Sex and communication effects in a mixed-motive game

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SEX AND COMMUNICATION EFFECTS IN A MIXED-MOTIVE GAME

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ABSTRACT

This study investigates the effects of restricted communication opportunity and the sex of the subject on co-operative responses made by British dyads in a 180-trial matrix version of Prisoner's Dilemma.

The first experiment employed 20 male, 20 female and 20 mixed-sex dyads who were assigned to one of four verbal communication conditions: none allowed; allowed before trial 1; allowed after trial 31; allowed throughout. No differences due to the sex of the dyad were demonstrated but communication allowed throughout elicited significantly higher levels of co-operation.

A financial incentive was introduced into the second experiment. Two communication conditions were retained: none allowed; allowed after trial 31. 10 male and 10 female dyads took part. Communication opportunity elicited higher levels of co-operation, especially for male pairs. Subjects were more than twice as co-operative when offered a financial incentive.

Both of these experiments were conducted by a female E, the author. When experiment 2 was replicated by a male E communicaction effects, but no sex effects, were observed. However, there were no effects due to the sex of the subject but there was a main communication effect when Expts. 2 and 3 were replicated in a balanced sex of E design. However, the female experimenter elicited higher levels of co-operation from all subjects regardless of their sex.

The data from Expts. 2-4 were analysed in a multiple E design. Communication opportunity elicited significantly higher levels of co-operation and female Ss were less co-operative in the presence of male experimenters, but only as the duration of the inter-action increased. The experimenters themselves were found to elicit different levels of co-operation from subjects regardless of the sex of the player or of the sex of E.

Experiment 2 was replicated by the author using 32 American students. American males were more co-operative than British men and both American and British women. No communication effects were observed. Experiment 2 was then repeated with E absent from the room. No significant main or inter-action effects were observed.

It seems that the presence of the experimenter, whatever their sex, helps to define the psychological environment in which the subjects' strategic inter-action occurs.

SEX AND COMMUNICATION EFFECTS IN A MIXED-MOTIVE GAME

by

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No material contained in this thesis has previously been submitted for a degree in this or any other University.

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CHAPTER ONE : INTRODUCTION

This chapter outlines the development of Game Theory and research into experimental games. Co-ordination Games, Zero-Sum and non Zero-Sum Games are discussed and the essential features of the Prisoner's Dilemma Game are noted.

1.1 Experimental Games

Game Theory was originally created as a new approach to economic problems and, as a branch of mathematics, has provided a method to formally investigate rational choice. Interest in Game Theory arose after the publication in 1944 of 'Theory of Games and Economic Behavior' by John von Neumann and Oskar Morgenstern which extended the use of mathematics to analyse outcomes of an individual's possible decisions when dependent on those of another person rather than on chance. This view was attractive to social psychologists who preferred to try and understand people as rational decision makers rather than as guided by instinctive and irrational drives. Traditional theories of interdependent decision making have tended to follow a causal, mechanistic model of human behaviour, but these have been able to provide only a partial analysis of deliberate, purposeful interdependent decisions where participants have preferences among the available outcomes. Although Game Theory has made positive contributions to economics it has had less effect than might have been expected on the theoretical development of the Social Sciences.

One difficulty is that there has been some confusion over terminology. Whilst activities such as chess are often referred to as 'games' by both the layman and the social scientist, other activities commonly referred to as 'games' by the layman (e.g. solitaire) are not amenable to Game Theory analysis. On the other hand, other events such as social and political conflicts, rarely referred to as 'games' by the layman, may be analysed in terms of the theory of games. According to the theory an important feature of gaming situations is that each participant has partial control over outcomes. The goal of the theory is to find a solution to such games.

According to Game Theory the decision makers have conflicting goals yet the outcomes are interdependent to a greater or lesser extent. Shubik (1964) proposed that each player is an autonomous decision making unit which operates towards an objective which will determine their choices according to the availability of resources. The use of these resources also depends on the rules of the game which prescribe certain limitations.

The model of reality is provided by a game of strategy, defined by Rapoport and Chammah (1965a) as "a situation in which two or more 'players' make choices among available alternatives (moves). The totality of choices determines the outcome of the game and it is assumed that the rank order of preference for the outcome is different for different players. Thus the 'interests' of the players are generally in conflict. Whether these interests are diametrically opposed or only partly opposed depends on the type of game" (P.9). Such a game must therefore have a set of n players, each with a set of strategies, and a pay-off function for each player (Wiberg, 1972).

Rapoport and Guyer (1966) have shown that there are 78 strategically different games in which two players can rank the four outcomes in a 2 x 2 matrix game, the simplest type of game. There are three main categories of games:- 1) purely co-operative (co-ordination) games; 2) purely competitive (zero-sum) games; and 3) non zero-sum games, termed 'mixed-motive' games by Luce and Raiffa (1957). Rapoport and Chammah's definition of a game of strategy actually excludes purely co-operative co-ordination games although they are included by Schelling (1960).

1.2 Co-ordination Games

These games are purely co-operative in nature as the interests of all the players coincide completely at all times. These games have received less attention than others partly because formal Game Theory cannot provide a solution as there is no conflict of interests. There is nothing in the formal structure of the game to point to a 'best' strategy.

An example of such a game for 2 players would be calling heads or tails for a coin - if both players choose the same they get £1 each. Solutions to such games may depend on tacit communication or non verbal cues and informal game analysis is helpful here. Where tacit communication is not possible players may have to use 'telepathic' communication and guess what the other person will choose based, wherever possible, on a salient feature of the game. It can be seen that the problem dissolves if overt communication is allowed.

Schelling (1960) has argued that co-ordination games are not as psychologically simple as they might appear. Often the strategies are quite subtle and may involve complex processes such as "I guess that you guess that I guess ...... etc."

1.3 Zero-Sum Games

The essential feature of zero-sum games is opposition of interests. They assume that when the pay-off to one player is equal to x the pay-off to the other player is - x, such as in poker. Thus the gains of one player are equal to the losses of the other. The rational solution, proved by Von Neumann and Morgenstern to exist for all zero-sum games, is to adopt the minimax strategy of maximising gains and minimising losses so that each player adopts a strategy which will guarantee him the best of the worst possible outcomes. Thus it is possible to identify the equilibrium points on the matrix where neither player (assumed to be logical) could regret his choice given knowledge of the other player's intentions.

An example of a zero-sum game is the Matching Pennies Game, described by Hamburger (1979). This is a two-person game where player 1 is called "Matchmaker" and Player 2 is termed "Variety-Seeker". Each player places a penny either head up or tail up so that the other player cannot see it. They then uncover the pennies simultaneously. Matchmaker gets both pennies if they show the same face but variety-seeker wins both pennies if they show one head and one tail. Thus, money is neither created nor destroyed and the gains of one player are equivalent to the losses of the other.

The evidence available appears to support the idea that the normative strategy prescribed by the theory is followed by naive players of zero-sum games. Lieberman (1960) using a 3 x 3 two-person zero-sum game found that by the final ten trials of the game ninety per cent of players made the rational choice as prescribed by the theory.

Rapoport and Chammah (1965a) identified two distinct types of two-person zero-sum game where the concept of rationality is an essential feature. One type, with a "saddle point" has a strategy which is most favourable for both players. To find the solution on the matrix the player chooses the payoff which is lowest in the row and highest in the column. This saddle point, named after the point on a horse's saddle which is lowest with respect to the horse's longitudinal plane and highest with respect to its vertical plane, is the rational strategy whose outcome cannot be improved by either player. The second type has no single best strategy yet there is a best mixture of strategies i.e. strategies are altered so that each strategy is chosen with a given relative frequency. Each player is then assured of the largest pay-off he can expect given the limitations of the particular game. In zero-sum games the formal solution is unaffected by communication opportunities as bargaining is not advantageous for rational players. To find the best strategy it is simply necessary to ask oneself what the worst possible outcome would be.

It can be seen, then, that zero-sum games conform more to the prescriptive requirements of Game Theory. Most recreational games are zero-sum but relatively few social encounters have the structural property that pay-offs for each outcome add up to zero. In non zero-sum (mixed-motive) games the concept of rationality is less clear since the interests of the players are neither strictly coincident nor strictly opposed.

1.4 Non Zero-Sum Games

The non zero-sum game defies complete formal analysis. The games involve two motives of co-operation and competition which co-exist between two players whose interests are therefore partly coincident and partly opposed. Thus in non zero-sum games, which involve more realistic representations of conflict situations under study in the social sciences (albeit in the encapsulated environment of a laboratory), the gain of one player is not necessarily equivalent to the loss of the other and both players may gain or lose at the same time. In addition to the inter-personal conflict existing in the game a player may also have intrapersonal conflict arising from the clash of motives.

Formal Game Theory is unable to provide a rational solution in mixed-motive games since there is no way of deciding the 'normative' strategy. Formal theory rests on the assumption that a player will obtain and process all the available information in a situation and that the response (to maximise gain and minimise loss) is strictly determined by this information. However, there is no one optimal strategy as compromise is possible and thus no convincing solution analagous to the minimax solution can be found.

Pruitt and Kimmel(1977) suggest that experimental games are an 'operational outgrowth' of the earlier theoretical developments which had limited applicability and weak predictive power. Earlier fields of study in social conflict and interpersonal relations had not fully acknowledged the interdependencies of the parties involved nor the influence of incentives on social behaviour. Experimental games provided a laboratory method to provide a precise definition of the reward structures and of the way parties are dependent on one another. Since formal theory is inadequate, informal analysis is necessary for insights into the pattern of choices made by players of mixed-motive games, as the "best" decision is ambivalent.

The range of possibilities in strategic interaction is immense. Not surprisingly, researchers have concentrated on the simplest of all games - the 2 x 2 game where two decision makers each have two options before them. Rapoport and Guyer (1966) were able to identify 78 strategically different 2 x 2 games and, of these, Rapoport(1967a) further identified twelve symmetrical games which have identical pay-off matrices for both players. Eight of these are described as "trivial" as they possess optimal equilibrium points i.e. the same outcome is most preferred by both players and there is therefore no conflict of interests. Rapoport defined four 2 x 2 non-trivial symmetrical games without optimal equilibria: Leader, Hero, Exploiter and Martyr. Each player has the same matrix and there is no single outcome that can be predicted by the formal theory as a conflict of interests exists. Rapoport (1967a) considers that each of these non-trivial symmetrical games bring four distinct types of psychological pressure to bear on the players. However, the four games have received unequal treatment by researchers and most empirical research has focused on the Martyr Game, more popularly known as Prisoner's Dilemma.

1.5 Prisoner's Dilemma

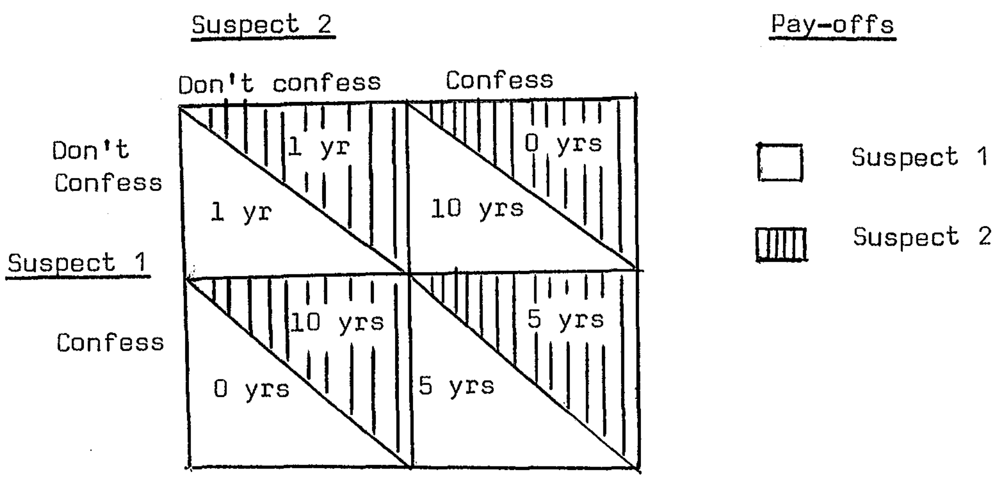
The Prisoner's Dilemma has generated much empirical research, largely due to its status as a genuine dilemma or paradox. For, as Rapoport and Chammah (1965a) state "the rational choice of strategy by both players leads to an outcome which is worse for both than if they had chosen their strategies 'irrationally' " (P.13).

Attention was first drawn to this game by Merrill Flood in 1951 but the interpretation normally given to the Prisoner's Dilemma (P.D.)

is attributed to A.W. Tucker. Two people suspected of being accomplices in a serious crime are arrested by the police and taken into custody where they are placed in separate cells, unable to communicate with one another. However, the prosecutor has insufficient evidence for a conviction without a confession from at least one of the prisoners. The following options are made known to them: 1) if one suspect confesses to the crime and the other suspect does not, suspect 1 is given his freedom for turning Queen's evidence and suspect 2 is given, say, a 10 year prison sentence; 2) if both confess, both suspects will receive a reduced prison sentence of 5 years; 3) if both suspects remain silent both will be convicted on a lesser charge and each receive prison sentences of 1 year.

These alternatives, and pay-offs resulting from choices made on the basis of these, can be presented in a symmetrical 2 x 2 matrix (Figure 1).

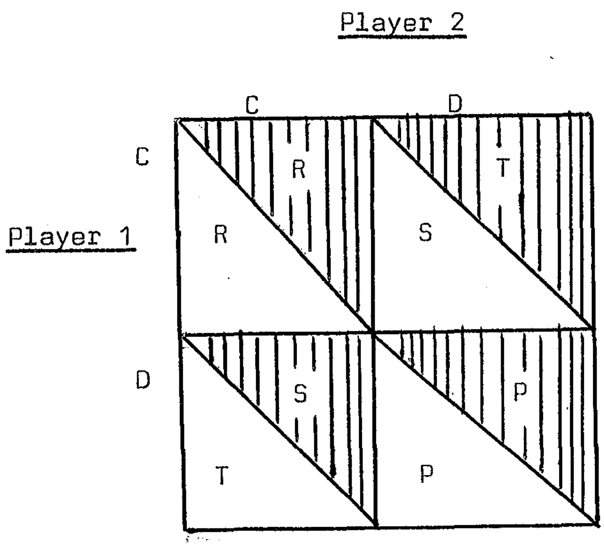
Figure 1 : A Prisoner's Dilemma Matrix



The dilemma of the suspects is that it is in their individual interests to confess whatever the other does but it is in their collective interests not to, thus generating a mixture of inter-personal and intrapersonal conflict.

Scodel et al (1959) defined the properties that a game of strategy must have in order to be 'Prisoner's Dilemma'. The pay-offs for co-operative choices (C) and competitive choices (the defection strategy, D) must satisfy given rules. These are shown below in Figure 2, where Rapoport's (1966) notation has been adopted.

Figure 2 : The Properties of Prisoner's Dilemma



where

R = Reward
S = 'Sucker's' pay-off
T = Temptation
P = Punishment

Rules

i) $2R > S + T > 2P$

ii) $T > R > P > S$

The player is faced with a series of binary decisions where the pay-off is a function of joint action. Choosing D is the individual's "best" or least risky strategy whilst the "best" strategy for maximising the pay-off for both is C. O'Connor et al (1972) point out that, according to Game Theory, "When faced with two 'risky' choices, the choice of greater pay-off, or utility, is always preferred" (P.21). In the Prisoner's Dilemma, however, the nature of rationality becomes increasingly ambivalent. The D strategy strictly dominates the C alternative in the sense that D is the best choice no matter what the other does. If either player chooses D it would be rational for the other player to do the same as he cannot be assured of a better outcome. But, paradoxically, if both players are rational in the game theoretic sense and always choose the alternative with the larger utility, (the only possible equilibrium pair DD) they both lose. The C alternative is more attractive only if one can be assured the other player will do the same. Thus, the minimax choice, D, may be motivated by caution, whereas the non-minimax strategy, C, has an element of risk.

Rapoport (1966) attempted to take into account the mutual perception of the other player's rationality when trying to account for the strategy of individual players:

> "The best outcome for both of us is (C,C). However, if player 2 assumes that I shall choose C, he may well play D to win the largest pay-off. To protect myself I will also play D. But this makes for a loss for both of us. 2 rational players certainly deserve the outcome (C,C). I am rational and, by the fundamental notion of Game Theory, I must

assume that player 2 is also rational. If I have come to the conclusion that C is the rational choice, he too must have come to the same conclusion. Now, knowing that he will play C, what shall I play? Shall I not play D to receive the greater pay-off? But if I have come to this conclusion, he has also probably done so. Again we end up with (D,D). To ensure that he does not come to the conclusion that he should play D, I had better avoid it also. For if I avoid it and am rational, he too will avoid it if he is rational. On the other hand, if rationality prescribes D, then it must also prescribe D for him. At any rate, because of the symmetry of the game, rationality must prescribe the same choice to both. But if both choose the same, then (C,C) and (D,D) are the only possible outcomes. Of these, (C,C) is clearly the better. Therefore, I should choose C " (P.141).

Luce and Raiffa (1957) maintain that the standard minimax strategy (D,D) is the only rational solution in a single trial version of P.D. They accept, however, that a tacit agreement to choose (C,C) may arise in multiplay P.D. but consider that this is unstable as unilateral defection will result in increased pay-offs for the defector. Thus, (D,D) may still be the only rational solution in multiplay P.D. since " ...... if a player defects and his opponent does not, then he profits; whereas, if he fails to defect and his opponent does, he loses more than if he would if they were both to defect ......" (P.97).

Rapoport and Chammah (1965a) distinguish between co-operative and non-co-operative games in the theory of non zero-sum games. This usage of 'co-operative' and 'competitive' dates back to von Neumann and Morgenstern (1944) and must not be confused with the more popular usage above to distinguish different strategic structures. Prisoner's Dilemma is, by definition, a non-co-operative game in this sense as a dilemma would no longer exist if the players could make an enforceable agreement to co-operate. However, if the agreement was not enforceable a new dilemma would arise as it is in the interests of each individual to break the agreement regardless of whether or not the other kept it. In this sense, Prisoner's Dilemma may be regarded as a series of different games. If one person failed to defect he would lose more if the other defected than if they both defected. Although the (C,C) choice is collectively more desirable it is unstable since each player must be both trusting <u>and</u> trustworthy (Rapoport,1964). The paradox of the Prisoner's Dilemma has led Luce and Raiffa (1957) to declare "There should be a law against such games!"(P.97). As a prescriptive theory then, Game Theory is inadequate in solving the conflicts associated with mixed-motive game; it seems therefore that the concept of rationality must be redefined.

One of the most reliable findings is the relatively low level of co-operation obtained on P.D. under most conditions (e.g. Gallo and McClintock, 1965). Luce and Raiffa (1957) maintained that whilst (D,D) is the 'rational' solution in a single trial version of the game a tacit agreement will be made to play (C,C) even though this is inherently unstable. This does not always seem to be the case. Empirical research employing the P.D. matrix as a research tool has attempted to answer the question: under what conditions will players be likely to trust each other sufficiently to risk adopting the mutually rewarding, but unstable, strategy? During the last twenty years or so, experimental gaming has generated over 1,000 published studies (Pruitt and Kimmel, 1977).

An extensive research programme in two-person games has been reported by Rapoport and Chammah (1965a) using seven different matrices conforming to the formal requirements of Prisoner's Dilemma. They found, as the theory predicts, that the distribution of choices between C and D alternatives varies as a function of the expected utilities of the alternatives. Thus, if the other pay-offs are held constant, the selection of the C alternative increases as R and S increase, and decreases as T and P increase.

Rapoport and Chammah (1965a) also demonstrated a marked tendency for one player to imitate the other in reiterated Prisoner's Dilemma and they consider that any effects due to personality differences become masked during prolonged interaction. Pairs of male students (nearly all of whom were unacquainted) played 300 iterations of P.D. and the pattern of choices over time was investigated. An initial trend towards increased defection was observed but, after a while, the frequency of co-operative choices increased, referred to as the 'recovery' period. Once CC is established defection is unlikely to be rewarded because of the 'retaliation' that would occur by the other player. Rapoport and Chammah concluded that the "steady decline of the unilateral states, i.e., the increasing predominance of CC and DD states, is evidently responsible for the fact that paired players become more and more like each other in repeated plays of Prisoner's Dilemma" (P.102).

It can be seen, then, that the choices in this type of mixed-motive game have often been thought to measure the co-operative or competitive orientations of the players. A 'co-operative' choice C (see Figure 2) is thus considered indicative of a trusting attitude towards the other player whilst the 'competitive' choice D indicates, in part, a distrust of the partner and a desire to maximise his own gains at the expense of the other player. This is a simplistic view and Wrightsman (1966) more realistically defined trusting behaviour to be evident not only when the subject simply chose C but when he also expected the other person to choose C (maximising the joint pay-off) and, furthermore, gave reasons such as trust, fairness or co-operation for doing so. In the same way, a D choice would only be considered as distrusting of the other player if the subject expected the other player to also choose D and gave concepts of distrust or 'fear' as reasons for doing so. More interestingly, perhaps, since this aspect is often disregarded in the literature, Wrightsman did not classify subjects' responses such as 'safety' or 'equality' to be indicative of either trusting or distrusting behaviour.

Ward (1972), however, argued that the concept of trust applies only to a subject's expectation of the other player's choices and that each choice in fact stems from both the expectation of the other player's choices <u>and</u> self-motivation. She suggested that whilst the expectations of subjects are related to attitudes towards others, self-motivation is related more to the personality dynamics of the individual. However, her 1972 study gave little support to this notion and a more useful approach in understanding choices on P.D. has been that of Messick and McClintock (1968). They assume three basic motivational orientations in the choices of any player of mixed-motive games : 1) maximising joint gain (related to co-operation); 2) maximising relative gain (related to competition); and, 3) maximising one's own pay-off (individualism).

Such approaches do, at least, begin to explore the motivational processes involved in game analysis, but all such models of behaviour assume that probabilities are constant within the individual throughout the game and this is clearly not the case. In addition each player is assumed to have full knowledge of the game and Luce and Raiffa (1957) see this as "the real source of unreality in the model" (P. 55). Mack and Knight (1972) have investigated the effect of additional information on choices in Prisoner's Dilemma. Mack and Knight hypothesised that increased information would tend to increase rational choice behaviour. They found that the addition of information about both the nature of the game and the consequences of Ss' choices resulted in a higher level of competitive behaviour. However, information on either the nature of the game or the consequences of strategy choices presented alone was insufficient to produce this effect.

Terhune (1970) has pointed out that intention in conflict situations is seldom obvious, and whilst a C choice may, indeed, be co-operative it may also be attempting to lure the other player into making the more vulnerable C choice in order to take advantage of such a move with the other player receiving the "Sucker's pay-off" (see Figure 2) on the next trial. Similarly, a D choice might be defensive or aggressive but could also be used as a 'threat' and (like the C choice) be used as a signal for establishing and co-ordinating choices which maximise the joint pay-off. On the other hand, Lieberman (1960), amongst others, has noted that subjects often vary their strategies simply out of boredom and one must therefore be very cautious in imputing intention in the results of any such interaction. Such effects may partly depend on the levels of incentives offered. However, it is clear to anyone having observed subjects play iterated Prisoner's Dilemma that subjects' choices indicate more than simply co-operation and competition or trust and suspicion. The author feels that it is more likely for there to be large individual differences in the meanings of response styles at any given point of the interaction and in the assignation of probabilities. However, in the study to be presented here, the concern is for differences in response styles between groups and for this reason the C choice will be broadly defined as a 'co-operative' choice and a D choice as a 'non-co-operative' choice (following Pruitt and Kimmel, 1977). This in no way detracts from the appreciation that in any one instance a whole range of complex motives may be involved both within and between individuals and, indeed, it is the author's experience that subjects themselves can usually supply plausible explanations for their behaviour.

The appeal of these games for researchers is that they provide a simple method for investigating aspects of strategic interaction that have been impossible to study by other means. The following two chapters examine some of the experimental gaming studies over the last thirty years.

CHAPTER TWO : INDEPENDENT VARIABLES AFFECTING GAME BEHAVIOUR

This chapter presents a general account of investigations to measure the effects of various parameters on the outcome of two-person variations of P.D. Matrix manipulations, pre-game instructions, incentive levels, the strategy and perception of the other player and communication opportunities are discussed. Individual differences are discussed in Chapter Three.

2.1 Pay-off Manipulations

Variations in the magnitude of pay-offs can occur as long as the ordinal rankings are maintained. In Prisoner's Dilemma this is when $2R > T + S > 2P$ and $T > R > S > P$. Game Theory assumes that matrix variations would not affect a change in subjects' behaviour because the relationships amongst the pay-off utility values have not altered. However, whilst the rules of the P.D. game can be maintained, it seems that the discrepancy between S and T (see Figure 2) can be manipulated such that the temptation to defect increases. Rapoport and Orwant (1972) proposed an index of competitive advantage, which can be calculated by subtracting the value of S from T. Minas et al (1960) found, as expected, that enlarging the competitive index resulted in a higher level of competitive (or, at least, non-co-operative) play.

In their 1965 (a) study Rapoport and Chammah used seven different matrices which conformed to the formal requirements of P.D. They found that, of these, the least biased towards either choice was one where $T = 10$, $R = 5$, $S = -10$ and $P = -1$. Rapoport and Chammah actually used pairs of subjects for their research (10 pairs played each of the games 300 times) whilst the 1966 study by Bixenstine and Blundell systematically varied pay-offs while the behaviour of the subjects' 'robot' opponent was held constant. However, as predicted, there was a smaller probability of an alternative being chosen when there was a decrease in its expected utility.

Other manipulations have tended to relax the rules of P.D. and are therefore not pertinent to the present discussion. However, it seems that in general subjects respond in predictable ways to manipulations of the pay-off matrix.

2.2 Pre-Game Instructions

Wrightsman et al (1967) noted that the instructions used in experimental games are often overlooked and it is certainly the case that they are seldom fully specified. Similarly, pre-game experience and instructions fail to be recorded.

Wrightsman, Lucker et al (1972) varied the completeness of three sets of instructions. The highest level of co-operative responses was produced by a set of instructions which included both basic information and illustrated examples. Bedell and Sistrunk (1973) argued that instructions using concepts such as 'game' and 'player' tend to present an individualistic set which, they claim, is linked to the frequently reported finding that women play less co-operatively than men on Prisoner's Dilemma.

2.3 Effects of Incentive

Most of the studies in this area have involved rewards in the form of real or imaginary money but the evidence is contradictory. At the time the present series of experiments were conducted (1975 - 1977) the level of incentive was not considered an important factor. One of the reasons for this may have been that pay-offs with real or imaginary money had been so small as to have had little effect on subjects' motivation. Inconsistent findings may also have been the result of using games which have different structural and conceptual properties and, moreover, few studies have varied the reward values within a constant experimental design.

Evans (1964) employed two incentive conditions : 1) imaginary money; 2) points to be added to S's examination score. He found no differences in the number of co-operative choices and concluded that generalisations could be made across situations. However, he used only a 6-trial P.D. game and we have seen that such a design is hardly likely to investigate the changing motivational factors which occur in multi-play P.D. The question of credibility also arises: do subjects really believe that their performance in the game will affect their examination score?

The above study compared an academic achievement incentive with an imaginary financial incentive. Other investigators have varied the levels of one type of incentive, usually a monetary incentive due to the ease of specifying values. For example, Gallo (1963) found that co-operative behaviour increased when fairly large amounts of real money were at stake compared to imaginary money. However, Gallo used the simulated trucker's game (see Deutsch and Krauss, 1962) and these effects may not be capable of generalisation to the traditional P.D. game. When Gallo (1966) used a P.D. matrix no significant effects on the level of co-operation were found when the reward values were varied. Unfortunately, each subject played in both of the treatment conditions which somewhat limits the conclusions that can be drawn from this study.

In another study using real and imaginary rewards Wrightsman (1966) employed three incentive conditions. In one condition Ss were told they could keep their winnings (apparently believed by 90 per cent of the subjects), in an imaginary money condition Ss played 'for fun' and in the third condition Ss were given no information. No significant differences in co-operative behaviour were demonstrated. However, the design was a sequential choice 2-trial game and generalisation to simultaneous choice multi-play P.D. would not be advisable.

It may be that incentive levels interact with the motivation of the subject. Stahelski and Kelley (1969) using a P.D. matrix paired together Ss who said they would compete prior to the game. In a points reward system they became increasingly 'competitive' over 30 trials whereas self-described 'co-operators' became less co-operative in both a money and a points incentive condition.

Radlow, Weidner and Hurst (1968) also used a P.D. matrix with an imaginary money condition and a real money condition where subjects were paid winnings on one randomly selected trial. The real money condition had some effect on increasing co-operative choices but the orienting instructions (e.g. whether Ss were given a co-operative or competitive set) were found to be more important. It seems, then, that incentives probably interact with other variables, yet to be fully specified, in determining choices on Prisoner's Dilemma.

2.4 Strategy and Perception of Other

Many studies have employed a simulated 'other player' where each S believes he is playing another subject but is, in fact, playing against a pre-programmed set of responses. McClintock et al (1963) used random strategies of 85 per cent, 50 per cent and 15 per cent co-operative responses from the simulated other player but found no demonstrable effect on the real subjects' choices. Even a 95 per cent co-operative strategy seems to be unable to elicit more than 50 per cent co-operative choices from the real subject (Bixenstine and Wilson, 1963). This tendency to exploit "pacifist" strategies has been found in many other games. Reychler (1979) demonstrated that the level of exploitation may depend on other factors as well. However, the pattern of C choices may have more effect than simply the frequency of C choices.

Solomon (1960) found subjects to be more co-operative when playing against a matching strategy from the simulated other player than against either an unconditionally non-co-operative <u>or</u> unconditionally co-operative strategy. Oskamp (1971) concluded that a change in programmed co-operation from low to high was more effective in eliciting co-operative responses from the subject than a change from high to low. This is consistent with the well-known study by Harford and Solomon (1967) which demonstrated that the 'reformed sinner' strategy of initial non-co-operation followed by unconditional co-operation and then conditional co-operation (where the stooge co-operates only if the subject co-operated in the preceding trial) is more effective in eliciting co-operation from a subject than the 'lapsed saint' strategy (an initial co-operative strategy followed by conditional co-operation).

The perception of the Other has been shown to influence game behaviour. Whilst Grant and Sermat (1969) found no clear link between status and behaviour, Mack (1976) found that status (where the Other's status was varied within a University setting) did have an effect. More non-co-operative behaviour was observed under conditions of equal status.

Information concerning the Other's past game behaviour also influences subjects' subsequent choices. Braver and Rohrer (1975) found that subjects co-operated more when the Other was depicted as trustworthy and co-operated less when they were perceived as exploitative. Baxter (1969) found that more co-operation occurred following information about the Other's co-operative, as opposed to their competitive, characteristics.

However, the author agrees with the position taken by Vinacke (1969) who argues that the introduction of a simulated 'other player' eliminates what may be the most important feature of the gaming situation and that attention should instead be focused on the outcome of games in which social inter-action is permitted to occur.

2.5 Effects of Communication Opportunities

As noted earlier, the traditional P.D. game does not allow communication between the players as the theory assumes the pay-off matrix contains all possible contingencies for each player to make a rational decision. However, even though communication opportunities are introduced, the game still remains non-co-operative in the theoretical sense as any pacts made are not enforceable. Thus, a new dilemma arises as it is in the collective interest to keep the agreement but in the individual interest to break the agreement regardless of what the other player does.

An early study by Mintz (1951) showed that the task of pulling cones out of a bottle which was slowly filling with water was facilitated by opportunities for discussion between the co-acting players. Common sense might well argue that opportunities for communication are more likely to increase the gross number of co-operative choices made by players, but the effects in two-person, non zero-sum games have not been clearly established and are probably related to the specific circumstances of each study. As has been the case with the investigation of personality variables, few replications have been made. Gallo and McClintock (1965) conclude, with reference to P.D., "Finally, opportunities for communication may, but do not necessarily, ameliorate the conflict present in the game" (P.75). For, as Terhune (1968) points out, the opportunities to communicate may not be used at all, used for the purposes of deceit or even used ineptly.

As in other areas of P.D. research, the generalisability of results is hampered by the definition of the independent variable. Wichman (1972) notes that, "Speaking into strange apparatus, passing 'canned noted', writing notes spontaneously, and talking to each other before making a decision have all been lumped together under the common rubric 'communication', while the many important non-verbal forms of communication have been largely ignored" (P.198). Wichman adds that the small numbers of trials often used in gaming designs do not allow the communication opportunities - or, indeed, the inter-action - to fully develop and many of the messages are incomplete. Wichman's(1972) study employed four communication conditions: 1) Isolation (where the subject cannot see or hear the other player i.e. the traditional P.D. game); 2) See only; 3) Hear only; and 4) See and Hear. He found that over 70 trials subjects who could see each other were slightly more co-operative than those in the Isolation condition, but overall, subjects able to use the full range of communication (See and Hear) behaved in a more mutually co-operative, or socially facilitating, way. Subjects in the Hear Only condition reached the same high level of co-operation as the See and Hear group by the last block of ten trials. He concludes: "The feeling that the other person can be influenced diminishes the compelling nature of the competitive choice for each S" (P.205).

Wrightsman, O'Connor and Baker (1972) conclude that, in general, opportunities for communication facilitate co-operative responding in the Prisoner's Dilemma although fixed or limited opportunities may not do so. There is also the possibility that the timing of the communication during the inter-action is important in determining positive or negative effects. Becker and McClintock (1967), for example, concluded that communication between subjects prior to play on P.D. increases the level of mutual trust and facilitates co-operative responding, whether it be due to a motive to maximise one's own gain or joint gain by such behaviour.

Any facilitating effect on joint co-operative behaviour by opportunities to communicate may well be overcome if the other player's behaviour encourages exploitation, or if there has been distrust within the context of the inter-action. This latter notion is consistent with Komorita and Mechling's (1967) study which found that the number of trials before the other player 'betrayed' the subject influenced the time it took to 'forgive'.

It seems obvious from Wichman's (1972) comments that more needs to be known about the exact nature of the communication between subjects. Thus, the content and the prior assumptions of the subjects (in terms of goals and expectations) about the nature of the task need to be more fully investigated.

2.6 Conclusions

Pruitt and Kimmel (1977) point out that the most consistent findings on P.D. result from manipulating situational variables such as the strategy of the 'other player', varying the matrix pay-offs and the experimental set provided by the instructions. They suggest that experimental games typically involve an unfamiliar strategic environment where subjects attempt to be as rational as possible towards certain goals. Each P.D. setting varies in the quality and quantity of interpersonal contacts although studies involving greater intimacy between the participants (e.g. Durkin, 1972) usually produce higher levels of co-operative behaviour. The traditional P.D. gaming paradigm does not allow communication as the theory assumes all information is known. However, informal analysis has demonstrated that even expectations about how the other will behave will influence attempts to make a rational, strategic decision.

CHAPTER THREE : INDIVIDUAL DIFFERENCES AND GAME BEHAVIOUR

This chapter examines the relationship between choices on two-person P.D. and personality or attitudinal characteristics. Differences due to organismic variables (e.g. sex of the player) are also discussed.

3.1 Personality Variables

Findings in this area have been inconsistent or conflicting. Vinacke (1969) points out that people are not rational in the game theoretical sense nor are guided wholly by responses to all available information in the situation. As noted in Chapter One, the intentions of the players may not be obvious and it seems reasonable to suppose that the interpretations of another's choices are likely to be partly a function of predispositions to be, say, suspicious or trusting of others. Terhune (1970) considers that personality effects may be separated into behaviour potentials brought by the individual to the situation (which are likely to determine the initial encounters) and the inter-actions between the personality and the situation which contribute to each player's personal definition of 'the game being played'.

Amongst the most well-known studies of the effects of personality variables are those by Deutsch (1960) and Lutzker (1960). Deutsch looked at both 'trusting' and 'trustworthy' aspects of the C choice and found that scores on the California F-Scale (a measure of 'authoritarianism') tended to correlate negatively with co-operative behaviour in a two trial version of the P.D. game. Subsequently, however, Wrightsman (1966) was unable to establish any relationship between authoritarianism and behaviour on a version of Prisoner's Dilemma. Fry (1965), using a 3 x 3 co-ordination game, also found no significant relationship.

Lutzker's (1960) study employed the Internationalism Scale (an inverse F scale correlate). He found that people having high scores on Internationalism made fewer non-co-operative responses in a Chicken Game[(1)] than those who had high scores on Isolationism. In addition, Internationalists tended not to decrease co-operative responding over time, unlike the Isolationists. In a study by McClintock et al (1965), which gave one of the two players a high power role with influence over the partner's outcome, Internationalists in the high power role responded more co-operatively than Isolationists to their simulated partner. However, conflicting results have been noted by, amongst others, Pilisuk et al (1965, 1968) who found no such differences between Internationalists and Isolationists in behaviour on a game designed to simulate an arms race. In a 21 - alternative Prisoner's Dilemma game, however, Pilisuk et al (1965) noted that subjects high on 'Tolerance for Ambiguity' (related to the F-Scale) were more likely to have a co-operative

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(1) Chicken (sometimes called 'Exploiter') differs from P.D. in that the protagonist must expose himself to risk of loss in order to threaten his opponent. Since $S > P$, the DD outcome has the lowest pay-off in the game (simulating a head-on collision) and punishment is always bilateral.

orientation on the game ('doves') than subjects with low 'Tolerance for Ambiguity' who played in a less co-operative way ('hawks').

Inconsistent results have also been demonstrated using the Machiavellianism Scale (Christie and Merton, 1958). Christie et al (1970) found that high Mach. subjects became increasingly exploitative over time in a restricted Chicken Game when they played against an 80% co-operative 'other'. However, Wrightsman (1966) using a non-restricted P.D. game found no such relationship between game playing behaviour and scores on the Machiavellianism Scale.

Several studies have used Wrightsman's (1966) Philosophies of Human Nature Scale (P.H.N.). Altruism, Trustworthiness and Strength of Will scores were found to correlate positively with co-operation in a Restricted Prisoner's Dilemma Game (Uejio and Wrightsman, 1967). However, this significant finding only held when the subject knew his partner was Caucasian. There was a non-significant negative correlation when the Other was Japanese. Wrightsman et al (1972) found a significant relationship between scores on the Altruism Scale in only one of 4 strategy conditions. No significant effects were noted for any of the other sub-scales of the P.H.N.

Dominance, as a personality trait, has also been investigated in attempts to correlate this trait with behaviour on games. Sermat

(1968) selected 20 high and 20 low dominance subjects who were matched with like and with unlike partners in a pre-game encounter. Subjects thought they were playing a Chicken Game with their partner but in fact played against a pre-determined strategy of 60% co-operation for 50 trials followed by 10% co-operation for 60 trials. Sermat found that dominant subjects played more competitively than submissive subjects on the last 60 trials. In addition, submissive subjects who were paired with similar partners prior to the game were subsequently less competitive than any of the other pairings.

Moore and Mack (1972) used high dominance, low dominance and mixed pairs for their study which employed a 300 trial version of a Prisoner's Dilemma game. The measure of dominance chosen was based on the 1939 Allport and Allport Ascendance - Submission Reaction Study. High dominance subjects, but not low dominance Ss, locked in sooner than mixed pairs and showed more D responses, mutual D responses and more lock-in mutual D responses than either of the other groups of subjects. In addition, dominant subjects initiated more D responses compared to low dominance Ss. The results confirmed Rapoport and Chammah's (1965a) prediction that personality variables could affect play on P.D. However, Moore and Mack pointed out that in their study the differences were only obtained "when one of the groups used in a comparison was such that the personality trait might be expected to add to the effect of the dominating strategy. The results, together with the failure of previous experimenters to find any individual correlates of behavior in this game, seem to indicate the weakness of the personality variable, relative to the nature of the game, in influencing behavior in the Prisoner's Dilemma" (P. 490).

Various studies have investigated the relationship between the player's mental state and their game playing behaviour. It might be expected that paranoid players would be less trusting, and therefore less co-operative, than the other players. However, Harford and Solomon (1969) found that paranoid patients were actually more co-operative than a sample of students. Knapp and Podell (1968), on the other hand, found significant differences between the levels of co-operation on the first trial of a Restricted Prisoner's Dilemma game, but by the 100th trial this difference had disappeared. However, their study employed a programmed 'other' and it was discovered that the patients were less affected by the differences in the strategies of the 'other' than the students.

It was suggested that a sense of group identity, fostering co-operative behaviour, emerges as part of the adjustment to hospital life. This view is supported by the 1969 study of Wallace and Rothaus who found that pairs of schizophrenic patients from the same ward played more co-operatively than pairs of subjects selected from different wards.

