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Threat Frequency and Contingency in a Threat-Vulnerable Game

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THREAT FREQUENCY AND CONTINGENCY IN A THREAT-VULNERABLE GAME

by

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To my father who died three months before the completion of this paper. He would have been very pleased.

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Abstract

The primary purpose of the present study was to determine the effects of threat frequency and contingency on game-playing behaviour in a threat-vulnerable game. A second purpose was to determine the stability of these effects when strategies were altered during the final 75 trials of the game. Threat was operationally defined as the use of a particular choice in a threat-vulnerable game. One hundred students enrolled in undergraduate courses at Wilfrid Laurier University played in one of nine programmed strategy conditions: all possible pairwise orderings of a passive, demanding contingent, and a demanding noncontingent strategy. The latter two strategies were yoked to one another and therefore differed only with respect to the contingency of threat. The passive strategy differed from the two demanding strategies in that the programmed opponent never used the available threat. Results indicated that both threat frequency and threat contingency had significant effects on the Column player's behaviour. However, the effects of contingency were observed earlier in the interaction sequence. In addition, delayed strategy effects were only obtained for the contingency variable. Postexperimental questionnaire data revealed that, contrary to previous reports, attributions of incompetence and foolishness were not necessary conditions for an exploiter to take advantage of a passive opponent.

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Introduction

Game theory is one form of mathematical analysis of social phenomena, the foundations of which were laid by Von Neuman and Morgenstern (1944). Few repercussions were immediately felt in the social sciences because formal game theory is concerned with deriving the rational solutions to various games rather than examining the actual behaviour of players. To date, the theory has been put to use by political scientists, economists, and psychologists.

The psychologist is interested in answering the question, "What determines how people play?" One method of answering this question is to manipulate a situational variable; the strategy of one of the players. When such a "player's" choices are predetermined by the experimenter and presented to the real player by a confederate, computer or by the experimenter himself, such sequences are called programmed strategies. The real participant is usually induced to believe that these programmed strategies are actual choices made by another person because participants play differently against a computer, although the opponent's strategy in both cases is identical (Orcutt & Anderson, 1977).

There is a number of different types of strategies, including contingent and noncontingent strategies. A contingent strategy relies upon the responses of the real player in determining what choice is delivered on a particular trial. Such choices, as delivered by the programmed opponent, are said to be conditionalized on the responses of the real player. In contrast, a noncontingent strategy delivers choices regardless of the responses made by the real player. A further distinction lies between concurrent and delayed strategy effects, a distinction first made by Oskamp (1971) in a comprehensive review of programmed strategy effects in mixed-motive games. Concurrent effects are those observed while strategies are continuing. Delayed strategy effects are observed once two or more different strategies have been discontinued, e.g., two groups receive different strategies initially, then both are treated identically for the remainder of the game.

Oskamp's (1971) review indicated that the organization or patterning of programmed input had a much greater effect on participants' responses than the overall level of reinforcement provided. That is, in the Prisoner's Dilemma game, studies have shown that contingent strategies produce higher levels of cooperative responding than noncontingent strategies having the same overall level of programmed cooperation. However, Oskamp (1971) also noted that the structure of the conflict situation must be regarded as a major factor in any general theory of conflict. Empirical studies have indicated that different effects are sometimes produced when similar variables are manipulated in strategically different games.

The present research was undertaken to examine the effects of contingent versus noncontingent strategies in a mixed-motive game which is strategically different from the Prisoner's Dilemma game: Game 21 in Rapoport and Guyer's (1966) taxonomy of 78 two-person, two-choice games. Unlike the Prisoner's Dilemma game,

Game 21 has a payoff structure which is asymmetrical for the two participants. If both players select their dominant response, one player (Column) receives his most preferred payoff, while the other player (Row) receives his next-to-least preferred payoff. In order to induce the Column player to select his non-dominant response such that the Row player can obtain his most preferred payoff, the Row player may choose to employ his own non-dominant response. Such a response by the Row player is viewed as a tacit threat to the Column player because Column would obtain his own next-to-least preferred payoff if the Row player unilaterally shifts from his dominant to non-dominant response.

Previous research using this game has indicated that the use of threat by the Row player (i.e., the choice of his non-dominant response) is successful in gaining concessions from Column and arriving at a more jointly equitable distribution of payoffs (Guyer & Rapoport, 1970). Two studies which have compared passive strategies (non-use of threat by Row) to demanding strategies (use of threat by Row depending upon the specific sequence of Column's responding) have indicated that the Column player will select his non-dominant response more frequently when playing against a demanding contingent strategy than against a passive strategy (Gruder & Duslak, 1973; Guyer & Gordon, cited in Rapoport et al., 1976). In addition, Guyer and Gordon (cited in Rapoport et al., 1976) reported that the probability of the Column player selecting his non-dominant response after both players had selected their dominant responses (i.e., appeasement) was higher when Column was playing against a demanding contingent strategy than against a passive strategy.

While these studies clearly demonstrated that a demanding contingent strategy is more effective than a passive strategy in gaining concessions from the Column player, they do not indicate whether the organization or patterning of threats is the major factor or whether it is just the occurrence of threats irrespective of their patterning which is important in gaining concessions from the Column player. The primary purpose of this research was to determine the relative effects of the patterning of threats (i.e., contingency) as opposed to the mere occurrence of threats (i.e., frequency). This was accomplished by the inclusion of a demanding noncontingent strategy. The demanding contingent and demanding noncontingent strategies were yoked to one another and therefore differed only with respect to the contingency of threat (i.e., the frequency of threat was identical). The passive strategy differed from the two demanding strategies in that the programmed opponent never used the available threat. Therefore, the passive strategy differed from the demanding noncontingent strategy in threat frequency alone. A comparison of the concurrent effects of these three strategies permitted an assessment of the independent contributions of threat frequency and of threat contingency to gaining concessions from the Column player.

A second purpose of the present study was to determine the effects of shifts in these three strategies on the behaviour of the Column player during the last 75 trials of the game. There are no studies in the literature which have examined the effects of strategy shifts in threat-vulnerable games and an examination of these effects would establish boundary conditions for the threat contingency or threat frequency variables. For example, if threat contingency is the prime determinant of gaining concessions from the Column player during the initial 75 trials, would this also be the case during the final 75 trials regardless of the strategy experienced initially or would exposure to the initial strategies moderate the effects of threat contingency during the final 75 trials? Answers to questions such as these were provided by an examination of the effects of strategy shifts.

In order to accomplish these objectives, participants in the present study played in one of nine programmed strategy conditions: all possible pairwise orderings of a passive, demanding contingent, and a demanding noncontingent strategy. Six of the strategy conditions involved a shift in strategy following 75 trials of the game while, for the remaining three strategy conditions, the programmed strategy remained the same for the entire duration of the game (150 trials).

The following extensive review of the literature is intentionally general. It is presented to serve as a bibliographic directory for those readers interested in areas other than the topic of this paper but also to serve to illustrate the wide range of questions to which experimental games have been applied. The reader who is primarily interested in the specific research undertaken in this paper is invited to turn to page 57.

Review of the Literature

Overview of Game Theory

Game theory employs as its basic model the game of strategy as distinct from the game of chance. To play a game against dice or nature is to make decisions under conditions of risk or uncertainty, a situation for which probability theory alone is a valuable tool. Yet sometimes we must make our decisions with respect to what we predict others will do, for the outcome is dependent not upon us alone but upon the combination of two or more persons' choices of action.

> Therefore what distinguishes games from nongames from the point of view of game theory . . . is whether certain choices of actions and certain outcomes are unambiguously defined, whether the joint choices can be precisely specified, and whether the choosers have distinct preferences among the outcomes.
>
> (Rapoport & Chammah, 1965, p.17)

A game theorist is interested in the following question: Given a particular game, what is the best way to play in order to maximize the minimum gain and minimize the maximum loss? This is a purely mathematical question which is based on the assumption that both players are rational. When both players are rational and choose their best strategies according to the dictates of formal game theory, the outcome is predetermined and nonindicative of anything other than the ability of the players to foresee all possible outcomes.

The theory is considered to be a normative rather than a descriptive model of behaviour because it prescribes how a rational player should play a game. Downing (1975) has attempted to integrate the prescriptive and descriptive models of behaviour by first deriving the rational solutions against various strategies of a simulated other in Prisoner's Dilemma games, and then examining how closely the behaviour of players in prior research conforms to the prescribed optimal strategies.

Games involving two people with two choices each (2 X 2 games) have most commonly been used as research tools. All such games can be represented in the general matrix form presented in Figure 1. Both players usually make choices simultaneously which determine the quadrant outcome (1, 2, 3 or 4). Outcomes are expressed in the form, R1C1, Row's choice always appearing first. By convention, the payoff to the Row player on a particular trial is placed in the lower left of each quadrant. Column's payoff is in the upper right. By altering the relationships among the parameters a, b, c, and d, various games can be created.

Some games are classified as zero-sum games. In such games the sum of the payoffs in each quadrant is zero. Rational behaviour consists of maximizing one's own payoff. In zero-sum games, maximizing one's own payoff necessarily minimizes the payoff to the other player. Therefore a rational player will play strictly competitively because the interests of the two players are diametrically opposed. There are two classes of zero-sum games: games with

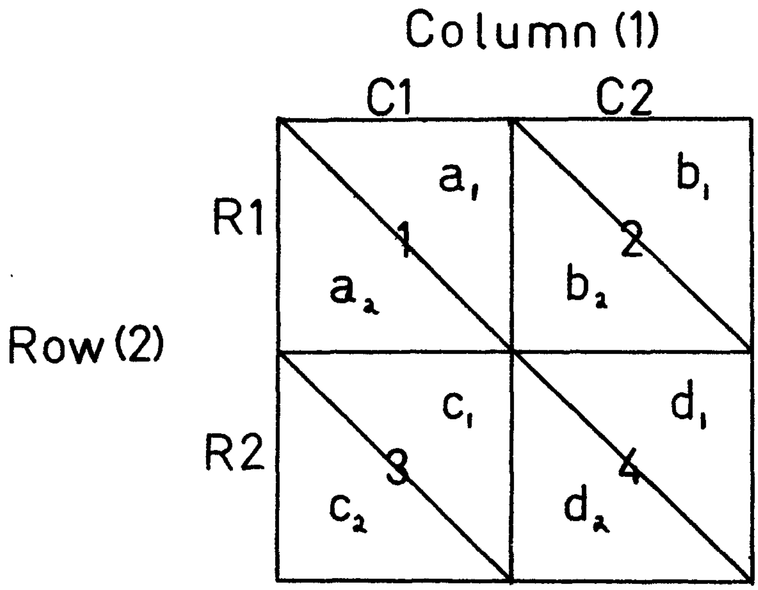


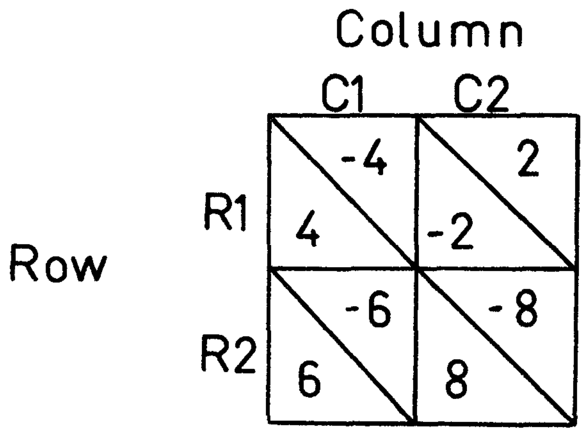
Figure 1. General Matrix Form

a saddlepoint and those without. A saddlepoint is an entry in a matrix in which the payoff to the Row player is simultaneously a minimum in its row and a maximum in its column. Figure 2 displays these two types of zero-sum games.

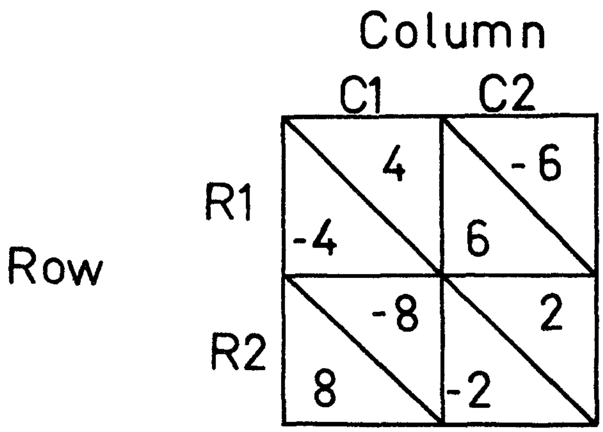
In zero-sum games with a saddlepoint the best two rational players can do is to choose the strategy which contains the saddlepoint (Rapoport, Note 1). Row, if rational, will select Choice 2 in such a game because +6 is the best of the worst payoffs. Likewise, a rational Column player will select Choice 1 using the identical logic. When these two choices are made, the outcome is the quadrant containing the saddlepoint (R2C1). Choosing a response on the basis of minimizing one's own losses and maximizing one's own gain is referred to as the minimax principle. The principle constitutes a general solution for all two-person zero-sum games with a saddlepoint.

Zero-sum games without a saddlepoint must be solved in a different manner: The minimax principle no longer dictates the best strategy. A solution to such a game requires selecting either Choice 1 or 2 with certain probabilities. This is known as a mixed strategy in contrast to choosing on the basis of the minimax principle, a pure strategy.

Of more interest are games in which the interests of the players are partially opposed and partially coincident (nonzero-sum or mixed-motive games). These games stand partway on the continuum from the simple to the more complex games. Not only conflict



A. Zero-sum Game with Saddlepoint



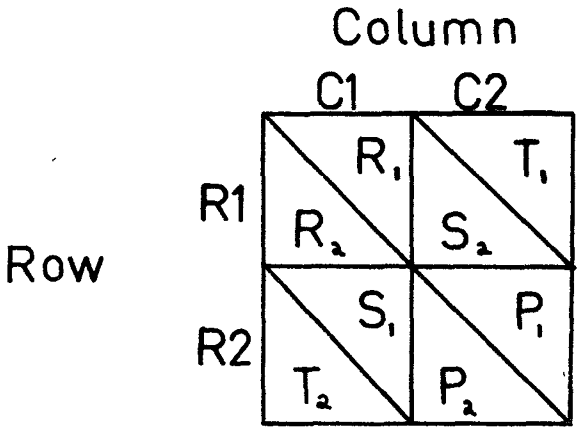
B. Zero-sum Game without Saddlepoint

Figure 2. Two Zero-Sum Games

between players but conflict within players becomes evident as each may be torn between cooperation for the common good and competition aimed at satisfying personal interest. Given that rational behaviour consists of making as many points for oneself as possible, what is the rational choice in such a game? Figure 3 displays the general matrix form of the Prisoner's Dilemma game or Game 12 in Rapoport and Guyer (1966) and also a Prisoner's Dilemma game matrix in which actual payoff values have been assigned. It should be noted that Game 12 is a symmetrical game. The motivational structure is identical for participants playing in the position of Row or Column.

The relationship among the payoff parameters must satisfy the following: (a) $S < P < R < T$, and (b) $2R > S + T$, in order for the game to be called Prisoner's Dilemma. The second condition is necessary in order to preserve the R1C1 outcome as the cooperative outcome. Otherwise players may take turns at obtaining T, the temptation or largest payoff.

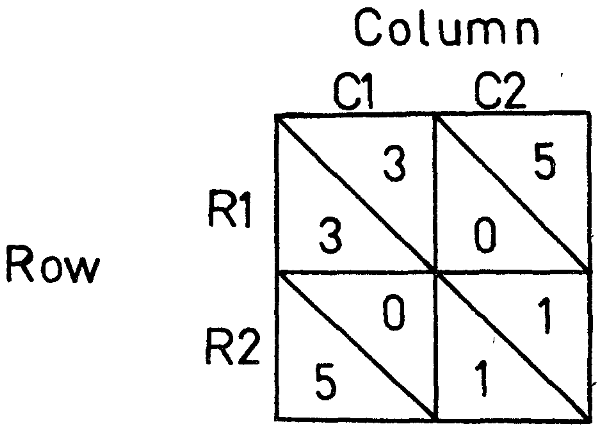
In a Prisoner's Dilemma game both players possess a dominating strategy. This is a strategy in which a player can expect to do no worse and generally better regardless of the strategy chosen by the other player. For example, in Figure 3B, Column's dominating strategy is Choice 2 because 5 is better than 3 and 1 is better than 0. Likewise, Row's dominating strategy is also Choice 2. The individually rational choice, then, for both players, is to play Choice 2. If both do so, both receive 1 unit. This outcome,



A. General Matrix Form

$S < P < R < T$

$2R > S + T$



B. Matrix with Values Assigned

Figure 3. Prisoner's Dilemma Game

R2C2, is a strongly stable equilibrium, so called because neither player can unilaterally depart from it without diminishing his own payoff. Notice, however, that R1C1 would result in greater payoffs to both players. This outcome is not an equilibrium. If Column or Row should unilaterally depart from the R1C1 outcome, he can gain a larger payoff. Therefore, a dilemma exists between collective and individual interests. The R1 or C1 choices are labelled cooperative responses.

