials of the PD game, the "impulsive" strategy produced an initially low level (40%) of C, but gradually rose to 65% over the last 60 trials. The "suspicious" and "exploit" strategies both produced lower levels of cooperation (45% and 30%, respectively, over the last 60 trials) than the "impulsive" strategy. The "trusting" strategy produced consistently higher levels of C, but was not different from the "impulsive" group. The strategy which produced the highest level of cooperation was the "cautious" one, leading to 75% Cs over the last 60 trials. This unusually high level of cooperation occurred even though defecting led to a substantially higher outcome than cooperating.

The effects of various pretreatments on the effectiveness of delayed matching strategies have also been studied. In a maximizing difference game, Gallo (1966) found no effect of an initial C or D response on the subsequent effectiveness of a delayed matching strategy. Both groups showed an increase over the 100 trials of the game from an initial level of 65% C to 90% C. Recall that there is no absolute gain from defecting in a maximizing difference game as the mutually cooperative outcome also produces the highest joint gain. Sermat and Gregovich (1966) used a delayed matching strategy after an initial C or an initial D in a 50-trial Ck game. They found the highest levels of cooperation were produced by those subjects whose initial choice was matched by one of the experimental conditions. These subjects reached a level of 70% Cs, whereas those subjects who received unilateral outcomes on trial 1 produced only 40% Cs. It appears that either an initial unilateral loss, or unilateral gain, can impede a cooperative resolution. In a later study, Sermat (1967) investigated a more complicated set of pretreatment conditions. Subjects received 30 trials of either unconditional cooperation or unconditional competition. Each of these conditions was followed by a C or D response on trial 31, then each of these four groups received 199 delayed matching trials. The results indicate that each of these pretreatments, followed by delayed matching strategies, increases cooperation. The cooperative pretreatment groups reached slightly higher levels of C (80% each) than the competitive pretreatment groups (75% for 30 trials of D followed by C, and 60% for 30 trials of D followed by D).

The effects of pretreatment conditions were also studied by Harford and Solomon (1967). They reasoned that the change from low cooperation to conditional cooperation would have very different effects than unconditional cooperation followed by a delayed matching strategy. They called the former sequence (3Ds, 3Cs, 24 delayed matching trials) a "reformed sinner" strategy, and the latter (3Cs followed by 27 delayed matching trials) a "lapsed saint" strategy. They found that the reformed sinner produced more overall cooperation (47%) than the lapsed saint (32%), but the level of cooperation was very similar on the last five trials. Sermat's (1967) data also indicate that initial competitiveness produces more initial cooperation in a Ck game, but over many trials the initially high level of competition tended to suppress the development of cooperation if the stooge used a delayed matching strategy. Oskamp (1968) also used "reformed sinner" (15Ds, 1C and 59 delayed matching trials) and "lapsed saint" (15Cs, 1D and 59 delayed matching trials) strategies in a Ck game. He found that both strategies produced a high level of cooperation (80%) in his college subjects, and both were considerably higher than a free-play condition (68%) in which subjects actually played each other. No difference was found by Crumbaugh and Evans (1967) between a reformed sinner (15Ds, 5Cs and 30 delayed matching trials) and a straight delayed matching strategy.

The effectiveness of particular types of strategies has been investigated by Deutsch et al. (1967). Deutsch used a 60-trial mixed-motive peg board game which permitted a variety of strategies to be used. The "turn the other cheek" strategy is similar to the unconditional cooperation used in many other studies (e.g., Minas et al., 1960; Scodel, 1962). The "nonpunitive" strategy is similar to one of conditional cooperation but does not reciprocate threats or aggression. The "deterrent" strategy is one of reciprocity of aggressive as well as cooperative moves by the other. There were also two types of reformed sinner strategies—one was followed by a "turn the other cheek" strategy and the other by a "nonpunitive" strategy. The results indicated that the deterrent strategy differs most from all the others. It produced the lowest level of cooperation and the lowest joint payoffs. The reformed sinner-nonpunitive and reformed sinner-turn the other cheek strategies produced the lowest levels of cooperation on the early trials, but both rose to high levels. The reformed sinner-turn the other cheek strategy elicited a sharp increase in cooperation over trials, while the reformed sinner-nonpunitive strategy showed a very slow increase. Using the reformed-sinner pre-treatments led to higher levels of cooperation than either the turn the other cheek or nonpunitive strategies used alone. All strategies except the deterrent strategy produced higher levels of cooperation than a control group in which two subjects actually played each other.

Rather than considering only the other's move on the previous trial, several investigators have chosen to conditionalize their programmed strategies on the response state of the previous trial. This may be done by specifying the probability with which each of the first-order conditional probabilities will be played. A mild, 50-trial PD game (T-R is small) was used by Pylyshyn et al. (1966) in such a study. They specified that the stooge would cooperate according to the following schedule: Cn+1/CCn = 1.0; Cn+1/CDn = .90; Cn+1/DCn = .20; Cn+1/DD = .20. This strategy led to about 60% cooperation, with the subjects becoming like the "other" on the trustworthiness, forgiveness and repentance measures (.70, .70 and .29, respectively). The subjects made considerably more trust responses than the stooge (.48). It is unclear why these authors used such a high level of forgiveness for their stooge, since such levels are rarely observed in real games (cf. Rapoport and Chammah, 1965). It is also interesting to note that such a high level of forgiveness was produced by the subjects in this situation. Rapoport and Mowshowitz (1966) performed a similar study, but used the data from a real game to determine the stooge's strategy. The stooge's schedule was the following: Cn+1/CC = .79; Cn+1/CD = .33; Cn+1/DC = .44; and Cn+1/DD = .20. The results indicate a level of cooperation of 41% over the last 50 trials of the 300-trial game. This level of cooperation is considerably lower than the 67% obtained in an identical real game, in which subjects actually played each other.

Although the first-order conditional probabilities in the rigged game were somewhat lower than in the real game, the ordering was identical in both cases.

The difference observed by Rapoport and Mowshowitz (1966) between the rigged and real game is an interesting one. If the stooge is programmed to play as a real subject would play, why do the subjects in the rigged game respond differently to this stooge than they would to a real other? Post-game questionnaires indicate that none of the subjects realized the game was rigged. Since the subjects were run in the same laboratory by the same experimenters and under the same conditions, one might guess that the stooge's behavior was not "real" in the same way that an actual group's behavior would be. In what way could the stooge's behavior be different? In the first place, the stooge's schedule was determined from the averaged data of an identical real game. Given that a bi-modal distribution of outcomes was masked by this averaging procedure, one might guess that the stooge's behavior was not representative of any single subject's behavior in the real game. In other words, the actual contingencies experienced by the subjects in the rigged game were very different from those they would receive in a real game. Furthermore, the contingent probabilities were obtained from the overall average of the real game, and it is well known that these probabilities change as a function of trials. Yet even when Rapoport and Mowshowitz allowed one of the conditional probabilities, C_{n+1}/CC_n, to change over trials, the results were very different from those of a real game.

Two studies which touch upon this issue of the nature of the contingencies are those of Crumbaugh and Evans (1967) and Downing et al. (1968). Both of these studies used yoked control designs, in which the stooge's responses were determined according to a delayed matching strategy, by one of the subjects. The other subject received exactly the same response pattern from the stooge, but this pattern was not necessarily contingent upon his behavior. Thus both subjects were playing against the same "opponent" and receiving the same % Cs, in the same sequence, but the contingent subject could exercise some control over the stooge's response pattern, whereas the noncontingent subject could not. The results in both studies indicate that the actual contingencies, over and above the proportion of Cs, are very important. The contingent subjects produced higher levels of C responses in both cases (65 and 78%) than the noncontingent subjects (20 and 40% Cs, respectively).

The specific contingencies, and the reactive nature of the stooge, appear to be very important determinants of behavior in these games. The different contingencies, and/or the static nature of the stooge, in Rapoport and Mowshowitz's study may account for the discrepancy between their rigged and real games. Such considerations raise some serious questions about the use of programmed "others" in psychological game research. But before discussing this issue, let us review just what these strategy studies have uncovered.

High levels of cooperation have not been obtained by using simple % C, noncontingent strategies. Subjects' reactions to such strategies appear to be exploitative, even if the "other" is an avowed pacifist. There is some mention in the literature that bimodal response distributions occur in response to these simple strategies, but very little has been made of this finding beyond noting its occurrence. In many cases, very few trials (< 60) have been used in these studies, and thus we have little data on the prolonged effects of these highly cooperative strategies. Subjects might feel guilty after prolonged exploitation, and switch to the mutually cooperative outcome.

There appear to be two general effects of various pretreatment conditions. The data indicate that initial defections prior to cooperation lead to higher final levels of cooperation than cooperative pretreatments. Initial concessions do seem to invite further exploitation, which may impede cooperation. The second general effect of pretreatment conditions is that response variability increases as the "other" shifts from the pre to final treatment condition. Dramatic and abrupt strategy changes lead to greater variability, which is also affected by the type and duration of the pretreatment.

Turning to the contingent strategies, it may be said that matching routines generally produce higher levels of cooperation than the noncontingent strategies. The matching strategy is also the most coercive strategy, since the subject is always punished immediately for defection and rewarded for cooperation.

The delayed matching strategy is not generally effective in producing high levels of cooperation, although it often produces significantly higher levels than various noncontingent routines. Those cases in which this strategy does produce fairly high levels (75%) of cooperation are usually games in which defection is costly (Ck) or cooperation is most economically rewarding (MDG). The effects of various pretreatments indicate that reformed sinner strategies tend to produce higher levels of cooperation than lapsed saint pretreatments, if both are followed by delayed matching routines. This finding, however, has not been confirmed by all studies using these routines. Some modifications of the delayed matching strategy, such as the "conciliatory" or "coaxing" routines used by some investigators, have also failed to produce very high levels of cooperation. The modification which produced the most cooperation was a "cautious" strategy which made cooperation conditional, with different probabilities, on the number of cooperative moves the subject made, increasing the probability as the number of Cs increased. This "cautious" strategy treated Ds in a similar manner, reciprocating them with a probability determined by their frequency. This reactive conditional strategy was more effective than a fixed-conditional strategy, in which the first-order conditional probabilities were fixed. The reactive strategy was superior, even though the values of the first-order conditional probabilities were determined by real subjects' behavior.

The "cautious" strategy, and others used by Gaebelein and Bixenstine (1968), are unique in that their stooge has a memory. Responses are conditionalized not only on what the subject did on trial n-1, but also on what he did on n-2 and n-3. This unique feature would seem to more nearly approximate the behavior of a real subject who would consider a particular move by his opponent in the light of what went before. If a subject perceives his opponent's C as an attempt to induce temporary cooperation so the opponent may then exploit him, the subject is not likely to be set up too often by such a sequence. But if the subject has learned, or perceives, that an opponent's C is likely to be repeated, his reaction may be very different.

This raises another entirely separate issue not yet considered—the subjects' perception of each other in the game situation. Presumably, subjects are attempting to guess what their opponents are going to do on each trial in order to most effectively plan their own strategy. If subjects have no prior knowledge of each other, their initial guesses should reflect their own biases about their opponent. As the game progresses and subjects accrue information about their opponents, their guesses should become more accurate, unless there are other considerations which serve to distort these perceptions. Let us now look at some studies which have considered how subjects perceive each other in a game situation, and how these considerations interact with the subject's strategy choice.

D. Interpersonal Perception in Conflict Situations

Although both structural and strategic variables play an important role in determining the behavior of protagonists in a conflict situation, it has become increasingly clear that such considerations alone cannot provide us with all of the necessary elements for a theory of conflict. The strategies reviewed above have primarily focused on a single aspect of our definition of strategy—the particular plan of action which is to direct the player's behavior. In fact, this restricted definition of strategy is often confused with the more general definition which includes the player's goal and the manner in which various contingencies are weighed. Very few studies have actually investigated the choice of a goal, and how the protagonists' impressions of each other may influence or alter this choice, or the choice of a response pattern.

Kelley and Stahelski (1970) have recently presented evidence indicating that individuals who explicitly set a cooperative goal for themselves in a game situation tend to perceive their opponent's goal and degree of responsibility for the nature of their interaction differently from those who set a competitive goal for themselves. Cooperators see their opponents as being heterogeneous—some are seen as cooperative, others as competitive. Competitors, on the other hand, tend to see their opponents as also being competitive regardless of the other's set goal. Furthermore, these Competitors do not see themselves as being anymore responsible for the low level of cooperation which results than their cooperative opponents. The Cooperators, however, who become behaviorally assimilated to their competitive partners, tend to see the Competitors as being more responsible for the uncooperative state which results.

Measures of protagonists' intentions and perceptions of each other are provided by those studies in which subjects have been required to guess what the other will do on each trial. The present review will focus upon these studies. Data from probability-matching experiments (Estes, 1964) indicate that subjects are sensitive to changes in the frequency of events, and will come to match the probabilities with their own responses, given sufficient trials. In part, this problem of probability matching is one which subjects in a mixed-motive game must face. Subjects in a game experiment do not necessarily want to match the other's response pattern but it would seem to be extremely helpful if they could predict the other's response pattern with some degree of accuracy. Several aspects of the problem are significant in that they differ from a probability-matching situation. In the probability-matching situation, the subject plays a one-person game against nature, and it is unlikely that nature will change its stimulus pattern as a result of the subject's attempted manipulations. In the two-person game, the other player has a psychology which must be discerned and interpreted, as well as manipulated. These are the very considerations which make mixed-motive games interesting to social scientists.

The fact that subjects are affected by whether or not they are playing against another real player, or against nature or a machine, has been demonstrated by Halpin and Pilisuk (1967). They ran three conditions with the same sequence of "moves" by the "other." The conditions varied in that the subjects were told that they simply had to probability match the sequence of lights, that they were playing against another real player, or that they were playing against a computer programmed to play the "best" strategy. The latter two conditions were presented as a PD game. The results indicate that the subjects predicted very accurately over the last 100 trials in the probability-matching condition, and when playing against the computer. However, when playing against a "real other," they tended to over-predict the occurrence of cooperative responses on the part of the "other," especially on the first 100 trials. Although the sequence of moves by the other was identical in each case, the knowledge that the "other" was a real person affected the subjects' perception in the situation. The over prediction of cooperative responses in the "real other" condition was primarily due to the male groups' predictions. Females tended to probability match in all cases.

There have been very few studies in which subjects have been required to predict the other's move on each trial of a PD or Ck game. Consequently, there is not the wealth of data which exists for other experimental game situations. Nevertheless, the half dozen or so studies which have been made present some interesting data. Perhaps the most basic question one can ask of these data is how well do the subjects probability match, and how accurate are they at predicting the other's behavior? Against programmed "others," the accuracy of prediction appears to be fairly high (Halpin & Pilisuk, 1967; Bixenstine & Blundell, 1966), no matter whether the subject thinks he is playing a real other or a machine. However, in the Halpin and Pilisuk (1967) study, only the females made accurate predictions, whereas the males over-predicted Cs. In the Bixenstine and Blundell (1966) study, the data are presented in correlational form; a correlation of 0.71 was obtained between the prediction of a C and the occurrence of a C by the other following such a prediction. Furthermore, these data were obtained after collapsing several matrices, only one of which was a PD game. In a real game, in which the other's strategy may be fluctuating over trials, it appears to be more difficult for subjects to accurately predict their opponent's choice. Tedeschi et al. (1968d) found that only five of twenty-four subjects predicted the other's behavior at a better than chance level in a real PD game. Of the 19 remaining subjects, 14 erred in the direction of over-predicting cooperation, a result similar to that observed by Halpin and Pilisuk (1967). It is interesting that the majority of Tedeschi's subjects erred in the direction of over predicting Cs, since the other was a real player. Halpin and Pilisuk's subjects, who over predicted Cs against a 70% C sequence in the probability matching condition, may have been approaching the best strategy, which would be to predict C 100% of the time. Since this 70% sequence was fixed they would be correct at least 70% of the time with such a strategy. Tedeschi's subjects seem to have distorted their perception of the situation rather than approach the optimal strategy. Unfortunately, no other data on this issue are reported in the literature.

Since there is very little information on the accuracy of prediction in real games, it is difficult to determine the direction of the inaccuracy, or the nature of the distortion. There are some data, however, on the predict-play combinations. There are four such combinations, and they introduce four new dependent variables. Given that the predict-play paradigm requires a subject to predict the other's move before making his own, these combinations may be considered as an expression of the subject's intention in making a particular response. If a subject makes a D, for instance, how does one know whether he is trying to exploit the other (because he guesses the other will make a C), or trying to defend himself (because he guesses the other will make a D). The predict-play paradigm provides just this information. The four predict-play combinations, and the intentions they may express are the following:

Predict Play	Interpretation
PC - PC	Cooperative
PC - PD	Exploitive
PD - PC	Apprehensive, martyr-like, suspicious
PD - PD	Defensive, punitive

in which the first PX is the predict segment and the second PX is the play segment. Notice that these variables are similar in meaning to the first-order conditional probabilities mentioned earlier. This state of affairs is very desirable, in that each of these variables should correspond to its appropriate counterpart. A high level of PC - PC is likely to be found where Cn+1/CCn is also high; similarly for PD - PC and Cn+1/CDn, PC - PD and 1 - Cn+1/DCn, and PD - PD and 1 - Cn+1/DD. Certain combinations of these variables may also be rather interesting. For example, a high level of PD - PD which is incorrect (i.e., DC outcomes actually prevail) may indicate that it is a fear of being exploited rather than a desire to exploit (i.e., low PC - PD) which is leading to an asymmetric outcome. Information of this sort might prove to be invaluable in pinpointing the specific reasons for a conflict, and thus assist in its resolution. To date, the data reported in the literature have been somewhat more straightforward, and have not been addressed to such issues. There are some data on the predict-play combinations; let us see what they tell us about the subjects' motives and intentions.

Terhune (1968) has shown that the level of PC - PC in a 1-trial game is related to a variety of social motives. Subjects high on Need Achievement produce the highest level of PC - PC (50-60%), and high Power-Oriented subjects produced the lowest levels (40%), with high Need Affiliators at intermediate levels.

The PD - PC variable was lowest for all groups (about 5 - 10%). The high Power subjects most often expressed an intention to exploit the other (PC - PD = 40%), while both Achievement and Affiliative Oriented subjects expressed such intentions much less often (5 and 15%, respectively). All groups were similar on the PD - PD variable at about 20%. Over a 30-trial PD game, Terhune (1968) found that the intentions, collapsed across motive groups, could be ranked in the following order: defensiveness (42%), cooperation (26%), exploitation (20%), and martyrdom (11%). No data are presented on the accuracy of these predictions, but given the low number of trials, it would be safe to assume that accuracy was low. This ranking, then, gives some idea of the distribution of intentions early in a game before subjects have an adequate opportunity to form accurate impressions of each other. The data also indicate that the over-prediction of Cs in these situations is not necessarily a sign of optimism, in that the other is perceived as being fair, honorable and cooperative. C predictions are almost as likely to be followed by D moves as by Cs. The predominance of PD - PDs also indicates that the group is both suspicious and willing to retaliate against defections. Worchel (1969) used five PD games which varied R and S, with a predict-play paradigm. He found that the predictions of Cs was highest in those games in which C choices were also highest (where T-R is a minimum). However, more Cs were predicted than played in all five games. Bixenstine et al. (1966b) noted this same result in a six-person PD game. They used two levels of communication and two levels of knowledge of the other's response in this game. They report that the only condition in which PC - PC increased over trials was in the communication-knowledge condition, which also produced the highest level of cooperation.

The only other study to report these predict-play combinations in a real game is one by Tedeschi et al. (1968 b, d). No difference was found in the level of C played between those dyads which were required to explicitly predict each other's moves, and those which simply had to play each other without making such predictions. Halpin and Pilisuk (1970) also report no difference between their predict and no-predict conditions. This finding also implies that requiring explicit prediction does not necessarily lead to a higher level of cooperation. Even if the predictions are correct, this is not the case. Tedeschi's "realists," whose predictions were accurate more often than one would expect by chance alone, actually made significantly fewer C choices than any of the other groups. The overall level of cooperation attained by the subjects in the predict condition was less than 30%.

With respect to the predict-play combinations, Tedeschi et al. (1968b) report only whether or not these variables are correlated with the first-order conditional probabilities. No actual data are presented. In general, the authors report that Rapoport and Chammah's (1965) interpretation of the conditional probabilities is supported by the data.

In summary, these studies leave the following impressions. Subjects are affected by the nature of the other player; whether he is a real player or a machine makes a difference both in the accuracy of his predictions, and in the type of intentions expressed by the subjects. The predict-play combinations indicate a high level of suspiciousness and willingness to retaliate against suspected defections. Cooperative and exploitative intentions are expressed about equally often and martyr-like intentions are infrequent. Most of the studies used fewer than 100 trials, so these tentative generalizations provide some indication of the distribution of intentions early in the game, before subjects have an adequate opportunity to form accurate impressions of one another. The general lack of accurate predictions may also be explained by the low number of trials. In any event, neither explicit predictions, nor accurate explicit predictions, necessarily facilitate high levels of cooperation. Although the predict-play paradigm appears to have a great potential for monitoring certain characteristics of the interaction process, investigators have only recently begun to use it to that end.

Chapter IV Study 1: PREASYMPTOTIC INTERACTION PROCESSES AND ASYMPTOTIC STATES IN A PRISONER'S DILEMMA GAME

Introduction

Although the game paradigm is considered an excellent tool for studying cooperation and conflict, the levels of cooperation, P(C), frequently observed are either low or intermediate. Only when the structure of the game is predisposed to cooperation (e.g. an easy PD game or MDG), or when extremely potent strategies are used (e.g. a matching strategy in a Chicken game), do subjects produce high levels of cooperation. To be sure, different game structures, as well as different programmed strategies, lead to statistically significant different levels of P(C). However, to conclude that one game structure, or a particular programmed strategy produces more "cooperation" than another game or strategy, seems to stretch the definition of cooperation if P(C) is not very high. Not only does it appear inappropriate to label a P(C) = .40 or .60 as "cooperative" (since both subjects could still be suffering considerable losses), but there would also seem to be other, more interesting questions which could be asked of the same data. For instance, it has occasionally been noted that there is a bimodal distribution of response states after many trials of a PD game, the majority of the dyads locking in on a CC response state, and the others locking in on DD states. The presence of this sort of asymptotic data suggests several questions. One basic question is simply, "What differentiates those dyads who reach a high level of cooperation from those who do not"?

This question could be answered in several ways. One could investigate attitudinal/personality variables which differentiate these groups. Or one might investigate cognitive styles which distinguish cooperators and noncooperators. Another approach might be to investigate how subjects perceive the game, or their opponents. All of these approaches have in fact been used to investigate behavior in a game situation. For example, several studies have shown that P(C) is negatively correlated with scores on the F-scale (cf. Terhune, 1970). These types of studies have in common the fact that they relate one type of game behavior, usually P(C), to some non-game behavior (e.g. F-scores). Studies of this sort are undoubtedly important in helping us understand what kinds of attributes are likely to induce or impede cooperation or conflict. However, information concerning the attributes of a protagonist are not always available, or accurate. Often, one only has information about the other which is obtained through direct interaction in a conflict situation. Even if one has information about the other's attributes, the ability to alter these attributes may be minimal, and one is still faced with affecting a desirable outcome through direct interaction with the other.

It is the purpose of the present study to relate one type of game behavior (an asymptotic state), to another type of game behavior (preasymptotic interaction patterns). The simplest way to phrase the question is, "What preasymptotic interaction patterns differentiate cooperators from noncooperators"? In order to answer this question several requirements must be met by the experimental design. First of all, a criterion of cooperation must be defined. This criterion should be rigorous enough such that those dyads who once reach it, maintain a high level of cooperation thereafter. In this sense, the cooperation may be considered asymptotic. Secondly, since different dyads might be expected to reach this criterion after varying numbers of trials it will be necessary to distinguish a dyad's preasymptotic and asymptotic behavior. This procedure will allow a comparison of preasymptotic interaction patterns between cooperators and non-cooperators. Unless this requirement is met, the behavior of dyads who are in very different interaction states will be obscured. Unless preasymptotic behavior is clearly distinguished from asymptotic behavior it is impossible to study the relation of one to the other. A third requirement is that a large number of trials are permitted so that the necessary asymptotic states will occur.

A final requirement of the design is that the game must be a real game in that two subjects actually play against each other rather than one subject against a programmed strategy. There are several reasons for this requirement. First of all, the aim of this study is to contribute to a descriptive theory of conflict. This requires that subjects are not confronted with an artificial situation, that is, one in which they are faced with an unrealistic sequence of play. Since it is not known if, or how, the preasymptotic behavior of a co-operator differs from that of a noncooperator, it is not possible to programme a stooge to induce cooperation. The review of strategies as independent variables indicates that the strategic manipulations used by various investigators have not been potent enough to induce cooperation in all, or even a majority, of the subjects. Indeed, strategy changes have been shown to increase variability in the subject population's responses, rather than induce a particular response pattern in all subjects (Swingle, 1968).

Furthermore, it has also been demonstrated (Evans & Crumbaugh, 1967; & Downing et al., 1968) that the particular response contingencies of the stooge are extremely important in determining the subject's behavior. It seems that the programmed strategies used have not been sophisticated enough to account for all of the important contingencies in the appropriate manner. Even if a particular programmed strategy had been successful in one of these investigations in terms of inducing cooperation, a descriptive theory of conflict would still require that we know how real subjects reach cooperation. The manner in which real subjects interact to reach a cooperative state could be very different from an arbitrary strategy which has been shown to be capable of inducing high levels of cooperation. Programmed strategies can only tell us how subjects react to these strategies, they cannot tell us how real subjects interact.

Comparing the preasymptotic interaction patterns of cooperators and noncooperators has several advantages over using a stooge in the more traditional treatment-groups design. Rather than attempting to induce subjects into one response pattern or another, the present approach allows a subject to act more normally, as he might in a social encounter with another individual. The actual behavior and the contingencies which arise should be more like those of a natural encounter, than if a programmed pattern of responses was played by the "other." Aside from providing data on actual interaction patterns, this procedure also allows the formation of two naturally occurring groups - the cooperators and noncooperators. If there is a bifurcation of the data which occurs spontaneously (i.e., without special experimental treatment), this would seem to be an obvious cue that different processes are occurring in different dyads. In the case of a game situation this bifurcation could mean either that some of the data is confounded, by subjects not understanding the instructions, for example, or that significant naturally occurring differences are in evidence. If the latter case is true, an obvious question is, "What are the interaction processes which lead to these different outcomes"?

When data are dichotomized in the manner proposed they are often open to a serious criticism. That is, since extremes of the data are being compared, one cannot help but find statistically significant differences. In the present study this criticism does not apply because of the nature of the comparisons to be made. In the present study the data will be dichotomized on the basis of the asymptotic state reached by a dyad, as defined by the criterion of cooperation. The relevant comparisons, however, will be between the preasymptotic interaction patterns of the cooperators and noncooperators. Although one would expect the asymptotic states of the cooperators and noncooperators to differ on measures that are mathematically related to the measure which determines the criterion, there is no mathematical reason to assume that preasymptotic measures of any sort should be significantly different. There may be theoretical reasons for assuming differences between the two groups on one preasymptotic measure or another but there is no reason to assume mathematical dependence between asymptotic and preasymptotic response patterns. Stated differently, it can be said that the preasymptotic variables are free to assume any value, regardless of the asymptotic state of the dyad. For example, although the cooperators would be expected to have a significantly greater proportion of asymptotic CC response states than the noncooperators, this fact puts no mathematical restraints on the preasymptotic values of Dn+1/Dn for the cooperators or noncooperators. Thus, one can legitimately ask such questions, "Do cooperators make less preasymptotic competitive reactance responses than do the noncooperators"? Establishing a criterion and comparing preasymptotic variables in this manner eliminates the problem of having dyads in extremely different interaction states, thereby obfuscating these differences, and overlooking the important question of the interaction patterns which lead to cooperation or conflict. The use of naturally occurring groups permits a study not only of the interaction patterns which subjects use to induce mutual cooperation, but also of those interaction patterns which are likely to lead to high levels of conflict. It would be a happy state of affairs to know not only what types of response patterns lead to cooperation, but also what types of patterns might avoid high levels of conflict even when full cooperation is unattainable.

The previous gaming studies referred to have provided a wealth of information concerning the effects of various game structures and strategies, differences between various populations, and many other variables discussed in the previous review. These studies have asked many important questions about conflict and cooperation and the above criticisms apply only to the inadequacies of the traditional game designs for answering the questions posed here.

What then are the specific questions one can ask using the procedure outlined above? Each of the dependent variables discussed above may be examined for differences between cooperators and non-cooperators. The most frequently used dependent variable, P(C), has been used by Deutsch (1962) and others as an operational definition of trusting behavior, the basic notion being that mutual trust is required for cooperation to occur. Deutsch's (1962) notion of trust requires that the trusting person both expose himself to the risk of loss, and forego a gain at the other's expense. The P(C) variable in a PD game meets these requirements. An alternative definition of trust is suggested by Rapoport and Chammah (1965), who interpret the stochastic variable Cn+1/DDn as a measure of trust. This variable meets Deutsch's requirements for trusting behavior, but is more stringent in that it specifies the condition (a DD response state) after which a C response is to be considered as trusting.

A notion related to that of trust is one of trustworthiness. A person is trustworthy, according to Deutsch, when, acting under the assumption that the other has made a trusting choice, the person reciprocates the other's choice instead of taking advantage of the other's vulnerability. If the assumption is made that a subject expects the other to remain consistent in his behavior, the stochastic measure of C reciprocity, Cn+1/Cn, may be used as an index of trustworthiness. Again, Rapoport's definition of a trustworthy response is more highly specified. The stochastic variable Cn+1/CCn is considered to be an index of trustworthiness in that it indicates a willingness to continue the tacit collusion established on trial n, rather than take advantage of the other's trusting behavior.

The mutual trust hypothesis may be stated as follows:

Hypothesis 1: The preasymptotic interactions of Cooperators will be characterized by trusting and trustworthy behavior.

An alternative hypothesis which will be considered is suggested by learning theory. Kelley et al. (1962) demonstrated that many subjects appear to learn a "win-stay, lose-shift" strategy in a minimal social situation. When many trials of a PD game are played, P(C) typically shows a gradual increase over trials and then levels off. The subjects appear to learn that C responses are more rewarding than Ds.

The basic hypothesis may be stated as follows:

Hypothesis 2a: The preasymptotic data of the Cooperators will indicate a greater net gain from C responses than from Ds.

Hypothesis 2b: The preasymptotic data of the Noncooperators will indicate a greater net gain from D responses than from Cs.

If C responses receive a greater net gain than Ds in the preasymptotic interactions, the subjects will become Cooperators. This notion implies that Cooperators are economically motivated instead of being trusting and trustworthy, as the mutual trust hypothesis suggests. Subjects cooperate because exploitation is not feasible. However, if exploitation is more profitable than cooperation, conflict will continue. This simple notion may be tested by calculating the difference between the number of points won in CC and CD response states, and the number of points won in DC and DD response states. If the net gain from CC+CD is greater than that from DC+DD, cooperation should result. If the net gain from DC+DD is greater than that from CC+CD, then conflict should continue.

A second reinforcement hypothesis may be formulated in terms of the frequency rather than the magnitude, of reinforcement. This hypothesis may be stated as follows:

Hypothesis 3a: The preasymptotic data of the Cooperators will indicate a higher frequency of reward from C responses than from Ds.

Hypothesis 3b: The preasymptotic data of the Noncooperators will indicate a higher frequency of reward from D responses than from Cs.

Although this hypothesis is not totally independent of the magnitude of reinforcement hypothesis, it is worth separate consideration. Confirmation of either hypothesis would lead to a similar interpretation of the motivations of the Noncooperators. They would be economically motivated. The magnitude hypothesis would lead to the same interpretation of the Cooperators' motivational orientation. However, confirmation of the frequency hypothesis would lead to an entirely different interpretation of the Cooperators' motivational state. If the frequency hypothesis were affirmed, this would suggest that the Cooperators are not necessarily trusting or economically motivated, but that they prefer a "sure thing" to a more risky reward of greater magnitude. This hypothesis may be tested by comparing the frequency with which Cs are rewarded against the frequency with which Ds are rewarded.

Note that calculating both the frequency and magnitude of reward requires that the unilateral response states be considered separately for each dyad member. This means that we must have some basis upon which to distinguish one dyad member from the other. Formal game theory assumes that both players are equally rational, and therefore may be treated alike. Most psychological gaming studies have likewise ignored the differences between dyad members. One basis which has some intuitive appeal, and one which would not provide a bias for one or another of the hypotheses listed above, is the relative occurrence of C responses. Whichever dyad member makes more Cs than his partner prior to asymptote will be called the high C (HiC) member, and the other, the low C (LoC) member. The HiC member will always be referenced as Subject 1, so that the representation of a response state XY will mean that the HiC member made an X on that trial, and the LoC member, a Y. This procedure of distinguishing some salient behavioral characteristics of dyad members is regarded as a step toward the development of a theory of social influence in conflict situations.

Method

Subjects.

Subjects were 20 male and 20 female undergraduates, paired in like-sexed dyads. Care was taken to ensure that dyad members were unacquainted, and that neither had any prior "game" playing experience. All subjects were paid volunteers, and were accepted from a variety of academic classes.

Apparatus

The apparatus consisted of two cubicle-like partitions which separated the subjects, but which allowed the experimenter to view both subjects from the control room through a one-way mirror. The subjects sat at these cubicles, next to each other, with their backs toward the experimenter. Each cubicle contained a payoff display in matrix format. This 2 x 2 matrix was made of plexiglass with the payoffs printed in each cell. The payoffs for each player were displayed in full to both players. The payoff to a particular player was printed in large type in each cell, and the other's payoff appeared in small type in each cell. The actual payoff values are reproduced below in Figure 5. These particular payoff values were chosen because they are reported to produce an overall level of P(C) = .50 (Rapoport & Chammah, 1965), and it was anticipated that approximately half of the dyads would produce very high levels of P(C), and the other half, very low levels of P(C).

A light behind each cell was used to indicate the outcome on any particular trial. The response keys were located on the same panel as the payoff display. To make a response, the subject simply had to press one of the buttons aligned with the row (or column) of his choice. Once a choice was made, a green light opposite the button, on the other side of the display, would light up and remain on until that trial was terminated.

A trial began with the sound of a buzzer. Subjects were required to respond within 6 seconds of this buzzer, after which the appropriate cell would light up, determined by the intersection of row

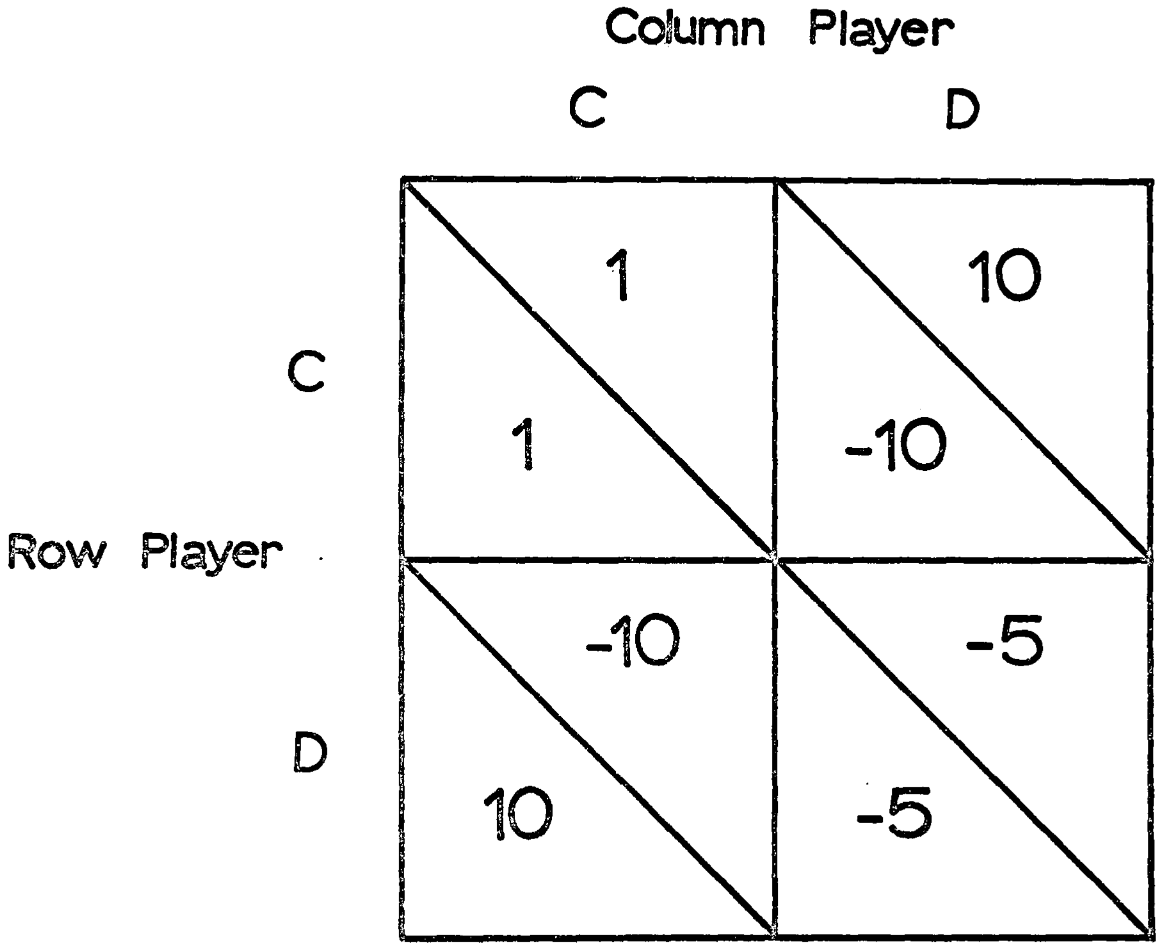


Fig.5. PD game used in Study 1.

and column players' choices. This cell would remain lit for 3 seconds, after which there would be a one-second pause, then the buzzer would signal the next trial. After 25 such trials, the buzzer would terminate, but the circuitry would continue on the same pattern for an additional 8 cycles. Then the entire pattern would be repeated again with the sound of the buzzer, as many times as necessary to obtain the desired number of trials.

All the programming apparatus was located in the control room behind the one-way mirror. The experimenter communicated with the subjects via an intercom, with which he also monitored their verbal interaction.

Score sheets were provided for each subject on which they were required to record their outcome in a gain or loss column on each trial. After every block of 25 trials, subjects were asked to sum their total gains and losses for that block of trials.

Procedure

When the subjects arrived, they were asked to be seated at one of the cubicles, and each was given a $1.00 stake. The experimenter, in the same room as the subjects, told them that the instructions would be read to them from the control room behind the one-way mirror. Each subject had a copy of the instructions, and each was asked to read along as the experimenter read the instructions aloud. They were told that the function of the $1.00 stake, and the use of the score sheets in front of them, would be explained in the instructions. They were then asked not to talk to each other, or to try to communicate in any way. The subjects were told they would be monitored by the experimenter from behind the one-way mirror to be sure they did not communicate. The presence of the intercom system was pointed out for their use if they had any questions.

The experimenter then went into the control room and read the instructions to the subjects over the intercom. The instructions described the means of playing the game and the method of monitoring one's gains and losses. Individualistic orientations were given, and reference to "game" or "partners" was avoided. It was made clear that subjects could keep whatever money they won in the situation. Complete instructions are presented in Appendix A.