The majority of studies examining the relationship between personality dimensions and mixed - motive games have failed to identify any relationship. The reader is referred to the review of the main research findings on personality effects under taken by Baxter (1972) who points out that comparisons between studies are made difficult by the fact that different matrices and procedures may be employed. To make generalisations even more difficult few replications have been made of studies yielding positive results between co-operative choices and personality dispositions and attitudes.

Baxter suggests, however, that 'need for achievement' is one variable which does yield consistent results (e.g. Terhune (1968) found subjects high on this measure are also the most co-operative, although this may depend on the set of the game) but even in this area various measures of the variable, in addition to differences in procedure, have been adopted. Oskamp (1971) demonstrated that situational variables interact with the type of reward structure, and it is therefore necessary to specify the procedure. Even in P.D. forms of mixed - motive games, many variables - in addition to the reward structure - may affect the choices. Such factors include the number of trials, the numbers of people involved, (i.e. two-person or n-person P.D.), the strategy of the 'other player' (if pre-programmed), the timing and knowledge of the pay-offs, whether choices are made simultaneously or successively, whether standard or expanded forms of P.D. are displayed and the number of choices available.

3.2 Personality Variables : Conclusions

It seems, then, that the personality traits brought to the game situation do not, by themselves, determine the outcome. However, Terhune (1970) concluded that personality dimensions may be influential and suggested various ways in which contemporary studies could be refined. These areas included increased attention to incentives, improved personality measurement, more complex experimental situations and increased attention to the inter-action of the player's personality and the game situation.

Pilisuk et al (1965) suggest it is the inter-action at each step of the game that will determine the effect that personality variables will have. Rapoport and Chammah (1965a) also concluded that it was the inter-action between the members of the dyad that was dominant rather than their predispositions towards co-operative behaviour, since with continuous inter-action partners came to behave alike. It seems likely that some situations depress personality effects and it should be remembered that the situational factors associated with the laboratory environment have not yet been fully explored; caution should therefore be exercised in extrapolating to the world at large.

3.3 Sex Differences

The study of sex differences has received much attention in the last decade (see, for example, Maccoby and Jacklin 1975), but Mischel (1968) points out that global trait terms such as 'masculine', 'feminine', 'aggressive', etc., are used to summarise what are, in reality, complex behaviour patterns. During socialisation it is reasonable to assume that many behaviours become sex-typed, acquiring different values and meanings for males and females, and many observed sex differences in adulthood may be the result of the sex-role appropriateness, or the social desirability, of a response. As many sex-typed behaviours are situation specific a knowledge of the environment in which behaviour occurs can facilitate the prediction of events. An interesting approach to the study of sex differences in behaviour is to attempt to discover the factors determining the selection of certain behaviours from the individual's repertoire of responses.

Role conflict seems more likely in women, as they - as do men - internalise the masculine values of the culture and in particular situations women have a lower self-esteem than men and may even be motivated to avoid success (Horner, 1968). Hoffman (1972) believes that females do not develop confidence in their ability to cope with the environment because of inadequate encouragement in their strivings for independence and exploratory play as children.

How, then, do these differences between men and women affect choices in mixed-motive games? Some people, for example, may be content to choose a satisfactory alternative rather than an optimal one, more closely resembling compromises found in real-life situations. Pruitt and Kimmel (1977) note that at least 68 studies in the experimental game literature have employed the sex variable, possibly due to the ease of recruiting subjects. As in other areas of investigation, different procedures and matrices have been adopted and a large number of studies report no significant differences due to the sex of the player (e.g. Kanouse and Weist, 1967; Lutzker, 1961; Bixenstine, Potash and Wilson, 1963; Evans and Crumbauch, 1966; Wilson and Kayatani, 1968). However, the review below will be concerned more with those studies that have demonstrated a sex difference.

The most often quoted finding is that males are more co-operative than females (e.g. Bedell and Sistrunk, 1973; Oskamp and Perlman, 1965; Rapoport and Chammah, 1965a; Hottes and Kahn, 1974). For example, Rapoport and Chammah (1965a) compared male pairs of subjects, female pairs and mixed-sex pairs in a multi-play P.D. design. They found that male pairs co-operated more than female pairs whilst mixed pairs, in general, had co-operation levels between the two. Rapoport and Chammah suggested that in the mixed-sex pairs women are 'pulled up' and men 'pulled down'.

We have seen that some studies have found no sex differences relating to co-operative behaviour, whilst a less often reported finding is that some studies have found females to actually co-operate more than men (e.g. Tedeschi, Bonoma and Novinson, 1970). However, the sex differences (if any) come about, as suggested by Rapoport and Chammah (1965a), during the interaction and as a result of the experimental conditions as male and female dyads typically start a game co-operating at the same level. Rapoport (1970) suggests that the inconsistent findings may be due to the strategy of the 'other player'. He suggests, for example, that a programmed opponent with a non-contingent strategy may fail to 'bring out' the females' weaker propensity to co-operate. However, other factors must be operating as Oskamp and Perlman (1965) were able to demonstrate sex differences (with men more co-operative than women) in a very short game of only 30 trials.

Many of the studies reporting sex differences imply greater rationality on the part of male players than of female players. Halpin and Pilisuk (1970) employed a Restricted Prisoner's Dilemma game where subjects played against a non-contingent strategy (70% co-operation) of the programmed 'Other'. Males showed a more rapid decline than females in attempts to communicate through co-operative responses on trials where non co-operation was expected from the 'partner'. Males also rapidly increased exploitative use of the D choice where co-operation was predicted from the 'partner'. Males were more liable to play the game as though the 'other' player was always going to choose C.

This tendency of males to respond more 'competitively' when playing against a non-contingent strategy (where the optimal strategy for the player is 100% D) has also been noted by Tedeschi, Bonoma and Lindskold (1970) who also found that females were less likely than males to take advantage of a threat option in the game.

Terhune (1970) reviewed the literature on sex differences and behaviour on games. Many studies have suggested that women are more emotional whilst men are more rational in their play, thus reflecting traditional sex role sterotyping. Terhune concluded that females react with greater retaliation when in a vulnerable position (e.g. Bixenstine and O'Reilly, 1966), they seek compromise thus avoiding competition, women are less exploitative of a co-operative 'other' but once crossed are less 'forgiving' and men tend to be more co-operative in response to a tit-for-tat strategy and to use it as a strategy themselves. In general, women are seen as being less co-operative than men in mixed-motive games and more likely to end up in "mutually punishing conflict deadlocks". It is considered that women therefore have difficulty in understanding strategic situations and fail to recognise the "rational" strategy.

Bedell and Sistrunk (1973) argue that those studies which have found women to be more co-operative than men have had a 'competitive' set, whereas an individualistic set is present when men are more co-operative than women. They suggest that women respond at the same level of co-operation regardless of the experimental variables whereas men may have been more responsive to the demand characteristics of the experiment. Bedell and Sistrunk report data from their own (1973) study in support of this, adding that females were more responsive to characteristics of the other player and were more co-operative in mixed-sex dyads than in like-sex dyads. The data suggests that men are primarily concerned with 'winning' or, at least, achievement whereas women tend towards social concerns. Such an interpretation is consistent with traditional sex-role stereotypes and with Horner's (1968) findings. Kahn et al (1971) support the notion that different goals are pursued by members of each sex. They found that men respond on the basis of strategic considerations and co-operate when playing with a partner who imitates his choices and 'compete' with a randomly responding partner. Both of these strategies are optimal if the goal is to maximise earnings.

In recent years there has been a change in traditional sex role stereotypy. Baefsky and Berger (1974) investigated the game playing behaviour of career oriented, and traditionally oriented, women. The former were more inclined to compete and less willing to opt for the self-defeating strategy. Cardi (1972) found that women who did not have stereotyped expectations of sex role behaviour competed more against men than women in a Prisoner's Dilemma game. In contrast, traditionally oriented women competed more with other women than with men. This is consistent with Ingram and Berger's (1977) finding, using single sex dyads.

Hottes and Kahn (1974) concluded that male players decide on a co-operative strategy in order to maximise their joint gains. Women on the other hand, tend to be less co-operative and this was considered to be a defensive measure in order to avoid failure rather than seek success, consistent with Horner's (1968) study of achievement motivation. It was shown in Chapter One that the strictly dominating minimax strategy, D, may be motivated by caution rather than competition. By choosing D, the "sucker's" pay-off is always avoided.

3.4 Sex Differences : Conclusions

It is clear that the findings are in-consistent although it is not, in the author's opinion, acknowledged sufficiently in the literature. The notion of 'rational behaviour' in mixed - motive games is difficult to define. Although the 'D' strategy strictly dominates it will be remembered that Rapoport (1966) concluded that ".....rationality must prescribe the same choice to both (players). But if both choose the same, then (C,C) and (D,D) are the only possible outcomes. Of these, (C,C) is clearly the better. Therefore, I should choose C" (P.141). The game should therefore allow for expectations of the Other to be taken into account. In some situations females may play more rationally than men. Mack, Williams and Kremer (1979) found that men tried to "exploit" the Other knowing that it was a computer, whereas females took into account the assumption that the Other was rational. Thus, the results of research in the area of sex differences and behaviour on mixed - motive games offer a confused picture.

Skotko et al (1974) consider that many of the sex differences noted on mixed - motive games are an experimental artifact. They have postulated a differential sensitivity of male and female subjects to aspects of the experimental set but their interpretation is extended to include characteristics attributed to the sex of the experimenter. Using a design which balanced the sex of the experimenter, Skotko et al found that female dyads were extremely non-co-operative in the presence of a _male_ experimenter. Although this finding does not explain the inconsistencies in the literature which have all - as far as the author is aware - employed male E's, the conclusion by Skotko et al that previously reported sex differences in choices on P.D. cannot be considered solely as a function of the subjects _or_ of their inter-action considered in isolation seems a reasonable one.

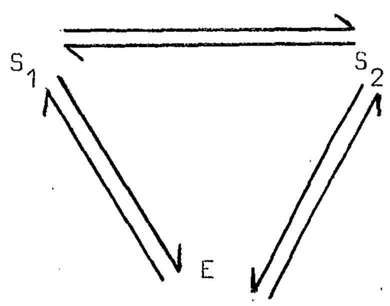
3.5 Research findings in the U.K.

To the author's knowledge, little research has been done in the U.K. on experimental games in general and even less on sex differences in choices on P.D. One noteworthy exception is David Mack, from the University of Loughborough, who has carried out an extensive research programme on experimental games. He replicated one of his studies, previously undertaken at the University of Minnesota, in Loughborough and found similar results (Mack 1975). The subjects were playing a machine previously programmed to make co-operative choices 80 per cent of the time. However, a television monitor showed pictures of students apparently preparing for the same game and subjects were unaware they were playing a machine. Women who thought they were playing women were less co-operative than men who thought they were playing men. However, women were more co-operative (as in Rapoport and Chammah's 1965a study) when they thought they were playing against men, lending some support to Horner's (1968) postulation of a motive to avoid success when women are in direct competition with men. However, Mack also found that men are also more co-operative when playing against a member of the opposite sex. In a personal communication it was discovered that a male experimenter conducted the study on the British population, although the experimenter was not present in the room during play. The study by Skotko et al (1974) would support the idea that this factor, in itself, may partly account for the sex differences exhibited.

As has been the case with much of the research on P.D., Mack's study has eliminated the most important feature of a social inter-action, namely the other player, with his own goals and expectations of the nature of the game being played. The instructions used concepts such as 'game' and 'player' and tended to present an individualistic set; Bedell and Sistrunk (1973) argued that this was a factor in the common finding that men are more co-operative than women. The matrix employed by Mack also included some negative pay-offs and it is possible that this introduced (psychologically) a win-lose 'competitive' element that differentially affects the sexes.

In an unpublished British study of sex differences using a Chicken matrix (a 'dangerous' game), Gibbs (1972) suggested that the Experimenter-Subject and Subject-Experimenter inter-actions in mixed - motive situations were also worthy of investigation. The experimental situation is effectively changed from a dyad into a triad when a two-person game is carried out in the presence of the Experimenter as shown in Figure 3.

Figure 3 : Inter-actions in 2-person games in the presence of E.



Argyle (1967) noted that the introduction of a third person, even in the role of observer, changes the essential nature of a dyad with regard to interpersonal behaviour and Gibbs (1972) suggested that the sex of the observer may have a further effect. This suggestion is supported by Skotko et al's (1974) study which postulated a differential sensitivity on the part of male and female subjects to characteristics attributed to the sex of the experimenter. No subject sex differences were demonstrated in the British study.

The following chapter describes the aims and design of the present series of experiments undertaken on a British student population.

CHAPTER FOUR : AIMS AND DESIGN OF THE INVESTIGATIONS

4.1 Aims

It was demonstrated in Chapters Two and Three that more needs to be known about two important areas of research on gaming behaviour: opportunities for communication and sex differences in choices. Despite many investigations it is still difficult to predict under what conditions men and women are willing to adopt the unstable but mutually rewarding (C,C) strategy. It is equally difficult to determine the effect that communication opportunity will have. Wrightsman et al (1972) concluded that communication opportunities probably facilitate co-operative responding but that limited opportunities may not. The timing of the communication opportunity was also considered important.

Hottes and Kahn (1974) actually varied a limited verbal communication opportunity during the inter-action of male and female dyads on a Prisoner's Dilemma game. This American study demonstrated that male students were more co-operative and imitative of a like - sexed partner than females. Although no main communication effect was observed an inter-action effect was noted. Males became more co-operative over time following verbal communication opportunity after trial 31. On the last trial block (trials 151 - 180) 100 per cent co-operation was demonstrated by the male dyads. Men tended to discuss the task in hand, whereas females tended to have socially oriented discussions. The females' preference for the strictly dominating minimax strategy, D, was considered a defensive measure.

However, this particular study raised more questions in the author's mind than provided answers. For one thing, could this finding be replicated with a British subject population? Mack's (1975) study replicated one of his own investigations previously carried out at the University of Minnesota and found similar results. However, Mack's study eliminated both a real-life 'other' and the presence of the experimenter. Although Gibbs's (1972) project included both of these the matrix conformed to the requirements of chicken and there were no opportunities for subjects to verbally communicate their intentions. Kremer (1980) also looked at sex differences in a British student population in play on "Leader", another symmetrical mixed-motive game. He found no differences either in the choice of strategy or in the propensity to change strategy.

Secondly, could the differences noted by Hottes and Kahn be demonstrated when the experiment was conducted by a female E, the author? The study by Skotko et al (1974) suggested that sex differences on P.D. were an experimental artifact and the result of employing a male E. However, it was noted in Chapter Three that this factor, by itself, could not account for the conflicting results in the literature although it is clearly an important element in the inter-action of which the experimenter is a part.

Thirdly, what other situational variables could be responsible for the sex differences in game behaviour noted by Hottes and Kahn? What features of the experimental situation make sex-role behaviour more salient and encourage 'defensive' choices by female players? For example, one such area may be the communication opportunity. What limiting effects does fixed communication opportunity have on female players and how does this affect the emergence of sex-typed behaviour? In addition, could female players be 'pulled up' by a male partner, as suggested by Rapoport and Chammah (1965a) and how would females make use of the communication opportunities if the other player was male rather than female?

The aim of the present investigation is therefore to clarify the position with regard to the effects of the sex of the subject and communication opportunities on co-operative choices in the iterated Prisoner's Dilemma.

4.2 Design

The author conducted a series of experiments with British students based on the Hottes and Kahn (1974) American study. The basic design employed a matrix version of P.D. and pairs of subjects simultaneously made their choices in the presence of the Experimenter.

Several preliminary studies were attempted by the author. One employed a student teacher population and another included political party membership as an additional variable to sex and communication opportunity. Both these studies had to be abandoned due to the very real difficulty of obtaining sufficient numbers of people willing to volunteer as subjects.

The present series of experiments employed students from Durham University where, again, volunteer subjects were in short supply. The design of the experiments requires pairs of subjects to be present and the insufficient numbers of volunteers, in addition to the many failed appointments, meant that there was insufficient time to run the control groups that would, in ideal circumstances, be necessary.

The first experiment of the series looks at the effects of sex and four levels of communication opportunity on co-operation and imitation in male, female and mixed sex dyads. This is presented in Chapter Five. A financial incentive is introduced into the second experiment (Chapter Six) which investigates the effect of sex (male and female dyads) and two levels of communication opportunity on co-operation and imitation. The effects of a financial incentive are investigated using a partial design as there is no low incentive control group. Corresponding treatment groups from the first experiment are compared with those from the second experiment, although the author appreciates that this is not an ideal research design. Environmental circumstances are bound to vary although it seems unlikely that there would be dramatic variations.

A financial incentive is retained for subsequent experiments which employ only male and female subject dyads under two communication conditions (none allowed and three minutes allowed after trial 31). The effects on levels of co-operation, only, are investigated.

The effects due to the sex of the experimenter are discussed in Chapter Seven whilst Chapter Eight is concerned with cultural differences and subjects' behaviour in the absence of the Experimenter.

Subjects in Experiment 2 provide data which serve as a baseline for partial designs in later experiments. While such a method may not provide an ideal data base - in that compared subjects have been tested at different times over the academic year - any other approach was considered to be impracticable, given that the subject pool diminishes over the academic year. It is the author's contention that the method employed - based on the assumption that subjects are drawn from a pool with equivalent replacements - is both adequate and necessary.

CHAPTER FIVE : THE EFFECTS OF SEX AND COMMUNICATION OPPORTUNITY ON CO-OPERATION AND IMITATION

5.1 Introduction

It was shown in Chapters Two and Three that the effects due to the sex of the subject and the opportunity to communicate on the number of co-operative choices on two-person Prisoner's Dilemma are far from conclusive. It was noted that one factor which may contribute to the inconsistent findings concerns variations in design and procedure. For this reason, the first experiment was based on an American study by Hottes and Kahn (1974). In that study, pairs of male and female University students played 180 iterations of Prisoner's Dilemma (matrix form) under one of three possible verbal communication conditions (none allowed; three minutes allowed before trial 1; three minutes allowed after trial 31). Subjects received a course credit for their participation.

Male students were found to be more co-operative and imitative of each other when playing a like-sexed partner than female students. Imitative play was considered to be a successful strategy in multi-play P.D. (if the goal is to maximise outcomes) as it tended to be associated with increased co-operation from the other player.

Although no main effect due to limited communication opportunity was noted male pairs, when allowed to talk to each other during the session, tended to discuss possible strategies whereas female dyads tended to have non-strategic, socially oriented discussions.

Hottes and Kahn concluded that men decided on a co-operative strategy in order to maximise their joint gains and were, therefore, more oriented towards winning. The greater frequency of D responses by the women was considered to be a defensive measure as their primary goal of social inter-action was restricted. Hottes and Kahn consider this interpretation to be consistent with Horner's (1968) study of achievement motivation which indicated that females' need for achievement was affected by a motive to avoid success.

5.2 Aim of the Investigation

The investigation is designed to establish the nature of sex differences in the co-operative and imitative behaviour of a British student population. Co-operation and imitation are also investigated under varied conditions of communication opportunity.

In order to examine the nature of male-female inter-action under varied communication conditions mixed-sex dyads are introduced into the Hottes and Kahn design. Unrestricted verbal communication availability is also introduced in order to investigate the way in which the different subject pairings make use of this.

5.3 Hypotheses

On the basis of previous research in the area (notably Hottes and Kahn, 1974; Rapoport and Chammah, 1965(a); Wichman, 1972) the following hypotheses were formulated:

1) Male subjects will be more co-operative than female subjects in the game situation.
2) Male subjects will be more imitative than female subjects in

the game situation.

3) Unrestricted verbal communication will elicit a higher level of co-operative behaviour from all subject pairings, regardless of sex, than limited communication opportunities.

4) Unrestricted verbal communication will elicit a higher level of imitative behaviour from all subject pairings, regardless of sex, than limited communication opportunities.

5) Co-operation levels will increase with the duration of the interation. Although the "learning effect" on repeated plays of P.D. would suggest less co-operation as the inter-action progresses Hottes and Kahn (1974) found that co-operation actually increased with time using this particular version of the game.

6) Imitative behaviour will increase with the duration of the inter-action.

No specific hypotheses were formulated with respect to mixed sex dyads or to inter-action effects. However, it was expected that mixed sex dyads would co-operate and imitate at an intermediate level, following Rapoport and Chammah (1965a).

5.4 Method

a) Subjects and treatment conditions.

One hundred and twenty volunteer undergraduate students at Durham University were recruited to help in the investigation. They were contacted either by advertisements in the students' union or by letter to all new students and were paid for their participation at the standard rate (then 60p per hour).

Twenty male pairs (MM), twenty female pairs (FF) and twenty mixed-sex pairs (MF) of students were randomly assigned to one of four communication conditions such that there were five male pairs, five female pairs and five mixed-sex pairs in each of the four conditions. ('Communication opportunity' refers throughout this study to the availability of verbal communication between subjects). The four communication conditions were as follows:-

i) no opportunity to communicate (0);

ii) opportunity to communicate for three minutes after the instructions but before trial 1 (1);

iii) opportunity to communicate for three minutes after trial 31 (31);

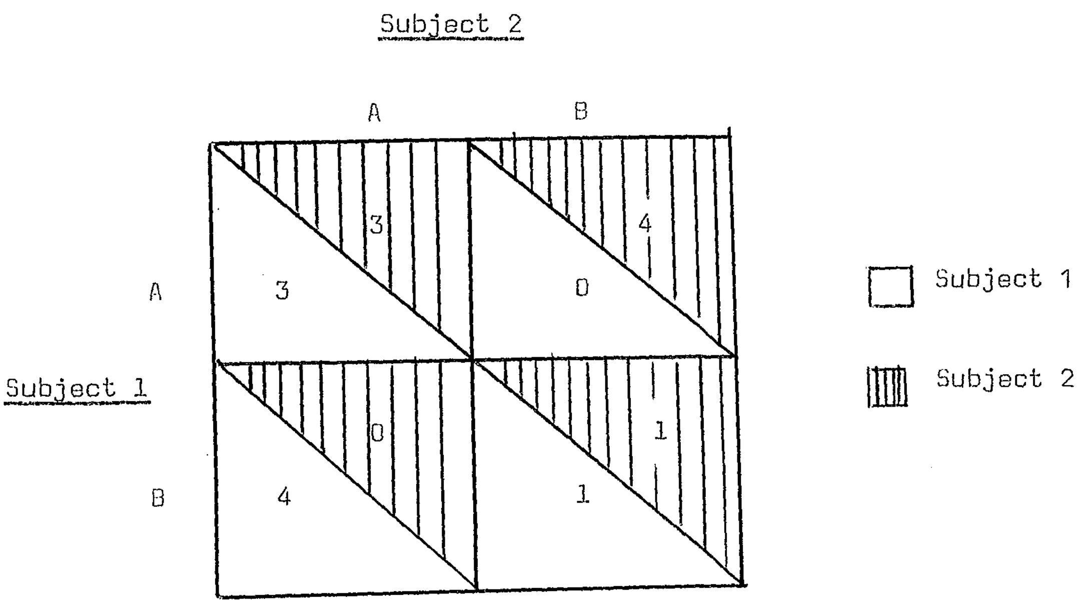
iv) opportunity to communicate throughout (T).

All subject pairs were previously unacquainted with each other and were unfamiliar with the task. They were all under the age of 25 years. Although it has not been conclusively determined empirically, one could argue that friends could be more or less co-operative depending on their face-saving motives and the meaning of 'yielding' in the situation. Several studies (e.g. Oskamp and Perlman, 1965; Swingle, 1968) have shown that friends usually (but not always) choose more co-operatively than strangers. In addition, Marlowe, Gergen and Doob (1966) have found that the level of co-operation is influenced by the anticipation of future inter-action (always a possibility with a University student population) but this effect is assumed to be random in the present design.

b) Apparatus and Procedure

Since the experiment was based on the study by Hottes and Kahn (1974) the same symmetrical matrix was employed (Figure 4). This matrix conforms to the formal requirements of P.D. outlined by Scodel et al (1959). The design and procedure outlined below forms the basis for all the experiments in the series. The data were collected at the University of Durham between 1975 and 1977.

Figure 4 : The Prisoner's Dilemma matrix



Subjects were led into the experimental room by the experimenter and seated on either side of a partition restricting non-verbal communication to a minimum. Both subjects, however, could see and be seen by the experimenter (See Figure 5). The experimenter in this instance was the author.

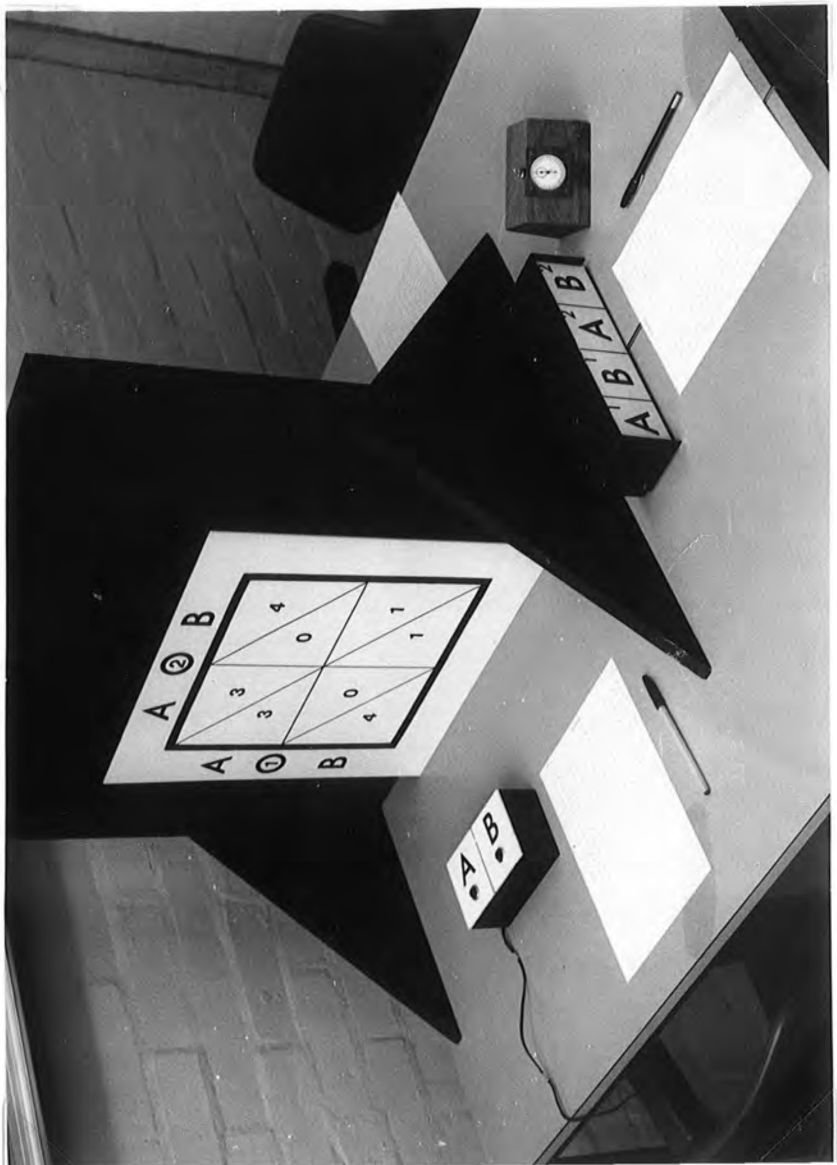


Figure 5 : The Apparatus (Expts. 1 - 5)

The instructions were taped (see Appendix XX for a full account) and played to the subjects as soon as they were seated. Each subject was provided with a pen and a record sheet which contained spaces for 300 responses (Appendix 1). Each subject indicated his/her choices by pressing either A or B buttons (corresponding to choices on the matrix panel) which were relayed to the experimenter's panel and could only be seen by E (Figure 6).

Figure 6 : The Experimenter's Panel

A^1	B^1	A^2	B^2

Subject 1's choices   Subject 2's choices

When both subjects had indicated their choices the experimenter stated which buttons had been pressed and what the pay-offs were after each trial. Subjects wrote down their own pay-off after each trial. Although this procedure was rather laborious it did ensure that subjects fully understood how they had obtained their respective pay-offs. Such a procedure was thought to be necessary since a small pilot study had indicated that even postgraduate psychology students had difficulty fully understanding the nature of the task until some way into the game. However, it introduced slightly more experimenter participation than in the original

Hottes and Kahn (1974) study, although the presentation was in standard form. A more efficient system could have been designed for subsequent experiments but the present method was retained to allow direct comparisions to be made between experiments in this series.

Subjects played 180 iterations of the P.D. game, with no time limit for making choices. Rapoport and Dale (1966) have demonstrated 'end' effects in iterated P.D. and suggest that this occurs as the participants anticipate defection on the last trial (for even if tacit co-operation has occurred there is nothing to lose by such defection as no retaliation can occur). Subjects were therefore not told how many trials were to be played.

Following the last trial, and before they could count their total score, subjects were asked to fill in a questionnaire. A copy is presented in Appendix 11. The subjects had to answer Questions 1 - 5 on a 6 point scale, the values of which were alternated to avoid choice bias in responses. As there was no neutral point, subjects were 'forced' to make a decision. Subjects answering Q3 were instructed that "communication" refers to both verbal and non-verbal methods (eg to the pattern of their choices). Questions 6 - 10 allowed the subject to answer freely and subjects could take as long as they needed to fill out the questionnaires. The questionnaire was based on that used in the Hottes and Kahn (1974) study but with two additional questions which were included to provide insights into Ss' expectations and preferences for the outcome of the inter-action.

The additional questions were as follows:

"What expectations did you have of your partner's strategy?"

"How concerned were you with your partner's score? Did you have a preference for the outcome of the game?"

After each session all subjects were fully de-briefed. They were asked not to discuss the experiment with other students who might be taking part in later experiments. In particular, they were asked not to refer to the task as a 'game' and it was explained that future subjects might be influenced to choose differently if they had preconceptions about the nature of the task. There were many requests for more information and E promised to send each subject brief details of the results as soon as they became available.

The subjects' choices on P.D. were analysed for two dependent measures, co-operation and imitation, following Hottes and Kahn (1974).

c) Instructions

The instructions were taped to avoid any bias in describing the available options, and to standardise presentation as much as possible. The instructions, which were similar to those used by Rapoport and Chammah (1965a), avoid the use of the terms co-operation and competition. In the present study a modification was introduced to exclude reference to 'game', 'player', etc. Such reference might lead subjects to believe that there was a 'my win, your loss' element such as is found in zero-sum games. The instructions used by Hottes and Kahn (1974) were not retained as it was discovered that concepts such as 'win', 'game' and 'player' were used. Their instructions also had an American bias which might not have been appropriate for use with British subjects whereas the instructions used by Rapoport and Chammah (1965a) seemed suitable for use with any subject population. The instructions for the present study are presented in Appendix XX.

After the instructions were played to the subjects the experimenter checked orally that each subject understood the matrix. The experimenter then answered any queries keeping the answers in as standard a form as possible and retaining the wording of the original instructions where possible. Questions regarding the point of the game and the 'best' strategies which could not be adequately answered by "you should try to get as many points for yourself as possible" were responded to with "you should do what you think best".

Non-verbal communication extraneous to the strategic considerations of the game was restricted by requesting subjects to remain seated. When verbal communication was permitted the experimenter discretely made notes of what was said.

However, the Hottes and Kahn study employed an incentive over all treatments, namely that an additional course credit would be given for 300 points gained during the session. This obviously could not be replicated within the constraints of an English University and subjects were asked simply to get as many points as possible.

5.5 Analysis of results

A. Co-operation

Co-operation was defined as the number of A choices made per subject dyad since the within-pairs' responses are not independent of each other, although the between-pairs' responses are (Rapoport 1963). The 180 iterations were divided up, for the purpose of analysis, into 6 trial blocks of 30 trials each. Thus, for each trial block, the subject dyad raw scores ranged 0 to 60; these are presented in Appendix 111. The mean scores are shown in Table 1.

Rapoport and Chammah (1965a) found in a 300 trial P.D. game, using male pairs only, that the initial trend was towards increased D responses (referred to by Rapoport and Chammah as 'defection', although as Pruitt and Kimmel (1977) point out this term implies the prior existence of an agreement to co-operate which was not the case). However, between trials 30 and 60, "recovery" set in and the freouency of co-operative choices increased. Subjects in their study were not permitted to communicate. Similarly, Wichman (1972), using a female subject population, found that the responses of female subjects in an Isolated condition reflected the general trends cited in Pruitt's (1967) review. The median level of co-operation on the initial trials was slightly less than 50 per cent. This declined over the first forty trials but rose to approximately the starting level by the 70th trial.

Table 1. Mean Co-operation Scores for Expt. 1

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad and the communication opportunity

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	19.2	11.8	7.8	7.2	14.0	8.6
	1	24.8	21.4	22.8	16.2	14.8	12.4
	31	10.4	18.4	17.8	18.4	16.6	19.4
	T	32.8	30.0	31.4	42.8	42.0	41.8
FF	0	18.8	15.4	13.0	11.0	10.6	10.0
	1	18.8	22.4	19.8	19.6	15.8	15.6
	31	20.4	10.6	6.4	3.0	6.2	8.6
	T	23.0	17.4	17.6	23.6	22.4	27.2
MF	0	15.0	10.6	3.6	8.6	4.4	3.8
	1	15.0	13.8	9.2	9.4	19.8	17.4
	31	20.8	21.6	22.2	15.6	13.2	19.6
	T	36.6	36.6	39.8	39.6	38.4	40.6

b) Total mean number of co-operative choices as a function of each treatment condition

Pairing

MM	FF	MF
20.95	15.80	19.80

Communication Opportunity

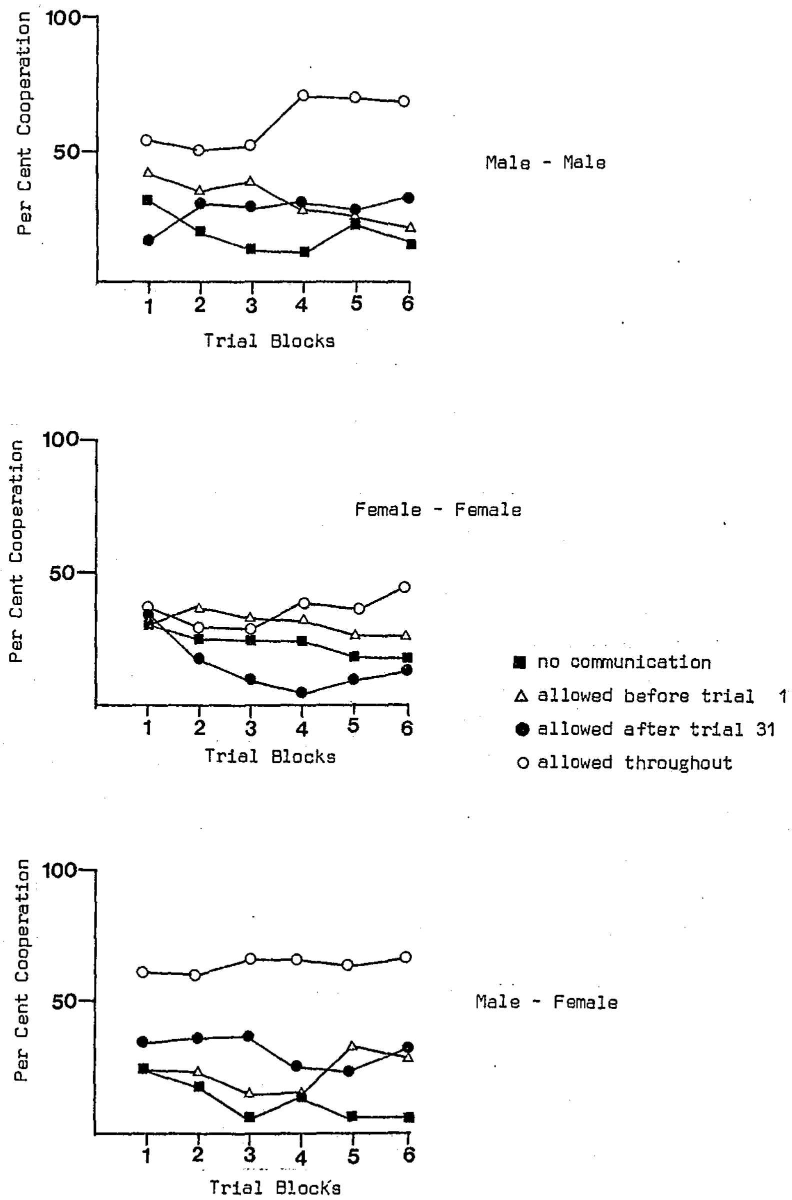
0	1	31	T
10.86	17.17	14.96	32.42

Trial Blocks

1	2	3	4	5	6
21.30	19.17	17.78	17.92	18.18	18.75

Subjects in a Hear Only condition began play at a much higher level but with a slight general trend towards less co-operation over the next 60 trials increasing dramatically in the last 10 trials. These trends can be compared with the O & T communication conditions for MM and FF dyads in the present study. Mean per cent co-operation scores for all treatment groups are shown graphically in Figure 7.

FIGURE 7. PERCENTAGE OF COOPERATIVE CHOICES OVER TRIAL BLOCKS FOR EACH SUBJECT PAIRING BY COMMUNICATION CONDITION (Expt. 1)



It can be seen that for female pairs in the no communication condition (which is similar to Wichman's (1972) Isolation condition) the mean level of co-operation began at just above thirty per cent and steadily declined throughout the inter-action to only 17 per cent on the 6th trial block. Female pairs allowed to talk to each throughout (corresponding to Wichman's Hear Only condition)initially co-operated at nearly 40per cent, dropped to 29 per cent on Blocks 2 and 3 but rose steadily on Blocks 4 and 5 to reach 45 per cent on trial block 6. Thus, the 'recovery' trends noted by Wichman (1972) did not occur at all in the no communication condition and occurred later and less dramatically when subjects were allowed to talk throughout.

The males in the no communication condition began co-operating at just above 30 per cent, falling to only 12 per cent on the 4th trial block. There was a slight increase on the 5th trial block to 23 per cent but this dropped to 14 per cent by the 6th trial block. Thus, the steady recovery noted by Rapoport and Chammah (1965a) has not been demonstrated in the present study, and the suggestion by Pruitt and Kimmel (1977) that subjects in multi-play P.D. shift strategies from short-range to long-range thinking, focusing on a goal of mutual co-operation, is not supported. Furthermore, the Hottes and Kahn (1974) study found that men were more co-operative than women, with the amount of co-operation increasing more rapidly over trials than for women. There was also a suggestion that men co-operated more over time after communication was allowed as the three-way inter-action "approached significance" ($p < \cdot 07$).

Examination of the means in Table 1 shows that male pairs tended to co-operate more than female pairs of subjects whilst mixed sex pairs played at an intermediate level, as suggested by Rapoport and Chammah (1965a). However, statistical analysis indicates that these differences are not significant ($p > 0.05$) and could be due to chance factors.

The number of A choices per subject dyad were analysed by a three-way, fixed factor analysis of variance design. (All such data throughout this study was first checked by computer as to its suitability for use with parametric statistical methods). The analysis of variance summary is shown in Table 2 below.

Table 2. Analysis of variance summary for number of co-operative choices for Sex (3 conditions) x Communication (4 conditions) over Trial Blocks (6 conditions) (Expt. 1)

Source	df	Sum of squares	mean square	F	P
Between dyads					
Sex (B1)	2	1753.80	876.90	0.79	0.53
Communication(B2)	3	23950.50	7983.50	7.15	0.0007
B12	6	5802.27	967.04	0.87	0.53
Error B12	48	53564.00	1115.92		
Within dyads					
Trial Blocks (W1)	5	513.97	102.79	1.20	0.31
W1B1	10	296.73	29.67	0.35	0.97
W1B2	15	2081.03	138.74	1.62	0.07
W1B12	30	2541.60	84.72	1.00	0.51
Error W1B12	240	20592.00	85.80		

However, although no differences between treatment groups attributable to the sex factor were observed the analysis confirmed that communication opportunity had a significant effect ($p=0.0007$) with a suggestion that this effect increased over time ($p=0.07$). No main effect due to the duration of the inter-action was noted. Graphs showing the mean co-operation scores as a function of communication opportunity and of communication opportunity over time are shown below in Figures 8a and 8b respectively. An a posteriori test was employed to see where the differences between the communication treatments lay. The Tukey test was employed throughout this study as it is a more conservative version of the Newman Keuls test (used by Hottes and Kahn, 1974) based on the 'least significant difference' method. Computations are presented in Appendix 1Va.