Games with three or more players differ radically from the two person games. One of the basic functions of n-person game theory is to give precision to the concept of potential power. A player can obtain a minimum payoff without joining any other, yet to obtain more he must form a coalition with at least one other player. Sometimes it is advantageous to join with a powerful player but if this should not be possible, a coalition with an impotent player in some games may aid in the maximization of gain. Thus, each player has some potential power which, with cooperation from others, may be realized. Since no sufficient theoretical model based on two-person game behavior has been built, it does not seem particularly fruitful to discuss n-person game theory but only to acknowledge its existence.

Psychological Uses of Experimental Games

A psychologist uses experimental games in an attempt to develop an empirical descriptive model of behaviour in conflict situations rather than a normative model of optimal behavior which assumes that both players are rational. The experimenter is primarily concerned with the question: What will happen when . . .? He is not usually interested in finding the best solution to the game. In general, studies indicate that players depart from the rational solutions prescribed by formal game theory (Guyer & Rapoport, 1970; Lieberman, 1960; Payne, 1965; Rapoport, Guyer, & Gordon, 1971; Tyszka & Grzelak, 1976). Psychological, sociological, and cultural factors can be assumed to be responsible for these departures.

To the psychologist, the experimental game offers a unique method of examining how various factors affect the decisions made in conflict situations. Some psychologists view the game as a dependent variable: They view the strategy choices of the participants as indicative of how persons with certain personality characteristics respond to real life conflicts. Hence, some research has been directed to the questions of how race (Knight & Mack, 1973), personality patterns (Bennet & Carbonari, 1976; Gillis & Woods, 1971), or nationality (Rapoport et al., 1971) affect strategy choices. In such investigations the crucial element is how closely the game resembles the real life situation (Rapoport, Note 1). Guyer and Rapoport (1972) see this particular use of experimental games as a manifestation of the traditional approach to the study of behaviour insofar as characteristics of individuals are seen as the prime determinants of the way in which he or she chooses among alternatives.

Rather than attribute gaming behaviour to characteristics of the individual, one can view the data as a consequence of the immediate environment. From this point of view, it is not absolutely necessary that the game closely resemble some situation in real life, for a model of behaviour can be constructed and related to data generated by the manipulation of factors within that environment (e.g., the matrix, the use of a simulated other, "one shot" versus iterated plays, etc.). In other words, the treatment of the gaming environment as an independent variable may lead to a model based upon responses which are contingent upon the reinforcement structure of the situation.

Despite the availability of 78 strategically different games (Rapoport & Guyer, 1966), psychologists have been preoccupied with the Prisoner's Dilemma game. This preoccupation is reflected in most reviews of the experimental gaming literature (Gallo & McClintock, 1965; Nemeth, 1972; Oskamp, 1971; Rapoport & Chammah, 1965; Rapoport & Orwant, 1962) although increasingly reference is being made to strategically different games (Pruitt & Kimmel, 1977; Rapoport, Guyer, & Gordon, 1976; Schlenker & Bonoma, 1978).

Variables in Experimental Games

"Gaming behaviour" is a general term representing a large number of very specific dependent variables. There is a preponderance of Prisoner's Dilemma game studies in which the proportion or percentage of cooperative responding (termed C choices) is of prime concern, sometimes to the exclusion of stochastic measures, transitional probabilities, and the number or length of runs.

Stochastic measures refer to the probability of a certain response occurring on trial n given that a certain outcome had occurred on trial n - 1. A general way of describing such a probability is p(R1/R1C1) and is read, "the probability of an R1 response given an R1C1 outcome on the previous trial." If p(R1/R1C1) = 1, the Row player is always following an R1C1 outcome with an R1 choice.

Transitional probabilities refer to the probability of a particular outcome occurring on trial n given that a certain outcome occurred on trial n - 1. These answer such questions as: Given an R1C1 outcome, what are the respective probabilities of this outcome being followed by an R1C2, R2C1, R2C2, or R1C1 outcome?

Length of runs refers to the number of times a particular outcome sequentially occurs. Long runs are referred to as "lock-ins". Usually what is examined is the duration or number of such runs, often R1C1 or R2C2 runs. However, one can also investigate how such runs begin and end.

Once participants have selected their choices over a given number of trials, the protocols can be analyzed to yield the above measures. These measures can often be interpreted in terms of "rich" psychological concepts. For example, with respect to the Prisoner's Dilemma game, the following propensities may be interpreted in descriptive psychological terms: (a) p(R1/R1C1) as trustworthiness, (b) p(R1/R1C2) as forgiveness, (c) p(R1/R2C1) as repentance, and (d) p(R1/R2C2) as trust (Amnon Rapoport & Mowshowitz, 1966).

One caution must be expressed with regard to interpreting these precise statistics in psychological terms: They vary in interpretation just as the term "cooperative responding" differs between various strategically different games. Caution is appropriate but dismissing these measures is not. Regretfully, very few of these measures are reported in studies despite the fact that they are strongly interrelated by mathematical interdependencies to the more commonly reported response frequencies. Rapoport (Note 1) states that experimental games tend to be used so as to "read off" only one or two of these measures under a variety of experimental manipulations The choice of which ones to report usually depends upon the primary interest of the experimenter in how they relate to real life situations or existing psychological theories. Despite the size of this body of literature, results are often inconclusive because of (a) the small number of participants, and (b) the omission of what the individual experimenter considers irrelevant data in terms of his or her particular interest.

The interest of the experimenter also dictates which of the three classes of independent variables will be manipulated in an experiment: (a) participant variables referring to characteristics of the players, (b) structural variables referring to the magnitude of payoffs or the relationship between payoffs, or (c) situational variables referring to conditions present in the experiment.

Participant Variables. A number of participant variables has been investigated in experimental games including family background (Crowne, 1966), personality patterns (Bennett & Carbonari, 1976; Deutsch, 1960; Gillis & Woods, 1971; Marin, 1973; Terhune, 1968, 1974), and sex of participants (Kahn, Hottes, & Davis, 1971; Oskamp & Perlman, 1965; Rapoport & Chammah, 1965). Rapoport et al. (1976) states that the relationship between personality variables and game-playing behaviour is tenuous given the abundance of both positive and negative findings using existing personality tests (see Terhune, 1970, for a review).

With respect to sex differences, the results are also mixed and appear to be affected by numerous other variables including the particular game (Caldwell, 1976; Carment, 1974; McNeel, McClintock, & Nuttin, 1972; Miller, 1967), the sex of the opponent (Mack, Auburn, & Knight, 1971; Rapoport & Chammah, 1965), the sex of the experimenter (Skotko, Langmeyer, & Lundgren, 1974), the strategy of the other (Bixenstine, Chambers, & Wilson, 1964; Komorita, 1965; Smith, Vernon, & Tarte, 1975), and the length of the game (Rapoport & Chammah, 1965). The most well-substantiated finding is that males and females do not differ initially but do differ as a function of the interaction during iterated Prisoner's Dilemma games. Females tend to become progressively more competitive in these games. The usefulness of the sex variable as a predictor of game-playing behaviour has been called into question by Ingram and Berger (1977) in an article which demonstrated that individual difference dimensions such as sex-role orientation affect the behaviour of women the Prisoner's Dilemma game.

Structural Variables. Structural variables can refer to the magnitude of payoff parameters within a particular game matrix or the ordinal relationship among the payoffs. When the ordinal relationships among the payoffs are altered, different games are created.

Some studies which have varied the magnitude of payoff parameters include Frenkel (cited in Rapoport et al., 1976), Guyer and Rapoport (1972), Jones, Steele, Gahagan, and Tedeschi (1968), Rapoport and Chammah (1965, 1966), and Steele and Tedeschi (1967). These studies attempted to identify predictors of choice in mixed-motive games that exist within the game itself. This prediction of behaviour may be aided by the establishment of utility functions for the players. A utility function indicates the value ascribed by a player to the possible outcomes in the game. Wyer (1969) attempted to determine whether behaviour in two-person games could be more easily predicted by transforming outcomes to utilities. A slightly greater proportion of the variance in participant's responses was accounted for by parameters defined in terms of utilities than by similar parameters defined in terms of the payoff values shown on the game matrix.

Studies which have directly compared the behaviour of players in different games include Miller (1967), Miller and Holmes (1975), Swingle and MacLean (1971), and Swingle and Santi (1972).

Rapoport et al., (1976) attempted to integrate available data from studies which investigated changes in the magnitude of payoffs. In both single-play (players choose only once per matrix) and iterated games, the player's choice frequencies generally reflected the direction of the corresponding changes in payoff magnitude (no tests of significance were performed).

Situational Variables. A large number of situational variables has been investigated within the experimental gaming literature including note-passing versus electronic feedback (Enzle, Hansen, & Lowe, 1975), the preexperimental relationship between protagonists (Wallace & Rothaus, 1969), information concerning the opponent's past behavior (Braver & Rohrer, 1975), modes of presentation of the game (Guyer, Hamberger, & Fox, 1973; Hamberger, 1974), how closely the experimental situation resembles a situation in real life (Young, 1977), the proximity of the players (Gardin, Kaplan, Firestone, & Cowan, 1973), incentive magnitude (Gallo, Funk, & Levine, 1969; Gallo & Sheposh, 1971; Knox & Douglas, 1971; Oskamp & Klienke, 1970; Shaw & Thorslund, 1975; see Shaw, 1972, for a review), effects of commitment to future interaction (Slusher, Roering, & Rose, 1974), the ability to reward or punish the other player for desirable or undesirable responses (Bedell & Sistrunk, 1975a, 1975b), the perceived status of the other player (Mack, 1976), the effects of modelling (Braver & Barnett, 1976), the relationship between motives and reward level (Friedland, Arnold, & Thibault, 1974), and perceived similarity and friendship (Krauss, 1966; McClintock, Nuttin, & McNeel, 1970; McNeel & Reed, 1975; Oskamp & Perlman, 1965).

The situational variable of communication has been found to increase cooperative responding in gaming situations (Cheney, Harford, & Solomon, 1972; Dawes, McTavish, & Shaklee, 1977; Scodel, Minas, Ratoosh, & Lipetz, 1959; Grandberg, Stevens & Katz, 1975). However, these findings have not been invariant. It appears that communication has different effects which depend on such variables as (a) timing of communication (Krauss & Deutsch, 1966; Marwell, Schmitt, & Shotola, 1971; Voissem & Sistrunk, 1971), (b) communication medium (Chapanis, 1971; Flint, Harris, & Rector, Note 2; Vitz & Kite, 1970; Wichman, 1970), (c) communication credibility (Benton, 1972; Gahagan & Tedeschi, 1968), and (d) communication content (Swensson, 1967; Wyer & Polen, 1971).

Strategy of the Other in Prisoner's Dilemma Games

All studies reported in this section involved the use of the standard Prisoner's Dilemma game in assessing the effects of the programmed strategy of the other. A programmed strategy may fall into one of three categories: (a) pure noncontingent strategies, (b) randomized noncontingent strategies, or (c) contingent strategies. A randomized noncontingent strategy is one in which the programme delivers a particular percentage of cooperative responses (C responses) over a number of randomly selected trials. A pure noncontingent strategy delivers either 100% or 0% C responses over the course of the game. A contingent strategy is a strategy which depends upon the responses of the real player in determining the responses of the programmed opponent.

Oskamp (1971) reported six studies in which the 100% C strategy was compared to the 0% C strategy. All studies indicated that 100% C produced substantially more concurrent cooperative responding than 0% C. Differences were significant for Sermat (1967) and Wilson (1969), very large but significance was not reported for Lave (1965) and Harford and Solomon (1967), and moderate in size but significance not reported for Scodel (1962) and Solomon (1960) who used sequential play. Studies which have compared extreme levels of randomized cooperation have found significant concurrent differences in the same direction as the 100% C and 0% C comparison (e.g., Heller, 1967; Knapp & Podell, 1968; Lynch, 1968; Shure & Meeker, 1968) with the exception of a study by Bixenstine, Potash, and Wilson (1963) who, by allowing their participants 10 free play warm-up trials may have obscured any strategy effects. In the study by Knapp and Podell (1968) participants were given 24 trials of 50% C before changing to a very high or low level of programmed cooperative responding and, as mentioned, they found a significant strategy effect, possibly because the change in the percentage of cooperation was noticeable to participants. One study (Lave, 1965) compared 100% C to 20% C: The 100% C strategy produced significantly more cooperative responding.

The studies presented above indicate that when two strategies with highly discrepant percentages of cooperative responding are compared, the highly cooperative strategy produced more cooperative responding on the part of the participants than the highly uncooperative strategy.

A tit-for-tat strategy is a contingent matching strategy which matches on trial n, the participant's response on trial n - 1. A number of studies has compared the behaviour of participants in a tit-for-tat strategy condition to those in one of various noncontingent strategy conditions. The exception to the rule is a study by Wilson (1971) in which the tit-for-tat strategy was compared to variations on a tit-for-tat theme. The tit-for-tat strategy produced the highest level of cooperative responding. Studies in which the conditional tit-for-tat strategy was compared to noncontingent strategies are presented here to demonstrate that, in Prisoner's Dilemma games, the tit-for-tat strategy evoked more cooperative responding than noncontingent strategies, even when the noncontingent strategy involved a comparable number of cooperative choices.

In sequential play situations in which the real player must choose first on each trial, the tit-for-tat strategy has been found to produce significantly greater cooperative responding than either 100% C or 90% C strategies and also 0% C or 10% C strategies (Solomon, 1960; Oskamp, 1974; Whitworth & Lucker, 1969). In simultaneous play situations, the tit-for-tat strategy has produced significantly more cooperative responding than 0% C (Crumbaugh &

Evans, 1967; Wilson, 1969) but was not significantly different (although in the expected direction) in effects from a 100% C strategy (Oskamp & Perlman, 1965; Wilson, 1969). However, the tit-for-tat strategy produced more cooperative responding than a 100% C strategy for participants characterized by own gain maximization (accumulating as many points for oneself as possible) versus relative gain maximization (accumulating points in excess of those of the opponent) as their central goal (Kuhlman & Marshello, 1975b; Oskamp, 1971).

These studies do not permit a statement that a conditional strategy is likely to produce more cooperative responding than a noncontingent strategy because the overall frequency of cooperative responding differs among the various strategies.

The problem can be overcome by the use of a yoked control design in which one group of participants plays against a tit-for-tat strategy. The "yoked" group receives a cooperative or non-cooperative response when the tit-for-tat programmed strategy delivers such a response to the first group. Hence, in the first group, the programme's responses are contingent upon the behavior of the real player while in the yoked control group, these choices are not contingent.

A number of studies has demonstrated that the contingent tit-for-tat strategy produced significantly more cooperative responding than a noncontingent strategy having the same level of programmed cooperative responding (Crumbaugh & Evans, 1967; Downing et al., 1975; Downing & Ritter, Note 3). Other studies also confirm the tendency of a tit-for-tat strategy to facilitate the development of cooperative responding when other variables interact at particular levels (Kahn et al., 1971; McNeel, 1973). For example, McNeel (1973) did find a contingency effect in the proportion of his sample characterized by own gain versus relative gain maximization as their central goal.

The results of the above studies demonstrate conclusively that the level of cooperative responding produced by participants is influenced by whether or not the programme is contingent. It is possible that a sense of control over the programmed other's responses is instrumental in the production of higher levels of cooperative responding on the part of participants. It may also be possible that the participants are attempting to maximize their gains: The cooperative response has been shown to be the rational choice against a tit-for-tat strategy (Downing, 1975; Downing et al., 1975).

In the present study, a major factor of interest was the stability of the respective effects of three strategies when preceded by a particular strategy during the first half of the game. Delayed strategy studies are the prime source of data which indicate that previous experience against a particular level of cooperative responding on the part of the simulated other influences behaviour. However, studies of concurrent strategy effects also provide relevant information as to these effects.

In terms of concurrent effects of strategies with changing cooperation levels either over the course of a game (Amnon Rapoport

& Mowshowitz, 1966) or after a number of trials (Bixenstine & Wilson, 1963; Swingle, 1968; Swingle & Gillis, 1968) it has been found that a change in programmed cooperation from a low to a high level produced more cooperative responding than the reverse sequence or no change in programmed cooperation. In delayed strategy studies such effects have also been noted for 0% C changing to 100% C versus a solely 100% C strategy (Scodel, 1962) and for a solely 4% C strategy versus strategies which change from 4% C to higher levels (Swingle & Coady, 1967).