Most of the questions the subjects asked were answered by rereading the relevant parts of the instructions. When both subjects were ready, the circuitry which controlled the start buzzer and various timers was initiated. The subjects' responses were recorded by the experimenter in the control room.

When 300 trials were completed, the subjects brought their score sheets and stakes into the control room. The total gains and losses for each subject were calculated and the appropriate amount was added to or subtracted from their stake. After the cash exchange was settled, another plea was made by the experimenter to the subjects to refrain from discussing the experiment with each other or anyone else, until two sessions had been completed (for a total of 600 trials). Subjects were initially recruited for "several sessions," and most seemed to anticipate more than just the two which were run.

The only difference in procedure between the first and subsequent sessions was that the instructions were not read by the experimenter after the first session. Copies of the instructions were available to both subjects, and they were given time to review them if they wished.

Informal post-game interviews were conducted to double-check on the subject's understanding of the instructions, and the maintenance of secrecy between both sessions.

Data Organization

Cooperation is arbitrarily defined as a condition in which each dyad member produces a level of $P(C) > .75$ per block for a minimum of three 25-trial blocks. The last trial of the previous block is regarded as the number of trials to criterion. This criterion was chosen instead of Rapoport's definition of a lock-in for the following reasons. Rapoport and Chammah (1965) define a lock-in as 23 CC or DD response states on the last 25 trials. Their definition is restricted to the last 25 trials, which is susceptible to the "end" effect (Rapoport & Dale, 1966), and does not consider what response state is predominant prior to this last trial block. Their definition defines a terminal rather than an asymptotic state. Thus their definition is perhaps too stringent in terms of the level of Cs required, and too limited in terms of duration.

The data prior to criterion are considered the preasymptotic data and are Vincentized into fifths to give an indication of the trend of a variable prior to asymptote. All of the Cooperators asymptotic data are collapsed into a final Criterion block for comparison with their own preasymptotic data, and with the Noncooperators' asymptotic state. All of the data for the Noncooperators are Vincentized into sixths, and the last Vincent block is considered the asymptotic state for the Noncooperators.

In order to test the reinforcement hypotheses some basis is required for distinguishing the members of each dyad. The dyad member who makes more Cs prior to criterion is referred to as the HiC member, and his partner as the LoC member. When representing response states, the HiC member will always be placed in the position of player 1.

Because the data will be in the form of probabilities, arcsine transformations will be performed on the data prior to analysis unless otherwise stated (Winer, 1962). All individual comparisons, where appropriate, will be made using the Newman Keuls procedure unless otherwise stated.

Results

The data of two female dyads have been eliminated from the final set of data, one because a dyad member confessed to "responding randomly," the other because one dyad member could not complete both sessions. Of the remaining 18 dyads, five (4 male and 1 female dyad) reached the cooperative criterion and 13 (6 male and 7 female dyads) did not. For the Cooperators, the average number of trials to criterion is 460; the range is from 300 to 525 trials. In order to provide a sufficient number of dyads in each criterion category, the sex of the dyad will not be considered separately as an independent variable in the following analyses.

Deutsch's formulation of the mutual trust hypothesis requires a comparison between Cooperators' and Noncooperators' preasymptotic values of P(C) and Cn+1/Cn. Figure 6 presents the values of P(C) for both groups for the first five trials, and over Vincent blocks.

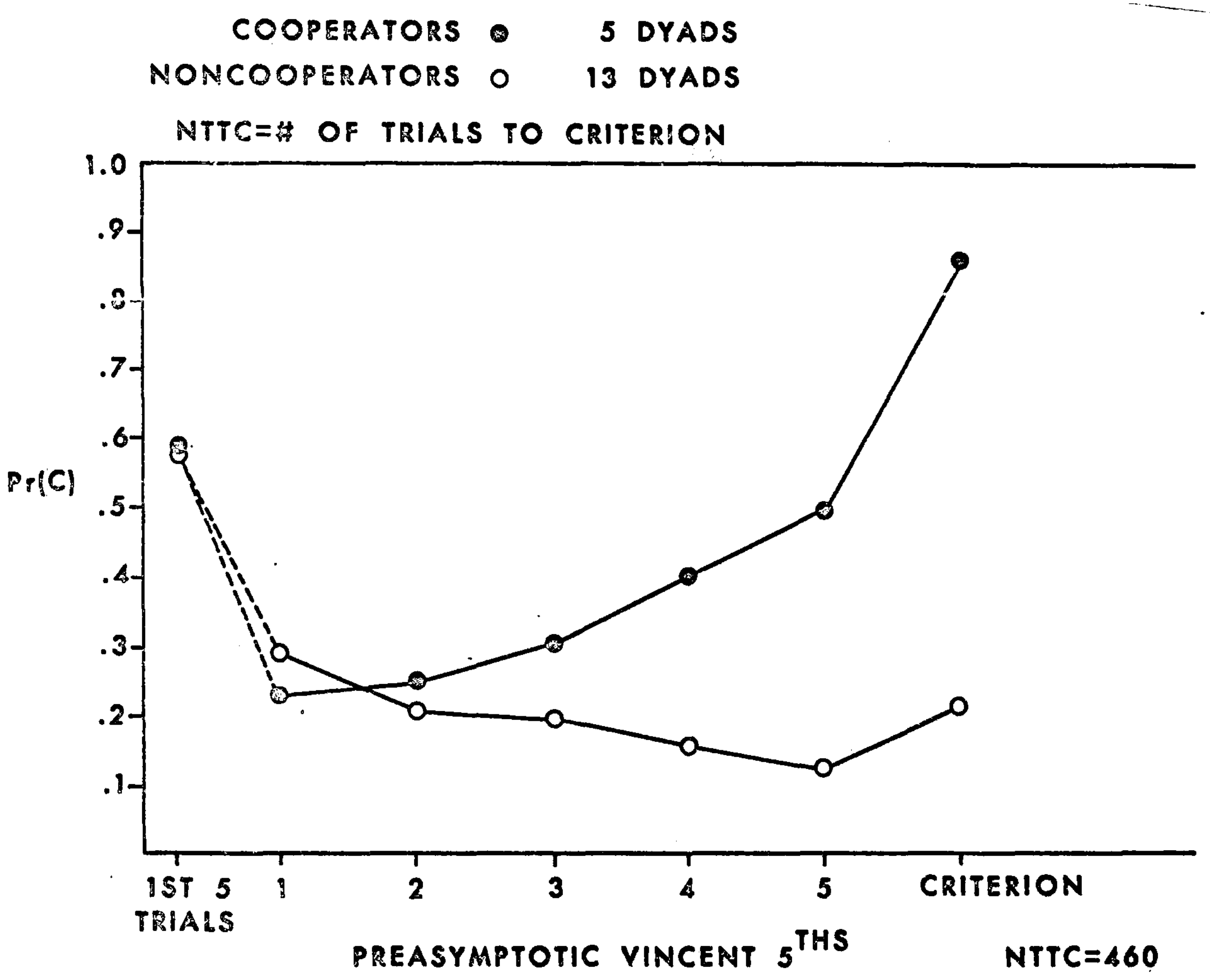


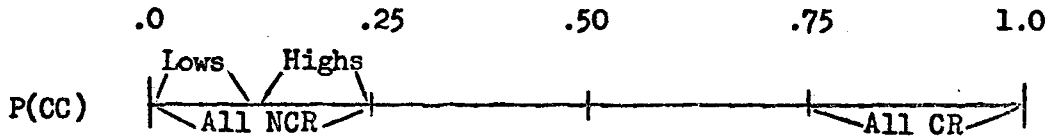
Fig.6. Probability of a cooperative choice, Pr(C), on the first five trials, over preasymptotic Vincent fifths, and at asymptote for Cooperators and Noncooperators.

Analysis of variance of the preasymptotic data only, indicates a significant Criterion Group ($F = 5.613$; $df = 1,136$; $p < .05$), Trials ($F = 2.432$; $df = 4,136$; $p < .05$), and a Trial blocks by Criterion Group interaction ($F = 6.098$; $df = 4,136$; $p < .01$). There is no difference between the groups on the first five trials.

Individual comparisons indicate that the Cooperators have a higher level of P(C) than the Noncooperators on the fifth Vincent block ($p < .05$). For the Cooperators there is a significant increase in P(C) from the first to the fourth and fifth Vincent blocks ($p < .05$). For the Noncooperators there is no Trials effect ($p > .10$).

In order to demonstrate that a bimodal distribution of CC states has in fact developed between these groups, the number of dyads from each group which fall within a certain range of P(CC) values are represented below. The horizontal line represents values of P(CC). Above the line are indicated the five dyads with the highest values of P(CC) over the first 100 trials, and the others. Only two of the five highest dyads over the first 100 trials eventually become Cooperators. All dyads make fewer than 25% CCs. Below the line are indicated the ranges of P(CC) for the Cooperator and Noncooperator dyads at the end of play. The data for the Cooperators represent the values of P(CC) for the trials subsequent to the 75 criterion trials. Because two Cooperators reached criterion in 525 trials, the post criterion data of only three Cooperator dyads is represented here. However, all five Cooperator dyads were run for an additional 300 trials on another day. All produced levels of P(CC) greater than .90 during this session. The data for the Noncooperators is taken from the last 100 trials.

First 100 trials



Post Criterion or Last 100 trials

The data for the Cooperators which is depicted in Fig. 6, suggests that these dyads undergo a rapid change in their level of C responding from the last preasymptotic block to asymptote. Examination of the data from individual dyads (presented in Appendix D) indicates that four of these five dyads reveal an increase in P(C) of at least .300 from the last preasymptotic block of 25 trials, to asymptote. Only one dyad shows a gradual increase over preasymptotic trials, as is the case when data are organized in the traditional manner. Even more dramatic than the change in P(C) is the rapidity with which the CC state is entered as depicted in Appendix D. However, the small n involved dictates caution in interpreting these data.

Table 1 presents the values of the reactance measures, Cn+1/Cn and Dn+1/Dn, collapsed over preasymptotic trials. Deutsch's formulation requires that the Cooperators make more Cn+1/Cn responses prior to asymptote than do the Noncooperators. Analysis of variance of these data indicates that Cooperators make significantly more cooperative reactance responses than Noncooperators prior to asymptote (F = 11.890;

df = 1,34; $p < .01$). For both groups the level of competitive reactance, Dn+1/Dn, is very high and analysis of variance indicates that there is no difference between groups ($p > .10$).

The use of conditional probabilities to describe interaction patterns assumes that there are sequential dependencies in the data. In order to examine directly the presence or absence of these sequential dependencies, sign tests (Siegel, 1956) were used. Difference scores between P(Cn+1/Cn) and P(C), and P(Dn+1/Dn) and P(D), for each subject provided the data for these analyses. In both cases these tests produced nonsignificant results ($p > .10$) for each group. These results indicate that there are no sequential dependencies in the cooperative or competitive reactance measures, and that the values of the reciprocity measures simply reflect the overall level of Cs made by each group.

Table 1 also presents the preasymptotic values of the first-order conditional probabilities for the Cooperators and Noncooperators. Analysis of variance indicates that only the measure Cn+1/CCn[1] is significantly greater for the Cooperators than the Noncooperators prior to asymptote ($F = 12.133$; df = 1,34; $p < .01$).

In order to examine the sequential dependencies in these conditional probabilities, sign tests were used on the difference scores between P(C) and a particular first-order conditional probability.

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[1]Because some dyads did not have a sufficient number of CC states (three or more) it was necessary to estimate their level of trustworthiness. This was done by taking the average level of trustworthiness of those dyads with three or more CC states and assigning this value to those dyads with an insufficient number. Noncooperator dyads were the only ones for whom this estimation procedure was required.

TABLE 1

PREASYMPTOTIC MEANS AND STANDARD DEVIATIONS* OF FIRST-ORDER STOCHASTIC MEASURES FOR COOPERATORS AND NON-COOPERATORS

MEASURE	COOPERATORS	NON-COOPERATORS	P
C_{n+1} / C_n	.483 (.243)	.257 (.136)	.01
D_{n+1} / D_n	.721 (.235)	.820 (.115)	NS
C_{n+1} / CC_n**	.732 (.241)	.402 (.257)	.01
C_{n+1} / DD_n	.161 (.097)	.168 (.123)	NS
C_{n+1} / CD_n	.378 (.327)	.247 (.170)	NS
C_{n+1} / DC_n	.266 (.236)	.189 (.105)	NS
	n = 5 DYADS	n = 13 DYADS	

* STANDARD DEVIATIONS IN PARENTHESES

** ELEVEN PER CENT OF THIS DATA IS ESTIMATED (SEE TEXT)

AVERAGE P(C) = .355 FOR COOPERATORS AND .193 FOR NONCOOPERATORS PRIOR TO ASYMPTOTE

The sign tests are significant for the trustworthiness variable, Cn+1/CCn, for both the Cooperators and Noncooperators ($p < .001$, one-tailed test). The level of trustworthiness is higher for most subjects than their preasymptotic level of P(C). Furthermore, the results of a Mann-Whitney U test (Siegel, 1956) indicate that the magnitude of the Cooperators' difference scores are greater than those of the Noncooperators ($p = .036$, one-tailed test). The only other occasion upon which the sign test is significant is for the Cooperators' trust, Cn+1/DDn - P(C) difference scores ($p < .055$, one-tailed test). In this case, the Cooperators are less likely to make Cs after a DD state than they are in general. Furthermore, a Mann-Whitney U test used to compare the magnitude of the difference scores indicates that the magnitude of the Cooperators' difference scores is greater than that of the Noncooperators ($p = .020$, one-tailed test).

The data required for a consideration of the reinforcement hypotheses are presented in Figure 7. Aside from the use of these data in evaluating the reinforcement hypotheses, these same data give an indication of the extent to which subjects coordinate their responses over trials. On the early trials DD response states predominate for both Cooperators and Noncooperators (Fig. 7B.). These DDs drop out of the Cooperators' data at a fairly constant rate, but continue to constitute the major portion of the Noncooperators' outcomes. By the fourth Vincent block the Cooperators are encountering significantly fewer DD response states than the Noncooperators. Analysis of variance yields an $F = 12.510$ (with $df = 1,80$; $p < .01$). Individual comparisons

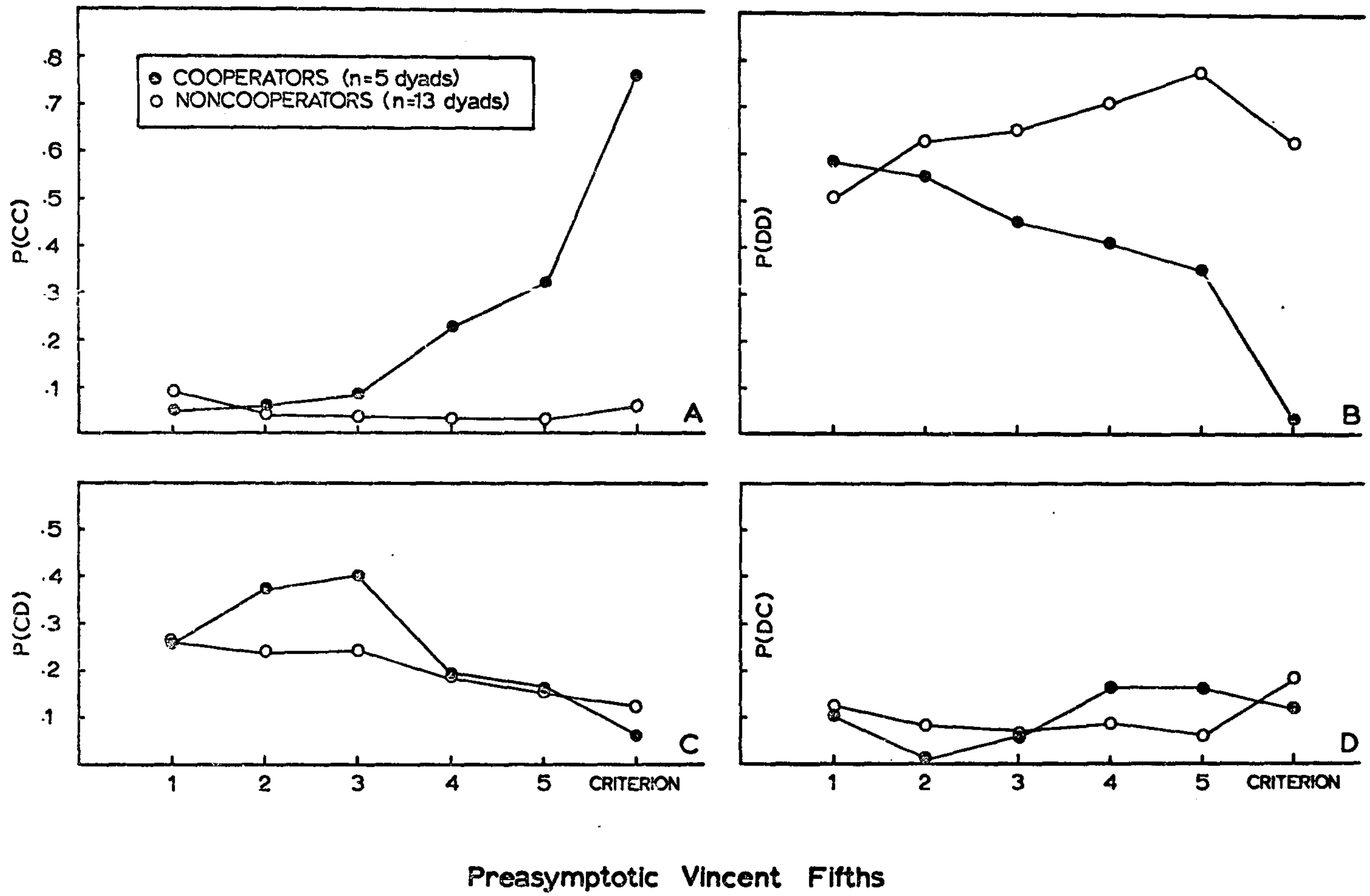


Fig. 7. Probability of a CC(A), DD(B), CD(C) and DC(D) response state over preasymptotic Vincent fifths and at asymptote for Cooperators and Noncooperators. Unilateral states are represented from the Hi C members position in this and all subsequent figures (see text).

indicate that the two groups differ at the fourth and fifth Vincent blocks ($p < .05$).

Analysis of variance of the data in Fig. 7 A. indicates a significant effect of Criterion Group ($F = 9.752$; $df = 1,80$; $p < .01$), Trials ($F = 5.957$; $df = 4,80$; $p < .01$), and a significant Criterion Group by Trials interaction ($F = 6.118$; $df = 4,80$; $p < .01$). Individual comparisons indicate that Cooperators encounter significantly more CCs than the Noncooperators on the fourth and fifth Vincent blocks ($p < .01$). Individual comparisons also indicate significant differences between Vincent blocks one and four, one and five, and two and five ($p < .01$ in each case). Noncooperators show no significant trials effect for CC response states.

The fact that the Cooperators seem to experience more CD outcomes than DC outcomes, suggests that one dyad member is attempting to influence his partner to cooperate. In order to test this notion the P(C) data were partitioned according to HiC and LoC members in each group. These data are presented in Fig. 8. The difference scores (HiC's level of P(C) minus LoC's level of P(C)) of the Cooperators and Noncooperators were submitted to analysis of variance. This analysis indicates a Criterion Group by Trials interaction ($F = 2.549$; $df = 4,64$; $p < .05$). Individual comparisons indicate that the Cooperators' difference scores on the second ($p < .05$) and third ($p < .10$) Vincent blocks are significantly greater than those of the Noncooperators. Furthermore, the Cooperators' difference score is greater on the second and third Vincent blocks than on the fourth and fifth Vincent blocks ($p < .05$). For the Noncooperators there is no Trials effect ($p > .10$).

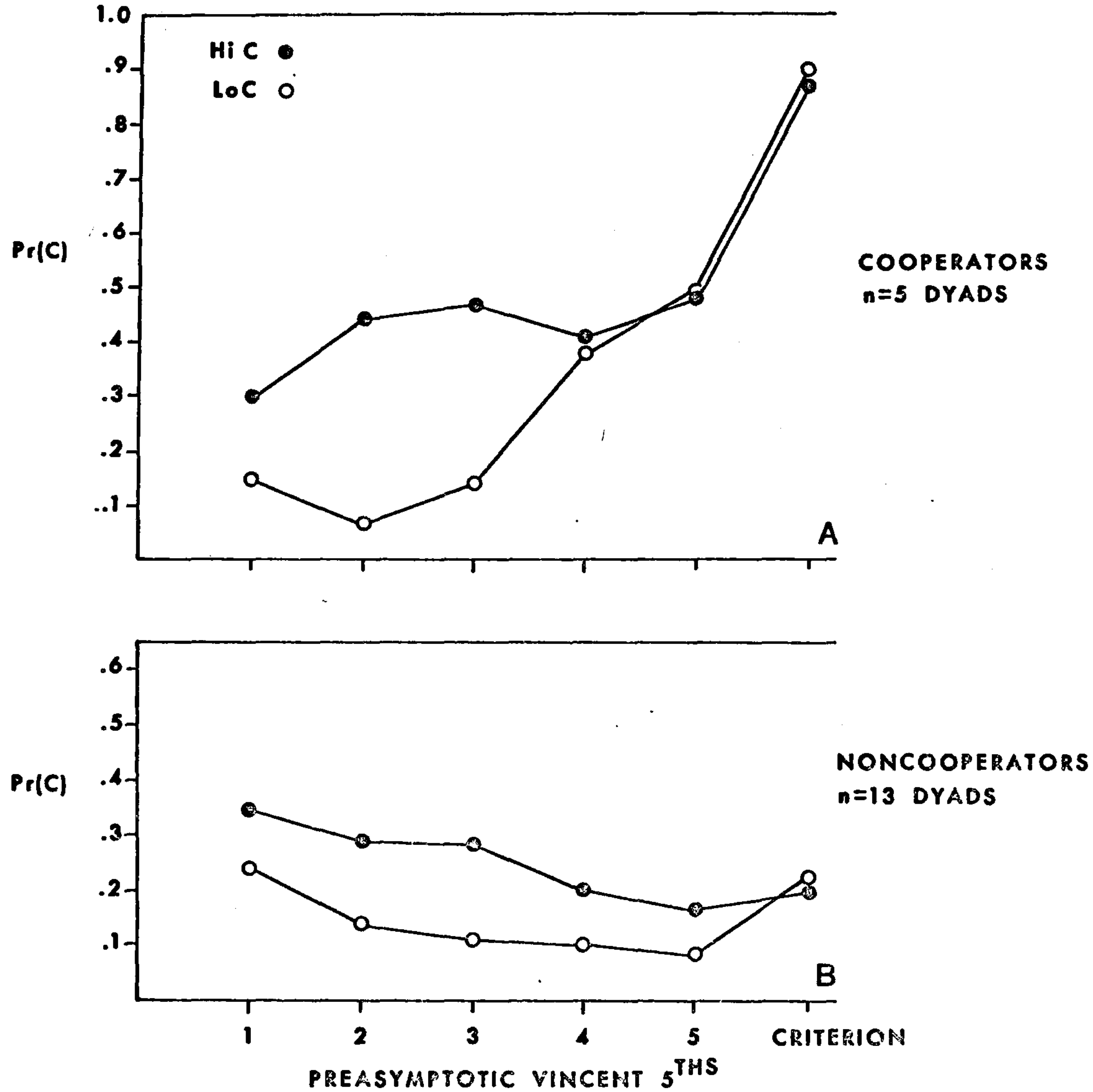


Fig.8. Probability of a cooperative choice, Pr(C), over preasymptotic Vincent fifths and at asymptote for both Hi C and Lo C Cooperators (A) and Hi C and Lo C Noncooperators (B).

The data in Fig. 9 may be used to evaluate the magnitude of reinforcement hypothesis. These data indicate that both groups of dyads receive predominantly negative outcomes with either response. The average outcome per trial is greater from a D response than a C for the Cooperators (Fig. 9 A.). Analysis of variance, without a transformation of the data, yields an $F = 8.002$ (with $df = 1,90$; $p < .01$). For the Noncooperators (Fig. 9 B.) analysis of variance indicates a significant interaction between Responses and Trials ($F = 4.988$; $df = 4,170$; $p < .01$). Individual comparisons indicate that the magnitude of reinforcement is stable over trials for C responses, but shows a significant decrease for Ds from trial block one to trial block five ($p < .01$).

The data in Fig. 10 may be used to evaluate the frequency of reinforcement hypothesis. These data (Fig. 10 A.) indicate that Co-operators receive a higher frequency of reward from Cs than from Ds. Analysis of variance yields an $F = 7.335$ ($df = 1,90$; $p < .01$) for Responses. Individual comparisons indicate that Cooperators receive a higher frequency of rewards from Cs than Ds on the last Vincent block ($p < .05$).

The frequency of reinforcement data for the Noncooperators is presented in Fig. 10 B. Noncooperators are negatively reinforced for D responses significantly more often than for Cs. Analysis of variance yields an $F = 23.176$ (with $df = 1,170$; $p < .01$) for Responses, and $F = 3.453$ (with $df = 4,170$; $p < .01$) for Trials, and an $F = 4.070$ (with $df = 4,170$; $p < .01$) indicating a significant Response by Trials

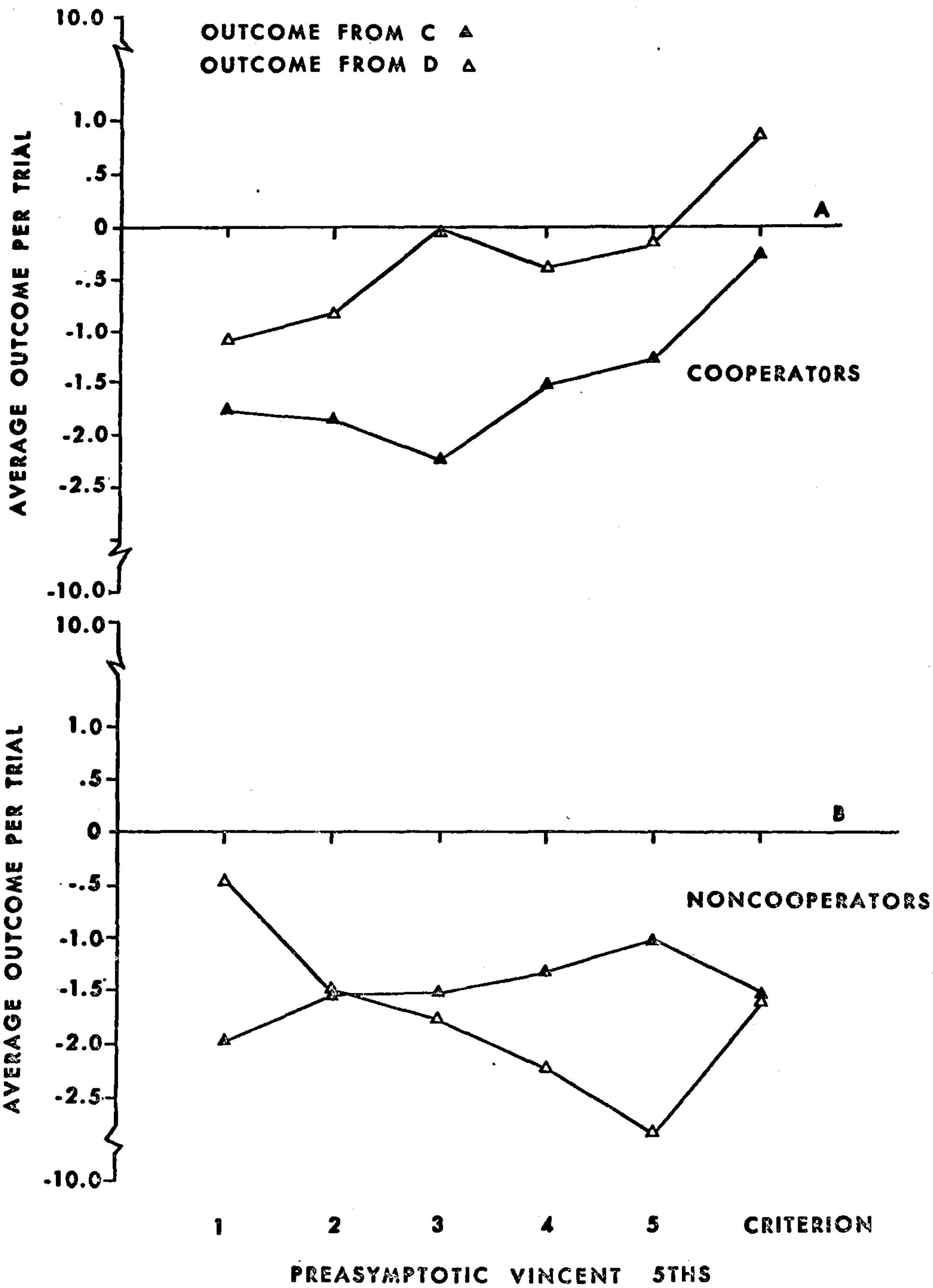


Fig.9. Average outcome per trial (in points) over preasymptotic Vincent fifths and at asymptote from both a cooperative (C) and a defecting (D) response for the Cooperators (A) and Noncooperators (B).

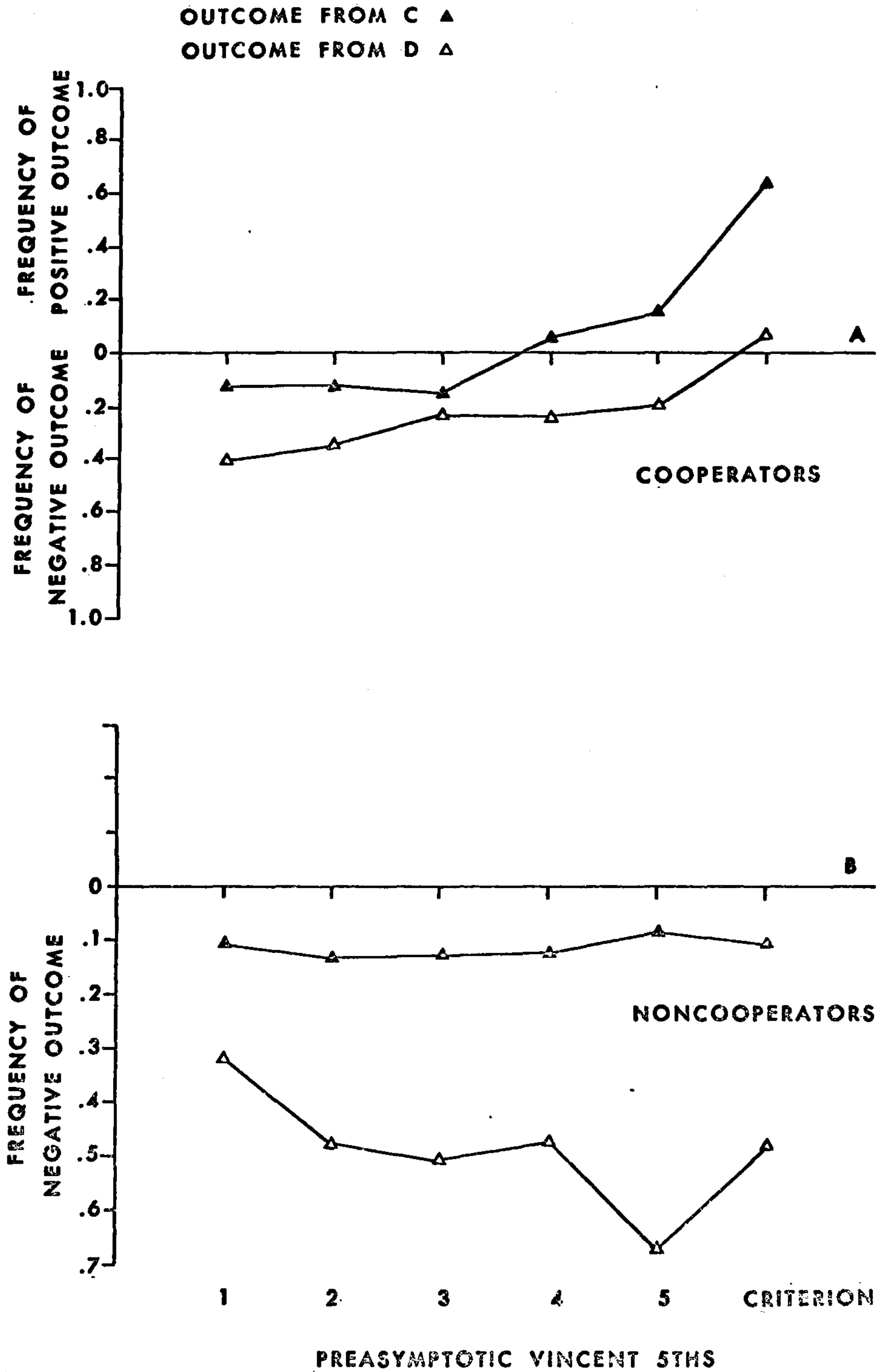


Fig.10. Frequency of both positive and negative outcomes over preasymptotic Vincent fifths and at asymptote from both a cooperative (C) and defecting (D) response for the Cooperators (A) and Noncooperators (B).

interaction. Individual comparisons indicate that Ds are negatively reinforced increasingly more often from trial block one to trial block five ($p < .01$).

Discussion

These data indicate that dyads, which would typically be collapsed into a single treatment group, produce extremely different asymptotic states without any special experimental treatment. The distributions of CC response states over the first 100 trials and at the end of play indicate a considerable change over trials. Initially, all dyads generate low levels of P(CC) and the particular value of P(CC) is not a good predictor of which dyads will end up as Cooperators. Only two of the five dyads with the initially highest levels of P(CC) became Cooperators. At the end of play, the distribution of CC states is clearly bimodal with the Cooperators at one extreme and the Noncooperators at the other. Data from a third 300 trial session confirms the fact that these Cooperator dyads attained an asymptotic state. None made fewer than 90% Cs over the entire session.

Dyads categorized on the basis of the criterion used may be differentiated on a number of preasymptotic variables. The analysis of variance results indicate that prior to asymptote, Cooperators make more trusting, P(C), and trustworthy, C_{n+1}/C_n and C_{n+1}/CC_n, responses than the Noncooperators. However, an examination of the sequential dependencies indicates that the difference in C reciprocity is due to the overall difference in level of P(C) between the two groups. Although one would also expect the level of trustworthiness to be higher if the level of P(C) is higher in one group than the other, the results of the sign test indicate that the level of trustworthiness cannot be accounted for in terms of the level of P(C). For both groups trustworthiness is independent of P(C). A C on n+1 is made with a higher probability after a CC state than Cs are made overall. Furthermore, the results of the Mann Whitney U test indicate that the magnitude of the difference between trustworthiness and P(C) is greater for the Cooperators than the Noncooperators. The analysis of variance results indicating a greater level of trustworthiness in the Cooperators, then, cannot be accounted for solely in terms of the Cooperators' higher level of P(C).

The fact that Cooperators are more trusting, P(C), and trustworthy, Cn+1/CCn, than the Noncooperators prior to asymptote lends partial support to the mutual trust hypothesis. Deutsch's notion of trust, and Rapoport and Chammah's notion of trustworthiness, differentiate the interaction patterns of these two groups. It is interesting to note that Rapoport's notion of trust, Cn+1/DDn, is a discriminator between the Cooperators and Noncooperators, but in the opposite direction to that predicted. Cooperators are less likely to follow a DDn with a Cn+1, relative to their overall level of Cs, than are the Noncooperators. The importance of the P(C) and P(Cn+1/CCn) variables is further emphasized in that a consideration of their preasymptotic values permits a high level of accuracy in classifying individual dyads as either Cooperators or Noncooperators (cf the section of Appendix C pertaining to Study 1).

Although the mutual trust hypothesis receives partial support from these results, it is clear that mutual trust is not a general characteristic of the Cooperators. The initial trials indicate no differences between the Cooperators and Noncooperators. Trusting behavior in the Cooperators clearly develops from an initially low level, and only after a considerable number of trials. This indicates that Cooperators are not necessarily predisposed to trusting or trustworthy behavior. The structural characteristics of this PD game entice the majority of subjects into making D responses for a considerable number of trials. The important question is how some dyads manage to overcome this tendency and develop mutually cooperative behavior patterns in spite of the structurally defined conflict situation.

The results of the magnitude of reinforcement hypothesis cannot account for the asymptotic data of the Cooperators. Prior to asymptote D responses receive a greater magnitude of reward than C responses. However, examination of the frequency of reward hypothesis indicates that prior to asymptote, Cs are in fact rewarded more often than Ds for the Cooperators.

The frequency of reinforcement hypothesis is not incompatible with the mutual trust hypothesis. An interesting question is whether the reinforcement of Cs is responsible for the development of mutual trust. Unfortunately, if the conditional probabilities are broken down into Vincent halves, there is insufficient data for some dyads (i.e. there are less than three occurrences of a particular response state) which precludes a comparison of the two groups over trials. Because it is not possible to examine changes in any of the conditional probability variables over trials, it is not possible to account for the development of mutually cooperative response states prior to asymptote. The fact that the Cooperators make a C with a high probability (i.e. $>$ .500) only after a CC state on the previous trial, suggests that the trustworthiness variable plays an important role.

The fact that the P(C) difference scores are greater for the Cooperators than the Noncooperators is also suggestive of the process by which mutual trust develops. The fact that the HiC Cooperators seem to experience more CDs than their LoC partners relatively early in the game (cf Fig. 7 C and D), but do not continue this relationship, suggests the following notion. The HiC dyad member indicates his willingness to trust early in the game and continues this trusting behavior for a considerable number of trials. This notion is supported by the analysis of variance of the difference scores between HiC and LoC members in each group. The magnitude of the Cooperators' P(C) difference scores is greater than that of the Noncooperators over Vincent blocks two and three. The LoC members begin to reciprocate this trusting behavior by the fourth Vincent block as evidenced by the increase in CCs. This description suggests that the LoC members must relinquish their Ds, which accounts for the drop in both CDs and DDs over trials, and the large outcome associated with the CD states on which they, as player 2, won the lion's share. This suggests further, that the reinforcement hypotheses must be revised to differentiate the outcomes of both dyad members since their outcomes are unequal for some trial blocks.

The fact that the average magnitude of reward for Cs is not greater than that for Ds may indicate that the CC state has a special salience for the Cooperators over and above the economic outcome associated with it. This saliency may very well be the fact that the CC state is the only one which allows both dyad members to be mutually rewarded. It does not appear that the mutual trust or "sure thing" notions are entirely adequate to explain the Cooperators' behavior. Even at asymptote, the level of CC is not at a maximum (Pr = 1.0) for all dyads. Although it seems somewhat difficult for the majority of dyads to enter the cooperative state in the number of sessions allowed, this state is not so fragile that once attained, occasional defections precipitate a conflict spiral out of it. A high level of CCs may provide a safe background against which one may enjoy whatever economic or social pleasures are afforded him by an occasional defection.

This discussion of the Cooperators' preasymptotic interactions must be tempered by a number of considerations. First of all the small n involved does not allow very strong generalizations to be made. Secondly, it is unfortunate that the conditional probabilities could not be partitioned more finely to give an indication of trend. This circumstance is unfortunate on two counts. The changes in P(C) and the response states over trials (Figs. 6 and 7) suggest that changes in conditional probabilities are also occurring, at least for the Cooperators. Trend information is likely to provide a more accurate picture of the interaction patterns which lead to a stable cooperative state. In addition, the results concerning the presence or absence of sequential dependencies are likely to be affected by this assumed change over trials. When measuring sequential dependencies it is usually assumed that the variables are stationary. By not being able to deal with trend effects it is difficult to determine whether sequential dependencies are actually present or absent.