It was found that communication allowed throughout was a significantly different treatment to the other three conditions (0, 1 and 31) and resulted in more co-operative choices being made by all pairings of subjects ($\alpha = 0.05$). This was, perhaps, to be expected from Wichman's (1972) study, although the mean level of co-operation in this condition was only just above 50 per cent. However, the Hottes and Kahn (1974) study, which only employed communication conditions 0, 1 and 31, found no main effect on co-operative choices although they noted a three-way inter-action ($p < 0.07$) with males in treatment 31 being more co-operative over time. On trial block 6 in this treatment they noted 100 per cent co-operation (i.e. $\bar{X} = 60$), whereas in this study $\bar{X} = 19.4$. However, the hypothesis that unrestricted

FIGURE 8a. MEAN NUMBER OF COOPERATIVE CHOICES AS A FUNCTION OF COMMUNICATION OPPORTUNITY (Expt. 1)

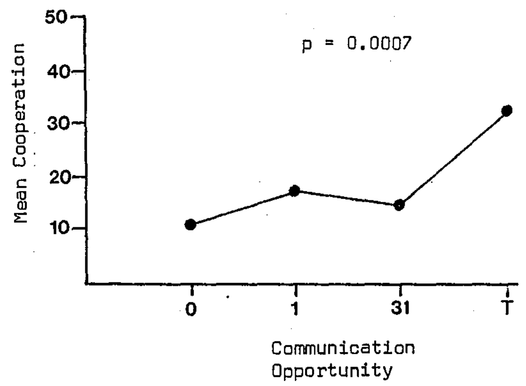
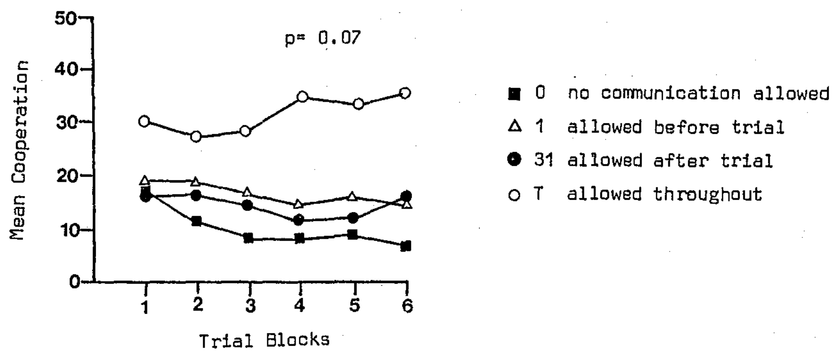


FIGURE 8b. MEAN NUMBER OF COOPERATIVE CHOICES AS A FUNCTION OF 4 LEVELS OF COMMUNICATION OPPORTUNITY AND TRIAL BLOCKS (Expt. 1)



communication will elicit a higher level of co-operation from subjects, regardless of the sex of the pairing, was confirmed.

Becker and McClintock (1967) concluded that communication between subjects prior to playing P.D. serves to increase the level of mutual 'trust' and facilitates co-operative responding by a motive to either maximise the individual or join gains. However, the results from this study and that of Hottes and Kahn do not appear to support that conclusion and the content of the verbal communication may be important. Hottes and Kahn noted, for example, that men were more attentive to the strategic considerations of the game whereas women's primary goal was social inter-action.

The experimenter made brief notes of any communication that occurred in the present study and this is described below.

B. Communication data

Forty-five dyads (N = 120) were allowed to communicate with their partner at a specified time during the course of the inter-action (viz., 1, 31 and T). In Hottes and Kahn's study all the dyads allowed communication engaged in it with a sex difference in the content of the discussion. Six out of ten dyads directly mentioned either an imitative or a 'play A' co-operative strategy, whereas only one female pair mentioned either strategy. They concluded that men were more oriented towards winning whereas women were more socially oriented, a factor contributing to the main sex effect in co-operative responding noted in their study. Although the main findings have not been replicated in the present study, interesting patterns emerged in the different groups of subject pairs allowed verbal communication (see Appendix Va for a more detailed account).

None of the dyads in any of the three pairings mentioned any strategy at all when verbal communication was allowed prior to trial 1, perhaps because they did not fully understand the nature of the task at this stage. The perception of strategic elements by females seemed to occur more in a mixed-sex pairing where four females agreed to the males' idea to press A and three others discussed alternative 'solutions', whilst only one female pair discussed strategies (agreeing to press A but not keeping to the arrangement). This finding is consistent with Rapoport and Chammah's (1965a) suggestion that women are 'pulled up' when playing with men. Although this was not the case in the traditional situation where no communication was allowed, Figure 7 suggests this may be the case when verbal communication is allowed throughout. For males in the mixed-sex pairs, seven considered strategic elements of the task when communication was allowed, whereas eight pairs discussed strategies in the like-sex condition, five of these making an agreement to press A.

Thus, there is some support for the notion that males perceive the strategic nature of the task more fully when given the opportunity to verbally communicate and seem more likely to suggest adopting a mutual AA strategy, although in the present study there were no differences due to the sex of the pairing in the actual number of co-operative choices made overall. Nor did the number of co-operative choices increase over time, an effect noted by Hottes and Kahn (1974), although there was a tendency ($p = 0.07$) for co-operative choices to increase over time when verbal communication was allowed. As noted earlier, in the present study where communication is not permitted (treatment 0), the trends over time in the traditional P.D. task are not consistent with Rapoport and Chammah (1965a) and others. However, as has been noted by some investigators, unreciprocated responses often occured. Rapoport (1963) refers to these chains of responses as the 'martyr run'. In the present study, one male S actually chose A 100 per cent of the time to his partner's 100 per cent B choice, on the (incorrect) understanding that as only one person could get 300 points (and by choosing B on Trial 1 his partner had already 'won') he might as well try and help him.

The data were also analysed with respect to imitative choices. Hottes and Kahn found that imitation also increased over time and that men imitated each other more than women, an effect which increased over time when communication was allowed. For males, the relationship between imitation and co-operation was highly positive while for females there was little relationship, suggesting that for males the adoption of an imitative strategy induces co-operation (or vice versa). The imitation data for the present study will now be considered.

C. Imitation

Tit-for-tat strategies in simultaneous play with a simulated 'other player' or confederate usually elicit fairly high levels of co-operation (e.g. Oskamp and Perlman, 1965). Crumbaugh and Evans (1967) found a contingent matching strategy elicited greater co-operation than a non-contingent strategy which had the same level of co-operative responses overall. Rapoport and Chammah (1965b) found that the choices of male players correlate positively with the choices of the other player on the previous trial; they suggested that imitation may be adopted as a strategy in order to maximise the player's outcomes in multi-play P.D. On the basis of this, Hottes and Kahn (1974) hypothesised that male dyads would adopt an imitative strategy sooner than female dyads and this was found to be the case. In the present study, imitation was initially defined as the correlation between the responses of one player with the immediately preceeding responses of the other player and was measured by the phi coefficient (P1) following Rapoport and Chammah (1965b) and Hottes and Kahn (1974).

However, various problems were encountered with the computation of the data. For example, using the formula for the phi coefficient

$$\phi = \frac{AD - BC}{\sqrt{(A+B)(C+D)(B+D)(A+C)}}$$

where A = AA choices
B = AB choices
C = BA choices
D = BB choices

the denominator for 100 per cent AA or BB combinations is zero. However, common sense would argue that such a correlation is +1.00, but the author was advised by colleagues that mathematically one is not justified in making this assumption and the problem is said to be indeterminate. There was also a problem encountered using the Fisher's Z transformation with this data, following Hottes and Kahn (1974). Phi coefficients of ± 1 were transformed by computer using Fisher's Z, where $Z = \frac{1}{2}\left[\log e\ (1+r) - \log e\ (1-r)\right]$, to infinity. Neither of these difficulties was resolved even following personal communications with Arnold Kahn, Joe Hottes and Anatol Rapoport, and the raw data was therefore converted to proportions instead (see Appendix V1).

Scores were converted to proportions by dividing the treatment total scores per dyad for Block 1 by 29 and for Blocks 2-6 inclusive by 30. The treatment means are shown below in table 3 and presented graphically in Figure 9.

Table 3. Mean Imitation Scores for Expt. 1

a) Mean frequency of imitative responses per trial block as a function of the sex of the dyad and the communication opportunity

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	0.57	0.73	0.77	0.84	0.81	0.83
	1	0.61	0.63	0.69	0.68	0.74	0.78
	31	0.72	0.80	0.83	0.80	0.86	0.85
	T	0.68	0.84	0.87	0.90	0.86	0.84
FF	0	0.64	0.75	0.78	0.80	0.82	0.83
	1	0.62	0.67	0.71	0.66	0.72	0.76
	31	0.64	0.79	0.85	0.83	0.85	0.81
	T	0.68	0.76	0.81	0.86	0.86	0.83
MF	0	0.69	0.75	0.87	0.81	0.88	0.89
	1	0.67	0.76	0.81	0.75	0.78	0.81
	31	0.57	0.81	0.84	0.77	0.80	0.78
	T	0.83	0.83	0.87	0.93	0.95	0.90

b) Total mean frequency of imitative responses as a function of each treatment condition

Pairing

MM	FF	MF
0.77	0.71	0.81

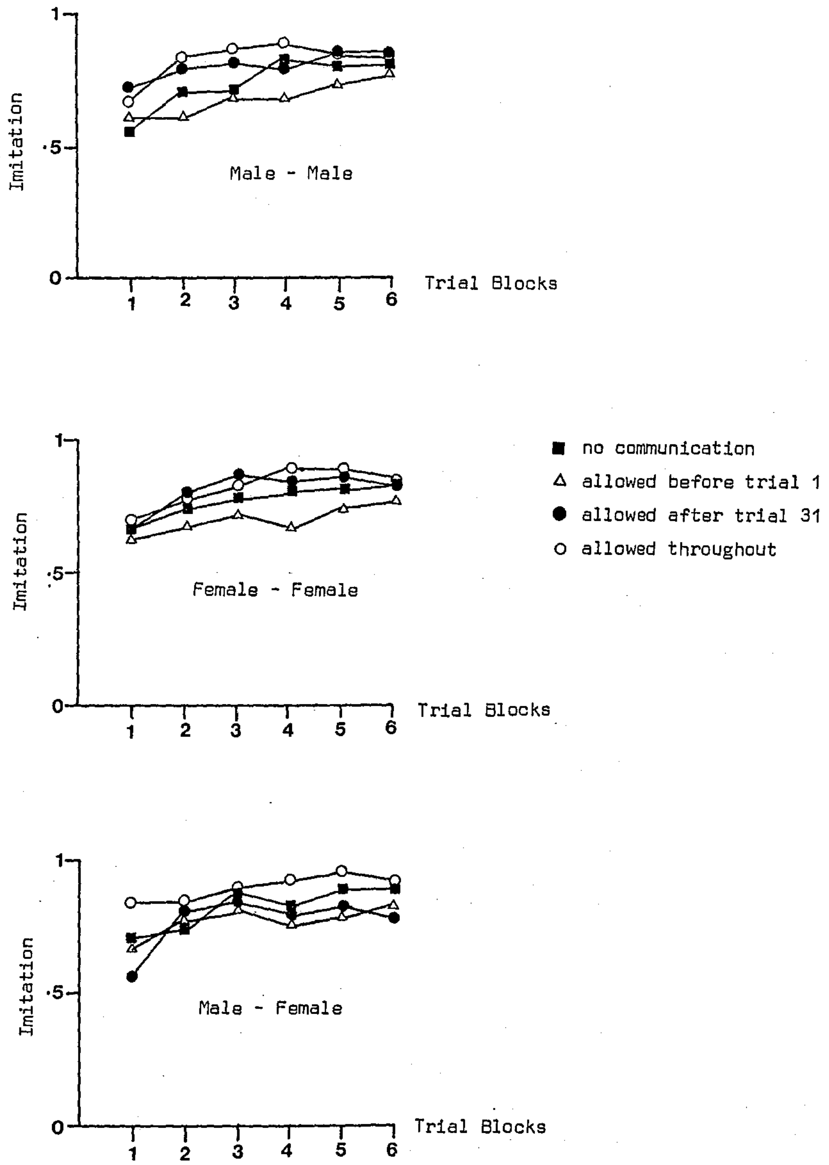
Communication Opportunity

0	1	31	T
0.77	0.69	0.79	0.80

Trial Blocks

1	2	3	4	5	6
0.65	0.74	0.79	0.79	0.81	0.81

FIGURE 9. PROPORTION OF IMITATIVE RESPONSES OVER TRIAL BLOCKS FOR EACH SUBJECT PAIRING BY COMMUNICATION CONDITION (Expt. 1)



In the study undertaken by Hottes and Kahn (1974) imitation increased more rapidly for males than females, was more affected by communication for males than females and increased over time. The data from the present study were analysed by a three-way, fixed factor analysis of variance design. The analysis of variance summary (table 4) suggests a tendency for imitation to be affected by the sex of the pairing ($p = 0.07$) and examination of the means (presented graphically in Figure 10a) suggests that there is a tendency for mixed-sex pairs to imitate each other more than female pairs. Thus is confirmed by the Tukey test, Appendix 1Vb. Communication opportunity also tended to increase imitation ($p = 0.09$), with the least amount of imitation occurring in treatment 1 (Figure 10b). However, the hypothesis that unrestricted communication opportunity would elicit higher levels of imitation than restricted communication was not supported. One significant ($\alpha \leq 0.05$) main effect was noted, namely that imitation increased with the duration of the inter-action ($p = 0.00000$, Figure 10c).

FIGURE 10a. MEAN IMITATION SCORES AS A FUNCTION OF SEX OF THE DYAD

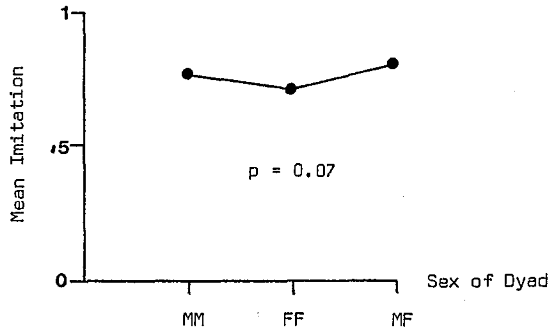


FIGURE 10b. MEAN IMITATION SCORES AS A FUNCTION OF COMMUNICATION OPPORTUNITY

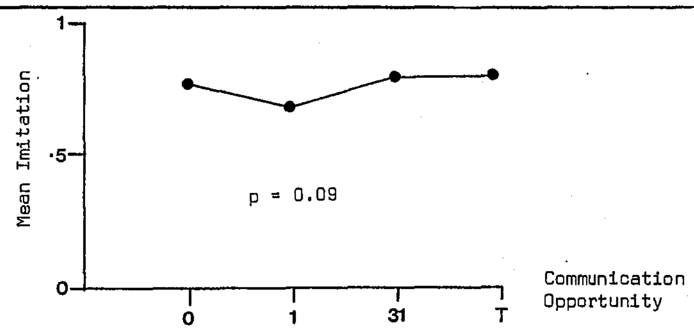


FIGURE 10c. MEAN IMITATION SCORES AS A FUNCTION OF THE DURATION OF THE INTERACTION

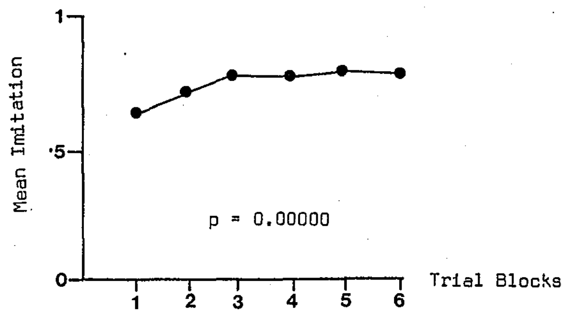


Table 4. Analysis of variance summary for imitation scores (proportions) for sex (3 conditions) x communication (4 conditions) over trial blocks (6 conditions) (Expt. 1)

Source	df	sum of squares	mean square	F	p
Between dyads					
sex (B1)	2	0.58	0.29	2.77	0.07
Communication (B2)	3	0.71	0.24	2.26	0.09
B12	6	0.56	0.09	0.89	0.51
Error B12	48	5.07	0.11		
Within dyads					
Trial Blocks (W1)	5	1.17	0.23	21.58	0.00000
W1B1	10	0.02	0.00	0.21	0.99
W1B2	15	0.18	0.01	1.12	0.34
W1B12	30	0.32	0.01	0.97	0.52
Error W1B12	240	2.61	0.01		

Thus, the present data supports only part of the Hottes and Kahn (1974) findings, namely that imitation increases over time. The hypothesis that men would imitate each other's choices more than women was not supported.

Hottes and Kahn also found that for male subjects, the relationship between imitation and co-operation was highly positive (suggesting that imitation produces co-operation or vice versa) whilst for female subjects there was little relationship. It has already been seen that several of their findings have not been reproduced here. The fact that the same amount of imitation in the present study occurred in communication condition 31 and T (when condition T elicited higher levels of co-operation than condition 31) leads one to suspect that a similar relationship between levels of co-operation and imitation will not be found.

D. Relationship between co-operation and imitation

Hottes and Kahn (1974) found a positive relationship between co-operation and imitation for male subjects from trial Block 1 onwards, whereas for females a significant positive relationship was found on trial block 1 only. In the present study, the number of co-operative choices and imitation scores (proportions) for each dyad were correlated separately by sex and trial blocks using the Pearson product-moment coefficient (see Appendix V11a for the raw scores for each dyad). The results, tabulated in Table 5, show that there is no relationship at all for either mixed-sex or male pairs whilst for females the relationship is significant from trial block 1 to trial block 3 inclusive, but in a negative direction. In other words, the lower the number of co-operative choices (the higher the number of B choices) made by females in trial blocks 1 - 3, the greater the imitation of the other's choices. In this sense imitation would then be seen as a strategy inducing non-co-operation (or vice versa).

Table 5. Co-relations between co-operation and imitation for each trial block by sex of pairing (Expt. 1)

Trial Block	Pairing		
	MM	FF	MF
1	0.09	-0.87 *	0.14
2	0.19	-0.73 *	-0.14
3	0.04	-0.92 *	-0.12
4	0.18	-0.30	0.02
5	0.08	-0.17	0.03
6	0.15	-0.06	-0.16

The author is unwilling to attempt an explanation in terms of different goals for the sexes in this instance (even if it could be done) as the use of the term 'imitation' in this context may be a misnomer. Whilst AB or BA matching strategies clearly contain an element of "I'll give you what you give me" can we be sure that AA or BB sequences do the same? May they not simply be the result of 'locking in' to these combinations, noted by Rapoport and Chammah (1965a) to occur frequently in multi-play P.D? Once AA is established defection is unlikely to be rewarded because of the retaliation that might occur. Similarly, once BB is established an A response is likely to be exploited. The fact that subjects choose the same is, in the author's opinion, not sufficient evidence for saying that the subjects imitate each other. However, the fact still remains that the data from the present study do not support the findings from the Hottes and Kahn study and

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* $p < 0.001$

require explanation. The data from the post-experimental questionnaire were analysed in the hope that subjects' comments would provide insights.

E. <u>The post-experimental questionnaire (Appendix 11)</u>

Responses to the open-ended questions were found to be difficult to categorise and the results for the series of experiments as a whole are discussed in Chapter Nine. They were, however, very useful in providing insights into each inter-action as many subjects were convinced of the 'correctness' of their responses and were unable to accept alternative possibilities.

Responses to the five forced-choice questions were analysed for sex differences using the Mann-Whitney U test, using the correction for tied data ($n_1, n_2 = 40$). Only scores for like-sex dyads were analysed. Raw scores are presented in Appendix V11la. The results are summarised in Table 6 below.

It can be seen that Q3 tended to elicit different responses from male and female players ($p = 0.06$ for a two-tailed test), consistent with Hottes and Kahn's (1974) findings. Men indicated that communication opportunity influenced their choices more than women, although the question does not specify whether the communication was strategic or social in nature. However, in the present study, subjects' reports do not match with the actual number of co-operative choices made. There was also a suggestion that men thought they had more influence over their partner's

Table 6. Summary of questionnaire data for Questions 1-5 (Expt. 1)

Question		Distribution of scores						Mean	Z	P
		1	2	3	4	5	6			
1. How much did your partner's choices affect the choices you made?	Male	1	3	0	9	12	15	4.83	0.99	0.32
	Female	1	0	0	7	15	17	5.15		
2. How much do you think you would like your partner personally?	Male	1	5	4	15	13	2	4.00	1.17	0.24
	Female	1	4	3	10	21	1	4.23		
3. How much did the communication between the two of you influence the choices you made?	Male	11	5	8	5	6	5	3.13	1.91	0.06
	Female	20	5	4	3	5	3	2.43		
4. How much influence did you have over the points your partner made?	Male	1	3	3	6	17	10	4.63	1.78	0.08
	Female	1	3	2	11	19	4	4.40		
5. How much or how often did you try to give your partner what he gave you?	Male	3	8	2	11	10	6	3.88	0.28	0.78
	Female	2	7	6	12	7	6	3.83		

choices than did women (p = 0.08 for a two-tailed test), supporting the notion that men attend to strategic considerations more than women, but Hottes and Kahn did not find significant differences in responses to this question. Nor did they find significant differences in response to Question 5 which directly asks subjects whether they were imitating their partner. The author feels that this supports the idea of subjects 'locking in' on mutual AA or BB sequences rather than adopting actual matching strategies.

5.6 Summary and Discussion of Results

a) Co-operation

In the present study no significant differences due to the sex of the dyad were demonstrated. The hypothesis that male dyads are more co-operative than female pairs was not supported.

Communication opportunity had a significant effect on co-operative responses but this depended on when it was made available. The hypothesis that unrestricted communication opportunity would elicit higher levels of co-operation than restricted communication, regardless of the sex of the dyad, was confirmed.

There was some support for the notion that men attend more to strategic considerations, as shown by the content of their discussions, but this did not influence the number of co-operative choices elicited.

The hypothesis that co-operation would increase over time was not supported.

b) 'Imitation'

'Imitative' behaviour was found to increase **with the duration of the inter-action thus confirming the hypothesis. 'Imitation'** tended to vary as a function of the communication opportunity.

There was a tendency for mixed-sex pairs to 'imitate' each other more than female pairs of subjects. No significant differences between male and female pairs were demonstrated and the hypothesis that male dyads are more imitative of each other than female pairs was not supported.

c) Relationship between co-operation and 'imitation'

It was found that, for female subjects on Blocks 1 - 3, the fewer the number of A choices made, the greater the imitation of the other player's choices. However, it was argued that 'imitation' was actually the result of 'locking in' on a certain sequence of choices, in this case BB. The fact that there were no sex differences in subjects' responses to Q5 (either in the present study or in Hottes and Kahn's 1974 study) further supports this conclusion.

d) Implications of differences in procedure

It is now necessary to consider the differences in procedure which may account for the discrepancies between the findings of the present study and those of Hottes and Kahn's (1974) study on which it is based.

One obvious difference is the sex of the experimenter. Skotko et al (1974) suggested that female subjects were only more non-co-operative in the presence of a male experimenter. Although it was noted in Chapter Three that this finding could not explain the results from other studies which report no sex differences in the level of co-operation, this factor must be seriously considered.

It was noted at the beginning of this chapter that the original instructions used by Hottes and Kahn (1974) were not retained. Wrightsman et al (1967) have suggested that the instructions to the subject may be one of the most overlooked variables in gaming research, a claim fully supported by the author especially with regard to the motivational set induced in a naive subject. However, the standard instructions used by Rapoport and Chammah (1965a) and modified here have frequently been adopted in the literature where sex differences have been reported. It is the author's contention that they induce, as do the instructions used by Hottes and Kahn (1974), an individualistic set. It will be remembered that Bedell and Sistrunk (1973) argued that those studies reporting sex differences in co-operation levels (with men being more co-operative than women) had an individualistic set. However, results from the present study suggest this view is too simplistic.

Subject factors may also be important. It is possible that subjects recruited by achievement incentive (course credits) as opposed to monetary incentive (60p per hour) play differently, especially in view of Horner's (1968) finding that women may 'fear' success when competing with men in achievement oriented situations. However, this is a difficulty which could not be overcome in the present study. Cultural differences between subjects may also be important as, to the author's knowledge, only Mack (1975) has studied sex differences on P.D. in this country.

Although he found sex differences in the expected direction subjects sat in isolation and played a programmed 'partner', thus minimising the social nature of the situation.

In the present study, with the exception of the T condition, co-operation was well below 50 per cent throughout the session and subjects often reported feeling bored and not seeing any point to the task. It will be remembered that Hottes and Kahn (1974) employed an incentive within the game (an additional course credit) for every 300 points accumulated. Whilst this could not be replicated at Durham University a monetary incentive could be adopted instead.

The literature concerning the effects of incentive levels is inconclusive, as was seen in Chapter Two. However, it seemed clear from subjects' reports in the present study that an incentive should be introduced into the game in order to raise the subjects' interest level and, hopefully, the level of co-operation. It was also hoped that the design would more closely approximate that of Hottes and Kahn (1974).

The following chapter describes the introduction of a financial incentive into the basic design of this series of experiments.

CHAPTER SIX : THE EFFECTS OF INCENTIVE

6.1 Introduction

Subjects in the Hottes and Kahn (1974) study were rewarded with a course credit for every 300 points they accumulated during the course of the game. This was a factor which could not be replicated in the present study, although a financial incentive could be introduced in its place.

At the time these experiments were being undertaken (1975–1977) it was argued by many (e.g. Gallo, 1966) that the level of incentive was not a crucial variable and for that reason it was not considered an important factor in the design of the previous experiment. However, subjects indicated either in answer to the post-experimental questionnaire or in discussion with E that they were often bored or thought the task pointless. Subjects' perceptions of having 'done well' in the context of the experiment varied greatly. It became clear to the author that a goal of achieving 300 points or more had to be related to an explicitly stated pay-off (in this case a financial pay-off).

It was decided to introduce a financial incentive in the second experiment of the series (£1 for every 300 points obtained). This was in order that the design would more closely approximate that of Hottes and Kahn (1974) and that subjects would not vary their choices simply out of boredom as suggested by Lieberman (1960). This is especially likely in a 180-trial P.D. game.

The basic instructions used in the first experiment were retained with as few modifications as necessary. The motivational set of the instructions was 'individualistic' and remained so throughout.

The same matrix and apparatus as Experiment 1 (see Figures 4 and 5) were retained for the second experiment which followed the same procedure as the previous experiment. However, it was decided to reduce the number of experimental treatments. This was due to the difficulty of obtaining subjects and the length of time required to undertake the earlier experiment because of the failure by volunteers to attend at the agreed time.

Previous research (e.g. Marwell, Schmitt and Shotola, 1971) suggested that communication may elicit higher levels of co-operation if it occurs after some experience of game playing. Although they referred to non-P.D. situations, other studies using P.D. games (e.g. Kahn et al, 1971) have found that co-operation increases after a low initial level around the 25th to the 30th trial. When communication was allowed after the 31st trial in the Hottes and Kahn (1974) study men tended to co-operate more over time than women. In the earlier experiment in the present series only communication opportunity allowed throughout elicited significantly more co-operation. However, it was expected that the introduction of a financial incentive would influence the strategic discussions noted in treatment 31 (see Appendix Va) which occur when Ss have had some experience of game-playing.

Thus, communication conditions 0 and 31 were retained as were MM and FF subject pairings.

6.2 Aim of the Investigation

The investigation is designed to establish the nature of sex differences in the co-operative and imitative behaviour of a British student population when a financial incentive is introduced into the task. Co-operation and imitation are also investigated under two conditions of restricted communication opportunity.

6.3 Hypotheses

On the basis of the study by Hottes and Kahn (1974), where significant effects due to the sex of the dyad and the duration of the inter-action were demonstrated, the following hypotheses were formulated:

1. Male subjects will be more co-operative than female subjects in the game situation.
2. Male subjects will imitate each other more than females in the game situation.
3. Co-operation levels will increase with the duration of the inter-action.
4. Imitative behaviour will increase with the duration of the inter-action.
5. The presence of a financial incentive will elicit higher levels of co-operation from subjects, regardless of sex and communication opportunity.

No specific hypotheses were formulated with respect to restricted communication opportunity or to inter-action effects.

6.4 Method

a) Subjects and Treatment Conditions.

In the second experiment of the series, forty undergraduate students at Durham University volunteered to help in the investigation. They were recruited by advertisement in the Students' Union or by a letter sent to all new undergraduates. In this instance, however, they were informed that they might be able to earn £1 during the course of the experiment rather than be paid at the rate of 60p per hour. It was assumed that subjects were obtained from the same volunteer population. All subjects were under the age of 25 years, were paired with like-sexed strangers and were unfamiliar with the task.

Ten male pairs (MM) and ten female pairs (FF) were randomly assigned to one of two communication conditions.

1) none allowed (0);
2) verbal communication made available for three minutes after trial 31 (31).

As in the previous experiment there were 5 dyads in each treatment condition.

b) Procedure

Subjects were seated on either side of the partition (see Figure 5) and provided with a pen and record sheet containing spaces for

300 responses (Appendix 1). Subject's choices were indicated by pressing A or B buttons and relayed to the experimenter's panel (Figure 6). As in the earlier experiment the experimenter (again the author) stated the choices and respective outcomes after each trial in as standard a manner as possible. Subjects wrote down their own pay-offs after each trial.

Follow 180 iterations, and before subjects could count their final score, subjects were asked to fill in a questionnaire as before (Appendix 11).

After each session subjects were fully de-briefed and any money owed to them was paid. They were asked not to discuss the task with other students who might be taking part in later experiments and E agreed to send them details of the results as soon as they became available.

The raw data obtained from each inter-action were analysed for two dependent measures: co-operation and imitation (following Hottes and Kahn,1974).

c) Instructions

As before, the instructions were taped to standardise presentation and, apart from introducing a financial incentive, were similar to the previous experiment. They are presented in Appendix XX.

The experimenter checked orally that subjects understood the matrix and answered questions regarding procedure. The answers given to the subjects were in as standard a form as possible keeping to the wording of the instructions where appropriate. Questions regarding the 'best' strategies were responded to by saying, "You should do what you think best".

Subjects played 180 iterations of the P.D. game although they were unaware of the number of trials that were to be played. Subjects in communication condition 31 were told after the 31st trial, "We'll have a break now. You can chat to each other for a few minutes, but not to me. Please remain seated". During this time the experimenter discretely made notes of anything that was said. The task was resumed after three minutes when E requested the subjects to, "Press when you're ready".

6.5 Analysis of Results

A. Co-operation

The degree of co-operation was again defined as the number of A choices made per subject dyad. The scores from the 180 trials were divided up for the purposes of analysis into six trial blocks of 30 trials each. The raw scores for each subject dyad are presented in Appendix 1X. The mean scores are shown below in Table 7 and presented graphically in Figure 11.

It can be seen from these graphs that the trends for male pairs and female pairs in the no communication condition more closely approximate the findings from other studies employing the

Table 7. Mean Co-operation Scores for Expt. 2

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad and the communication opportunity.

Pairing	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	19.6	14.4	17.8	18.2	23.4	30.8
	31	25.2	51.4	54.2	58.4	55.6	52.6
FF	0	24.6	24.6	23.2	30.6	28.4	27.4
	31	20.8	27.4	22.6	28.6	30.4	34.4

b) Total mean number of co-operative choices as a function of each treatment condition

Pairing

MM	FF
35.13	26.92

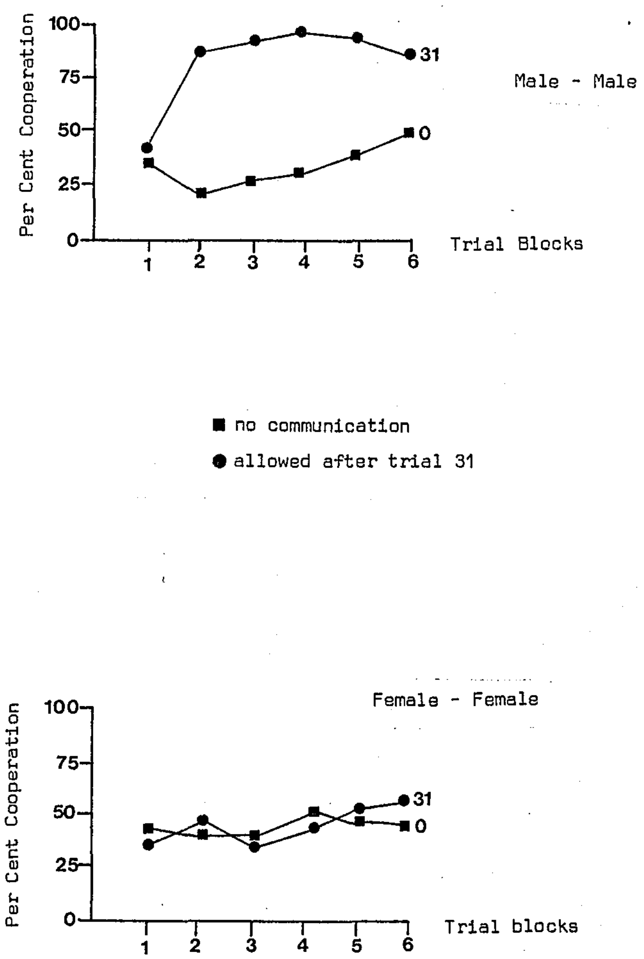
Communication Opportunity

0	31
28.58	38.47

Trial Blocks

1	2	3	4	5	6
22.55	29.45	29.45	33.95	34.45	36.30

FIGURE 11. PERCENTAGE OF COOPERATIVE CHOICES OVER TRIAL BLOCKS FOR EACH SUBJECT PAIRING BY COMMUNICATION CONDITION (Expt. 2)



traditional P.D. game. Rapoport and Chammah (1965a) noted that men initially made more D responses but between trials 30 and 60 they 'recovered' to make an increasing number of co-operative choices. This initial decline in co-operation and subsequent 'recovery' was not demonstrated in the earlier experiment. However, in this instance the number of co-operative choices made by male pairs declined between trial blocks 1 and 2 (i.e. between the 31st and 60th trial) but increased ('recovered') steadily thereafter. Similarly, Wichman's (1972) female subjects in an Isolation condition initially co-operated just below 50 per cent. This declined over the first forty trials but rose to approximately the starting level by the 70th trial. It can be seen from Figure 11 that in the present study the female dyads' scores over time were fairly consistent, unlike the previous experiment where the level of co-operation declined steadily throughout the inter-action to only 17 per cent on trial block 6.

Both Rapoport and Chammah (1965a) and Wichman (1972) allowed their subjects to exchange points for money. Thus the introduction of a financial incentive in the present study seems to have had the effect of eliciting levels of co-operation that are more in agreement with previous American studies. Does it then have similar effects on sex differences in the level of co-operation? Figure 11 suggests that there is an inter-action effect between the sex of the subject and the communication opportunity and this is confirmed by statistical analysis.

The number of A choices per subject dyad were analysed by a three-way fixed factor analysis of variance design. The analysis of variance summary is shown below in Table 8.

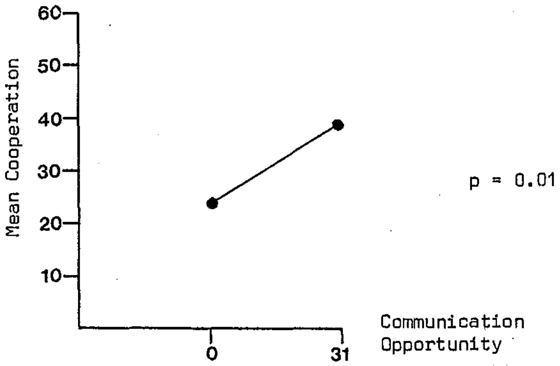
Table 8. Analysis of variance summary for number of co-operative choices for Sex (2 conditions) x communication (2 conditions) over Trial Blocks (6 conditions) (Expt. 2)

Source	df	Sum of Squares	Mean Square	F	p
Between Dyads					
Sex (B1)	1	2025.41	2025.41	2.40	0.14
Communication(B2)	1	6645.41	6645.41	7.88	0.01
B12	1	5866.01	5866.01	6.96	0.02
Error B12	16	13485.27	842.83		
Within Dyads					
Trial Blocks(W1)	5	2497.98	499.60	5.38	0.0004
W1B1	5	542.84	108.57	1.17	0.33
W1B2	5	1263.64	252.73	2.72	0.03
W1B12	5	1057.64	211.53	2.28	0.05
Error W1B12	80	7428.73	92.86		

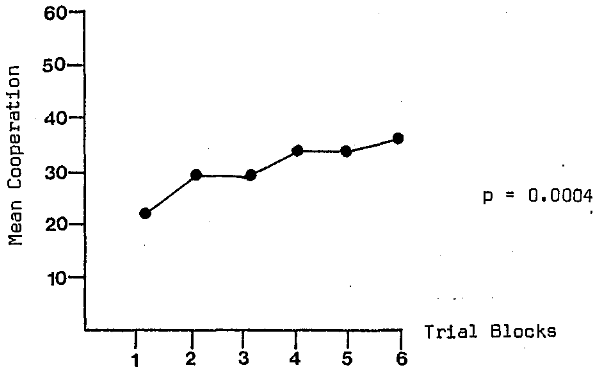
Hottes and Kahn (1974) found significant main effects due to the sex of the dyad and the duration of the inter-action. In the present study, however, the hypothesis that male subjects will be more co-operative than females was not supported. Co-operation levels did increase with the duration of the inter-action ($p = 0.0004$) as can be seen from Figure 12b. Although no specific hypothesis was formulated with respect to limited communication opportunity it can be seen from Figure 12a that the number of co-operative choices was greater when verbal communication was

FIGURE 12. GRAPHS TO SHOW SIGNIFICANT EFFECTS(Expt. 2)

a) Mean Number of cooperative choices as a function of communication opportunity.



b) Mean Number of cooperative choices as a function of trial blocks.



c) Mean number of cooperative choices as a function of communication opportunity and the duration of the interaction.

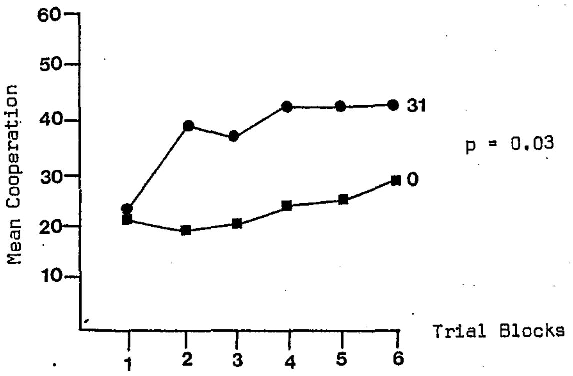
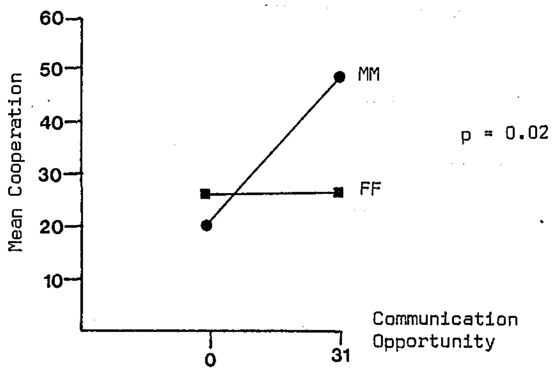


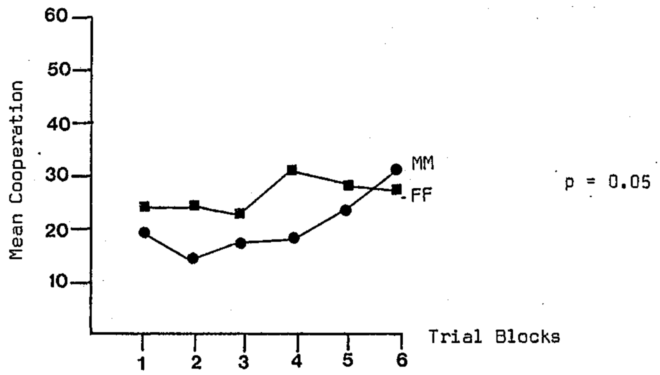
FIGURE 12 CONTINUED

d) Mean number of cooperative choices as a function of the sex of the dyad and the communication opportunity.