In a study by Smith et al. (1975), male and female participants played a 60 trial Prisoner's Dilemma game consisting of 10 pretreatment trials against either an 80% C or 20% C programmed other, followed by 50 trials of within-trial tit-for-tat (the programme matches the participant's response on the same trial.) On the final 50 trials, both male and female participants were more cooperative after having played against the 80% C versus 20% C pretreatment. The data also indicated that when the initial few trials were programmed cooperatively, cooperative responding by the participants increased at a significantly greater rate than when the initial few trials were predominantly competitively programmed. This study is not directly comparable to the results of the above studies because the 80% C pretreatment followed by a within-trial tit-for-tat is not equivalent to a high - low sequence of programmed cooperation.

Harford and Hill (1967) and Harford and Solomon (1967) have found that a "reformed sinner" stategy (0% C, then tit-for-tat) produced significantly more delayed cooperative responding in Prisoner's Dilemma games than a "lapsed saint" strategy (100% C, then tit-for-tat) for up to 20 trials but the effect has been shown to dissipate when the tit-for-tat strategy is continued for 60 trials or more (Oskamp, 1970; Sermat, 1967). This lack of differences after pretreatment between the final tit-for-tat strategies suggests that the concurrent effects of such a strategy override the delayed effects of previous strategies, particularly when the final period of programmed tit-for-tat responding is prolonged. In addition, no significant differences have been reported between solely tit-for-tat strategies and reformed sinner strategies (Crumbaugh & Evans, 1967; Harford & Hill, 1967; Sermat, 1967).

Threat in Two-Person Conflict Situations

Social conflicts often involve the exchange of explicit or tacit threats. An explicit threat is one which is specific with regard to the course of action the recipient or target must take to avoid punishment and to the magnitude of the punishment exacted for noncompliance. This type of threat may be operationally defined as an if-then statement (Kelley, 1965) usually communicated in the form of a message. A typical threat message in research using the Prisoner's Dilemma game reads, "If you do not make Choice 1 on the next trial, I will take 10 points from your total." Behavioural compliance consists of the recipient making the designated choice on post-message trials as required by the source of the threat.

The effectiveness of explicit threats in producing compliance has been shown to be a function of the cost of threat enforcement (Mogy & Pruitt, 1974), the status of the threatener (Faley & Tedeschi, 1971), threat credibility (Horai & Tedschi, 1969; Nacci and Tedeschi, 1973), the distribution of the power to punish (Berkowitz, Hylander, & Bakaitis, 1973; Michener & Cohen, 1973), the magnitude of the threatened punishment (Bonoma & Tedeschi, 1973; Tedeschi, Bonoma, & Brown, 1971), the choice behaviour of the source (Bonoma & Tedeschi, 1973; Horai & Tedeschi, 1975), the wording of the threat message (Schlenker, Bonoma, Tedeschi, & Pivnick, 1970), and knowledge of the threatener's prior experience with another player (Michelini, 1975).

The behaviour of the threatener has been shown to be affected by target compliance (Monteverde, Paschke, & Tedeschi, 1974; Tedeschi, Bonoma, & Lindskold, 1970), whether the target can also threaten and retaliate (Tedeschi, Bonoma, & Novinson, 1970), the cost of the use of threat (Tedeschi, Horai, Lindskold, & Faley, 1970), the magnitude of retaliation (Lindskold, Bennet, & Wayner, 1976) and whether the threatener is a group or an individual (Lindskold, McElwain & Wayner, 1977).

Tacit threats are communicated by the actual sequence of choices in a gaming situation. Hence an individual involved in a game may, through his choice behaviour, punish the other in an attempt to reach his desired goal. The Deutsch and Krauss (1960, 1962) Trucking game is an example of a social conflict situation in which threat is of a tacit nature. Each player is told that he or she is the operator of a trucking company with the goal of delivering goods to a destination. Operating costs are assessed on the basis of time taken to deliver these goods. Conflict between players is generated from the layout of available delivery routes, the shortest and most lucrative route being a one-lane road which only one truck may use at a time. Threats may be introduced into the paradigm by providing gates to the players. These gates may be lowered to prevent the other from using the shorter one-lane road to reach his destination. Borah (1963) and Kelley (1965) have stated that this operational definition of the concept of threat is unsatisfactory: The gates may be used to punish the opponent, to trick him, to administer revenge, or to signal whose turn it is to use the fastest route.

Like the effectiveness of explicit threat, the effectiveness of tacit threat also depends upon a number of variables including the threatener's satisfaction with payoffs (Frenkel, cited in Rapoport et al., 1976; Guyer & Rapoport, 1972), the magnitude of the penalty the threatener can inflict (Guyer & Rapoport, 1972), and the cost of threat usage (Guyer & Gordon, cited in Rapoport et al., 1976). These studies will be reported in more detail in the section dealing with empirical studies of threat-vulnerable games.

Theorists differ in their estimation of the effects of threat availability on behaviour in strategic interactions. Deterrent and anti-deterrent (escalation of conflict views) of threat have been subjected to experimental investigation. Deutsch and Krauss (1960, 1962) suggest that threat availability decreases the level of cooperation as measured by the magnitude of players' joint payoffs (welfare outcome). Hornstein (1965) showed that the use of unambiguous contingent threats in a real-estate game reduced the likelihood of agreement. Other studies indicate no such relationship (Black & Higbee, 1973; Meeker, Shure, & More, 1964; Shomer, Davis, & Kelley, 1966; Tedeschi, 1970). Whether the availability of explicit threat does or does not exacerbate conflict is a moot question due to findings which have indicated that an interaction exists between threat availability and communication availability. Both Smith and Anderson (1975) in a Deutsch and Krauss type game and Nardin (1968) in an expanded Prisoner's Dilemma game have demonstrated that tacit threat is detrimental to cooperation when communication is permitted but not when communication is prohibited. Santi and Wells (1975) investigated the effects of communication opportunity (forced, optional, or no communication) on behaviour in a 2 X 2 game in which tacit threats were transmitted via choices. Results indicated that the communication variable did not significantly affect game-playing behaviour.

The present study is concerned with a situation in which threat is always available to the programmed opponent. When this is the case, it is possible to assess the effects of the use or non-use of this form of power.

<u>Studies of Non-Use of Power</u>

A general term to describe the opponent's strategy in all of the studies to be presented in this section is "passivity." The range of studies in which passivity has been examined is broad, as are the operational definitions of the term. Studies include both field and gaming experiments. Most studies indicate that pacifist behaviour should not be recommended as a means for avoiding conflict and increasing cooperation (see Ofshe, 1971, for a theoretical review).

A large body of literature concerned with pacifism has used gaming situations rather than 2 X 2 games as the primary experimental tool. For example, Shure, Meeker and Hansford (1965) had participants play against a totally passive simulated opponent in an experimental situation in which either player could achieve an initial advantage and proceed to continually dominate the situation. The player who did so could receive a large payoff indefinitely if he chose not to reciprocate the pacifist's initially cooperative behaviour. Both could shock the other for undesirable responses. The pacifist, however, never used the shock mechanism but did block the participant's goal responses and forced him to use violent means to acquire the payoff. In one condition, the pacifist's nonviolent intentions and anti-violence background (Quaker) were communicated to participants. In another, the pacifist actually disarmed himself by the non-use of actions which could acquire for him the opportunity to both dominate and shock the participants.

This guaranteed that no reprisal would occur. The effectiveness of the pacifist strategy was not impressive. The percentage of participants who initially indicated a willingness to cooperate was 48%. By the end of the experiment, the percentage of participants actually cooperating (taking turns in the use of a limited message transmitter) was 39%. The total number of participants who cooperated was not affected by a clarification of the pacifist's intentions of disarmament. It can be concluded that a simulated pure pacifist strategy in such a game does not induce high levels of cooperation on the part of participants. Using similar experimental situations, other studies have extended the work of Shure et al. (1965) to include differences between a shocking and a warning pacifist (Vincent & Tindell, 1969), balanced and unbalanced conditions in terms of shock ratio (Tindell & Vincent, 1970), and availability of shock purchasing power (Vincent & Schwerin, 1971).

In such an experimental situation used in the above experiments, pacifist strategies have not been effective in the induction of cooperation for a number of reasons including the lack of an influence channel between the pacifist and an audience which can control the other participants (Ofshe, 1971), the use of confederate teammates who exerted group pressure on the participants to exploit the pacifist (Meeker & Shure, 1969), and the features of the game itself (the participants took considerable risk in allowing the pacifist to dominate).

Studies which do suggest that a pacifist strategy may be effective include Tedeschi, Bonoma, and Novinson (1970), Dorris (1972), Marwell, Schmitt, and Boyeson (1973), and Lindskold et al. (1976).

Tedeschi et al. (1970) found that participants used a penalty option more frequently in conditions where a simulated opponent could retaliate than in conditions in which he could not. Lindskold et al. (1976) found no significant differences between the behaviour of participants playing against a nonretaliatory opponent and those playing against opponents who retaliated at higher levels (in terms of points to be taken from the participant's total). In other words, the pacifist strategy was no more or no less effective than the other strategies.

A field study by Dorris (1972) is relevant to passivity in that pacifists often make moral appeals when in conflict with a potential aggressor. The participants were unwitting coin dealers who were approached by confederates posing as coin sellers who made (a) a moral or neutral appeal; and (b) had either been exploited by or had been fairly treated by a previous dealer. Those dealers who had received the moral appeal made higher final price offers regardless of the information communicated by the seller concerning his treatment by a previous dealer.

Marwell et al. (1975) found that previous experience against an unconditionally cooperative opponent (an opponent who both chose to participate in a cooperative vs. an individual task and never took points from the participants's total) resulted in the eventual cooperation and non-exploitation by 12 out of 13 participants. To choose to participate in the cooperative task was more lucrative, hence the discrepancy between this and the study by Shure et al. (1965). Results were explained in terms of the effect of communication of pacifist intent via the opponent's choices to work cooperatively and not to take points from the participant.

The results of the above studies cannot be meaningfully compared because of the lack of standardization between the various situations used and the concomitant diversity in the operational definition of the concept of passivity.

Swingle (1970) conducted a study in which it was possible to examine one variable under which the non-use of available power may differentially invite exploitation. He used three matrices which varied the power position of the participant relative to the opponent: participant in power, equal power and opponent in power. The opponent responded on the basis of an unconditionally cooperative strategy, allowing the player to obtain his highest payoff on any single trial. Participants made significantly more exploitative responses when playing against an unconditionally cooperative powerful opponent than when playing against either an unconditionally cooperative equal or less powerful opponent. These results were also supported by Black and Higbee (1973) in conditions where no threat-message was available to the male participants. Exploitative responses occurred with a significantly greater frequency in the opponent-in-power condition than in the participant-in-power condition. The explanation for such behaviour revolves around perceptions of the unconditionally cooperative opponent. These include the attribution of stupidity to the opponent (Swingle, 1974), the motivation to exploit a seemingly weak opponent (Lave, 1965), and the belief that the opponent will hesitate to use a high level of power out of fear or guilt about the effects of the use of such power (Swingle, 1970).

Threat-Vulnerable Games: Theoretical Considerations

Rapoport and Guyer (1966) have presented a taxonomy of two-person two-choice games in which each player has a strong preference-ordering of outcomes. Three members of the class of games having a single threat-vulnerable equilibrium appear in Figure 4. An equilibrium outcome is one from which neither player can unilaterally depart without diminishing his own payoff. With reference to Game 21 it can be seen that both players have a dominating strategy, for regardless of the other's choice, both obtain a larger payoff by playing their first choices (R1 or C1). However, if Column were to depart from C1 to C2 while Row remained static, his or her payoff would be diminished by 1 unit. Should Row unilaterally depart from R1 to R2 while Column remained static, Row would also suffer a loss. Equilibrium outcomes in which a player may induce but not force the other to shift are called threat-vulnerable equilibria. An inducement to shift is said to be present when it is to the Column player's advantage to shift rather than to suffer the consequences of the Row player's shifting. If, however, after

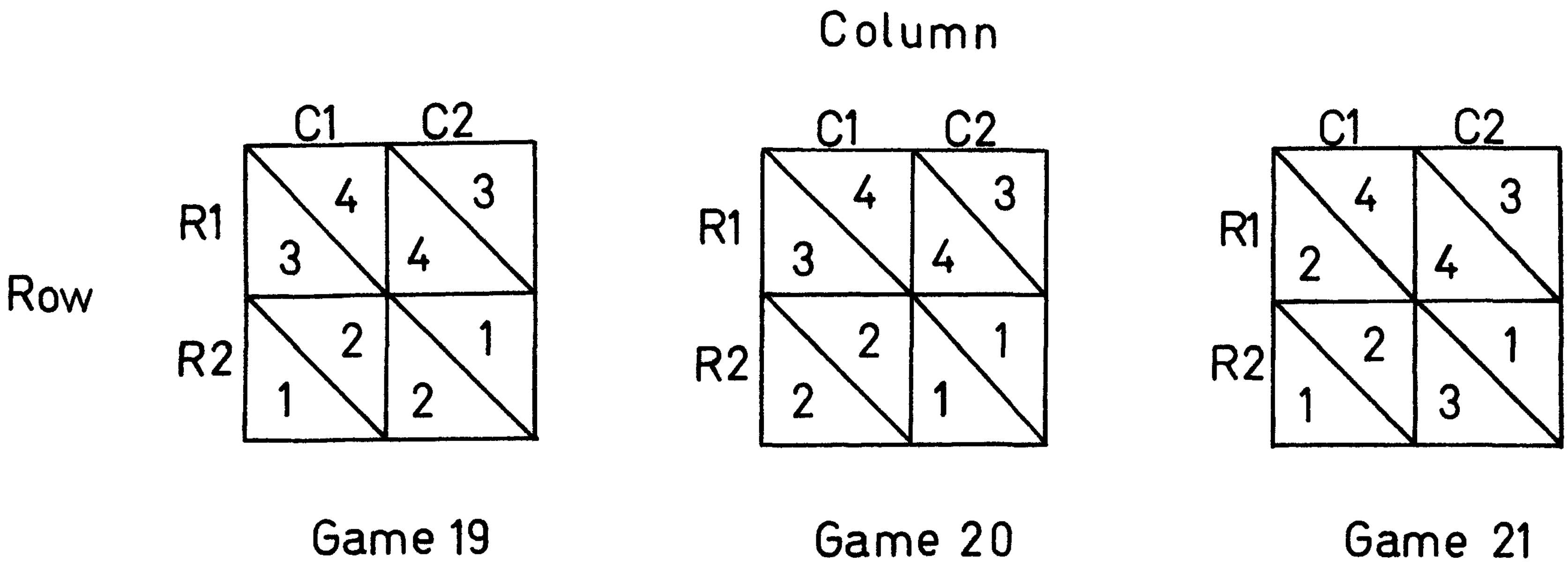


Figure 4. Ordinally Defined Games with Threat-Vulnerable Equilibria

Row shifts it is to Column's advantage to shift, he is said to have been forced to shift.

In Game 21, if both players select their dominating strategies, the Column player obtains his most preferred outcome (4) but the Row player obtains his next-to-least preferred outcome (2). The only way in which Row can obtain his most preferred outcome is for him to induce Column to choose non-dominantly, (i.e., choose C2). Up to this point in our discussion there is no reason why Column would respond non-dominantly. But, should Row unilaterally do so, Column would receive his next-to-least preferred outcome (2). Therefore, Row may obtain his most preferred outcome if Column perceives or is persuaded that it is to his advantage to shift rather than to suffer the consequences of the Row player shifting.

It should be pointed out that a unilateral departure by Row reduces not only Column's payoff but also his own. For this reason a departure by Row may be regarded as the use of threat against Column which has a certain cost of execution. It should also be noted that once an R2C1 outcome occurs it is not in Column's best interest to shift to C2 so as to give Row the opportunity to shift to R1 and obtain his most desirable payoff in R1C2. From Column's point of view it is more advantageous for him to appease Row by shifting occasionally to C2 from the R1C1 outcome rather than to suffer through the costly outcomes of R2C1 and R2C2. Therefore it can be proposed that Row's threat would be effective only if it is not carried out.

As in the Prisoner's Dilemma game, there is a number of dependent variables which can be examined including the probability of non-dominant responding (R2 or C2 choices), and stochastic measures for which descriptive labels have been assigned (Guyer & Rapoport, 1970). The stochastic measures in Game 21 are:

Column:

p(C2/R1C1) <u>Appeasement</u> or Column's propensity to select his non-dominant response on trial *n* given that both players had selected their dominant response on trial *n* - 1. The motivation behind such a shift may be to forestall the use of threat by Row or to satisfy some standard of fair play.

p(C2/R2C1) <u>Capitulation</u> or Column's propensity to select his non-dominant response on trial *n* given that he had selected his dominant response previously and Row had selected his non-dominant response on trial *n* - 1.

p(C2/R1C2) <u>Generosity</u>. When Column repeats a C2 choice after the R1C2 outcome he is giving Row his largest payoff once again.

p(C1/R2C2) <u>Doublecross</u>. In shifting to C1 after an R2C2 outcome Column prevents Row from obtaining the spoils of his revolt.