The most important issue in this discussion centres on the fact that due to the descriptive nature of this study, it is not possible to make causal statements regarding which interaction patterns lead to which asymptotic states. It is the purpose of these studies to provide a description of preasymptotic interaction patterns which differentiate dyads who reach high or low states of cooperation. Only when some confidence is gained in the stability and generality of these interaction patterns, will an experimental manipulation be undertaken to determine if the pattern in question is indeed causally related to certain asymptotic states.

Aside from any considerations of the hypotheses discussed, there are several characteristics of the data worthy of note. It is somewhat surprising that more differences between Cooperators and Noncooperators are not observed in the preasymptotic data. It may be the case that the differences observed are sufficient to account for the different asymptotic states. However, it may also be the case that the differences are too subtle to be detected by the methods used. The first-order conditional probabilities of trust, repentance and forgiveness, for example, do not differentiate these groups when these variables are collapsed across preasymptotic blocks. Yet it is clear these variables must change over trials for the Cooperators, if not for the Noncooperators. Similarly, it is interesting that these groups do not differ in D reciprocity, which is high for both groups. It is unfortunate that the combination of a small n, and the lack of sufficient cases which occur if the preasymptotic data is partitioned more finely, does not allow the trends in these variables to be investigated. At the same time it is fairly clear that the preasymptotic interactions generated by these, and the other variables studied, are very different from the programmed strategies typically used in gaming studies. Another characteristic of the data which is surprising is that the Cooperators show an increase of 40% in their level of P(C) from the last preasymptotic block to asymptote. This jump occurs without benefit of verbal interaction, and it occurs in both dyad members almost simultaneously. Yet neither member exploits the other. This suggests that some aspects of the preasymptotic interactions have a very potent effect on the dyad. Whatever these aspects might be, it is clear that a high level of P(C) (i.e. over 50%), is not a necessary condition for this to occur. This finding raises some serious questions about the use of P(C) as a major dependent variable. The absolute level of P(C) may not be the best index of whether dyads will become Cooperators (cf Appendix C for alternative indices). A considerable number of trials was required before differences occurred between Cooperators and Noncooperators in the level of P(C). The present data suggest that examining the interaction patterns which are involved in permitting this rapid increase in mutual cooperation to occur, will require a more thorough investigation of role effects. The levels of P(C), CC, and the frequency of reward for Cs, are all relatively low for the Cooperators in absolute value prior to asymptote, even though they are greater than for the Noncooperators. This finding suggests that studies investigating the relation of nongame measures (e.g. attitudinal/personality characteristics) to game behavior may be expanded to include some of these measures other than the frequently used P(C).

The inferences made concerning the interaction processes which lead to one or another asymptotic state, must be tempered by a number of considerations. Aside from the small n involved, and the inability of the data to yield information of the trends of the stochastic variables, there is also the issue of the differences between the HiC and LoC dyad members. All Cooperators are not alike, nor are all Noncooperators similar. Collapsing these differences into two dichotomized categories does not allow these types of inferences to be very accurate. The fact that the difference in level of P(C) between HiC and LoC members in the Cooperators is greater than that in the Noncooperators, raises several interesting questions. One important question concerns the nature of an "influence attempt" which is likely to succeed and how it differs from one which fails. Further development is required along the lines of differentiating dyad members as well as differentiating asymptotic groups.

Summary and Conclusions

This study was designed to determine the preasymptotic interaction patterns which discriminate dyads which reach a cooperative asymptotic state from those which do not. The data lend partial support to a mutual trust hypothesis as suggested by Deutsch (1962) and Rapoport and Chammah (1965). However, the hypothesis formulated must be revised. Since both the Cooperators and Noncooperators appear very similar on the early trials, it cannot be said that trust and trustworthiness, as predispositional attributes, differentiate these two groups. Rather, it is the ability of the Cooperators to develop these behavior patterns in a conflict situation which makes them different from the Noncooperators. The interaction patterns which encourage or impede this development require further study.

Chapter V Study 2: DIFFERENTIAL INFLUENCE ATTEMPTS OF COOPERATORS & NONCOOPERATORS IN A PD GAME

Introduction

The focus of the present study will shift from a concern with the gross interaction patterns which differentiate Cooperators and Noncooperators prior to asymptote, to a concern with the differential relationships which distinguish the preasymptotic interactions within each of these groups. The basic question is as follows: What are the characteristics of an influence attempt which is successful in inducing a cooperative state, and how does it differ from one which fails? The answers to these questions require a closer comparison of the differences in the preasymptotic behavior patterns between HiC and LoC members in each group. Organizing the data in a fashion which neglects these differences obfuscates the social influence processes which encourage or impede a cooperative outcome.

A considerable amount of data exists on the characteristics of influence attempts which fail to induce an asymptotic level of cooperation. These studies have been reviewed in the previous section on strategy, and for present purposes may be categorized as three general types. Some strategic manipulations have attempted to induce high levels of cooperation by example, by presenting the subject with a high level of programmed cooperation (e.g. Minas et al., 1960; Oskamp & Perlman, 1965). Appeals to a "universal" norm of reciprocity (Gouldner, 1960) have also been used in an attempt to induce subjects to cooperate (e.g. Komorita, 1965; Wilson, 1969). A third type of social influence study is one in which various pretreatment procedures are used in conjunction with some variant of the first or second type of manipulation (e.g. Bixenstine & Wilson, 1963; Swingle & Coady, 1967; Harford & Solomon, 1967). Not all studies in the above categories were designed specifically to induce high levels of cooperation. However, for present purposes the main point is that none of these influence attempts did result in such an outcome.

In contrast to the bulk of data on influence attempts which failed, there is a paucity of information on the characteristics of a successful influence attempt. Rapoport & Chammah (1965) have reported that some dyads in a particular treatment condition have attained high levels of cooperation. However, little is known about the interaction patterns of these dyads, which differentiate them from other dyads in the same treatment condition who fail to attain cooperation. The previous study provides some data on this issue. Study 1 indicates that Cooperators are more trusting, P(C), and trustworthy, Cn+1/CCn, than Noncooperators prior to asymptote. However, this mutual trust develops after a considerable number of trials, and the preasymptotic level of P(C) is quite low. Although the previous data do not permit an examination of the trend of all the variables over trials, it is clear from the data regarding the level of P(C) for HiC and LoC Cooperators that these groups differ considerably. What theoretical notions can account for this difference in the success enjoyed by the cooperative dyads?

Rather than addressing itself to this issue of social influence in a conflict situation, the mutual trust hypothesis simply describes the dyadic conditions necessary for the occurrence of cooperation. Nothing is indicated about the manner in which one dyad member may influence another to behave in a trusting and trustworthy manner. The notions developed by Osgood (1962) are much more appropriate for a consideration of this issue.

The Osgood strategy is a complex one, originally developed as a method for reducing cold war tension between the East and the West. Attempts have been made to test some aspects of the Osgood proposal (Pilisuk & Skolnick, 1968; Gaebelein & Bixenstine, 1968) but the results are equivocal. The Osgood proposal is too complex to test in a single study, and it is not the purpose of the present study to attempt such a task. However, Osgood's proposal contains some notions concerning the characteristics of a successful influence attempt which might assist the present effort.

Osgood suggests that a successful attempt to reduce tensions must contain the following elements. The initiator of the tension reduction must clearly signal the other of his willingness to cooperate, and this signal must possess certain characteristics if it is to be successful. To make the signal convincing the initiator must go beyond words and commit himself to a line of action which is risky. If the magnitude of the risk is not such that the other is convinced of the initiator's sincerity, the other is likely to suspect a trap, which could serve to escalate the conflict. On the other hand, if the level of risk is too great, the other may seize the opportunity to exploit this apparent weakness. The difficulty, of course, is the ability to specify a degree of risk dramatic enough to be a clear signal of cooperative intent, but not so dramatic as to leave the initiator entirely at the other's mercy. If the initiator's cooperative gesture is reciprocated, both parties may then move to the next salient rung on the deescalation ladder. If the initial gesture is not reciprocated, the initiator must stand firm and avoid the impression that his overture was motivated by a position of weakness.

The strategic manipulations reviewed earlier which failed to produce high levels of cooperation seem to have fallen outside of the range described by the Osgood proposal. The first type of strategic manipulation, setting a cooperative example, errs on the side of being mistaken for a sign of weakness or submission. The second type, appealing to a norm of reciprocity, errs on the side of being inadequate to clearly signal a sincere gesture of cooperation. None of the three types of manipulations satisfies all of the conditions suggested by Osgood.

These suggestions from the Osgood proposal and the previous data lead to a notion of a "cautious trust" on the part of the dyad member who successfully assumes the role of initiating cooperation. What characteristics of this cautious trust satisfy the conditions outlined above? Although the mutual trust hypothesis is limited for our present purpose, it does suggest which variables are of some importance. The trusting response, P(C), and the trustworthiness response, Cn+1/CCn, proved to differentiate Cooperators from Noncooperators in the previous study. What is the role of these variables in the influence attempt initiated by the HiC member?

The magnitude of the difference in level of P(C) is one condition which must be satisfied as indicated in the previous study. Although the Osgood proposal suggests that the HiC member must necessarily be more trusting than his partner, this does not imply that he should also be more trustworthy. In fact, an argument may be made that the HiC member should be no more trustworthy than his LoC partner. The HiC member's "excess" Cs should not be randomly distributed in terms of the outcome on the previous trial. The HiC member should be able to most effectively signal his partner, without appearing weak, by selectively distributing his "excess" Cs after CD or DC response states. In Study 1 the Cooperators demonstrated a negative dependency on a DD state. This suggests that the HiC members are not likely to distribute any "excess" Cs after a DD outcome. Such behavior should signal the HiC member's propensity to forgive the other's occasional exploitation, and to repent after his own defections. However, by not making more trustworthiness responses, Cn+1/CCn, than his LoC partner, the HiC member may convey the information that he will retaliate unless the other reciprocates his cooperative gesture, and retains the mutually beneficial outcome. The initiator thereby insures negative outcomes for the other on a scale determined by the other's defection from the CC state.

This "firmness" on the part of the HiC member is considered an important aspect of a cautious trust. It is essential because signs of weakness or submission invite further exploitation. This aspect of strategic interaction is entirely overlooked by the mutual trust hypothesis. The previous data suggest another manner in which this firmness may be expressed. Although Cooperators exhibit more mutual trust prior to asymptote than Noncooperators, Cooperators also exhibit a very high level of D reciprocity (Pr = .72). Such a behavior pattern is obviously not incompatible with attaining a state of high cooperation, provided that the other conditions outlined above are also satisfied. Indeed, this degree of firmness may be an essential element. This relationship may be incorporated into a notion of cautious trust in the following manner. HiC members will reciprocate Ds less often than LoC members during the signalling phase of their interaction (because HiC members are predicted to play more forgiveness, Cn+1/CDn, responses). However, the HiC member's level of D reciprocity will increase to that of the LoC member if the latter does not reciprocate the HiC's cooperative gesture. The LoC members must come to match the HiCs' level of P(C) prior to the rapid jump into the asymptotic state. Once the LoC members indicate their willingness to accept the initiators' gesture, they may proceed to the next salient rung on the deescalation ladder—full cooperation in the PD game.

In summary, the elements of a cautious trust may be said to include an adequate signalling of one's cooperative intention, combined with a firmness which discourages exploitation as described above. Given this description, the following hypothesis may be stated:

Hypothesis 1: The preasymptotic interaction patterns of the Cooperators will be characterized by a cautious trust which is initiated by the HiC members. The preasymptotic interaction patterns of the Noncooperators will lack one or more of the elements of a cautious trust.

So far nothing has been said about the timing of the initiator's gesture, either in terms of onset or duration. The previous data indicate that several blocks of trials are likely to pass before the initiative is begun. The structural characteristics of a difficult PD game are likely to dominate whatever predispositions to cooperate or compete exist in the subject population. Regarding the duration of a successful influence attempt, the previous data also suggest that several trial blocks will be necessary.

In order to monitor the changes in the subjects' orientations as the interaction progresses, an explicit prediction procedure will be used. This procedure requires each subject to predict the other's move before making his own choice on each trial (cf. Terhune, 1968; Halpin & Pilisuk, 1970). This procedure reduces some of the ambiguity involved in interpreting a particular response by providing information regarding the subject's intention in making that response (cf. Chapter 3, D). It is a useful procedure in that the data it provides should be congruent with the theoretical notions which generated the hypothesis concerning the effectiveness of a cautious trust. Tedeschi et al. (1968b) indicate that the intention data generally support the interpretations given to the first-order conditional data by Rapoport and Chammah (1965).

The early phases of the interaction are not likely to differentiate either the Cooperators and Noncooperators, nor the HiC and LoC members within these groups. The structural characteristics will dominate. However, while the HiC members are initiating their cooperative gestures, one would expect an increase in cooperative and forgiving intentions (PC-PC and PD-PC)[1], and a concomitant decrease in exploitative intentions (PC-PD) for these subjects. The HiC members should also be expected to increase their PD-PD responses as an expression of their firmness, if the LoC members do not reciprocate their cooperative gesture.

This description permits the formulation of a second hypothesis:

Hypothesis 2: The intentions of the protagonists, as reflected by their predict-play combinations, should be congruent with their behavior as outlined by the notion of a cautious trust.

Method

Subjects.

Subjects were 20 male and 20 female undergraduates, paired in like-sexed dyads. Care was taken to ensure that dyad members were unacquainted and that neither had any previous "game"-playing experience. All subjects were paid volunteers, and were recruited for "several sessions" from a variety of academic classes.

Apparatus.

The apparatus was basically the same as that used in the first study, with two additions. From the subjects' perspective, the apparatus differed in only one way. Each subject cubicle was equipped with two additional response buttons, used to predict the other player's

[1] PX-PY indicates a predict X-play Y combination, thereby preserving the order in which the subject makes the responses.

choice on each trial. These buttons differed from the subject's own choice buttons in color and location. The predict buttons were red, and were aligned with the appropriate rows for Column player, and with the appropriate columns for Row player. The same payoff matrix used in the first study was used again here (cf. Fig. 5).

Additional apparatus was also acquired so that both predict and play responses could be recorded automatically on a paper tape punch.

Procedure.

The procedure for dealing with subjects was basically the same as in the first study. The instructions, of course, were extended to describe the use of the red predict buttons, and were modified slightly from the first study. Pilot data indicated that the interval alloted for making a response in the first study (6 sec.) was adequate for subjects to both predict the other's choice and make their own response, and was therefore left unaltered. Because the 300-trial sessions in the first study took longer than an hour, including instructions, calculation and payment of the session's outcome to each player, scheduling problems often arose with the subjects who were attending classes on an hourly basis. Consequently, the sessions in the present study were cut to 200 trials per day, and were run for three days. The exchange rate was increased from that of the previous study so that the maximum possible outcome per day was similar in each case.

The instructions were similar to those of the previous study.

Additional instructions were included to describe the prediction procedure. It was emphasized that subjects should predict what choice they thought the other would actually make, not what they would like them to make. Complete instructions may be found in Appendix B.

Data Organization

The criterion used for cooperation in the previous study proved to have sufficient heuristic value and will be retained for the present study. As in the previous study, dyad members will be categorized into HiC and LoC members, depending on which member makes more Cs prior to asymptote. In the representation of response states the HiC member will always be referred to first and the LoC member second.

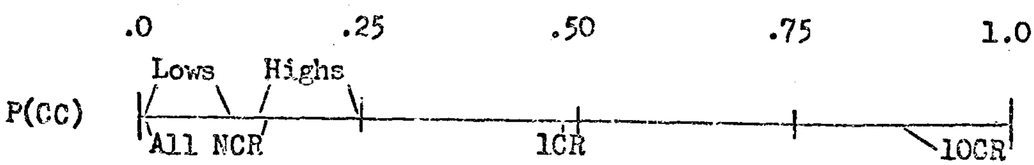
The procedures used for calculating the probability of reinforcement and the average net outcome per trial are identical to those used in the previous study.

Results

Twelve of the 20 dyads reached the cooperative criterion (8 female and 4 male dyads) and 8 did not. For the Cooperators, the average number of trials to criterion is 320; the range is from 100 to 525. All of the data presented below are divided according to criterion and collapsed across sex within each of these groups.

Below is a representation of the distribution of P(CC) over the first 100 trials and subsequent to the 75 criterion trials. Above the line is presented the range of P(CC) for the 12 highest dyads, eight of

First 100 trials



Post Criterion or Last 100 trials

whom became Cooperators, and the eight lowest dyads. No dyad experienced more than 26% CCs over the first 100 trials. Subsequent to criterion, there is a bimodal distribution of CC states with 10 Cooperators generating between 85 and 100% CCs. (One Cooperator dyad experienced 48% CCs following criterion. Another Cooperator dyad reached criterion in 525 trials, and could not provide any post criterion data.) No Noncooperator dyad experienced more than 17% CCs on the last 100 trials. These data are presented below the line.

Figure 11 contains the proportion of C responses made by HiC and LoC members of both the Cooperators (Fig. 11 A) and Noncooperators (Fig. 11 B). Over the first 5 trials there are no differences between HiC and LoC members within either group ($p > .25$), indicating that predispositional variables cannot account for which dyad member assumes the role of initiating the cooperative gesture. Analysis of variance of the preasymptotic P(C) data (collapsed over HiC - LoC) indicates there are no differences between groups over Vincent blocks ($F = 2.683$; $df = 1,38$; $p > .10$) or between HiC and LoC Cooperators on the 25 trials immediately prior to criterion ($p > .20$). The rapid increase in P(C) made by the Cooperators from the last preasymptotic block to asymptote is a pattern which occurs in the majority of these dyads, as is evident from the block by block (50 trials) data presented in Appendix D.

In order to test the notion that the signalling component is contained in the P(C) difference scores (HiC - LoC), the difference scores over Vincent blocks from each group were compared using an analysis of variance. The magnitude of the Cooperators' difference scores is not greater than those of the Noncooperators on any of the

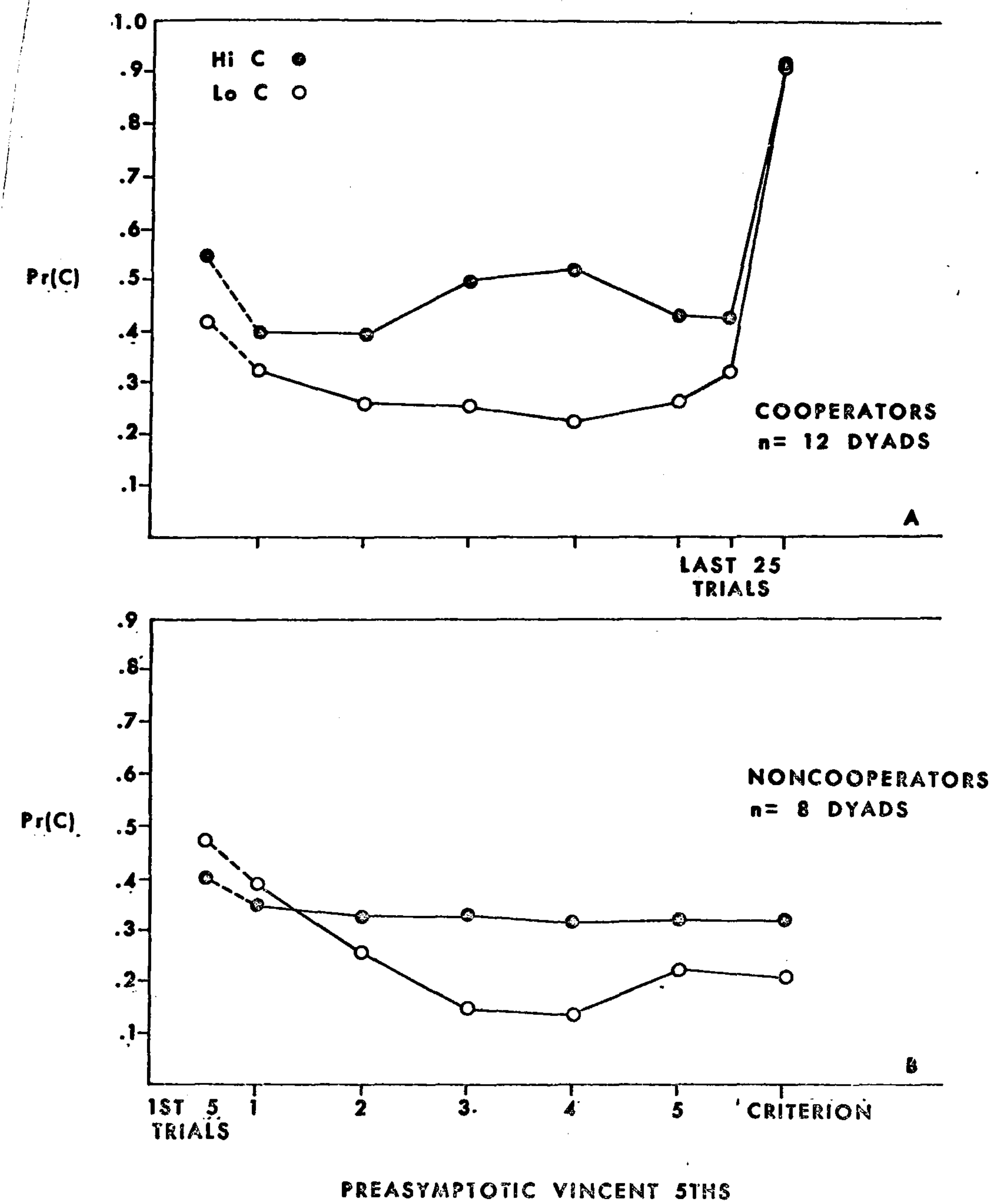


Fig.11. Probability of a cooperative choice, Pr(C), on the first five trials, over Vincent fifths and at asymptote for both Hi C and Lo C Cooperators (A) and Hi C and Lo C Noncooperators (B). For the Cooperators, data is also included for the last 25 preasymptotic trials.

Vincent blocks ($p > .10$). However, it may be the case that the signalling component is confined to either the forgiveness or repentance variable as described above. This possibility will be examined below.

In order to determine how the HiC members distribute their "excess" Cs in relation to the various response states, first-order conditional probabilities were computed for each group (Fig. 12). These data are organized in Vincent halves, although a finer resolution of trend would be preferable. This was necessary because of the absence of sufficient cases for each of the response states (a criterion of 3 or more cases was required), for each dyad, over each of the five pre-asymptotic blocks. In fact, even while limiting the analysis to Vincent halves it was still necessary to use an estimation procedure[2] for one of the variables (Cn+1/CCn).

Analyses of variance comparing the Cooperators and Noncooperators on each of the first-order conditional probabilities indicates no overall differences between groups. There is, however, a significant decrease in Cn+1/DD over Vincent halves for both groups ($F = 4.418$; $df = 1,76$; $p < .05$). As predicted, there is no role effect for the Cooperators on the trustworthiness variable ($p > .10$). HiC Cooperators do not tend to distribute whatever excess Cs they do make, after CC states.

In order to determine whether or not the first-order conditional probabilities are dependent upon the overall level of P(C), sign tests on the P(C) - conditional probability difference scores were applied for each group. Both Cooperators and Noncooperators tend to make

[2] If there were not 3 or more cases of a particular condition in the interval desired for a particular dyad, the variable in question was assigned a value computed by taking the average of those dyads with a sufficient number of cases.

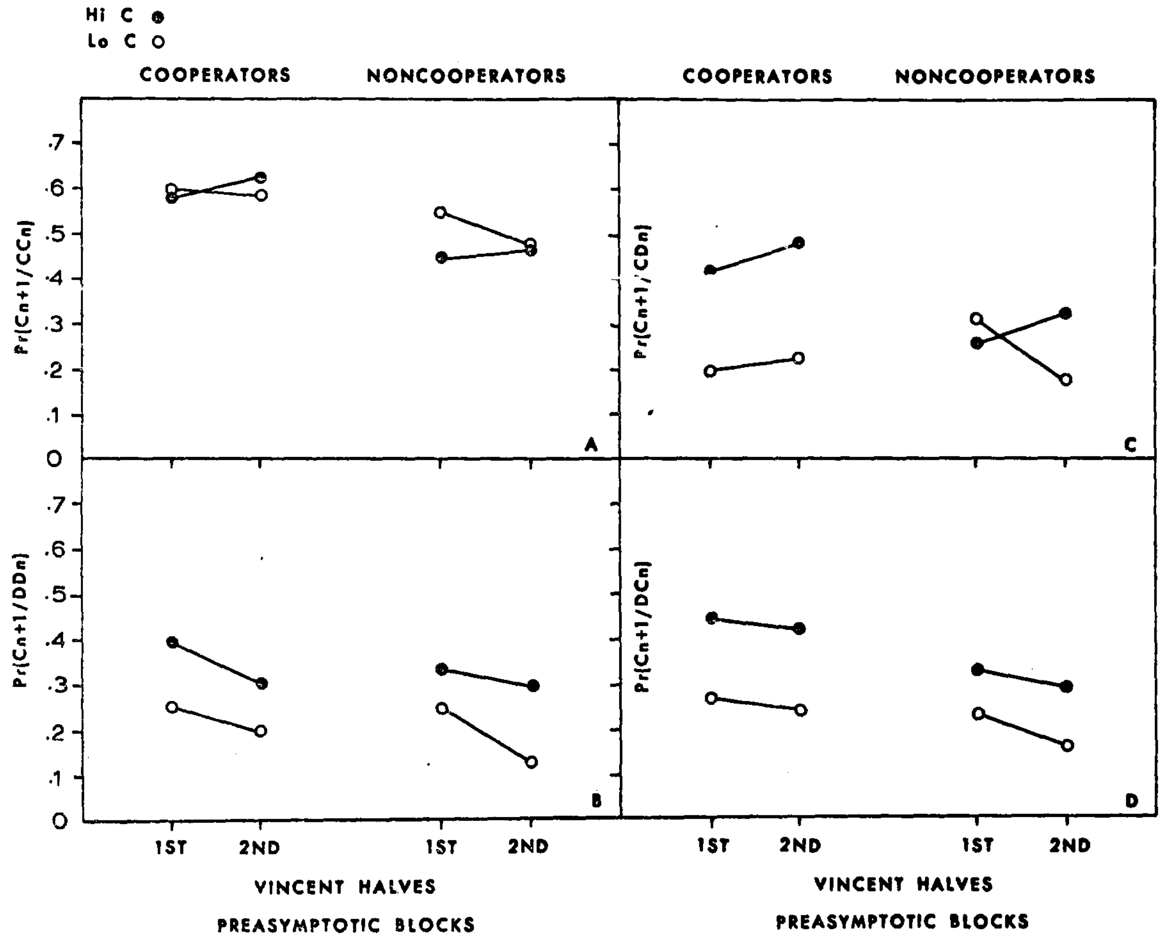


Fig.12. Probability of a trustworthiness, Pr(Cn+1/CCn)(A), trust, Pr(Cn+1/DDn)(B), forgivness, Pr(Cn+1/CDn)(C), and repentance, Pr(Cn+1/DCn)(D), responses for both HIC and LoC Cooperators and HiC and LoC Noncooperators, over preasymptotic Vincent halves. Prior to asymptote the average P(C)=.359 for Cooperators and =.283 for Noncooperators.

trustworthiness responses, Cn+1/CCn, more often than they make Cs in general ($p < .002$ and $< .011$, respectively; one-tailed test). For the Cooperators, the forgiveness variable, Cn+1/CDn, also suggests independence of the overall level of P(C) by the sign test ($p < .076$, one-tailed test). Each of the other first-order conditional probabilities appears to be dependent upon the average level of P(C) prior to asymptote ($p > .10$).

In order to determine whether the magnitude of the Cooperators' difference scores on the trustworthiness or forgiveness variables are greater than those of the Noncooperators (with respect to their overall level of P(C)), Mann-Whitney U tests were used. The results indicate that there is no difference when considering the trustworthiness variable ($p > .10$), but that the forgiveness-trust difference scores are greater for the Cooperators than the Noncooperators ($p < .044$, one-tailed test). In addition, analysis of variance of the forgiveness difference scores (i.e. HiC - LoC) between the Cooperators and Noncooperators, yields a significant $F = 5.452$ (with $df = 1,18$; $p < .05$).

Although these first-order conditional probabilities cannot yield a finer resolution regarding changes over trials, the reactance measures do provide some information along this line. Figure 13 presents the cooperative and competitive reactance measures on the first 10 trials, and over Vincent halves for both groups, and on the last 25 preasymptotic trials for the Cooperators. (Due to insufficient data, the cooperative reactance measures on the first 10 trials are not presented for the Noncooperators.) Analyses of variance of the

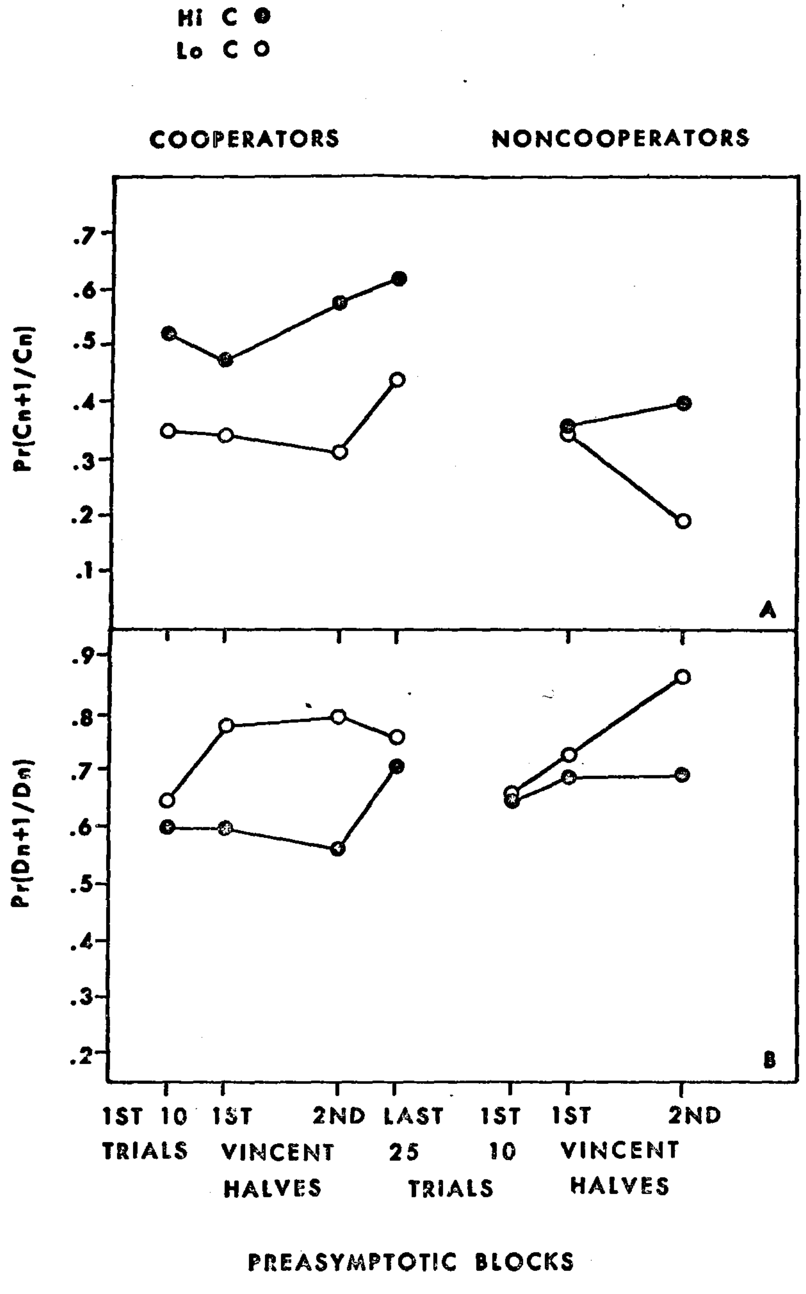


Fig.13. Probability of a cooperative, Pr(Cn+1/Cn) (A), and competitive, Pr(Dn+1/Dn) (B), reciprocity response for both Hi C and Lo C Cooperators and Hi C Lo C Noncooperators on the first ten trials and over preasymptotic Vincent halves.

first 10 trials indicate no Role effects for either criterion group ($p > .25$ in each case). Analysis of variance indicates that the Co-operators make more cooperative reactance responses over Vincent halves than the Noncooperators ($F = 4.229$; $df = 1,76$; $p < .05$). Analyses of variance of the cooperative reactance over Vincent halves indicate a significant role effect for the Cooperators ($F = > .96$; $df = 1,44$; $p < .01$), but not for the Noncooperators ($p > .05$). The Cooperators' role effect is washed out on the last 25 preasymptotic trials ($p > .05$). Analysis of the difference scores indicates that the Cn+1/Cn role effect is no greater for the Cooperators than the Noncooperators ($p > .10$). The level of D reciprocity is presented in Figure 13 B. Analysis of variance indicates no difference between Cooperators and Noncooperators, in either overall level of D reciprocity or the magnitude of their Dn+1/Dn role effects ($p > .10$). There are, however, significant role effects for both Cooperators and Noncooperators ($F = 24.19$; $df = 1,44$; $p < .001$; and $F = 7.43$; $df = 1,28$; $p < .01$, respectively).

Sign tests applied to the Cn+1/Cn minus P(C), and Dn+1/Dn minus P(D) difference scores, indicate that both reciprocity variables are independent of the overall levels of P(C) and P(D), respectively, for the Cooperators only ($p < .011$ in both cases; one-tailed test). In addition, a Mann-Whitney U test between the Cooperators' and Non-cooperators' Dn+1/Dn minus P(D) difference scores, suggests that the magnitude of the Cooperators' difference scores is greater than those of the Noncooperators ($p < .10$; one-tailed test).

Figure 14 presents the proportion of each predict-play combination on the first 10 trials, over Vincent halves for both groups, and on the last 25 preasymptotic trials for the Cooperators.

On the first 10 trials only the PD-PD variable distinguishes the two groups ($F = 5.326$; $df = 1,38$; $p < .02$). The Noncooperators are more likely to respond to a suspected defection with a D response than are the Cooperators on these early trials. Over Vincent halves the Cooperators make more cooperative (PC-PC) and fewer exploitative (PC-PD) intentions than the Noncooperators ($F = 5.500$; $df = 1,76$; $p < .05$; $F = 4.204$; $df = 1,76$; $p < .05$, respectively). The absence of any appreciable role effects is counter to the predictions of hypothesis 2.

These data suggest that subjects may not be attempting to accurately predict the other's response, but may be using the "predict" responses in a somewhat different manner. Although the Cooperators' predictions are accurate more often than the predictions of the Noncooperators ($F = 8.50$; $df = 1,266$; $p < .004$), individual comparisons indicate that this holds only at asymptote ($p < .01$). At asymptote the Cooperators also predict a higher level of C responses than the Noncooperators ($F = 14.51$; $df = 1,266$; $p < .001$). Prior to asymptote the accuracy of both groups is at the chance level. Previous studies using this paradigm (Halpin & Pilisuk, 1967, 1970; Tedeschi et al., 1968 b, d) have also noted that subjects tend to overpredict the other's level of C responding. Since it is necessary to anticipate a C from the other if one is to anticipate a gain, this phenomenon suggests that subjects use their "predict" buttons to indicate what they would like the other to do. Their "wishful thinking" tends to distort their predictions and decrease their accuracy.

Although this distortion phenomenon is suggested for both groups, one might expect the Cooperators and Noncooperators to differ in the

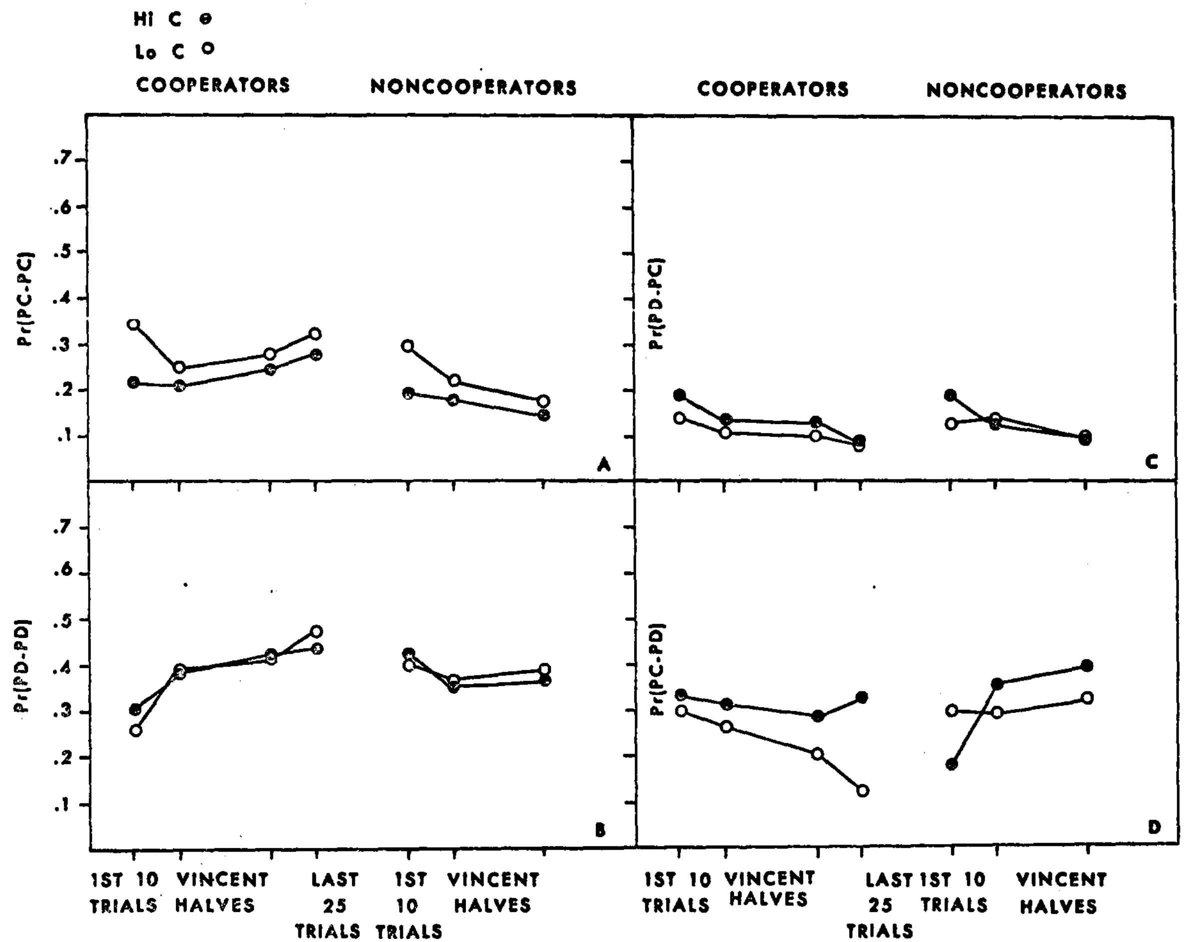


Fig.14. Probability of a cooperative, Pr(PC-PC) (A), defensive, Pr(PD-PD) (B), forgiving, Pr(PD-PC) (C), and exploitative, Pr(PC-PD) (D), intention on the first ten trials and over preasymptotic Vincent halves for both Hi C and Lo C Cooperators and Hi C and Lo C Noncooperators. For the Cooperators, data is also presented for the last 25 preasymptotic trials.

actions they take in conjunction with these distortions. If this interpretation is valid, one would expect the Cooperators to combine their overprediction of Cs for the other, with a C response themselves, more often than they would combine such a prediction with a D. Cooperators want to realize a net gain, but they are willing to allow their partners to gain also. The Noncooperators, on the other hand, are likely to combine their overprediction of Cs with a D response more often than with a C. They also want to gain, but their eye is on the lion's share (T), and they show little concern for the other's outcome.