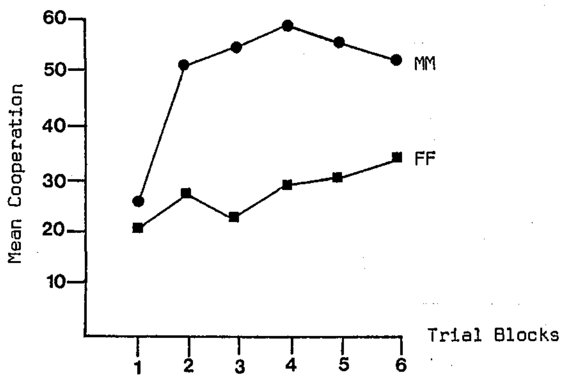


e) Mean number of cooperative choices as a function of the sex of the dyad and the duration of the interaction under 1) no communication and 2) communication allowed after trial 31.

1) 0



2) 31



allowed after trial 31 ($p = 0.01$). In addition, subjects allowed to talk made more co-operative choices as the duration of the inter-action increased (Figure 12c). This two-way inter-action is significant ($\alpha = 0.05$) from Block 2 onwards following the three minute communication period (Tukey test, Appendix 1Vc).

The previous study found no effects on the number of co-operative choices attributable to the sex of the dyad. However, a two-way inter-action between the sex of the dyad and communication opportunity has been demonstrated in the present study where a financial incentive has been introduced into the design. Men were very much more co-operative than women when they were allowed to talk to each other after the 31st trial; this inter-action effect is shown in Figure 12d. The three-way inter-action was also significant ($p = 0.05$) and Figure 12e shows that males made more co-operative choices than females over time when given the opportunity to communicate.

In the Hottes and Kahn (1974) study the effect of communication availability for women actually decreased their co-operative responding, an effect which was significant on Trial Block 4. This effect was not observed in the present study nor was a sex difference such as that described by Rapoport and Chammah (1965a) when subjects are not permitted to communicate. However, this study does support Hottes and Kahn's main assertion that male pairs, when given the opportunity to verbally communicate after some experience of game playing, will increase their level of co-operative responding (Hottes and Kahn, 1974). This is in spite of the differences in the studies noted in the discussion in Chapter Five. The present study was conducted by a female experimenter on a British subject population and a financial rather than an academic incentive was offered (both for recruitment purposes and for achieving 300 points during the course of the game). The instructions were also different, although they present an individualistic set.

The communication data was examined to see if male pairs attended more to strategic considerations during the course of their conversations than did women, as suggested by Hottes and Kahn (op. cit.). The previous experiment in the present series supported this notion although it was noted that there were no differences in the level of co-operation that could be attributed to it. In the present experiment ten dyads were allowed to communicate verbally with their partner during the course of the inter-action. This opportunity was made available for three minutes following trial 31. The following account summarises the way pairs of subjects made use of this opportunity; a more detailed account is presented in Appendix Vb. Of the five male pairs, four made use of this time to discuss possible strategies and all four mentioned 'press A' as being the best joint strategy. Three of these pairs made an agreement to press A throughout the rest of the inter-action, with one subject only defecting on two trials. Of the five female pairs, four talked to each other in the break but only two pairs mentioned pressing A. Of these, one pair could not reach agreement whilst the other pair decided it was more fun not to both press A but instead to "try not to press B together".

Hottes and Kahn (1974) found that six out of ten male dyads directly mentioned either an imitative or 'play A' strategy while only one out of ten female dyads did so. In the present study no pairs (either male or female) mentioned an imitative strategy but four of the five male pairs mentioned pressing A compared to two of the five female pairs. The number of subjects involved here is, of course, too small to attempt a convincing statistical analysis. However, a confounding factor is that four of the five female dyads wondered whether it was "against the rules" to talk about the experiment compared with only one male dyad. It may be that females conform more to the demand characteristics of the situation in their desire to please E and do the 'right thing'.

Again, then, there is tentative support for the proposition that males perceive the strategic nature of the task more fully or, at least, make better use of communication opportunities. This results in a higher level of co-operative responding when there is an incentive to do so.

B. 'Imitation'

The data for the second experiment were also analysed with respect to 'imitative' choices in spite of the author's misgivings regarding this concept, noted in the previous chapter. Scores were converted to proportions by dividing the treatment total scores per dyad for Block 1 by 29 and for Blocks 2 - 6 inclusive by 30. The treatment means are shown below in Table 9 and raw scores are presented in Appendix X1. The data were analysed by a three-way fixed factor analysis of variance design.

Table 9. Mean 'imitation' scores for Expt. 2

a) Mean frequency of 'imitative' responses per trial block as a function of the sex of the dyad and the communication opportunity

Pairing	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	0.53	0.61	0.54	0.55	0.67	0.67
	31	0.58	0.87	0.94	0.97	0.89	0.91
FF	0	0.57	0.68	0.60	0.66	0.67	0.72
	31	0.60	0.68	0.74	0.68	0.73	0.70

b) Total mean frequency of 'imitative' responses as a function of each treatment condition

Pairing

MM	FF
0.73	0.67

Communication Opportunity

0	31
0.62	0.77

Trial Blocks

1	2	3	4	5	6
0.57	0.71	0.70	0.71	0.74	0.75

It will be remembered that the Hottes and Kahn (1974) study found that 'imitation' increased more rapidly for males than for females, males tended to be more affected by opportunities for communication and 'imitation' increased over time. The ANOVA summary (Table 10) indicates that, as in the Hottes and Khan Study and the previous experiment, 'imitation' increased over time ($p = 0.0003$). There was a tendency for communication opportunity to influence the amount of 'imitative' behaviour ($p = 0.06$) an effect which tended to increase over time ($p = 0.06$). Again, there was no indication of any sex differences in 'imitative' behaviour such as that described by Hottes and Kahn (1974). Thus, only one of the hypotheses regarding 'imitative' behaviour was supported.

Table 10. Analysis of variance summary for 'imitation' scores (proportions) for Sex (2 conditions) x Communication (2 conditions) over Trial Blocks (6 conditions) (Expt. 2)

Source	df	sum of squares	mean square	F	p
Between dyads					
Sex (B1)	1	0.11	0.11	0.63	0.55
Communication(B2)	1	0.69	0.69	3.87	0.06
B12	1	0.39	0.39	2.17	0.16
Error B12	16	2.84	0.18		
Within dyads					
Trial Blocks(W1)	5	0.43	0.09	5.84	0.0003
W1B1	5	0.05	0.01	0.67	0.65
W1B2	5	0.17	0.03	2.26	0.06
W1B12	5	0.10	0.02	1.41	0.23
Error W1B12	80	1.17	0.01		

It was argued in Chapter Five that so-called 'imitation' may simply be the result of 'locking in' to mutual AA or BB sequences. Although this argument is still retained, the data from the present study were further analysed to discover what relationship, if any, exists between co-operation and 'imitation' following Hottes and Kahn (op.cit.). It will be remembered that they found a highly positive relationship for male subjects whilst there was little relationship for females.

C. Relationship between co-operation and 'imitation'

The number of co-operative choices and 'imitation' scores for each dyad were correlated separately by sex and trial blocks using the Pearson product-moment coefficient (see Appendix V11b for raw data). The results, tabulated in Table 11 show that if 'imitative' strategies are indeed adopted, then this induces co-operation (or co-operation induces imitation) on Trial Blocks 3 and 4 for male pairs and on Trial Blocks 2,4,5 and 6 for female subjects.

Thus, in the present study females appear to have shown more consideration to strategic elements as suggested by 'imitative' play and frequency of co-operative responses. However, this did not result in a higher level of co-operative choices than men as no sex differences in the overall level of co-operation were noted and, indeed, males co-operated more than females when verbal communication was made available (Figure 12d). Thus, the general notion that 'imitative' play increases the likelihood of co-operative responding (or vice versa) cannot be supported. It was

Table 11. Co-relations between co-operation and 'imitation' for each Trial Block by sex of pairing (Expt. 2)

Trial Block	Pairing	
	MM	FF
1	0.03	-0.57
2	0.50	0.65 *
3	0.65 *	0.31
4	0.65 *	0.65 *
5	0.48	0.74 *
6	0.60	0.92 *

noted in Chapter One that various strategies are probably employed at different stages of each inter-action which are unique and the author feels the notion of 'imitative' play on 2-person P.D. is misleading. Subjects' own reasons for their behaviour are considered more reliable evidence.

E. The post-experimental questionnaire (Appendix 11)

Subjects' responses to the open-ended questions are discussed in Chapter Nine. Their responses to the five forced-choice questions were analysed for sex differences using the Mann-Whitney U test ($n_1, n_2 = 20$). Raw scores are presented in Appendix V111b and the results are summarised below in Table 12.

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* $p \leqslant 0.05$

Table 12. Summary of questionnaire data for Questions 1 - 5 (Expt. 2)

Question		Distribution of Scores						Mean	U	p
		1	2	3	4	5	6			
1. How much did your partner's choices affect the choices you made?	M	0	0	1	5	4	10	5.2	140.5	>0.05
	F	2	1	1	2	11	3	4.4		
2. How much do you think you would like your partner personally?	M	1	2	5	5	7	0	3.8	186.5	>0.05
	F	1	2	3	7	6	1	3.9		
3. How much did the communication between the two of you influence the choices you made?	M	4	1	0	0	4	11	4.6	123.0	<0.05
	F	5	4	3	3	1	4	3.2		
4. How much influence did you have over the points your partner made?	M	1	3	2	0	8	6	4.5	153.5	>0.05
	F	1	4	1	4	8	2	4.0		
5. How much or how often did you try to give your partner what he gave you?	M	2	1	2	5	4	6	4.3	127.0	<0.05
	F	5	3	1	7	2	2	3.2		

Table 13. Further analysis of subjects' responses to Question 3 (Expt. 2)

Communication Condition		Distribution of Scores						Mean	U	p
		1	2	3	4	5	6			
0	M	3	1	0	0	3	3	3.8	49.0	>0.05
	F	0	3	2	2	1	2	3.7		
31	M	1	0	0	0	1	8	5.4	17.5	<0.05
	F	5	1	1	1	0	2	2.6		

As in the earlier experiment, male subjects indicated that communication had influenced their choices more than female subjects ($p < 0.05$ for a 2-tailed test). Subjects had been instructed to take the term 'communication' to include patterns of choices in addition to any verbal communication made. A further analysis was made of the data for question 3 ($n_1, n_2 = 10$) with the dyads' responses being compared for each communication condition. The results are summarised in Table 13 where it can be seen that there is a sex difference in the degree to which subjects believe verbal communication affected their choices. Eight out of ten male subjects in treatment 31 indicated that communication had greatly affected their responses compared to only two out of ten female subjects, but there were no such differences in treatment 0. It was seen earlier that it was in the former condition that male subjects were more co-operative than females and there is now direct evidence that it is the verbal communication which influences the frequency of men's co-operative responding when a financial incentive is introduced in to the experimental design.

There was also a significant sex difference in answers to the question, "How much or how often did you try to give your partner what he gave you?" Men indicated that they attempted to imitate their partner's choices more than did women. In neither the Hottes and Kahn (1974) study nor in the first experiment of the present series was a significant difference noted in responses to this question. It was argued in Chapter Five that the sequence of choices in 2-person multi-play P.D. is not necessarily indicative of an adoption of an imitative strategy, whereas a subject's matching (tit-for-tat) strategy of a programmed opponent is more likely to be so. Subjects' responses to the questionnaire, however, are considered by the author to be a more appropriate indication of whether imitation is adopted as an actual strategy.

Table 14. Further analysis of subjects' responses to Question 5 (Expt. 2)

Communication Condition		Distribution of scores						Mean	U	P
		1	2	3	4	5	6			
0	M	2	1	1	3	2	1	3.5	42.0	> 0.05
	F	3	2	0	3	1	1	3.0		
31	M	0	0	1	2	2	5	5.1	20.0	< 0.05
	F	2	1	1	4	1	1	3.4		

A further analysis was made of the data for question 5 ($n_1, n_2 = 10$) with dyads' responses compared in each communication condition (See Table 14). It seems that imitative behaviour (as judged by subjects' responses to the post-experimental questionnaire) occurs more for male pairs than for female pairs only when the test conditions allow subjects to verbally communicate. Five men indicated strongly that they tried to give their partner what he gave them in this condition compared to only 1 woman. Three of the five male pairs in this condition actually made an agreement to both make the same choice and press A together whereas none of the female pairs made such an agreement. It was in this condition that men also co-operated more than women ($p = 0.02$), suggesting that imitative behaviour is linked with the frequency of co-operative choices. Here, then, is actual concurrence between the content of male subjects' communication, their intention (as judged by the questionnaire data) and their behaviour on iterated Prisoner's Dilemma.

However, the actual measure of imitation employed in this study (the number of times each subject's response matched the other subject's previous response, per 29 or 30 trials) did not show similar trends. Indeed, when correlated with the frequency of co-operative responses, 'imitative' responses correlated positively with co-operation on Blocks 3 and 4 for men and on Blocks 2, 4, 5 and 6 for women. This suggests that although 'imitation' thus defined, may be correlated with the degree of co-operation it is not necessarily the case nor is it a good indicator of the overall level of co-operation.

Due to the difficulties noted with the above measure of imitation similar analyses in future studies were not attempted. Rather, subjects' intentions were inferred from responses to the post-experimental questionnaire which is considered to be a more valid indication of their attention, if any, to strategic considerations.

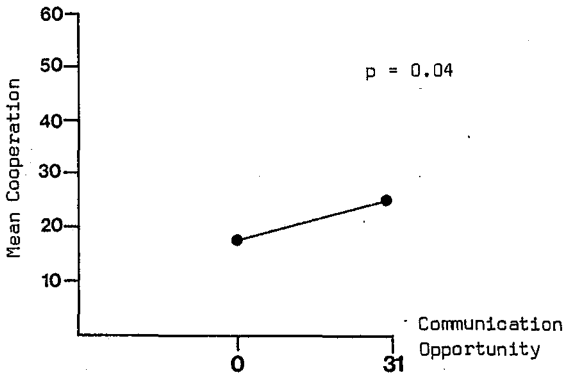
F. <u>The effects of a financial incentive</u>

It will be remembered that although the B strategy strictly dominates both subjects are better off pressing A if the other does the same. It may seem obvious to many that an incentive, whether financial or academic, would provide the stimulus to take the task more seriously and to attempt to increase the number of points gained. To assess the significance of the financial incentive in the present study (£1 for every 300 points gained) the data were compared with the same treatment conditions from the initial experiment where no financial incentive was offered. This is, of course, a partial design. In ideal circumstances a control low incentive group should have been run at the same time. However, in Chapter Four the author indicated the difficulties that had occurred as a result of low numbers of volunteer subjects. For the purposes of this analysis it is assumed that all subjects are drawn from the same pool and that their allocation to each treatment is random.

The co-operative responses thus derived were analysed by ANOVA for the effects of the following factors: sex (2 conditions : MM and FF), communication opportunity (2 conditions : 0 and 31) financial incentive (2 conditions : none and £1) over trial blocks (6 conditions : blocks 1 - 6). The mean scores for these groups are shown in Appendix X as is the analysis of variance summary table. The significant main and inter-action effects ($p \leq 0.05$) are expressed in graphical form in Figure 13.

FIGURE 13. GRAPHS TO SHOW SIGNIFICANT EFFECTS: POOLED DATA (Expt. 1 and Expt. 2)

a) Mean number of cooperative choices as a function of communication opportunity.



b) Mean number of cooperative choices as a function of the sex of the dyad and the communication opportunity

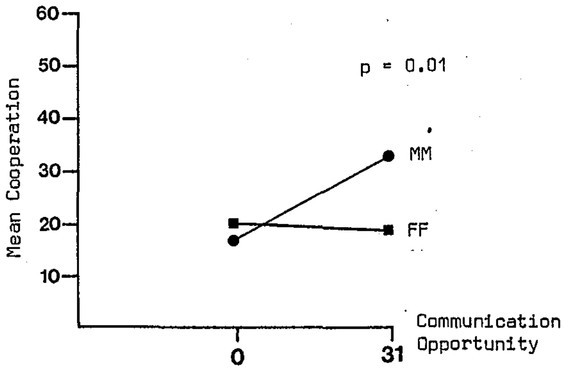
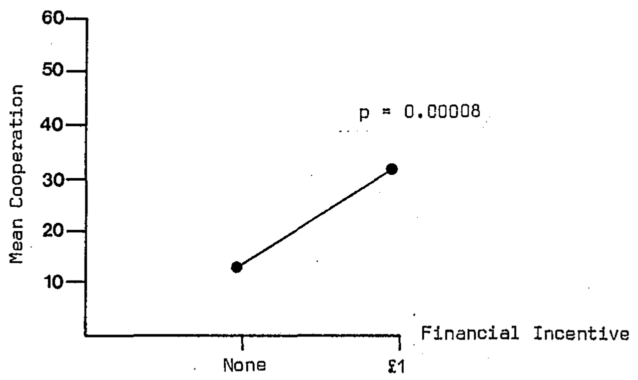
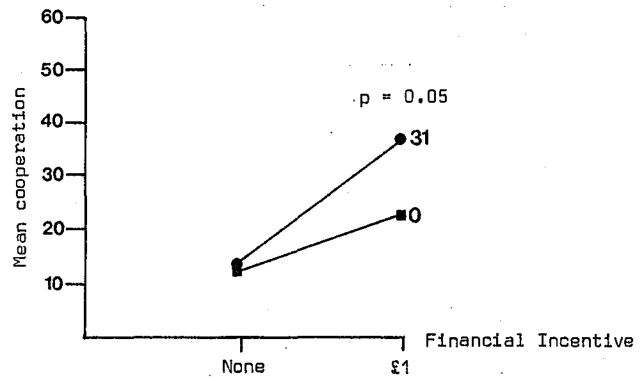


FIGURE 13 CONTINUED

c) Mean number of cooperative choices as a function of financial incentive.



d) Mean number of cooperative choices as a function of communication opportunity and financial incentive.



e) Mean number of cooperative choices as a function of communication opportunity and the duration of the interaction.

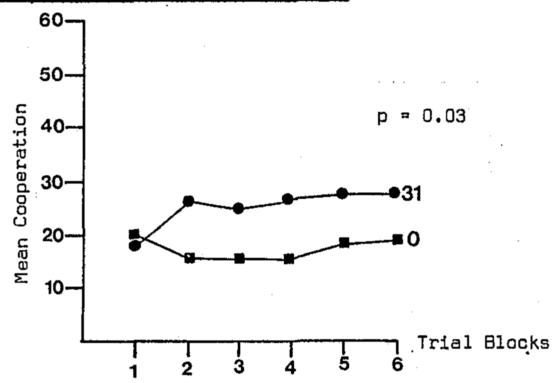
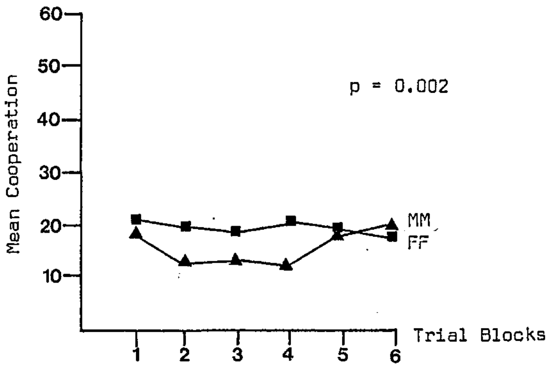


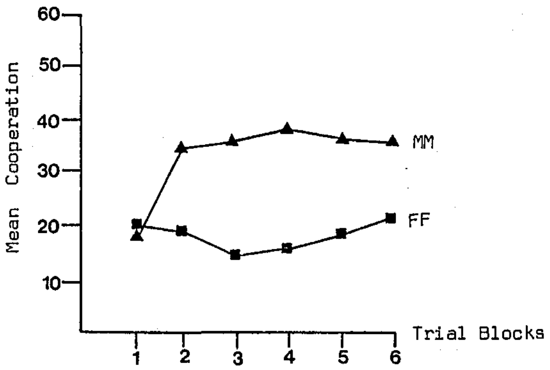
FIGURE 13 CONTINUED

f) Mean number of cooperative choices as a function of sex of dyad, communication opportunity and the duration of the interaction.

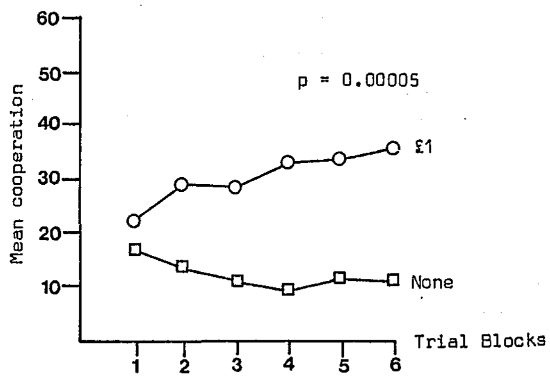
i) no talking allowed



ii) talking allowed after trial 31



g) Mean number of cooperative choices as a function of financial incentive and the duration of the interaction.



Co-operative choices were made more frequently when verbal communication was allowed after trial 31, an effect which was greater for men than for women (Figures 13a and 13b respectively). Both of these effects were influenced by the duration of the inter-action and Figures 13e and 13f show that this is in the direction of increased co-operation.

More pertinent, perhaps, to the present discussion is that the presence of a financial incentive(£1 for every 300 points gained) had a significant effect on the frequency of co-operative choices, regardless of sex or communication opportunity (Figure 13c), thus confirming the hypothesis. This effect increased over time (Figure 13g). Subjects offered a financial incentive were more than twice as co-operative than in the no incentive condition (Experiment 1) the mean co-operation being 51.72 per cent and 21.22 per cent respectively. This is in sharp contrast to those studies cited earlier which report slight or no differences although in this case the reward level is relatively high. Another possible explanation for the observed discrepancy lies in the fact that the present study employed a multi-play P.D. design. Figure 13g shows that subjects make more frequent co-operative responses over time when offered a financial incentive but co-operate less over time when no financial incentive is introduced. The differences between the treatment means are significant from trial block 2 onwards (Tukey test, Appendix lVd, $\alpha = 0.05$). In other words, the differences between the two groups only reach significance from about the 30th iteration onwards and are unlikely to be tapped in shorter versions of P.D.

The presence of a financial incentive was also found to have a greater effect on the frequency of co-operative responding when verbal communication was allowed after trial 31 (Figure 13d). The mean co-operation was 64.12 per cent when limited communication opportunity was made avalable to subjects after some experience of game playing - nearly three times as much as in the no communication treatment (21.7 per cent). Thus, the financial incentive was retained at this level for subsequent experiments in the series.

6.6 Summary and discussion of results

a) Co-operation and the effects of incentive

In the second experiment of the series where a financial incentive was introduced the pattern of play overall more closely resembled previous studies reported in the U.S.A. Both communication and the duration of the game affected co-operation and subjects in treatment 31 became increasingly co-operative as the game progressed. Although there was no main effect due to the sex of the dyad men in treatment 31 were very much more co-operative than women in the same condition, an effect which increased over time. Three of the five male pairs (but no female pairs) in this condition made an agreement to both press A, an agreement which was not broken except by one subject on only two trials. Unlike the previous experiment there was more direct support for the suggestion that men attend more to strategic considerations as indicated both by their responses to the post-experimental questionnaire and by the greater number of co-operative responses elicited when communication was allowed.

Other comparisons with the first experiment (which employed similar procedures and subject populations and was conducted by the same experimenter) allow generalisations to be made about the effects of a financial incentive. Subjects offered a financial incentive were more than twice as co-operative than those who were not with the level of co-operation increasing over time. The introduction of an incentive also had a greater effect when limited verbal communication was permitted.

b) 'Imitation' and the relationship with co-operation

'Imitation' was found to increase over time and to tend to be affected by the opportunity to communicate. However, no sex differences were demonstrated nor was a highly positive relationship between 'imitation' and co-operation found for men (as suggested by Hottes and Kahn, 1974). Indeed, in the present study, a positive relationship was found on four trial blocks for women but on only two trial blocks for men. This measure of 'imitation' seems to have little predictive value on overall levels of co-operation, however. Men's responses to the post-experimental questionnaire in treatment 31 indicated that communication affected their choices more than those of women. Men also attempted to match their partner more than did women. It was in condition 31 that significant differences in the level of co-operation were noted.

The results from the present study which includes a financial incentive more closely resemble those of Hottes and Kahn (1974), at least with respect to co-operation. However, no main sex effect in the level of co-operative responses has been demonstrated as no differences were found in the traditional P.D. situation where no talking is permitted. Although there is no reason to assume that such sex differences on traditional P.D. are universal (cultural differences are explored in Chapter Eight) an obvious difference between the present study and the American studies previously described is the sex of the experimenter.

Skotko et al (1974), in a study which did not permit verbal communication between the subjects, suggested that sex differences in co-operation levels were a function of the sex of the experimenter. They demonstrated that female dyads were more sensitive than males to the sex of E and were extremely non-co-operative in the presence of a male experimenter. It was noted in Chapter Three that this finding, by itself, could not explain the inconsistencies in the literature. However, since sex differences in the most frequently reported direction were demonstrated in Experiment 2 when limited communication was allowed it might be expected that a male E running an experiment with an identical design and subject population would elicit lower levels of co-operation in females under both communication conditions 0 and 31. This aspect is explored in Chapter Seven.

CHAPTER SEVEN : THE EFFECTS DUE TO THE SEX OF THE EXPERIMENTER

7.1 Introduction

The idea that an Experimenter may exert an influence on the behaviour of subjects is not a new one and many experiments have demonstrated that certain biosocial characteristics such as the sex, race, age or religion of the data collector may be important (Rosenthal, 1966). However, little is known about the mechanism accounting for the differences and Rosenthal (op.cit.) attempts to distinguish between active effects associated with unitentional differences in behaviour and passive effects associated with appearance alone.

There is some evidence that experimenter effects are active and may interact with the sex of the subject. For example, female experimenters tend to smile more and female subjects tend to be the recipients of more smiles regardless of the sex of the experimenter. A number of investigations show the differential treatment of male and female subjects and the reader is referred to Rosenthal (1966) who concludes: "An experiment employing male and female subjects is likely to be a different experiment for the males and the females. Because experimenters behave differently to male and female subjects even while administering the same formally programmed procedures, male and female subjects may, psychologically, simply not be in the same experiment at all " (p.56).

Zelditch, as early as 1955, commented on the greater 'socio-emotional' concern of the feminine role compared to the concern with task accomplishment for the masculine role. In spite of the recent growth of the Women's Movement and attempts to change the nature of the 'feminine role' studies in mixed-motive situations continue to draw similar conclusions. Men in the Hottes and Kahn (1974) study were considered to be success oriented and opportunistic whilst women were considered to be more socially oriented, playing defensively when their primary goal (that of social inter-action) was restricted. However, the study of Skotko et al (1974) suggested that the sex differences on P.D. were an artifact and the result of females playing non-co-operatively only in the presence of a male experimenter. Bedell and Sistrunk (1973) concluded that females are more sensitive to characteristics of the other player than are males and Skotko et al (1974) extended this notion to also include the characteristics of the experimenter. They recognised, as did Gibbs (1972), that the experimenter was a previously unexplored variable in mixed-motive situations and that the experimental situation, far from being a dyadic inter-action as it is viewed theoretically (Rapoport, 1970), is an example of a social inter-action which includes both the subjects and experimenter. Skotko et al suggested that there may be sex differences in the relevant experimental field (and thus in the subjects' interpretation of the 'game being played') which is influenced by the sex of the experimenter. However, no attempt was made to specify what attributes (other than the gender of E) differentially affect male and female subjects. It was noted in Chapter Three that this factor, in itself, could not explain results from those studies reporting no subject sex differences or differences in the opposite direction which also employed male E's.

In the present series of experiments which have so far employed a female E (the author) no sex differences were noted when there was no financial incentive. However, when a financial incentive was introduced into the game men played more co-operatively than females but only when allowed to talk to each other for three minutes after Trial 31. It was discovered in a personal communication to Vincent Skotko that no incentive had been used in his study as it had not been considered an important factor. It would seem from the findings of the present study that sex differences in elicited co-operation may also be demonstrated in the presence of a female E when communication has been allowed after some experience of game playing and when there is a financial incentive. It was expected that a male experimenter undertaking an experiment with the same design as Experiment 2 of the series would elicit lower levels of co-operation in female subjects under both communication conditions 0 and 31. This factor was subsequently explored in Experiment 3.

7.2 Aim of the investigation (Expt. 3)

The investigation is designed to establish the nature of sex differences in the co-operative behaviour of a British student population under two conditions of restricted communication opportunity in the presence of a male experimenter.

7.3 Hypotheses (Expt. 3)

On the basis of the findings in Experiment 2 and the Skotko et al (1974) study the following hpyotheses were formulated:

1. Male subjects will be more co-operative than female subjects in the game situation.
2. Co-operation will increase when opportunities for communication are made available.
3. Co-operation levels will increase with the duration of the inter-action.
4. A male experimenter will elicit different levels of co-operation from female S's than a female experimenter.

No specific hypotheses were formulated with respct to any other inter-action effects.

7.4 Method (Expt. 3)

a) Experimenter

This experiment was intended as a replication of Experiment 2 employing a male (rather than a female) experimenter.

The male experimenter was an undergraduate psychology student in the second year of a three year course at Durham University. He had originally been a subject in the first experiment and had volunteered to help in subsequent experiments. He was paid at the rate of 60p per session, the same rate at the time as subjects taking part in psychology experiments. Subjects for the experiment were recruited in the same way as before but on this occasion the author sent out appointment letters to volunteers with the male experimenter's name on.

The author trained the volunteer experimenter to conduct the experiment in as similar a manner as possible to the previous experiments. Close attention in particular was paid to having the minimum of inter-action with the subjects and to providing standard responses to subjects' queries. The advantage was that the student had previously been a subject **himself** and had experienced such an inter-action and been fully de-briefed in the context of that inter-action. Thus he was able to appreciate the need for standard responses and the importance of not referring to the task as a 'game' in the presence of the subjects. The instructions were re-taped by the student experimenter who had listened several times to the author's tape so that the instructions were presented in as uniform a way as possible. The experimenter had a practice run with two naive female volunteers and any problems were dealt with at that stage.

b) Subjects and treatment conditions

In the third experiment of the series, forty undergraduate student volunteers were recruited from Durham University. As has been the case in previous experiments, student pairs were all under the age of 25 years and were unknown to each other and to both the author and volunteer experimenter. Students were informed that they might be able to earn £1 during the course of the experiment. Ten male pairs (MM) and ten famale pairs (FF) who were previously unacquainted with each other and naive as to the nature of the task were randomly assigned to one of the two communication conditions (no communication (0) or verbal communication restricted to three minutes after Trial31(31))such that there were 5 male dyads and 5 female dyads in each communication condition.

c) Procedure and instructions

Subjects were greeted by the experimenter and seated on either side of the partition which restricted non-verbal communication. Both subjects, however, could see and be seen by the experimenter (Figure 5). Each subject was provided with a pen and record sheet which contained spaces for 300 responses (Appendix 1). Subjects' choices on the P.D. game (Figure 4) were again indicated by pressing A or B buttons which were relayed to the experimenter's panel (Figure 6) and the experimenter stated the choices and outcomes after each trial. Subjects kept a record of their own payoffs after each trial.

The instructions were re-taped by the volunteer experimenter and the wording was the same as for the previous experiment where a financial incentive was offered (see Chapter Six). The same set of instructions, similar to that used by Rapoport and Chammah (1965a), was retained so that direct comparisons between experiments could be made. The experimenter checked that subjects understood the matrix and answered any queries in as standard a manner as possible using the wording from the instructions where appropriate. Queries concerning "best" strategies were responded to with "Do as you think best".

Subject dyads played 180 iterations of the game although they were unaware of how many trials were to be played. Following this, and before they could count their final score, subjects were asked to fill in a questionnaire (Appendix 11). After each session subjects were informed as to the nature of the study and were promised a summary of results. They were asked not to discuss the experiment with other students who might take part at a later date and the difficulty of obtaining subjects - especially naive ones - was explained.

The raw data obtained from the inter-action were analysed for the number of co-operative choices.

7.5 Analysis of Results (Expt. 3)

A. Co-operation

The degree of co-operation was again defined as the number of A choices made per subject dyad. Scores from 180 trials were divided up into six trial blocks of 30 trials each. Raw scores are presented in Appendix X11. The mean scores are shown below in Table 15.

Table 15. Mean Co-operation Scores for Expt. 3

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad and the communication opportunity

Pairing	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	25.4	18.0	20.6	32.0	40.8	41.6
	31	33.0	51.2	47.0	44.2	49.8	49.0
FF	0	22.4	23.8	20.0	19.6	27.2	25.2
	31	33.8	43.2	41.0	41.2	39.6	38.8

b) Total mean number of co-operative choices as a function of each treatment condition

Pairing

MM	FF
37.72	31.32

Communication Opportunity

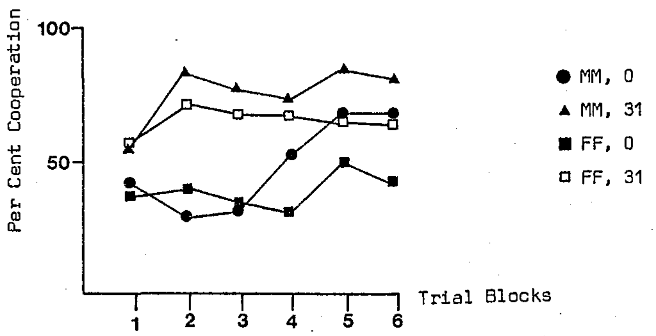
0	31
26.38	42.65

Trial Blocks

1	2	3	4	5	6
28.65	34.05	32.15	34.25	39.95	38.65

The graph in Figure 14 shows that in the traditional multi-play P.D. condition where no verbal communication was permitted males initially co-operated 42 per cent of the time decreasing to 30 per cent on trial block 2. They 'recovered' from trial Block 3 onwards

FIGURE 14. PERCENTAGE OF COOPERATIVE CHOICES OVER TRIAL BLOCKS FOR EACH SUBJECT PAIRING BY COMMUNICATION CONDITION (Expt. 3)



and were co-operating 69 per cent of the time by the final trial block. This pattern of play is consistent with Rapoport and Chammah's (1965a) study using male pairs in iterated P.D. which was undertaken by a male investigator. In addition, higher levels of co-operation were demonstrated for male pairs on later trial blocks in the second experiment of the present series which was conducted by a female investigator. For female subjects in the no talking condition the trends are less clear with the level of co-operation on trial block 6 being only 5 per cent higher than the initial level.

When limited communication was permitted men intially co-operated 55 per cent of the time rising to 85 per cent on trial block 2 following communication opportunities after the 31st trial. By trial block 6 they were co-operating 81 per cent of the time. Women began co-operating 56 per cent of the time rising to 72 per cent on trial block 2, following communication opportunities. By trial block 6 the amount of co-operation had slowly decreased to 64 per cent.

In experiment 2 of this series, conducted by a female experimenter, co-operative choices were greater when verbal communication between subjects was permitted after trial 31, an effect which increased over time. There was no main effect due to the sex of the dyad although a two-way inter-action was demonstrated with men co-operating more than females when allowed to talk, an effect which also increased over time. It was expected that when a male E conducted the experiment females would be less co-operative than males under both communication conditions as was the case in Hottes and Kahn's (1974) study. Skotko et al's (1974) conclusion that sex differences on P.D. were an artifact of experimental manipulation and the result of females being less co-operative than males in the presence of male experimenters increased such an expectation.

However, examination of Figure 14 suggests that this expectation cannot be upheld. The number of A choices per subject dyad (the gross index of co-operation) was analysed by a three-way fixed factor analysis of variance design. The ANOVA summary is shown below in Table 16.

Table 16. Analysis of variance summary for number of co-operative choices for sex (2 conditions) x communication (2 conditions) over trial blocks (6 conditions) (Expt. 3)

Source	df	sum of squares	mean square	F	p
Between dyads					
Sex (B1)	1	1228.80	1228.80	0.77	0.60
Communication(B2)	1	7938.13	7938.13	4.98	0.04
B12	1	2.70	2.70	0.00	0.97
Error B12	16	25492.67	1593.29		
Within dyads					
Trial Blocks (W1)	5	1615.07	323.01	1.72	0.14
W1B1	5	726.70	145.34	0.78	0.57
W1B2	5	1331.77	266.35	1.42	0.22
W1B12	5	462.80	92.56	0.49	0.78
Error W1B12	80	14989.33	187.37		

The results from the third experiment of the series which employed both a male experimenter and a financial incentive do not support either the findings of Hottes and Kahn (1974) or those of Skotko et al (1974). No main or inter-action effects due to time or to the sex of the pairing were demonstrated in the present study, contrary to expectations. Indeed, there was only one significant main effect ($p = 0.04$) which was due to the availability of verbal communication. As suggested in Figure 14 the limited opportunity to verbally communicate after trial 31 elicited greater levels of co-operation from most subjects regardless of sex and the duration of the inter-action.

Unfortunately, the experimenter neglected to make a brief record of subjects' conversations in treatment 31 and it is not known which pairs were attentive to the strategic considerations of the game. The only data that are available is that four of the five male dyads and all five of the female dyads made use of the opportunity to communicate. However, it seems from the results of Experiments 2 and 3, which both employed monetary incentives, that the opportunity to communicate after some experience of game playing somewhat ameliorates the conflict in the game.

B. The effects due to the sex of the experimenter

To assess the significance of the sex of the experimenter the present data were compared with that from Experiment 2, although the data had been collected on different occasions.

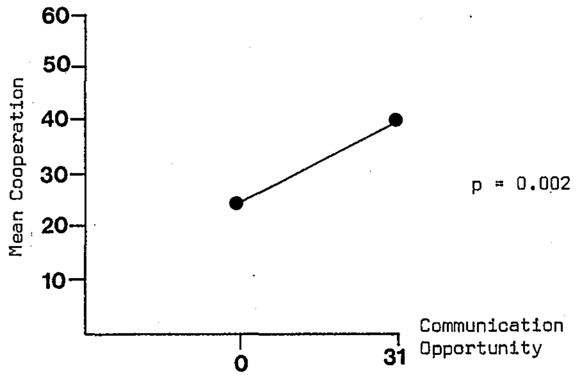
The co-operative responses thus derived were analysed by ANOVA for the effects of the following factors : sex of the subject (2 conditions:MM and FF), communication opportunity (2 conditions:0 and 31), sex of the experimenter (2 conditions:Male and Female) and trial blocks (6 conditions:blocks 1 - 6). The mean scores are presented in Appendix X111 as is the ANOVA summary table. The significant main and inter-action effects ($p \leqslant 0.05$) are expressed in graphical form in Figure 15.

Contrary to expectations, no differences due to the sex of the subject or of the experimenter were observed in the balanced sex of E design. However, as might have been expected from the previous analysis, communication opportunity significantly affected the amount of co-operation elicited, acting to increase the likelihood of co-operative responding (Figure 15a). Co-operation overall was found to increase over time (Figure 15b), an effect observed in Experiment 2 but not Experiment 3. Co-operation also increased more over time when communication was allowed (Figure 15c).

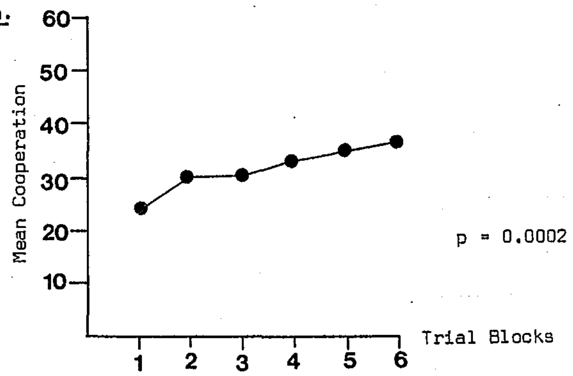
Thus, the differences between the significant findings from Experiment 2, Experiment 3 and the Hottes and Kahn (1974) study cannot be solely explained by the sex of the experimenter. Although there are slight procedural differences between the Hottes and Kahn study and the present study this cannot explain the differences observed in subjects' choices when Experiment 2 was replicated by a male experimenter. This topic will be returned to later in the chapter.