Row:

p(R2/R1C1) <u>Revolt</u> or Row's propensity to choose non-dominantly given that he and the Column player had chosen their dominant responses on trial n - 1.

p(R2/R2C1) *Persistence* refers to Row's propensity to respond non-dominantly given that he had previously chosen in this way while the Column player had selected his dominant response on trial n - 1.

p(R2/R1C2) *Dissatisfaction*. Following an R1C2 outcome, Column has the opportunity to re-establish the natural outcome by shifting to C1, provided Row repeats R1. Therefore, p(R2/R1C2) is the probability that Row will not allow the natural outcome to be established, hence it is a measure of his dissatisfaction even after having received the largest payoff.

p(R2/R2C2) *Distrust*. Following an R2C2 outcome, Row has the opportunity to obtain his largest payoff by shifting to R1 if Column plays C2 again on the next trial. For Column to switch to C1 on the next trial would re-establish the natural outcome given Row plays R1. Row manifests his distrust by playing R2 again so that if Column does shift the outcome R2C1 will result: Column receives the decrement in payoff immediately rather than on the next trial.

Very often only four of the above measures are reported (appeasement, capitulation, revolt and persistence) because of the low frequency of occurrence of R1C2 and R2C2 outcomes necessary to calculate reliable generosity, doublecross, dissatisfaction and distrust measures(e.g., Rapoport et al., 1976, p. 194; Santi & Wells, 1975).

Threat-Vulnerable Games: Empirical Studies

Participant Variables. Edwards and Gordon (cited in Rapoport et al., 1976) examined the performance of female and mixed pairs in Game 19. Rapoport et al. (1976) used male pairs. When the performances of male and female players were compared, the largest differences involved the sex of the Column player. When Column was a woman, both male and female Row players resorted to the R2 choice more frequently. Male Column players demonstrated a higher frequency of C2 responses than female Column players against either a male or female Row player.

Rapoport et al. (1971) compared the performance of Danish and American players in Game 19. American and Danish students played 100 times as Row and 100 times as Column on each of three different matrices which varied the discrepancy between Row's and Column's payoffs at the natural outcome. No systematic differences were found in outcome distributions for the three different matrices. This finding was explained in terms of a contagion effect: Participants developed a fixed manner of playing, thereby showing little sensitivity to variations in game structure. This contagion effect has also been found in the Prisoner's Dilemma game (Rapoport & Chammah, 1965). An analysis of conditional propensities generally supported the conjecture that Danes are more submissive than Americans in the Underdog role of the game (i.e., as Row): The propensity of American Row players to play R2 following each of the four outcomes was larger than that of Danes. As Column players, Americans and Danes did not differ with respect to the willingness to yield to threat and differed only slightly on the appeasement propensity: Americans appeased slightly more frequently than Danes. It is probable that the behaviour of both Danes and Americans in either role of the game was dependent upon the behaviour of the other player. However, these effects were not ascertained because any one player alternated between playing as Row or as Column. Therefore any one player may have adopted a fixed manner of playing in either or both roles.

In a second experiment, each participant played against three Column strategies and against three Row strategies. The six strategies were fixed (i.e., were not probablistic). Participants were therefore able to discern and adjust their counterstrategies accordingly. Such strategies are more likely to make participants aware that their opponent is programmed to respond in a patterned manner. For example, Row's strategies were as follows:

(a) "Passive" strategy: 100% R1

(b) "Modest" strategy: The programme used R2 only after three consecutive C1 choices by the participant. The programme then remained with R2 until the participant shifted to C2 at which time it shifted to R1.

(c) "Demanding" strategy: The programme used R1 only after a C2 choice, and always used R2 after a C1 choice on the part of the participant.

When fixed strategies are used, differences can be explained in terms of differences in discerning the optimal counterstrategies. American students tended to play closer to the prescribed optimal strategies than the Danish students.

Sequences in the initial experiment in which bona fide players chose R1 or C1 consistently for 100 trials were examined to determine their effects, under the assumption that, because such extreme strategies occurred only occasionally, participants were not likely to falsely assume that they were playing a programmed opponent. Results supported those of the initial experiment: Danes tended to play submissively in the Underdog role of the game and also tended to exploit a passive Underdog more than Americans did. These differences were not noted in the second experiment which suggests that when participants are relatively sure that the opponent is indeed another person, differences in behaviour are manifested. Participants were not matched on other variables, such as grade point average, hence there is considerable difficulty in ascribing the observed differences to nationality alone.

Structural Variables. Of the three threat-vulnerable games, only Games 19 and 21 have been used as research tools. Four studies will be presented in this section. These studies have relied predominantly on descriptive presentation of very large amounts of data and have not included statistical tests of significance.

Rapoport et al. (1976) compared outcome frequencies and stochastic measures between the two games. These games differ only in the position of Row's next-to-most and next-to-least preferred payoffs. With respect to outcome frequencies, the two games were very similar. In 9 out of 10 pairs, "Row had to work for his share at about the same rate, that is, to resort to R2 about 15 to 30 percent of the time" (p.191).

Interpretation of the stochastic measures is identical for the two games. In both games, the following rank ordering of Row's propensity of playing R2 obtained: p(R2/R2C2) > p(R2/R2C1) > p(R2/R1C2) > p(R2/R1C1). However the difference between the two game matrices did modify the mean values of p(R2/R2C2) and p(R2/R1C1) appropriately: "Revolts" were lower in Game 19 (.11) than in Game 21 (.15) because an R1 choice in Game 19 may result in a higher payoff than in Game 21. The propensity p(R2/R2C2) was higher in Game 21 (.56) than in Game 19 (.41) because an R2 choice in Game 21 may result in a higher payoff than in Game 19. The rank ordering of Column's propensities differed between the two games. In Game 19, the following rank ordering obtained: p(C2/R2C2) > p(C2/R1C2) > p(C2/R1C1) > p(C2/R2C1). In Game 21, the first and second propensities were reversed in order, as were the third and fourth. Since Column's payoff are identical in both magnitude and position in both these games, the reversal could not be satisfactorily explained. The authors suggested that the reversal may be a consequence of an indirect effect, i.e., the difference in Row's payoff structure between the two games. The difference in the mean values of p(C2/R2C2) was considered to be relatively meaningless in view of the fact that the outcome R2C2 occurred very infrequently in both Game 19 and Game 21 (a mean frequency of 3 and 4 trials, respectively, in a 100 trial game). This study indicated that the results of experiments using Game 19 or Game 21 are comparable and that the frequency with which a choice is repeated is related to the rank of the associated payoff.

The effects of payoff magnitudes have been examined in Game 21. Making one choice per presented matrix theoretically reflects the decision of a rational player because he or she is not susceptible to patterns of reward or punishment which are inherent in iterated games. To vary the particular game and the relative magnitude of payoffs within each game would supposedly aid in identifying the relative weight with which game theoretical factors contribute to the strategy choices observed in iterated games.

Guyer and Rapoport (cited in Rapoport et al., 1976) varied three dimensions in Game 21: (a) Row's dissatisfaction with the natural outcome, (b) Row's threat to Column, and (c) Row's cost of threat usage. Row's dissatisfaction was varied by increasing the discrepancy between his and Column's payoff in the R1C1 outcome quadrant. Row's threat to Column was varied by increasing the discrepancy between Column's payoff in the R1C1 outcome and Column's payoff should Row choose R2 while Column remained static. Major findings included: (a) the more "satisfied" Row was, the greater the percentage of R1 and C1 responses by the Row and Column players respectively; (b) the lower the magnitude of Row's threat to Column, the greater the percentage of C1 choices by Column; and (c) when the cost of threat usage to Row was high, the percentage of R2 responses by Row decreased. These observations generally indicated that choice behaviour varies as a function of payoff magnitudes usually in the expected direction.

Guyer and Gordon (cited in Rapoport et al., 1976) examined the performance of 18 pairs of participants in 100 trial games, including Game 19. As in the single play experiment, payoff changes in iterated games do modify choice frequencies. Stochastic measures were also shown to vary as a function of changes in payoff magnitudes. The direction, magnitude and explanation of such changes in game-playing behaviour as measured by either choice frequencies or conditional probabilities has yet to be drawn into a cohesive body of literature, most likely because of the difficulty in assimilating contradictory findings into an empirically derived model of behaviour.

Situational Variables. Guyer and Rapoport (1970) investigated the performance of 10 pairs of male undergraduates in Game 21. The matrix used in presented as Variant 2 in Figure 5. This study is presented here in order to facilitate a comparison with the subsequent Santi and Wells (1975) study in which the two indepen-

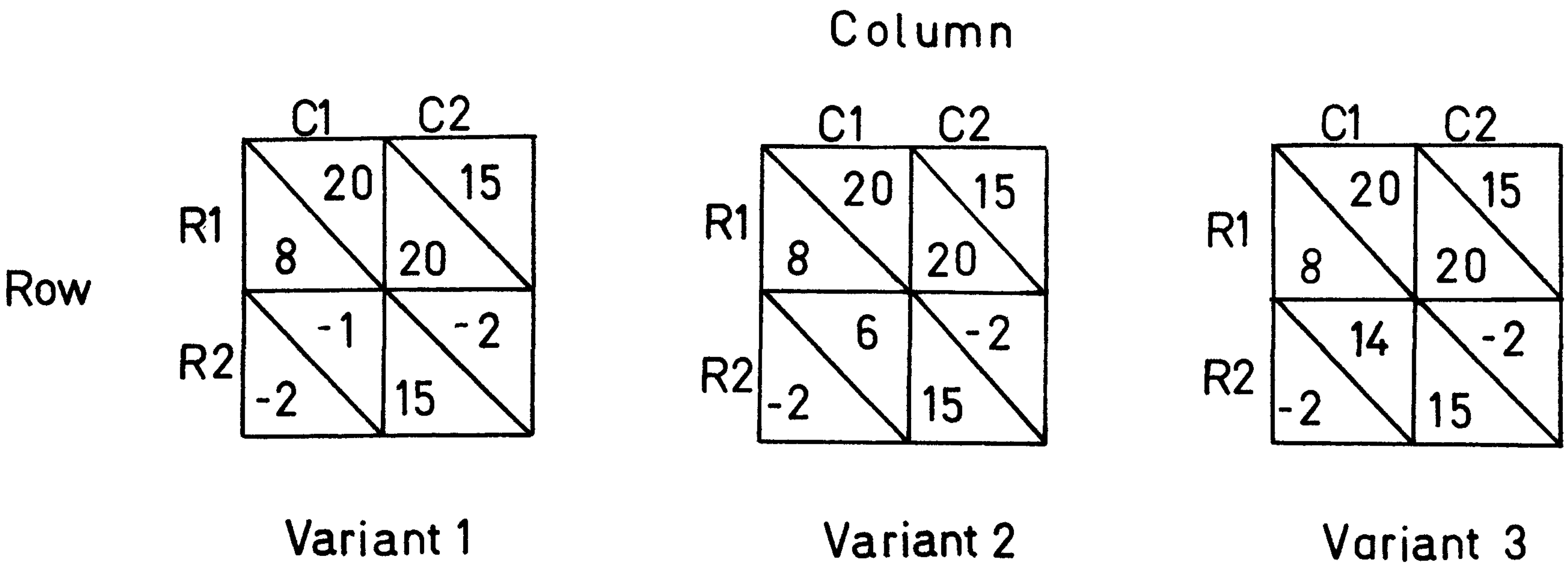


Figure 5. Variants of Game 21 (Santi & Wells)

dent variables were situational and structural in nature. The game was played for 300 trials. Two questions were of prime importance: (a) Does Row use his threat option against Column (R2) in attempting to gain his (Row's) most preferred payoff in the outcome R1C2, and (b) is this use of threat by Row successful in obtaining concessions from Column (a C2 choice)? The mean percentage of each of the four possible outcomes indicated that Row does carry out his threat and that Column does depart from the C1 choice: The mean combined percentages of the outcomes R2C1 and R2C2 and the outcomes R1C2 and R2C2 were 13% and 28% respectively. A high correlation between the frequency of R1C2 and R2C1 outcomes, $\underline{r} = +.83$, $\underline{p} < .05$, suggested that the use of the R2 choice by Row may be successful in gaining concessions from Column. However, R1C2 outcomes occurred more than twice as frequently as R2C1 outcomes (24% vs. 9% respectively) suggesting that appeasement also played a role in Column's concession-making behaviour because Column is making C2 responses in excess of those "demanded" by the use of R2 by Row.

Conditional probabilities also provided data relevant to the two primary questions. The conditional propensity, p(R2/R1C1), or the likelihood that Row will carry out a threat against Column, was .10. The likelihood that Column would appease Row, p(C2/R1C1), was .12. The likelihood that Column would capitulate to Row's threat, p(C2/R2C1), was .23. Evidently, Row does occasionally use threat and Column does make concessions in the form of appeasement or capitulation. The correlations between Row's likelihood of using threat, p(R2/R1C1), and Column's likelihood of appeasement, p(C2/R1C1), indicated that the more likely Row was to use threat, the more likely Column was to appease, $\underline{r} = +.69$, $\underline{p} < .05$. Also, the more likely Row was to use threat, the more likely Column was to capitulate, p(C2/R2C1), $\underline{r} = +.96$, $\underline{p} < .01$.

Santi and Wells (1975) have also supplied data relevant to the effect of Row's behaviour on Column. One hundred and eighty male participants played 125 trials of Game 21 on one of three matrices which varied Row's threat to Column by increasing the discrepancy between Column's payoff at the R1C1 outcome and his payoff should Row choose R2 while Column remained static. The three variants are presented in Figure 5. Row's threat to Column is highest in Variant 1 and lowest in Variant 3. Three communication conditions (forced, optional and no communication) constituted a second independent variable. This variable did not significantly affect gaming behavior.

However, significant variant effects were found. Row's probability of playing an R2 response decreased significantly, $\underline{p} < .001$, from Variant 1 (approximately .60) to Variant 2 (approximately .42) to Variant 3 (approximately .27). Row's propensity to revolt, p(R2/R1C1), and to persist, p(R2/R2C1), and Column's propensity to appease, p(C2/R1C1), also decreased significantly, $\underline{p}$'s $< .05$, as Row's threat to Column decreased. With respect to the appeasement propensity, Variants 1 and 2 differed from 3, $\underline{p} < .05$, but not from each other: Appeasement was greater in variants with high or moderate threat than in a variant with low threat. Thus, predictably, when there was substantial cost to Column when Row carries out a threat, Column was more likely to choose his non-dominant response after and R1C1 outcome more frequently as the use of threat by Row increased. It would appear at first glance that Column was indeed susceptible to changes in the magnitude of Row's threat (noted by Guyer & Rapoport, 1972). An alternative explanation may be that Column's behaviour was in part a function of the Row player's responses to the changes in payoff magnitude.

This interdependence of behaviour is further highlighted by a comparison of the Guyer and Rapoport (1970) and Santi and Wells (1975) studies. Any meaningful comparison must be performed on the differences in behaviour on Variant 2 (no communication condition) of the Santi and Wells experiment. Variant 2 is identical to the matrix used by Guyer and Rapoport, therefore permitting a comparison of the performance of players across the two studies. In the Guyer and Rapoport study, Row selected R1 on 86% of the trials whereas in the Santi and Wells study, Row did so on 47% of the trials. In view of these differences, it might be expected that Column's behaviour would be substantially different. However, in both studies, Column chose his dominant strategy (C1) on 70% of the trials and capitulated, p(C2/R2C1), with a propensity of .23. The largest difference in behaviour occurred with respect to the appeasement propensity, p(C2/R1C1). In the Santi and Wells (1975) study, the propensities for revolt and appeasement were .42 and .41 respectively. In the Guyer and Rapoport (1970) study, these propensities were .10 and .12. It appears that the index of behaviour most affected by changes in Row's behaviour is the appeasement propensity. Is Column appeasing more frequently because Row's behaviour differs between the two studies or do other variables account for the difference? Neither study singularly or in comparison with the other yields a definitive conclusion concerning the effect of one player's behaviour upon the other. To draw such a conclusion requires that the behaviour of one player be placed under experimental control such that evidence for causality, if any, can be gathered.