In order to test this notion, difference scores were computed for each group, comparing the magnitude of their cooperative and exploitative intentions (PC-PC and PC-PD). If the magnitudes of these intentions are similar, it may be inferred that the dyads are in an internal state of conflict. If there is a dominance of one intention over the other, it may be inferred which is the stronger motive. Analysis of variance of the difference scores (PC-PD minus PC-PC) yields a significant $F = 9.381$ ($df = 1,38$, $p < .01$). The Noncooperators show a greater dominance of exploitative over cooperative intentions than the Cooperators (.168 vs .025). The mean difference score for the Cooperators suggests that this group is experiencing intrapersonal conflicts, whereas the Noncooperators display a clear dominance of exploitative motives. The Cooperators' internal state of conflict may account for the considerable number of trials required to reach a cooperative criterion.

Given the internal state of conflict suggested by the Cooperators' predict-play combinations, it is worth considering what role reinforcement contingencies may have in resolving this conflict. As in the previous study, it is possible to calculate the magnitude and frequency of reinforcement obtained from both C and D responses. These calculations are made from the response state data presented in Fig. 15. The data in Fig. 16 A represent the average outcome per trial from both C and D responses for the Cooperators. For the C responses (circles), analysis of variance with no data transformation indicates a significant role effect ($F = 39.60$, $df = 1,110$, $p < .001$), Trials effect ($F = 15.16$, $df = 4,110$, $p < .001$), and a significant role by Trials interaction ($F = 3.23$, $df = 4,110$, $p < .01$). Individual comparisons indicate that LoC Cooperators obtain a greater magnitude of reward from C responses than do their HiC partners on trial blocks two ($p < .05$), three, four and five ($p < .01$ in each case). Although the average outcome per trial is negative for both dyad members, the LoC members are doing better with C responses than their partners. The relationship between HiC and LoC Cooperators with D responses (triangles) is similar. Analysis of variance with no data transformation indicates a significant role effect ($F = 17.25$, $df = 1,110$, $p < .001$). Individual comparisons indicate that LoC members obtain a greater magnitude of reward from D responses than their HiC partners on trial blocks three ($p < .01$) and four ($p < .05$). In this case, however, the LoC's outcome is positive rather than negative. In their switch to an asymptotic state of cooperation, it is clear that economic considerations are not responsible.

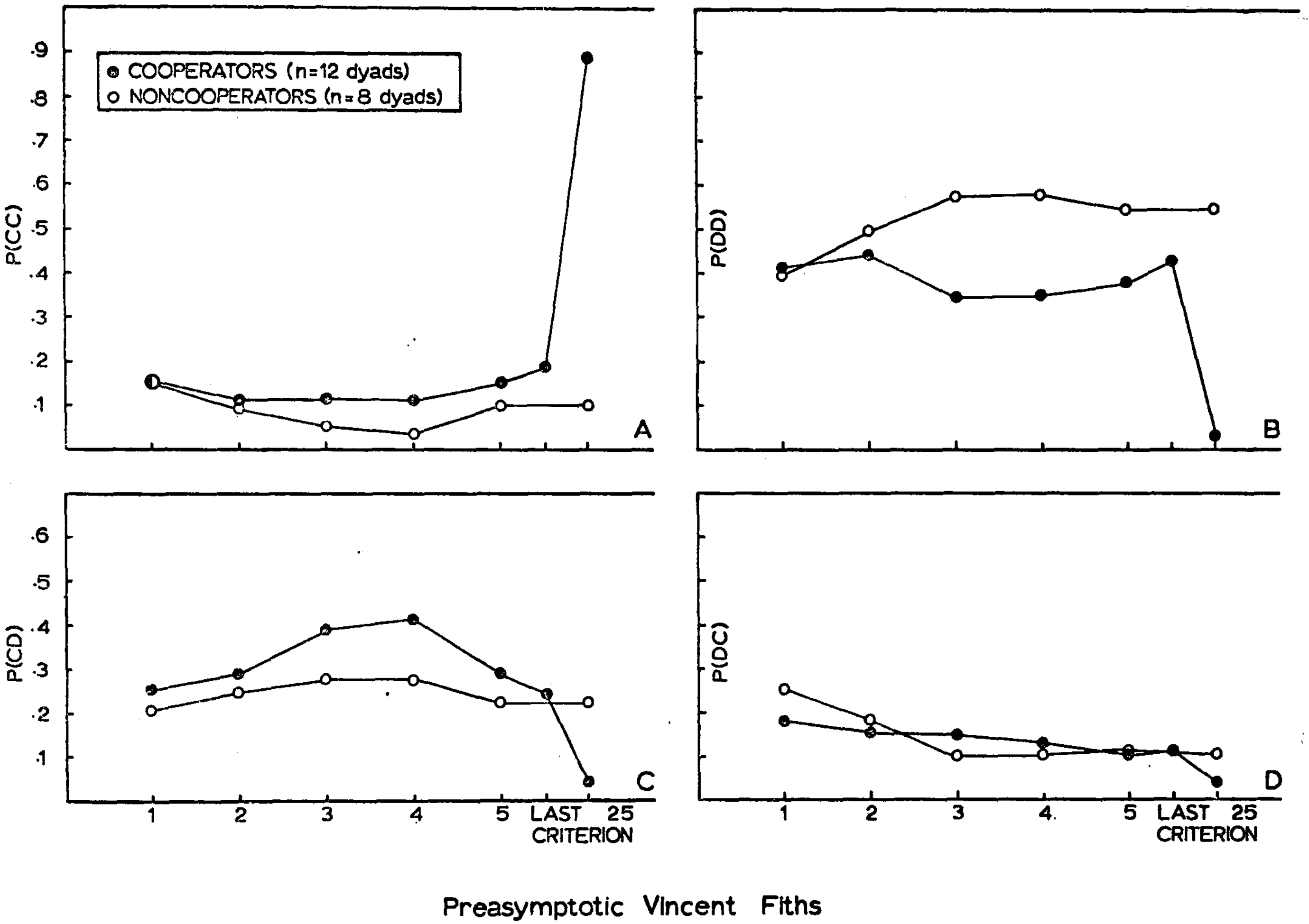


Fig. 15. Probability of a CC (A), DD (B), CD (C) and DC (D) response state for Cooperators and Noncooperators over preasymptotic Vincent fifths and at asymptote. For the Cooperators, data is also presented for the last 25 preasymptotic trials. Unilateral response states are presented from the Hi C member's position (see text).

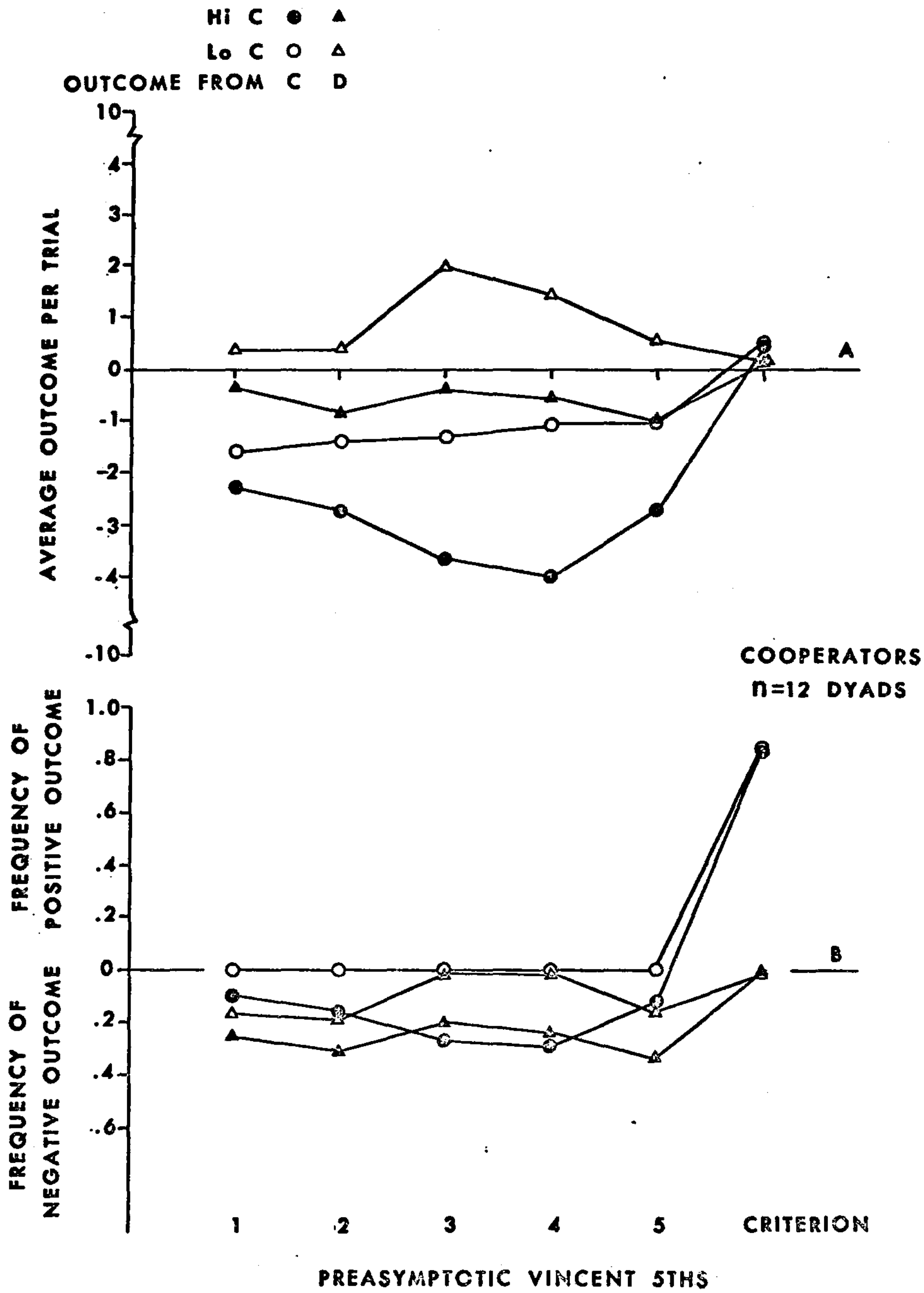


Fig.16.A. Average outcome per trial (in points) from a cooperative (C) and defecting (D) response for both Hi C and Lo C Cooperators over preasymptotic Vincent fifths and at asymptote.

16.B. Frequency of positive and negative outcomes from a cooperative (C) and defecting (D) response for both Hi C and Lo C Cooperators over preasymptotic Vincent fifths and at asymptote.

The data bearing on the frequency of reinforcement are presented in Fig. 16 B. The LoC Cooperators obtain rewards from Cs (circles) significantly more often than do their HiC partners ($F = 23.84$; df = 1,110; $p < .001$). The LoC members are rewarded more often on trial blocks three and four ($p < .01$ in each case). The frequency of obtaining a reward from a D response (triangles) is also higher for the LoC members than their partners ($F = 8.55$; df = 1,110; $p < .004$). Both responses, then, are rewarded more often for the LoC members. On the last preasymptotic block, both partners show a trend toward fewer rewards from Ds, and more rewards from Cs. It seems doubtful, however, that this effect could account for the large jump in P(C), from .37 on the last 25 preasymptotic trials to .92 at asymptote.

Discussion

As in the previous study, the formation of two quite distinct groups occurs without any experimental manipulation. These groups may be discriminated not only by the presence or absence of the cooperative criterion, but also on the basis of their post-criterion data, and their preasymptotic interaction patterns. The distribution of CC states indicates that the Cooperators and Noncooperators are found at opposite ends of the continuum at the end of play, although they begin at the same level. Prior to criterion these groups are also discriminable on the basis of the presence or absence of a cautious trust strategy.

The cautious trust strategy is evident in the preasymptotic interactions of the Cooperators in that they display both the cooperative signalling and firmness components as predicted. The cooperative signalling component is evident in the forgiveness role effect (cf Fig. 12). The magnitude of the Cooperators' role effect is greater than that for the Noncooperators as indicated by analysis of variance. Furthermore, the sign test indicates that the Cooperators' level of forgiveness is independent of their overall level of C responding. In this situation, the successful cooperative influence attempt is characterized by a concentration of "excess" Cs after the CD state in particular. The P(C) difference scores do not discriminate the Cooperators and Noncooperators if the effects of the previous response states are not considered. Analysis of the overall P(C) difference scores between groups produces nonsignificant results. In addition, there is no trustworthiness role effect for the Cooperators indicating that this variable serves a firmness function. HiC Cooperators defect from this state as often as their partners, thereby indicating that they will maintain a high P(C) only if the LoC partner is willing to reciprocate.

The other aspect of the firmness component is evident in the Cooperators' high level of D reciprocity. The sign test indicates that the level of D reciprocity is independent of the overall level of Ds for the Cooperators, but not for the Noncooperators. In addition, the D reciprocity role effect which occurs for the Cooperators over Vincent halves is washed out on the last 25 preasymptotic trials as indicated by the analyses of variance. After they have been generating "excess" Cs for a considerable number of trials, and their LoC partners do not reciprocate, the HiCs increase their level of D reciprocity to that of their partners (over .70). It is interesting to note that this D reciprocity is accompanied by a fairly high level of C reciprocity (over .50). These data indicate that high levels of D reciprocity are not necessarily indicative of a noncooperative outcome. Rather than using a single variable to predict outcomes, it is necessary to examine a broader pattern of interactions which may juxtapose seemingly incongruent elements. (See Appendix C for a consideration of using the cautious trust strategy to predict the outcomes of individual dyads.)

The reinforcement data indicate that economic factors are not primary in determining the final outcome. The average outcome per trial is greater for D responses than for Cs, for both Hi and LoC Cooperators. The LoC members in particular appear to be doing well with Ds, yet they switch to Cs. The HiC members, on the other hand, do very poorly with Cs, yet they continue making Cs as often as Ds. The rapid jump into the CC state at asymptote indicates that this cooperative outcome assumes a special salience for these dyads, over and above the economic factors involved. The competing tendencies to both cooperate and exploit, as evidenced by the Cooperators' predict-play combinations, account for the fact that several trial blocks are required for the CC state to acquire this salience. The frequency of reinforcement data suggests that this salience develops just prior to asymptote, as Cs come to receive positive outcomes more often than Ds for both dyad members.

The preasymptotic interaction patterns of the Hi and LoC Noncooperators present a very different picture. The influence attempt suggested by the HiC - LoC difference scores indicates that the HiC Noncooperators expose themselves to less risk than their Cooperator counterparts. The characteristics of this influence attempt by the HiC Noncooperators permit several interpretations. These HiC members may be strategically naive, and unable to initiate an effective balance between signalling the other and avoiding overexposure to risk. Their relatively high level of initial suspicion, indicated by their early level of PD-PD responses, may account for the fact that they erred on the side of exposing themselves to a minimal risk.

A second interpretation of this influence attempt is that it is designed to set up the other for exploitation, rather than to induce cooperation. Credence is lent to this possibility by the fact that HiC as well as LoC Noncooperators express exploitative tendencies more often than cooperative tendencies.

One of the difficulties involved in attempting to describe the processes underlying the Noncooperators' behavior is that they are a less homogeneous group than the Cooperators. They are negatively defined by the absence of a certain criterion, rather than positively, by a criterion for high conflict. This situation will be dealt with in the next study.

As in the first study, the development of an asymptotic cooperative state was characterized by a step function. The generality of this phenomenon needs to be examined using different matrix values. Within each of the criterion groups, it was found that the relationships which developed between members were very different. The use of a criterion for cooperation and the procedure of distinguishing dyad members on the basis of their roles in the interaction appear to be valuable techniques for investigating the characteristics of various types of influence attempts in conflict situations.

The predict-play paradigm has served several functions. Using the same matrix values as in the first study, the predict-play procedure in the second study served to reduce the average number of trials to criterion by over 30%. This procedure turns out to be economical as well as informative regarding the subjects' motivational orientations.

The predict data indicate that subjects do not accumulate accurate information about their opponents' choices from trial to trial. The accuracy of their predictions is at chance level, as they distort their perceptions of the other in the direction of overpredicting the other's C choices. These data indicate a lack of rationality in the formal game theoretic sense (Luce & Raiffa, 1967). Given the average number of trials to criterion and the fairly consistent preasymptotic levels of P(C), a high degree of accuracy would be expected if the task were one of probability matching in a simple two-choice situation. Halpin and Pilisuk (1970) also provide data indicating that if such a situation is cast in terms of a PD game, subjects tend to deviate from an optimal matching strategy. The structural characteristics of the PD game elicit particular social motives, rather than strategic considerations in the formal sense. The predict-play combinations capture these motives, rather than the strategic thinking of the protagonists.

The early predict-play combinations may be viewed as personality variables, indicating predispositions to respond in particular ways to this conflict situation. These early predict-play responses indicate how the protagonists perceive each other before they have an adequate opportunity to obtain information about each other's behavior. It is interesting to note that the only variable which distinguishes Cooperators from Noncooperators on the first 10 trials is the PD-PD combination. The Noncooperators tend to combine their suspicious tendencies with deterrent, or punishing responses (D) more often than the Cooperators. Predispositions to compete or cooperate also fail to distinguish which dyad member is likely to assume the role of initiating a cooperative influence attempt. This finding leads to the conclusion that predispositional variables alone are not important determinants of a stable outcome. The notion of a cautious trust developed above, indicates that the interactions within the conflict situation, the give and take of the struggle itself, is a more important determinant than the subject's initial response to the situation.

Conclusions

A pattern of cautious trust characterizes the preasymptotic interactions of the Cooperators. The basic components of a cautious trust involve a signal of willingness to cooperate, and a firmness which discourages exploitation.

The Noncooperators do not give evidence of a cautious trust in their preasymptotic interactions. The influence attempt of the HiC members is less pronounced than that of the HiC Cooperators.

The predict-play response combinations are not totally congruent with the behavior patterns as outlined by the notion of a cautious trust. Rather than providing a trial-by-trial monitor of the player's strategic thinking, these responses appear to reflect more general aspects of the subjects' motivational orientations.

Additional data are required regarding the generality of the step function, the role of predispositional variables, and the utility of a cautious trust strategy in different conflict situations.

Chapter VI Study 3: TOWARD A DESCRIPTIVE THEORY OF CONFLICT RESOLUTION: SOME FACTORS WHICH INFLUENCE STABLE OUTCOMES

Introduction

The previous studies in this series demonstrate that the relationships which develop between dyad members in the course of a conflict differentiate asymptotic states of high and low cooperation. Dyads who attain a high level of cooperation have been characterized by a cautious trust strategy. The major purpose of the present experiment is to determine the effectiveness of this strategy across different conflict structures. The basic question is "How are the two components of a cautious trust, i.e. cooperative signalling and firmness, affected by different conflict situations"? Before discussing the specific hypotheses to be tested in this regard, it is necessary to consider some methodological issues which have arisen in the previous studies.

Methodological Issues

The step function in P(C) noted in the previous studies is a very dramatic demonstration of the rapidity with which dyads enter a cooperative state after prolonged conflict. However, it is possible that this effect is an artifact of the experimental procedure. Because subjects were run for several sessions, there is the possibility that the subjects colluded outside of the laboratory, and agreed to cooperate in order to insure their joint maximization. If this were the case, one would expect to see a dramatic increase in the level of P(C) from one session to the next. One dyad in the first study and four dyads in the second match this pattern. In addition to confounding the P(C) step function, the occurrence of such cases would also tend to obscure the preasymptotic interaction patterns which might differentiate Cooperators and Noncooperators.

A second issue regarding the step function is its generality over various payoff matrices. It is known that the average level of P(C) is higher in an "easy" PD game (i.e. where T-R is small) than in a difficult game, such as the one used in the previous studies (Rapoport & Chammah, 1965). By increasing R relative to T, the tendency to cooperate is encouraged by making cooperation more rewarding. Another method of encouraging cooperation via payoff manipulations involves increasing P from PD to Ck status (Rapoport & Chammah, 1966). This manipulation makes defections potentially more costly: P thereby acts as a deterrent. If the assumption is made that these overall higher levels of P(C) do not reflect a higher asymptotic level of P(C), it then follows that both an easy PD game and a Ck game must produce a lower average number of trials to criterion than the payoffs used in the previous studies. The use of an easy PD game and a Ck game should permit a lower number of trials to criterion, thereby allowing criterion dyads to be formed within a single session. The use of these different payoff structures should serve to test the generality of the step function, as well as avoid the problem of collusion between subjects.

Another issue which must be dealt with concerns a criterion for high conflict, as well as for high cooperation. In the first two studies the Noncooperators were defined by their failure to reach a cooperative criterion. This procedure is not satisfactory because these dyads could be in any of several noncooperative states. Some dyads may be locked in a state of high conflict, although others may have successfully avoided this pitfall while still failing to attain a high level of cooperation. Collapsing these dyads into a single category of Noncooperators does not permit an investigation of the interaction patterns which lead to these very different states. This procedure is not satisfactory for providing a maximal contrast between high and low states of cooperation.

Another problem with the previous criterion is that it is defined in terms of an individual subject measure, P(C), rather than a dyadic measure. It would be more appropriate to use a dyadic measure since cooperation or conflict is a dyadic, not an individual state.

Previous studies using a criterion for cooperation or conflict have not investigated preasymptotic interaction patterns. These studies have been interested in the effects of either structural (Rapoport & Chammah, 1965) or personality variables (Pilisuk et al., 1965) on the distribution of final outcomes. Consequently, they define their criterion for high or low cooperation in terms of the responses on the last block of trials. Since these response patterns may have endured for several trial blocks prior to the last block, this procedure does not meet the present requirement of clearly distinguishing preasymptotic and asymptotic states. The criteria to be used are defined below. Following Pilisuk et al. (1965) dyads who attain a state of high cooperation will be referred to as Doves, and those who attain a state of high conflict will be labelled Hawks.

Generality of the Cautious Trust Strategy

Changing the payoff values to test the generality of the step function will also serve the need for determining the effectiveness of a cautious trust strategy in different conflict situations. The requirements of a successful influence attempt are not likely to be identical over a wide range of conflict structures. In the studies reviewed above (cf. Chapter 3) this question of the relative effectiveness of various strategies over different structures has generally not been considered. These studies have been concerned primarily with the main effects of strategy, and not with interactions between strategy and structure. At present, there is a paucity of theoretical notions addressed to this important issue.

The notion of a cautious trust differs from most other strategies which have been studied in game situations, in that it consists of two distinct, and functionally independent components--a cooperative signalling and a firmness component. Rather than consider these behavior patterns as components of a single strategy, it has more often been the case that these patterns have been compared with each other in terms of their effectiveness in inducing cooperation. The previous studies indicate the importance of combining these components into a single strategy, and it is now necessary to investigate the relative importance of these components across changes in payoff values. The cautious trust developed above may be expanded to consider such interactions between strategy and structure. The two components of a cautious trust, the effective signalling and the firmness components, may be considered independently. In an easy PD game, should the magnitude of the cooperative signal be larger or smaller than in a difficult PD game? Should the initiator of the cooperative gesture be more or less firm than in a difficult PD game? These questions may be considered in terms of the magnitude of the P(C), Cn+1/CCn, Cn+1/CDn and Dn+1/Dn role effects.

Concerning the magnitude of the cooperative gesture, it may be argued that a larger risk should be taken in an easy PD game compared to the requirements of a more difficult game. Because the other's temptation to defect is decreased, there is less risk involved in making a C response. Therefore, in order for the initiator to adequately signal his willingness to cooperate via trusting responses, a larger P(C), or forgiveness role effect is required in an easy PD game. On the other hand, it may also be argued that a small risk is sufficient. Since an easy PD game is predisposed to a cooperative solution, this structural characteristic should play a relatively greater role. Combined with this structural disposition, a smaller P(C), or forgiveness role effect should be sufficient.

Those dyad members who initiate a larger cooperative signal may do so because they perceive their partners as insensitive to the structural characteristics of an easy PD game and/or because they themselves are insensitive to these structural dispositions. If the assumption is made that successful initiators are most sensitive to both their partners' behavior and the structural aspects of the situation, the smaller role effect argument would appear to have the upper hand.

Another argument in favor of the efficacy of a minimal role effect involves the assumption that a decrease in the difference between T and R will produce a decrease in the temptation to defect for all subjects. If T, S and P are held constant and R is increased to make cooperation more rewarding, this manipulation may effect different subjects very differently. This manipulation may elicit cooperative dispositions from some subjects, but others may see the situation as one in which they can defect frequently, both because they perceive the other as less likely to defect, and because any losses incurred may be more easily regained. In order to counter the latter disposition, the initiator of a cooperative influence attempt would have to maintain a minimal cooperative signal as well as a high level of firmness.

The firmness component of a cautious trust is expressed by the absence of a role effect for trustworthiness, Cn+1/CCn, and a high level of D reciprocity. The absence of a trustworthiness role effect may be considered an element of the firmness component in that each partner requires something of the other (a CC outcome) prior to reciprocating Cs with a high probability. The firmness is evident in both the conditions placed on a high probability of returning a C, and in the mutuality, where initial differences are washed out prior to asymptote.

The other element of the firmness component is a high level of D reciprocity. If the value of P, the outcome associated with mutual defection, is increased from PD to Ck status, the question arises what role the firmness component has in establishing a cooperative outcome.

Should Ds be reciprocated at the same level as when P is lower, or is even more firmness required? The assumption was made above that the Doves are characterized by a greater sensitivity to the structural aspects of the situation. This greater sensitivity should be reflected in a lower level of D reciprocity in the Ck than in the PD game. Because of the larger loss associated with a D outcome in a Ck game, subjects who are sensitive to the distrust and vengefulness such large losses are likely to elicit, will tend to avoid these outcomes. Thus the level of D reciprocity which is part of a cautious trust will be lower in a Ck game, than in a corresponding PD game.

It follows from the above considerations that a strong co-operative signalling component, and/or a weak firmness component, will lead to a state of high conflict. The absence of role effects predicted for the Doves indicates that these dyad members will be very similar to each other in their reactions to the conflict situation. This prediction suggests that very disparate reactive dispositions will lead to high conflict outcomes. If one dyad member attempts to influence his partner by setting a cooperative example, he may be inviting exploitation. In an easy PD game, where T-R is small, any losses incurred from punishment against attempted exploitation may be easily regained. If one dyad member demonstrates his insensitivity to the structural aspects of the conflict and is grossly exploited by the other, a conflict spiral will follow which will lead to a high level of conflict. Furthermore, if it is true that these Hawk dyads are insensitive to the structural aspects of a conflict situation, the same pattern of disparate reactive dispositions is likely to be found in the high conflict groups in both the PD and Ck games.

The above considerations lead to the following set of hypotheses:

Hypothesis 1a: If the structural aspects of a conflict situation are predisposed toward cooperation (e.g. an easy PD or Ck game), then similar reactive dispositions which combine components of cooperative signalling with firmness will characterize the preasymptotic interactions of the Doves.

Hypothesis 1b: Disparate reactive dispositions which include unguarded and unilateral cooperative signals will characterize the preasymptotic interactions of the Hawks.

Such reactive dispositions may be evident in a high mutual level of Cn+1/CCn for the Doves. (A value of Pr(Cn+1/CCn) between .60 and .80 may be expected, based on the Cooperators' data in Study 2 and the criteria for cooperation, respectively.) By way of contrast, the Hawks should indicate a significantly lower level of Cn+1/CCn, and give evidence of an unguarded cooperative signal by way of a P(C) and/or forgiveness, role effect.

Hypothesis 2a: If the structural aspects of a conflict situation are predisposed toward cooperation, then reactive dispositions which include strong and mutual components of firmness will characterize the Doves, and weak components of firmness will characterize the Hawks.

Hypothesis 2b: If the structural aspects of a conflict situation include a highly punitive component (e.g. a Ck game), then the preasymptotic interactions of the Doves will be characterized by a firmness component which is less than that of the Doves in the absence of such a component.

Such reactive dispositions should be evident in a significantly higher level of D reciprocity for the Doves, compared to the Hawks, and a decrease in D reciprocity for the Doves in the Ck game. The Hawk's unilateral and unguarded signal should also result in significantly more forgiveness, Cn+1/CDn, responses for the initiator of the signal.

In a conflict situation, not all parties reach stable states of high cooperation or conflict. Some parties prolong the struggle without attaining either of these solutions. Several dyads in a pilot study with an easy PD and Ck game failed to reach the criteria set for either the Doves or the Hawks. These dyads will be referred to as Mugwumps, again following the example of Pilisuk et al. (1965).

The question arises as to whether this label is appropriate in terms of the motivational orientations of these subjects. The label Mugwump implies that these subjects cannot resolve their own internal conflicts between cooperating and competing. Their undecidedness should lead to an intermediate level of P(C) which insures an equitable, if not profitable, outcome. Note that simply because these dyads do not attain either of the other criteria, this does not mean their individual behavior patterns must reflect an intermediate level of P(C). It is possible, for example, that a behavior pattern similar to the preasymptotic pattern predicted for the Hawks occurs for the Mugwumps prior to asymptote. The difference between the Hawk and Mugwump pairs may be that in the Mugwumps, the HiC member is willing to submit to domination by the LoC partner. This submission would eliminate the retaliatory pattern anticipated for the HiC Hawks. The few studies investigating dominance and submissiveness (Marlowe, 1963; Fry, 1965; Sermat, 1968) have produced some evidence that these variables play a role in mixed-motive games. However, even when subjects with extreme scores on tests of these variables are selected for study, the effects are not strong ones. Given the unselected sample and the free play which is allowed in the present study, it seems unlikely that the Mugwump pairs would all be composed of one dominant and one submissive partner, neither of whom alter their dispositions in the entire course of their interaction. The more plausible expectation is that the label Mugwump is an appropriate one for these dyads. If these dyads are characterized by indecision, only extreme structural situations should alter their behavior.

These considerations lead to the following hypothesis:

Hypothesis 3: Reactive dispositions which lack components of cooperative signalling and/or firmness will characterize the interactions of the Mugwumps.

Such reactive dispositions should be evident in intermediate levels of P(C) (between .40 and .60), and a general absence of role effects.

The Role of Predispositional Variables

The above hypotheses emphasize the importance of reactive dispositions over predispositional variables. Predispositional variables may be viewed as personality characteristics which determine an individual's initial reaction to a given situation. These tendencies are revealed on the early trials before subjects have an opportunity to either fully assess the situation or the characteristics of their partners. Each subject brings to the situation a set of predispositional tendencies (e.g. to cooperate, to compete, to manipulate, etc.), one of which dominates the subject's behavior on the early trials. Depending upon whether or not these tendencies are fulfilled, they will remain the same or change, as the individual changes his perception of either the situation or those with whom he is interacting. These changes in disposition may be referred to as reactive dispositions. The particular reactive dispositions which emerge during an interaction are determined by the individual's hierarchy of dispositions which constitute his personality.

A third factor which is responsible for the final outcome of a dyad's interaction in a game situation, is the chance pairing of particular subjects. Subjects with different combinations of predispositions will produce different reactive dispositions, which in turn will lead to different asymptotic states.

Predispositional variables have been studied by examining the subjects' responses on the first few trials (e.g. Rapoport & Chammah, 1965; Pilisuk et al., 1965; Terhune, 1968), and by investigating personality characteristics. Several studies have investigated the effects of various personality types or factors on the level of cooperation, P(C), in mixed-motive games. Sex (Rapoport & Chammah, 1965), friendship (Oskamp & Perlman, 1966), status (Grant & Sermat, 1969), ethnic origin (Swingle, 1969), race (Hatton, 1967), dominance-submissiveness (Sermat, 1968), and a variety of social motives (Terhune, 1968; 1970), have been investigated. Terhune's own work, and that of others, led him to conclude that:

> 1. The achievement, affiliation, and power motives do indeed predispose individuals to behave in different ways when playing Prisoner's Dilemma...
>
> 3. In extended social interaction, initial experiences can have a marked effect on subsequent conflict or cooperation (1968, p. 18).

With the possible exceptions of Rapoport and Chammah (1965) and Pilisuk et al. (1965), these studies have not related predispositional variables to stable outcomes. The question naturally arises what relation these predispositions have to stable states of cooperation or conflict. One way of examining this relationship is by considering the behavior patterns of the different groups on the early trials. The data from the first two studies suggest that predispositions to cooperate or compete are generally unrelated to stable outcomes. No differences have been found between groups of high and low cooperation on the early trials.

Rapoport and Chammah (1965) found that if the first trial was a CC or DD response state, the probability was greater than chance that the dyad would end up in that state at the end of a 300 trial game. The importance of having matched, by chance, similarly predisposed subjects is also suggested by data from Pilisuk et al. (1965) who found that if both subjects had a high tolerance for ambiguity, the probability was high that they would become Doves. The chance mixing factor mentioned above seems to play a role in determining the effects of predispositional variables on stable outcomes. These considerations lead to the following hypothesis.

<u>Hypothesis 4</u>: Predispositions to cooperate or compete, etc., will determine stable outcomes in conflict situations only in special cases in which both dyad members have strong and similar dispositions.

Support for this hypothesis should be evident in the data of those dyads who reach one of the criteria immediately. Such dyads are not expected to lose these criteria once attained.

Another way of investigating the role of predispositional variables in determining stable outcomes is by relating the results of personality tests to these outcomes. The effects of personality on cooperation and conflict have recently been reviewed by Terhune (1970). He argues that the study of personality on cooperation and conflict must focus on the configuration of personalities in an interacting system, rather than on personality characteristics of single individuals. Terhune's arguments are persuasive in terms of the type of design needed to demonstrate these personality effects in conflict situations. However, the question remains as to the relation between these personality configurations, and the reactive dispositions which have been described as determining the stable outcomes. Data from the previous studies suggest that these personality characteristics and reactive dispositions may interact in very complex ways. In fact, the question remains as to whether personality variables in an unselected population sample (i.e. one not selected for extreme types), are related to stable outcomes. An unselected sample does not preclude the possibility of extremely different stable states as evidenced in the previous studies. The question which remains is whether such samples contain sufficient numbers of extreme types to account for the outcomes which occur. If these personality types are absent in the unselected sample, the reactive dispositions which characterize a cautious trust, or an unsuccessful influence attempt, must account for the stable outcomes. Extreme personality types may play major roles in conflict situations, as Terhune (1970) has indicated, and the importance of studying these variables is beyond question. However, not only individuals with extreme personalities find themselves in interpersonal conflicts. The manner in which non-extreme types resolve conflicts is also an important issue.

Authoritarianism as measured by the California F-scale is one of the few personality variables which indicate a consistent pattern in relation to measures of cooperation and conflict (cf. Terhune, 1970). High F-scores are associated with low levels of cooperativeness. Kelley and Stahelski (1970) have recently theorized that high F scores tend to attribute their own beliefs to others. Thus the high F person's belief that war and conflict are inevitable is attributed to those with whom he interacts. This view of others, combined with the high F person's punitiveness (Adorno et al., 1950), has the earmarks of a self fulfilling prophesy. Furthermore, such a pattern of interpersonal perception and reaction resembles that anticipated from members of the high conflict groups in the present experiment, especially from the LoC members. The LoC Hawks seem to be the best candidates for high levels of authoritarianism because of their anticipated failure to reciprocate their partners' cooperative gestures. The HiC Hawks are expected to initiate a cooperative gesture and to retaliate only after their offer is rejected. Kelley and Stahelski (1970) present evidence indicating that subjects who are disposed to cooperation, but who are matched with competitively disposed partners, will be behaviorally assimilated to their competitive partners.

In view of the above considerations, it might be expected that high F-scorers will tend to be Hawks, and low F-scorers will tend to be Doves. However, because the subject population will not be selected for high and low F-scores there may not be a sufficient number of extreme types to test this notion. If F-scores turn out to be unrelated to stable outcomes, this result may be taken to support the present thesis that reactive dispositions, rather than predispositional variables, are more important determinants of conflict outcomes in the majority of cases.

Method

Subjects.

A total of 196 female undergraduates served as paid volunteers. Subjects were recruited from a variety of academic classes, and care was taken to insure that dyad members were not acquainted with each other.

Apparatus.

The apparatus was identical to that used in the previous studies. The "easy" PD game and Ck game used are presented in Fig. 17.

Procedure.

The procedure was essentially the same as that used in the previous studies. However, in the present study greater care was taken to insure that subjects understood the instructions. After they finished reading the Instruction Sheet, each subject was required to answer a series of questions concerning their own and the other's outcome, and what constitutes a correct prediction for each of the

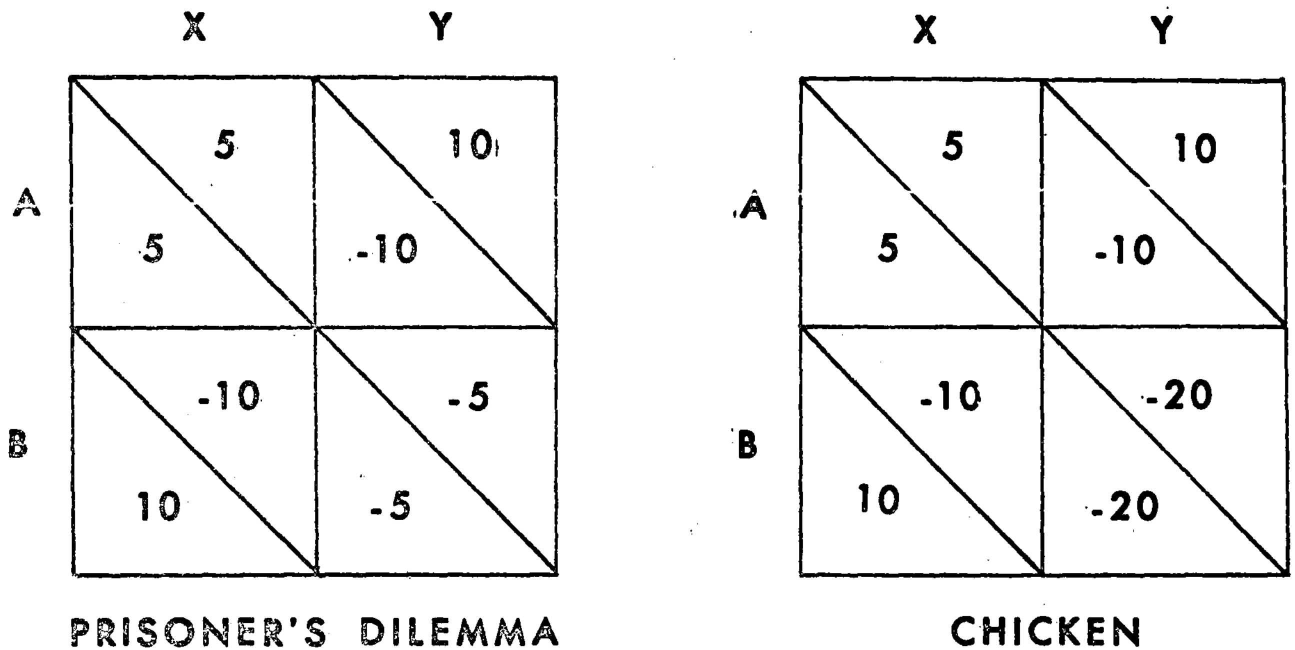


Fig. 17. Payoffs for the PD and Ck games used in Study 3.

possible outcomes. Subjects answered these questions simultaneously by pointing to the appropriate cell entry, or response button. Subjects were required to answer these questions perfectly before the experiment proceeded.