FIGURE 15. GRAPHS TO SHOW SIGNIFICANT EFFECTS FOR POOLED DATA (Expts. 2 and 3)

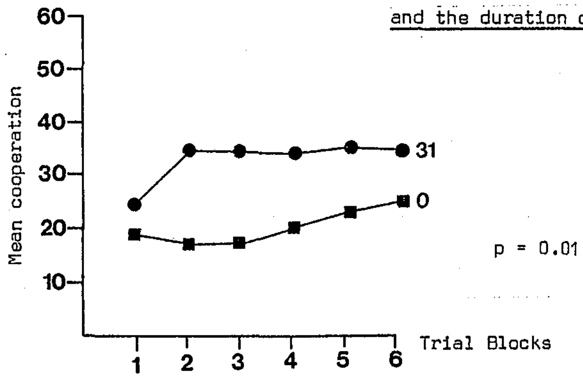
a) Mean number of cooperative choices as a function of communication opportunity.



b) Mean number of cooperative choices as a function of the duration of the interaction.



c) Mean number of cooperative choices as a function of the communication opportunity and the duration of the interaction.



C. The post-experimental questionnaire

Responses to the five forced-choice questions were analysed for differences due to the sex of the respondent using the Mann-Whitney U test ($n_1, n_2 = 20$). Responses to the open-ended questions are discussed in Chapter Nine. Raw scores are presented in Appendix V111 and the results are summarised below in Table 17.

Table 17. Summary of questionnaire data for Qs. 1 - 5 (Expt. 3)

Question (See Appendix 11)		Distribution of Scores						Mean	U	P
		1	2	3	4	5	6			
1	M	0	0	3	1	6	10	5.15	185.5	>0.05
	F	1	0	0	1	11	7	5.10		
2	M	0	3	1	8	5	3	4.20	198.0	>0.05
	F	0	1	4	6	7	2	4.25		
3	M	3	1	2	3	4	7	4.25	183.5	>0.05
	F	3	1	2	3	7	4	4.10		
4	M	1	2	1	1	6	9	4.80	160.5	>0.05
	F	0	4	3	2	5	6	4.30		
5	M	4	2	2	1	3	8	4.05	199.0	>0.05
	F	3	2	1	1	7	6	4.25		

It will be remembered that in Experiment 2, conducted by the author, men indicated that the opportunity to communicate (Q.3) affected their choices more than for women and that they imitated their partner more than did women (Q.5). However, in the third experiment of the series where a male E replicated the previous experiment, no differences were found in subjects' responses that could be attributed to the sex of the dyad.

7.6 Summary (Expt. 3)

The hypothesis that male subjects would be more co-operative than female subjects in the presence of a male experimenter was not supported. Co-operation did not increase over time, contrary to expectations. This had been a significant effect in both Expt. 2 and in the Hottes and Kahn (1974) study. However, a significant main effect due to the communication availability was noted. Subjects allowed to talk for three minutes after trial 31 were more co-operative overall than subjects not permitted to talk. However, since the experimenter neglected to record the content of the conversations it is not possible to say how the subjects made use of this opportunity. Nor did the questionnaire data indicate any sex differences in strategies (e.g. imitative behaviour).

The hypothesis that a male experimenter would elicit different levels of co-operation from female subjects than a female experimenter was not supported by the pooled data from Expts. 2 and 3. No differences due to the sex of the subject or to the sex of the experimenter were observed. However, the data for Experiments 2 and 3 were collected at different times and subjects were not strictly allocated at random to the different experimenters. In this instance it was therefore decided to replicate Expts. 2 and 3 in a balanced sex of E design using volunteer male and female student experimenters.

7.7 Aim of the investigation (Expt. 4)

The investigation is designed to establish the effects of the sex of the experimenter on sex differences in the co-operative behaviour of a British student population under two conditions of restricted communication opportunity.

7.8 Hypotheses (Expt. 4)

On the basis of the previous analysis from the pooled data (Expts. 2 and 3) and the results from the Skotko et al (1974) study the following hypotheses were formulated:

1. Co-operation will increase when communication is permitted.
2. Co-operation will increase with the duration of the inter-action. The "learning effect" of repeated P.D. would lead us to expect less co-operation as the inter-action progresses. However, no effect was noted in Expt. 3 but co-operation increased significantly over time in the Hottes and Kahn (1974) study and in Expt. 2.
3. The male experimenter will elicit lower levels of co-operation from female subjects than the female experimenter. The Hottes and Kahn (1974) study indicated that in the present version of

P.D. male subjects are success oriented and play opportunistically, adhering to strategic considerations and oriented to maximise outcomes. Skotko et al (1974) demonstrated that this may be so only when male and female pairs interact in the presence of a male E.

No specific hypotheses were formulated with respect to the sex of the subject or the sex of the experimenter (main effects) or to other interaction effects.

7.9 Method (Expt. 4)

a) Experimenters

The male and female volunteer experimenters were psychology undergraduates at Durham University. They were paid at the current hourly rate for subjects helping in similar projects. Both students had been subjects in the first experiment of the series and had some understanding of the Prisoner's Dilemma game and of the procedure in the laboratory setting. Subjects were recruited in the same way as for the previous experimental sessions using the new experimenter's name on the appointment letter. Subjects were selected at random from the pool of volunteer Ss and allocated to either the male E or female E treatment. The volunteer experimenters were trained by the author with the emphasis on the minimum amount of inter-action with subjects and providing standard responses to subjects' queries. The instructions (Chapter Six) were re-taped by each experimenter and each was given a practice trial session with two naive subjects so that any problems could be identified and resolved.

b) Subjects

In the fourth experiment of the series, forty volunteer students were recruited from Durham University for each E treatment. As has been the case throughout this study subjects were under the age of 25 years and unknown to both the author and to the volunteer experimenter. Subjects were randomly assigned to the treatment conditions such that there were five dyads in each treatment according to sex of E, sex of S and communication opportunity (0 and 31). In addition, neither friends nor acquaintances were paired together.

c) Procedure and instructions

Subjects were greeted by the volunteer experimenter for that session and seated on either side of the partition on which the matrix was attached (Figure 5). Although subjects' non-verbal communication was restricted to a minimum both subjects could see and be seen by the experimenter. The instructions had the same wording as those employed in experiments 2 and 3 and subjects again played 180 iterations, although the record sheet contained spaces for 300 responses (Appendix 1). Queries prior to play were answered in as standard a manner as possible. A post-experimental questionnaire was completed by subjects (see Appendix 11) before they could assess their total score. Following payment, if any, subjects were de-briefed by the author and promised a summary of the results when the data were analysed. They were asked not to discuss the task with anyone who might participate in later sessions.

7.10 Analysis of Results (Expt. 4)

A Co-operation

The degree of co-operation was defined as the number of A choices made per subject dyad. Raw scores for Experiment 4 are presented in Appendix XlV. Scores were divided up for the purposes of analysis such that there were 6 blocks of 30 trials each. The mean scores are shown below in Table 18. The data were analysed by a four-way fixed factor analysis of variance design (Table 19).

Examination of the mean number of co-operative choices in Table 18 suggests that the female experimenter elicited a higher level of co-operation from all subjects, regardless of sex, than the male experimenter. There is also a suggestion that female pairs are less co-operative than male pairs, that communication opportunity elicits higher levels of co-operation from all subjects than no communication and that co-operation increases over trial blocks. However, when the data were subjected to an analysis of variance (Table 19) only three of the above main effects were significant ($p \leq 0.05$) as there was only a slight tendency ($p = 0.09$) for female pairs to co-operate less than male pairs. However, this is in the same direction as would be expected from most other studies in this field. Two significant inter-action effects were observed : Trial Blocks x sex of

Table 18. Mean Co-operation Scores for Expt. 4

i) Mean number of co-operative choices per trial block as a function of the sex of dyad and the communication opportunity

a) Male

Pairing	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	33.4	29.0	26.2	33.8	32.0	35.8
	31	36.0	50.6	47.8	48.0	48.6	49.2
FF	0	24.6	24.4	23.4	23.8	19.2	21.4
	31	23.4	33.4	33.0	31.0	31.4	29.8

b) Female E

Pairing	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	34.0	36.6	46.4	44.8	46.4	42.6
	31	28.4	52.0	54.4	51.8	50.4	54.4
FF	0	24.6	30.4	36.6	45.0	43.6	49.4
	31	35.4	50.6	48.2	47.8	48.6	49.4

ii) Total mean number of co-operative choices as a function of each treatment condition

Sex of E

M	F
32.9	43.8

Pairing

MM	FF
42.2	34.5

Communication Opportunity

0	31
33.7	43.0

Trial Blocks

1	2	3	4	5	6
30.0	38.4	39.5	40.8	40.1	41.6

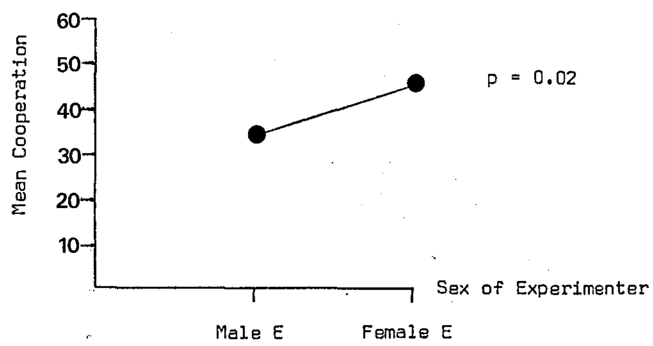
Table 19. Analysis of variance summary for number of co-operative choices for sex of E (2 conditions) x sex of S (2 conditions) x Communication (2 conditions) over Trial Blocks (6 conditions) (Expt. 4)

Source	df	Sum of squares	mean square	F	p
Between dyads					
Sex of E (E)	1	7183.20	7183.20	6.26	0.02
Sex of S (S)	1	3534.34	3534.34	3.08	0.09
Communication(C)	1	5329.84	5329.84	4.64	0.04
ES	1	1475.10	1475.10	1.29	0.27
EC	1	203.50	203.50	0.18	0.68
SC	1	127.60	127.60	0.11	0.74
ESC	1	310.54	310.54	0.27	0.61
Error	32	36731.93	1147.87		
Within dyads					
Trial Blocks (T)	5	3598.07	719.61	7.00	0.0000
TE	5	1435.37	287.07	2.79	0.02
TS	5	46.64	9.33	0.09	0.99
TC	5	1256.34	251.27	2.44	0.04
TES	5	409.87	81.97	0.80	0.55
TEC	5	296.87	59.37	0.58	0.72
TSC	5	315.77	63.15	0.61	0.69
TESC	5	337.84	67.57	0.66	0.66
Error	160	16450.07	102.81		

Experimenter and Trial Blocks x Communication. The graphs in Figure 16 indicate clearly that co-operation increases over time when communication is allowed and that it also increases over time in the presence of a female Experimenter. Thus, no convincing differences which could be attributed to the sex of the dyad or to a sex of S x Sex of E inter-action were demonstrated. This is in contrast to Hottes and Kahn's (1974) study which, like many other studies exploying a P.D. matrix, found men to be more co-operative than women. These findings also conflict with Skotko et al's (1974) suggestion that sex differences on P.D. are due to females becoming increasingly non-co-operative when playing in the presence of a male experimenter. However, from the author's point of view, a more interesting observation is that the above findings are also discrepant with the results from the previous single E design and the pooled analysis in the present study where no differences due to the sex of experimenter were noted. The only effect which has so far been noted in all the analyses is a main communication effect. It is not possible to invoke the now familiar suggestion that discrepant findings may be the result of differences in structural properties or procedural aspects of the game. For all the experiments presented here which have employed a financial incentive have had identical apparatus and procedure with the exception, of course, of the experimenter. This aspect will be returned to later in the chapter.

FIGURE 16. GRAPHS TO SHOW SIGNIFICANT EFFECTS (Expt. 4)

a) Mean number of cooperative choices as a function of the sex of the experimenter.



b) Mean Number of cooperative choices as a function of the communication opportunity.

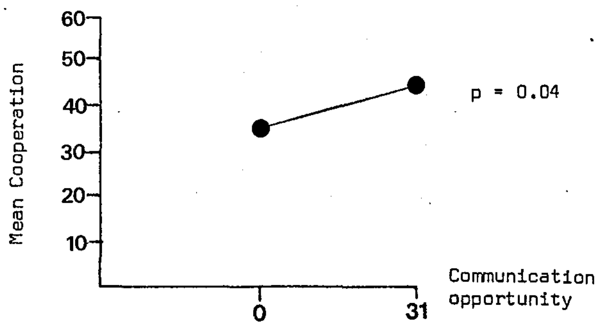
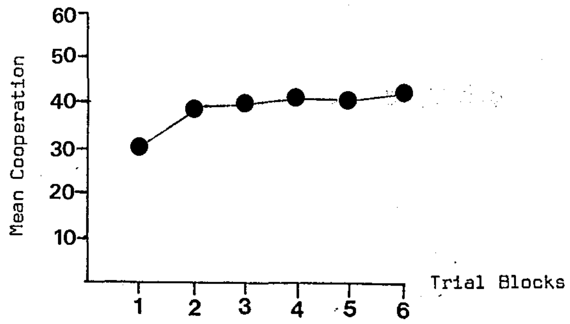


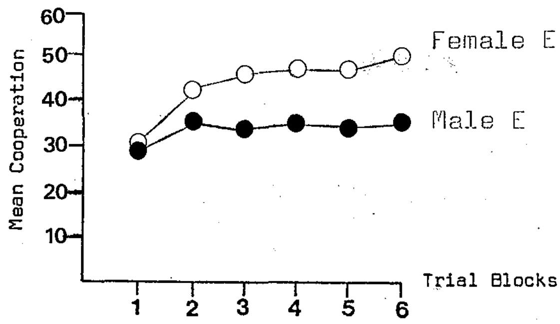
FIGURE 16 CONTINUED

c) Mean number of cooperative choices as a function of the duration of the interaction.



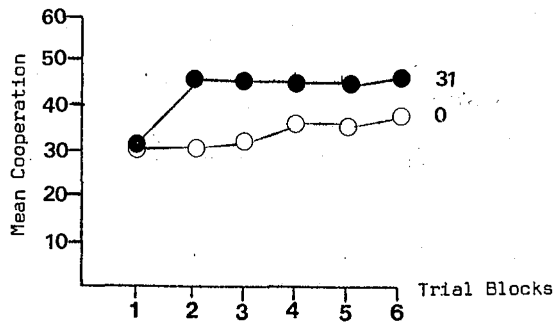
p = 0.0000

d) Mean number of cooperative choices as a function of the trial blocks and the sex of the experimenter.



p = 0.02

e) Mean number of cooperative choices as a function of the trial blocks and communication opportunity.



p = 0.04

B. Communication Data

Both experimenters made brief notes of any communication that occurred between subject dyads in treatment 31. All ten dyads permitted to talk after the 31st trial made use of the opportunity when the male experimenter was present whereas only four male pairs and three female pairs verbally communicated when the female E was present. In the former case three of the male pairs and two of the female pairs mentioned pressing A as being a possible 'solution', but no differences in the overall number of co-operative choices were demonstrated. When the female E conducted the experiment all the pairs who spoke to each other mentioned pressing A although one pair reported feeling distrustful of their partner whilst another pair reported feeling antagonistic. This supports the notion that communication may not necessarily be advantageous. None of the pairs in either experiment suggested an imitative strategy and in neither experiment were any differences in choices demonstrated that could be attributed to the sex of the pairing or to the communication availability. A more detailed account of the communication data is reported in Appendix V.

The results contrast with those of Hottes and Kahn (1974) who reported that six out of ten male dyads and only one out of ten female dyads discussed either a 'play A' or an imitative strategy. In Experiment 2 of this series four of the five male pairs discussed a 'play A' strategy whilst only two female pairs did so. There was tentative support for the proposition that males perceive the strategic nature of the task more fully or, at least, make better use of the communication opportunities. In Experiment 2 this resulted in a higher level of co-operative responding by male dyads following opportunities for verbal communication, but such an effect was not demonstrated in Experiment 4 above.

C. The post-experimental questionnaire

Responses to the five forced-choice questions for Expt. 4 were analysed for differences due to the sex of the respondent using the Mann-Whitney U test. As has been the case with the previous experimental data the responses to the open-ended questions are discussed in Chapter Nine. Raw scores are presented in Appendix V111 and the results are summarised below in Table 20.

It can be seen from Table 20 that three of the subjects' responses in Expt. 4a and six of the subjects' responses in Expt. 4b had to be discarded as questions 1 - 5 had not been completed as instructed. The volunteer experimenters reported that they had not checked that subjects understood what was required and it was not immediately obvious to some Ss. Unfortunately, the author did not check that the questionnaires had been correctly completed at the debriefing session.

Table 20. Summary of questionnaire data for Qs. 1 – 5 (Expt. 4)

a)Expt. 4a : Male E

Question (See Appendix 11)		Distribution of Scores 1	2	3	4	5	6	Mean	U	P
1	M	1	0	1	1	5	10	5.17	231.5	>0.05
	F	1	2	1	2	9	4	4.47		
2	M	1	2	1	5	9	0	4.06	117.5	> 0.05
	F	0	3	6	7	2	1	3.58		
3	M	3	0	2	2	4	7	4.39	127.5	>0.05
	F	7	3	0	2	1	6	3.26		
4	M	2	3	2	2	5	4	3.94	161.0	> 0.05
	F	3	3	3	1	5	4	3.74		
5	M	0	2	0	1	6	9	5.11	86.5	< 0.05
	F	2	3	5	3	2	4	3.63		

b) Expt. 4b : Female E

Question (see Appendix 11)		Distribution of Scores 1	2	3	4	5	6	Mean	U	P
1	M	0	0	0	3	6	6	5.20	109.5	>0.05
	F	0	1	0	1	5	12	5.42		
2	M	0	3	3	5	4	0	3.67	115.5	>0.05
	F	0	2	5	4	5	3	4.11		
3	M	3	0	1	0	6	5	4.40	135.0	> 0.05
	F	3	1	1	6	0	8	4.21		
4	M	2	0	3	4	3	3	4.00	116.0	>0.05
	F	1	3	0	3	7	5	4.42		
5	M	3	0	3	3	2	4	3.87	95.5	>0.05
	F	0	0	3	2	7	7	4.95		

However, there were no sex differences in subjects' responses to any of the five questions in Experiment 4b (female E) but a sex difference in the response to Q.5 was demonstrated in Experiment 4a (male E). This question directly asks S how much he imitated his partner by asking "How much or how often did you try to give your partner what he gave you?" Men reported that they attempted to imitate their partner more often than did women. The suggestion by Hottes and Kahn (1974) that the adoption of an imitative strategy induces co-operation (or vice versa) was not upheld, however, as men did not show higher levels of co-operative responding than women in the presence of the male E. The only other significant sex differences ($p \leqslant 0.05$ for a 2-tailed test) in subjects' responses to Qs. 1 - 5 in Experiments 2 - 4 inclusive were in response to Q.3 and Q.5 in Experiment 2 where men reported more often than women that communication affected their choices and that they attempted to imitate their partner. It was in that experiment that men were also more co-operative when allowed verbal communication but this effect has not been replicated in the later studies.

7.11 Summary (Expt. 4)

The hypotheses that co-operation will increase with the duration of the inter-action and when communication is allowed were confirmed. It was not possible to uphold the third major hypothesis as no main or inter-action effects attributable to the sex of the subjects were observed. However, the sex of the experimenter did make a difference to the overall amount of co-operation elicited, with the female experimenter eliciting more than the male experimenter, an effect which increased over time.

The above data do not, for the most part, confirm the most often reported findings on sex differences in Prisoner's Dilemma. The possibility that the sex differences in choices demonstrated in mixed-motive gaming situations are an artifact of the experimental situation has to be considered, although it may not be due solely to the sex of E as suggested by Skotko et al (1974). Such a proposition would explain both the anomalies in the literature and the discrepant findings of the present study with regard to the sex of the subject pairing.

The pooled data from Experiments 2 - 4 inclusive were subsequently analysed for the effects, if any, of the experimenter within a multiple balanced sex of E design.

7.12 Analysis of pooled data (Expts. 2 - 4)

Experiments 2 - 4 used the same apparatus, procedure, incentive condition, treatment conditions and subject population and differ only with respect to the person conducting the experiment. The availability of verbal communication has indicated consistent results in that its presence ameliorates the conflict in the game. Inconsistent results have been demonstrated regarding effects due to the duration of the inter-action and a variety of results have been obtained with respect to the sex of the subject, the sex of the experimenter and any inter-action effects.

A. Aims of the analysis

It was therefore decided to pool the available data to see if any trends emerged. The data for the three experiments were not collected at the same time and consequently subjects were not strictly allocated at random to different experimenters. However, it was felt that pooling the data together (as has been done in previous analyses in this study) was justifiable as subjects were obtained from the same pool of Ss and recruited in the same way. To this extent their allocation to each experiment is assumed to be random.

B. Hypotheses

On the basis of the previous analyses the following results were expected:

1. Co-operation will be higher when communication is allowed between subjects;
2. Co-operation will increase with the duration of the inter-action.

No particular effects were predicted with respect to the sex of the subject, the sex of the experimenter or to any inter-actions, although it was expected that the sex of the experimenter would influence the pattern of play.

C. Procedure

The raw scores (number of A choices per subject dyad in each block of 30 trials) were analysed by ANOVA for four fixed factors:

Sex of Experimenter (2 conditions) x Communication Opportunity (2 conditions) x Sex of Subject (2 conditions) over Trial Blocks (6 conditions). The random factor (the Four Experimenters) was nested in the Sex of E factor.

D. Results

The overall means for each treatment condition are shown below in Table 21. The summary ANOVA table for the pooled data is presented in Appendix XV and the significant effects are expressed in graphical form in Figure 17.

Table 21. Total mean number of co-operative choices as a function of each treatment condition : pooled data (Expts. 2 - 4)

1) Fixed factors

Sex of Experimenter

Males	Females
33.70	37.43

Communication Opportunity

0	31
29.31	41.81

Pairing

MM	FF
39.31	31.82

Trial Blocks

1	2	3	4	5	6
27.79	35.06	35.15	37.43	38.46	39.49

2) <u>Random factor</u>

Experimenters

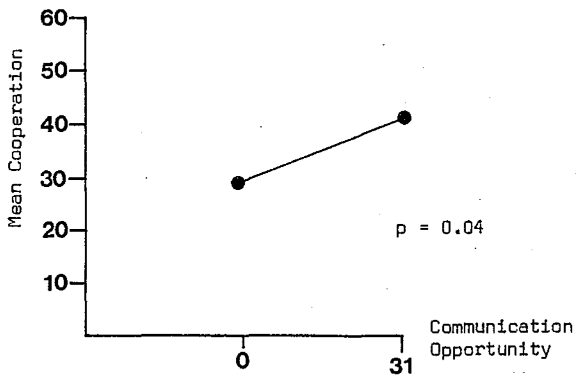
Expt. 2	Expt. 3	Expt. 4a	Expt. 4b
31.03	34.52	32.88	43.83

The analysis of the pooled data (N = 160) supports the main expectation that, overall, communication opportunity and the duration of the interaction will elicit significantly higher levels of co-operative responses from subjects (Figures 17a and b). Co-operation also increases with time when subjects are allowed to talk after Trial 31 (Figure 17c). However, neither the main effect due to trial blocks nor the interaction effect were found over all the three experiments analysed separately.

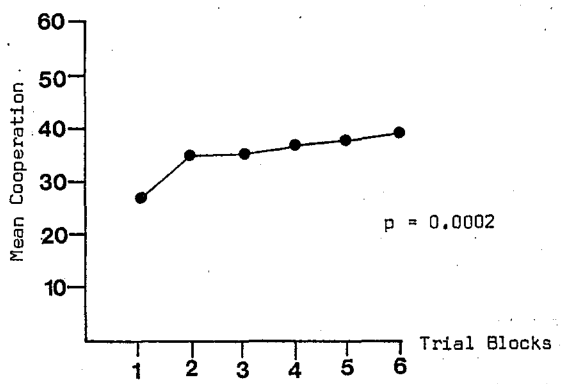
There was a tendency ($p = 0.08$) for the sex of the dyad to influence the level of co-operation and men were found to be significantly more co-operative than women as the duration of the inter-action increased (Figure 17d). There was also some support for Skotko et al's (1974) suggestion that females are less co-operative in the presence of male experimenters as a significant three-way interaction showed that females were increasingly less co-operative over time in the presence of male experimenters (Figure 17e). However,

FIGURE 17. GRAPHS TO SHOW SIGNIFICANT EFFECTS: POOLED DATA (Expts. 2-4)

a) Mean number of cooperative choices as a function of communication opportunity.



b) Mean number of cooperative choices as a function of the duration of the interaction.



c) Mean number of cooperative choices as a function of communication opportunity and the duration of the interaction.

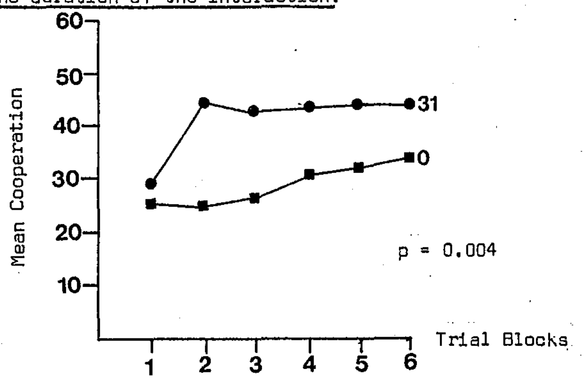
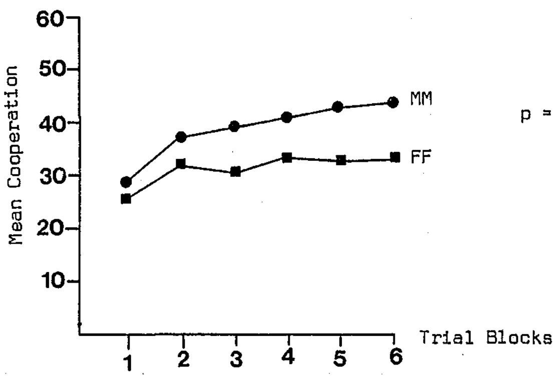


FIGURE 17 CONTINUED

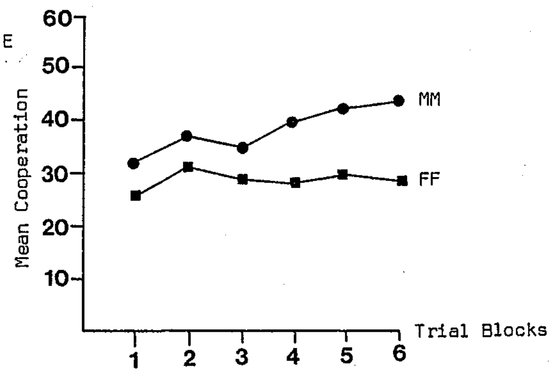
d) Mean number of cooperative choices as a function of the sex of the dyad and the duration of the interaction.



p = 0.03

e) Mean number of cooperative choices as a function of the sex of the experimenter, the sex of the dyad and the duration of the interaction.

1) Male E



p = 0.03

2) Female E

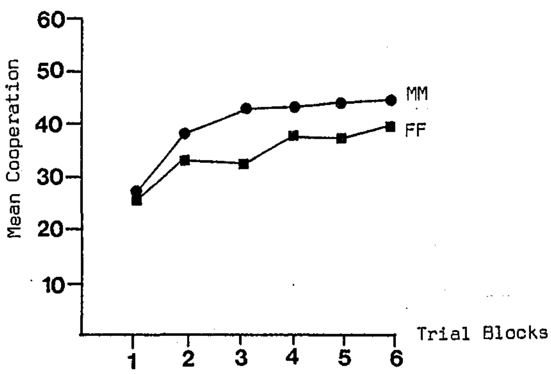


FIGURE 17 CONTINUED

f) Mean number of cooperative choices as a function of the experimenter.

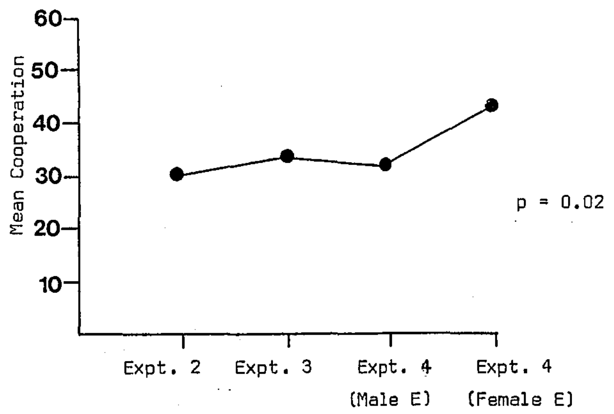
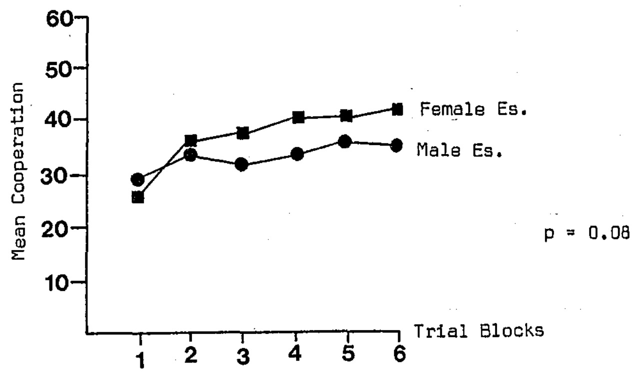


FIGURE 18. MEAN NUMBER OF COOPERATIVE CHOICES AS A FUNCTION OF THE SEX OF E AND THE DURATION OF THE INTERACTION (Expts. 2-4)



Skotko was able to demonstrate a Sex of S/Sex of E inter-action in a game of only 50 trials which, incidentally, did not include an incentive. Again, none of these results was demonstrated in any of the three experiments analysed separately.

The bulk of the literature concerning sex differences and communication availability of P.D. has used a single experimenter design. In view of this, it was interesting to note that the experimenters themselves had a significant effect on the level of co-operation (Figure 17f) with the female Experimenter in Expt. 4 eliciting the highest levels of co-operation from all subjects. There was also a tendency ($p = 0.08$) for the level of co-operation over time to be influenced by the sex of the experimenter, with female Es eliciting higher levels over all treatments as the game progressed (Figure 18).

E. Discussion of results and further analysis

Such findings, above, go part of the way to explaining the anomalies in the literature concerning sex differences and communication availability on choices in P.D. It seems that in a P.D. design similar to this study higher levels of co-operation are more likely if communication opportunities are made available some time after game-playing experience and as the game progresses. It also seems that if sex differences are demonstrated men are more likely to be more co-operative than women, an effect which increases over time. This difference may be increased by females becoming relatively less co-operative than males over time in the presence of a male experimenter. Yet only some or none of these effects may be demonstrated in a single E design, and it was shown that the experimenter himself (herself) may elicit significantly different levels of co-operation from both male and female subjects. Any theory which attempts to account for the differential sensitivity of male and female subjects to the sex of the experimenter (with or without a time factor) must also be able to account for the differential sensitivity of <u>all</u> subjects to unintentional differences in the behaviour of the experimenter, whether those behaviours are sex-typed or not. Skotko et al's study did not attempt to specify which attributes of E (other than gender) differentially affect subjects and this would seem a fruitful area for further research.

Skotko et al's design differs in several important respects from the present design and it is possible that their findings are an artifact of that design. In their study the primary test of their hypothesis was based on the total percentage of "competing" responses and only included 50 trials. The instructions (which simply described the available options and did not include a goal of any kind) were read by naive E's to the subjects who were told how many trials were to be played.

No verbal communication was allowed between subjects and no verbal feedback of pay-offs was given, as the panel for each subject was activated by lights which indicated the respective pay-offs. The matrix was similar to that of the present design but incorporated a "temptation" value (see Figure 2) of 5 instead of 4. Subjects played only for points whereas in the present study subjects were offered £1 for every 300 points accumulated. It will be remembered that in the present design the introduction of a financial incentive increased the amount of co-operation elicited but did so for both men and women.

Many of the findings in the present study have been influenced by the duration of the inter-action. In order to clarify the differences in results over 50 trials the pooled data above were re-analysed following Skotko et al (1974). The percentages of B responses per subject dyad over 50 trials (no communication condition only) were analysed by a mixed model ANOVA for sex of E (2 conditions) x sex of S (2 conditions) with a random experimenter factor nested within the sex of E. The raw data are presented in Appendix XVl and the mean scores are tabulated below in Table 22.

Table 22. Mean percent B choices over 50 trials : pooled data (Expts. 2 - 4)

Sex of E	Experiment	Pairing		Mean Total
		MM	FF	
Male	Expt. 3	63.0	62.4	62.7
	Expt. 4	47.8	59.2	53.5
Female	Expt. 2	72.2	60.8	66.5
	Expt. 4	43.8	59.8	51.8
	Mean Total	56.7	60.5	

Examination of the mean scores does not suggest any differences in B choices due to either the sex of the dyad or the experimenter, although there appears to be differences between the experimenters. The analysis of variance summary (Table 23) confirms this and indicates a tendency ($p = 0.06$) for different experimenters to elicit different levels of B choices, even over 50 trials. Experimenter 2 (the author) elicited the highest levels of B choices and the female experimenter in Expt. 4 elicited the lowest levels. The Tukey test (Appendix 1Ve) confirmed that experimenter 2 elicited significantly higher levels of B choices than the other female experimenter ($\alpha = 0.05$), but there were no differences due to factors associated with the other experimenters. These findings are consistent with the analysis of the number of co-operative choices over 180 trials for all treatment groups (see Figure 17f). However, they differ from Skotko et al's results which demonstrated both overall sex differences and a sex of E x sex of S inter-action with females showing greater "defection" under a male E ($p < 0.025$). In the present study where the data (180 trials) from three experiments were pooled both the overall sex differences and the sex of E x sex of S inter-action were only exhibited as the game progressed (Figure 17, d and e). However, these effects are weak and may not be demonstrated in single E designs as we have seen. There remains the possibility that there are cultural differences between American and British male and female students and these differences, if any, are explored in the following Chapter.

Table 23. Analysis of variance summary for percentage of B choices for sex of E (2 conditions) x sex of S (2 conditions) with a random E factor nested within sex of E (Pooled data : 50 trials)

Source	df	sum of squares	mean square	F	p
Between dyads					
Sex of E (A)	1	11.03	11.03	0.01	0.88
Sex of S (B)	1	148.23	148.23	0.27	0.66
AB	1	24.03	24.03	0.04	0.83
Random					
E's/Sex of E (C)	2	1503.65	751.83	3.04	0.06
BC	2	1118.45	559.22	2.26	0.12
Error	32	7920.00	247.50		

7.13 Conclusions

The author agrees with Skotko et al's conclusion that previously reported sex differences in P.D. response styles "are not solely a function of the Ss nor of the Ss' inter-action considered in isolation" (p. 712). They concluded that a balanced sex of E design was necessary in any studies investigating subject sex differences. However, there still remains the problem that any theory postulating a differential sensitivity of male and female subjects to personal characteristics of the experimenter must also take into acount the fact that different experimenters in this study (regardless of sex) elicited different levels of co-operation from their subjects. This suggests that all subjects, regardless of sex, respond to the personal 'style' of the E and subject and experimenter factors (and opportunities for communication) may interact in a variety of ways, as yet unspecified, accounting for the anomalous results from single E designs presented here. How, then, would subjects choose in the absence of the experimenter? This aspect is investigated in the following chapter.

CHAPTER EIGHT : CULTURAL DIFFERENCES AND THE LEVELS OF CO-OPERATION IN THE ABSENCE OF THE EXPERIMENTER.

8.1 Introduction

There has been a tendency to assume that sex differences on Prisoner's Dilemma are universal even though they have not always been demonstrated. It seems that sex differences may be obtained with British students but only if sufficiently large numbers of subjects are used over many trials in a multiple E design (see Chapter Seven). It is true that Mack (1975) found sex differences on P.D. with a British student population but his subjects played against a programmed 'other' and in isolation from the experimenter. Thus, generalisations to dyadic inter-actions (or triadic as they are more usually) should be made with caution.

A plausible explanation for differences between the findings from the designs presented here and the Hottes and Kahn (1974) study is that sex differences in co-operative responses are primarily an American phenomenon. A similar, but weaker, tendency is exhibited in British students but this may be masked by the effects due to the inter-action with the experimenter (regardless of sex).

The above hypotheses were investigated by two further studies in the present series:

i) a replication of Experiment 2, using American students as subjects (single E design - the author as E);

ii) a replication of Experiment 2, with E (the author) absent from the room during the subjects' inter-action.

8.2 Experiment 5 : Cultural differences

i) Aims of the investigation

The investigation is designed to establish the nature of sex differences in the co-operative behaviour of American students under two conditions of communication opportunity.

The data will also be compared with that from Experiment 2 in order to investigate cultural differences in the level of co-operation on Prisoner's Dilemma.

ii) Hypotheses

Several hypotheses were formulated based not only on the Hottes and Kahn American study but also on the results of Experiment 2 of this series which employed the author as E.

In the study using American subjects it is expected that:

1. Male subjects will be more co-operative than females.
2. Communication opportunity will elicit higher levels of co-operation from all subjects regardless of sex.
3. Male subjects will be more co-operative than females when limited communication opportunities are made available.
4. Co-operation will increase with the duration of the inter-action.
5. American dyads will play differently to British dyads.

No other inter-action effects were specified.

iii) Method

a) Subjects and treatment conditions

For this study all the American students then studying at Durham University were contacted by letter. In all, there were about 45 students and, of these, 32 agreed to take part and kept the appointment to do so. Due to the small number of subjects available and the need to make comparisons with earlier experiments in the series the author was retained as the sole experimenter.

All the subjects were under 30 years and were unknown to the experimenter. Unfortunately some of the students were on an exchange programme and had been on an introductory course together. Thus, although self-described 'friends' were not paired together, some Ss knew their partners by name. Fortunately, as it was the beginning of the academic year, (1976/77), most subjects were unknown to each other. Subjects had been informed that they might earn £1 during the course of the experiment and all subjects were naive as to the nature of the task.

Eight male pairs (MM) and eight female pairs (FF) of volunteer American students were randomly assigned to one of the two communication conditions, 0 (none allowed) and 31 (verbal communication allowed for three minutes after the 31st trial). The only restriction on random allocation was that there should be equal numbers of dyads in each of the four treatments above.

b) Procedure and instructions

Subjects were seated on either side of a partition which restricted non-verbal communication, extraneous to the task, to a minimum. As has been the case in earlier experiments both subjects could see, and be seen by, the experimenter (Figure 5). Each subject was provided with a pen and record sheet which contained spaces for 300 responses (Appendix 1). Subjects' choices were indicated by pressing A or B buttons which were relayed to the experimenter's panel (Figure 6) and E stated the choices and respective pay-offs after each trial. Subjects recorded their own gains on the sheet provided.

Instructions were the same as those for Experiment 2 which employed a financial incentive and were taped by the author in an attempt to standardise presentation. Following the presentation of instructions the experimenter checked that subjects understood the matrix (Figure 4) and any queries were answered in as standard a manner as possible.

Subject dyads played 180 iterations of the game but were not told beforehand how many trials were to take place. The post-experimental questionnaire (Appendix 11) was completed by Ss prior to counting their final score and to being debriefed. Subjects were later sent details of the results.

The number of A choices per subject dyad were analysed by ANOVA and the data were also compared with that from Experiment 2 which employed a British student population.

iv) Analysis of results

A. Co-operation

Co-operation was defined as the number of A choices per subject dyad and these were divided up, for the purpose of analysis, into 6 trial blocks of thirty trials each. Raw scores are presented in Appendix XV11. The mean scores for each treatment are shown below in Table 24 and expressed as percentages in graphical form in Figure 19.