Guyer and Gordon (cited in Rapoport et al., 1976) reported such an experiment, using Game 19, in which the behaviour of participants was investigated as a function of three Row strategies and three Column strategies. Eighteen pairs of participants played a 100 trial game in each of the following conditions:

(a) as Row against Column's

1. "Adamant" strategy: 100% C1
2. "Tight" strategy: p(C1/a single R1) = .75

   p(C1/a single R2) = 1.00

   In this strategy Column indicates a willingness to share voluntarily but refuses to shift to C2 after Row uses R2.
3. "Semi-yielding" strategy: p(C1/a single R1) = 1.00

   p(C1/a single R2) = .50

   p(C2 a single R2) = .50

   Column refuses to share voluntarily but will shift to C2 after Row uses R2 with a probability of .50.

(b) as Column against Row's

1. "Passive" strategy: 100% R1

2. "Modest" strategy:

p(R1/a single C1) = 1.00

p(R1/two consecutive C1's) = .75

p(R2/two consecutive C1's) = .25

p(R1/three consecutive C1's) = .50

p(R2/three consecutive C1's) = .50

p(R2/four or more C1's) = 1.00

p(R1/C2) = 1.00

This strategy reflects a gradual increase in Row's propensity to select R2 as the number of C1 choices increases.

3. "Demanding" strategy

p(R1/a single C1 or C2) = 1.00

p(R1/two consecutive C1's) = .50

p(R2/two consecutive C1's) = .50

p(R2/three or more consecutive C1's) = 1.00

Row manifests a more rapid increase in the selection of R2.

Five matrices, presented in Figure 6, were used to assess the effects of changes in Row's satisfaction with the R1C1 outcome and Row's cost of threat usage. Row's satisfaction was manipulated by increasing the discrepancy between Row's and Column's payoff at

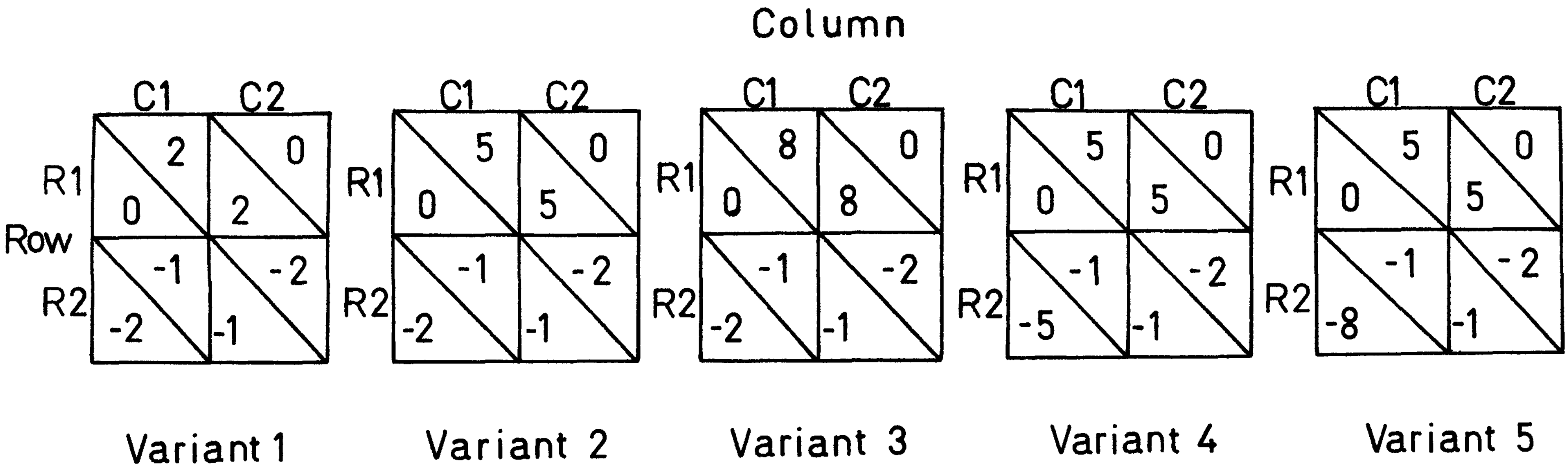


Figure 6. Variants of Game 19 (Guyer & Gordon, cited in Rapoport et al., 1976)

the R1C1 outcome (Varants 1, 2 and 3). Cost of threat usage was manipulated by altering Row's payoff at the R2C1 outcome (Variants 4 and 5). None of the following results was subjected to tests of significance.

The effects of Column's strategies on the probability of non-dominant reponding were slight. The mean probabilities of R2 responding taken across all variants were .21, .20, and .24 for each of the adamant, tight and semi-yielding strategies respectively. The tight strategy evoked less persistence, p(R2/R2C1), than the adamant strategy in Variants 1, 2 and 3. Therefore, Guyer and Gordon surmise that the reduced probability of R2 responses against the tight strategy is attributable to the reduced probability of persistence rather than to a reduced unconditional frequency of R2. The probability that Row would revolt, p(R2/R2C1) was larger in Variants 1, 2 and 3, against the tight strategy than against the adamant strategy (.12 vs. .06 respectively), despite the fact that an R2 choice is completely ineffective against both these strategies. Guyer and Rapoport suggest that Row may believe that Column's occasional sharing in the tight strategy condition is a result of his (Row's) own occasional resort to threat. The structural manipulation affected the probability of R2 responding consistently: Regardless of the programmed strategy, the probability of R2 responding increased as Row became more dissatisfied and decreased as the cost of threat usage became excessive.

The effects of Row's strategies on Column form a less convoluted picture. The probability of C2 responding was lower against Row's passive strategy than against Row's modest and demanding strategies (.16, .28 and .29 respectively). The results are most clear with respect to Column's tendency to appease the Row player, p(C2/R1C1). Across all variants, Row's modest and demanding strategies evoked a higher mean probability of such responses than the passive strategy (.45, .46 and .21 respectively). There was little difference in the mean probability of C2 responding after the R2C1 outcome (capitulation) between Row's modest and demanding strategies. Evidently, Column's behaviour does differ as a function of Row's strategies, especially with regard to voluntary sharing behaviour.

These results are similar to those of Gruder and Duslak (1973) in which the severity of retaliation was manipulated structurally. The study was designed to eliminate those procedural features of previous studies of the effectiveness of pacifist strategies (e.g., Shure et al., 1965) which may have encouraged participants to be extremely competitive. The threat-vulnerable game used in the experiment is displayed in Figure 7. Participants played against one of three programmed strategies: (a) nonretaliatory, (b) low retialiatory, and (c) high retaliatory. A nonretaliatory opponent chose Row 1 on every trial thereby leaving himself open to exploitation by the participant (who could consistently choose C1). The opponent never used the potential threat inherent in the matrix by which he could lower Column's payoff by 20 points

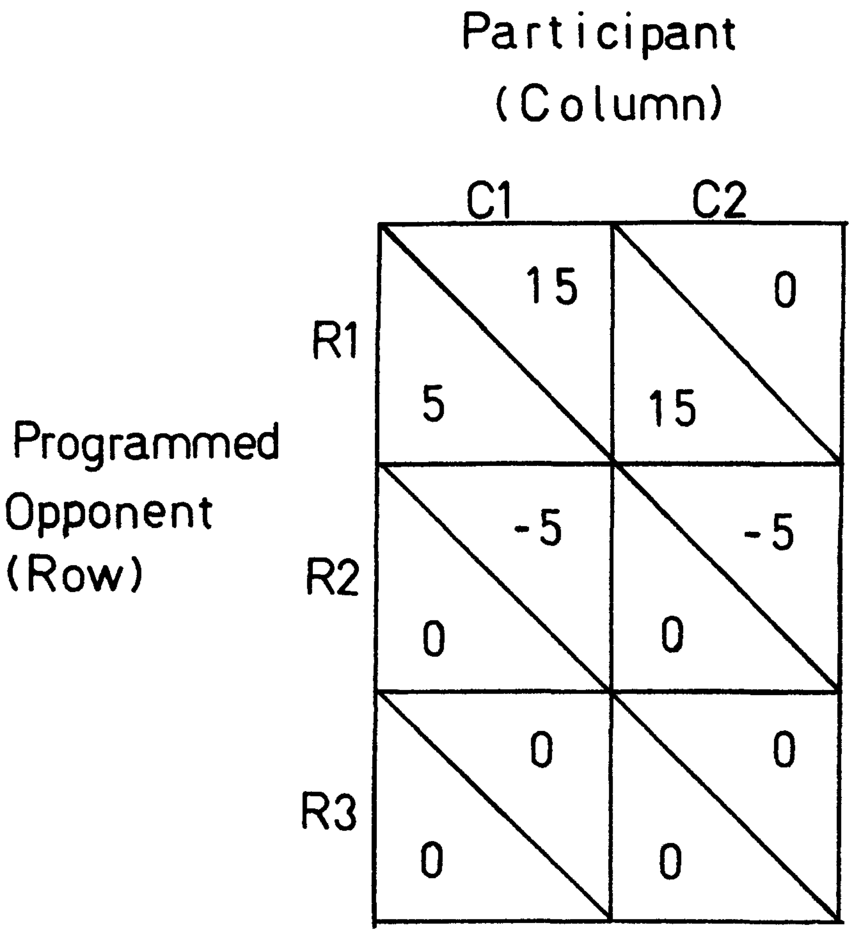


Figure 7. Mixed-Motive Threat-Vulnerable Game (Gruder & Duslak, 1973)

and possibly induce Column to play C2. The low retialiatory opponent chose R1 unless the participant chose C1 more than once consecutively, in which case R3 was chosen until the player shifted to C2. The simulated opponent thereby reduced his own and Column's payoffs for failure to alternate between C1 and C2 choices. Such alternating behaviour represented non-exploitative behaviour. In the high retaliatory condition, the programme substituted R2 for R3 in the low retaliatory strategy. Therefore Column's failure to alternate reduced his total point payoff by 5 points. At first glance it would appear that the low and high retaliatory strategies did not differ in the frequency of retaliation but did differ in the severity of threat (R2 vs. R3 choices). No data were presented to determine whether the two strategies in practice did differ in the frequency of retaliatory choices. Of course, these two strategies did differ in the frequency of retaliation from the nonretaliatory strategy. The measure of cooperation was the number of times the participant chose C2. Results indicated that the low retaliatory strategy elicited more cooperative responding than the high retaliatory strategy, which elicited more than the nonretaliatory strategy. These differences increased over trials. A second experiment was conducted in which the severity of retaliation (low or high, as manipulated structurally), and the presence of retaliation were the two variables. As in Experiment 1, results indicated that no retaliation elicits fewer cooperative responses than either the high or low retaliatory strategies.

In summary, both the Gruder and Duslak (1973) and the Guyer and Gordon (cited in Rapoport et al., 1976) experiments indicated that when the effects of a passive noncontingent strategy were compared to those of a contingent more demanding strategy in threat-vulnerable games, the former strategy produced a lower frequency of non-dominant responding and, in the latter study, a lower propensity to share voluntarily (appease). Therefore these two strategies differed with respect to both the frequency and contingency of threat, making statements about the effects of threat frequency alone tenuous.

Overview of Experimental Design

Guyer and Rapoport (1970) did indicate that the behaviour of either a Row or a Column player in Game 21 is influenced by the behaviour of their opponent. The comparison between this and the Santi and Wells (1975) study suggested that a change in the behaviour of the Row player may be suspected as having an effect on the behaviour of the Column player, particularly as measured by the appeasement propensity, p(C2/R1C1).

The effect of the Row player's behaviour on the Column player's behaviour was investigated by Gruder and Duslak (1973) and by Guyer and Gordon (cited in Rapoport et al., 1976) who, by placing the frequency of threat usage by Row under experimental control, demonstrated that the probability of non-dominant responding by Column is higher against a Row player who uses threat than against one who does not. The probability of making a C2 response after an R1C1 outcome (appeasement) was also shown to be higher against a more demanding Row player (Guyer & Gordon, cited in Rapoport et al., 1976). In both these studies, the passive (100% R1 strategy) was noncontingent in contrast to the more demanding strategies. In view of previous Prisoner's Dilemma game research which indicated that contingent strategies produce more cooperative responding than noncontingent strategies, even when the overall level of programmed cooperative responding is identical (e.g., Crumbaugh & Evans, 1967; Downing et al., 1975), it is possible that previously observed differences in Column's behaviour as a function of the frequency of threat usage by Row, are actually either partially or wholly attributable to differences in contingency between the Row strategies.

The primary purpose of the present experiment was to separate the respective effects of threat frequency and contingency in a threat-vulnerable game. A second purpose was to examine the stability of these effects when strategies were altered in the final 75 trials of the game. That is, are the effects stable regardless of which strategy was experienced during the initial 75 trials of a 150 trial game? To answer these questions, participants played against one of nine programmed stragegy sequences: all possible pairwise orderings of passive (P), demanding contingent (DC), and demanding noncontingent (DNC) strategies. These nine sequences are placed into a conceptual framework in Figure 8. "Initial strategy" refers to the first 75 trials of a 150-trial game. Cells are numbered in order to facilitate later discussion of the pairing of cells for the purpose of yoking the demanding strategies.

Initial Strategy	Final Strategy* P	Final Strategy* DC	Final Strategy* DNC
P	1 P P	2 P DC	3 P DNC
DC	4 DC P	5 DC DC	6 DC DNC
DNC	7 DNC P	8 DNC DC	9 DNC DNC

* P = Passive Strategy
DC = Demanding Contingent Strategy
DNC = Demanding Noncontingent Strategy

Figure 8. Cells in Experimental Design

The P strategy consisted of continual R1 responding on the part of the programmed opponent. The following response contingencies (as in Guyer and Gordon, cited in Rapoport et al., 1976) were operative during the administration of the DC strategy:

p(R1/a single C1 or C2) = 1.00

p(R1/two consecutive C1's) = .50

p(R2/two consecutive C2's) = .50

p(R2/three or more consecutive C1's) = 1.00

The identical response was simultaneously delivered to the participants who received the yoked DNC strategy.

The primary question was whether the frequency of threat usage or threat contingency (or both) was the critical determinant of Column's choice behaviour. This was addressed by a comparison of the first 75 trials of the initial P (cells 1, 2, and 3), initial DC (cells 4, 5, and 6), and the initial DNC (cells 7, 8, and 9) strategies. This was a one-way analysis of concurrent strategy effects.

If threat frequency alone is the prime determinant of Column's behaviour, the P strategy should differ significantly in its effects from both the DC and DNC strategies which themselves should not differ. If this is the case, then the direction of the findings were expected to be the same as in the Gruder and Duslak (1973) and the Guyer and Gordon (cited in Rapoport et al., 1976) studies: the higher the frequency of threat usage, the higher the probability of concessions (probability of non-domiant responding and appeasement) by Column.

If threat contingency alone is the prime determinant of Column's behaviour, the DC strategy should differ significantly from both the DNC and P strategies. However, the DNC and P strategies should not differ significantly. The DC strategy was expected to evoke a higher probability of concessions from Column than either the DNC or P strategies on the basis of the results of studies using the Prisoner's Dilemma game which indicated that contingent strategies produced more cooperative responding than noncontingent strategies having the same overall level of programmed cooperation (e.g., Crumbaugh & Evans, 1967).

If both threat frequency and threat contingency are important determinants of Column's behaviour, significant differences were expected between all comparisons of the three strategies. If this is the case, two possible orderings of the results are DC > DNC > P or P > DNC > DC. However, the former ordering is a more likely outcome given the previous results of Gruder and Duslak (1973) and Guyer and Gordon (cited in Rapoport et al., 1976). The finding that both threat frequency and contingency are important determinants of Column's behaviour would offer an explanation as to why previous studies have found that demanding strategies produced more concessions by Column than passive strategies.

Lastly, if neither threat frequency nor contingency affect Column's behaviour, there should be no significant differences among all comparisons of the three strategies. Such an outcome would be most unlikely given that previous studies do indicate that passive and demanding strategies differentially affect the behaviour of the Column player (Gruder & Duslak, 1973; Guyer & Gordon, cited in Rapoport et al., 1976).

To determine the effects of previous experience with a particular strategy (P, DC, or DNC) on each of the final strategies, the final 75 trials of all cells were compared to one another in a 3 (initial strategy) X 3 (final strategy) design.

If previous experience regardless of the particular initial strategy has no effect upon Column's behaviour, comparisons between the means of the final strategy conditions should reveal the same results as the between participants analyses conducted on the first 75 trials. However, if the type of initial strategy experienced does have an effect upon Column's behaviour which differs as a function of the particular final strategy, then a significant initial X final strategy interaction should occur. That previous experience does affect the behaviour of players has been demonstrated using the Prisoner's Dilemma game (Harford & Hill, 1967; Harford & Solomon, 1967; Smith et al., 1975). No studies have examined these effects in threat-vulnerable games.

Method

Participants

Ninety male students enrolled in undergraduate courses at Wilfrid Laurier University during the period January to August 1978, served as participants. They were randomly assigned to the nine strategy conditions using a block randomized procedure.