The matrix display was changed for each new dyad such that the PD and Ck games alternated on each session.

Data Organization

The criterion for cooperation is redefined in terms of the proportion of CC states a dyad experiences. Twenty out of 25 CC states for three consecutive 25-trial blocks, or for all blocks after the first such block, is the criterion for high cooperation. Although this criterion is not as stringent as that used by Rapoport and Chammah (1965) in terms of the proportion of CC states, it is longer in duration, thereby insuring that an asymptote has been attained. The first set of 25 trials with 20/25 CC states will be considered the first asymptotic block. This set of 25 trials need not coincide with the 25 trials blocks after which subjects stop their interaction in order to calculate their gains and losses. The criterion for the conflict group will not be symmetrical with that for cooperation. If the criterion were symmetrical (i.e. 20/25 DDs for three consecutive 25 trial blocks), it would be too stringent to provide an adequate number of dyads to study. The DD state is less stable than the CC state because of the high losses involved, especially in a Ck game. The criterion for the conflict group will therefore be set at 10/25 DD states for three consecutive 25 trial blocks, or for all blocks left after the first such block. Dyads who meet neither of these criteria will be categorized as Mugwumps. In order to provide a roughly comparable number of trials over which to compare the various categories, the first 100 trials of the Mugwumps' interaction will be considered their preasymptotic data.

In order to provide a sufficient number of dyads in each of these categories, subjects will be run until there are at least ten dyads in each of the Dove, Mugwump, and Hawk categories in both the PD and Ck games. The goal is to produce 120 subjects, equally distributed in each of these categories.

The role of initiator (HiC member) is defined as in the previous studies.

Immediately after completing the session subjects were asked to fill out a "questionnaire," which was the California F-scale. The questionnaires were completed while the subjects were still separated in their booths, and communication was forbidden.

Results

A. The Distribution of Outcomes

The distribution of all dyads into the various categories is presented in Table 2. The Matched Cooperators are those dyads whose members both showed strong predispositions to cooperate and who maintain this cooperative interaction throughout. These dyads reached the cooperative criterion immediately. The Matched Competitors are those dyads whose members both show strong competitive predispositions. These dyads reached the criterion for high conflict immediately and maintain this level of conflict throughout. The presence of a punitive component (P) in the Ck game seems to inhibit strong predispositions of either type.

TABLE 2

DISTRIBUTION OF DYADS INTO THE VARIOUS CATEGORIES USED, BY MATRIX CONDITION

	PRISONER'S DILEMMA		CHICKEN	
MATCHED COOPERATORS	10		5	
DOVES	11		13	
MUGWUMPS	11		14	
HAWKS	11		10	
MATCHED COMPETITORS	5		0	
N.G.	2		0	
D-S	2		1	
LOST CR	0		3	
TOTAL	52	+	46	= 98 DYADS

MATCHED COOPERATORS - HIGH COOPERATORS WITHOUT PREASYMPTOTIC DATA

MATCHED COMPETITORS - HIGH CONFLICT WITHOUT PREASYMPTOTIC DATA

N.G. - SPOILED DATA

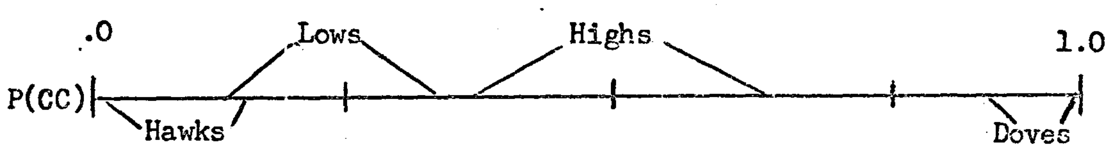
D-S - EXTREME DOMINANT - SUBMISSIVE RELATIONSHIP

LOST CR - REACHED HIGH COOPERATION AND THEN LOST CRITERION

Three dyads in the Ck game reached the cooperative criterion, but failed to maintain this cooperative state for the duration of their interaction. One of these dyads reached criterion immediately. Three other dyads produced a very unusual interaction pattern. These dyads developed a dominant-submissive relationship which was maintained for many trial blocks. This relationship is evident in that the HiC member made at least .60 more C responses than her partner for at least 75 consecutive trials. Stable states of cooperation or conflict did not occur in these dyads. That such a relationship is very unusual in these games will be made clear below. Finally, two dyads (NG) produced data which could not be used due to equipment failure in one case, and reported subject apathy in the other.

The distribution of CC states from the first half of each dyad's preasymptotic data, and from their post-criterion data are presented below for each game. Only the subjects who make up the Dove and Hawk dyads are considered here. Although there is a much broader distribution

PD Game: First Half of Preasymptotic Data



Post-Criterion Data

Ck Game: First Half of Preasymptotic Data

Post-Criterion Data

of CC states on the early trials of both the PD and Ck games, the post-criterion data indicate a clear bimodal distribution of CC states with the Doves and Hawks at opposite ends of the continuum. In the PD game six dyads from the 10 highest on the early trials eventually became Doves. In the Ck game seven of the early Highs became Doves. In the Ck game one Dove and two Hawk dyads reached criterion after 175 trials and therefore could not provide any post-criterion data.

B. Predispositions and Outcomes

The data of the Matched Cooperators and Matched Competitors support the hypothesis that predispositional variables are related to stable outcomes only in special cases in which both parties have strong and similar dispositions. However, if this hypothesis is valid one would predict that dyads with preasymptotic data who reach different asymptotic states, should not differ in their initial level of cooperativeness. The value of P(C) on the first five trials for the Doves, Mugwumps and Hawks in both matrix conditions is presented in Figs. 18 and 19. For the first five trials, analysis of variance indicates a significant Category effect ($F = 3.62$; $df = 2,108$; $p < .03$). Individual comparisons indicate that the Doves make more Cs than the Hawks ($p < .05$). Mugwumps also tend to make more Cs than the Hawks, but

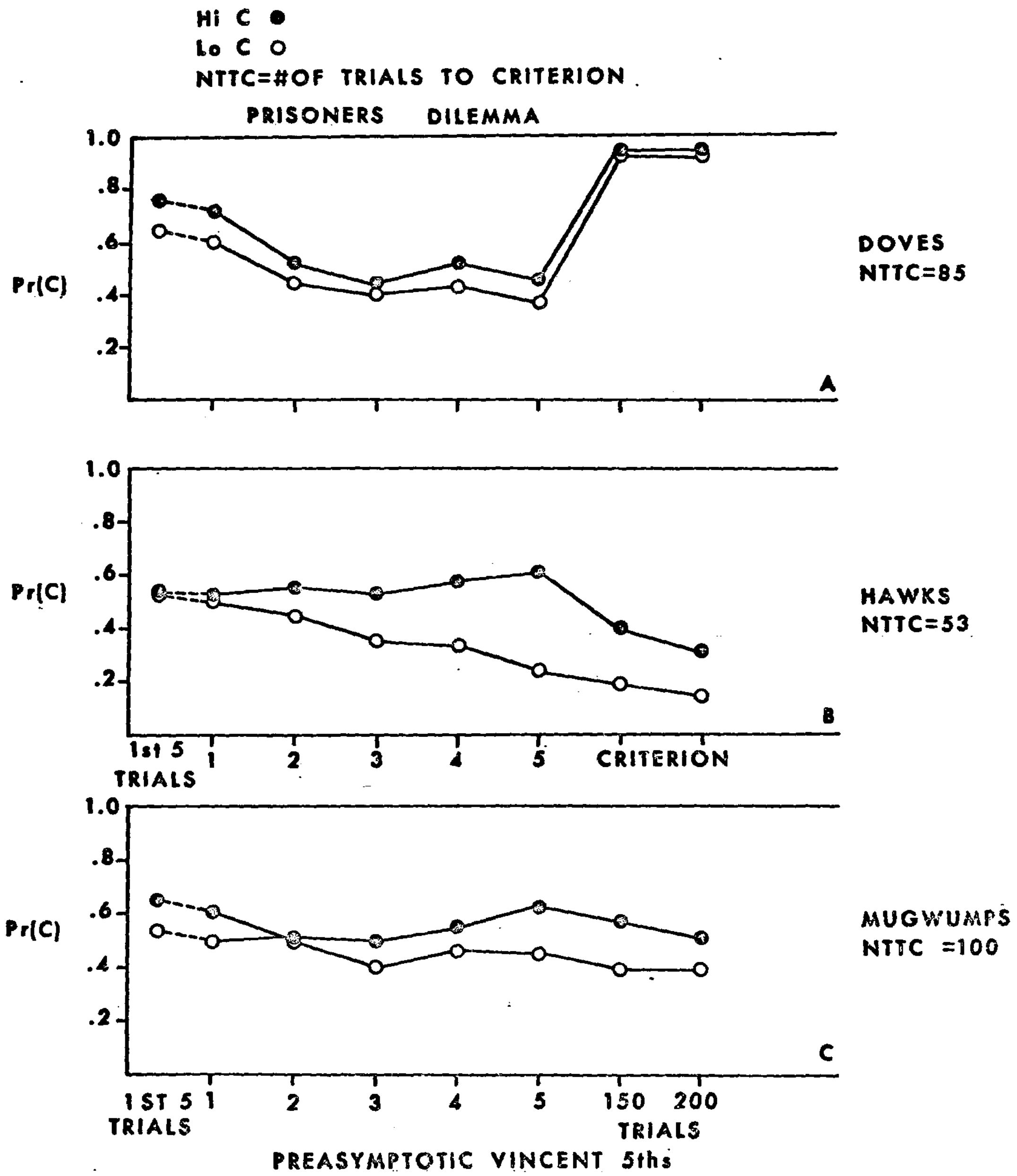


Fig.18. Probability of a cooperative choice, Pr(C), in the PD game on the first five trials, over preasymptotic Vincent fifths and over asymptotic halves for Hi C and Lo C Doves (A), Hi C and Lo C Hawks (B) and Hi C and Lo C Mugwumps (C).

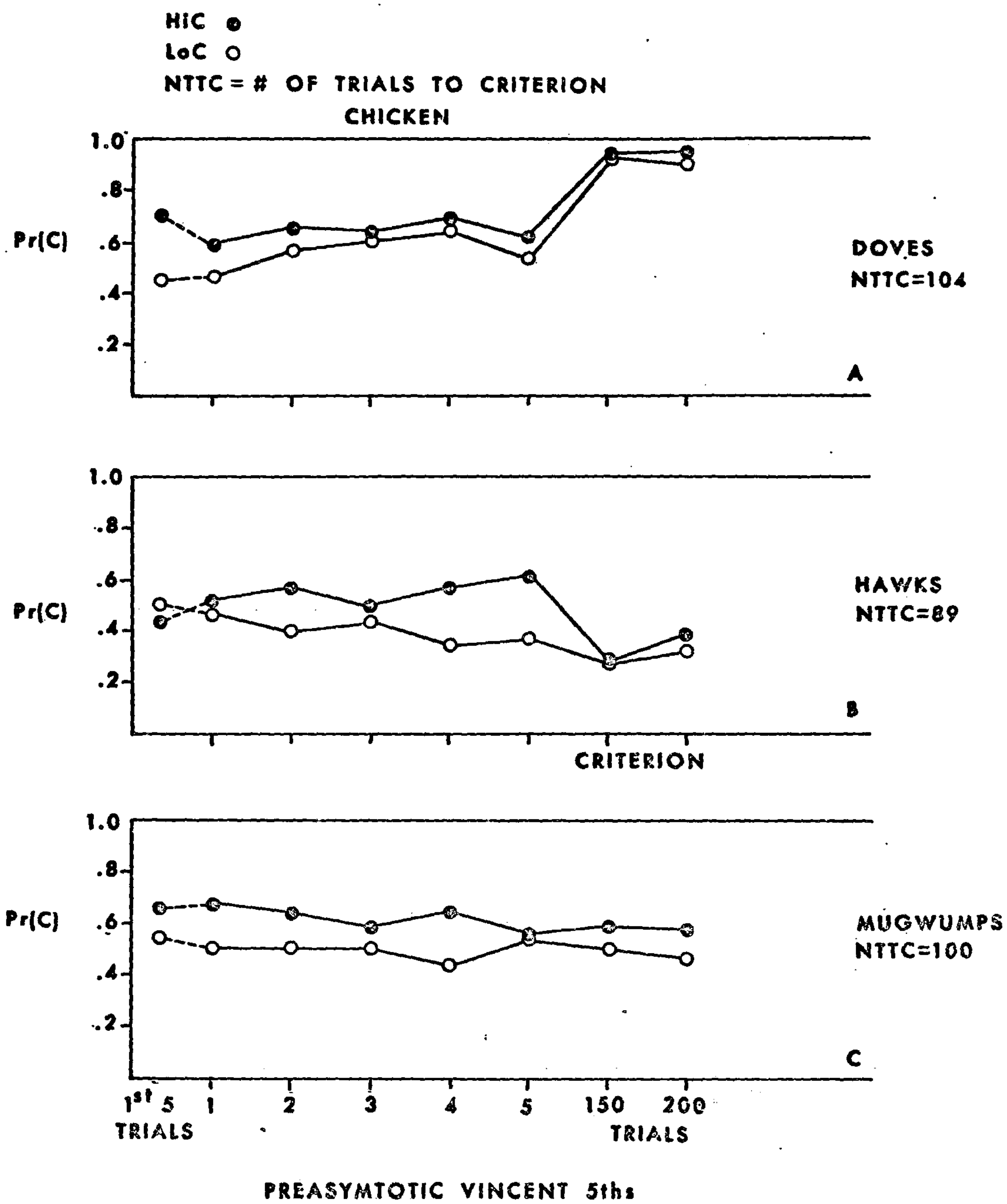


Fig.19. Probability of a cooperative choice, Pr(C), in the Ck game on the first five trials, over preasymptotic Vincent fifths and over asymptotic halves for Hi C and Lo C Doves (A), Hi C and Lo C Hawks (B) and Hi C and Lo C Mugwumps (C).

this effect does not reach the conventional level of significance ($p > .05$). These data indicate that moderately cooperative predispositions are related to cooperative outcomes if both parties are similarly predisposed. (Only a marginal P(C) role effect occurs over the first five trials, $F = 3.24$; $df = 1,108$; $p > .05$.) However, intermediate predispositions may result in either intermediate or high states of conflict. Individuals' reactions to these initial interactions are important in determining the stable outcomes. These reactive dispositions are important even in the case of subjects with moderate cooperative predispositions, as indicated by the number of trials required for them to reach criterion (cf. Figs. 18 and 19).

C. Authoritarianism and Outcomes

Table 3 contains the F scores for HiC and LoC members for each Category and Matrix condition. It is clear from these data that extreme authoritarians do not have a high frequency of occurrence in this unselected sample. The means for all groups fall within the middle third of the F scale, and only four subjects scored on the upper third (only two of whom became LoC Hawks). Therefore, it is not possible to test the notion regarding the relationship between extreme personality types and stable outcomes. However, given the absence of extreme types it is still possible to examine the relationship between F-scores and outcomes. Analysis of variance indicates that there are no main effects of Role, Category, Matrix ($p > .10$) and no interactions ($p > .10$). These results indicate that intermediate levels of authoritarianism are not related to stable outcomes in either an easy PD or Ck game. Although the number of Matched Cooperators and Matched Competitors is not large

Table 3

MEASURES* OF AUTHORITARIANISM FOR EACH CATEGORY, ROLE AND MATRIX

	Prisoner's Dilemma		Chicken	
	Hi C	Lo C	Hi C	Lo C
Matched Cooperators	3.28 (.837)	3.15 (.782)	3.14 (1.34)	2.54 (.762)
Doves	2.92 (.810)	3.10 (.631)	2.81 (.558)	2.76 (.751)
Mugwumps	2.85 (.643)	2.47 (.909)	3.06 (.821)	3.21 (.869)
Hawks	3.03 (1.03)	3.58 (.776)	2.92 (1.10)	3.32 (.604)
Matched Competitors	3.21 (1.63)	2.67 (.503)	Not	Available

* Means and standard deviations (in parenthesis)

enough to warrant statistical analysis, the data available suggest that strong predispositions to cooperate or compete are expressed in the absence of extreme levels of authoritarianism. The absence of personality effects lends support to the notion that reactive dispositions are more important determinants of stable outcomes, than predispositional variables, in the absence of extreme personality types.

D. Reactive Dispositions and Outcomes

Hypotheses 1-3 which are concerned with the relationship between reactive dispositions and stable outcomes, require a P(C) role effect for the Hawks in both matrices, but that such a role effect be absent for the Doves. An analysis of variance of P(C) over preasymptotic blocks for each Role, Category and Matrix produced the results shown in Table 4. Individual comparisons indicate that the Role by Category interaction supports Hypothesis 1. There is no Role effect for the Doves ($p > .10$), but the HiC Hawks make more Cs than their partners on the fourth and fifth preasymptotic Vincent blocks ($p < .01$). The absence of a Role by Category by Matrix interaction indicates that these patterns are similar in both games. Individual comparisons confirm this result.

The fact that predispositional variables are not related to outcomes in any simple direct fashion is reflected in the Trials by Category by Matrix interaction ($F = 2.00$; $df = 8,432$; $p < .05$). Individual comparisons indicate that the Doves in the PD game show a significant decrease in P(C) from the first, to the second through the fifth preasymptotic blocks ($p < .01$). In the Ck game, the Doves show

Table 4

ANALYSIS OF VARIANCE* OF P(C) FOR ROLE, CATEGORY, MATRIX AND TRIAL BLOCKS

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	p
Between Variables					
ROLE (A)	7.492	1	7.492	29.61	< .001
CATEGORY (B)	2.190	2	1.095	4.33	< .02
A X B	.954	2	.477	1.88	
MATRIX (C)	1.897	1	1.897	7.50	< .01
A X C	.000	1	.000	.00	
B X C	1.120	2	.560	2.21	
A X B X C	.118	2	.059	.23	
S/G Error Term	27.330	108	.253		
Within Variables					
TRIALS (D)	.902	4	.226	2.15	
D X A	.743	4	.186	1.77	
D X B	.479	8	.060	.57	
D X A X B	1.516	8	.189	1.81	
D X C	1.223	4	.306	2.91	< .05
D X A X C	.333	4	.083	.79	
D X B X C	1.679	8	.210	2.00	< .05
D X A X B X C	.324	8	.040	.39	
T. S/G Error Term	45.310	432	.105		

* Arcsine transformation

an increase in the preasymptotic level of P(C) from the first to the fourth Vincent block ($p < .01$).

Support for Hypothesis 3 is also provided by this three-way interaction. In both matrix conditions the Mugwumps show no effect of Trials ($p > .20$) although there is a Role effect for P(C) on the fourth Vincent block in the Ck game ($p < .05$).

In order to directly test the difference in the P(C) role effects between Dove and Hawk dyads, difference scores were computed and submitted to analysis of variance. The results ($F = 6.704$; $df = 1,152$; $p < .02$) indicate that the magnitude of the P(C) role effect is significantly greater for the Hawks than for the Doves. Individual comparisons indicate that this occurs only on trial blocks four and five ($p < .01$ for both blocks in the PD game, and $p < .05$ and $p < .06$ for blocks four and five, respectively, in the Ck game).

These results regarding the relations which develop within the Dove and Hawk dyads are identical to those obtained in a pilot study in which the thirteen Dove and ten Hawk dyads were examined. The patterns of reactive dispositions were identical to the present results in spite of the small number of dyads in each of the games used.

It is interesting to note that individual comparisons of the Category by Matrix interaction indicate that in the PD game there is no difference in the overall level of P(C) between any of the groups ($p > .10$). In the Ck game, the Doves' overall level of P(C) is greater than that of both the Mugwumps and Hawks ($p < .05$).

The first-order conditional probabilities collapsed over preasymptotic blocks are presented in Table 5. The overall preasymptotic levels of P(C) associated with each of these groups are as follows: in the PD game, Doves = .495, Mugwumps = .513, and Hawks = .465; in the Ck game, Doves = .601, Mugwumps = .556, and Hawks = .480.

Hypothesis 1 requires that the Doves make more trustworthiness responses, Cn+1/CCn, than the Hawks and that a role effect be absent for the Doves. Analysis of variance of the trustworthiness data indicates a significant Role effect ($F = 9.97$; $df = 1,108$; $p < .003$), Category effect ($F = 8.98$; $df = 2,108$; $p < .001$) and a significant Category by Matrix interaction ($F = 3.50$; $df = 2,108$; $p < .03$). Both the Doves and the Mugwumps are more trustworthy than the Hawks ($p < .01$) in the PD game, but in the Ck game the Doves are more trustworthy than Hawks and Mugwumps ($p < .01$). An examination of the Role by Category by Matrix interaction indicates that the difference between HiC and LoC members occurs only in the Ck game, and then only for the Mugwumps and Hawks ($p < .05$). Thus the Doves in both games display an absence of a role effect as predicted.

Sign tests indicate that the level of trustworthiness is greater than the overall level of P(C) for both the Doves and Hawks in the PD game ($p < .006$ and .001, respectively; one-tailed test), but in the Ck game, the sign test is significant only for the Doves ($p < .001$, one-tailed test). In neither game are the sign tests significant for the Mugwumps ($p > .05$ in each case, two-tailed test). Mann-Whitney U tests, comparing the magnitudes of the trustworthiness - P(C) difference for the Doves and Hawks in each game, are not significant.

TABLE 5

PREASYMPTOTIC MEANS AND STANDARD DEVIATIONS* FOR FIRST-ORDER CONDITIONAL PROBABILITIES FOR EACH CATEGORY, ROLE, AND MATRIX

	PRISONER'S DILEMMA		CHICKEN	
	HI C	LO C	HI C	LO C
	$P_r\ (C_{n+1}\ /\ C_nC_n)^+$			
DOVES	.787 (.134)	.751 (.205)	.854 (.152)	.720 (.205)
MUGWUMPS	.755 (.237)	.608 (.220)	.724 (.175)	.449 (.162)
HAWKS	.485 (.367)	.426 (.304)	.713 (.236)	.475 (.236)
	$P_r\ (C_{n+1}\ /\ D_nD_n)$			
DOVES	.478 (.258)	.390 (.258)	.525 (.172)	.549 (.147)
MUGWUMPS	.541 (.173)	.526 (.078)	.684 (.205)	.609 (.185)
HAWKS	.605 (.222)	.413 (.217)	.515 (.168)	.528 (.264)

* STANDARD DEVIATIONS IN PARENTHESES

+ ESTIMATES WERE MADE FOR < 3% OF DATA (SEE TEXT)

TABLE 5 (continued)

PREASYMPTOTIC MEANS AND STANDARD DEVIATIONS* FOR FIRST-ORDER CONDITIONAL PROBABILITIES FOR EACH CATEGORY, ROLE, AND MATRIX

	PRISONER'S DILEMMA		CHICKEN	
	HI C	LO C	HI C	LO C
		$P_r\ (C_{n+1}\ /\ C_nD_n)$		
DOVES	.383 (.213)	.208 (.212)	.429 (.170)	.437 (.233)
MUGWUMPS	.412 (.162)	.240 (.085)	.502 (.188)	.403 (.189)
HAWKS	.401 (.202)	.164 (.168)	.482 (.200)	.359 (.174)
		$Pr\ (C_{n+1}\ /\ D_nC_n)$‡		
DOVES	.476 (.286)	.399 (.335)	.587 (.214)	.396 (.199)
MUGWUMPS	.541 (.288)	.414 (.155)	.556 (.165)	.531 (.196)
HAWKS	.588 (.334)	.313 (.221)	.476 (.273)	.304 (.256)

* STANDARD DEVIATIONS IN PARENTHESES

‡ ESTIMATES WERE MADE FOR $<1\%$ OF DATA (SEE TEXT)

The trustworthiness variable has been discussed in terms of a combined signalling and firmness component. The Doves are the only group which use this variable to serve these dual functions. Signalling elements are apparent in the stochastic measures for the other groups, but the firmness element is lacking. For example, there is a significant Role effect for the repentance, Cn+1/DCn, ($F = 9.49$; $df = 1,108$; $p < .003$), and forgiveness, Cn+1/CDn, variables ($F = 13.51$; $df = 1,108$; $p < .001$), the HiC members being more repentant and forgiving. The forgiveness variable also shows a significant Matrix effect ($F = 14.04$; $df = 1,108$; $p < .001$), and a Role by Matrix interaction which does not reach the conventional level of significance ($F = 3.42$; $df = 1,108$; $p > .05$). The level of forgiveness is generally higher in the Ck game, and partners tend to show similar propensities more so in the Ck than the PD game.

Analysis of variance of the trust propensity, Cn+1/DDn, shows significant Category ($F = 3.77$; $df = 2,108$; $p < .03$) and Matrix effects ($F = 5.18$; $df = 2,108$; $p < .01$). It is the Mugwumps who show the strongest propensity to break a DD state ($p < .05$) across matrix conditions. However, the overall level of trust is higher in the Ck game ($p < .05$).

Sign tests used to examine the independence of these conditional probabilities on the overall level of P(C), produced the following results. In the PD game the Doves' level of repentance, Cn+1/DCn, is lower than their overall level of P(C) ($p < .05$, two-tailed test). The PD Doves also tend to make a lower level of trust and forgiveness responses than C responses, but the results are not significant ($p > .05$ in each case, two-tailed test). Both the Hawks and Mugwumps in the PD game make a lower level of forgiveness than C responses ($p < .05$ and $.01$, respectively, two-tailed test).

In the Ck game the sign tests reveal a difference in the Doves' trust, Cn+1/DDn, - P(C) levels ($p < .001$, one-tailed test), indicating that fewer Cn+1/DDn responses are made than C responses. All other sign tests for the first order conditional probabilities are nonsignificant in the Ck game.

When dealing with conditional probabilities the similarity or differences of the conditional states is always of interest. The response states upon which the above propensities are conditionalized are presented in Fig. 20. Analysis of variance of the CC states over preasymptotic Vincent thirds indicates a significant category effect ($F = 4.47$; $df = 2,54$; $p < .02$). Comparison of the Category by Matrix interaction indicates that there is no Category effect in the PD game, but that the Doves in the Ck game experience more CC outcomes prior to asymptote than either the Mugwumps or Hawks ($p < .05$). The preasymptotic DD data show a significant Matrix effect ($F = 9.29$; $df = 1,54$; $p < .004$), and a Matrix by Trials interaction ($F = 5.21$; $df = 2,108$; $p < .01$). Individual comparisons indicate that the level of DD is higher in the PD than the Ck game ($p < .01$), and that in the PD game there is a significant increase from the first to the second ($p < .01$) and third ($p < .05$) preasymptotic blocks. There is no trials effect in the Ck game ($p > .10$).

Hypothesis 2 requires that the level of D reciprocity be higher for the Doves than the Hawks. The reciprocity data over Vincent halves are presented in Fig. 21. Analysis of variance of the D reciprocity

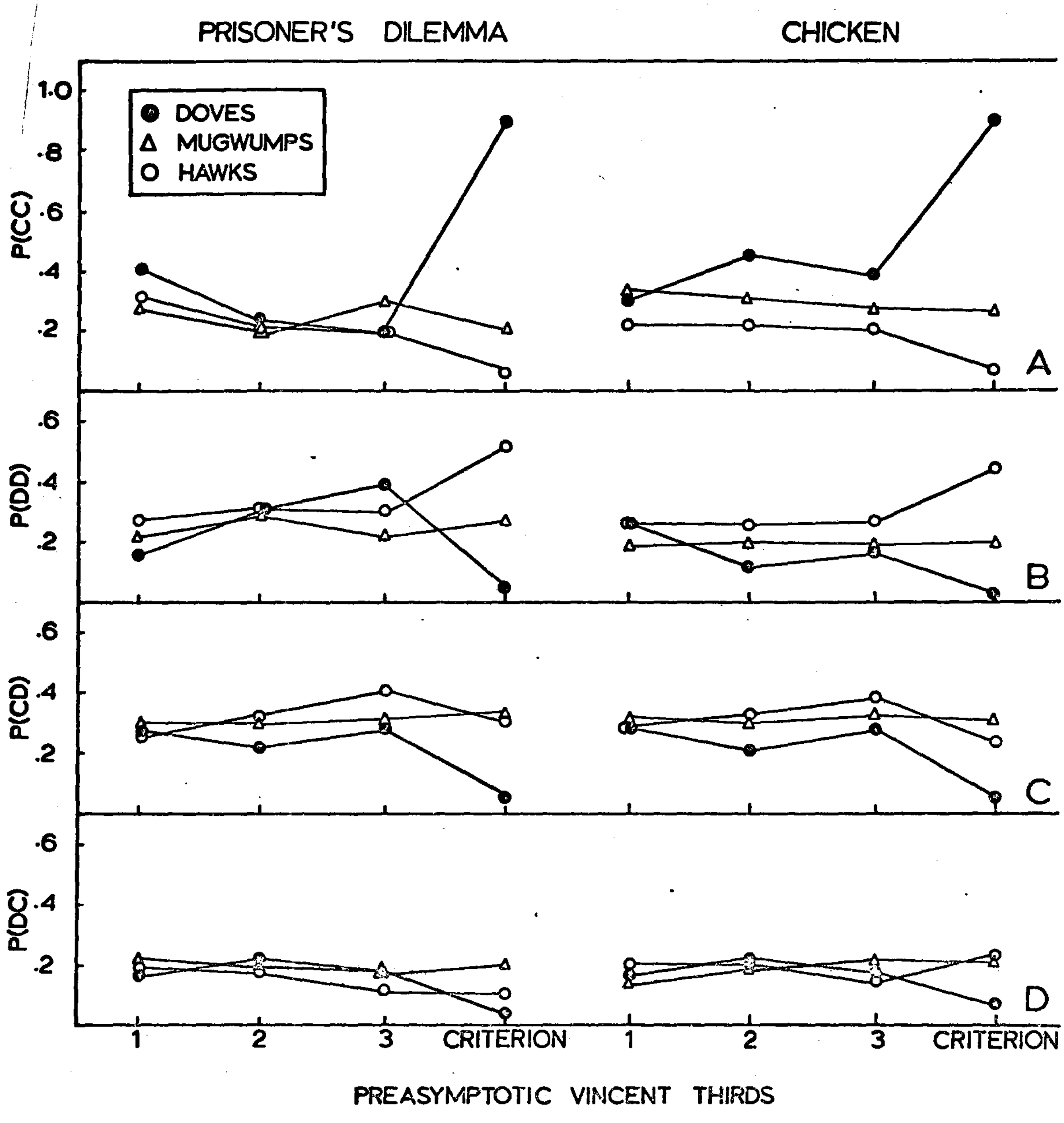


Fig. 20. Probability of a CC(A), DD(B), CD(C) and DC(D) response state over preasymptotic Vincent thirds and at asymptote for the Doves, Mugwumps and Hawks in both the PD and Ck games.

data indicates a significant Role effect ($F = 9.29$; df = 1,108; $p < .01$), Category effect ($F = 3.19$; df = 2,108; $p < .05$), and Matrix effect ($F = 17.69$; df = 1,108; $p < .01$). Individual comparisons indicate that the Doves are more firm in their interactions than the Mugwumps ($p < .05$), but that the Dove-Hawk difference is only marginal ($p < .10$). The Doves in the Ck game make less Dn+1/Dn responses than in the PD game as predicted ($p < .05$). There is a general suppression of this response in the Ck game for all categories ($p < .01$). The Role effect which indicates that LoC members make more Dn+1/D responses than their partners occurs only in the PD game ($p < .01$).

Sign tests, comparing the difference between the levels of D reciprocity and P(D), are significant for the Doves and Mugwumps in the PD game ($p < .001$ in each case, one-tailed test), but not the Hawks. In the Ck game, both the Doves and Hawks tend to make a lower level of Dn+1/Dn than Ds overall ($p > .01$ for both; two tailed test).

The cooperative reciprocity data presented in Fig. 21 was submitted to an analysis of variance which indicates a significant Role effect ($F = 34.95$; df = 1,108; $p < .001$), and Category effect ($F = 8.61$; df = 2,108; $p < .01$). Individual comparisons indicate that the role effect occurs in each group except the PD Doves. Comparisons of the Category effect indicates that the Doves produce a higher level of Cn+1/Cn responses than the Mugwumps ($p < .05$) and Hawks ($p < .01$). The Mugwumps also produce more such responses than the Hawks ($p < .05$).

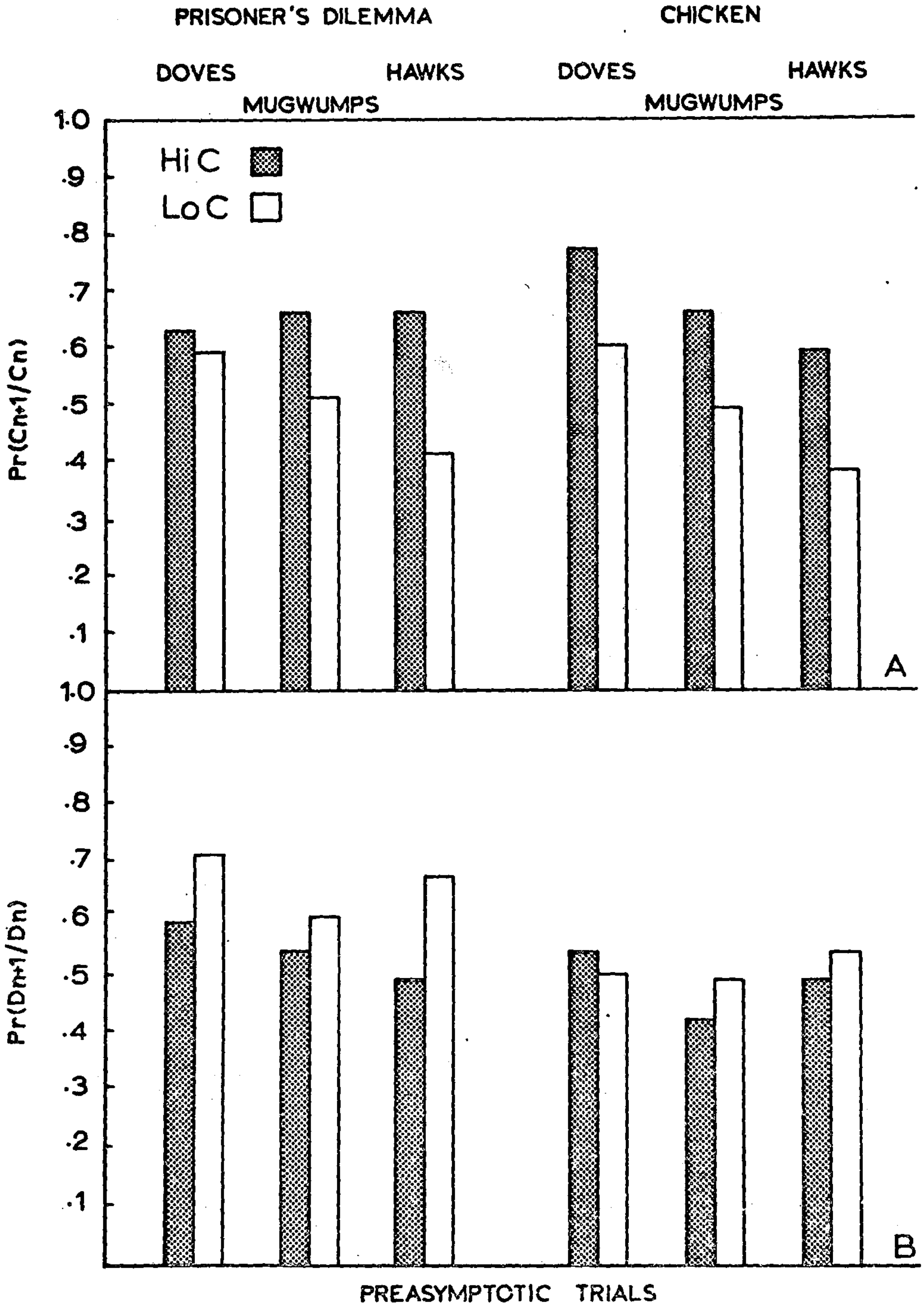


Fig. 21. Probability of a cooperative, Pr(Cn+1/Cn) (A), and competitive, Pr(Dn+1/Dn) (B), reciprocity response for HiC and LoC Doves, Mugwumps and Hawks over preasymptotic trials, in both the PD and Ck games.

Sign tests applied to the preasymptotic reciprocity - P(C) or P(D) differences indicate the following results. Both the Doves and Mugwumps in the PD game make more Cn+1/Cn responses than C responses ($p < .001$ in each case; one-tailed test). These groups also make more Dn+1/Dn responses than Ds overall ($p < .001$ in each case; one-tailed test). Mann-Whitney U tests, comparing the magnitude of the difference between these reciprocity measures and their respective baselines are nonsignificant.

In the Ck game both the Doves and Hawks indicate an independence of Cn+1/Cn on the overall level of P(C) ($p < .001$ and .006, respectively; one-tailed test). The Mann Whitney U test indicates that the magnitude of the difference is greater for the Doves than the Hawks ($p < .001$, one-tailed test). In terms of the D reciprocity - P(D) differences, both the Doves and Hawks indicate a negative dependency, making fewer Dn+1/Dn than Ds overall ($p < .001$ in both cases; one-tailed tests). The Mann Whitney U test comparing these differences is not significant.

E. Motivational Orientations

The predict-play data may be examined to determine whether there are differences in the subjects' motivational orientations which are congruent with their reactive dispositions. The various predict-play combinations over preasymptotic Vincent halves are presented in

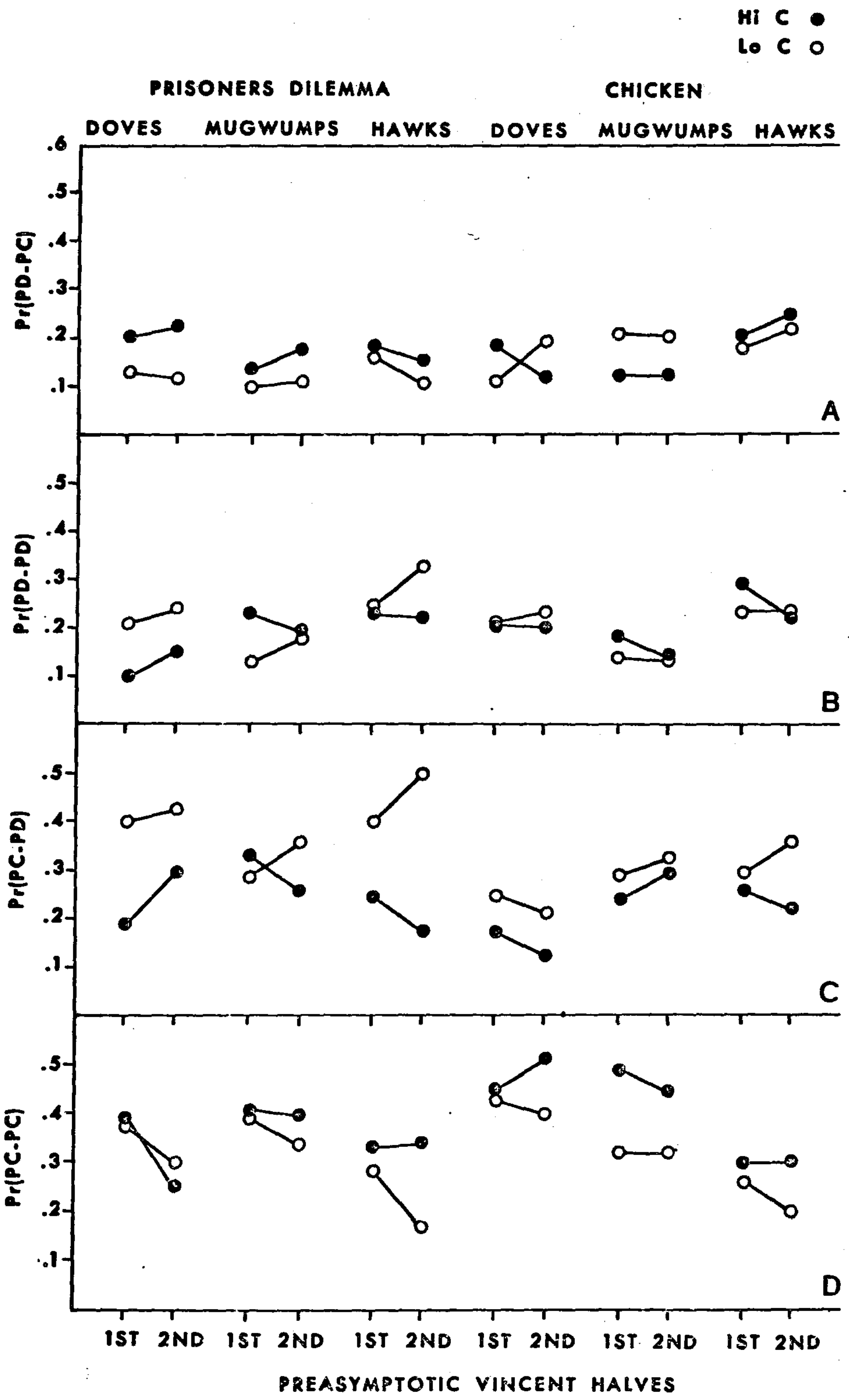


Fig. 22. Probability of a forgiving, Pr(PD-PC) (A), defensive, Pr(PD-PD) (B), exploitive, Pr(PC-PD) (C) and cooperative, Pr(PC-PC) (D) intention for Hi C and Lo C Doves, Mugwumps and Hawks, over preasymptotic Vincent halves, in both the PD and Ck games.