Table 24. Mean Co-operation Scores (Expt. 5)

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad and the communication opportunity

Pairing	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	45.75	48.50	47.00	46.00	49.00	50.75
	31	40.25	49.00	58.00	56.75	55.50	53.75
FF	0	17.00	15.75	28.75	22.50	23.50	25.75
	31	18.25	20.25	22.00	22.25	26.25	25.00

b) Total mean number of co-operative choices as a function of each treatment condition

Pairing

MM	FF
50.02	22.27

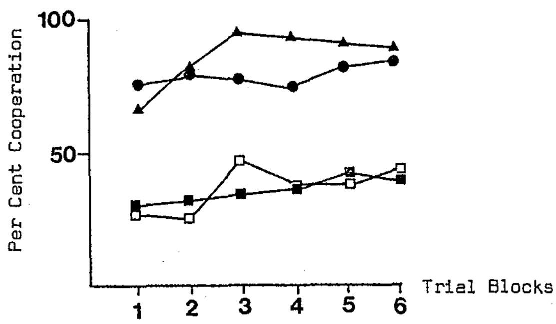
Communication Opportunity

0	31
35.02	37.27

Trial Blocks

1	2	3	4	5	6
30.31	33.38	38.94	36.88	38.56	38.81

FIGURE 19. PERCENTAGE OF COOPERATIVE CHOICES OVER TRIAL BLOCKS FOR EACH SUBJECT PAIRING BY COMMUNICATION CONDITION (Expt. 5)



MM,0

MM,31

FF,0

FF,31

The distribution of scores in Figure 19 shows that in the traditional multi-play P.D. condition (where no verbal communication was permitted) males initially co-operated 76 per cent of the time, a level which had increased to 85 per cent by trial block 6. When the same experiment was run using a British subject population (Expt. 2) males initially co-operated only 33 per cent of the time and co-operation only rose to just above 50 per cent by the final trial block. British males in condition 31 increased their co-operative responses from trial block 2 onwards following the three minute communication period and eventually co-operated at similar levels to the American males in the present experiment. American females in condition 0 began co-operating at the 28 per cent level, compared to 35 per cent for British females. These levels had reached 43 per cent and 46 per cent respectively by trial block 6. When allowed to talk after trial 31 the level of co-operation rose to only 42 per cent for American women on the final trial block compared to 57 per cent for British women.

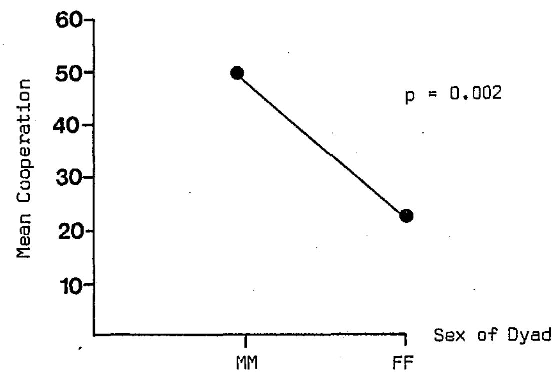
Examination of the mean scores for the American students, presented in Table 24 suggests that there may be a main effect on co-operative responses due to both the sex of the dyad and the duration of the inter-action. A three-way analysis of variance was computed on the data for Sex (2 conditions) x Communication (2 conditions) x Trial Blocks (6 conditions). The summary table is presented in Table 25 and the significant effects are expressed graphically in Figure 20.

Table 25. Analysis of variance summary for number of co-operative choices for Sex (2 conditions) x Communication (2 conditions) over Trial Blocks (6 conditions)(Expt. 5)

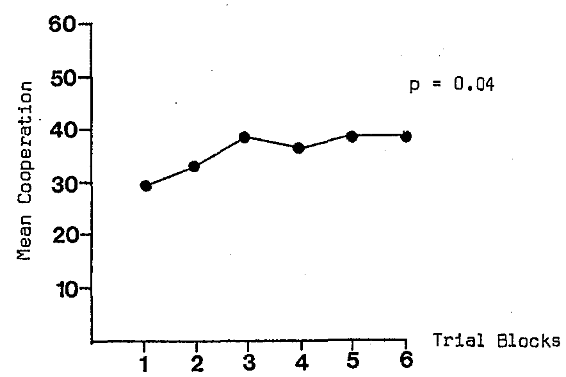
Source	df	sum of squares	mean square	F	p
Between Dyads					
Sex (B1)	1	18481.50	18481.50	15.71	0.002
Communication (B2)	1	121.50	121.50	0.10	0.75
B12	1	108.38	108.38	0.09	0.76
Error B12	12	14114.92	1176.24		
Within Dyads					
Trial Blocks (W1)	5	1007.71	201.54	2.52	0.04
W1B1	5	70.00	14.00	0.17	0.97
W1B2	5	140.50	28.10	0.35	0.88
W1B12	5	417.38	83.48	1.04	0.40
Error W1B12	60	4806.08	80.10		

FIGURE 20. GRAPHS TO SHOW SIGNIFICANT EFFECTS (Expt. 5)

a) Mean number of cooperative choices as a function of the sex of the dyad.



b) Mean number of cooperative choices as a function of the duration of the interaction.



It can be seen that there are, indeed, two significant main effects when Experiment 2 was replicated with an American subject population. Figure 20 shows that American males were more than twice as co-operative as American females ($p = 0.002$) and that co-operative levels, overall, increase with the duration of the inter-action ($p = 0.04$). No main or inter-action effects due to the communication opportunity were observed.

These findings demonstrate sex differences in co-operation consistent with Hottes and Kahn's (1974) study which employed American subjects. Thus, when Experiment 2 was replicated with an American subject population a main sex effect was observed in a single E design, an effect which had been elusive in the previous single E designs. However, no inter-action effects were demonstrated.

The communication data were examined for differences associated with the sex of the dyad.

B. Communication Data

All four male dyads permitted verbal communication after the 31st trial made use of the opportunity, talking together throughout most of the three minutes. Three of the four pairs directly mentioned a 'play A' strategy (none mentioned an imitative strategy) whilst the fourth pair had tacitly reached such an agreement prior to the break. However, of the female dyads only two pairs spoke, one of whom simply said, "Don't know what to say...um...," followed by silence. The other pair agreed to choose A and then talked about topics of mutual interest; this pair had the highest total co-operation score of all the American females in this treatment.

It will be remembered that the Hottes and Kahn study noted that six out of ten males directly mentioned either a 'play A' or an imitative strategy whilst only one out of ten females did so. The above data support the notion that American men make better use of communication opportunities than do American women and are more attentive to strategic considerations. Certainly it was E's impression that the American men were very much more relaxed and friendly towards each other in the experimental setting than were both American women and British Ss of both sexes. They also had no qualms about discussing the task and several said E could "throw out the results if they're not what she wants."

However, the fact that American men made better use of communication opportunities than women was largely irrelevant in the context of the present experimental design. Men were extremely co-operative anyway and the communication opportunity simply served to slightly enhance this tendency so that pairs co-operated at the 90 per cent level or above. Females were relatively non-co-operative ($<$ 50 per cent) and the opportunity to verbally communicate about strategies or, indeed, <u>social</u> considerations was only taken advantage of by one dyad who managed to do both.

The questionnaire data was examined for insights into subjects' choices which might be associated with the sex of the dyad.

C. The post-experimental questionnaire

Responses to the five forced-choice questions were analysed for differences due to the sex of the respondent. The Mann-Whitney U test was employed with α =0.05 for a 2-tailed test (n_1, n_2 = 16). Responses to the open-ended questions are discussed in Chapter Nine. Raw scores are presented in Appendix V111 and the results of the analysis are summarised below in Table 26.

Table 26. Summary of questionnaire data for Qs. 1-5 (Expt. 5)

Question (See Appendix 11)		Distribution of scores						Mean	U	P
		1	2	3	4	5	6			
1	M	1	3	0	2	7	3	4.25	116.0	>0.05
	F	1	2	0	2	7	4	4.50		
2	M	2	1	3	2	7	1	3.88	126.0	>0.05
	F	2	0	2	6	5	1	3.94		
3	M	6	1	1	2	3	3	3.25	123.0	>0.05
	F	5	2	3	1	3	2	3.06		
4	M	0	0	3	3	7	3	4.63	108.5	>0.05
	F	0	1	3	5	4	3	4.31		
5	M	1	1	0	1	6	7	4.94	69.0	<0.05
	F	0	3	3	6	1	3	3.86		

Thus, American men rated themselves as trying to give their partner the same as he gave them more often than did American women (Q.5). This is direct evidence that men attempted to imitate each other more than did women and is associated with high levels of co-operation in this experiment. This finding is consistent with Hottes and Kahn's suggestion that imitation indicates attention to strategic elements of the task. Hottes and Kahn (1974) only noted significant differences in response to Q.3 ("How much did the communication between the two of you influence the choices you made?") but no such effect was found here.

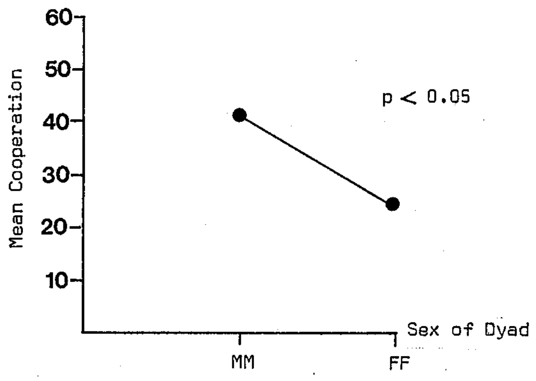
D. The effects due to cultural differences

The data from the present experiment were compared with that from Experiment 2 as both were single E designs having the author as experimenter. The reader is referred to Chapter Six for the analysis of results from Experiment 2. As the procedure and design for each experiment were identical allowing direct comparisons to be made the analysis of variance for the pooled data included a fourth fixed factor of "culture", of which there are 2 conditions (British and American populations).

In ideal circumstances, however, a British group of subjects should have been tested at the same time. The mean scores and ANOVA summary table are presented in Appendix XV111. The significant main and inter-action effects are expressed in graphical form in Figure 21 in order to help clarify the discussion.

FIGURE 21. GRAPHS TO SHOW SIGNIFICANT EFFECTS: POOLED DATA (Expt. 2 and Expt. 5)

a) Mean number of cooperative choices as a function of the sex of the dyad.



b) Mean number of cooperative choices as a function of the communication opportunity

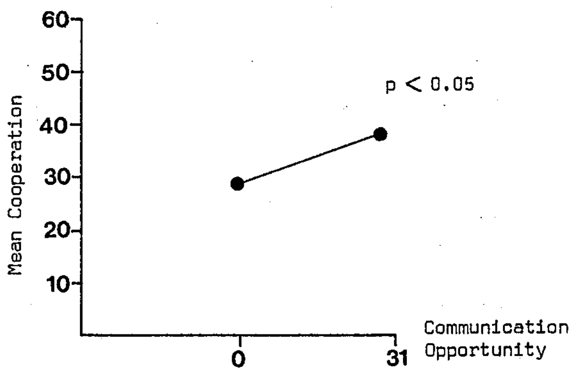
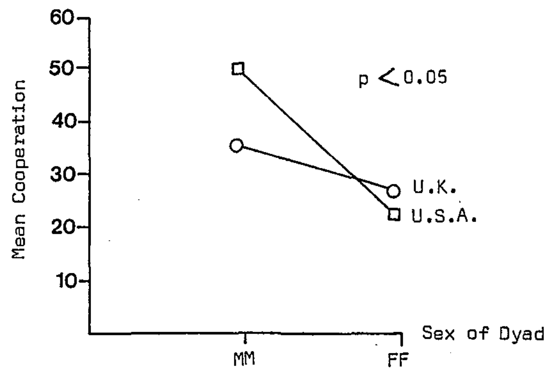
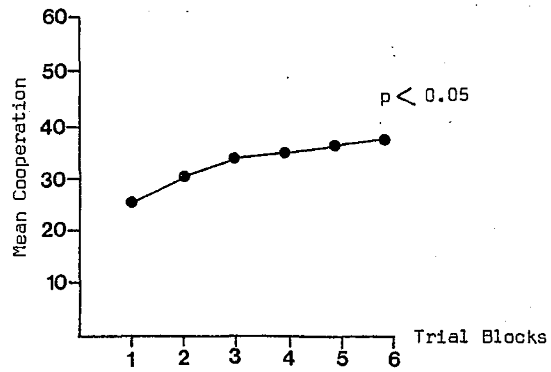


FIGURE 21 CONTINUED

c) Mean number of cooperative choices as a function of the sex and culture of the dyad.



d) Mean number of cooperative choices as a function of the duration of the interaction.



e) Mean number of cooperative choices as a function of the communication opportunity and the duration of the interaction.

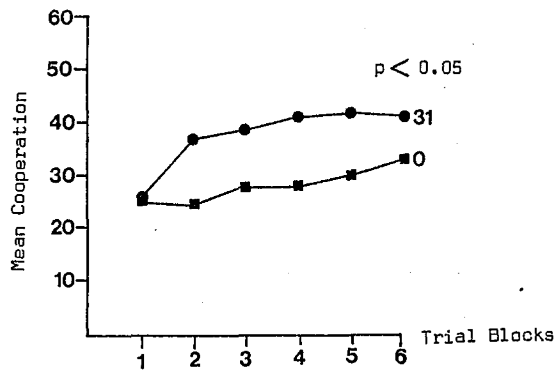
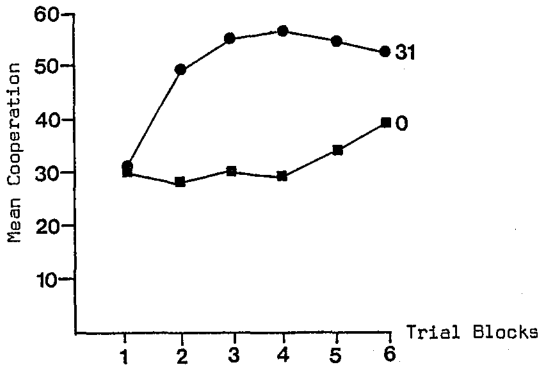


FIGURE 21 CONTINUED

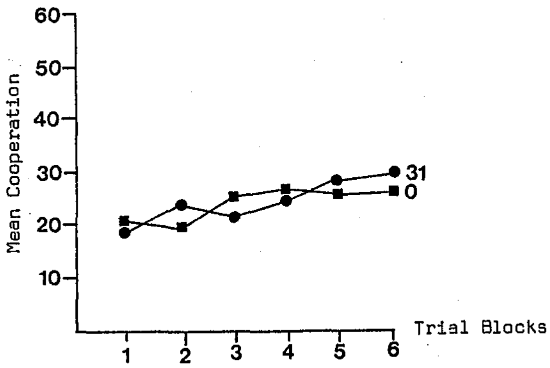
f) Mean number of cooperative choices as a function of the sex of the dyad, the communication opportunity and the duration of the interaction.

male dyads



$p < 0.05$

Female dyads



The analysis indicated several significant main and inter-action effects which were to be expected from the pooled data. Men, overall, were found to be more co-operative than women, an effect which increased over time when communication was allowed (Figures a and f). Communication opportunity, overall, was also found to elicit more co-operative responses than no communication opportunity (Figure b) and more co-operative responses were made overall as the game progressed (Figure d). More co-operative responses were made by subjects over time when communication was allowed (Figure e).

However, more importantly for the purposes of the present discussion, there was an inter-action effect between the sex and the culture of the dyad (Figure c). American men had the highest mean co-operation level ($\bar{X}$ = 50.02) and American women had the lowest level ($\bar{X}$ = 22.27). British men and women came somewhere in between $\bar{X}$ (MM) = 35.13; $\bar{X}$ (FF) = 26.92; The Tukey test was employed to see which of the mean scores are significantly different from each other (see Appendix lV for computations). American men were found to be significantly more co-operative (α = 0.05) than any of the other three groups and British men were found to be more co-operative than American women but not British women.

V) Summary

The hypothesis that American men would be more co-operative than American women was supported with American men being more than twice as co-operative. No main effect due to the communication opportunity was observed, nor did American men co-operate more than women when communication was allowed. Although it seemed that the men made better use of the communication time (i.e. attending to strategic considerations) this had little effect as co-operation was high for this group even in the no communication condition.

The hypothesis that co-operation would increase with time when American Ss play P.D. was confirmed, as was the expectation that cultural differences would have an effect. However, cultural differences interacted with the sex of the players. American men were significantly more co-operative than American women and both the British groups; British men were only more co-operative than American women.

Here, then, is a possible explanation for the discrepancies between the present study and the most often reported findings in the American literature. All other things being equal (i.e. the design and procedure for the game, including the identity of the Experimenter in a single E design) it seems that the co-operative behaviour of men and women is <u>not</u> a universal phenomenon. As suggested earlier, the marked sex differences are more likely to be an American phenomenon with similar but weaker tendencies exhibited in British subjects in multiple E designs.

Of course, it is quite likely that the American subject population studying in England is not a random selection of American students. In addition, the £1 incentive does not have the same value as for British students. This was a difficulty which could not be resolved in the present study. One other discrepancy still remains, however. Skotko et al's (1974) study suggests that sex differences - even with American subjects - are not likely to be exhibited in the presence of a female E (i.e. sex differences are due to female Ss becoming less co-operative in the presence of a male E). A confounding variable is that the E in the present study was English and there is no reason to assume that the behaviour of Es is universal either. However, the author believes that the significant main effect due to the sex of the dyad noted in Experiment 5 is further evidence for the importance of the personal style of E (rather than the sex of E) in the elicitation of sex differences. The reader is referred to Chapter Seven for a discussion of this topic.

It was also suggested earlier in this chapter that the weaker propensities of British male and female students to co-operate at different levels on P.D. may be masked by effects due to the inter-action with the experimenter. This aspect was investigated in the following experiment in which the experimenter (the author) was not present in the room during the subjects' inter-action.

8.3 Experiment 6 : Absent experimenter

i) Aims of the investigation

The investigation is designed to establish the nature of sex differences in the co-operative behaviour of British students under two conditions of communication opportunity in the absence of a third person, the experimenter. The data will also be compared with that from Experiment 2 in order to investigate the influence of the experimenter on the level of co-operation on Prisoner's Dilemma.

ii) Hypotheses

Several hypotheses were formulated based on the findings from the previous experiments in the series.

In the absence of the experimenter during the inter-action:

1. Male subjects will be more co-operative than female subjects.
2. Communication opportunity will elicit higher levels of co-operation from all subjects regardless of sex.
3. Men will be more co-operative than females when limited communication opportunities are made available.
4. Co-operation will increase with the duration of the inter-action.
5. Subject dyads will play differently according to whether E is present or absent during play.

No other inter-action effects were specified.

iii) Method

a) Subjects and Treatment Conditions

The same matrix was employed as for the previous experiments (see Figure 4) and the British subjects were recruited from the same pool of students either by letter or by advertisement. All subjects were under the age of 25 years and were unknown both to the experimenter and to the other member of the dyad. As has been the case in earlier experiments they were recruited on the understanding that they might be able to earn £1 during the course of the experiment.

Forty-four of the students contacted kept their appointments but, of these, the results from four pairs of subjects had to be discarded due to the failure of the experimental equipment. Thus, 36 students who were naive as to the nature of the task were randomly assigned to the treatment groups such that there were five like-sexed pairs (MM and FF) in communication condition 0 and four like-sexed (MM and FF) in communication condition 31.

b) Procedure and Instructions

In order to run this experiment it was necessary to modify the apparatus so that pay-offs could be indicated directly to the subjects without the intervention of the experimenter. All other attributes of the design and procedure remained the same.

Subjects were met by the experimenter and seated on either side of the partition as shown in Figure 22. Each subject was

Figure 22. The Apparatus (Expt. 6)

provided with a pen and record sheet containing spaces for 300 responses (see Appendix 1). Each subject indicated his/her choice by pressing either the A or B button. When both had made their choices the corresponding pay-off box lit up both the subjects' panels giving feedback without requiring the experimenter to be present. Unknown to the subjects their choices were also relayed to the experimenter's panel (Figure 6) in the adjoining room where E was able to record their choices. A hidden microphone was also present in the subjects' room so that E could record any strategic discussions and check that subjects did not talk to each other except when it was permitted. The experimenter was able to press a buzzer which indicated to Ss when communication opportunity was available. The modified instructions were pre-recorded. E, having instructed Ss to listen carefully to the tape, switched on the tape recorder before leaving the room. Thus, the minimum of E $\rightleftarrows$ S inter-action occured as subjects were not permitted to ask questions.

The instructions were similar to previous instructions in the present series and were only modified to explain the procedure and to include practice trials. The instructions are presented in Appendix XX.

However, several practice runs with postgraduate psychology students indicated that subjects could not be relied upon to only press their button once before the pay-off box lit up. Uncertainties arose, such as whether they had pressed the button properly, especially if their partner was taking a long time to choose and the pay-off box had not been activated. A few subjects also kept their fingers on the same button for some time, especially in AA or BB runs. Such behaviour had the effect of causing anomolies in the system, (e.g. two panels lighting up) and subject 1 was therefore instructed by E to activate the re-set switch to his left (see Figure 22) when this occurred. In fact, because of problems with the equipment or of general uncertainty one or two subjects did check with their partner that they were doing the right thing. However, except for the four discarded results none of these Ss talked after the fifth trial (except when it was permitted) and none discussed strategies or attempted to befriend the other. Thus, from E's point of view, all the Ss that took part in the study were trustworthy in the unsupervised situation and the data were therefore retained for analysis.

Subjects were fully de-briefed at the end of the session after completing the post-experimental questionnaire (Appendix 11) and were sent details of the results when they were available.

iv Analysis of Results

A. Co-operation

The gross index of co-operation was again defined as the number of A choices made per subject dyad. Scores were divided up into 6 blocks of 30 trials each; mean scores are shown below in Table 27. Raw scores are presented in Appendix XV11 and Figure 23 expresses the mean per cent levels of co-operation in graphical form.

Table 27. Mean co-operation scores (Expt. 6)

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad and communication opportunity

	Communication Opportunity	Trial Blocks					
		1	2	3	4	5	6
MM	0	21.40	12.20	15.60	26.80	32.80	30.20
	31	30.75	29.75	30.50	25.25	25.00	28.50
FF	0	27.00	22.20	23.20	22.60	23.80	22.60
	31	22.75	40.00	40.00	38.25	43.75	42.50

b) Total mean number of co-operative choices as a function of each treatment condition

Pairing

MM	FF
25.44	29.93

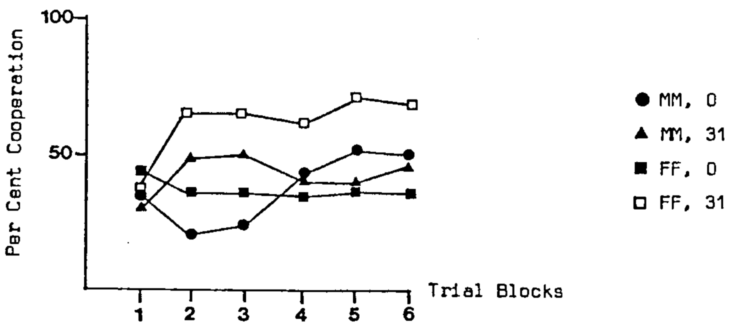
Communication Opportunity

0	31
23.37	33.08

Trial Blocks

1	2	3	4	5	6
25.33	25.06	26.44	27.83	31.00	30.44

FIGURE 23. PERCENTAGE OF COOPERATIVE CHOICES OVER TRIAL BLOCKS FOR EACH SUBJECT PAIRING BY COMMUNICATION CONDITION (Expt. 6)



It can be seen that males in the no talking condition initially declined in the level of co-operative responding on trial block 2 but had 'recovered' by trial block 4 to above the initial level. Females in the no talking condition never regained the initial level after a decline on trial block 2. However, males in condition 31 actually declined in co-operative responding over time, in contrast to the results from Experiment 2 when E was included in the inter-action. Females, on the other hand, increased their level of co-operation reaching 71 per cent by trial block 6.

Examination of the overall means in table 27b suggests that there are no main effects due to the sex of the dyad or the duration of the inter-action but that there may be differences due to the availability of communication. In fact, this is not confirmed by statisical analysis as can be seen by the ANOVA summary in table 28. No main or inter-action effects were observed and hypotheses 1 - 4 outlined above were not supported by the data.

The communication and questionnaire data were examined for insights into how subjects made their choices in the absence of the experimenter.

Table 28. Analysis of variance summary for number of co-operative choices for Sex (2 conditions) x Communication (2 conditions) over Trial Blocks (6 conditions) (Expt. 6)

Source	df	sum of squares	mean square	F	p
Between dyads					
Sex (B1)	1	542.26	542.26	0.45	> 0.05
Communication (B2)	1	2517.69	2517.69	2.09	> 0.05
B12	1	562.22	562.22	0.47	> 0.05
Error B12	14	16883.70	1205.98		
Within dyads					
Trial Blocks (W1)	5	586.96	117.39	0.10	> 0.05
W1B1	5	360.96	72.19	0.61	> 0.05
W1B2	5	769.19	153.84	1.31	> 0.05
W1B12	5	1350.09	270.02	2.29	> 0.05
Error W1B12	70	8238.01	117.69		

B. Communication data

Although the experimenter was not present in the room there was, unknown to the subjects, a hidden microphone so that E could hear what was being said in the next room. This was in order to check that the correct procedure was being observed and to record any strategic discussions made during the communication opportunity. All the subjects were informed of this after the experiment and it was explained that if they had been told prior to the inter-action their subsequent behaviour might have been different. Subjects were asked if their data could be used in the analysis and fortunately no one objected (or they were too reserved or polite to refuse).

All of the four male dyads permitted to talk made use of the opportunity but only one pair made an agreement to press A. Another pair discussed the outcomes in general terms but not the advantages of these outcomes, hence their discussion could hardly be called strategic, although it was task-oriented. A third pair simply checked with each other that the sounding of the buzzer meant they could talk and then said nothing. A member of the fourth pair said, "The longer you wait, the less time you have to get points" and the pair resumed making their choices (without further talking) before the buzzer sounded again.

Of the female dyads, three of the four pairs spoke to one another and two of these agreed to press A together. The third pair talked about the method of recording scores and when the buzzer would sound again. This pair said afterwards that they thought it would be cheating to discuss strategies.

The above is evidence that the strategic nature of the task may be perceived just as well by females as males when E is not present. Although there were no statistically significant differences Figure 23 demonstrates that females co-operated at a higher level when communication was allowed, reaching 71 per cent by trial block 6 compared with only 48 per cent for males. Whether larger numbers of subjects would show these trends, which are the reverse of those in

Experiment 2, to be significant remains a matter for speculation.

C. The post-experimental questionnaire

Responses to the five forced-choice questions were analysed, as in previous experiments, for differences due to the sex of the respondent. The Mann-Whitney U test was employed with $\alpha = 0.05$ for a 2-tailed test ($n_1 = 17$, $n_2 = 18$). Responses to the open-ended questions were difficult to categorise and are discussed in Chapter Nine, although they were extremely useful in making sense of the outcome of each interaction. Raw scores are presented in Appendix V111 and the results of the analysis are summarised below in Table 29. Unfortunately, one of the male S's responses had to be discarded as the questionnaire had not been completed as instructed.

Table 29. Summary of questionnaire data for Qs 1-5 (Expt. 6)

Question (See Appendix 11)		Distribution of scores 1	2	3	4	5	6	Mean	U	P
1	M	1	2	0	1	7	6	4.71	136.0	> 0.05
	F	2	1	0	3	7	5	4.50		
2	M	3	3	3	5	3	0	3.19	78.0	< 0.05
	F	0	2	1	6	7	2	4.33		
3	M	3	1	0	2	7	4	4.24	126.5	> 0.05
	F	6	4	1	0	1	6	3.22		
4	M	2	2	2	2	3	6	4.18	150.0	> 0.05
	F	1	4	0	3	4	6	4.28		
5	M	1	2	3	2	3	6	4.29	101.0	> 0.05
	F	7	3	0	1	3	4	3.11		

A sex difference was found in response to Q.2 which asks, "How much do you think you would like your partner personally?" Females indicated more strongly than men that they thought they would like their partner. Whether such a response stems from the insecurity of "being in the same boat" in the absence of the experimenter is unclear. Such insecurity might consolidate females' desire for social inter-action but not necessarily exclude a desire for strategic inter-action (as evidenced by the communication data).

One possibility is that females usually respond more to the presence of the experimenter (the authority figure) than to their partner, but are able to respond more to each other in the absence of E. Such an explanation would be able to account for sex differences in response to both male E's and the personal styles of all E's, in terms of the amount of authority they may be invested with (whether sex-typed or not). In the absence of E the females' level of co-operation was slightly (but not significantly) higher than the males' and increased when the social situation was expanded to include communication opportunities. American men, it will be remembered, were not at all intimidated by the presence of E and several even said that E could discard the results if they were not what was required. This group was also the most co-operative in experiments employing the author as experimenter. To observe the effects associated with the experimenter's presence during the inter-action the data from Experiments 2 and 6 were pooled and analysed together.

D. The effects due to the presence of the experimenter

The data from Experiment 6 were compared with that from Experiment 2 as both were single E designs having the author as experimenter. The procedure and design for each experiment were as similar as possible but allowed for either the presence of absence of the experimenter in the inter-action. In ideal circumstances the data should have been collected at the same time with subjects being allocated to the treatments at random. However, due to the difficulty of obtaining subjects Expt. 2 was used as a baseline with the assumption that subjects were drawn from the same pool and allocated at random.

The analysis of variance thus included a fourth fixed factor of "presence of the experimenter" of which there are two conditions (present and absent). The mean scores are presented in Appendix XlX, as is the ANOVA summary table. The significant main and inter-action effects from the pooled data are expressed in graphical form in Figure 24 to help clarify the discussion.

As would be expected from the separate analyses the pooled data yielded several significant main and inter-action effects. Communication opportunity was found to elicit higher levels of co-operation from all subject dyads than no communication and co-operative responses also increased as the game progressed (Figures 24a and c respectively). As expected, co-operative responses increased more over time when limited communication was permitted (Figure 24d).

FIGURE 24. GRAPHS TO SHOW SIGNIFICANT EFFECTS: POOLED DATA (Expt. 2 and Expt. 6)

a) Mean number of cooperative choices as a function of the communication opportunity.

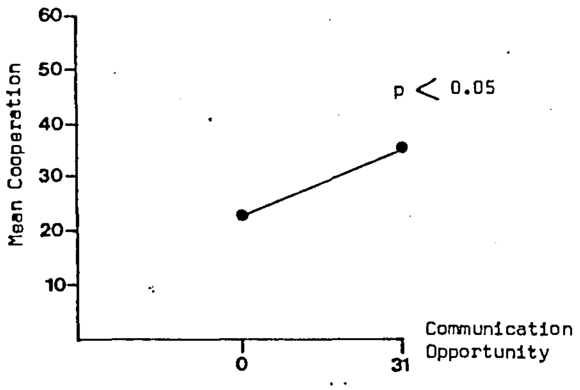
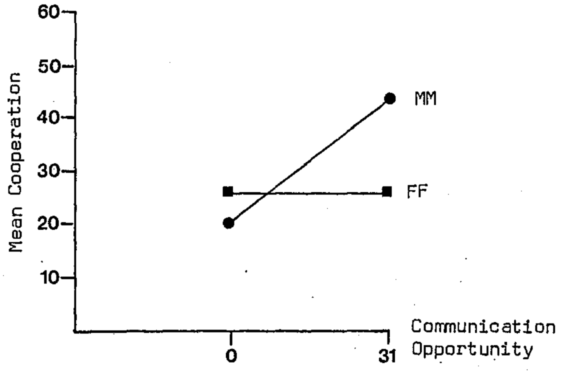


FIGURE 24 CONTINUED

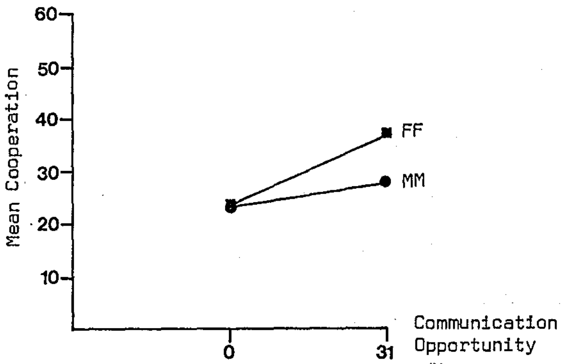
b) Mean number of cooperative choices as a function of the sex of the dyad, the communication opportunity and the presence of the experimenter.

E present



$p < 0.05$

E absent



c) Mean number of cooperative choices as a function of the duration of the interaction.

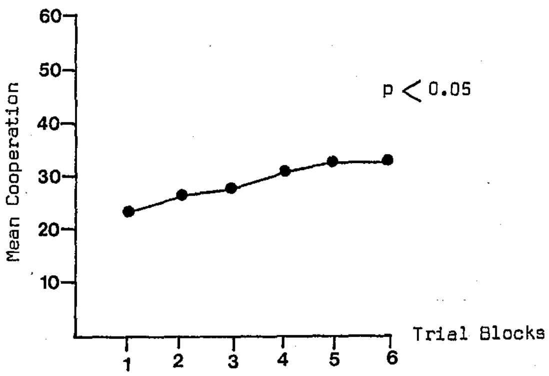
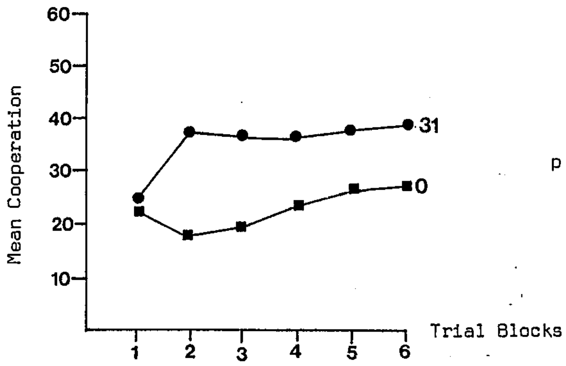


FIGURE 24 CONTINUED

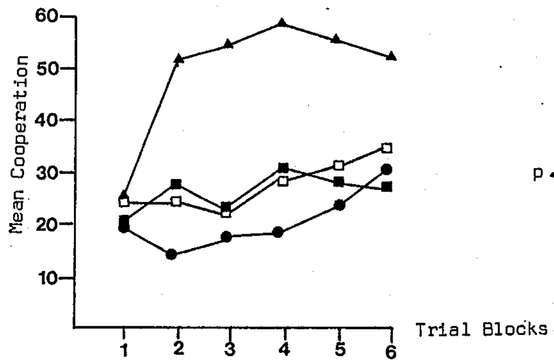
d) Mean number of cooperative choices as a function of communication opportunity and the duration of the interaction.



p $<$ 0.05

e) Mean number of cooperative choices as a function of the sex of the dyad, the communication opportunity, the presence of the experimenter and the duration of the interaction.

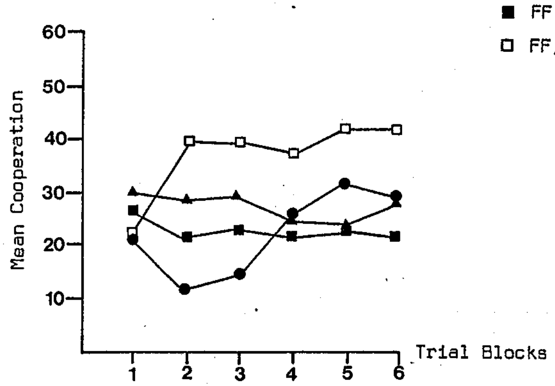
E present



p $<$ 0.05

● MM,0
▲ MM,31
■ FF,0
□ FF,31

E absent



More pertinent, perhaps, to the present discussion was that although there was no main effect due to the presence or absence of E there was a significant inter-action between the sex of the dyad, the communication opportunity and the presence of the experimenter (Figure 24b). The Tukey test was employed to see where the significant differences lay (Appendix 1V). It was found that the high level of co-operation ($\bar{X}$ = 49.57) elicited from males when allowed to talk in the presence of the experimenter was significantly different from that elicited in all other treatments with the exception of females allowed to talk in the absence of the experimenter. A four-way inter-action was also noted (Figure24e) which suggests that the level of co-operation elicited from men who were allowed to talk in the presence of the experimenter increases more over time than for the other treatments(except women allowed to talk in the absence of E).

v) Summary

No main or inter-action effects were observed in the amount of co-operation when the experimenter was absent from the room during the inter-action. The hypothesis that subject dyads will play differently according to whether E is present or absent during play is partially supported by a significant three way inter-action between the sex of the dyad, the communication opportunity and the presence of the experimenter. Men allowed to talk in the presence of E co-operated far more than any other treatment group with the exception of women allowed to communicate when E was absent from the room during play.

It was shown in Chapter Seven that several or none of the main or inter-action effects could be significant in single E designs with a British subject population. It was only when an American subject population was used that a main effect due to the sex of the dyad was noted.

However, when E (the author) was absent from the room during dyadic inter-actions with British subjects none of the significant main and inter-action effects observed when E was present were demonstrated. The results from these experiments are summarised below in Table 30. All of these experiments have had the author as experimenter.

Table 30. Summary of ANOVA data from Expts. 2, 5 and 6 analysed separately (F ratios)

Source	Expt. 2 E present UK subjects	Expt. 5 E present USA subjects	Expt. 6 E absent UK subjects
Between dyads			
Sex	2.40	15.71 *	0.45
Communication	7.88 *	0.10	2.09
Sex x Communication	6.96 *	0.09	0.47
Within dyads			
Trial Blocks	5.38 *	2.52 *	0.10
Blocks x Sex	1.17	0.17	0.61
Blocks x Communication	2.72 *	0.35	1.31
Blocks x Sex x Communication	2.28 *	1.04	2.29

* $p \leq 0.05$

The author is not aware of any American research on dyadic inter-actions which has both a similar design and procedure to the present series and investigates the influence of the experimenter. Certainly the above data from a British subject population (with a British E) suggests that far from masking the weak tendencies to exhibit sex differences in co-operative behaviour on P.D. the presence of the experimenter (and, hence, the inter-action with E) actually serves to elict them. The pooled data from Experiments 2 and 6 (Figure 24b) suggests that male pairs actually co-operate more in the presence of E (or this particular E, the author) than in the absence of E - but only when limited communication opportunity (i.e. more information) is made available. This level of co-operation was no different to that observed by females allowed to talk in the <u>absence</u> of E, however.

8.4 <u>Conclusions</u>

The above data supports Skotko et al's (1974) hypothesis that sex differences in P.D. response styles are not simply a function of the Ss or of their inter-action. However, it goes beyond their general conclusion that <u>females</u> may respond more to the 'personal' characteristics of the other subject and the experimenter (although they did suggest that the effect may be shared in some circumstances by males).

It was shown in Chapter Seven that subjects respond differently with different experimenters and Experiment 6 demonstrated that significant effects are probably due to the inter-action with E. When the experimenter did not intrude on the subjects' inter-action no significant effects in response styles on P.D. attributable to the sex of the dyad, the communication opportunity or the duration of the inter-action were observed. Whether this would be the case with an American subject population remains a matter for speculation. However, to conclude (as did Hottes and Kahn, 1974) that men are success oriented and play opportunistically on P.D. whilst women play defensively would be an over-simplification of the issues involved.

CHAPTER NINE : THE POST-EXPERIMENTAL QUESTIONNAIRE

All subjects who played the P.D. game were asked to fill in a questionnaire (see Appendix 11) in order to provide insight into how Ss determined their choices in the game. The analyses of the five forced-choice questions for differences due to the sex of the respondent have been presented in the preceding chapters. The results from Experiments 1 - 6 are summarised in Table 31 below.

Table 31. Summary of quesionnaire data for Qs 1 - 5 (Expts. 1 - 6)

Expt.		1	2	3	4a	4b	5	6
Q 1	M	4.83	5.15	5.15	5.17	5.20	4.25	4.71
	F	5.15	4.40	5.10	4.47	5.42	4.50	4.50
2	M	4.00	3.75	4.20	4.06	3.67	3.88	3.19 *
	F	4.23	3.90	4.25	3.58	4.11	3.94	4.33
3	M	3.13	4.60 *	4.25	4.39	4.40	3.25	4.24
	F	2.43	3.15	4.10	3.26	4.21	3.06	3.22
4	M	4.63	4.45	4.80	3.94	4.00	4.63	4.18
	F	4.40	4.00	4.30	3.74	4.42	4.31	4.28
5	M	3.88	4.30 *	4.05	5.11 *	3.87	4.94 *	4.29
	F	3.83	3.20	4.25	3.63	4.95	3.86	3.11

Thus, no convincing trends were revealed that could be attributed to the sex of the respondent. British men indicated that verbal communication opportunity influenced the choices they made more than

* $p \leq 0.05$

did women in Experiment 2 but not in any of the other single E designs. British men also indicated they attempted to imitate their partners more than women did, but only in Experiments 2 and 4a, as did American men in Experiment 5. However, in the sixth experiment of the series when the experimenter was absent from the room during the subjects' inter-action, women indicated they felt they would like their partner more than men did although they were not significantly more co-operative.

The responses to the open-ended questions (Qs. 6 - 10) were found to be extremely useful in understanding the outcome of specific inter-actions but, like Hottes and Kahn (1974), the author found them difficult to categorise. Ambiguous, contradictory and sometimes confusing answers were often given either in response to one or to several questions. Following Hottes and Kahn (op.cit.) the responses were categorised for strategic intentions as follows:-

maximise gain;

defensive/random;

both or other.