Ten participants had to be replaced because they or their partners (participants were run in pairs) indicated on the post-experimental questionnaire that they did not accept the experimental manipulation. Two such pairs occurred in cell 1. The others were unsystematically distributed over three cells.

Overview of Experimental Situation

Two participants were seated in separate rooms which visually and accoustically isolated them from each other and from the experimenter. Each room contained a game console on which there were two response buttons, a display window (on which the matrix was placed) a counter which automatically recorded the participant's own scores, and a "go-light." The label "Player B" was placed above each participant's go-light. Each room also contained a tape-recorder.

In order to yoke the DNC strategy condition to the DC strategy condition for either 75 or 150 trials, the following cells of the design were run simultaneously: cells 2 and 3, cells 4 and 7, cells 5 and 9, and cells 6 and 8. All cells were filled at a comparable rate.

The Game

Game 21 was used rather than Game 19 in order to investigate the possibility that the use of threat and the appeasement propensity are positively related (Guyer & Rapoport, 1970; Santi & Wells, 1975). This relationship was also indicated by Guyer and Gordon (cited in Rapoport et al., 1976). To facilitate comparisons between these studies the assignment of payoffs to the game as defined by the ordinal ranking of payoffs was identical to Guyer and Rapoport (1970) and Variant 2 of the Santi and Wells (1975) study. The game matrix is presented in Figure 9.

Procedure

As soon as both participants were seated, the experimenter individually drew their attention to a typed set of instructions and informed each that he could read along as the instructions were delivered by the tape-recorder. A transcript of the instructions can be found in Appendix A. Participants were told that the experiment was concerned with "how people make simple decisions in a two-person situation which has payoffs." They were also told that the payoff depended both "on what you do and what the other person does." Following Guyer and Rapoport (1970), all participants were given an individualistic orientation. They were told, "your goal in the game is to make as many points as possible for yourself without regard to the number of points earned by the other." Lastly, all participants were informed that, "at the end of the game, for every 10¢ showing on your counter, you will receive 1¢."

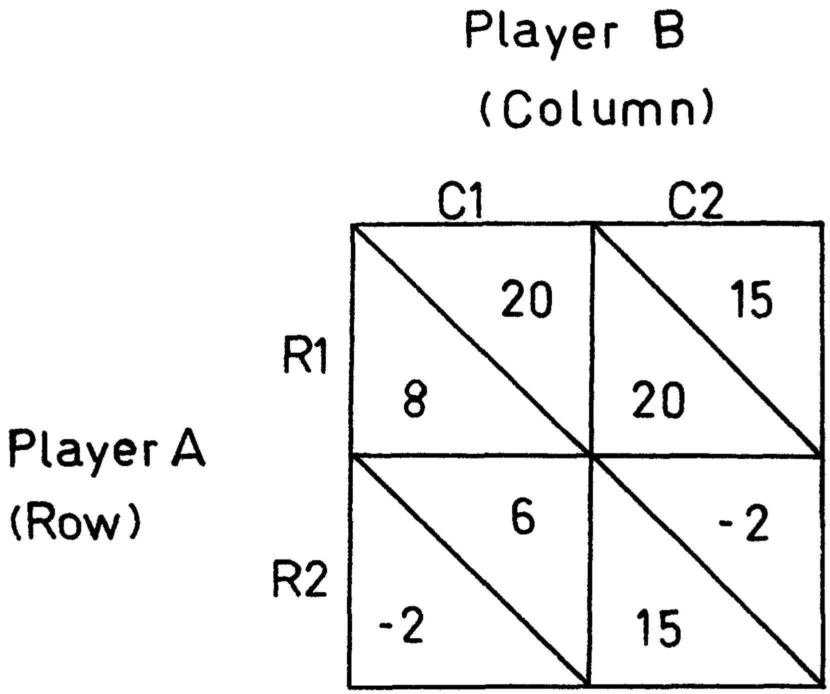


Figure 9. Game 21 Matrix

Participants were probed to ensure that they understood the ramifications of making each choice available dependent upon the other's choices. This was accomplished by asking two questions:

If you make Response 1 and the other person makes Response 2, how many points do you get. . . how many points does he get?

If you make Response 2 and the other person makes Response 1, how many points do you get . . . how many does he get?

If a participant answered incorrectly, the experimenter repeated the instructions and asked the questions once again.

Participants were then asked: If your counter reads 1430 points, how much money will you receive?

Upon completion of the probe, the game began. The start of a trial was indicated by a red go-light. The participant made a response by pushing Response 1 or Response 2. The responses of both players and the experimenter were recorded by an event recorder. Feedback on each trial was provided by a 5 sec illumination of the appropriate quadrant of each participant's matrix as determined by the joint choices of the individual participant and the experimenter. During this 5 sec visual display, the participant's own points were automatically accumulated and displayed on a counter. There was a 5 sec delay between the termination of feedback and the onset of the red go-light. Therefore, the inter-response interval was approximately 11 sec. There were 150 trials of the game.

Description of Programmed Strategy Sequences

When a DC strategy for either 75 or 150 trials was to be delivered, the following response contingencies were operative in order to conform to the strategy used by Guyer and Gordon (cited in Rapoport et al., 1976).

p(R1/a single C1 or C2) = 1.00

p(R1/two consecutive C1's) = .50

p(R2/two consecutive C1's) = .50

p(R2/three or more consecutive C1's) = 1.00

Programmed responses were delivered on a one-trial lag basis. An R1 response was always delivered on trial 1. For example, if on trials 1 and 2, C1 responses were made by the participant, the probability of an R2 response being delivered on Trial 3 was .50.

An alternator (Lehigh Valley Electronics, Model No. 241-05) was used to determine with a 50/50 probability whether an R1 or an R2 response was delivered following two consecutive C1 responses on the part of the participant. The identical response was simultaneously delivered to the participant in the DNC yoked group. When two players were present who had been assigned to a condition receiving the P strategy for either 75 or 150 trials, the experimenter delivered continual R1 responses. Six of the nine strategy sequences required a change in strategy. This began on trial 76.

At the end of the game, all participants were given a post-experimental questionnaire (see Appendix B) which queried each as to what he thought of the other player and what he thought the experimenter was trying to find out in the experiment. Once this had been completed the participants were given cash based on their point total. The maximum any one participant could earn was $3.00. This amount was attainable only if the player chose C1 on every trial against a 150 trial P strategy. Each participant was also asked to sign his name and address on an envelope so that at a later date he would receive a summary of experimental findings. Care was taken to impress upon each participant that the procedure of the experiment should not be divulged until he had received the results.

Results

All analyses, including tests of simple main effects and multiple comparisons were performed on arcsin transformed data. This transformation is useful when the means and variances are proportional and the observations have a binomial distribution (Kirk, 1968; Winer, 1962). Inspection of these data suggested that in fact means and variances were proportional.

Overall Trends in Outcome Frequencies

Table 1 shows the distribution of the four outcomes for the initial strategy conditions. These data were derived solely from the first 75 trials of the initial P, DC and DNC cells. Table 2 shows the distribution of the four outcomes for the three final strategy conditions. These tables are presented to provide an overview of gross trends in the data. The following presentation of these data is intended to serve a descriptive function, the importance of any observations being contingent upon subsequent statistical tests which appear in later sections.

Both tables show that the outcomes R1C2 and R2C2 occur infrequently regardless of whether these data are derived from the initial or final strategy conditions. These two outcomes require a C2 response on the part of the participant. The C1 response appears to have been made more frequently as seen in the much higher mean percentages of the R1C1 and R2C1 outcomes.

A second trend is also evident: The occurrence of the R1C1

Table 1

Mean Percentages of the Four Outcomes for the

Initial P, DC, and DNC Strategy Conditions

	Quadrant Outcome			
	1 Natural (R1C1)	2 Sharing (R1C2)	3 Threat (R2C1)	4 Concession (R2C2)
P	84.7	15.3	----	----
DC	38.4	12.5	38.4	10.7
DNC	40.6	10.3	40.2	8.9

Note. Quadrants 3 and 4 are undefined for the Passive strategy condition.

Table 2

Mean Percentages of the Four Outcomes for the

Final P, DC and DNC Strategy Conditions

	Quadrant Outcome			
	1 Natural (R1C1)	2 Sharing (R1C2)	3 Threat (R2C1)	4 Concession (R2C2)
P	89.0	11.0	----	----
DC	33.6	18.4	38.8	9.2
DNC	40.6	10.8	41.8	6.8

Note. Quadrants 3 and 4 are undefined for the Passive strategy condition.

outcome is highest in the P strategy condition followed by the DNC and DC strategy conditions regardless of whether the strategy condition is final or initial. Therefore, the C2 response occurs more frequently in the DC strategy condition than in the other two strategy conditions.

Initial Strategy Effects

The primary analysis of initial strategy effects across the first 75 trials was directed toward determining whether one or both of threat frequency or threat contingency are important determinants of the Column player's behaviour.

The mean probability of non-dominant responding (C2 responding) in the three initial strategy conditions is presented in Table 3. The mean probability of C2 responding was low in all conditions as reflected previously by the overall trends in outcome frequencies. A one-way analysis of variance revealed no significant effect of strategy condition, $\underline{F}(2,87) = 2.68$, $\underline{p} > .10$.

The probability of non-dominant responding is not as sensitive a measure as the stochastic measures of appeasement, p(C2/R1C1), and capitulation, p(C2/R2C1), which are conditionalized on the R1C1 and R2C1 outcomes respectively.

Stochastic measures refer to the probability of a certain response occurring on trial $\underline{n}$ given that a certain outcome had occurred on trial $\underline{n}$ - 1. A general way of symbolizing such a probability is p(C1/R1C1). This represents "the probability of a C1 response given an R1C1 outcome on the previous trial." Precisely

Table 3

Means and Standard Deviations of the
Probability of Non-Dominant Responding Across Initial
Strategy Conditions

	Strategy Condition		
	P	DC	DNC
Mean	.153	.232	.192
Standard Deviation	.187	.135	.191

because these measures are conditionalized they more directly "tap" the responses of the Column player to the behaviour of the Row player. Four outcomes are possible in any 2 X 2 game. For any one stochastic measure to be defined for a player, the frequency of a particular quadrant outcome must exceed the criterion number (3 or more). It was necessary to estimate conditional probabilities when the number of opportunities (i.e., quadrant outcomes) was insufficient. The mean conditional probability of those Column players for whom the number of quadrant outcomes was sufficient was assigned to those players for whom the number of quadrant outcomes was insufficient. The effect of estimation was considered slight. For example, only 1/90 observations for the appeasement propensity were estimated (1.1%) before the analysis of initial strategy effects was performed. Due to the small number of estimations made with respect to the appeasement, p(C2/R1C1), and capitulation, p(C2/R2C1), measures, it is unlikely that the concomitant reduction of within-cell variances resulted in significant positive bias in the analyses of variance.

The very infrequent occurrence of the R1C2 and R2C2 outcomes which are necessary to obtain reliable estimates of the generosity, p(C2/R1C2), and doublecross, p(C1/R2C2), propensities made estimation prohibitive. During the initial 75 trials, the frequency of the R1C2 outcome did not exceed the criterion number for 34 out of a total of 90 participants. The frequency of the R2C2 outcome did not exceed the criterion number for 15 out of a total of 60 participants. Descriptive statistics for these propensities across the initial strategy conditions are presented in Appendix C.

Appeasement propensities, p(C2/R1C1), in the initial strategy conditions appear in Table 4. A one-way analysis of variance revealed a significant effect of initial strategy condition, $F(2,87) = 8.33$, $p < .01$. A Newman-Keuls test indicated that the propensity for appeasement was significantly higher, $p < .05$, in the DC strategy condition than in both the P and DNC strategy conditions which themselves did not differ significantly, $p > .05$. That the DNC strategy condition did not differ significantly from the P strategy condition is direct evidence that the frequency of threat alone is not the prime determinant of the Column player's propensity to appease. Rather, the analysis indicates that contingency is the prime determinant of the Column player's propensity to appease during the initial 75 trials of the game.

A comparison of the effects of the DC and DNC strategy conditions on the capitulation propensity, p(C2/R2C1), also tended to support the finding that the contingency of threat affects the Column player's behaviour. Capitulation propensities in the initial strategy conditions appear in Table 5. Capitulation is not defined for the P strategy. A one-way analysis of variance revealed a significant effect of initial strategy condition, $F(1,58) = 11.18$, $p < .01$. The capitulation propensity was significantly higher in the DC strategy condition than in the DNC strategy condition. These two strategy conditions differed only in the contingency of threat.

Table 4

Means and Standard Deviations of the Appeasement Propensity, p(C2/R1C1), Across Initial Strategy Conditions

	Strategy Condition		
	P	DC	DNC
Mean	.111	.255	.114
Standard Deviation	.138	.231	.106

Note. 1.1% of the appeasement data is estimated (1/90 observations).

Table 5

Means and Standard Deviations of the Capitulation Propensity, p(C2/R2C1), Across Initial Strategy Conditions

	Strategy Condition	
	DC	DNC
Mean	.342	.157
Standard Deviation	.234	.163

Note. 3.3% of the capitulation data is estimated (2/60 observations).

Therefore, the observed difference is attributable to the threat contingency variable.

The results of the analysis of initial strategy effects leads to the tentative conclusion that threat contingency alone is the prime determinant of the Column player's behaviour, particularly the propensity to appease.

Final Strategy Effects

The purpose of these analyses was to examine the stability of the above results when participants have been exposed to the various initial strategy conditions treated as treatments. Only data derived from the final 75 trials were subjected to analyses.

The mean probability of C2 responding during the final 75 trials is presented in Table 6 as a function of both initial and final strategy conditions. Regardless of the initial strategy condition, the mean probability of C2 responding was highest in the final DC strategy condition followed by the final DNC and P strategy conditions in that order. The mean probability of occurrence of non-dominant responding associated with the final P, DC and DNC strategy conditions were .110, .276, and .176 respectively. A 3 X 3 analysis of these data revealed a significant main effect of final strategy, $\underline{F}(2,81) = 8.27$, $\underline{p} < .01$ (see Appendix D for ANOVA Table). A Newman-Keuls test indicated that all comparisons within this main effect were significant, $\underline{p} < .05$. There was no significant effect of initial strategy, $\underline{F}(2,81) = 1.54$, $\underline{p} > .10$, and also no significant initial X final strategy interaction, $\underline{F} < 1$. These results indicate

Table 6

Means and Standard Deviations* of the

Probability of Non-Dominant Responding as a Function of

Initial and Final Strategy Conditions

Initial Strategy	Final Strategy		
	P	DC	DNC
P	.081 (.195)	.205 (.137)	.125 (.135)
DC	.053 (.142)	.343 (.091)	.189 (.153)
DNC	.195 (.245)	.279 (.311)	.215 (.238)

*Standard deviations in Parentheses

that both threat frequency and contingency are important determinants of the Column player's probability of non-dominant responding during the final 75 trials of the game. This appears to be independent of the initial strategy conditions.

Only two of the more sensitive stochastic measures could be examined: appeasement, p(C2/R1C1), and capitulation, p(C2/R2C1). During the final 75 trials, the number of R1C2 outcomes did not exceed the criterion number (3 or more) for 42 out of a total of 90 participants. Therefore, the generosity propensity, p(C2/R1C2), was not submitted to analysis. With respect to the doublecross propensity, p(C1/R2C2), the number of R2C2 outcomes did not exceed the criterion number for 22 out of a total of 60 participants. Descriptive statistics for these two propensities as a function of initial and final strategy conditions are presented in Appendix E.

The appeasement propensities during the final 75 trials are presented in Table 7 as a function of both initial and final strategy conditions. The propensities of the final DC and DNC strategy conditions are similar and both are higher than the propensities of the final P strategy conditions. These data were submitted to a 3 X 3 analysis of variance (see Appendix F for ANOVA Table). This analysis revealed a significant main effect of final strategy condition, $F(2,81) = 6.42$, $p < .01$. A Newman-Keuls test indicated that the DC and DNC strategy conditions differed significantly from the P strategy condition, $p < .05$, but not from each other. This finding suggests that during the final 75 trials, threat frequency alone

Table 7

Means and Standard Deviations* of the

Appeasement Propensity, p(C2/R1C1), as a Function of

Initial and Final Strategy Conditions

Initial Strategy Condition	Final Strategy Condition P	DC	DNC
P	.105 (.240)	.143 (.117)	.155 (.134)
DC	.039 (.089)	.389 (.315)	.316 (.319)
DNC	.135 (.168)	.181 (.162)	.194 (.202)

Note. 2.2% of the appeasement data is estimated (2/90 observations).

* Standard deviations in parentheses

is the prime determinant of this measure of the Column player's behaviour rather than threat contingency which exerted an effect during the initial 75 trials. There was no significant main effect of initial strategy condition, $F(2,81) = 1.57$, $p > .10$, and also no significant initial X final strategy interaction, $F(4,81) = 2.06$, $p > .10$. Therefore, participant's levels of appeasement during the final 75 trials appeared to be independent of the strategy condition experienced during the initial 75 trials.