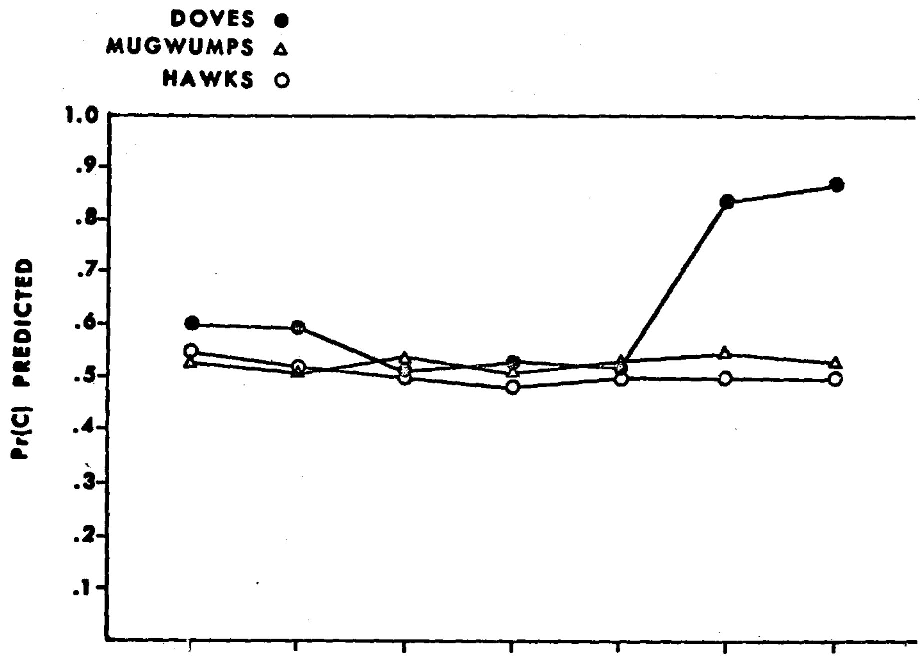
Fig. 22. Analysis of variance of the PD-PC responses indicates no difference over any of the main variables ($p > .10$). In general, these forgiveness responses are very low; not even the HiC Hawks appear willing to intentionally match a C with a suspected defection. Although all groups respond to a suspected defection with a C equally often, the Hawks are more likely to respond to such a suspected defection with a D than any other group (Fig. 22 B). Analysis of variance indicates a significant Category effect ($F = 5.37$; $df = 2,108$; $p < .001$). Individual comparisons indicate the Hawk-Mugwump and Dove-Mugwump differences are both significant ($p < .01$). The Dove-Hawk difference when collapsed across matrices is also significant ($p < .01$) although the level of PD-PD is relatively higher for the Doves in the Ck game. The Category by Matrix interaction is not strong enough ($p > .10$) to warrant further comparisons. The absence of a Matrix effect indicates that subjects in the Ck game are as willing to punish suspected defections as those in a PD game.

There is a Matrix effect, however, ($F = 10.23$; $df = 1,108$; $p < .002$) for the attempted exploitation variable, PC-PD. There is also a significant Role effect ($F = 12.44$; $df = 1,108$; $p < .001$), Trials by Role interaction ($F = 4.56$; $df = 1,108$; $p < .03$), and a Category by Matrix interaction which does not reach the conventional level of significance ($F = 2.89$; $df = 2,108$; $p < .06$). It is the Doves and Hawks in the PD game who attempt exploitation more often than their counterparts in the Ck game ($p < .01$ and $p < .05$, respectively). The Mugwumps are similar in both games ($p > .10$). The Role effect indicates that HiC members attempt exploitation less often than their partners ($p > .01$). This Role effect for the Doves is particularly interesting in view of the similarity in P(C) for these pairs.

The data for cooperative intentions, P̍C–PC, is presented in Fig. 22 D. Analysis of variance indicates a significant Role effect ($F = 9.44$; $df = 1,108$; $p < .003$), Category effect ($F = 12.04$; $df = 2,108$; $p < .001$), Trials effect ($F = 4.24$; $df = 1,108$; $p < .05$), and a significant Category by Matrix interaction ($F = 3.72$; $df = 2,108$; $p < .03$). In the PD game the Mugwumps express more cooperative intentions than either the Doves ($p < .05$) or Hawks ($p < .01$). However, in the Ck game the Doves are more cooperatively oriented than both the Mugwumps ($p < .05$) and Hawks ($p < .01$). The Ck Mugwumps also make more PC–PC responses than the Hawks ($p < .05$) in the Ck game.

F. Perception of the Other and Accuracy of Perception

Some notion of how the subjects in these different groups perceive each other may be obtained from the data in Fig. 23 which contains the level of C predicted by each Category on the first 10 trials and over preasymptotic and asymptotic blocks. Because there are no Role or Matrix effects for the level of C predicted, or the accuracy of these predictions, the data are collapsed over these dimensions. There is no difference between Categories on the first 10 trials ($p > .10$), as all groups predict a high level of Cs. Analysis of variance of the remaining data in Fig. 23 indicates a significant Trials by Category interaction ($F = 6.97$; $df = 12,648$; $p < .001$). Individual comparisons indicate that the Doves predict more Cs at asymptote than the other groups ($p < .01$), and also more than their



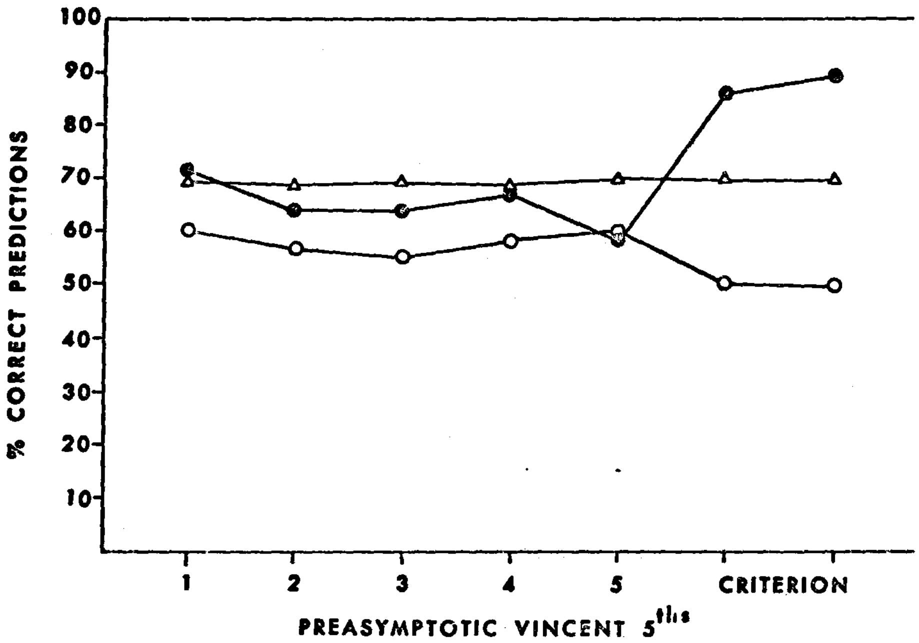


Fig. 23 (TOP). Probability of a cooperative prediction, Pr(C), by the Doves, Mugwumps and Hawks over preasymptotic Vincent fifths and asymptotic Vincent halves, collapsed over PD and Ck games.

Fig. 24 (BOTTOM). Percent correct predictions for the Doves, Mugwumps and Hawks over preasymptotic Vincent fifths and asymptotic halves, collapsed over PD and Ck games.

own preasymptotic level ($p < .01$). It is interesting to note that the Hawks continue predicting an intermediate level of Cs for over 100 trials after reaching the criterion for high conflict.

The accuracy of these predictions is plotted in Fig. 24. Analysis of variance indicates a significant effect of Category ($F = 8.59$; $df = 2,108$; $p < .001$), Trials ($F = 2.13$; $df = 6,648$; $p < .05$), and a Trials by Category interaction ($F = 5.87$; $df = 12,648$; $p < .001$). Individual comparisons indicate that it is only the Doves who increase their accuracy over trials, from the preasymptotic to asymptotic blocks ($p < .01$). At asymptote both the Doves and Mugwumps are more accurate than the Hawks ($p < .01$) and the Doves are also more accurate than the Mugwumps ($p < .01$).

Discussion

The present study not only confirms the previous finding that very different relationships develop within different dyads in the same experimental condition, but also indicates some stable characteristics of these relationships which are associated with high states of cooperation or conflict across various conflict structures. The bimodal distribution of CC states which occurs at the end of play clearly differentiates the Doves and Hawks. Furthermore, this bimodality does not exist on the early trials but develops within the course of the game.

The notion of a cautious trust has proven to be a useful one for discriminating the preasymptotic interaction patterns of groups attaining high, low or intermediate states of co-operation. The preasymptotic interactions of the Doves are characterized by a small P(C) role effect, and high levels of trustworthiness and D reciprocity, as compared to the Hawks according to the analyses of variance. Furthermore, the sign tests indicate that the trustworthiness and D reciprocity variables are independent of the overall level of P(C) for the Doves in both games. For the Hawks and the Mugwumps, either the D reciprocity or trustworthiness variable is dependent upon the overall level of P(C) in one or the other of these games. Only the Doves satisfy the conditions described as a cautious trust.

The relationship which develops between the members of the Hawk dyads is a very different one from that of the Doves. The Category by Role interaction of the preasymptotic P(C) data indicates that the HiC Hawks in both games initiate a large P(C) role effect which is met by their partner's exploitativeness.

The stability of these interaction patterns in a variety of game structures is maintained despite the typical effects of structure on P(C) and other variables which are often used as indices of conflict or cooperation (e.g. Rapoport & Chammah, 1966). The invariance of these relationships across various matrices is of particular interest in view of the strong effects usually reported for variations in payoff (Rapoport & Chammah, 1965, 1966; Steele & Tedeschi, 1967; Jones et al., 1968).

The present data speak to the need for considering how various components of the interaction process are combined to produce these different outcomes, rather than using only a single index of cooperation such as P(C). If the values of P(C) were collapsed over Roles in each of the Categories this information would not have as much value in predicting the ensuing asymptotic states as knowledge of the dyads' interaction patterns (cf. Appendix C).[1] In the case of the PD Doves, for example, the use of the preasymptotic level of P(C) would be very misleading in terms of predicting the stable outcomes. This most frequently used index of cooperation shows a significant drop over preasymptotic blocks for the Doves. Similarly, the preasymptotic level of P(C) observed for the Hawk pairs gives little indication of what state these dyads are likely to attain. It is also interesting to note the dissociation of the trusting, P(C), and

[1]Appendix C contains a comparison of different decision rules for predicting stable outcomes on the basis of an individual dyad's preasymptotic data, for each of the studies contained in the present work.

trustworthy, P(Cn+1/CCn), responses which are usually reported to be highly correlated (e.g. Rapoport & Chammah, 1965). For example, the Doves in the PD and Ck games have very different levels of P(C), but very similar levels of trustworthiness.

Another interesting point is that those dyads who failed to reach a cooperative outcome generally lack the firmness rather than the cooperative signalling component. Their levels of P(Cn+1/CCn) and P(Dn+1/Dn) are generally lower than those for the Doves. The firmness component is not only missing from the mutual trust hypothesis (Deutsch, 1962), but is actually counter intuitive to that notion. It is also interesting to note that the high preasymptotic level of D reciprocity found in the Doves occurs at intermediate levels of D responses. A high frequency of Ds would indicate a component of belligerence or toughness, rather than firmness. The distinguishing mark of a firmness component is that it is a measured response, contingent upon the other's defection. Another important aspect of the firmness component is that it is expressed in a variety of ways. Not only is the level of D reciprocity high, but there is also an absence of role effects for the P(C) and P(Cn+1/CCn) variables. The importance of these patterns is especially evident in the Ck game where these variables indicate large role effects for the Hawks.

The interaction patterns of the Mugwumps indicate that their label is appropriate. These dyads are generally characterized by an absence of both signalling and firmness components, and intermediate dispositions compared to the Doves and Hawks. It is clear that a dominant-submissive relationship does not occur in these dyads, nor does either member appear to initiate an influence attempt like those observed in either the Dove or Hawk pairs. It must be noted, however, that these dyads avoid a conflict spiral although they do not achieve the rewards of mutual cooperation. The factors which account for this prolonged intermediate state of conflict require further study. Many real life conflicts are characterized by prolonged interactions with indeterminant outcomes. The present data indicate that if a dyad has not attained a high state of cooperation or conflict by 125 trials in these types of situations, then it is likely to maintain an intermediate relationship for many trials thereafter. Such information should prove useful in designing future studies to investigate the effectiveness of various influence attempts, and/or situational variables (e.g. communication), in moving these dyads toward a cooperative outcome.

The importance of these various interaction patterns is further emphasized by the data pertaining to the predispositional variables. Predispositional variables seem to play an important role in determining stable outcomes when both parties have strong, matched predispositions. This simple case is exemplified by the Matched Co-operators and Matched Competitors. However, there is another, less direct, manner in which predispositions are related to outcomes. On the first five trials, the Doves make more C responses than the Hawks. However, this initial difference between these groups is not maintained over preasymptotic blocks. Furthermore, although both PD and Ck Doves indicate highly cooperative predispositions, their reactions to these initial levels of P(C) are quite different. Similarly, the Mugwumps and Hawks react quite differently to their similar, and initially intermediate, dispositions. These different reactive dispositions indicate that the relationships between intermediate cooperative predispositions and final outcomes are not simple, intuitively obvious ones. Other studies (Rapoport & Chammah, 1965; Pilisuk et al., 1965; Terhune, 1968) which report a relationship between predispositional variables and terminal states do not distinguish between those dyads who lock in on a criterion state immediately and those who require considerable interaction before doing so. Partitioning these dyads serves to clarify this important relationship. The procedure of distinguishing various criterion groups also serves to clarify the importance of the different reactive dispositions.

Further support for the importance of these reactive dispositions over predispositional variables is available from the data on authoritarianism. Due to the lack of extreme authoritarians in the unselected sample it is not possible to test the notion that particular configurations of these extreme types are related to outcomes. Only four subjects scored on the upper third of the F scale, and only two of these subjects became LoC Hawks. The subjects' homogeneity regarding authoritarianism did not prevent a wide range of outcomes from occurring, indicating that this personality disposition cannot account for these outcomes. However, to conclude that the reactive dispositions rather than predispositional variables are responsible for these outcomes may be objected to on the following grounds. It is possible that the personality configurations within the various criteria groups differ on some dimension other than authoritarianism (cf. Terhune, 1970 for a list of personality variables related to cooperation). Although this possibility cannot be disproven it seems to be improbable, given the large samples which usually require screening before one obtains a large enough n to conduct a study of extreme types. It would appear to be even less likely that these extreme types vary along a single dimension in an unselected sample. If there are a variety of extreme types in each of the criteria groups then we are led to the conclusion that a variety of personality configurations result in similar reactive dispositions and consequent outcomes. Given the large number of personality characteristics, the reactive dispositions may provide a much more economical means of describing conflict behavior. If, on the other hand, the unselected sample is relatively free of extreme types on any personality dimensions, then the reactive dispositions may be the only relevant means of describing conflict behavior. To know that a party's relationship is characterized by certain reactive dispositions after a period of time, is much more relevant than knowing both parties to the conflict are intermediate on authoritarianism. However, it is unwarranted to conclude at this time that in an unselected sample, the outcomes of a conflict are determined primarily by the reactive dispositions, until other personality dispositions are directly examined. Whether or not extreme personalities are characterized by similar reactive dispositions is also a matter for further study.

The characteristics of the various reactive dispositions which encourage or impede cooperative outcomes in a free play situation are quite different from those used in studies of programmed strategies (cf. Chapter 3, C). These different reactive dispositions help to explain the increased variability resulting from particular strategic manipulations noted by Swingle (1968) and others. In addition, the descriptions of these reactive dispositions provide information which should help assess the effectiveness of various strategic manipulations. Many of the small effects of strategy manipulations often reported in the literature (cf. reviews by Gallo & McClintock, 1965; Becker & McClintock, 1967; Vinacke, 1969), are very likely due to a confounding by these very different reactive dispositions in the subject population. In a recent study, for example, it is shown that different personalities react to the same strategic manipulation in very different ways (Teger, 1970). Discussions of the failure of strategic manipulations to produce specific outcomes have recently been in terms of the structural (Oskamp, 1970) or demand and/or situational characteristics (Nemeth, 1970) of the mixed-motive paradigms used. The present data indicate that the reactive dispositions leading to high cooperation or conflict are relatively stable across some structures. Furthermore, the data of the Matched Cooperators and Matched Competitors, indicate that a given conflict structure need not produce any conflict at all, or an extremely high level of conflict, depending upon the configurations of predispositions. The obvious need is for a general theory of conflict which can account for the interaction between dispositional, structural and other variables. Suggestions from the present series of studies are presented below.

In addition to providing a description of the strategic interactions which are associated with high states of cooperation and conflict, the present data also indicate an unusual feature in the behavior pattern of the cooperative dyads--the step-function in P(C). This step function occurs in both the PD and Ck games and occurs not only for the Doves, but also for the HiC Hawks. The magnitude of this jump is, of course, limited by the preasymptotic level of P(C). The Ck Doves, with a high preasymptotic level of P(C), indicate a smaller jump than the PD Doves. Although the preasymptotic levels of P(C) are similar for the HiC Hawks in both games, those in the Ck game indicate a greater drop. This step function is not an artifact of the averaging procedure used, but occurs in the majority of dyads (see Appendix D).

The occurrence of these rapid changes in response patterns indicates what drastic effects the preasymptotic interactions can produce. The combination of an unguarded attempt at cooperation and a strong disposition to exploit, not only leads to a high level of conflict, but also leads to a rapid escalation of the conflict, which persists for many trials. The combination of a cooperative signal with firmness, however, leads to a rapid mutual increase in cooperation without benefit of explicit communication or formal agreement.

Although the direction of the step function is predictable from the preasymptotic interaction patterns (cf. Appendix C), it is not yet known what factors determine precisely when the shift will occur. For the Doves, the combination of cooperative and exploitative tendencies, indicated by the predict-play data, must account for the fact that some interaction is required before a stable cooperative state is attained. The changes in the relative status of these tendencies which might account for the shift, seem to occur simultaneously with the behavioral changes rather than to precede them. The Doves do not indicate that they perceive each other to be cooperative, nor do they indicate a greater ability to correctly predict each other's choices, just prior to asymptote. This ability to shift both intentions and behavior very rapidly suggests that a cognitive flexibility component is involved. Pilisuk et al. (1965) found that if both dyad members were high on tolerance for ambiguity they would be likely to attain a high state of cooperation. Although this personality characteristic may play a role in the interactions of the Doves, it alone cannot account for precisely when the behavioral shift occurs.

As for the Hawks, the HiC members appear to shift their mode of responding after they reach a threshold of frustration and/or humiliation, subsequent to repeatedly obtaining the sucker's payoff. This, of course, is not an explanation of their behavior but it indicates that emotional variables are considerably more relevant to the Hawks' outcome, in contrast to the cognitive elements which seem to play a role for the Doves. Again, although it is not yet possible to specify precisely when the HiC Hawk member will retaliate, the description of this process provides a baseline against which the effects of manipulated variables may be examined.

Summary and Conclusions

The present study has demonstrated that a cautious trust, characterized by cooperative signalling and firmness components, characterizes the preasymptotic interactions of dyads who attain a stable cooperative state. This strategy is effective in both an easy PD and Ck game. Interactions which are characterized by disparate reactive dispositions lead to stable states of high conflict. This pattern also proved to be stable across game structures. Interactions which are characterized by intermediate reactive dispositions attain neither of these extreme states, but remain intermediate for many trials.

Predispositional variables have a simple, direct relationship to outcome states only in special cases where both parties have strong and similar predispositions. Moderate predispositions to cooperate are related to cooperative outcomes in complex ways. Either intermediate or high states of conflict may follow from intermediate cooperative dispositions, depending upon the characteristics of the reactive dispositions which develop.

The various asymptotic states which developed spontaneously in the present study (i.e. without any special experimental manipulation), did so despite the fact that the vast majority of the subjects have very similar, intermediate scores on the F-scale. This result was taken as support for the present thesis that reactive dispositions are primarily responsible for these outcomes. Whether or not extreme personality types will manifest similar reactive dispositions is open to investigation.

The familiar step function in P(C) for the high cooperation group is interpreted as evidence of a cognitive flexibility variable existing in these dyads. The sharp drop in P(C) manifest by the HiC Hawks is described in terms of an emotional element.

The detailed descriptions provided for each of the groups of high, low and intermediate cooperation should permit a more refined investigation of the various modes of conflict management in future studies. The very different dispositions contained in an unselected sample undoubtedly confound the effects of any experimental manipulation. In particular, the information obtained on the interaction patterns which do not lead to a state of high cooperation, should serve to define more sharply the precise needs of these groups.

Chapter VII GENERAL OVERVIEW:

SOME CONSEQUENCES OF TAKING STABLE OUTCOMES SERIOUSLY

The purpose of this final section is to draw together the issues examined in this series of studies, and to draw out more fully some implications of these results.

The starting point of these studies was a question concerning the relationship between states of stable cooperation and conflict, and the interaction patterns which produce these states in a real game situation. Noting the occurrence of a bimodal distribution of final outcomes (Rapoport & Chammah, 1965), the initial task was to investigate preasymptotic interaction patterns which differentiate these naturally occurring groups. The procedure adopted to study these differences was to establish a criterion of stable cooperation, and then to test a number of hypotheses concerning the preasymptotic interaction patterns which might distinguish the criterion from the noncriterion dyads.

It was believed necessary to adopt the particular criterion used for a number of reasons. First, high levels of cooperation (i.e. $P(C) > .70$) are uncommon in the literature even when special efforts have been made to produce such results (e.g. Scodel et al., 1959; Bixenstine & Wilson, 1963; Shure et al., 1965). Given the suggestion that the usually employed averaging procedures obscure high levels of cooperation attained by at least some dyads, it appeared reasonable to separate these dyads for special scrutiny. Secondly, previous work on outcomes (Rapoport & Chammah, 1965; Pilisuk et al.,

1965) considers only the terminal state reached by a dyad. In order to investigate various forms of conflict resolution it was necessary to clearly separate preasymptotic and asymptotic states, so that the preasymptotic interactions to be examined would not be confounded by dyads who had already attained a stable outcome. It makes sense to study modes of conflict resolution only in dyads who are in conflict.

Using this procedure, it was found that neither a mutual trust nor a series of reinforcement hypotheses could account for the asymptotic states attained by various dyads. However, when the relationships which develop within different dyads are considered a cautious trust strategy is found to characterize those dyads who reach a stable cooperative state. This cautious trust notion is of interest for several reasons. First, it is a descriptive strategy, actually used by real individuals, and it differs considerably from those strategies tested in numerous studies (cf. Chapter 3, C) where one of the individuals was programmed to play in a particular manner. Second, this notion is unusual in that there is not a single principle underlying the strategy used. Rather, two distinct components are involved, either of which may vary independently of the other in different conflict situations. It is the patterns of these signalling and firmness components which are important in determining outcomes. The particular pattern involved, and the effects of situational and structural variables upon the cautious trust strategy will be discussed below.

A further consequence of the criterion procedure used is the finding that the shift from an intermediate level of P(C) to the asymptotic state of cooperation is a very rapid one. By collapsing the various asymptotic states into a single treatment category, the traditional methods of data analysis not only obscure these various outcomes, but also obscure the process by which these outcomes are obtained. The level of P(C) does not increase gradually into a state of asymptotic cooperation, and may in fact decrease from an initial level prior to the jump into asymptote. This jump indicates that subjects do not gradually learn to make C responses, but that other, perhaps cognitive and/or emotional, factors account for the rapid change in response pattern. This finding limits the usefulness of P(C) as an index of cooperation if the effects of role, category and asymptotic state are not considered. If these conditions are not considered then levels of P(C) may provide useful descriptions of group differences. However, given the large degree of variability within unpartitioned groups such procedures are not likely to provide accurate descriptions of various modes of conflict resolution, or of the effects of various experimental treatments (e.g. communication or information conditions) on these modes of conflict resolution.

As an example of the consequences of organizing the data in these different ways, consider the results obtained concerning the effects of behavioral predispositions. When subjects are presented with various cooperative or competitive pretreatments the results are often contradictory. Some studies have demonstrated that noncontingent cooperative pretreatments lead to lower levels of cooperation after so many trials (Bixenstine & Wilson, 1963; Swingle, 1968; Teger, 1970), whereas other studies find either no change after cooperative or competitive pretreatments, or similar changes subsequent to both manipulations (Bixenstine et al., 1963; Gallo, 1966; Sermat & Gregovich, 1966; Crumbaugh & Evans, 1967; Harford & Solomon, 1967; Sermat, 1967; Oskamp, 1968). These discrepancies may be attributed to differences in matrices used, the various post-treatment manipulations employed, and several other variables. The main point is that predispositions do not have such powerful effects that they determine outcomes. Indeed, none of the above studies considered the relation between predispositions and outcomes. Those studies which did investigate this relationship (Rapoport & Chammah, 1965; Pilisuk et al., 1965) report that particular terminal states are associated with particular predispositions. The higher the initial level of cooperation, the more likely is the terminal state to be a cooperative one.

Terhune's work led him to conclude that--"The prognosis for cooperation seems generally best when both actors are cooperative at the start " (1968, p. 18). Terhune, however, did not investigate stable outcomes, and the present data indicate that such a conclusion holds only under certain circumstances. The method of data organization used in the present studies specifies more clearly the precise conditions under which this simple relationship between predispositions and outcomes holds. Predispositions are directly related to outcomes only in those special cases where both members exhibit very strong predispositions. This is true of both cooperative and competitive propensities as indicated by the Matched Cooperators and Matched Competitors. If the matched cooperative predispositions are not strong they may still be related to a cooperative outcome, but whether or not this is a simple, direct relationship depends on the structural aspects of the conflict. Both the PD and Ck Doves showed higher initial levels of P(C) than the Hawks, but only in the Ck game did the level of P(C) remain high over preasymptotic blocks. In the PD game, the initial level of P(C) indicates a sharp decline over preasymptotic blocks. Furthermore, in difficult PD games (Studies 1 & 2), no relationship was found between predispositions and outcomes. This relationship appears to be more complicated than the above quote suggests. It is affected by the structure of the situation first of all, and if the structure of a conflict is such that it elicits, or permits, cooperative predispositions the relationship is still dependent upon the relative strengths of these dispositions and their mutuality. Yet, even when fairly high and mutual predispositions to cooperate occur, the manner in which they lead to a cooperative outcome is still affected by structural variables. When dyads are not partitioned into various outcome categories these relationships are obscured.

In terms of the practical aspects of conflict management the present data indicate that predispositions to cooperate are relatively important in certain situations, and that in other circumstances a decrease from an initially high level of cooperation is not necessarily indicative of a poor prognosis. Interference in the latter situation (e.g. by a labor-management mediator, or a family therapist) might well impede rather than assist a cooperative outcome.

Another example of some consequences of these different methods of data organization involves the relationship between trusting, P(C), and trustworthy, Cn+1/CCn, behavior. Some studies report a very high correlation between these variables (e.g. Deutsch, 1960a, used Cn+1/Cn as a measure of trustworthiness; and Rapoport & Chammah, 1965). However, data from the present studies indicate a clear dissociation of these responses in certain situations. The level of trustworthiness has been consistently high prior to asymptote for each of the high cooperation groups whereas the level of trusting behavior has varied greatly. Furthermore, although role effects are evident for the members of the cooperative groups on the trusting variable, trustworthiness behavior consistently shows an absence of role effects. The present data also indicate important differences between the various outcome groups in trustworthiness prior to asymptote although there are no differences in overall levels of P(C).

It is not difficult to explain these discrepancies given the different methods of data organization used. The traditional methods of organization do not partition dyads on the basis of their outcomes and therefore the levels of P(C) and P(Cn+1/CCn) become highly correlated as some dyads lock-in on CC states and others on DD states. Although the high correlation between trusting and trustworthy behavior is an intuitively appealing one, it is not an adequate description of the relationship between these variables in an unresolved conflict situation. The approach of investigating preasymptotic differences between naturally occurring groups has indicated that this distinction between trusting and trustworthy behavior is one which is made only by those dyads who attain a cooperative solution. Failure to consider the possibility of this distinction could easily lead to erroneous conclusions concerning the effects of various manipulations. If only P(C) is considered no effects may be evident and a poor prognosis for a cooperative outcome may be assumed. However, without also considering the level of trustworthiness such a prognosis is unwarranted. An important question which remains is whether or not this distinction also characterizes successful attempts at conflict resolution in non-game situations.

Another point contrasting the traditional and present methods of data organization can be made concerning the use of the predict-play paradigm. The level of accuracy, the nature of the interpersonal perceptions which occur, and the subjects' intentions as reflected by their predict-play combinations may be considered. The few studies reporting data of this type indicate that subjects are fairly accurate although they tend to overpredict the level of Cs presented to them by the other (Bixenstine & Blundell, 1966; Halpin & Pilisuk, 1967, 1970). Tedeschi et al. (1968d), however, reports that only five of twenty-four subjects predicted the other's behavior at a better than chance level in a real PD game. The present data indicate that it is the Doves who indicate the highest degree of accuracy, whereas the Hawks tend to continue overpredicting Cs even after they lock in on a DD state. The fact that the level of accuracy is generally not high prior to asymptote for the Doves is puzzling. Their rapid jump in P(C) indicates that dramatic changes have occurred and one would expect these changes to be indicated in their interpersonal perceptions, and in their accuracy in predicting each other's behavior. This, however, is not the case. Whether these results are an accurate reflection of the subjects' interpersonal perceptions, or whether this technique is simply not picking up these changes prior to asymptote, is a matter for future study. The high level of accuracy evidenced by the Mugwumps is also somewhat puzzling, especially given the difficult pattern each partner must predict.

Using traditional methods of data organization Weyer (1969) has indicated that a consideration of both the utility of various outcomes and the subject's expectations of the other's response may lead to accurate predictions of behavior in 2 x 2 game. However, since the Matched Cooperators and Matched Competitors lock in not only on a CC response state, but also in a PC-PC combination, the increased accuracy gained from considering expectations as well as utilities is somewhat misleading. Accuracy may be increased, but the relationship between expectations and outcomes is obscured. The present data indicate that expectations actually reflect the other's behavior (an assumption made by Weyer) only for the Matched Cooperators and Doves, and for the latter only at asymptote. The relationship between expectations and behavior prior to asymptote, before the conflict is resolved in one way or another, is not yet clear.

Studying the predict-play paradigm some investigators report no difference in subjects' level of P(C) related to whether or not they are required to predict each other's behavior (Tedeschi et al., 1968b, d; Halpin & Pilisuk, 1970). However, when a sufficient number of trials is allowed such that asymptotic states occur there does seem to be an important difference in the level of C responding between explicit predict and "no" predict conditions. Using the same matrix structure and experimental conditions, the number of trials required to attain a cooperative criterion decreased by more than 30% (NTTC = 460 in Study 1 and 320 in Study 2). Although one might assume that in a "no" predict condition the subjects are predicting the others' responses and simply not reporting them, requiring them to explicitly predict each other's responses does have a large and important effect. In addition, requiring subjects to consider the other's position affects different subjects quite differently. Those who reach a cooperative solution do so much more rapidly whereas the noncooperators' level of P(C) is relatively unaffected by these conditions.

One of the most important consequences of the present method of data organization involves the description of a strategy actually used in a real game which leads to a high level of cooperation. This cautious trust strategy is quite different from those investigated in rigged games. One of the most interesting findings is that the two components of this cautious trust strategy, the signalling and firmness components, are strategies which have usually been studied in terms of their relative, rather than combined effectiveness. In addition, the present data describe how these components vary under different conflict conditions.

The information provided concerning the size of a successful signalling component should prove helpful for future research. One of the great difficulties with the proscriptions of notions like the Osgood (1962) proposal is that the balance between making a clearly credible cooperative gesture, without leaving oneself totally vulnerable, is an extremely delicate one. Small signals in a high conflict situation either go unnoticed or are not credible if perceived. Large cooperative signals are more likely to be exploited than reciprocated. The conflict literature contains many examples of both situations. It has been demonstrated that a "conciliatory" strategy (Pilisuk & Skolnick, 1968) in a simulated arms race does not produce results different from a straight delayed matching strategy. Delayed matching strategies sometimes produce levels of P(C) which are higher than one might expect in a short run real game (Komorita, 1965; Crumbaugh & Evans, 1967; Wilson, 1969), but the data are not asymptotic. Wilson (1969) used a "coaxing" strategy which is similar to a mild role effect, with little success in inducing high levels of cooperation. It is also clear that very large role effects are ineffective, as evidenced by the high degree of exploitation found when a stooge is programmed to play a high proportion of noncontingent C responses (Minas et al., 1960; Solomon, 1960; Bixenstine et al., 1963; McClintock et al., 1963; Oskamp & Perlman, 1965; Scodel, 1962; Lave, 1965; McKeown et al., 1967; Wrightsman et al., 1968; Phelan & Richardson, 1969; Wilson, 1969). Simple matching strategies generally produce higher levels of cooperation than delayed matching strategies (Solomon, 1960; Oskamp & Perlman, 1965; Tedeschi et al., 1968c; Wrightsman et al., 1968), but such a strategy occurs in a real game only in special cases when subjects lock in on a CC or DD state immediately, as do the Matched Cooperators and Matched Competitors.

The present data offer some insight into the magnitude of a successful influence attempt in a variety of situations. In retrospect, the size of a successful cooperative signalling component appears to be related to the initial level of conflict elicited by the conflict situation in each of the present studies. In the difficult PD game used in the first study, the size of a successful cooperative signal is larger than the unsuccessful signal. When an explicit prediction paradigm is used in conjunction with this same PD game, the size of a successful cooperative signal is slightly smaller than it is in the first study. In the easy PD and Ck games used in the third study the relationship between a successful and unsuccessful signalling is the reverse of that in the first two studies. In the last study the successful signal is smaller than the unsuccessful one. Paralleling this decrease in the size of a successful cooperative signal from Studies 1 to 3 is a decrease in the initial level of conflict (DD on the first Vincent block). The decrease in the initial level of DD from the first to the second study may be accounted for in terms of the explicit prediction paradigm used in the second study. This procedure appears to make subjects somewhat more sensitive to the implications of their own choices, and allows them to somewhat more successfully avoid the DD state relative to the subjects not required to explicitly predict each other's choices. The further decrease in DDs in the third study may be accounted for in terms of the structural changes from the difficult to the easy PD and Ck games.

An interesting feature of these DD data is that the level is similar for both high and low cooperation groups within any particular game. Although a particular game situation may elicit a similar level of conflict in most dyads, it is the dyads' reactions to this situation which determine the outcome. A high level of initial conflict is not necessarily indicative of a poor outcome, if it is handled properly. These concomitant changes in the magnitude of both successful and unsuccessful role effects and the initial level of DD, over each of the present studies are plotted in Fig. 25.[1] The data from all those dyads who qualified as either Matched Cooperators or Matched Competitors are also included. These data suggest the simple principle that the greater the initial level of conflict the greater the magnitude of the signal required for indicating one's cooperative intention. These data also suggest what the magnitude of a successful role effect should be, given a particular level of conflict to begin with. Since it is clear that very large or very small role effects (e.g. 100% Cs, or 100% C reciprocity) are unsuccessful, such information is crucial for further investigation of cooperative social influence processes in conflict situations. Although the "magnitude" of a cooperative signal may not be easily extrapolated to other real-life conflicts, the present method of data organization permits the investigation of factors which might influence the size and effectiveness of such a signalling component.

The above notion is open to all of the criticisms which may be leveled against any post-hoc explanation, and is presented here only as a stimulus for future studies. Although speculative, the simple principle stated above has a great deal of appeal on both intuitive and empirical grounds, and has some important theoretical implications as well. If there is little or no conflict in a relationship there is

[1] For simplicity, the values of the P(C) role effects are plotted for each study although in Study 2, it was the forgiveness variable which revealed a significant role effect. The magnitudes of the difference in forgiveness between the HiC and LoC partners are .205 and .067 for the Cooperators and Noncooperators, respectively.