Hottes and Kahn only categorised responses to two questions : "Did you use a strategy?" and "How did you determine your choices?" However, in the present study, subjects often gave responses which were not further elaborated (e.g. "Yes"). Thus, the responses to all five of the open-ended questions were trichotomized as above according to the overall impression. The raw data are presented by sex in Table 32.

Table 32. Responses to the post-experimental questionnaire (Qs. 6 - 10)

Experiment	Sex of S	Strategy		
		Maximise gain	Defensive/random	Both or other
1 $(n_1, n_2 = 40)$	M	13	9	18
	F	8	12	20
2 $(n_1, n_2 = 20)$	M	9	0	11
	F	4	3	13
3 $(n_1, n_2 = 20)$	M	5	2	13
	F	7	2	11
4a Male E $(n_1, n_2 = 20)$	M	2	2	16
	F	8	3	9
4b Female E $(n_1, n_2 = 20)$	M	6	1	13
	F	6	0	14
5 $(n_1, n_2 = 16)$	M	5	0	11
	F	4	3	9
6 $(n_1, n_2 = 18)$	M	7	1	10
	F	5	6	7

However, the author found that the questions were too open-ended and often not specific enough to enable allocations to these categories to be made with much degree of confidence. For this reason no statistical analysis was attempted. However, had such an analysis been made it would also have been necessary for the categorisations to be checked by an independent person.

In general, where Ss said they wanted to get the highest score possible this was scored as a desire to maximise gain whereas a desire to maximise joint gain was categorised as 'both or other'. This, of course, was not always clear from subjects' responses as, for example, several said they wanted to get the highest possible score but added that they did not want to get more than their partner. Other Ss, having misunderstood the instructions to imply that they should get more than their partner, were content to press B after one AB outcome which put them four points ahead. In their own eyes they had maximised their gain yet the questions were not sufficiently directed to discover whether B was a defensive move or a move to maintain the gain <u>over their partner</u>. Several Ss said they wanted to win but it was unclear what strategy, if any, had been adopted as this is not much different from saying they did not wish to lose. In the main, responses which were categorised as defensive or random were much less ambiguous as these subjects were generally closed to alternative possibilities and were difficult to enlighten even during de-briefing.

In their 1974 study, Hottes and Kahn found that men were more likely than women to state that they attempted to maximise their gain. Women, on the other hand, were more likely than men to state that they chose out of boredom or in a random or defensive manner ($p < 0.01$). They suggested that their findings were consistent with Horner's (1968) thesis that women are more likely than men to avoid failure rather than seek success. Further evidence in support of this was provided by the fact that women also made more non-co-operative choices, the rational choice in a game theoretical sense which minimises loss if one is uncertain what the other will do.

In the present series of experiments Hottes and Kahn's findings were largely unsupported. For example, in the first experiment the number of men and women choosing defensively were 9 : 12 respectively, compared to 1 : 11 in the Hottes and Kahn study. When a financial incentive was introduced (Expt. 2) the ratio was 0 : 3 even though men played more co-operatively than women when verbal communication was allowed. At first glance, the data for 'maximise gain' are consistent with this increase in co-operation as 9 men indicated they employed this strategy compared to only 4 women. But in Experiment 4a only 2 men compared to 8 women indicated they attempted to maximise gain, yet women were not more co-operative. The pooled scores for Experiments 2, 3, 4a and 4b revealed that 22 men and 25 women attempted to maximise gain and 5 men and 8 women chose out of boredom or defensively or at random. In fact, the pooled data for co-operative choices indicated that women were more non-co-operative over time, but the questionnaire data has not been particularly illuminating with regard to comparisons between groups. Even the data for the American subjects (Expt. 5) did not concur with the data from the Hottes and Kahn study (0 men and 3 women indicated they played defensively or randomly or chose from boredom) even though significant sex differences were observed in the levels of co-operation. When the experimenter was absent

(Expt. 6) 1 man and 6 women indicated they chose defensively or at random, yet no sex differences emerged in the pattern of play. Subjects in general reported they had been very bored when the experimenter was not present in the room. As one female S wrote in response to Q.6, "Kept pushing button 'B' for 'BORING'."

The author indicated earlier that the responses to the open-ended questions were often difficult to categorise although they were helpful in understanding specific inter-actions. One difficulty with all questionnaire data is the perceived social desirability of a response.

An example of this may be the following :

Q. How concerned were you with your partner's score? Did you have a preference for the outcome of the game?

A. I wanted to earn £1 but I thought the way we scored was best for mutual benefit, as my partner deserves the £1 as much as me.

It is difficult to know whether S was genuinely concerned with equity or whether he wished to be perceived as being so.

Many subjects were content to describe <u>what</u> they did, but not <u>why</u> they did it. The following responses were frequently given to the question "How did you determine your choices?" : "By what went previously"; "I knew what my partner would choose and chose accordingly"; "Tried to break the B chain"; "By the payout board"; "Break the bank in the long run"; "Sequence of A's followed by one B".

Several subjects produced confusing responses even when they attempted to give reasons for their choices. For example:

Q. "Did you use a strategy in this experiment? If so, what was it?"

A. "Since if we both pushed A we wouldn't get a very high result, I tried using a pattern so partner could pick it up and also push A so we could both get 3 instead of 1. Clearly we both could have pushed B all the time but that would result in a low score".

Q. "How did you determine your choices?"

A. "By pressing A twice she transferred to A so giving me a couple of 4 : 0 scores." <u>OR</u>

A. "I used mostly B because I was certain of getting points, but sometimes A because I felt the experiment was loaded against subject 1".

Q. "How concerned were you with your partner's score? Did you have a preference for the outcome of the game?"

A. "Very - it was the only way either of us could get anything, rather than each cut our own throats in a fight - it was surely better for only me to commit suicide so that the other person could gain" (i.e. he pressed A to his partner's B).

There was slight evidence that American females were less aware of possible strategies than American males as their questionnaire responses were often very confused. One female said she chose randomly and then added : "no real concern over outcome pointwise, but interest in individual pairs - why combination of 2 A's didn't arise as often as 2 B's". Another said : "At first I thought we were both trying to get as many points as possible but then it got tiring trying to outwit her, so since we both seemed content to get three points, I just kept pressing B". (She actually pressed A.) On the whole, the responses of the American women proved the most difficult to categorise although the men found the task just as boring as the women did - one respondent said he wanted to "just get it over with before left hand fell off". Yet, although they were bored, American men managed to sustain a high level of mutual co-operation.

There was some evidence that subjects with a competitive orientation saw little point in changing their strategy. Such responses were "Obviously I tried to win", or "I tried to beat her, else there wouldn't have been much point doing it. Just pressing A or B could be done without thinking by a trained animal. If you've got to think, might as well try to score".

In order to specify more precisely which factors in the experimental situation influence the subjects choices, far more directed questions covering a wider range are required (including the influence of the experimenter and the demand characteristics of the experimental situation). What was evident to the author in examining the questionnaire responses was the large variation in subjects' responses. One subject said he determined his choices by telepathy whilst another said that "the influence and the noise of his 'B' button was appreciated though not used all the time". In fact, both A and B buttons squeaked slightly if pressure was applied and impartial observers were unable to tell the difference. Pilisuk et al (1976) believe that a significant degree of illicit signalling may occur within the laboratory setting and several subjects reported that they had used 'squeaks' or pauses as possible signals and had attempted to look for consistencies. Others felt that by both pressing A all the time it would be "cheating", or as one subject put it, "not giving what was expected in the experiment". Another subject said he was not interested in getting the money but wanted to see if his partner would respond to his "generosity".

On the whole, one was left with the distinct impression that subjects had not been playing the same game at all! The utilities of the matrix cannot be assumed to be the utilities of the subjects. It is hard to disagree with Shaw and Thorslund (1975) that "whether or not certain variables affect measures of central tendency, they may have large and psychologically meaningful effects on variance" (p.121).

CHAPTER TEN : DISCUSSION

This study has attempted to investigate the effects of restricted verbal communication opportunity and the sex of the subject on co-operative responses of British dyads in a Prisoner's Dilemma game. The main findings that have emerged from this study are summarised below and discussed in the context of other recent studies of P.D.

10.1 The effects of verbal communication opportunities

It will be remembered that the traditional P.D. game does not permit any form of communication between the players who are assumed to have full information with which to make a rational decision. However, even though agreements may be made during communication opportunity they are not enforceable and the P.D. game would still be non-co-operative in the theoretical sense. A new dilemma simply arises as it is in the individual's interest to break the pact regardless of what the other does. It was noted that the generalisability of results from P.D. studies has been reduced by inconsistent definitions of the independent variable and, in addition, many of the messages between subjects have been incomplete.

The first experiment of the series employed four levels of verbal communication opportunity where non-verbal communication between dyads was restricted by a partition. Subjects made more co-operative choices when communication was allowed throughout the inter-action than when no communication was allowed or when limited communication was allowed before trial 1 or after trial 31. Wichman's (1972) study also confirmed that the more freely subjects can communicate the more likely they are to achieve the goal of mutual co-operation. Restricting the communication opportunity merely serves to increase uncertainty and Nemeth (1970) argues that in such a 'mechanical' inter-action the norm of reciprocity may not occur. Subjects need to clarify possible motives underlying the selection of choices and Deutsch (1958) argues that subjects who have a competitive orientation have little commitment either to what they communicate or to trust their partner's response.

However, when a financial incentive was introduced into the second experiment of the series, even limited communication opportunity after trial 31 elicited higher levels of co-operation from all subjects regardless of sex, an effect which increased over time. Men were more co-operative than women in this condition and this effect also increased over trial blocks. The view proposed in Chapter Six, that high levels of co-operation are due entirely to the presence of a financial incentive, was found to be too simplistic an explanation, since the results of Experiment 2 were not capable of replication by other experimenters. For, although limited communication elicited increased co-operation for all Ss in Experiment 3, no inter-action effects with the sex of S or time were demonstrated. In a balanced sex of E design (Expt. 4) a main communication effect was demonstrated which increased over time. No effects due to the availability of limited communication were noted when Experiment 2 was replicated using American subjects (Expt. 5) or when E was absent from the room during the subjects' inter-action (Expt. 6). Thus both the cultural background of the subject and the experimenter himself (herself) seem to influence the effects of communication opportunity and the presence of a financial incentive is only one means of altering the meaning of the experimental situation. However, when the data from Experiments 2 - 4 were pooled in a multiple E design a significant main effect due to the communication availability after trial 31 was again noted, an effect which inter-acted with the duration of the inter-action.

Thus, although even limited communication opportunity is more likely to elicit increased levels of co-operation with British subjects, and to do so more as the inter-action progresses, this effect has only been demonstrated in the presence of the experimenter. The effects of the communication availability are therefore probably dependent on the nature of the subjects' inter-action with the experimenter.

Although communication availability may decrease uncertainty the conflict inherent in the game or may not be ameliorated. The experimenter himself (herself) is a salient figure in determining the psychological environment in which the subjects' strategic inter-action occurs.

10.2 The effects due to the sex of the dyad

The sex variable has also been a popular area for study using experimental game methodology. However, as in the case of the communication variable, investigators have adopted a variety of procedures and employed games which differ structurally and conceptually. Hence, generalisations across situations should only be attempted with caution for whilst some researchers report sex differences others do not.

The most often published finding on P.D. is that males are more co-operative than females, suggested by Bedell and Sistrunk (1973) to be due to a differential sensitivity to the demand characteristics of the experiment. It will be remembered that Skotko et al (1974) extended this idea to include the sex of the experimenter as they demonstrated that the extreme non-co-operation of female dyads only occurred in the presence of a male experimenter.

The first experiment of the present series found no differences which could be attributed to the sex of the dyad. Although these results did not concur with Hottes and Kahn's (1974) study on which the experiment was based, the experimenter in this instance was female. This factor supported the thesis put forward by Skotko et al (1974). However, when a financial incentive was introduced into the design (Expt. 2) men were more co-operative than women when allowed limited verbal communication after trial 31, an effect which increased with the duration of the inter-action, even though the experimenter was female.

Initially it seemed that the presence of both a financial incentive and restricted communication opportunity would explain the discrepant findings of Experiment 2 and the Skotko et al (1974) study. Again, such a view was found to be too simplistic for when Experiment 2 was replicated no main or inter-action effects due to the sex of the subject were noted (Expts. 3 and 4) nor were any effects demonstrated when E was absent from the room during the subjects' inter-action (Expt. 6). American subjects on the other hand, in a single E design, performed more in accordance with the published literature (with the exception of the Skotko et al (1974) study). Males were more than twice as co-operative as females, even though the experimenter was female (and British).

When the data from Experiments 2 - 4 were pooled in a multiple E design, female subjects were found to be less co-operative over trial blocks than males and were more likely to be so in the presence of a male experimenter. However, different experimenters were found to elicit different levels of co-operative responses from Ss regardless of sex and none of the above effects can be predicted in a single E design with any degree of confidence - at least with British subjects. It was suggested that, as for the communication variable, any differences due to the sex variable are probably elicited by aspects of the subjects' inter-action with the experimenter in multi-play P.D.

Psychologically, the pool of subjects taking part in Experiments 2, 3 and 4 were not in the same experiment at all and the experimenter himself (herself) serves to define the experimental context and the appropriateness of responses. It was noted that any theory which attempts to account for the differential sensitivity of males and females to experimental demand characteristics in multiple E designs must also be able to account for the differential sensitivity of all subjects in single E designs. As yet, no theory is able to do this adequately.

10.3 Subjects' definition of 'the game being played'

The findings from the present study strongly indicate that the subjects, regardless of sex, took part in psychologically different experiments, although Expts. 2 - 4 were based on the same design. The formal theory is based on the assumption that both parties know each other's utility functions, preferences and attitude towards risk taking and that these are constant throughout the inter-action. Howard (1976) has argued that what is required is a theory that can explain both the rational and the apparently irrational choices.

Shaw and Thorslund (1975) noted that the traditional P.D. game is insensitive to the changeable dynamic aspects of interpersonal conflicts. They found, for example, that variable rewards and large rewards both alleviate boredom but that variable rewards do not increase individual differences as much as large rewards do. In the latter case some subjects become more co-operative whilst others become less so. Messé, Dawson and Lane (1973) suggested that some subjects actually react negatively in high-reward P.D. and perceive that they are being over-paid. Equity theory (e.g. Adams, 1965) predicts that subjects would alleviate such feelings by a strategy of mutual non-co-operation which would have the effect of minimising their earnings. Messé et al, in support of this, found that Ss who worked 1½ hours on a task prior to playing P.D. were more co-operative on a high-reward P.D. than on a low-reward P.D. The opposite was found for Ss who only played the game, however, and this supports the idea that subjects have an internal standard of what constitutes 'fair pay' for participation. Subjects in the present series of experiments may have thought the task of achieving 300 points was quite difficult and, therefore, the payment of £1 was fair. When offered a financial incentive (Expt. 2) they were more than twice as co-operative as in the no incentive condition (Expt. 1).

Braver and Rohrer (1975) also found high levels of co-operation when Ss were told their partner had previously 1) played in a mutually co-operative game or 2) been an exploited martyr or 3) responded defensively in the face of his partner's continued competitive choices. Walster et al (1973) had earlier postulated that in situations of perceived unfairness or injustice an equity norm operates to restore positive outcomes to the recipients. Braver and Rohrer interpreted the behaviour of their subjects as being motivated by such an equity norm, especially in view of the high levels of co-operation noted when Ss were told that their partner had been an exploited martyr. This is consistent with Braver and Barnett (1974) who suggested that the perceived goal of the other strongly influences Ss' degree of co-operation.

Kuhlman and Marshello (1975) noted that subjects adopt strategies that effectively maximise the type of reward which is psychologically meaningful to them. They used four decomposed games where the subject has a set of n alternatives (in this case, 3). Each alternative specifies the outcome both to S and to their partner.

Their subjects were assessed as having co-operative, competitive or individualistic orientations on the basis of their choices across the four games. So-called co-operative subjects co-operated with both a tit-for-tat and a 100% programmed co-operation strategy but 'defected' with a 100% programmed 'defection' strategy. Individualistically oriented Ss 'defected' against both 100% co-operation and defection strategies but co-operated with a tit-for-tat strategy. Competitive subjects, however, 'defected' against all three strategies of the 'other player'. Kuhlman and Marshello found no differences in the numbers of men and women in any of the motivational categories and suggest, therefore, that there are no intrinsic differences between the sexes. This is consistent with the idea that the demand characteristics of the experiment, which include the experimenter, serve to define the appropriateness of responses, some of which may be sex-typed.

Kelley and Stahelski (1970) looked at the effects of subjects' beliefs about their partner's intentions on P.D. They put forward the idea that the attribution of a co-operative or competitive orientation on the part of the other player will be influenced by the Ss' own intentions. In their 'triangle hypothesis' Kelley and Stahelski argue that basically co-operative people are able to perceive others as co-operative, competitive or a mixture of both, whereas competitive Ss attribute only competitive intentions. Such a restricted view usually leads to a self-fulfilling prophecy as the partner is forced into the position of having to also compete (unless he is willing to be a martyr). Many of the responses to the questionnaire in this study indicated that competitive subjects do not appreciate how their own behaviour influences others. Eiser (1978) suggests that this perceptual difference may affect the kind of information such subjects look for in an unfamiliar strategic environment. In support of this, Eiser and Tajfel (1972) found that competitive subjects were less interested than co-operative Ss in infering reasons for their partner's behaviour and more interested in controlling the outcomes.

However, the structure of the game being played may be significant in this context. Miller and Holmes (1975), amongst others, have argued against a type of personality disposition affecting choices on P.D. They note that on P.D. the meaning of the so-called 'competitive' move is not always clear and whilst they were able to confirm the triangle hypothesis as occurring in traditional P.D. they could not do so on an expanded version which included both a 'defensive' and a competitive move.

The symbolic inter-actionists' view is that subjects will behave in socially defined situations in such a way as to create favourable 'situated identities'. The goal structure of P.D. is ambiguous and players may attempt to define moves in such a way that they may be seen to be either 'good players' or 'good persons. Alexander and Weil (1969) manipulated both the goal-ambiguity and the dispositional inferences implied by different choices. They found that the meaning of the moves in play changed greatly according to the treatment and varied within treatments. Regardless of the external experimental controls subjects put themselves in psychologically different experimental conditions by their subjective decisions about the goal of the game. Alexander and Weil concluded that individuals are concerned about being good subjects and felt that subjects' concerns about the formation of a situated identity in the course of an experiment may be more pervasive in experimental social psychology in general than has previously been realised.

Strategies are likely to be chosen according to both the goals of S and the expectations of the other's behaviour. Harsanyi (1962) pointed out that stereotypic expectations of utilities are more likely between members of the same group or culture. However, we have seen from the present study that the presence of the experimenter serves in part to define the meaning of the situation and, hence, the appropriateness of responses. The experimenter has effectively changed the dyad into a triad and various factors may be responsible for affecting the performance of certain responses including sex-role stereotypes. As Fraser (1978) points out in a discussion of group processes, "Two's a dyad, three's a small group" (p.176). Ruble and Higgins (1976) argue that socialisation, institutional barriers and the immediate social situation all help to maintain the sex-role status quo. They support Lewin's (1935) suggestion that feelings of group membership may be influenced by social contexts - such as the sex composition of a group - which affect behaviour within that context. Hoffman and Maier (1961), for example, found that women did better on a problem solving task in a mixed-sex group than in all female groups. Aries (1976) found that men were more able to talk about themselves and their feelings in mixed-sex groups but were more concerned with competition and status in an all male group. Female groups, on the other hand, tended to have a more personal orientation and allowed men to dominate in a mixed-sex group. The results from the single E designs presented in the present study suggest that the general behaviour of the experimenter, regardless of sex, affects the performance of the sex-role stereotype under certain circumstances (e.g. when the author is E) whereas in a multiple E design female subjects were more likely to be less co-operative than men in the presence of a male E.

10.4 Conclusions

Subjects in general have different expectations, both of 'the game being played' and how their behaviour will be interpreted by E who is a participant - observer. Platt (1973) argues that the traditional P.D. paradigm creates a "social trap" where subjects have no guidelines for evaluating their behaviour and no ways of discovering the intentions of the other person. The 'quasi-economic' pay-offs also have symbolic values which are unlikely to be psychologically equivalent (Eiser, 1978). Subjects often choose outcomes which will suffice, rather than choose the 'best' outcome as prescribed by the theory, as moral issues are often raised.

It remains to be convincingly explained why choosing the minimax strategy, D, is sex-typed. However, it seems that the presence of a male experimenter is more likely to enhance the salience of sex roles but a female E may produce the same effect. Colman (1982) has suggested that some experimenters induce a stronger feeling of 'evaluation apprehension' in female than in male Ss. Females may tend to choose D more frequently in order not to 'lose' and thus appear more foolish than their partner. Rapoport and Chammah (1969) have also found a marked sex difference on Chicken with females choosing D more frequently than men. Hottes and Kahn (1974) argued that females respond defensively to the demand characteristics of the P.D. game and choose D - yet C is the cautious choice in Chicken. Colman (1982) argues that a D choice in both games ensures that the subject will not receive the "sucker's" pay-off and suggests that women are more anxious than men to avoid appearing more foolish than their partners in certain circumstances. Not only is such a theory capable of empirical testing, it may also explain the variation in levels of co-operation elicited from subjects by different experimenters. It would remain to be discovered what attributes of E affected the 'evaluation apprehension' of subjects overall.

The influence of the experimenter in determining subjective utilities (in terms of goals and expectations) would seem to be crucial and the context in which behaviour is evaluated can no longer be ignored by theory.

CHAPTER ELEVEN : OVERVIEW

This Chapter looks at the historical development of the experimental gaming tradition in the absence of adequate theory. The generalizability of findings to real life situations is discussed and current theoretical developments in social psychology are examined. The limitations of experimental games as models of social inter-action are noted but it is argued that gaming is only one of several methods available to aid in the understanding of human conflict.

11.1 Historical perspective

All the early research on co-operation and competition neglected the study of social inter-action. In addition, many of the investigations had inadequate operational definitions and were conceptually weak. As noted earlier in Chapter One, the realisation that co-operative and competitive interests could be linked followed the publication of 'Theory of Games and Economic Behavior' by von Neumann and Morgenstern in 1944. Game matrices were felt by many researchers to precisely define an inter-dependent reward structure. The "mixed-motive" nature of conflict, so described by Schelling (1960), has had both methodological and theoretical impact. Deutsch (1980) has referred to conflict as a situation which "exists whenever incompatible activities occur" (p.10) and Pruitt and Kimmel (1977) point and that not only do these games provide behavioural measures they also "permit conflict without tears" (p.366).

During the last 25 years Deutsch (1980) maintains that research has concentrated on bargaining and negotiation behaviour in three main areas in order to answer the questions:

1) under what conditions will players arrive at a mutually satisfactory outcome which will maximise joint pay-offs?
2) under what conditions can one player bargain in order to do better than the other?
3) what are the cognitive and normative factors involved in reaching a stable and "just" agreement?

In general Deutsch would argue that co-operative behaviour both elicits and is elicited by perceived similarities of the players, a readiness to be helpful and trusting and friendly behaviour, whereas competitive behaviour induces and is induced by threats, deception, rigidity and so on. Various strategies are suggested for winning conflicts or increasing one's bargaining power, but they are complex and no systematic theory of social influence has been developed. However, the areas researched include 'ignorance', 'toughness', 'belligerence' and 'bargaining power' and Deutsch argues that there is some support for surprising tactics in this area. It was seen in Chapter Nine that many researchers have begun to look at the determinants of an agreement between conflicting parties but Deutsch (1980) points out that the principle of equity is only one of the many principles of 'distributive justice', and other moral issues may be raised.

Deutsch believes that in the last fifty years significant progress has been made both methodologically and empirically. The development of experimental gaming and simulations has provided other areas of social science with research tools. In addition, many 'common-sense' beliefs about bargaining have only turned out to be 'half truths' and we now understand more about conciliation, escalation and so on. However, Deutsch believes that this level of awareness does not begin to match the urgent social need for the understanding and management of conflict situations. The research tradition has also tended to neglect theorizing but, as many writers have pointed out, this is characteristic of much of experimental social psychology in general.

11.2 Game theory

Game theory assumes people are rational decision makers. It is a cognitive approach which provides guidelines for rational decisions making. It had been hoped that the theory would help to solve conflicts in real life but it was soon observed that much of human behaviour may not be guided solely by the principles of rationality. In game theoretic terms a solution is a statement of how people should play if the principles of rationality (guided by preferred outcomes) are followed. However, psychological variables such as motivation, morality, altruism and so on are not accounted for in the theory. Billig (1976) points out that these are not necessarily mutually exclusive with the assumption of rationality as it may simply be that people's utilities are difficult to calculate - they may still base their choices on the principle of maximising gains. Billig notes that a crucial difficulty is the measurement of rewards as one ends up with a circular statement where rewards are estimated according to 'whatever people do'. It was shown in Chapter One how subjects often make mutually disadvantageous choices by choosing the strictly dominating 'rational' strategy, D.

Howard (1971, 1974) has attempted to extend the mathematical framework in the development of metagames. Many theorists now believe that metagame theory provides a rational solution to P.D. and other mixed-motive games but others disagree. The player chooses from a set of metastrategies which are conditional on the expected choices of the other player. Rapoport (1976 b) believes this is an 'escape from paradox' - the rational choices are prescribed in unambiguous form and the paradox appears to be resolved. However, the theory does not help a player choose a strategy if he does not know what the other will do. Nevertheless this may well be one area of theoretical development.

Billig (1976) comments that there has been little attempt to improve the basic analysis of such games so that the 'solution' can prescribe mutual co-operation. He argues that, "The social world is not a neutral mathematical universe. The failure of Game Theoretic strategies to arrive at a common-sense solution to the prisoner's dilemma situation in a controlled laboratory situation is ample proof of that" (p. 197). We have seen that the same choices on a game matrix can have quite different subjective meanings and the matrix utilities cannot be assumed to be the players' utilities. Contingent and sudden shifts in strategy both affect the play of the Other as, even in the absence of verbal communication opportunities, subjects interpret the meaning of the situation. The psychological importance of strategies needs to be determined.

11.3 Generalizability of gaming situations

The P.D. situation may well be typical of many everyday interaction sequences. Hamburger (1979) shows how may urgent economic and social problems can be usefully analysed as 'dilemma games'. Schelling (1960), in particular , has been influential in applying the conceptual framework of game theory to the analysis of international, political, social and economic situations. Coalition-formation and voting have also attracted game-theoretic analysts and the games tend to reflect the increased complexity of such events.

However, the case for the generalizability of gaming situations to real-life events has been the subject of criticism in recent years, especially since the formal theory "does not offer an adequate account even of behaviour in the games themselves" (p. 153; Eiser, 1978). Rapoport (1968) considers that the "laboratory phase ought to be considered as the incubation period of a science" (p. 469), giving the opportunity for theory building which may (or may not) apply to real life. The question of the relevance to real life conflicts should, he believes, be postponed until after an intensive study of such games in their own right. Rapoport and Chammah (1965a) argue that simply because of its triviality P.D. may tap 'psychological propensities' better than a real life situation as the subjects are uncertain of the focus of the study. They argue that as it is more difficult to present a front under such circumstances well-established habits are likely to be elicited. Pruitt and Kimmel (1977) argue that the reverse is more likely to be the case. They suggest that the findings on P.D. reflect behaviour in an unfamiliar strategic environment whose limitations actually encourage Ss to innovate rather than rehearse well-formed habits.

Pruitt and Kimmel (1977) refer to experimental games as a research tradition which has been both loved and hated. Eiser (1978) likens Rapoport's approach to that of a gold prospector panning for gold in the same place without success for most of his life claiming he prospects there for the scenery!

Wrightsman et al (1972) stated that they were unaware of any studies which compared the amount of co-operation elicited in a laboratory task with co-operation in real-life tasks. At that time only a few studies had looked at choices on matrix games and more life-like tasks even within a laboratory setting. Orwant and Orwant (1970) found that interpreted versions of P.D. matrices elicited significantly more co-operation than abstract versions. However, one of the difficulties with such studies is that pay-offs in the interpreted versions are unlikely to be isomorphic with the numberical pay-offs of the abstract versions and there is a large body of literature to show that subjects are extremely sensitive to changes within the reward structure. Sermat (1970) concluded that if evidence of the ecological validity of laboratory game behaviour can not be presented then "the theoretical contribution of game research may have to be stated in other terms than its relevance to inter-personal behaviour in real-life situations" (p. 108).

Eiser and Bhavnani (1974) introduced contextual variations in the Ss' perceptions of the context of the game, viz., no further information; a simulation of economic bargaining, a simulation of international negotiations; a study of friendly or unfriendly interactions. The frequency of C choices in both the 'economic' and no information conditions was similar to that usually reported in the literature. However, there were significantly higher levels of co-operative choices made in the 'inter-personal' and 'international' conditions. Eiser and Bhavnani concluded that extrapolations to real life situations "must depend for their validity at least partly on whether the subjects themselves interpret the game as symbolic of the situations in question" (p. 97).

Hamburger (1979) argues that the application of game analysis at least provides insight into social behaviour in real world events. However, he adds one or two notes of caution to looking at inter-active situations as games to see how they may be played. One common error is to treat a variable sum game as if it were a pure conflict game (this, he notes, often happens in real-life inter-actions). Another difficulty is working out who the players are in the inter-action - there may be many nations against others or within-nation manoevering involved. Players may make mistakes by over-looking alternatives or by confusing alternatives and their utilities may change during the inter-action although the theory assumes that utilities are constant. Hamburger also considers that the theory may have to be revised to include these psychological variables, even in laboratory dyadic inter-actions.

Colman (1979) has been able to look at the behaviour or subjects in abstract and life-like tasks which possessed strategically identical structures. Colman's hypothesis, that life-like simulations would elicit even fewer C choices than abstract versions, was confirmed using both Chicken and Prisoner's Dilemma games. Colman noted that the frequency of C choices was often determined by 'strategically irrelevant psychological factors' and suggested that the ecological validity of abstract games must depend in part on the psychological features of the real-life interactions to which the experiments are generalised.

The relevance of interpersonal studies to the study of inter-group relations also needs to be investigated; many researchers assume an interpersonal model is valid as a model for broader inter-group processes. However Billig (1976) points out that a strong element of reductionism is involved in the analysis of the social context of decision making, studies of interpersonal bargaining and simulated conflict. This reductionist tendency, argues Billig, has prevented both a wider social analysis and attempts to investigate the 'ideological roots of rationality'.

11.4 Current trends in social psychology

"Facts" in social psychology may be produced only by the methods designed to produce them, argues Armistead (1974a). In the 1970's it was becoming more accepted that "subjects" are constrained by the experimental situation with the experimenter determining the content of the session. Mixon (1974) has pointed out that an experiment is a 'situation of almost unrivalled compliance'. Armistead asks, "Can we accept that the social psychologist is not creating reality, rather than discovering it?" (p. 18) and, "In general, can you quantify the nature of a person's experience, his interpretation of his surroundings, the meaning of his statements, the nature of his emotions?" (p. 19). For example, important questions about the nature and meaning of conflict phenomena may be ignored when variations in conflict behaviour are studied. Armistead argues that social psychologists often construct a social reality out of what is available and there is a tendency to assume that the investigations are value free rather than acknowledging the effects that values have on research.

Ring (1967) has criticised the social psychologists' 'fun and games' attitude to experimentation and Pruitt and Kimmel (1977) point out that, "Researchers often seem to start with the experimental games and ask questions secondarily about what to study" (p. 369). They add that the sex variable is an example of this and it may seem that the present study is no exception. However, although the convenient research design is no doubt one of the reasons why experimental games have generated so much empirical research, replications have been rare. This may partly explain why the issue of "meaning" in experimental conflict was able to be shelved for so long.

The reductionist approach of the Behaviourist tradition tended to focus on regularities of behaviour and to make generalizations that could be quantified. Armistead (1974b) believes that a person's experience of a situation is an important topic in its own right in the study of social behaviour. We have seen from the present study that apparently similar behaviour has quite different meanings for different players in different circumstances.

Armistead argues for the use of "primary" data - people's own accounts of their experiences through more or less structured methods. Introspection, diaries, interviews and discussions may all play a part. Armstead (1974b) argues that what people say about their experiences is a public event i.e. it is repeatable and is amenable to assessment by observers in the same way as 'reaction times and ticks on questionnaires'. Although such accounts will be more ambiguous Armistead, and others, argue that the dimension of meaning can no longer be ignored.

However, safeguards are suggested in devising generalizations from experimental data. Toch (1972) and others explored the experience of violent men by 'stepping into their shoes' and attempting to reconstruct their (unique) perspectives. Interviewers were peers rather than social scientists and they were also involved in the analysis of the data as they were familiar with the context of the behaviour. In the final analysis, Toch's summaries were discussed together by a group of people in order to begin constructing a typology and to attempt to make valid and acceptable generalizations and explanations.

Most critics of contemporary social psychological research would agree with Heritage's (1974) assertion regarding the context of an individual's actions. He argues that researchers may not substitute the experimenter's view of the situation however irrational the subjects construction might appear to be. The history of an individual's social milieu and his personal development within this milieu is part of the explanation of social action, (Harré, 1974). In his article 'Blueprint for a new science' he introduces the concept of ethogeny - the study of human lives as they are really lived. Harré distinguishes three patterns of social action: 1) formal episodes where the individual is a free agent deliberately following known rules; 2) biological episodes where the individual is a spectator of physiological mechanisms; 3) enigmatic episodes. These refer to most human experiences in that we do not understand the origins of the episodes or how they are produced and a psychological component is necessary. Harré argues that scenarios replicating reality can be constructed which introduce the dimension of social meaning and which can aid the understanding of the nature of the episode in question.

In much the same vein, Mixon (1974) has observed that the naturalistic experiment is also limited in the study of social rules and roles. However, he argues that role-playing is a very flexible technique that can be used in any rule-context to understand social episodes. He considers that social psychologists have been too concerned with making general observations about groups of people based on average scores. Such data are invariably affected by extreme scores and overgeneralizations, which would not be tolerated if they were the observations of a "bigoted" layman, are likely to occur.

There is, of course, also the danger of 'throwing the baby out with the bath water' and perhaps what many are arguing for is simply a broader basis for the study of social inter-action. The area of mixed-motive conflict has been method-bound in the absence of a comprehensive and adequate theory. But it has not been alone in this. Mixon (1974) argues that laboratory methods favoured by social psychologists in general simply provide people with only one role, that of experimental subject within a single rule-context (the psychological experiment). We have seen from the present series of experiments that there are large individual differences in people's behaviour even in such a restricted social situation as the P.D. game. Such individual differences within a group are as psychologicallly meaningful as the group differences. A laboratory experiment is, after all, a special type of social situation where the experimenter is invested with a considerable amount of authority and where the person playing the role of experimental subject does what he believes is appropriate in that context.

11.5 Conclusions

Billig (1976) points out that even though experimental situations are contrived and controlled the subjects are not. The experimental situation is itself social and operates according to a rule structure. There has been a shift in emphasis away from collecting quantitative data in studies of experimental conflict to understanding why people behave as they do in such situations. Thus, there is now more interest in Prisoner's Dilemma as an experimental situation per se. However, it is important to remember that a conventional experiment is only of limited use and should not dictate the kinds of questions posed.

Deutsch (1980) points out that the reliance on experimental games in the study of conflict has led to the neglect of processes involved in the development of inter- and intra-group conflict. However, he notes that these limitations can be supplemented by other procedures and he includes field studies in this.

Pruitt and Kimmel (1977) believe, as does the author, that there is continuity between what occurs in the laboratory and in real life. They suggest that measures of goals and expectations should be routinely introduced into future P.D. designs which should attempt to investigate how people collect information about their partner's intentions and expectations. Certainly, studying how participant-observers (e.g. experimenters) influence subjects' interpretations of the P.D. situation is worthy of further investigation as so much of social behaviour depends on how people believe their actions will be interpreted and evaluated by others. Rosenthal (1966) has documented evidence of investigator bias, but the author is unaware of any research other than that of Skotko et al (1974) which has attempted to look at the influence of E in choices on P.D.

In any event, we can no longer assume that P.D. research undertaken in the U.S.A. is necessarily applicable here and there is a need for replications to be carried out as a matter of routine. A more rigorous use of control groups would obviously be necessary in any further study. The large variation between dyad scores in any treatment group (also noted by Gibbs, 1972) suggests that each inter-action is worth studying in its own right, perhaps under certain circumstances using the systematic observation and analysis techniques currently gaining favour in the Behavioural Sciences. Mixon (1974) argues strongly in favour of role-play for use in the systematic exploration of social episodes, for example. In any event, conclusions emanating from the laboratory require verification in a variety of naturalistic settings.

The laboratory situation is not necessarily invalid if the relevant variables and demand characteristics have been properly understood. This has clearly not been the case in the history of experimental games and, as Eiser (1980) comments: "Almost in spite of itself, gaming research has provided evidence of the ability and apparent need of individuals to invest novel situations with evaluative meaning, even where researchers have attempted to remove all such meaning from the experimental context. Gaming research was founded on the assumption that co-operative and competitive behaviour is under the control of outcome contingencies. Yet, paradoxically, it is the gaming literature itself that provides the most direct evidence of the inadequacy of any analysis based purely upon a definition of pay-off structure, without consideration of how that structure, and more general features of the experimental situation, are interpreted by the subjects themselves" (p. 197).

Alexander and Weil recommended as early as 1969 that attention should be focused both on the meanings that subjects attach to the situations they confront and to the dispositional characteristics implied by their actions within that context. They concluded, "If we pursue the questions of situational meaning and situated identity we may discover that people inside and outside the laboratory are responding primarily to the meanings they believe others will attach to their behaviours" (p. 141).

Pruitt and Kimmel (1977) argue that theory building rather than theory testing must now take priority in the field of strategic inter-action. For some years researchers have been demonstrating that subjects do not always behave 'rationally' in the game theoretic sense yet they have not revised the concept of rationality. The context in which behaviour occurs can no longer be ignored by the theory. The present study indicated that even in an artificial laboratory environment subjects define the situation for themselves within that context. The presence of observers also helps to define the psychological environment in which the strategic inter-action occurs. Information about subjective utilities and how players believe their behaviour will be evaluated is necessary in order to develop an adequate theory to explain the inter-action between the social structures and the cognitive processes of participants. What is required is a coherent theory capable of explaining interpersonal behaviour in a variety of settings of which the laboratory environment is just one.

BIBLIOGRAPHY

Adams J.S. (1965) Inequity in social exchange. In Berkowitz L. (ed.) Advances in Experimental Social Psychology (vol.2). New York : Academic Press

Alexander C.N. & Weil H.G. (1969) Players, Persons, and Purposes : Situational meaning and the Prisoner's Dilemma Game. Sociometry 32, 121-144

Allport G.W. & Allport F.H. (1939) A-S Reaction Study : a scale for measuring ascendance - submission in personality. New York : Houghton Mifflin

Argyle M. (1967) The Psychology of Interpersonal Behaviour. Harmondsworth : Penguin

Aries E. (1976) Interaction patterns and themes of male, female and mixed groups. Small Group Beh. 7 (1) 7 - 18

Armistead N. (1974a) Introduction. In Armistead N. (Ed.) Reconstructing Social Psychology. Harmondsworth : Penguin

Armistead N. (1974b) Experience in Everyday Life. In Armistead N. (Ed.) Reconstructing Social Psychology. Harmondsworth : Penguin

Baefsky A. & Berger B. (1974) Self sacrifice, co-operation and aggression in women of varying sex-role orientations. Pers. Soc. Psychol. Bulletin 296-298

Baxter G.W. (1969) The effects of information about and race of other player upon co-operation in a two-person game. Unpublished Ph.D. Dissertation, Peabody College

Becker G.M. & McClintock C.G. (1967) Value : Behavioural decision theory. In Farnsworth P.R. et al (Eds.) Annual Review of Psychology, Vol. 18. Palo Alto, Calif. : Annual Reviews

Bedell J. & Sistrunk F. (1973) Power, opportunity costs, and sex in a mixed-motive game. J. Pers. Soc. Psychol. 25, 2, 219 - 226

Billig M. (1976) Social Psychology and Intergroup Relations. London: Academic Press

Bixenstine V.E. & Blundell J.H. (1966) Control of choice exerted by structural factors in two-person non-zero-sum games. J. Confl.Res. 10, 478 - 487

Bixenstine V.E. & O'Reilly E.F. (1966) Money VS. electric shock as pay-off in a Prisoner's Dilemma Game. Psych. Record 16, 251 - 264

Bixenstine V.E., Potash H.M. & Wilson K.V. (1963) Effects of levels of co-operative choice by the other player on choices in a Prisoner's Dilemma Game : Part 1. J. Abn. Soc. Psychol. 66, 308 - 313

Bixenstine V.E. & Wilson K.V. (1963) Effects of levels of co-operative choice by the other players in a Prisoner's Dilemma game : Part 11. J. Abn. Soc. Psychol. 67, 139 - 147

Braver S.L. & Barnett B.(1974) Perception of opponent's motives and co-operation in a mixed-motive game. J. Confl. Res. 18 (4) 686 - 699

Braver S.L. & Rohrer V. (1975) The effects of information concerning the opponents' past game behaviour. J. Confl. Res. 19 (4) 652 - 662

Cardi M.W. (1972) The relationship between sex role stereotype and trust among women as measured by co-operation and competition. Unpublished Ph.D. Thesis, Ohio State Univ.