The capitulation data during the final 75 trials as a function of initial and final strategy conditions are presented in Figure 10. These data were submitted to a 3 X 2 analysis of variance to determine delayed strategy effects (see Appendix G for ANOVA Table). The analysis revealed a significant main effect for initial strategy, $F(2,54) = 4.29$, $p < .05$, a significant main effect for final strategy, $F(1,54) = 14.61$, $p < .01$, and a significant initial X final strategy interaction, $F(2,54) = 5.36$, $p < .01$. The interaction is displayed in Figure 10. A test of simple main effects revealed a significant difference, $p < .05$, for the capitulations propensity between the final DC and final DNC strategy conditions when the initial strategy condition was P or DC, but not when the initial strategy condition was DNC, $F < 1$. When the initial strategy condition was P or DC, the capitulation propensity was significantly higher in the final DC strategy condition. Therefore, there was an effect of threat contingency on the capitulation propensity when the initial 75 trials were either P or DC. The test

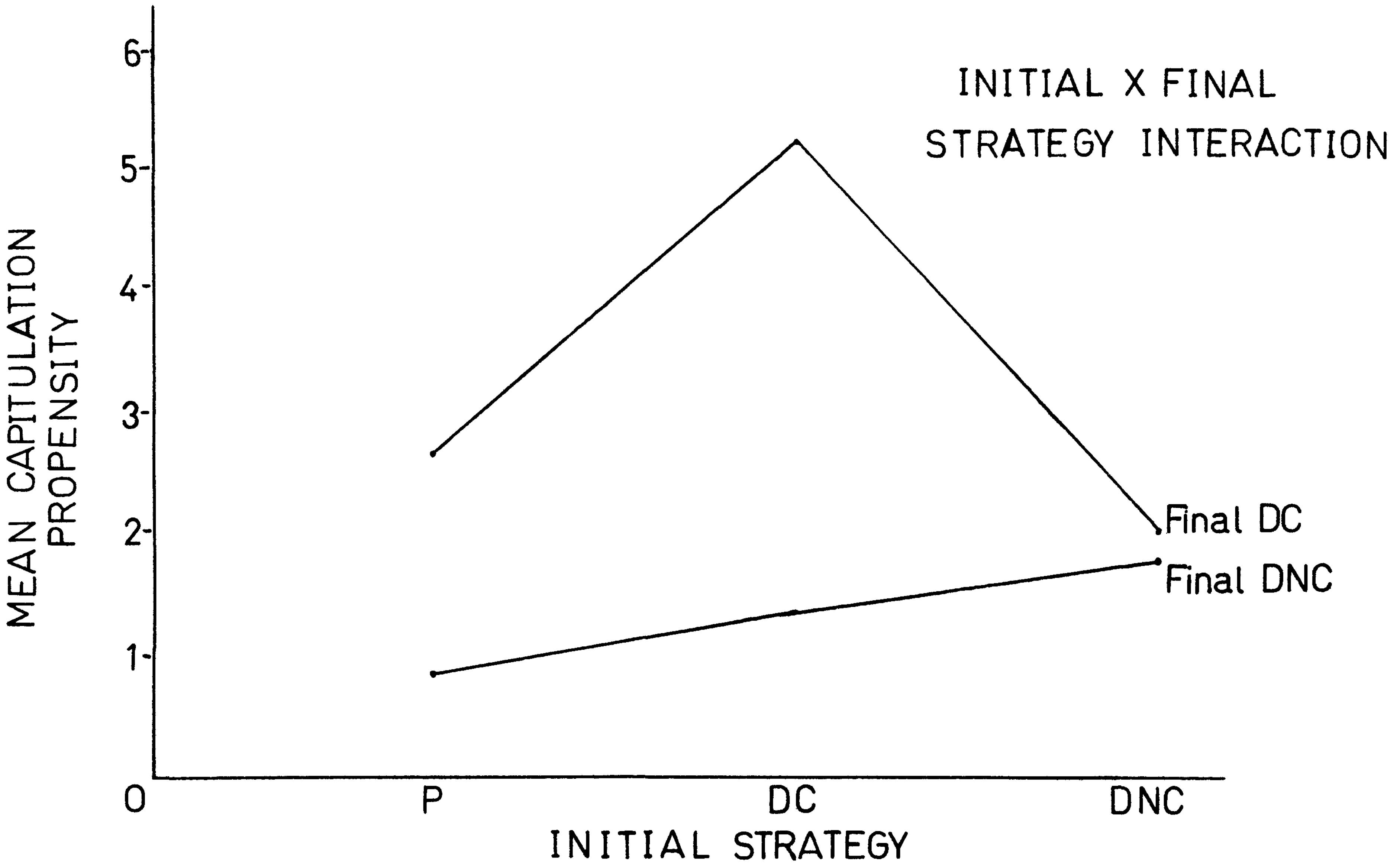


Figure 10. Initial X Final Strategy Interaction for the Capitulation Propensity, p(C2/R2C1)

of simple main effects also indicated that the level of capitulation in the final DC strategy condition varied significantly, $p < .01$, as a function of the initial strategy condition, while the level of capitulation in the final DNC strategy condition did not significantly vary across initial strategy conditions, $F < 1$. A Newman-Keuls test indicated that the level of capitulation in the initial DC-final DC strategy condition (.527) was significantly higher, $p < .05$, than the capitulation levels of both the initial P-final DC (.262) and initial DNC-final DC (.201) strategy conditions which themselves did not differ significantly, $p > .05$. The lack of an effect of threat contingency when the initial strategy condition was DNC may be attributable to participants in the initial DNC - final DC condition simply not detecting the change in contingency.

Questionnaire Data

A factor analysis of the 24-item postexperimental questionnaire was carried out in order to reduce these data to a set of underlying dimensions or factors. The factor scores were subjected to a 3 X 3 analysis of variance to determine whether differences in questionnaire responses were attributable to the particular strategy sequence experienced.

Principal factoring with iterations generated seven factors from the 24 items. These factors were orthogonally rotated using a varimax solution (Nie et al., 1975). The first three factors accounted for 76.7% of the total variance (45.9%, 21.5% and 9.2% respectively). Factor 4 ("Cleanliness") accounted for an additional

7.6% of the variance, but was not viewed as related to game-playing behaviour. Therefore, only the factor scores for the first three factors were submitted to an analysis of variance. Table 8 presents the items which had factor loadings greater than or equal to .50 on the three factors.

Factor 1 was labelled "Evaluative" on the assumption that the items reflected the participant's impression of the other's general disposition as revealed during the course of the game. Items representing Factor 2 appear to be related to the participant's judgement of the other's game-playing style or ability and this factor was therefore labelled "style". Factor 3 ("Calmness") was so labelled because of the apparent nature of the two items "calm-agitated" and "tense-relaxed".

Factor 1, 2 and 3 scores were submitted to separate analyses of variance which indicated a significant final strategy main effect for Factor 3 scores only, $\underline{F}(2,81) = 3.35$, $\underline{p} < .05$ (see Appendix H for ANOVA Table). The mean Factor 3 scores for the final strategy main effect were 0.3495, -0.2200, and -0.1294 for the final P, DC and DNC strategy conditions respectively. A Newman-Keuls test revealed that opponents using a passive strategy during the last 75 trials were perceived as being significantly more calm than opponents using either a DC or DNC strategy which themselves did not significantly differ, $\underline{p} > .05$. With the exception of Factor 3, it appears that the Column player's perception of the opponent does not vary significantly as a function of the opponent's game-playing

Table 8

Items Associated with Derived Factors

Item	Factor Loading
Factor 1: Evaluative	
Warm-Cold	.51
Pleasant-Unpleasant	.69
Honest-Dishonest	.71
Untrustworthy-Trustworthy	.64
Good-Bad	.72
Nice-Awful	.78
Hostile-Friendly	.83
Peaceful-Ferocious	.50
Happy-Sad	.58
Factor 2: Style	
Intelligent-Unintelligent	.60
Weak-Strong	.53
Cowardly-Brave	.61
Active-Passive	.84
Competitive-Noncompetitive	.73
Factor 3: Calmness	
Calm-Agitated	.85
Tense-Relaxed	.62

behaviour in this experiment.

Supplementary Analyses

Three one-way analyses of variance for the final 75 trials of the game were performed on each of the following three dependent measures across cells 1, 5 and 9 in which participants had experienced one of the P, DC or DNC strategies for the entire 150 trial game: (a) the probability of non-dominant responding, (b) the appeasement propensity, and (c) the capitulation propensity. Descriptive data for these supplementary analyses are presented in Table 9. All data were arcsin transformed prior to analyses.

The analysis of the probability of non-dominant responding data revealed a significant effect of strategy condition, $F(2,27) = 6.30$, $p < .01$. A Newman-Keuls test indicated that the probability of non-dominant responding was significantly lower, $p < .05$, in the P strategy condition than in both the DC and DNC strategy conditions which themselves did not differ significantly, $p > .05$, suggesting that the frequency of threat is the prime determinant of final C2 responding over the final 75 trials of the game.

A significant effect of strategy condition was also revealed on both the more sensitive appeasement and capitulation propensities, $F(2,27) = 4.29$, $p < .05$, and $F(1,18) = 18.31$, $p < .01$, respectively. A Newman-Keuls test indicated that the appeasement propensite was significantly lower, $p < .05$, in the P strategy condition than in the DC strategy condition but was not significantly lower

Table 9

Means and Standard Deviations* of the Probability of Non-Dominant Responding, Appeasement and Capitulation Propensities Across the Final 75 Trials of Cells 1, 5, and 9

Dependent Measure	Strategy Condition		
	P	DC	DNC
Probability of Non-Dominant Responding	.081 (.195)	.343 (.091)	.215 (.238)
Appeasement Propensity	.105 (.240)	.389 (.315)	.194 (.202)
Capitulation Propensity**	----	.527 (.189)	.179 (.179)

* Standard deviations in parentheses

**10% of the capitulation data is estimated (2/20 observations) than in the DNC strategy condition, $p > .05$. The DC and DNC strategy conditions were only marginally significantly different, $p < .10$. The capitulation propensity was significantly higher in the DC strategy condition than in the DNC strategy condition. For the unchanged strategy conditions, it appears that when two strategies differ with respect to both threat frequency and contingency, there is a significant difference in the Column player's propensity to appease.

Discussion

The primary purpose of this experiment was to separate the respective effects of threat frequency and threat contingency in a threat-vulnerable game. A second purpose was to examine the stability of these effects when strategies were altered in the final 75 trials of the game.

The essential features of any operational definition of threat include (a) the communication of an intention to do something detrimental to the interests of the other (Deutsch & Krauss, 1962; Tedeschi, Bonoma, & Brown, 1971), and (b) the ability to carry out the threatened punishment contingent upon noncompliance by the other (Black & Higbee, 1973; Kelley, 1965; Tedeschi et al., 1971). In explicit threat situations, communication of such contingent threats is achieved by sending a message in the form of an if-then statement. Punishment is exacted by taking points from the other player's total. In tacit (structural) threat situations, communication of such threats is made via choice behaviour.

In Game 21, the operational definition of threat (an R2 choice) is consistent with the view held by game theorists that threat is a strategic move which is used by a player with the intention of influencing another player's behaviour (Schelling, 1960). The Row Player can induce the other player to shift to C2 if the other can be made to see that it is to his advantage to do so rather than to suffer the consequences of the Row player shifting. Inducement is the potential use of an R2 choice. If, after a number of Cl responses by the Column player, the Row player uses threat, it can be said that the use of the R2 choice communicates a contingency which may influence the behaviour of the threatened player.

In the present study, a Row player who never used threat was said to be playing a passive strategy. The Row player was a passive player in the sense that he was continually and unconditionally cooperative He allowed the Column player to obtain his most preferred payoff indefinitely while he himself did not (a) attempt to induce a shift, or (b) exact punishment for failure to shift, in order to obtain his own most preferred payoff. Such nonuse of the power to exert control over his own payoffs is identical to the behaviour of pure pacifists in other threat-vulnerable games (Gruder & Duslak, 1973; Guyer & Gordon, cited in Rapoport et al., 1976; Rapoport et al., 1971).

A programmed strategy of 100% cooperative responding in a Prisoner's Dilemma game is also a passive strategy in that the unconditionally cooperative player allows the other to obtain his most preferred payoff on every trial. There is, however, no threat in a Prisoner's Dilemma game because the use of the individually rational choice (the payoff on any trial) does not serve to induce a shift on the part of the other player. This difference in structure between the two games may account for the finding that, in the Prisoner's Dilemma game, the passive 100% cooperative strategy evokes more cooperative responding on the part of participants than very low levels of programmed cooperation, whereas in Game 21, the passive strategy evokes less "sharing" behaviour than the more demanding strategies.

In both non-matrix gaming situations (e.g., Shure et al., 1965; Vincent & Tindell, 1969), and in threat-vulnerable game studies (Gruder & Duslak, 1973; Guyer & Gordon, cited in Rapoport et al., 1976), the pacifist strategy has not been successful in inducing cooperation. In threat-vulnerable games, when the passive noncontingent strategy was compared to the more demanding and contingent strategies, the passive strategy evoked both a lower probability of non-dominant responding by the Column player and a lower probability of appeasement.

The inclusion of the demanding but noncontingent (DNC) strategy in the present study, was meant to provide a method for determining whether threat frequency or threat contingency is the prime determinant of the Column player's behaviour. By extension, the use of the DNC strategy also permits the examination of the stability of these effects under three conditions (prior exposure to the three initial strategies).

Overall Results

In general, Column players in the present study were not predisposed to deviate frequently from the rational choice on any single trial of the game. The overall level of the probability of non-dominant responding was .189 across all conditions. That C1 is the preferred choice of the Column players is further supported by the doublecross propensity, p(C1/R2C2), which was higher than all other propensities where such comparisons are possible in the present study. Previous studies using threat-vulnerable games in either real play or simulated opponent situations have found similar results (Gruder & Duslak, 1973; Guyer & Gordon, cited in Rapoport et al., 1976; Guyer and Rapoport, 1970; Rapoport et al., 1971; Santi & Wells, 1975). However, both the probability of non-dominant responding and the more sensitive stochastic measures were affected by the frequency and the contingency of threat.

The present data indicated that both threat frequency and threat contingency had significant effects on various aspects of the Column player's behaviour. Threat frequency was a determinant of both the Column player's probability of non-dominant responding as well as the propensity to appease during the final 75 trials of the game. Threat contingency affected both the levels of appeasement and capitulation during the initial 75 trials, as well as the probability of non-dominant responding during the final 75 trials. In addition, an effect of threat contingency on the capitulation measure during the final 75 trials was found which was dependent upon the strategy condition experienced during the initial 75 trials. Overall, the pattern of results suggests that the effects of threat contingency can be observed at earlier points in the interaction sequence than the effects of threat frequency.

Delayed Strategy Effects

Only one significant delayed strategy effect was found in the present study. The interaction of initial and final strategies for the capitulation propensity resulted from a significant delayed strategy effect for the final DC strategy condition. Specifically, the capitulation propensity for the final DC strategy condition was not significantly different for the initial P - final DC and the initial DNC - final DC conditions but both of these differed significantly from the initial DC - final DC strategy condition. This finding is consistent with previous research using the Prisoner's Dilemma game (Oskamp, 1970; Sermat, 1967), where it was found that the current contingent nature of tit-for-tat strategy overrides the effects of prior exposure to both the noncontingent 0% and 100% cooperative strategies.

This interaction indicated that there was an effect of threat contingency (in terms of the final DNC vs. the final DC strategy comparison) on the capitulation propensity when the initial strategy had been P or DC but not when the initial strategy condition had been DNC. Two explanations for the lack of an effect of threat contingency when the initial strategy condition had been DNC are possible: (a) The addition of threat contingency in the shift from the initial DNC to the final DC strategy was not discernible; or (b) Although the Column player may have been sensitive to the shift, psychological factors such as "getting back" at the previously inconsistent opponent by responding dominantly, regardless of the contingencies of the current DC strategy, were coming into play. In future research, the former interpretation might be verified if, at the point of the shift, a few trials of sequential R1 responding or an explicit communication concerning a change in strategy were delivered such that the Column player may be sensitized to the shift. If the discernibility of the shift had been enhanced, perhaps an effect of threat contingency might have been found when the initial strategy condition had been DNC as well.