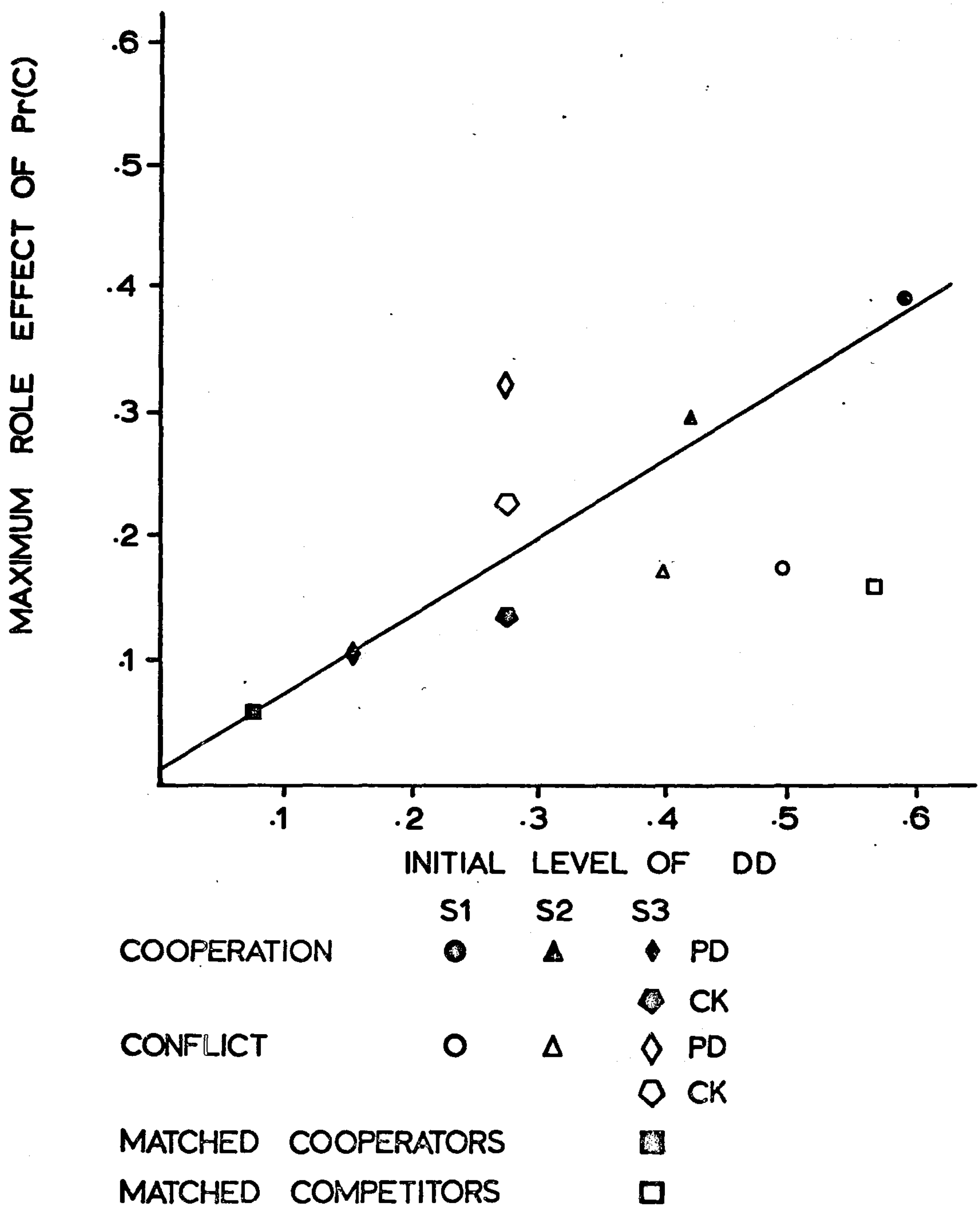


Fig.25. Relationship between the maximum Pr(C) role effect (Hi C vs Lo C members) and the initial level of conflict (DD states on the first Vincent block) for the high cooperation and high conflict groups from Studies 1 through 3.

obviously no need for one party to influence the other to move away from conflict. Indeed, attempts to do so in such circumstances may only arouse suspicion and instigate a conflict, as suggested by the folk lore regarding the husband who presents his wife with an expensive gift, out of the blue. Ingratiation techniques (Jones, 1965) which lack subtlety may produce conflicts rather than the desired effect of strengthening the social bond.

On the other hand, if a high level of conflict exists the suspicions and frustrations it is likely to arouse would seem to require a very pronounced signalling component, e.g. estranged business or marriage partners, and a variety of international situations. The absence of a cooperative gesture of some sort can only allow the conflict to continue. Examples of successful deescalation from a level of high conflict are far from numerous in the literature.

In fact, it has recently been proposed that individuals who set cooperative goals for themselves in a conflict situation will behave cooperatively only if their partner is also cooperative, otherwise they are likely to become behaviorally assimilated to their competitively oriented partners (Kelley & Stahelski, 1970). Such a pattern is suggested by the Hawks' data in the third study. However, in the first two studies it is the LoC Cooperators who become behaviorally assimilated to the HiC members. Although the conditions of the present study are not directly comparable to those of Kelley and Stahelski, it is important to note that subjects without strong cooperative predispositions (which might be expected from subjects who choose cooperative goals) may reach a high level of cooperation if the influence attempt used is adequate. Those subjects in Kelley and Stahelski's work who reach a high level of cooperation do so very rapidly (85% Cs on the first 10 trials) after expressing cooperative goals. This very high level of cooperation may well be due to the requirement of having subjects explicitly set goals for themselves at the onset. These dyads seem most similar to the Matched Cooperators of the present series. Those subjects who set competitive goals for themselves and were matched with similar types by Kelley and Stahelski, seem most similar to the Matched Competitors in the present series. While these groups are interesting in their own right they are not necessarily the most appropriate groups for studying conflict resolution. Subjects may formulate or reformulate their goals within the interaction situation, rather than having explicit and fixed goals at the outset. Kelley and Stahelski argue that once a goal is set a subject may become behaviorally assimilated to a differently oriented opponent without changing his own goal orientation. In the present data, both the magnitude of the role effects and the step function for the high cooperation groups, suggest that goal orientations may indeed change. The disturbing aspect of the former work is that it assumes those who set cooperative goals are likely to become behaviorally assimilated to competitors, but not vice versa. The present data, which are not concerned with an explicit commitment to a particular goal, indicate that LoC members will indeed become behaviorally assimilated to their more cooperative partners under certain conditions. If the simple assumption is made that goal orientations are reflected in the early levels of P(C), the present data indicate that the degree of spontaneous goal setting behavior is affected by the structure of the conflict situation. The "easier" the game (i.e. the lower T-R and P) the more likely will extreme goals be set. However, whether such strong and clear goals are set is not the only issue which determines a dyad's outcome. Unclear, or mixed goals may be set in any of these conditions, and it is precisely these dyads which can yield the most useful information concerning modes of conflict resolution. When Kelley and Stahelski matched cooperative and competitive goal setters the results presented suggest a greater degree of variability than for other groups. The important question would appear to be what outcomes these mismatched dyads obtain. Data is presented for only 30 trials and is intermediate in level of P(C), so it is impossible to determine what their outcomes would be. Goals, like predispositions and personality variables, may effect outcomes only in special cases. It is the interaction within the conflict itself which appears crucial. The present work is the first (to my knowledge) which describes the actual interaction patterns of subjects who move through a conflict situation to a clear and prolonged state of cooperative interaction. An important implication of the cautious trust strategy is that most parties may be moved toward a cooperative outcome by the strategy of the other, although a cautious trust may not be adequate in all cases.

So far, only the signalling component of the cautious trust strategy has been discussed. The firmness component is also important, not only because its role is not predicted by such notions as the mutual trust hypothesis, but also because its presence indicates that the road to successful conflict management is not all sweetness and light. The difficulty in being firm without eliciting a conflict spiral is no less delicate than deciding upon an adequate signalling component. It is instructive to note that it is the absence of this firmness component, rather than the absence of the signalling component, which characterizes most unsuccessful dyads. Especially if a party has set a cooperative goal for themselves, the use of firmness may create a certain amount of dissonance because our cultural values do not easily juxtapose such notions with a positive bond. Simply setting a cooperative example regardless of the other's behavior, may reduce such dissonance in the short run, but the long term effects look bleak if the Hawks' interaction is accepted as a model of this situation. Acquiring the ability to juxtapose cooperative and firmness components may constitute an integral part of learning to manage conflict.

In the present studies the degree of firmness for the high cooperation groups as measured by D reciprocity, is fairly stable in each of the PD games used. The magnitude of this component is relatively unaffected by the changes in the difference between T and R in the difficult and easy PD games.

It is only in the Ck game that the high cooperation groups indicate a lower level of D reciprocity. These data suggest that the level of firmness required is inversely related to the magnitude of a punitive component which is cojoined with the most desirable outcome. This notion also makes a great deal of intuitive sense. If a party is attempting to influence someone toward a cooperative outcome they are likely to use the minimum amount of firmness necessary in order to emphasize their own resolve without instigating further antagonism. In a situation where the punishment for defection is high, the effects of this firmness component are likely to be greater, and perhaps to endure longer, than in a situation where the punitive component is smaller. The same level of firmness would likely be perceived as excessive by the other and lead to a conflict spiral. The Doves in the Ck game appear to be sensitive to this process and therefore their level of D reciprocity is lower than for their counterparts in the PD game.

The presence of a firmness component for the Doves may also be inferred from the absence of a role effect for the trustworthiness variable, Cn+1/CCn. It is only after the CC state that the probability of a C response is greatly enhanced even though the overall level of P(C) is either steady or actually declining. The absence of a role effect indicates that neither partner is willing to take a greater initiative than the other. Each defects from the CC state at a rate roughly determined by the other's rate of defection from this state. Whatever changes in trustworthiness occur over preasymptotic blocks must resemble a tracking phenomena for the Doves rather than a role effect as occurs for the Ck Hawks.

The description of the reactive dispositions which characterize a cautious trust strategy has proven to be much more useful than information regarding either predispositional or personality variables in predicting outcomes. These latter variables are somewhat more intrapersonal rather than interpersonal, which may account for their differential effectiveness. Intrapersonal variables may indicate an individual's reaction to life in general, but not necessarily to any particular situation. The interpersonal dimensions reflected by the reactive dispositions are more specific both in terms of the situations in which they are likely to occur, and in terms of what behavior should be forthcoming. Although there may well be intrapersonal conflicts involved in an interpersonal conflict situation (as reflected by the predict-play data for example), the resolution of one type is not necessarily dependent upon the prior resolution of the other. Indeed, the present data, especially the jump in P(C), suggest that these types of conflicts may be resolved simultaneously rather than successively. The intrapersonal type does not seem to require solution prior to the interpersonal conflict, but rather their resolutions appear to be somewhat interdependent.

These conclusions should not be taken to imply that predispositional variables are not related to outcomes. The present data indicate that they do play an important role. However, it is necessary to understand the sphere of influence of these variables, just as the cautious trust strategy and other reactive dispositions are limited in terms of the situations in which they have a potent influence. Perhaps the most important point to be made in this entire study is that the effects of predispositions, personalities, reactive dispositions, and a host of other variables are most relevant in terms of the outcomes which occur. Simply because any of these variables affect a dyad's behavior after n number of trials does not mean this dyad will necessarily reach a stable cooperative outcome after 75 or 100 trials.

Surely all of these variables are important to investigate in their own right, but what are they relevant to if not the stable interaction patterns to which they give rise? The data discussed above indicate that the road to a cooperative state is not always paved with early cooperative gestures or good intentions. If any single human relationship is characterized by good intentions it is that of courtship. The divorce rates attest to the insufficiency of such intentions alone to maintain a stable and harmonious relationship. Conflict, being the ubiquitous phenomenon that it is, is likely to arise even in situations where good intentions and mutual interests exist and where personalities fall within the normal range. Without the anchoring effects of stable outcomes the important effects of the many variables involved in a conflict situation may be easily lost in the unpartitioned groups used in the traditional methods of data organization.

A descriptive theory of conflict behavior requires that more information be obtained concerning the actual interaction patterns leading to various outcomes. Given the large number of potential strategies which could be manipulated by an investigator, it would behoove the student of conflict behavior to eliminate those sequences which are irrelevant through careful descriptive studies, rather than rely on this intuition alone. Indeed, such descriptive studies should provide considerable grist for the intuitive mill. We must first understand conflict behavior as it occurs before we can hope to successfully manage it.

Some Unresolved Issues Associated with the Present Approach

Although the methods of data organization used in the present studies may have certain advantages for answering questions concerning various modes of conflict management, this advantage does not come cost free. Several difficulties should be outlined so that they may be dealt with in the future. One of the basic issues, of course, is the definition used of a criterion of cooperation or conflict. The particular values chosen here have been primarily determined by the levels of cooperation and conflict observed in other works. The guidelines used were that the values chosen should be clearly extreme compared to most other works, and should remain stable for a large number of trials. Although these guidelines are still considered reasonable ones, it is clear that the actual values chosen may influence other important variables such as the number of trials to criterion, and the step function. Further work is required to determine precisely what criteria have the greatest heuristic value over a broad range of experimental conditions.

The establishment of criteria greatly reduces the within group variability at asymptote. This procedure has the definite advantage of clearly defining the groups one is studying. The price for this privilege is that the balloon of variability pops out in another area--the number of trials to criterion, and consequently the number of trials per Vincent block. This type of variability is more tolerable, and indeed, one might employ the technique of redefining the problem as the answer and suggest that the different rates with which different dyads enter an asymptotic state account for a good deal of the pre-asymptotic variability within criterion groups. The number of trials to criterion may turn out to be an important characteristic of a particular dyad in terms of both the members' emotional exchanges and the stability of their relationship over a variety of situations.

The general issue of the stability of these asymptotic states is another one which deserves further attention. How stable are these interactions over time, and what factors effect this stability? Given a state of high conflict, what strategic manipulations are required (of the HiC member? of the LoC member?) to reduce the conflict? Given a stable impasse as with the Mugwumps, what are the factors which are likely to move them toward cooperation? or conflict? One of the issues which must be faced in answering these questions concerns the number of trials to be permitted for the dyads to reach a criteria. Although the reactive dispositions present us with a good index of what direction the step function is likely to take, the factors which determine precisely when a dyad will switch into an asymptotic state are still unclear. The present data indicate that one such factor is the structural characteristic of the conflict. If we wish to study successful cooperative role effects a structure which elicits a high initial level of conflict appears necessary. The price the investigator must pay for observing and studying this phenomenon is a long wait for the dyads to reach criterion. If the investigator is not prepared to wait for more than 200 trials in order to attain stable outcomes, then to answer some of the questions posed above he must still decide what criterion to use for stability--25 trials? 50? 100?

There are no set a priori methods by which these issues may be resolved. Hopefully, the questions raised here will be approached in a variety of ways, and alternative methods of data organization designed to answer such questions will be forthcoming.

Appendix A

INSTRUCTIONS

PART 1 Mechanics of the Situation - How to Play

You can see that the panel in front of you is divided into four squares. Each square has two numbers on it. Below the panel there are two buttons. Later, you can push one or the other of these buttons. The numbers in the squares indicate the number of points each of you can win or lose on a particular trial, depending on which buttons are pushed. The number of points you win or lose is printed in large type. The number of points the other player wins or loses is printed in smaller type.

Note that your two choice buttons allow you to choose one of two rows (if you are player #1), or columns (if you are player #2). The green lights indicate to you alone which choice you have made. The other player cannot see what choice you have made. When you hear the buzzer, that will be the signal to begin a trial. You should then choose which row (if you are player #1), or column (if you are player #2), you wish to select. After a few seconds, when both of you have made your choices separately, a light will go on behind the numbers, indicating to each of you what both you and the other player have won or lost on that trial. The square that lights up depends on which button you choose to push and the button the other person pushes. After each trial, write down how much you win or lose on the score sheet provided for you. Then the buzzer will come on again and the procedure will be repeated. This will happen 25 times and then you will be asked to add up your gains and losses. Then a new series will begin.

PART 2 Objectives for each player - Purpose

Your objective in this situation is very simple and familiar. It is to win as much money as possible. Each of you has been given a stake of $1.00. At the end of the session, the points you have won or lost will be exchanged for cash and added or subtracted from your stake. The exchange rate will be 1/5 ¢ per point, for example, 10 points will be worth 2 ¢. Since there will be many trials, the opportunity exists to more than double your stake. However, it is also possible to lose your entire stake.

PART 3 Some information about the structure of the situation

Note that each player can potentially win or lose as much as the other player. However, this will not necessarily happen. Look at the upper right hand square (if you are player #2), or the lower left hand square (if you are player #1). It shows you that the largest win for you (10 points), is coupled with the largest loss (-10 points), for the other person. It should be clear by now that your wins or losses on a particular trial or sequence of trials, depend not only on which choice you make (which button you press), but also on the choice the other player makes. Of course, neither of you knows what choice the other has made until after you both have made your choices. Then, when the numbers light up, each of you can tell which choice the other made. IT IS EXTREMELY IMPORTANT THAT YOU DO NOT ATTEMPT TO COMMUNICATE WITH THE OTHER PLAYER by talking, laughing, or in any way indicating how you feel about what is happening. Your gains for the day will be forfeited if you do.

Nevertheless, it is obvious that some forms of communication may occur over repeated trials. For instance, you may learn to expect what the other player will do. But of course, the other player will also learn what to expect from you, and he could change his choice accordingly so that he would win the largest amount for himself, which would be the greatest loss for you.

Please read these instructions over again and ask any questions you may have before we begin. We will be observing you through this one-way window to be sure you do not communicate (except perhaps through your choices). There is an intercom here over which we will give you instructions when necessary.

After the experiment is over-------

PLEASE do not discuss this experiment with the other player or anyone else, as they may be taking part in a later experiment.

Thank you.

Appendix B

INSTRUCTIONS

Before describing all the buttons and lights on the panel, I want to tell you what your objective should be in this situation. Your objective is very simple and familiar - to make as much money for yourself as possible. Each of you has been given a $1.00 stake to begin. Now it is possible to more than double your stake. However, it is also possible to lose your entire stake. Whatever the final outcome - whether you win or lose money - that will be the amount you get to keep for participating in this experiment.

You can make or lose money by accumulating or losing points. At the end of the experiment the number of points you have won or lost will be exchanged for cash at the rate of .3 ¢ per point. That is, 10 points are worth 3 ¢. Your gains or losses will be added to or subtracted from your $1.00 stake.

You can win or lose points by making choices with the black buttons on your panel. One of you (#1) is a row player, and the other (#2) is a column player. This means that player #1 chooses one of the two rows on the panel and player #2 chooses one of the two columns. The numbers in each square of the panel indicate how many points can be won or lost if you end up in that particular square. Notice that the gains and losses for you and the other player are not necessarily the same in each square. The number of points <u>you</u> win or lose is printed in <u>large</u> type in each square and the number of points the <u>other</u> player wins or loses is printed in <u>smaller</u> type.

When the buzzer sounds that will be the beginning of a trial. Then you are to press one of your black buttons to indicate which row (or column) you wish to choose. After both of you have made your choices independently, a light will go on behind the square which is the intersection of your row and column choices. The number in large print in that square is your gain or loss for that trial. When you press the black button a green light will go on opposite that button. This is simply a reminder to you of which choice you have made. The other player cannot see what choice you have made until after you both have made your choices separately.

It should be clear that the number of points you win or lose is not determined solely by the choice you make, but also by which choice the other player makes. For instance, if row player chose the top row and column player chose the first column, both players would gain 5 points. But if row player chose the top row and column player chose the second column, then row player would loose 10 points and column player would gain 10 points.

Each of you has been provided with a score sheet. After each trial please write down the number of points you have won or lost in the appropriate space. After every block of 25 trials there will be a pause so that you may add up your gains and losses for that set of trials.

Are there any questions up to this point?

O.K. Now about the red buttons. Notice that the red buttons on your panel are identical to the other player's black buttons. That is, row player (#1) has a set of red buttons which allow him to choose column 1 or 2, and column player (#2) has a set of red buttons which allow him to choose row 1 or 2. You are to use the red buttons to guess what choice you think the other player will make with his black buttons. Guess what move you think the other player will actually make; do not use your red buttons to indicate what you would like the other player to do. When the buzzer signals the beginning of a trial the first thing you must do is guess what the other player will do by pushing a red button, and then make your own choice accordingly. The other player cannot tell whether you've guessed his move correctly. And the accuracy of your guesses has nothing to do with how many points you win or lose. A red light will go on when you press the red button as a reminder of which guess you've made.

Just to review, the sequence of events will occur as follows:

1) the buzzer will signal the beginning of a trial;

2) guess the other player's move by pressing one of your red buttons;

3) make your own choice by pressing one of your black buttons;

4) when the square lights up, indicating your gain or loss, record the result on your score sheet;

5) wait for the buzzer again.

Any questions?

One last instruction. It is very important that you do not attempt to communicate with the other player in any way. Please do not talk, sigh, or laugh, or in any way give an indication of how you feel about what is happening. Your gains for the day will be forfeited if you violate this rule.

Appendix C:

Decision Rules for Classifying Individual Dyads as Cooperators or Noncooperators

The data presented above indicate that the strategy described as a cautious trust is associated with stable cooperative outcomes for at least some dyads. This conclusion, however, is based on averaged data and the question arises* as to whether the notion of a cautious trust is useful for predicting stable outcomes from the preasymptotic data of single dyads. In order to examine the utility of this concept for predicting outcomes in single dyads, a series of decision rules have been developed for determining whether a particular dyad will attain a particular stable state, from an examination of the dyad's preasymptotic data. The success rate for correctly classifying dyads on the basis of these decision rules is very high (80 to 100% correct) for each of the three studies reported here. Different decision rules are necessary for each study since each was run under different matrix and/or predict-play conditions. The decision rules and success rates for each study are presented below.

Study 1: Difficult PD Game

It is of interest to compare the effectiveness of the cautious trust strategy in predicting an individual dyad's outcome, with the effectiveness of a decision rule based on the most frequently used dependent variable in mixed-motive games, P(C). If a P(C) criterion is set at $\geqslant .300$, based on the average level of P(C) in a dyad prior to

*Dr. H. M. Jenkins is to be thanked for this suggestion.

asymptote, then 15 of the 18 dyads are classified correctly (83%). Four dyads are classified as Cooperators, three correctly, under this rule. Of the 14 dyads classified as Noncooperators, 12 are correct.

Now let us consider the effectiveness of a decision rule based on a cautious trust strategy.

Decision Rule: If both dyad members have a preasymptotic level of trustworthiness greater than .500, then classify the dyad as a Cooperator. Otherwise, classify the dyad as a Noncooperator.

This decision rule, involving the single variable which incorporates both the signalling and firmness components of a cautious trust, correctly classifies 17 of the 18 dyads in Study 1 (94% correct). The single error occurs in the case of a Cooperator being incorrectly classified as a Noncooperator. This particular dyad reached the cooperative criterion on the first trial of the second day of play, after ending the first day's play in a very high state of conflict. The interval between successive sessions appears to have functioned as a "time out," which Miller (1967) has demonstrated increases the level of cooperative responding.

Study 2: Difficult PD Game with Predict-Play Condition

If the P(C) criterion for Study 2 is set at > .350, then 14 of the 20 dyads are classified correctly (70%). Six of the eight Noncooperators, and eight of the 12 Cooperators are correctly classified.

The notion of a cautious trust gives rise to the following rules.

<u>Decision Rule #1</u>: If both dyad members have a preasymptotic level of trustworthiness greater than .500 and the HiC member does not exceed the LoC member by more than .150, then classify the dyad as a Cooperator.

This rule classifies six dyads, five correctly.

<u>Decision Rule #2</u>: If a dyad gives evidence of a cooperative signal via a forgiveness role effect (HiC > LoC by at least .210), and a firmness component by both making a level of D reciprocity $\geqslant$ .500, then classify the dyad as a Cooperator.

This rule classifies five dyads, and all are correct.

<u>Decision Rule #3</u>: If none of the above conditions are satisfied, classify the dyad as a Noncooperator.

This rule classifies nine dyads, seven of which are correct.

This set of decision rules correctly classifies 17 of the 20 dyads in this study (85%). One Noncooperator dyad is incorrectly classified as a Cooperator and two Cooperators do not meet any of the conditions outlined in decision rules 1 and 2. One of these two incorrectly classified dyads is a dyad which reached the cooperative criterion on the first trial of a particular day's session.

It was necessary to run a large number of trials and to space these trials over several sessions in order to obtain enough Cooperator dyads (only two dyads reached the cooperative criterion in the first session). However, by running dyads over several sessions on different days, the data appear to be confounded. Dyads which reach criterion on the second or third days of play have a history of interaction which is bound to affect the nature of an influence attempt. Furthermore, four of the 12 Cooperator dyads reached criterion on the first block of trials in a session. Their stable outcome may have been affected as much by their "time out" between sessions, as by any strategic considerations within their interactions. (Post-game interviews suggest that external collusion between players during the "time out" period did not occur.) In summary, the procedure of running dyads over several sessions has distinct disadvantages if one is interested in delineating preasymptotic interaction patterns which distinguish Cooperators and Noncooperators.

Study 3: An Easy PD and a Ck Game

A. Easy PD Game

If a P(C) criterion is set at $\geq .500$ then five of the 10 Doves and seven of the 10 Hawks in this game are correctly classified (60%).

The notion of a cautious trust gives rise to the following rules.

Decision Rule #1: If there is an absence of a P(C) role effect (i.e. HiC - LoC difference is $< .200$ on 2/3 of the last 3 blocks or $< .300$ on 1/3 of the last 3 blocks), then classify the dyad as a Dove. If such a role effect does exist, then classify the dyad as a Hawk.

This single rule, which only considers the magnitude of the cooperative signal, classifies 17 of the twenty dyads correctly (85%). Nine of the 10 Doves and eight of the 10 Hawks are correctly identified. If the firmness aspect of a cautious trust is also considered we find that the two Hawks who were incorrectly classified as Doves do not display any evidence of firmness (i.e. D reciprocity is $< .500$ for at least one member). Furthermore, the single Dove dyad which was misclassified under Rule #1, displays both signalling and firmness components in its preasymptotic interactions through a high and mutual level of trustworthiness. Therefore, if the firmness element is also considered, a full 100% of the Doves and Hawks are classified correctly.

B. Chicken Game

If we again set the P(C) criterion at .500, then 17 of the twenty dyads in this game are correctly classified (85%). Three Hawks are incorrectly classified as Doves using this rule.

The decision rules based on a cautious trust notion are presented below.

<u>Decision Rule #1</u>: If both dyad members display a level of trustworthiness greater than .500 then classify the dyad as a Dove, otherwise classify it as a Hawk.

This single variable which incorporates both the signalling and firmness components of a cautious trust correctly classifies 18 of the twenty dyads (90%). One Dove and one Hawk dyad are misclassified. The incorrectly labelled Doves display a trustworthiness role effect (HiC > LoC by .500) and a high level of D reciprocity, indicating signalling and firmness components, respectively. The incorrectly labelled Hawks continue to be misclassified when alternate criteria are examined.

If instead of using the trustworthiness variable as the major criterion, decision rule #1 from the PD game in Study 3 is applied, the following results occur. Six of the 10 Hawks and eight of the 10 Doves are classified correctly. The two Doves who are incorrectly labelled under this decision rule display a high and mutual level of trustworthiness. Of the four Hawks who are incorrectly labelled due to the absence of a P(C) role effect, three of them display a complete absence of firmness. In each of these dyads there is a trustworthiness role effect (HiC - LoC $>$.400) and at least one dyad member displays a level of D reciprocity of less than .500. These considerations lead to an accuracy of 95% for the dyads in this Chicken game.

Although these levels of accuracy are very high they involve only the groups of maximal contrast. When the Mugwumps in both games are considered, the degree of accuracy decreases somewhat. Let us consider all 60 dyads in this last study, specifying the decision rules for Doves, Hawks and Mugwumps. The rules will be slightly different than those given above.

Decision Rule for Classifying Doves: If a dyad does not display a P(C) role effect (i.e. HiC - LoC difference is $<$.300 on all three of the last three Vincent blocks), and also displays a) a high and mutual level of trustworthiness (i.e. $>$.500 for both), or b) both a trustworthiness role effect (i.e. HiC $>$ than LoC by at least .300) and a high and mutual level of firmness (i.e. D reciprocity $>$ .500 for both), then classify the dyad as a Dove.

This rule correctly classifies 10 of the Doves in the PD game and eight in the Ck game.

Decision Rule for Classifying Hawks: If a) there is a P(C) role effect (i.e. HiC - LoC difference $\geq$.300 on at least one of the last three Vincent blocks), or b) there is a trustworthiness role effect (HiC - LoC difference $\geq$.300) and at least one member lacks firmness (i.e. D reciprocity is $\leq$.500), then classify the dyad as a Hawk.

This rule correctly classifies 10 of the PD Hawks and eight of the Ck Hawks. If these revised rules are applied only to these extreme groups, an accuracy of 100% and 80% is obtained for the PD and Ck game, respectively.

<u>Decision Rule for Classifying Mugwumps</u>: If a dyad does not display either of the above behavior patterns, then classify the dyad as a Mugwump.

This rule correctly classifies one of the PD and two of the Ck Mugwumps. The overall levels of accuracy then are 70% and 60% correct (21/30 and 18/30) for the PD and Ck games, respectively. Given that all 60 dyads are being considered, this degree of accuracy is very encouraging. By chance alone, one would expect only 33% accuracy.

By way of contrast, let us compare the accuracy of the decision rules based on a cautious trust with some alternatives. In the above presentation the effectiveness of the overall level of P(C) has been considered and found to produce better than chance results when only the extreme groups are compared. Let us examine the effectiveness of a simple P(C) criterion for all the data. If a criterion of $P(C) < .400$ is set for the Hawks, and a $P(C) > .600$ for the Doves, the .400 - .600 interval falls to the Mugwumps. Using these criteria, 15 of the 30 dyads in the PD game and 14 of the 30 dyads in the Ck game, are correctly identified, yielding 50% and 47% accuracy, respectively.

If different P(C) criteria are set, the results are very similar. If instead of setting absolute values of P(C), the highest 10 values of P(C) are considered Doves, the lowest 10 values are labelled Hawks and the middle 10 values classified as Mugwumps, the following results occur. In the PD game 15 of the 30 dyads, and in the Ck game, 19 of the 30 dyads, are correctly classified (50% and 63%, respectively).

These results speak to the superiority of the cautious trust notion for providing decision rules to accurately classify individual dyads, over the use of the most popular dependent variable in conflict research using a mixed-motive paradigm. The cautious trust strategy provides information about how the generally higher level of Cs found in the Cooperators' preasymptotic data is distributed in terms of the dyadic relationship. The many studies which programmed various levels of P(C) to their subjects found little difference between one value of programmed P(C) and another (cf. Introduction). These studies did not consider any other aspects of the interdyadic relationship in terms of temporal or role effects. It is to these issues that the notion of a cautious trust strategy contributes some important information, which should aid in the design of future studies in which strategy is manipulated as an independent variable.

The levels of accuracy for predicting outcomes in the Ck game are very similar for the cautious trust and the second P(C) rule. However, it may be argued that the cautious trust rule is more useful both in terms of understanding the important processes which are operating, and in designing further studies. The cautious trust rules specify much more information about the relationship which is necessary for a dyad to develop if cooperation is desired. The implication of the second P(C) rule is that the more preasymptotic cooperation the more likely is the dyad to attain a cooperative outcome. Although this may be true in certain cases, e.g. a Ck game, the cautious trust rules have the advantage of covering a broader range of conflict situations (e.g. 70% correct in the PD game compared to 50% accuracy for the P(C) rule). The degree of detail offered by the cautious trust strategy provides reasonable hypotheses to be tested experimentally. The P(C) rule makes no such promises.

Although the cautious trust notion allows the accurate prediction of stable outcomes from the preasymptotic data of most dyads, there are clearly other elements which are important for the establishment of a cooperative state. The level of accuracy for the Mugwump dyads is very low, several of whom display a cautious trust. Whether these results indicate that the pattern of play described as a cautious trust is not a sufficient cause of cooperative outcomes, or whether there is an interaction between strategy and some other, perhaps cognitive and/or emotional, factors, is a matter for further study.

Appendix D: Data

The trial by trial responses of each dyad in each of the four games reported is presented here. The data is presented in the following format: 1 = both partners make Cs; 2 = HiC partner makes a C and LoC partner makes a D; 3 = HiC makes a D and LoC makes a C; 4 = both partners make a D.

The numbers in the extreme left hand column are the subjects' identification numbers, e.g. in Study 1, the first dyad consists of subjects identified as 26 and 28. Next follows the responses over two 25 trial blocks, followed by a number indicating the number of trials to criterion (NTTC) for that dyad. The number in the extreme right hand column indicates the dyad's level of P(C) over the corresponding 50 trial block.

11 STUDY 1 EXTENDED PLAY OF PDG
MATRIX VALUES 1,1 -10,10 10,-10 -5,-5
CRITERION = 75 PER CENT 'C' RESPONSES FOR 3 CONSECUTIVE 25 TRIAL BLOCKS
NO PREDICT CONDITION STRAIGHT PLAY
300 TRIALS PER DAY MAXIMUM 600 TRIALS
NTTC = NUMBER OF TRIALS TO CRITERION
C
C

COOPERATORS

SUBJECT'S ID		TRIALS (25 ... 50)	NTTC	P(C)
26	28	33333111333344333333333344244433442444422444444244444	450	.30
26	28	44442444444444424444444444444244444444442444444444	450	.04
26	28	44424344334444334443344344444434334434444443334333	450	.19
26	28	34444443443433344444444344433344343433334444424344	450	.19
26	28	44442444444444323444342443422244444444344443441244434	450	.16
26	28	43241111112324432443443424444112324432432324432324	450	.39
26	28	23112312412311243111231111112431111243111112431113	450	.72
26	28	124311123111111111123124311231243111244311112444431	450	.66
26	28	11112311112443111111124443111112311231112431111234	450	.72
26	28	11111121111123311112311123112311111231123111231112	450	.83
26	28	31111111111123111111111231111111112311111231111111112	450	.90
26	28	31123111112311111111111124311123111112311112323111	450	.83
21	23	41134432434113443243332441144342444434412441243411	475	.37
21	23	24433443433444434413244134141324313144223334133424	475	.36
21	23	444434243424334244344333433444433434334444333443	475	.23
21	23	4334444443334433443333444334334443343433343444333344	475	.26
21	23	34344334433434344333434334443344344334334344434434	475	.24
21	23	343444444443334434434444343343433443333433444433333	475	.24
21	23	434443342344433334344444443343334444243333444343434	475	.22
21	23	33444344434444444424443444444444244434444444434444443	475	.10
21	23	34444443344444124413434441244344443344434443444444	475	.18
21	23	24444444444441111111111111111112431122411111211123	475	.66
21	23	11111111111231111111111111111111111111111111111111	475	.98
21	23	33411111111111111111111111111111111111111111111124	475	.93
1	3	33333441322342424443444424443442334444243444442444	300	.23
1	3	22444323431441444414144141144441444414444441414444	300	.28
1	3	44444444444414441111144444244444444434444444444334444	300	.16
1	3	434343434442434344444442443333342444333442444334443	300	.21
1	3	44433344444444444443444444444444444444444444444444	300	.04
1	3	34344344444434434444444444443434444444444444444444	300	.07
1	3	111111111111131111111111311131111111111111111331111111	300	.95
1	3	1111113333113111113311113133311111111111111111331111111	300	.87
1	3	113111333111133111111113111111331333111311111311111	300	.86
1	3	11111111311113111111111311111311111111111111131311111111111	300	.94
1	3	11111131111111113131111113111111111111131311131111113	300	.92
1	3	11111111111111111111111111131111111311111111111111111	300	.98
5	7	42442444444444324244444434444444444444444444444444	525	.06
5	7	44433333333333333333333313333333334433333333333333	525	.46
5	7	33443333333333333333333333333333333333333333333331	525	.49
5	7	33333333333333333333333333333333333333333333333333	525	.50
5	7	33333333333333333333333323344333333333333333333333	525	.48
5	7	33333333333333333333333333333333333333333333333333	525	.50
5	7	31133111111111111111111111113111111111111111122121221224	525	.87
5	7	31212222221111122121212121222122221222222211111133	525	.71
5	7	13133133311313434322113241412123432443442423444444	525	.45
5	7	43333333333311311111111112121221121212211122212222	525	.71
5	7	21212222222222222222222211111111111111111131333111111	525	.75
5	7	11111111111111111111113111111111111111111111331111112	525	.96
13	15	33344344343444443444434434444442443444444444444444	525	.11
13	15	24444443444444444444444422444444444444444444444444	525	.05
13	15	22444424444444444444444422444444444444444444444444	525	.06
13	15	22444444444444444444444442244444444444444444444444	525	.04
13	15	44434221224322423244141114444414444444444444443244	525	.25
13	15	44411111112243244324444443232311244443112443244444	525	.38
13	15	23111243231123244324444431111111244443243111112444	525	.51
13	15	32444323244431231111243243112324432444432443111112	525	.46
13	15	323243244443243111111112311111111123244323232444	525	.58
13	15	32324442323244323232324433232323232324323231111112	525	.48

13	15	3232344411111111111111112311111111111111111111112	525	.86
13	15	1111112314111441111111111111111111111121111111111141	525	.89

NONCOOPERATORS

10	12	42143344344443334424433343413344413331443344433344	600	.30
10	12	24443444333444333444324343444313443344433444433444344	600	.23
10	12	44334244443344433444344333433433444333244444333444 3	600	.23
10	12	23433444344434441244344434443444434143443434433444 4	600	.20
10	12	44344334424344444343343344343334443341434444444344 43	600	.20
10	12	43443444433444324444344434442444434444444434434443434	600	.14
10	12	34234431444333443431444342433444344434244434444424 44	600	.22
10	12	44322444444442444444424444444443244444444432432323443 24	600	.16
10	12	23442424444443444444443211121214243411112243422434 44	600	.35
10	12	42443444344444244443422434444444432432323232323232 12	600	.27
10	12	43232342432123232123443212112323232232142343232111	600	.52
10	12	41232111112434414323232342344321212322341244323234	600	.48
17	19	24341234123423244223442444132412343212441223414224	600	.39
17	19	22441243422243424342241242324423424343244424211242	600	.34
17	19	22324221434441434143422441123224122342412234413442	600	.40
17	19	12422212434344424243244242421232412443143222434224	600	.36
17	19	22242342212434242224224442244424242442444141112 1342	600	.35
17	19	22344112422442142142243242432243443434443443444412	600	.32
17	19	44444442444424444424444444444244444444444444444444	600	.04
17	19	44444444444444444244444444444444444444444444444444	600	.01
17	19	24444444444444444444444444444444444444444444444444	600	.01
17	19	44444444444444444444444444444444444444444444444444	600	.00
17	19	44444444444444444444444444444444444444444444444444	600	.00
17	19	22444444444444444444444444342344224324121111211122	600	.31
14	16	34223343442434344244434444122324442442334444344444	600	.22
14	16	24334443424344344344443444344424444444444444344444	600	.12
14	16	33444424444444444444443444444444444444444444444444	600	.04
14	16	44444444444444444444444444334443443444444444444444	600	.04
14	16	44444244444444444444444444444444444444444444444444	600	.01
14	16	44444444444444444444444444444444444444444444444444	600	.00
14	16	11211241121112121334434213114113422341132342342313	600	.60
14	16	44132324411231231234113441423314441142233423411344	600	.47
14	16	41141323244411444114344143222313114323243114243432	600	.46
14	16	31122332113421134213423423312344441232333424343423	600	.47
14	16	41233421123441143224333443422434344211341442334423	600	.40
14	16	41123442334221123342343444111111111231133424411244	600	.53
18	20	22442444244441412442444124442444244442444444444444	600	.16
18	20	44414444442444444444444444244444444244444444344444 4	600	.06
18	20	44244444444444444444244444444444444444444444444444	600	.02
18	20	13431344234434434423444424413332444244443434342444	600	.25
18	20	44244444424444444444444444333132334244433333424444	600	.18
18	20	43334424443333444444443344444333444434443444444433 34444	600	.15
18	20	43313334333333444444443344444444444423344444444234444	600	.20
18	20	44423344444442344444444443313344444444441334444444444	600	.15
18	20	34244444434444433333344443331333333444444442344444 4	600	.22
18	20	33334444424444444444444444444244444444444444444444	600	.06
18	20	44444424444444444444444444442334442344444444444444	600	.06
18	20	44234444444444442344444444444444444444444444444444	600	.04
6	8	34233113422224344424444441122243434442343424433444	600	.30
6	8	44222444222324242413242424344434444442444442244444 4	600	.21
6	8	22444334444433224444444442212234222122444442222444	600	.26
6	8	44444444442222444444444422444443444444222444444432	600	.12
6	8	44444444442223231211122422121122212224412224342244	600	.42
6	8	44413442432444244324424444333442444444444442244444 4	600	.15
6	8	24444444444444444442444432421424241424243242224224	600	.19
6	8	12224322342242431242442221124422442432244322244342	600	.37
6	8	24424224322434424244244243322444224242224444444442	600	.23
6	8	42444324443442424442222442444343244444221222122222244	600	.28
6	8	33444434444244442444444442243444424244442444122442 4	600	.16
6	8	44434444444444444344444444444444444441221212422242	600	.16
9	11	43413343443324343433434434314424343444141112434324	600	.33
9	11	24334412324234433434433434333443444344234434424434 3	600	.26
9	11	43442444432444441412334444324424444444443442444444	600	.16

9	11	34343443444344444444444443432444444244442433244444	600	.13
9	11	44432444444444444442444444324444444443344444443444444	600	.08
9	11	34444443444444444344444434444434444441234243443444444	600	.12
9	11	43324434243424444444243424443244444444244444444444444	600	.13
9	11	44441441442323232323232323232323232323232323232323	600	.44
9	11	12312312414432323232324431233224344124321342144324	600	.45
9	11	14142432323244432323244431443232324323232323243234	600	.39
9	11	14443232323232323232323232323232323232323232323232	600	.48
9	11	43232432324323232323232324324432323243232323232323	600	.43
2	4	11123342443133244214412431432444424412434341224344	600	.38
2	4	34414241111233243444112241224112241224344224124242	600	.45
2	4	24434444444422344224242244444242442222444244344444 24	600	.19
2	4	44224444444442444444444444444424444444344442444444	600	.06
2	4	44444444444424444344444444444424444444444344444444244	600	.05
2	4	44444444444444444444444424444444444444443444444444444	600	.02
2	4	33334333444344411333441133333344333344233334423442 4	600	.36
2	4	43344444441133423423234234423443333423443344424443 4	600	.28
2	4	44423444433444444233344424444343344444444444424444444	600	.13
2	4	44424333333444444444444444442444444444444444433333 4	600	.13
2	4	44444423344444444444444424444444444444444444444444	600	.04
2	4	44444444444444444424444444444443334444444444444444	600	.04
22	24	41441412441344434242423424442244422342244344124342	600	.29
22	24	44234444224444242424244444244424442444422444444441122	600	.19
22	24	34444441243442424244423334242432442444244443344441 34	600	.23
22	24	24444424424444444334444443244444444443444444434444444 4	600	.09
22	24	44443444433444444444444444444444443444444444444444	600	.04
22	24	44444444444444444444444444444444444444444444444444	600	.00
22	24	44444444444444444444444444444444444444444444444444	600	.00
22	24	44444444444444444444444444444444444444444444444444	600	.00
22	24	44444444444444444444444444444444444444444444444444	600	.00
22	24	44444444444444444444444444444444444444444444444444	600	.00
22	24	44444444444444444444444444444444444444444444444444	600	.00
22	24	44444444444444444444444444444444444444444444444444	600	.00
30	32	14242222413342212133244224123342422222223111122224	600	.49
30	32	21122344421442121123242422234424243223423244421211	600	.44
30	32	23242422234424243223423242424122434222222443413142	600	.37
30	32	42322111122342421422412243444434444434344344444434	600	.31
30	32	44444444344434444444444444444443444444444444444444	600	.03
30	32	34444444434444444444444444443444443344444343444443 43	600	.09
30	32	34344444444444444444444444444444444434444444444444	600	.03
30	32	44444444444444443443443443444434434434434434434434	600	.11
30	32	43443444344434434443443444444444444444444444444444	600	.08
30	32	44444444344444444444444444444444433333333333333333	600	.18
30	32	33333333344444444444444444444444433333333333333333	600	.25
30	32	33333333344344344333433334343333333333333333333333	600	.41
17	19	24412334444124434213224433244433324443424434434444 4	600	.27
17	19	34434444244444444444244344444244224422244444444444444	600	.11
17	19	42222222222242222444444444444444444424444444442444444444	600	.15
17	19	22222222222244444444444424444444444422222444444 2222	600	.21
17	19	22442444444444422224444444444224444444444244222224 4444	600	.15
17	19	22222244444444444444442222244444444444444444444 2222	600	.15
17	19	22222444444224444442442442444424444424444424444424444	600	.14
17	19	44444444444444444444444442244444444444444444444444442	600	.03
17	19	24444444442444444444444444444444444444444444444444	600	.02
17	19	24444444442444444444444424444444444444444444444444	600	.03
17	19	24444444444444444444444444244444444444444444444444	600	.02
17	19	24444444444444444444444442244444444444444444444444	600	.03
25	27	34433343334344444443422444344433434434444443444244444	600	.17
25	27	44244444424434444444444244244333443434444434444444444 4	600	.11
25	27	33444444444444341212123424343234324433243214342243 3	600	.32
25	27	24434424323444413444434444444444422444322434432443 2	600	.20
25	27	44244324324444244424432323242322323243243244432324	600	.29
25	27	43244443243444444122344443424443243244324434444424 44	600	.20
25	27	21212222242244242224431244243224444223111224322112 2	600	.44
25	27	24431224324434244211222222222111222222211222221122 2	600	.52
25	27	22222311224434444444444344444433244444444431224444 34	600	.23
25	27	43444444444443433224344444444433224444344344344434 2	600	.16
25	27	44344444434444444444444444111222224324344411244434 44	600	.20
25	27	42424242411242412424232342224344222434444344434444	600	.28

29	31	23132422444342423342424422442442444424424444444444	600	.21
29	31	42444444444444424444444444444444444424444444444444	600	.03
29	31	44444444444444444424444444444444444444444444444444	600	.01
29	31	44444444444444444444444444444444444444444444444444	600	.00
29	31	44444444444444444444444444444444444444444444444444	600	.00
29	31	44444444444444444444444444444444444444444444444444	600	.00
29	31	44444444444444444444444444444444444444444444444444	600	.01
29	31	44444244444444444444444444444444444444444444444444	600	.20
29	31	44444444444444334423334442334444423332334244424444	600	.03
29	31	44444444444444334444424444444444444444444444444444	600	.00
29	31	44444444444444444444444444444444444444444444444444	600	.00
29	31	44444444444444444444444444444444444444444444444444	600	.00
29	31	44444444444444444444444444444444444444444444444444	600	.00
9	11	24421342244342443222443411124111224111444242124442	600	.41
9	11	44444243424244444243424334234444443442443444442444	600	.15
9	11	42441312324414242441422234231414422442344422243442	600	.34
9	11	42324243424412444424422224324224444222224424222444	600	.27
9	11	42422424441232244244444434422342424444233242242224	600	.29
9	11	41444424442242443444444444444344442444424424424444	600	.12
9	11	31313131322424132442424341314244242434131424424331	600	.43
9	11	32442431113333133333422344234411131333333333333333	600	.50
9	11	33333333333333334213231334132233243333341341113333	600	.52
9	11	33341334134244334244224442422444344444242343344413	600	.28
9	11	42442443434411313244224434434434234244131323131313	600	.38
9	11	24423333333333333343344333333333333333333334443333	600	.42

CD TOT 0250

STUDY 2 EXTENDED PLAY OF PD GAME
PREDICT PLAY PARADIGM
MATRIX VALUES 1,1 -10,10 10,-10 -5,-5
200 TRIALS PER DAY FOR MAXIMUM OF 600 TRIALS
NTTC = NUMBER OF TRIALS TO CRITERION
C
C

COOPERATORS

SUBJECT'S ID		TRIALS (25 ... 50)	NTTC	P(C)
9	11	43334334444444444244444444444244444244444444444444	500	.08
9	11	44444244444344444244444444244444444444434444444444	500	.05
9	11	44424444444444424444444444444333333344444444444444	500	.09
9	11	44333344444444423334444444233334444423344233424444 44	500	.20
9	11	33333333334444444444433333333333333334444234444443333	500	.31
9	11	34343444423334444423333333333333333333333333333344	500	.38
9	11	44333333333333333333333333333333333342333333333333	500	.47
9	11	33444333333333334444333333333333331334424243444444 2	500	.34
9	11	34244444441113111111111111111111111131111123312333	500	.85
9	11	11111243443311111243444111111113232342343423344 44	500	.55
9	11	11111111111111111111111111111111111132111111111111	500	.98
9	11	11111111111111111111111111111111111111111111111111	500	1.00
25	27	33133442424344444424443444444413433443434444423444 4	425	.20
25	27	34413324344444113333444444223444444444434444444333 33	425	.25
25	27	33333333444442344443441332434444113333444442344443	425	.28
25	27	33333333333333333333333333333333333331333333333333	425	.01
25	27	34434442444444444333333333343333333333133331333333 33	425	.38
25	27	33333333333333333333333333333333333333333333333333	425	.50
25	27	33333333333333333333333333344444433333333334444444444	425	.35
25	27	44444444444444444433344444443434343434343434343434 1	425	.16
25	27	44444444211344444421113444111111111111111111111111 1	425	.64
25	27	11111111111111111111111111111111111111111111111111	425	1.00
25	27	11111111111111111111111111111111111111111111111111	425	1.00
25	27	11111111111111111111111111111111111111111111111111	425	1.00
6	8	33313423113231314134113141132344131322324334424411	400	.54
6	8	44442114421143443423444214442341441342244331344343	400	.33
6	8	44444224324431333133311333133313324434422444414422	400	.39
6	8	33424134424423424444224334444444244444444234424433 23	400	.22
6	8	33131331323313221332313442344434142344434211344413	400	.46
6	8	44132434211111313333311111111311111113211111423444	400	.69
6	8	34142344434211111311113222423132243321111111111111	400	.66
6	8	11111111111111111111113223321112243111111112222111 1	400	.85
6	8	33311111111113311111111111111111111111111111111121	400	.94
6	8	23311111111132111224111111111111111111111111111111	400	.91
6	8	11111111111111111111111111111111111111111111111111	400	1.00
6	8	11111111111111111111111111111111111111111111111112	400	.99
26	28	23423342424424424242424244424442224113344234423233	525	.30
26	28	43444344444444423421113424234223422442422422242 11	525	.32
26	28	11342241124342242241123443422411243444443444444222	525	.36
26	28	11222121342412412343424242444243424224344242424244	525	.35
26	28	13442113422242111111111111111113421322223241322413 2	525	.65
26	28	13422241322414222413222411322222241324141422241324	525	.48
26	28	14422432242224224134224242134222243422413422241342 4	525	.38
26	28	13242422322424141422244222243424424244414241424424	525	.33
26	28	12241442422324242413424442111342242424224324344244 4	525	.35
26	28	42434424441344244413424444424144243442434444442443 4	525	.20
26	28	42444442344244444243442423111111111111111111111111 1	525	.57
26	28	31111111111111111111111134211111111111111111111111	525	.95
22	24	43224324342431113241144134232411132231311323413232	225	.52
22	24	11132134213243213213232432132321113423213444442132	225	.54
22	24	32321344421132341313444233423244113232332422222422 4	225	.44
22	24	41321341323421344224322441322424132423442442223424	225	.39
22	24	31134424323124324411111211111132211111111111111111	225	.75
22	24	11111111111111111111111111111111111111111111111111	225	1.0
22	24	11111111111111111111111111111111111111111111111111	225	1.0
22	24	11111111111111111111111111111111111111111111111111	225	1.0
22	24	11111111111111111111111111111111111111111111111111	225	1.0

22	24	11111111111111111111111111111111111111111111111111	225	1.0
22	24	11111111111111111111111111111111111111111111111111	225	1.0
22	24	11111111111111111111111111111111111111111111111111	225	1.0
30	32	22341423223412243243123213414432334342434343434433	225	.39
30	32	43434432334443423431313344412441233411341142211111	225	.46
30	32	41123412341243411112433224422442242444244444342444	225	.35
30	32	32434443121243421234411124424324344312243434434322	225	.38
30	32	31111311323232241111111311113411111113421121132123	225	.76
30	32	11134221111113241111111131111134211321111234111312	225	.78
30	32	23224432432424424432444411113211111111111111341224	225	.55
30	32	11111111111113421111111121111111111111111111111113	225	.94
30	32	11111111111111111111111112431112111111111111111111	225	.95
30	32	11111111241111111111113111111111111111111111111111	225	.96
30	32	11111111111111111111111111111111111111111111111111	225	1.0
30	32	11111111111111111111111111111111111111111111111111	225	1.0
34	46	11323223243242424421342113113241114241324424132413	200	.50
34	46	13242134242432322441342441442442244224424424424424	200	.30
34	46	13424424424442443244444421344424444444424444424424	200	.17
34	46	13444444444444444444444444344424344444444344442444 44	200	.08
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
34	46	11111111111111111111111111111111111111111111111111	200	1.0
38	40	31211243422134132134243422244422442413423422432432	200	.41
38	40	11422134422241324323411323224332413422441342322332	200	.46
38	40	11242342232442243443344223344344413111112244311112	200	.46
38	40	11112444323111321112312341112443443243432341123111	200	.58
38	40	11111111111111111111111111111111111111111111111111	200	1.0
38	40	11111111111111111111111111111111111111111111111111	200	1.0
38	40	11111111111111111111111111111111111111111111111111	200	1.0
38	40	11111111111111111111111111111124324312443321111111	200	.84
38	40	11111111111111111111111243423111111111111111111111	200	.92
38	40	11111111111111111111111111111111111131111111111111	200	.99
38	40	11111111112111111311111111111111111131111111111111	200	.97
38	40	11111111111111111111111111111111111111111111111111	200	1.0
2	4	24413342433422342412324244244421112433342444123414	475	.37
2	4	13244132431243334244243442234232244422342444333442	475	.33
2	4	44443334444444344424434341112444411314443323444244	475	.26
2	4	44224444431312424244444244244411234334411242443443	475	.29
2	4	22222222222222222222222222222222222222222222222222	475	.50
2	4	22222222222222222222222222222222222222222222222222	475	.50
2	4	22222222222222222222222222222222222222222222221222	475	.51
2	4	22222222222222222222222222222222222222222121111231	475	.55
2	4	24224424442444444444324442444311111111244311124444	475	.34
2	4	44444444444443111111244444311111111111111211111111	475	.60
2	4	11111111111111111111111111111111111111111111111111	475	1.0
2	4	11123111231112311123111233111243111231112311123114	475	.77
18	20	23434114133413244334424344342333444243344441342444	400	.31
18	20	44243444243442434444444423444244334444424444424444	400	.13
18	20	44244444444444444444444443444444444444444444444444	400	.02
18	20	44444444444444444444444443444444444444444444444444	400	.01
18	20	33434423423344233423342443342332333424444442344443	400	.28
18	20	34424442444334443444444443424443444344444423444444	400	.12
18	20	33442444344344424444444443424244444444444344442433	400	.13
18	20	44443442444443233233131314314323441333243443324444	400	.33
18	20	11111111111111111111111111111111111111111111111111	400	1.0
18	20	11111111111111111111111111111111111111111111111111	400	1.0
18	20	11111111111111111111111111111111111111111111111111	400	1.0
18	20	11111111111111111111111111111111111111111111111111	400	1.0
29	31	43342441133424442444223424243344422422211344442244	100	.29
29	31	44423342422442112211111123342334421321342244224224	100	.45
29	31	23111111111111111111111111111111111111111111111111	100	.98
29	31	11111111111111111111111111111111111111111111111121	100	.99
29	31	13311111111111111111111111111111111111111111111111	100	.98

29	31	11111111111111111111111111111111111111111111111111	100	1.0
29	31	11111111111111111111111111111111111111111111111111	100	1.0
29	31	11111111111111111111111111111111111111111111111111	100	1.0
29	31	11111111112111111111131111111141111111111111111111	100	.96
29	31	11111111111111111111144111111141111111111111111111	100	.94
29	31	11111111111111111111111111111111111111111111111111	100	1.0
29	31	11111111111111111111111111111111111111111111411111	100	.98
33	35	21322434233114131143142242431344231444432341242324	175	.44
33	35	43213222344432314324132131243213213232344424134421	175	.46
33	35	44444323412423244321322234423324434444242313324441	175	.33
33	35	32231342333444434444434443332411111111111111111111	175	.57
33	35	11111111111111111111111111111111211111111111111111	175	.99
33	35	11113111111111111111111111111123111111111111113412	175	.93
33	35	11111111111111111111111111111111111133221111111111	175	.96
33	35	32111143231121331111211342111111111111111111111114	175	.83
33	35	11111111123222324111111111111111111111111111111111	175	.91
33	35	11111111112242324111111111111111111111111111111111	175	.91
33	35	11111111111111111111111111111322441111111111111111	175	.93
33	35	11111111111111111111111111111111111111111111111111	175	1.0

NONCOOPERATORS

5	7	44112443443434124433441133443442411444343443334434	600	.31
5	7	43433443334433444244444433334444424434424444432444	600	.18
5	7	44444444444324444444443344444444444444422244444444	600	.07
5	7	44444444244432444444344224444344422244224442222422	600	.18
5	7	23224422432244424432244422432424442444432244442442	600	.24
5	7	22224443224443444441122222443444344424443422224442	600	.26
5	7	44444342444434434424444224444443444111224344344432	600	.20
5	7	44343422443224344444444112244344334444444444442331	600	.22
5	7	22444441111224344434434224444344443444442444444442	600	.21
5	7	43344444424434444332444444324343324433444441243443	600	.20
5	7	44444244344433444444444344244334444443444444423444	600	.11
5	7	24444443444444444444444444344434444444443444444444	600	.05
21	23	12312333344423444143444332433421343123344342114214	600	.40
21	23	43323123311323223311214412433334444143342344332344	600	.44
21	23	34324334443343344243234412234344443443443412434342	600	.28
21	23	44342434343444434343434343343434444433433333333334	600	.26
21	23	14443434441444434244334343344444434112443444141424	600	.25
21	23	43344344413244433424434434243434243444444434434443	600	.20
21	23	44432434443444434434444443443434444443444334434441	600	.16
21	23	24344434443444444344344444344434434244343444444444	600	.13
21	23	44343434344433444443444442434434443443444443441344	600	.16
21	23	43443444244344434444434444434434442434444434444344	600	.12
21	23	42244444443444434443444444434444443444444244444444	600	.08
21	23	34434444444344444443444444444344444434444444443444	600	.08
37	39	24411323424242422222244122224222441221224342221122	600	.44
37	39	41223441122411411221223414144322234244211233443434	600	.46
37	39	14132424132422442421421442344431143224432422441132	600	.40
37	39	41432442434344344343444434344434344334344433444341	600	.22
37	39	33444443431322343324243244234323341443322444433414	600	.32
37	39	43444342332334243344434344344444333334444443334333	600	.27
37	39	44444333344333441333333411333341341333413333413342	600	.42
37	39	34234343333343334333334333444242444424442444444424	600	.25
37	39	43342443434343333433433444442434343433444344444444	600	.23
37	39	41414334431424344133334333434334444443442444442343	600	.28
37	39	32434111111334224434444133414133441331331343331333	600	.49
37	39	34244343424343333334344444423434334444444424243443	600	.23
10	12	12233232244441122342344211244122324344444122342234	600	.40
10	12	44412343442444413444424313443442344243344444334443	600	.23
10	12	44344344443444342423234424442414444344444344144244	600	.18
10	12	44444344234444344244433423444444444441443444244444	600	.13
10	12	34343423444344444444344234444444444344444244444434	600	.12
10	12	34444423444444434444444444444444444444444444444444	600	.05
10	12	34444444444444444444444443444211133434233423413413	600	.23
10	12	34233442334444442434444444434234444444444421113423	600	.22
10	12	44442344344443444442344234442232344444444344444442	600	.15
10	12	21342111111111111111111113342334234234444211111113 4	600	.68
10	12	23423422334211111113423211321321132342342342342434	600	.52
10	12	42323423411132241113234232334243423424342434424443	600	.39

1	332441323443132433244434444344431444414432434344434	600	.27
1	343314313244431331344432433244444333443444444133324	600	.32
1	332344434424414444344442434344244324324344343133234	600	.39
1	334434344431131331313334314324333243144433243444432	600	.39
1	344444244324433444434244432424244344234444111131324 3	600	.28
1	322432411111111111111124141112311123111231124111232	600	.75
1	311123243111243111243243131112311124311123112443114	600	.65
1	311123111243111243133111441114131131143341332432434	600	.62
1	344322444244311123111233223241112431112311124333342	600	.54
1	343244431112311124323433111231112431112431112333111	600	.62
1	323333441112112433334243244343343113334241114343343	600	.46
1	343441133334224113423244334422433241134343442424443	600	.36
17	1922444343444344444331244124312434433433414432434344	600	.28
17	1944432334244344443421211222232323344342212332423444	600	.36
17	1932232222443444443443434444334444444433444443344344 44	600	.19
17	1934444343443434444344444434444434444443444444444444 34	600	.10
17	1922222222224443432244444444443443444444444332444444 44	600	.19
17	1944444444444444443444444444422222444343244444444444 44	600	.09
17	1944444444444444444444444444444444444444444444444444 44	600	.00
17	1944444444444444444444444444444444444444444444444444 44	600	.00
17	1922222222244432444444444444443244444444444444444444 3	600	.14
17	1922444444444444444322444441224432444444443244324442443	600	.17
17	1924444444443123223224321124443243444444432444444432432	600	.27
17	1944432444312323224432444344444444444444434444443444344	600	.17
13	153442444141311344434443131313144111131313242444444424	600	.43
13	154424222422444434444443444111113344344413442424242444	600	.27
13	154424242442444441411343243424241324242224444424434444	600	.25
13	152442244444442422222444422444444422224422442444422444	600	.20
13	154133422244224442444422224444444444424444232244443344	600	.21
13	152113442111133444442444213422442232444442342442222 13	600	.38
13	152242422442424442444424444244244244244244444442222 22	600	.20
13	154422422444222424422444422422422442442424244442242 44	600	.23
13	152111111132342124244444444422224444444444244444444444	600	.28
13	153424444424444224444422222221214222234444424442242	600	.27
13	154244442244442224444444222422244422244442244444222442	600	.22
13	152224444222444422244222444424442444422444444222242442	600	.22
14	163342213124133122331241444331324434224314243411334 4	600	.45
14	162132242342234223443334433323433113444333224444313 44	600	.38
14	164333243413344242424134344244313442233424343413432 4	600	.33
14	161331132444113334244434341323134443443131113233443 4	600	.44
14	164444143443424344443422444144413442442232334442434 44	600	.23
14	164223442323444223344444442442422344411344244134444 23	600	.27
14	164424444244421234441213444424444342421442434444344 22	600	.24
14	164444213344244444233444443422341134442442334442334 44	600	.25
14	162441132323134244213424323313244344244424233441113 2	600	.41
14	163113223324421114424423441323442442313242432344243 4	600	.39
14	164244442324221334434422334443231324413244443444244 4	600	.28
14	164133113242233244424424424443424244442344441334244 4	600	.28

CD TOT 0276

STUDY 3 PD GAME

DOVES

MATRIX VALUES 5,5 -10,10 10,-10 -5,-5
CRIT EQ 20+/25 CC PLUS HIGH C THEREAFTER
C
C

SUBJECT'S ID	TRIALS (25 … 50)	NTTC	P(C)
86 88	11113442442333244411111111111111111111111111111111	020	.79
86 88	11111111111111111111111111111111111111111111111111	020	1.00
86 88	11111111111111111111111111111111111111111111111111	020	1.00
86 88	11111111111111111111111111111111111111111111111111	020	1.00
54 56	11123232342341232341111111111111111111111111111111	20	.82
54 56	11111111111111111111111111111111111111111111111111	20	1.00
54 56	11111111111111111111111111111111111111111111111111	20	1.00
54 56	11111111111111111111111111111111111111111111111111	20	1.00
6 8	21121122321121122143344142241423444222324444121342	55	.49
6 8	32442411111111111111111111111211111111111111111111	55	.90
6 8	11111111111111111111111111111111111111111111111111	55	1.00
6 8	11111111111111111111111111111111111111111111111111	55	1.00
22 24	21111111311111324311111111131112431111312324111131	70	.81
22 24	12413212433242424411111111111111111111111111111111	70	.79
22 24	11111111111111111111111111111111111111111111111111	70	1.00
22 24	11111111111111111111111111111111111111111111111111	70	1.00
182184	24322224242222424242242424244242224244413442411224 3	155	.33
182184	24324324442444244343244444443444434434444333444444	155	.16
182184	44444444444343444444424333334434334444444444444244	155	.13
182184	44444444111131111111111111111111111111111111111111	155	.83
174176	11311141141333414112333343344444423424424442424111	110	.45
174176	34242211111131342233424114234424422334424244221111	110	.48
174176	32342241111111111111111111134211111111111111111111	110	.87
174176	11111111113422111111111111111111111111111111111111	110	.95
38 40	33111112244311112432444331231123123124431132123412	120	.59
38 40	32331231112444433444443131111111112443244343233311	120	.52
38 40	24444331243144444444331111311111111111111111111124	120	.65
38 40	11111111111124411111111111111113321111111111111111	120	.92
70 72	24412443111111224413424122443422441134244444434111	115	.43
70 72	24434434334434443411111112433443231111112334433444	115	.46
70 72	44444444444433441111111111111111111111111111111111	115	.70
70 72	11111111111111111111111111111111111111111111111111	115	1.00
146148	34232323242344434443232323232323231111133123323143	125	.50
146148	31113232311313233244232411111121313241323124234344	125	.58
146148	23113231324344242442231311111111111111111111112111	125	.73
146148	11311111111111111111111111111111111111111111111111	125	.99
178180	11132224111322241111132222433243244111132224241111	65	.62
178180	13224111113224111113224111111111111111111111111113	65	.84
178180	11111111111111111111111324111111111111111111111111	65	.96
178180	11111111111111111111111111111111111111111111111111	65	1.00

MUGWUMPS

SUBJECT'S ID	TRIALS	NTTC	P(C)
2 4	12121341142134211234341243234322243442344244434111	200	.46
2 4	22434433434434444111111122341244112132342432411111	200	.50
2 4	21111233114222342243341112341111242224422441112121	200	.59
2 4	11112121211111121112222422332343244344444444334444	200	.49
118120	23424211221434434112443124343444243342443444422244	200	.33
118120	43432224444432112211242443421111211111212222243433	200	.51
118120	11112111212232124421112111224434122434412121413414	200	.60
118120	14132444341422344111243442342343441121112321123234	200	.47
142144	32423242241134314113112211134131322324243222242132	200	.54
142144	43324244113432244122324142214122242132142342244224	200	.42

142144	442122232324241113232324223222213224222242134432434	200	.45
142144	42222424422344234424222322434224222244412424342222	200	.33
186188	13232134311344431313413124113132423232131323341341	200	.56
186188	32312323313333333344112411342111142111112313333333	200	.61
186188	33333333333333333343333343334333333411334241334244	200	.44
186188	343333333433333343334333333411334241334244341212312	200	.45
14 16	32331332433244334233424333224411114241113424424324	200	.43
14 16	34222434412424422333442211111342342411112334241111	200	.50
14 16	11133424424442424344223442111113424224424233342221	200	.41
14 16	11442234421111134242244242333422211144242433434232	200	.44
18 20	23413341423423142321443111223223231233124123132314	200	.53
18 20	21441231434213214423123142321332432143414341433243	200	.47
18 20	21321431214433223143331432132143414323432344143232	200	.48
18 20	44123224412321432114321431243322323341132132132132	200	.53
66 68	12111112332411241121323231241232341124213432344411	200	.59
66 68	13423443433433424342211244344234342342111233421111	200	.44
66 68	21243423444334434232432223444411121244443423111221	200	.41
66 68	11221124434434423244434134423244434111121121112234	200	.47
102104	11244124411422331112434232422342343411233412334112	200	.50
102104	34124112422323342233343412341123411244312341124211	200	.51
102104	11123441123232112343324243423212434124323423424124	200	.47
102104	44431244322122344311243441124344312321112432123312	200	.48
106108	13432413223423441333234234413214234134341323234434	200	.42
106108	31343424323411323231134341131132134332343341132411	200	.54
106108	32333243111323234132432333243111323234132432343233	200	.51
106108	43423231341132314132334234313441332332332313434134	200	.48
190192	113111121211314231324342411111111111111111131211132	200	.78
190192	111132211111111111323442132432223232134113232332424	200	.62
190192	24213132423311342432132422443211324113422423224422	200	.47
190192	32411323434411341132242332441332242441131132424224	200	.47

HAWKS

CRIT	EQ 10+/25 DD PLUS 10+/25 DD PLUS 10+/25 DD		
94 96	334423311332334444442334433334444444424444442344444	30	.24
94 96	333444444444434444444444443333334444444444444444433	30	.12
94 96	333233231313144444444444332334444444444444444444413	30	.24
94 96	313344444444133133132444444444444444443333344444444	30	.32
98100	41111111344241111342412224112244113442443444111344	25	.51
98100	334423444242244221113242422444423444444444244443444	25	.24
98100	422444444444424444444442342444444444444444444244444	25	.07
98100	44444444444444444444442444244444444244444444444444	25	.03
62 64	41232411243244123412342441124423341112434243424242	050	.44
.62 64	43424124442423412123424324343241412441242424242442	050	.34
62 64	42424442244244422442444442444242444444244444434244	050	.14
62 64	43244424444244444434244432444244442444424344244244	050	.14
126128	43424424243424242414422234422411323223224422421324	65	.35
126128	22442244232224113224134224222423424244442344442442	65	.32
126128	34244234244222432322243442444442442244434424444224	65	.23
126128	244444244444444424444224421234424424234444244444444	65	.15
158160	33231143423423334413324433343434411334223343444234	25	.38
158160	33442434422443342413334443342334444233344233442344	25	.28
158160	441133243334442334423444434423444344441131333234444	25	.31
158160	34233233424441134234234444433444344411313313323444	25	.35
162164	11134311442233424124111341234233411111344242431112	140	.55
162164	12441111334232343112434111111131323411113231112443	140	.63
162164	11132111341113421113211131113411141332334243433443	140	.63
162164	11124433422342444322444421132342442422444422444444	140	.30
78 80	23314213444114142422411221223421112441422234422222	065	.48
78 80	24112242412224132424232444124214224424224422242422	065	.38
78 80	222242244242441242214424424422242443242422224224222	065	.32
78 80	4224224411242221124222241224222424224222412412442243	065	.41

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122124|21244332441234233234433433324433444343334234334343    25    .34
122124|43444334233444433443431433344131234143444444441111    25    .33
122124|32124433444334443133443334434433234122344343444444    25    .29
122124|44444434343243344334132333444414134113144411124334    25    .36

130132|21214223234323443431323431443443434143434343434134    25    .37
130132|3434444434343344443424434443444434344334443244443333    25    .20
130132|3333444434343344444444443243444443334443444434344444    25    .17
130132|43333444434334444433443333434344443444344334434334    25    .22

 82 84|32132314141413211412412412314232141414323211413144    75    .55
 82 84|13241341213231441321413214134132443413433443414134    75    .48
 82 84|44142414134341323434334433243234234434243234244441    75    .33
 82 84|34323434344234444242223213442344342344234442344444    75    .25


CHICKEN GAME
                              DOVES
CRIT  EQ  20+/25  CC PLUS HIGH C THEREAFTER
 MATRIX VALUES  5,5 -10,10 10,-10 -20,-20
C
C
SUBJECT'S                     TRIALS                               NTTC    P(C)
  ID                            25                      50

 57 59|33334424233434442243441111311111111111111322113242 2    50    .58
 57 59|11111111113111111111111111111111111111111111111111    50    .99
 57 59|11111112432311111111111111111111111111111111111111    50    .94
 57 59|11111111111111111111111111111111111111111111111111    50   1.00

141143|33244112332241111111111111111111111111111111111113   015    .85
141143|11111111111111111111111112411111111111111111111111   015    .97
141143|11111111111111111111111111111111111111111111111111    15   1.00
141143|11111111111111111111111111111111111111111111111111    15   1.00

 53 55|24233344322441112241211112411112243111231112311112    95    .64
 53 55|43111231111123111231111112311112311112323111211112    95    .81
 53 55|41111123111111111111411121111111111111111132311111    95    .90
 53 55|11111111111111111121111111111111111111111111111111    95    .99

 25 27|21231311224422212442122344111132241111113111342224   100    .60
 25 27|24343423411113221324131111113321111332211111321113   100    .69
 25 27|11111111111113411111111111311111111113111111111111   100    .95
 25 27|11111111111111341111111111111111111111111111111111   100    .97

117119|21111122413113211311111112112121124133341133241342    80    .71
117119|33111112333111332333343422431111111111111111111111    80    .77
117119|11111111111111111111111111111111111111111111111111    80   1.00
117119|11111111111111111111111111111111111111111111111111    80   1.00

113115|22424224222444344434444434241124111111111111112111    90    .54
113115|11111111111111111113442222244322244344432323111211111    90    .65
113115|11111111111111111111211111111111111111111111111111    90    .99
113115|11111211111111111111111111111111114111111111111111112    90    .96

 89 91|22244411234122342323421232121234141234124123124123   130    .51
 89 91|23232341431324142323233441313141413131314232323232   130    .52
 89 91|23234142321123234432323122343441111111111111111113   130    .65
 89 91|11111131111111111111111111111111111111111111111111   130    .99

 65 67|11211121142441233311341312324111112433432332422241   150    .59
 65 67|11132233224341142213412422343443444312323332242431   150    .46
 65 67|14434313434434232214411241123232231123111241112311   150    .56
 65 67|11111111111111111111111111111111242411111111111112411   150    .91

149151|11143412111213334111423111111111111231134112311 2311   155    .75
149151|11111111111111123123211334412324123423233333441111 1   155    .68
149151|11111133344434434343421111233433434344342113334322   155    .47
149151|33444211111111111141111111111111111111111111111111   155    .89

 73 75|12112212313123241124124121222223124443112431123141   175    .60
 73 75|11124312111212212212311111122331241132311332212331   175    .71
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73 75|23311231124312323112443431112311244221332311244221     175    .58
73 75|33211211421312324112132312311111111111112311111111     175    .79

                          MUGWUMPS

 5  7|14113413213231212322141132132122132323231421124233     200    .61
 5  7|23233233411214232141321122233241312324122442121234     200    .54
 5  7|13211123241123131232312414112323123123243123242331     200    .61
 5  7|23242323124231123242331242444323232312423323241213     200    .48

37 39|44323141134113123314131313114421114131141133312414     200    .61
37 39|11311421321114134131131131221321141143131221231214     200    .69
37 39|13233223332411311241311432411414111442232341321412     200    .57
37 39|23412431323114313132311431111313232242322234221442     200    .56

41 43|14123323234213223343412343412414231144213412312341     200    .50
41 43|41243423122144414142411122411231232312411231231112     200    .57
41 43|31114231123232312311231231231233231412341232312112     200    .64
41 43|31241233231234231231233231233242323231233242323231     200    .54

81 83|34111431231423111113414142233413424212142341223214     200    .55
81 83|21242443443224132433443334233413233143133413424212     200    .42
81 83|14234223214212424434432241324334433342334132331431     200    .42
81 83|31413142242424224242342323423414421412121234123214     200    .45

85 87|23134131241411122311422231134122332412121113224331     200    .61
85 87|13243111322433113243112343241331132423132411113142     200    .59
85 87|24111131131313411322321134211113212111132111111321     200    .75
85 87|11321132412134111113211321321341113124113223223323     200    .67

101103|31132341332411313441111334211113411343444111132133    200    .61
101103|42321342321131134242131322243342113422231321311334    200    .55
101103|11313213213213411321322313213113222134132132142132    200    .65
101103|11321113421342111342134211344211321321132131132132    200    .65

105107|12411341341133214134141123321134313241313223213141    200    .60
105107|23411341131413241114331111323214114221241142123422    200    .60
105107|31143422341134114411234131413123234332433423342224    200    .49
105107|31132411431134311333343113343223224431214334243324    200    .51

109111|42411231422224212342442414344242412444133434411343    200    .39
109111|44111134224332434243421113222113133431111334433224    200    .52
109111|34222422224413434111111343344131132222241324424 1311  200    .51
109111|32431334443113414422241132244132243242424324242224    200    .40

133135|22123211211221212122121222121221112212212223222422    200    .66
133135|21124321221121223241222244221222222243443432222242    200    .49
133135|22343443412222224312222244324433222411112224111224    200    .47
133135|33122332222431122232224111222243322243343112224112    200    .54

97 99|12231122332342124233332122121221421124212224342211     200    .57
97 99|14224124122242323424223422342234241233242324231312     200    .44
97 99|32431242414234123232424412423124244244424424424212     200    .36
97 99|34244244242123212122422422124222212424244412424421     200    .40

                          HAWKS
 CRIT|  EQ  10+/25 DDPLUS 10+/25 DD PLUS 10+/25 DD

 1  3|43143241143411224114241142422242424142324424444243     025    .39
 1  3|24414432424134422443423424342444431234323444224344     025    .28
 1  3|24344334423343144342444233443231424312441431424414     025    .33
 1  3|44143242333244112311231244424312424312431444324443     025    .40

 9 11|44324432412413242324121124432212341222122332234122     065    .47
 9 11|21223212244121144214412443341441442343234342344431     065    .41
 9 11|24231324434332434324434432334134443232432434432324     065    .33
 9 11|32434444433232432434442434232432343243444243342434     065    .27

17 19|23123124112432234312321431232341431124343131111111     175    .60
17 19|11112244334242434111244244344112444344112434343112     175    .43
17 19|44333242444311111111111224431111222443244311124112     175    .59
17 19|24121112411224122432243433224434422342224444412443     175    .39

29 31|14214413224444231313133242413114243133242432432224 1   100    .47
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29	31	1223224321322431324313244324313244443133143243l324	100	.45
29	31	4443133134431334413443244134433344434133243324 3344	100	.35
29	31	3241344131324314243443244324443133342433444334 3324	100	.35
45	47	2312241112433131243224322224344224344343224344 3223	025	.42
45	47	2244444444442434222434232441221343443443244324 43244	025	.26
45	47	1121411122112211222332111211241124111223211211 4112	025	.72
45	47	3124331432332431112232112114112312433143233243 2434	025	.54
145	147	3113324113143241131442344411332242423244222223 4224	175	.46
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145	147	3342424424424242411313113442341334242424233211 3313	175	.43
145	147	1333424424232311133131311134424442444242424221 2444	175	.42
33	35	3334334422443333433443343333333333334443341113 34113	100	.41
33	35	3313331334333433324411343333333333341233333444 12333	100	.47
33	35	3434224424422344442422442244444224422242242222 24244	100	.25
33	35	4224242222442442442344444244442442442344444244 44242	100	.18
61	63	3243424441134412132333342222441243422243422343 44444	100	.36
61	63	2123443344342244344344443444222341324411214221 1123	100	.38
61	63	4224322344444343434343443444443443434334434444 4434	100	.19
61	63	4333344344343344444443443333443443433443433433 44433	100	.24
125	127	2424111111113333441324332222224222242422244333 444	100	.47
125	127	3233311341124343113431341133334113433341333341 34332	100	.53
125	127	4444344342444444444444444334434224334422334244 22411	100	.21
125	127	1134434442444424334233243344341111131422431111 3443	100	.43
129	131	3142114214142221223432243434144344234413242224 3243	025	.41
129	131	4444434444442443441443244234231243232443232344 4444	025	.23
129	131	2422344241241424433242443442443243243212412432 4424	025	.32
129	131	1244344432124344432232421144344112442143434124 12344	025	.38

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