The interaction also indicated that the Column player's behaviour during the final DNC strategy condition was independent of the initial strategy condition. The explanation for such an outcome may lie in the programme's rules for feedback. In all DC strategy conditions, once an R2C1 outcome had occurred, the only way to re-establish the R1C1 outcome was to shift to C2 (i.e., capitulate). If the participant repeated the C1 response, R2 responses continued. In all DNC strategy conditions, to shift to C2 after the R2C1 outcome would not necessarily guarantee the re-establishment of the R1C1 outcome. In fact, for these participants, deviation from the C1 response could result unpredictably in the R2C2 outcome, giving the player his least preferred payoff. Given the undesirable consequences of deviations from C1 in all DNC strategy conditions, the finding that the capitulation propensities for the final DNC strategy condition were determined by the current noncontingent nature of the DNC strategy independent of initial strategy conditions appears reasonable.

The effects of threat contingency and threat frequency are difficult to separate for the capitulation measure because this measure is not defined for the passive strategy. However, data presented above suggest that the contingency rather than the frequency of threat during the initial 75 trials affected the level of capitulation for the final DC strategy condition. Therefore, stating that the capitulation measure is sensitive to the contingency of threat does not mean that threat frequency has no role whatsoever in determining the propensity to capitulate. However, the present data failed to show any delayed effect of threat frequency on capitulation, while at the same time showing a strong delayed effect of threat contingency.

Previous research using Game 19 (Guyer & Gordon, cited in Rapoport et al., 1976) has shown that two contingent strategies, differing only in the frequency of R2, will produce very similar levels of capitulation indicating again that threat frequency may not be an important determinant of the Column player's propensity to capitulate. On this basis, it might be suggested that the lower propensity to capitulate found in real play situations versus simulated opponent situations may be attributable to the lack of consistent contingent use of R2 by the bona fide Row players rather than the concomitant lower frequency of R2 in real play situations (Guyer and Gordon, cited in Rapoport et al., 1976; Guyer and Rapoport, 1970; Rapoport et al., 1971; Santi and Wells, 1975, Variant 2).

The effects of threat frequency and threat contingency can be separated with respect to the appeasement and the probability of nondominant responding measures as well. Previous research which compared two contingent and demanding strategies to the P strategy

(Gruder and Duslak, 1973; Guyer and Gordon, cited in Rapoport et al., 1976) found that the P strategy evoked both a lower propensity of appeasement and a lower probability of non-dominant responding. The findings of the present study were consistent with this research in that both during the initial and final 75 trials, the P strategy evoked a significantly lower propensity to appease than the DC strategy. Although threat contingency was the prime determinant of the Column player's propensity to appease across the initial strategy conditions, threat frequency was the prime determinant behaviour across the final strategy conditions and this was independent of the strategy condition experienced during the initial 75 trials. Thus, the results for the appeasement propensity were consistent with the suggestion that appeasement is sensitive to differences in the Row player's behaviour (Guyer and Rapoport, 1970; Santi and Wells, 1975) but the results further revealed that this measure of the Column player's behaviour was affected by both the frequency and contingency of threat, albeit at different points in the interaction.

While both threat frequency and threat contingency affected the probability of non-dominant responding during the final 75 trials of the game, independent of the initial strategy condition, this measure was not as sensitive as the stochastic measures. Given that participants in the DC strategy conditions tended to both appease and capitulate more frequently than in other strategy conditions, the significant difference in the probability of non-dominant responing between the final DC and final DNC strategy conditions could be expected. That the final P and final DNC conditions differed significantly as well can only be attributed to the current differences in the frequency of threat. Thus, both threat contingency and threat frequency were important determinants of overall C2 responding.

In summary, on those measures for which the effects of threat frequency and threat contingency could be separated, it was found that both variables were important determinants of the Column player's behaviour. That response contingency is an important determinant of behaviour in Prisoner's Dilemma games has been noted by previous researchers (Crumbaugh & Evans, 1967; Downing et al., 1975; Downing & Ritter, Note 3; Kahn et al., 1971; McNeel, 1973). The effects of threat contingency were pronounced for the capitulation measure, were sequence dependent, but did not definitely rule out the possibility that threat frequency may also play a role in determining the levels of capitulation for Column players.

Postexperimental Questionnaire

As noted above, the present findings verified the results of previous studies in that the passive strategy in threat-vulnerable games was not successful for inducing cooperation.

The explanation for such findings usually focuses on the attributions an exploiter might make about his victim (Gruder and Duslak, 1973; Swingle, 1974). Participants' behaviour in games has been shown to be affected by the personality dispositions which are attributed to the opponent (Marlowe, Gergen, and Doob, 1966) and by their perception of the opponent's intentions (e.g., to be fair or exploitative, etc.) at the onset of the game (Gruder, 1971; Murdoch, 1967). A passive opponent who leaves himself open to continued exploitation may be perceived as foolish or incompetent in comparison to an opponent who responds by removing himself from the vulnerable position. An unconditionally cooperative opponent is perceived in a very similar light (Swingle, 1974).

No support was found in the present study for such an explanation of the differences in behaviour between the DC and P strategy conditions. Only Factor 3 ("Calmness") was found to differentiate the demanding strategies from the passive strategy. This finding appears quite reasonable given that "Calmness" would seem to be most easily inferred from the frequency with which an opponent uses the R2 choice. Hence, although the participant's behaviour differed as a function of the simulated opponent's behaviour, his perception of the other was relatively quite stable. Evidently, an exploiter can continue to take advantage of a "victim" without necessarily attributing to that individual any greater or lesser degree of intelligence, honesty, trustworthiness, et cetera. Hence, contrary to previous reports it appears that attribution of incompetence and foolishness are not necessary conditions for an exploiter to continue taking advantage of a passive opponent (Gruder & Duslak, 1973; Gruder, 1971; Marlowe et al., 1966).

Conclusions

The following are the major contributions which this research has made to the experimental literature on threat-vulnerable games.

1. The present study replicates previous findings that a demanding contingent strategy is more effective than a passive strategy in gaining concessions from the Column player.
2. The present study goes beyond previous work in demonstrating that two separable aspects of the demanding contingent strategy, namely the patterning of threat and the frequency of threat, both make independent contributions to the gaining of concessions from the Column player. However, a simple statement of the relative importance of these two aspects is difficult to make because their relative effectiveness depends both on the specific dependent variable and the point in the interaction sequence which is examined.
3. The effects of strategy shifts were also complicated by the nature of the dependent variable considered. For the capitulation propensity, the effects observed during the last 75 trials depended upon the strategy experienced during the first 75 trials. However, for both the probability of non-dominant responding and the appeasement propensity, the effects observed during the last 75 trials were a function of the strategy conditions in effect at that time and did not depend upon the type of strategy experienced during the first 75 trials. These

differential strategy shift effects for the appeasement and capitulation measures are consistent with previous research which indicated that appeasement may be more responsive to shifts in strategy on the part of the Row player than capitulation.

4. The high level of "exploitation" noted in the passive strategy condition is entirely consistent with previous reports in the literature. Gruder and Duslak (1973) suggested that the failure to respond to exploitation results in the exploiter attributing foolishness or incompetence to the passive opponent and that these attributions lead the exploiter to continue to take advantage of the passive "victim." Data obtained from the postexperimental questionnaire lend no support to this hypothesis. In fact, they indicate that the attribution of negative traits is not a necessary condition for an exploiter to continue taking advantage of a passive opponent.

5. Future research might best be directed toward the examination of the respective effects of threat frequency and threat contingency when different shifts in strategy conditions are undertaken. Researchers interested in such shifts might be advised to (a) ensure that a shift from a noncontingent yoked control strategy to a contingent strategy is preceded by a number of predetermined responses or an explicit communication which would ensure that such a shift is perceived by participants, and (b) include stochastic measures in any

study because of their evident sensitivity to the behaviour of the other player. Under these experimental conditions it would be possible to parse out the separate effects of threat frequency and contingency when shifts in strategy are pronounced.

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APPENDIX A

INSTRUCTIONS

Instructions

Please read along with and pay close attention to the following instructions as they are presented. We are interested in how people make simple decisions in a two-person situation which has payoffs. The payoff you get depends both on what you do and what the other person does. On the table in frontof you is a panel with two buttons marked "Response 1" and Response 2", a counter marked "Your points", a red "Go-light", and a display window. You will notice that the display window has a piece of paper attached to it which is divided into 4 boxes. The numbers in red are the number of points you win or lose; the numbers in black are the number of points that the other player wins or loses.

The game is played as follows: One of you is "Player A" and the other is "Player B". To find out whether you are "Player A" or "Player B" look at the panel in frontof you. Above the red "Go-light" you will see a lable which indicates whether you are "Player A" or "Player B".

When the red light on your panel goes on, push response button 1 or 2. Be sure to make your response as soon as the red light goes on and do not push the response buttons at any other time. The person you are playing against will make choices on his panel at the same time you do. The numbers in the 4 boxes indicate the payoffs. For example, if Player A pushes Response 1 and Player B pushes Response 1, the upper left-hand box of your display window will light up, showing that Player A has won 8 points and Player B has won 20 points. If Player A pushes Response 2 and Player B pushes Response 2, the lower right-hand box of your display window will light up, showing that Player A wins 15 points and Player B loses 2 points.

If Player A pushes Response 1 and Player B pushes Response 2, the upper right-hand box of your display window will light up, showing that Player A wins 20 points and Player B wins 15 points. If Player A pushes Response 2 and Player B pushes Response 1, the lower left-hand box of your display window will light up showing that Player A loses 2 points and Player wins 6 points.

Remember, the numbers in red show the number of points you get; the numbers in black show the number of points that the other person gets. You will both start the game with 50 points. The points you win or lose will automatically be added to or subtracted from this number. After you and the other player have made a response and one of the boxes lights up, you may look at the counter to your right to see how many points you have accumulated. Your goal in the game is to make as many points as possible for yourself without regard to the number of points earned by the other. There will be a number of trials in this experiment, but you will not know in advance how many there will be. At the end of the game, for every 10 points showing on your counter, you will receive 1 cent.

I will now ask each of you a couple of questions to make sure that you have understood the game. Please remain seated. I will be with you in a moment.

Turn the tape recorder off by pressing the stop button.

APPENDIX B

POSTEXPERIMENTAL QUESTIONNAIRE

Here is a list of word pairs which might be used to describe other people. This is a "person perception task" - that is, we are interested in the impressions participants in this experiment form of each other based on the games you have just finished playing. Thus, we would like <u>your impressions of the other participant</u> in this experiment. Please place a check mark on the appropriate line for each pair of adjectives.

You will not see each other again in this experiment, and your ratings will be kept confidential, of course. So please mark down how you really feel.

WARM ___: ___: ___: ___: ___: ___: ___: COLD

SELFISH ___: ___: ___: ___: ___: ___: ___: GENEROUS

REPUTABLE ___: ___: ___: ___: ___: ___: ___: DISREPUTABLE

INTELLIGENT ___: ___: ___: ___: ___: ___: ___: UNINTELLIGENT

WEAK ___: ___: ___: ___: ___: ___: ___: STRONG

CRUEL ___: ___: ___: ___: ___: ___: ___: KIND

YOUNG ___: ___: ___: ___: ___: ___: ___: OLD

DIRTY ___: ___: ___: ___: ___: ___: ___: CLEAN

CALM ___: ___: ___: ___: ___: ___: ___: AGITATED

PLEASANT ___: ___: ___: ___: ___: ___: ___: UNPLEASANT

COWARDLY ___: ___: ___: ___: ___: ___: ___: BRAVE

ACTIVE ___: ___: ___: ___: ___: ___: ___: PASSIVE

HONEST ___: ___: ___: ___: ___: ___: ___: DISHONEST

UNTRUSTWORTHY ___: ___: ___: ___: ___: ___: ___: TRUSTWORTHY

PEACEFUL ___: ___: ___: ___: ___: ___: ___: FEROCIOUS

TENSE ___: ___: ___: ___: ___: ___: ___: RELAXED

GOOD ___: ___: ___: ___: ___: ___: ___: BAD

UNFAIR ___: ___: ___: ___: ___: ___: ___: FAIR

NICE ___: ___: ___: ___: ___: ___: ___: AWFUL

HOSTILE ___: ___: ___: ___: ___: ___: ___: FRIENDLY

HAPPY ___: ___: ___: ___: ___: ___: ___: SAD

COMPETITIVE ___: ___: ___: ___: ___: ___: ___: NONCOMPETITIVE

BEAUTIFUL ___: ___: ___: ___: ___: ___: ___: UGLY

UNSOCIABLE ___: ___: ___: ___: ___: ___: ___: SOCIABLE

Do you have any additional comments concerning the other participants in this experiment?

What do you think the experimenter was trying to find out in this experiment?

APPENDIX C

GENEROSITY AND DOUBLECROSS PROPENSITIES ACROSS INITIAL STRATEGY CONDITIONS

Table A

Means and Standard Deviations of the
Generosity Propensity, p(C2/R1C2), Across Initial
Strategy Conditions

	Strategy Condition		
	P	DC	DNC
Mean	.427 (19)[a]	.241 (21)	.522 (16)
Standard Deviation	.213	.193	.478

[a] Numbers in parentheses indicate the number of participants for whom the number of quadrant outcomes exceeded the criterion (3 or more).

Table B

Means and Standard Deviations of the Doublecross Propensity, p(C1/R2C2) Across Initial Strategy Conditions

	Strategy Condition	
	DC	DNC
Mean	.579 (25)[a]	.673 (20)
Standard Deviation	.241	.180

[a] Numbers in parentheses indicate the number of participants for whom the number of quadrant outcomes exceeded the criterion (3 or more).

APPENDIX D

ANALYSIS OF VARIANCE TABLE FOR THE PROBABILITY OF NON-DOMINANT RESPONDING

Table C

Analysis of Variance of the Probability of Non-Dominant Responding as a Function of the Initial and Final Strategy Conditions

Source	*SS*	*df*	*MS*	*F*
A (Initial Strategy)	.913	2	.457	1.54
B (Final Strategy)	4.901	2	2.451	8.27*
A X B Interaction	1.091	4	.273	.92
Error (Between)	24.015	81	.296	

*$p < .01$

APPENDIX E

GENEROSITY AND DOUBLECROSS PROPENSITIES AS A FUNCTION OF THE INITIAL AND FINAL STRATEGY CONDITIONS

Table D

Means and Standard Deviations of the Generosity Propensity, p(C2/R1C2), as a Function of Initial and Final Strategy Conditions

Initial Strategy Condition	Final Strategy Condition		
	P	DC	DNC
P			
Mean	.362 (3)[a]	.484 (5)	.360 (4)
Standard Deviation	.156	.356	.257
DC			
Mean	.574 (2)	.230 (9)	.456 (6)
Standard Deviation	.104	.206	.341
DNC			
Mean	.510 (5)	.581 (6)	.438 (8)
Standard Deviation	.333	.364	.338

[a] Numbers in parentheses indicate the number of participants for whom the number of quadrant outcomes exceeded the criterion (3 or more).

Table E

Means and Standard Deviations of the Doublecross Propensity, p(C1/R2C2), as a Function of Initial and Final Strategy Conditions

Initial Strategy Condition	Final Strategy Condition DC	Final Strategy Condition DNC
P		
Mean	.695 (6)[a]	.653 (7)
Standard Deviation	.383	.248
DC		
Mean	.776 (9)	.647 (6)
Standard Deviation	.193	.225
DNC		
Mean	.599 (5)	.681 (5)
Standard Deviation	.309	.180

[a] Numbers in parentheses indicate the number of participants for whom the number of quadrant outcomes exceeded the criterion (3 or more).

APPENDIX F

ANALYSIS OF VARIANCE TABLE FOR THE APPEASEMENT PROPENSITY

Table F

Analysis of Variance of the Appeasement Propensity,

p(C2/R1C1), as a Function of the

Initial and Final Strategy Conditions

Source	SS	df	MS	F
A (Initial Strategy)	.970	2	.485	1.57
B (Final Strategy)	3.968	2	1.984	6.42*
A X B Interaction	2.543	4	.636	2.06
Error (Between)	25.006	81	.309	

*$p < .01$

APPENDIX G

ANALYSIS OF VARIANCE TABLE

FOR THE CAPITULATION PROPENSITY

Table G

Analysis of Variance of the Capitulation Propensity,

p(C2/R2C1), as a Function of the

Initial and Final Strategy Conditions

Source	SS	df	MS	F
A (Initial Strategy)	1.970	2	.985	4.29*
B (Final Strategy)	3.359	1	3.359	14.61**
A X B Interaction	2.465	2	1.232	5.36**
Error (Between)	12.410	54	.230	

*$p < .05$

**$p < .01$

APPENDIX H

ANALYSIS OF VARIANCE TABLE

FOR SCORES ON THE THIRD FACTOR

Table H

Analysis of Variance for Scores on the Third Factor

Source	*SS*	*df*	*MS*	*F*
A (Initial Strategy)	1.276	2	.638	.762
B (Final Strategy)	5.620	2	2.810	3.355*
A X B Interaction	1.646	4	.412	.492
Error (Between)	67.836	81	.837	

* $p < .05$