Christie, R., Gerken K. and Marlowe D. (1970) The penny-dollar caper. In R. Christie and F. Geis (Eds.) Studies in Machiavellianism. New York : Academic Press

Christie R. and Merton R.K. (1958) Procedures for the sociological study of the values climate of medical schools J. Med. Ed. 33, 125 - 153

Colman A.M. (1979) Abstract and Lifelike Experimental Games. Unpublished doctoral dissertation, Rhodes Univ.

Colman A.M. (1982) Game Theory and Experimental Games : a study of strategic inter-action. Oxford : Pergamon

Crumbaugh C.M. & Evans G.W. (1967) Presentation format, other-person strategies, and co-operative behaviour in the Prisoner's Dilemma. Psychol. Reports 20, 895 - 902

Deutsch M. (1958) Trust and suspicion. J. Confl. Res. 2, 265 - 279

Deutsch M. (1960) Trust, trustworthiness, and the F scale. J. Abn. Soc. Psychol. 61, 138 - 140

Deutsch M. (1980) Fifty years of conflict. In Festinger L. (Ed.) Retrospections on Social Psychology. N.Y. : O.U.P

Deutsch M. & Krauss R.M. (1962) Studies of interpersonal bargaining. J. Confl. Res. 6, 52 - 76

Durkin, J.E. (1972) Moment-of-truth encounters in Prisoner's Dilemma. In Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (Eds.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif : Brooks Cole

Eiser J.R. (1978) Co-operation and competition between individuals. In Tajfel H. & Fraser C. (Eds.) Introducing Social Psychology. Harmondsworth : Penguin

Eiser J.R. (1980) Cognitive Social Psychology. Maidenhead : McGraw-Hill

Eiser J.R. and Bhavnani K. (1974) The effect of situational meaning on the behaviour of subjects in the Prisoner's Dilemma Game. <u>Eur. J. Soc. Psych</u>. 4, 93 - 97

Eiser J.R. and Tajfel H. (1972) Acquisition of information in dyadic inter-action. <u>J. Pers. Soc. Psych</u>. 23, 340 - 345

Evans G. (1964) Effect of unilateral promise and value of rewards upon co-operation and trust. <u>J. Abn. Soc. Psychol</u>. 69, 587 - 590

Evans G. & Crumbaugh C. (1966) Effects of Prisoner's Dilemma format on co-operative behaviour. <u>J. Pers. Soc. Psychol</u>. 3, 486 - 488

Fraser C. (1978) Small groups : 1. Structure and leadership. In Tajfel H. & Fraser C. (Eds.) <u>Introducing Social Psychology</u>. Harmondsworth : Penguin

Fry C.L. (1965) Personality and acquisition factors in the development of co-ordination strategy. <u>J. Pers. Soc. Psychol</u>. 2, 403 - 407

Gallo P.S. (1963) The effects of different motivational orientations in a mixed-motive gsme. Unpublished doctoral dissertation, University of California

Gallo P.S. (1966) The effects of modes of presentation and large rewards on a prisoner's game. Technical Report No. 18, Dept. Psychology, University of California

Gallo P.S. & McClintock C.G. (1965) Co-operation and competition behaviour in mixed-motive games. J. Confl. Res. 9, 68 - 78

Gibbs J. (1972) Sex, superstition and co-operation in a mixed-motive game of chicken. Unpublished undergraduate project, Dept. Psychology, University of Leicester

Grant M.J. & Sermat V. (1969) Status and sex of others as determinants of behaviour in a mixed-motive game. J. Pers. Soc. Psychol. 12, 151 - 157

Halpin S.M. & Pilisuk M. (1970) Prediction and choice in the Prisoner's Dilemma. Beh. Science 15, 141 - 153

Hamburger H. (1979) Games as Models of Social Phenomena. San Francisco : W.H. Freeman & Co.

Harford T. & Solomon L. (1967) 'Reformed sinner' and 'lapsed saint' strategies in the Prisoner's Dilemma game. J. Confl. Res. 11, 104 - 109

Harford T. & Solomon L. (1969) Effects of a reformed sinner and a lapsed saint strategy upon trust formation in paranoid and non-paranoid schizophrenic patients. J. Abn. Psychol. 74, 498 - 504

Harré R. (1974) Blueprint for a New Science. In Armistead N.(Ed.) Reconstructing Social Psychology. Harmondsworth : Penguin

Harsanyi J.C. (1962) Bargaining in ignorance of the opponents' utility function. J. Confl. Res. 6, 29 - 38

Heritage J. (1974) Assessing people. In Armistead (ed.) Reconstructing Social Psychology. Harmondsworth : Penguin

Hoffman L.W. (1972) Early childhood experiences and women's achievement motives. J. Soc. Issues 28, 129 - 155

Hoffman L.R. & Maier N.R.F. (1961) Sex differences, sex composition and group problem solving. J. Abn. Soc. Psychol. 63, 453 - 456

Horner M.S. (1968) Sex differences in achievement motivation and performance in competitive and non-competitive situations. Unpublished doctoral dissertation, University of Michigan

Hottes J.H. & Kahn A. (1974) Sex differences in a mixed-motive situation. J. Pers. 42 (2) 260 - 275

Howar d N. (1971) Paradoxes of rationality : Theory of Metagames and Political Behaviour. Cambridge, Mass. : M.I.T. Press

Howard, N. (1974) "General" metagames : An extension of the meta-game concept. In Rapoport A (ed.) Game Theory as a theory of conflict resolution Dordrecht : D. Reidel

Howard N. (1976) Prisoner's Dilemma : The solution by general metagames. Beh. Science 21, 524 - 531

Harsanyi J.C. (1962) Bargaining in ignorance of the opponents' utility function. J. Confl. Res. 6, 29 - 38

Heritage J. (1974) Assessing people. In Armistead N. (Ed.) Reconstructing Social Psychology. Harmondsworth : Penguin

Hoffman L.W. (1972) Early childhood experiences and women's achievement motives. J. Soc. Issues 28, 129 - 155

Hoffman L.R. & Maier N.R.F. (1961) Sex differences, sex composition and group problem solving. J. Abn. Soc. Psychol. 63, 453 - 456

Horner M.S. (1968) Sex differences in achievement motivation and performance in competitive and non-competitive situations. Unpublished doctoral dissertation, University of Michigan

Hottes, J.H. & Kahn A. (1974) Sex differences in a mixed-motive situation. J. Pers. 42 (2) 260 - 275

Howard N. (1971) Paradoxes of rationality : Theory of Metagames and Political Behaviour. Cambridge, Mass. : M.I.T. Press

Howard N. (1974) "General" metagames : An extension of the metagame concept. In Rapoport A (Ed.) Game Theory as a theory of conflict resolution Dordrecht : D. Reidel

Howard N. (1976) Prisoner's Dilemma : The solution by general metagames. Beh. Science 21, 524 - 531

Ingram B.L. & Berger S.E. (1977) Sex role orientation, defensiveness and competitiveness in women. J. Confl. Res. 21 (3) 501 - 518

Kahn A., Hottes J.H. & Davis W. (1971) Co-operation and optimal responding in the Prisoner's Dilemma game : The effects of sex and physical attractiveness. J. Pers. Soc. Psychol. 17, 267 - 279

Kanouse D.E. & Wiest W.M. (1967) Some factors affecting choice in the Prisoner's Dilemma. J. Confl. Res. 11, 206 - 213

Kelley H.H. & Stahelski A.J. (1970) Social inter-action basis of co-operators' and competitors' beliefs about others. J. Pers. Soc. Psychol. 16, 66 - 91

Knapp W.M. & Podell J.E. (1968) Mental patients, prisoners and students with simulated partners in a mixed-motive game. J. Confl. Res. 12, 235 - 241

Komorita S.S. & Mechling J. (1967) Betrayal and reconciliation in a two-person game. J. Pers. Soc. Psychol. 6, 349 - 353

Kremer J.M.D. (1980) Pre-emptive game behaviour and the emergence of leadership. Unpublished doctoral Thesis, Loughborough University of Technology

Kuhlman D.M. & Marshello A.F.J. (1975) Individual differences in game motivation as moderators of pre-programmed strategy effects in Prisoner's Dilemma. J. Pers. Soc. Psychol. 32 (5), 922 - 931

Lewin K. (1935) Psycho-sociological problems of a minority group. Character & Personality 3, 175 - 187

Lieberman B. (1960) Human behaviour in a strictly determined 3 x 3 matrix game. Beh. Sci. 5 (4), 317 - 322

Luce R.D. & Raiffa H. (1957) Games and Decisions. New York : Wiley

Lutzker D.R. (1960) Internationalism as a predictor of co-operative game behaviour. J. Confl. Res. 4, 426 - 430

Lutzker D.R. (1961) Sex role, co-operation and competition in a two-person, non-zero-sum game. J. Confl. Res. 5, 366 - 368

Maccoby E. & Jacklin C. (1975) The Psychology of Sex Differences. London : Oxford Univ. Press

Mack D. (1975) Skirting the competition. Psychology Today 8, 39 - 41

Mack D. (1976) Status and behaviour in the reiterated Prisoner's Dilemma game. Psychol. Record 26, 529 - 532

Mack D. & Knight G.P. (1972) Information on the nature of the game as a determinant of behaviour in the Prisoner's Dilemma. Psychon. Sci. 27 (2) 99 - 100

Mack D. Williams J.G. & Kremer J.M.D. (1979) Perception of a simulated other player and behavior in the reiterated Prisoner's Dilemma game. Psych. Record 29, 43 - 48

Marlowe D, Gergen K.J. & Doob A.N. (1966) Opponent's personality, expectation of social inter-action, and interpersonal bargaining. J. Pers. Soc. Psychol. 3, 206 - 213

Marwell G., Schmitt D.R. & Shotola R. (1971) Co-operation and inter-personal risk. J. Pers. Soc. Psych. 18, 9 - 32

McClintock C.G., Gallo P.S. & Harrison A (1965) Some effects of variation in other strategy upon game behaviour. J. Pers. Soc. Psychol. 1, 319 - 325

McClintock C.G., Harrison A., Strand S. & Gallo P.S. (1963) Internationalism - isolationism, strategy of the other player and two-person game behaviour. J. Abn. Soc. Psychol. 67, 631 - 635

Messé L.A., Dawson J.E. & Lane I.M. (1973) Equity as a mediator of the effect of reward level on behavior in the Prisoner's Dilemma Game. J. Pers. Soc. Psychol. 26 (1), 60 - 65

Messick D.M. & McClintock C.G. (1968) Motivational bases of choice in experimental games. J. Exp. Soc. Psychol. 4, 1 - 25

Miller D.T. & Holmes J.G. (1975) The role of siuational restrictiveness on self-fulfilling prophecies : A theoretical and empirical extension of Kelley and Stahelski's triangle hypothesis. J. Pers. Soc. Psychol. 31, 661 - 673

Minas J.S., Scodel A., Marlowe D. & Rawson H. (1960) Some descriptive aspects of two-person, non-zero sum games J. Confl. Res. 4, 193 - 197

Mintz A. (1951) Nonadaptive group behavior. J. Abn. Soc. Psychol. 46, 150 - 159

Mischel W.(1968) Personality and Assessment. New York : Wiley

Mixon D. (1974) If you won't deceive, what can you do? In Armistead N. (Ed.) Reconstructing Social Psychology. Harmondsworth : Penguin

Moore M.F. & Mack D. (1972) Dominance - ascendance and behaviour in the re-iterated Prisoner's Dilemma game. Acta Psychologica 36, 480 - 491

Nemeth C. (1970) Bargaining and reciprocity. Psychol. Bull. 74, 297 - 308

O'Connor J., Baker N. & Wrightsman L.S. (1972) The nature of rationality in mixed-motive games. In Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (Eds.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Orwant C.J. & Orwant J.E. (1970) A comparison of interpreted and abstract versions of mixed-motive games. J. Confl. Res. 14, 91 - 97

Oskamp S. (1971) Effects of programmed strategies on co-operation in the Prisoner's Dilemma and other mixed-motive games. J. Confl. Res. 15 (2), 225 - 259

Oskamp S. & Perlman D. (1965) Factors affecting co-operation in a Prisoner's Dilemma game. J. Confl. Res. 9, 359 - 374

Pilisuk M., Brandes B. & Van den Hove D. (1976) Deceptive sounds : Illicit communication in the laboratory. Beh. Science 21, 515 - 523

Pilisuk M., Potter P., Rapoport A. & Winter J.A. (1965) War hawks and peace doves : Alternative resolutions of experimental conflicts. J. Confl. Res. 9, 491 - 508

Pilisuk M. Skolnick P. & Overstreet E. (1968) Predicting co-operation from the two sexes in a conflict simulation. J. Pers. Soc. Psychol. 10, 35 - 43

Platt J. (1973) Social traps. Am. Psychologist 28, 641 - 651

Pruitt D.G. (1967) Reward structure and co-operation : The decomposed Prisoner's Dilemma game. J. Pers. Soc. Psychol. 7, 21 - 27

Pruitt D.G. & Kimmel M.J. (1977) Twenty years of experimental gaming : Critique, synthesis, and suggestions for the future. Ann. Rev. Psychol. 28, 363 - 392

Radlow R., Weidner M.F. & Hurst P.M. (1968) Effect of incentive magnitude and motivational orientation upon choice behavior in a two-person, non-zero-sum game. J. Soc. Psychol. 74, 199 - 208

Rapoport A. (1963) Formal games as probing tools for investigating behavior motivated by trust and suspicion. J. Confl. Res. 7 (3), 570 - 579

Rapoport A. (1964) Strategy and Conscience. New York : Harper & Row

Rapoport A. (1966) Two Person Game Theory : The essential ideas. Ann Arbor : Univ. Michigan Press

Rapoport A (1967a) Exploiter, leader, hero and martyr. The four archetypes of the two by two game. Beh. Sci. 12, 81 - 84

Rapoport A (1967b) Escape from paradox. Sci Am. 217 (1), 50 - 56

Rapoport A. (1968) Prospects for experimental games. J. Confl. Res. 4, 461 - 470

Rapoport A. (1970) Editorial comments. J. Confl. Res. 14, 65 - 67

Rapoport A. & Chammah A. (1965a) Prisoner's Dilemma. Ann Arbor : Univ. Michigan Press

Rapoport A. & Chammah A. (1965b) Sex differences in factors contributing to the level of co-operation in the Prisoner's Dilemma Game. J. Pers. Soc. Psychol. 2, 831 - 838

Rapoport A. & Chammah A. (1969) The Game of chicken. In Buchler I.R. & Nutini H.G. (Eds.) Game Theory in the Behavioral Sciences. Pittsburgh : Univ. Pittsburgh Press

Rapoport A. & Dale P.S. (1966) The 'end' and 'start' effects in iterated Prisoner's Dilemma. J. Confl. Res. 110, 363 - 366

Rapoport A. & Guyer M.A. (1966) A taxonomy of 2 x 2 games. Gen. systems 11, 203 - 214

Rapoport A. & Orwant C. (1962) Experimental games : A review. Beh. Science 7, 1 - 37

Reychler L. (1979) The effectiveness of a pacifist strategy in conflict resolution : an experimental study. J. Confl. Res. 23, 228 - 260

Ring K. (1967) Experimental social psychology : Some sober questions about some frivolous values. J. Exp. Soc. Psychol. 3, 113 - 23

Rosenthal R. (1966) Experimenter Effects in Behavioral Research. New York : Appleton - Century - Crofts

Ruble D.N. & Higgins E.T. (1976) Effects of group sex composition on self-presentation and sex-typing. J. Soc. Issues 32 (3), 125 - 132

Schelling T.C. (1960) The Strategy of Conflict. Cambridge : Harvard Univ. Press

Scodel A., Minas J.S., Ratoosh P & Lipetz M. (1959) Some descriptive aspects of two-person, non-zero-sum games. J. Confl. Res. 3, 114 - 119

Sermat V. (1968) Dominance - submissiveness and competition in a mixed-motive game. Brit. J. Soc. Clin. Psychol. 7, 35 - 44

Sermat V. (1970) Is game behavior related to behavior in other interpersonal situations? J. Pers. Soc. Psychol. 16, 92 - 109

Shaw J.I. & Thorslund C. (1975) Varying patterns of reward and co-operation : The effects in a Prisoner's Dilemma game. J. Confl. Res. 19 (1), 108 - 122

Shubik, M. (Ed.) (1964) Game Theory and Related Approaches to Social Behavior. New York : Wiley

Skotko V., Langmeyer D. & Lundgren D. (1974) Sex differences as artifact in the Prisoner's Dilemma game. J. Confl. Res. 18 (4), 707 - 713

Stahelski A.J. & Kelley H.H. (1969) The effects of incentives on co-operators and competitors in a Prisoner's Dilemma game. Paper presented at the Western Psychological Association convention, Vancouver, B.C.

Swingle P.G. (1968) Effects of prior exposure to co-operative or competitive treatment upon subjects' responding in Prisoner's Dilemma. J. Pers. Soc. Psychol. 10, 44 - 52

Tedeschi J.T., Bonoma T. & Lindskold S. (1970) Threatener's reactions to prior announcement of behavioural compliance or defiance. Beh. Science 15, 171 - 179

Tedeschi J.T., Bonoma T. & Novinson N. (1970) Behaviour of a threatener : Retaliation vs. fixed opportunity costs. J. Confl. Res. 14, 70 - 76

Terhune K.W. (1968) Motives, siuation, and interpersonal conflict within the Prisoner's Dilemma. J. Pers. Soc. Psychol. 8, 1 - 24

Terhune K.W. (1970) The effects of personality in co-operation and conflict. In Swingle P. (Ed.) The structure of conflict. New York : Academic Press

Toch H. (1972) Violent Men. Penguin

Uejio E.K. & Wrightsman L.S. (1967) Ethnic group differences in the relationship of trusting attitudes to co-operative behavior. Psych. Reports 20, 563 - 571

Vinacke W.E. (1969) Variables in experimental games : Toward a field theory. Psychol. Bull. 71, 293 - 317

Von Neumann J. & Morgenstern O. (1944) Theory of Games and Economic Behavior (2nd ed.) Princeton : Princeton Univ. Press

Wallace D. & Rothaus P. (1969) Communication, group loyalty, and trust in the P.D. game. J. Confl. Res. 13, 370 - 380

Walster E., Berscheid E. & Walster G.W. (1973) New directions in equity research. J. Pers. Soc. Psychol. 25, 151 - 176

Ward L.M. (1972) Separating the contributions of personality and attitudinal determinants of choice behaviour in a two-person game. In Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (Eds.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wiberg H. (1972) Rational and non-rational models of man. In Israel J. & Tajfel H. (Eds.) The Context of Social Psychology. London : Academic Press

Wichman H. (1972) Effects of isolation and communication on co-operation in a two-erson game. In Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (Eds.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wilson W. & Kayatani M. (1968) Intergroup attitudes and strategies in games between opponents of the same or of a different race. J. Pers. Soc. Psychol. 9, 24 - 30

Wrightsman L.S. (1966) Personality and attitudinal correlates of trusting and trustworthy behaviours in a two-person game. J. Pers. Soc. Psychol. 4, 328 - 332

Wrightsman L.S., Bruininks R.H., Lucker W. & Anderson W.H. (1967) Effect of subject's training and college class and other's strategy upon co-operative behavior in a Prisoner's Dilemma game. Un-published manuscript, George Peabody College

Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (1972) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wrightsman L.S. et al (1972) Effects of other person's race and strategy upon co-operative behavior in a Prisoner's Dilemma game. In Wrightsman et al (Ed.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wichman H. (1972) Effects of isolation and communication on co-operation in a two-person game. In Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (Eds.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wilson W. & Kayatani M. (1968) Intergroup attitudes and strategies in games between opponents of the same or of a different race. J. Pers. Soc. Psychol. 9, 24 - 30

Wrightsman L.S. (1966) Personality and attitudinal correlates of trusting and trustworthy behaviors in a two-person game. J. Pers. Soc. Psychol. 4, 328 - 332

Wrightsman L.S., Bruininks R.H., Lucker W. & Anderson W.H. (1967) Effect of subject's training and college class and other's strategy upon co-operative behavior in a Prisoner's Dilemma game. Un-published manuscript, George Peabody College

Wrightsman L.S. Jr., O'Connor J. & Baker N.J. (1972) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wrightsman L.S. et al (1972) Effects of other person's race and strategy upon co-operative behavior in a Prisoner's Dilemma game. In Wrightsman et al (Ed.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Wrightsman L.S., Lucker W.G., Bruininks R.H. & O'Connor J. (1972) Effects of extensiveness of instructions upon co-operation in a Prisoner's Dilemma Game. In Wrightsman et al (Eds.) Co-operation and Competition : Readings on Mixed-Motive Games. Belmont, Calif. : Brooks Cole

Zelditch M. (1955) Role differentiation in the nuclear family : A comparative study. In Parsons T. & Bales R.F. (Eds.) Family, Socialization and Interaction Process. New York : Free Press

Appendix 1

RECORD SHEET

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Appendix 11

Post-Experimental Questionnaire

Name ....

1. How much did your partner's choices affect the choices you made?

\+ ___ ___ ___ ___ ___ ___ −

2. How much do you think you would like your partner personally?

− ___ ___ ___ ___ ___ ___ +

3. How much did the communication between the two of you influence the choices you made?

\+ ___ ___ ___ ___ ___ ___ −

4. How much influence did you have over the points your partner made?

− ___ ___ ___ ___ ___ ___ +

5. How much or how often did you try to give your partner what he gave you?

\+ ___ ___ ___ ___ ___ ___ −

6. Did you use a strategy in this experiment? If so, what was it?

7. What expectations did you have of your partner's strategy?

8. Did your partner use a strategy in this experiment? If so, what was it? Did it confirm or deny your expectations?

9. How did you determine your choices?

10. How concerned were you with your partner's score? Did you have a preference for the outcome of the game?

Appendix III

Co-operation : Raw Scores (Expt. 1)

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	20	24	11	8	5	5
		10	7	5	14	45	25
		18	7	0	0	0	0
		27	8	16	10	17	11
		21	13	7	4	3	2
	1	32	32	39	27	33	32
		10	1	2	1	0	0
		15	14	6	11	8	5
		28	22	26	16	26	18
		39	38	41	26	7	7
	31	1	54	60	60	60	60
		15	8	9	7	3	18
		14	13	5	8	8	6
		15	17	15	17	12	13
		7	0	0	0	0	0
	T	19	16	28	42	26	25
		24	6	5	4	4	4
		37	8	4	48	60	60
		24	60	60	60	60	60
		60	60	60	60	60	60

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
FF	0	18	16	4	9	12	8
		26	13	19	9	10	11
		23	24	25	17	15	15
		24	24	27	20	16	16
		3	0	0	0	0	0
	1	19	12	13	21	24	18
		17	20	19	22	16	22
		20	22	29	20	11	12
		12	37	24	21	11	20
		26	21	14	14	17	6
	31	19	20	9	3	3	0
		20	8	6	2	6	12
		18	1	0	0	0	18
		18	1	0	0	0	0
		27	23	17	10	22	13
	T	11	4	13	7	6	7
		28	19	21	21	21	18
		24	17	21	18	15	12
		25	23	11	13	10	39
		27	24	22	59	60	60

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MF	0	19	1	0	0	0	0
		20	17	7	15	9	9
		13	26	5	23	9	7
		22	9	6	5	4	3
		1	0	0	0	0	0
	1	4	0	0	6	53	40
		21	13	17	10	12	4
		25	17	11	6	1	0
		16	23	17	20	11	25
		9	16	1	5	22	18
	31	12	1	0	2	3	0
		26	9	4	0	6	17
		34	38	25	23	10	27
		16	3	25	10	3	2
		16	57	57	43	44	52
	T	54	42	51	60	60	60
		28	25	32	18	12	23
		4	0	0	0	0	0
		56	56	56	60	60	60
		41	60	60	60	60	60

Appendix IV

Computations for the Tukey Test

a. Expt. 1 : The effects of communication opportunity ($\alpha = 0.05$)

Communication treatment	Means
T	32.42
1	17.17
31	14.96
0	10.86

$$HSD = q_r \left[\alpha , n_r, df\right] \sqrt{\frac{MS\ error}{n}}$$

$$\simeq 3.63 \sqrt{\frac{85.80}{15}}$$

$$\simeq 8.68$$

b. Expt. 1 : The effects of sex of dyad on 'imitation' ($\alpha = 0.05$)

Sex of dyad	means
MF	0.81
MM	0.77
FF	0.71

$$HSD \simeq 3.31 \sqrt{\frac{0.0109}{20}}$$

$$\simeq 0.08$$

c. Expt. 2. : Communication over trial blocks (α = 0.05)

Communication	Trial Blocks					
	1	2	3	4	5	6
0	22.1	19.5	20.5	24.4	25.9	29.1
31	23	39.4	38.4	43.5	43	43.5

$$\text{HSD} \simeq 4.71 \sqrt{\frac{92.86}{10}}$$

$$\simeq 14.35$$

d. Expt. 2. : Incentive over trial blocks (α = 0.05)

Financial Incentive	Trial Blocks					
	1	2	3	4	5	6
0	17.20	14.05	11.75	9.9	11.85	11.65
£1	22.55	29.45	29.45	33.95	34.45	36.35

$$\text{HSD} \simeq 4.62 \sqrt{\frac{80.00}{20}}$$

$$\simeq 9.24$$

e. Pooled data : Expts. 2 - 4 The effects of the experimenter on per cent B choices (α=0.05)

Expt.	Means
2	66.5
3	62.7
4a	53.5
4b	51.8

$$\text{HSD} \simeq 3.85 \sqrt{\frac{247.5}{20}}$$

$$\simeq 13.54$$

f. Pooled data : Expts. 2 and 5

Treatment	mean
USA x MM	50.02
UK x MM	35.13
UK x FF	26.92
USA x FF	22.92

HSD $\simeq$ 3.63 $\sqrt{\dfrac{87.38}{8.89}}$ (using harmonic mean $\tilde{n}$)

$\simeq$ 11.38

g. Pooled data : Expts. 2 and 6

Treatment	mean
MM x 31 x E2	49.57
FF x 31 x E6	37.88
MM x 31 x E6	28.29
FF x 31 x E2	27.37
FF x 0 x E2	26.47
FF x 0 x E6	23.57
MM x 0 x E6	23.17
MM x 0 x E2	20.70

(using harmonic mean $\tilde{n}$)

HSD $\simeq$ 4.36 $\sqrt{\dfrac{104.44}{4.71}}$

$\simeq$ 20.53

Appendix V

Communication Data

a. Expt. 1

MM pairs, treatment 1

Four of the five dyads made use of the opportunity to communicate, although only briefly. None mentioned strategy although E's impression was that the verbal interaction, when it occured, was more friendly than for the female dyads in the same condition.

MM pairs, treatment 31

Again four of the five dyads made use of this opportunity to verbally communicate, and all discussed possible strategies (lending support to the notion that some subjects may have a better understanding of the task at this stage). Only one pair thought that a 'play A' strategy was best for both whilst another pair thought that a 'play B' strategy was best. No dyads suggested imitation as a strategy. Total co-operation was highest in the pair who agreed to press A (295/360) and almost non-existent (7/360) in the pair who did not make use of the opportunity to talk, supporting the 'common sense' view that making use of communication opportunities facilitates co-operative behaviour.

MM pairs, treatment T

All five dyads made use of the opportunity to communicate, with four pairs directly mentioning a 'play A' joint strategy, although several pairs lapsed into long silences. Two pairs agreed to press A almost immediately, having the highest co-operation scores (360/360) and (324/360), another pair agreed to press A half-way through the game (217/360) and the fourth pair agreed to press A but both defected on the next trial and did not resume negotiations (156/360). The fifth pair spoke briefly, lapsing into silence without mentioning any strategy, and had the lowest amount of co-operation in any dyad in this condition (47/360). Again, this supports the notion that it is how the opportunities to communicate are used that is important.

<u>FF pairs, treatment 1</u>

Only two of the five dyads engaged in verbal communication and neither of these mentioned strategy directly, although one subject suggested the task was a game which could be worked out mathematically. In both cases the conversations were brief.

<u>FF pairs, treatment 31</u>

Only one pair spoke and then briefly, without mentioning possible strategies. Three of the other four pairs laughed with embarrassment and said nothing. These pairs of females did not utilise the communication opportunity either in a social sense or in the context of the task.

<u>FF pairs, treatment T</u>

Two of the five dyads spoke and then only briefly. Only one of these mentioned strategy at all, and although they agreed to press A they did not keep to the agreement or resume the discussion although they had opportunities to do so. Again the opportunities to communicate were not utilised effectively, even in a social sense.

MF pairs, treatment 1

Four of the five pairs spoke, with the males in all cases initiating the conversation. However, none mentioned strategy (either imitative or co-operative). Total co-operative choices tended to be higher where a 'friendly chat' occurred throughout the three minutes (112/360 and 103/360) and lowest (60/360) when silence occurred.

MF pairs, treatment 31

All of the dyads spoke in this condition with females initiating the conversation in four of the cases. Four of the pairs discussed strategy, one pair agreed to press A, another pair agreed to alternate (imitate?) between A and B and two pairs agreed to press B. Not surprisingly, perhaps, co-operation was highest in the pair who agreed to press A. Of the four females who discussed strategy, one said the task depended on competition (and then agreed to press A), two suggested pressing B in case the men got bored with pressing A (?) and one could not decide on the 'best' choice. Such findings lend tentative support to the idea that females are not as perceptive to the strategic elements of the situation. Of the four males, however, one suggested pressing A, two acquiesced to the female suggestion to press B (although they felt that A was the best 'solution') and one could not decide. This is consistent with the notion that men are 'pulled down' in mixed-sex dyads.

MF pairs, treatment T

However, rather surprisingly perhaps, only three of the five pairs who were unrestricted in the amount of communication allowed actually took advantage of this at any point in the session. Of these, two females and one male initiated the conversations, but males in all cases suggested the 'play A' strategy which was agreed to by the females, although we cannot be certain that females did not think of this option for themselves but waited for the male to 'take the lead'.

b. Expt. 2

MM pairs

Four of the five pairs in treatment 31 made use of the opportunity to talk to their partners. All of these four pairs mentioned pressing A as possibly being the best joint strategy, although one pair did not reach the agreement before play was resumed. Two of the pairs wondered whether it was allowed to discuss strategies or if it was "against the rules" - they were not, of course, given any feedback by E. Both members of the pair that remained silent agreed afterwards that they thought they could not talk about the experiment and there was therefore no point in talking. The total co-operation (195/360) was substantially lower than in the other subject pairings.

FF pairs

As with the male dyads four of the five pairs allowed to talk after trial 31 actually did so. However, they did not use the time in the same way as the MM pairs. Only two of the dyads mentioned pressing A and, of these, one pair queried whether they could talk about the task and could not reach an agreement and the other pair decided it was more fun not to both press A but instead to "try not to press B together"! Such a decision might well rest on the attractiveness of the financial alternative as an alternative to having fun with the game. However, Hottes and Kahn (1974) found that even a personally relevant 'carrot' (a course credit) did not influence women to be co-operative. The three remaining pairs, including the pair who remained silent, reported that they thought they could not talk about the task.

c. Expt. 4

a) Male E

MM pairs

All five pairs made use of the opportunity to communicate. Three of the pairs mentioned pressing A and, of these, two pairs made an agreement to both press A (total co-operation = 343 & 321) whilst one pair did not resolve the dilemma (total co-operation = 249). A fourth pair talked about tutorials and said the task was "not exactly taxing". Discussion afterwards revealed that they had held an implicit assumption before the 31st trial that mutual AA was the best choice for both (total co-operation = 358). Total co-operation was lowest (130) in the fifth pair who had no such assumptions and used the three minutes to talk about lectures.

FF pairs

All five pairs made use of the opportunity to communicate, although two pairs said very little. Of these, one pair simply said, "Hello" and another pair agreed that it was "tricky when you can't see who you're talking to". Total co-operation for these pairs was 103 and 19 respectively. A third pair talked about the accumulating scores with one saying she did not see the point of it and the other suggesting that it was something to do with risk. This was followed by silence; total co-operation was 136 in this pair. The remaining two pairs talked about pressing A, with one pair making a firm agreement to do so (total co-oerpation = 321). The other pair made no such joint decision, but agreed that the task was not competitive (total co-operation = 331).

b) Female E

MM pairs

Four of the five pairs spoke, all of whom mentioned pressing A as a possible strategy. Three of these pairs made an agreement to press A, having total co-operation scores of 316, 351 and 312. The fourth pair did not made an agreement as one S said he did not trust the other to press A (total co-operation = 221). The fifth pair who sat in silence had a slightly higher level of co-operation (267) than the pair who stated that they did not trust each other. This suggests that it is necessary to specify the content of any communication that S's engage in rather than assume that it will be used to their advantage.

FF pairs

Only three of the five pairs in treatment 31 actually spoke to each other, all of whom mentioned pressing A. Two of these pairs made an agreement to press A (total co-operation = 329 and 323) although the highest number of co-operative choices (358) was made by a pair who did not talk at all as they had made an implicit agreement to press A before the 31st trial. Again the quality of the communication seems to be important as in the case of the third pair who talked to each other one S reported feeling "antagonistic" towards her partner. The other subject had suggested pressing A, but S was not convinced. The other subject said it should be obvious and S did not like "her attitude". However, this pair co-operated more than the fifth pair who did not make use of the communication opportunity and had no implicit assumptions about the nature of the task.

Appendix VI

Imitation Scores : Proportions (Expt. 1)

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	0.517	0.633	0.800	0.867	0.900	0.933
		0.517	0.800	0.550	0.717	0.600	0.667
		0.552	0.767	1.000	1.000	1.000	1.000
		0.741	0.767	0.833	0.867	0.667	0.700
		0.534	0.667	0.667	0.767	0.900	0.833
	1	0.552	0.600	0.517	0.483	0.617	0.583
		0.655	0.967	0.950	0.950	1.000	1.000
		0.621	0.633	0.800	0.767	0.767	0.867
		0.534	0.483	0.567	0.667	0.583	0.617
		0.672	0.467	0.633	0.550	0.750	0.817
	31	0.638	0.767	0.750	0.767	0.900	0.783
		0.983	0.967	1.000	1.000	1.000	1.000
		0.776	1.000	1.000	1.000	1.000	1.000
		0.655	0.683	0.833	0.733	0.767	0.800
		0.569	0.567	0.567	0.500	0.633	0.677
	T	0.603	1.000	1.000	1.000	1.000	1.000
		1.000	1.000	1.000	1.000	1.000	1.000
		0.724	0.750	0.850	0.967	1.000	1.000
		0.431	0.800	0.867	0.867	0.900	0.867
		0.638	0.667	0.617	0.650	0.400	0.350

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
FF	0	0.569	0.717	0.633	0.583	0.717	0.733
		0.552	0.717	0.533	0.667	0.717	0.700
		0.534	0.650	0.517	0.717	0.717	0.617
		0.638	0.750	0.867	0.700	0.717	0.750
		0.914	1.000	1.000	1.000	1.000	1.000
	1	0.707	0.583	0.633	0.583	0.667	0.667
		0.552	0.700	0.567	0.550	0.700	0.650
		0.569	0.550	0.633	0.433	0.633	0.583
		0.569	0.667	0.617	0.600	0.600	0.717
		0.517	0.567	0.683	0.617	0.500	0.800
	31	0.569	0.533	0.767	0.900	0.900	1.000
		0.603	0.783	0.883	0.917	0.867	0.783
		0.741	0.967	1.000	1.000	1.000	0.417
		0.707	0.967	1.000	1.000	1.000	1.000
		0.534	0.600	0.683	0.800	0.617	0.717
	T	0.724	0.850	0.783	0.750	0.833	0.833
		0.414	0.550	0.533	0.533	0.517	0.583
		0.483	0.500	0.633	0.617	0.633	0.617
		0.655	0.800	0.833	0.850	0.883	0.783
		0.431	0.383	0.617	0.967	1.000	1.000

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MF	0	0.638	0.967	1.000	1.000	1.000	1.000
		0.552	0.567	0.750	0.500	0.700	0.767
		0.690	0.500	0.833	0.700	0.833	0.800
		0.621	0.733	0.767	0.867	0.867	0.900
		0.966	1.000	1.000	1.000	1.000	1.000
	1	0.500	0.667	0.700	0.683	0.717	0.733
		0.707	0.733	0.967	0.967	0.667	0.867
		0.862	1.000	1.000	0.867	0.783	0.550
		0.603	0.583	0.667	0.817	0.967	1.000
		0.690	0.817	0.700	0.400	0.783	0.917
	31	0.534	0.767	0.867	1.000	0.817	0.817
		0.655	0.967	1.000	0.933	0.967	1.000
		0.534	0.500	0.617	0.617	0.683	0.383
		0.603	0.883	0.817	0.717	0.917	0.950
		0.517	0.917	0.900	0.567	0.617	0.767
	T	0.897	1.000	1.000	1.000	1.000	1.000
		0.897	0.933	0.933	1.000	1.000	1.000
		0.879	1.000	1.000	1.000	1.000	1.000
		0.931	0.750	0.817	1.000	1.000	1.000
		0.552	0.483	0.617	0.667	0.767	0.483

Appendix V11

Imitation and Co-operation : Raw Scores

a. Expt. 1

Block	MF Coop.	MF Imit.	MM Coop.	MM Imit.	FF Coop.	FF Imit
1	19	0.638	20	0.534	18	0.638
	20	0.552	10	0.741	26	0.534
	13	0.690	18	0.552	23	0.552
	22	0.621	27	0.517	24	0.569
	1	0.966	21	0.517	3	0.914
	4	0.862	32	0.552	19	0.569
	21	0.690	10	0.655	17	0.569
	25	0.603	15	0.621	20	0.552
	16	0.500	28	0.534	12	0.707
	9	0.707	39	0.672	26	0.517
	12	0.655	1	0.983	19	0.569
	26	0.534	15	0.638	20	0.603
	34	0.534	14	0.655	18	0.741
	16	0.603	15	0.569	18	0.707
	16	0.517	7	0.776	27	0.534
	54	0.931	19	0.638	11	0.724
	28	0.552	24	0.431	28	0.414
	4	0.879	37	0.724	24	0.483
	56	0.897	24	0.603	25	0.655
	41	0.897	60	1.000	27	0.431
2	1	0.967	24	0.667	16	0.750
	17	0.567	7	0.767	13	0.650
	26	0.500	7	0.767	24	0.717
	9	0.733	8	0.800	24	0.717
	0	1.000	13	0.633	0	1.000
	0	1.000	32	0.600	12	0.667
	13	0.817	1	0.967	20	0.550
	17	0.583	14	0.633	22	0.700
	23	0.667	22	0.483	37	0.583
	16	0.733	38	0.467	31	0.567
	1	0.967	54	0.967	20	0.533
	9	0.767	8	0.767	8	0.783
	38	0.500	13	0.683	1	0.967
	3	0.883	17	0.567	1	0.967
	57	0.917	0	1.000	23	0.600
	42	0.750	16	0.667	4	0.850
	25	0.483	6	0.800	19	0.550
	0	1.000	8	0.750	17	0.500
	56	0.933	60	1.000	23	0.800
	60	1.000	60	1.000	24	0.383

Block	Pairing					
	MF		M		FF	
	Coop.	Imit.	Coop.	Imit.	Coop.	Imit.
3	0	1.000	11	0.667	4	0.867
	7	0.750	5	0.833	19	0.517
	5	0.833	0	1.000	25	0.533
	6	0.767	16	0.550	27	0.633
	0	1.000	7	0.800	0	1.000
	0	1.000	39	0.517	13	0.617
	17	0.700	2	0.950	19	0.633
	11	0.667	6	0.800	29	0.567
	17	0.700	26	0.567	24	0.633
	1	0.967	41	0.633	14	0.683
	0	1.000	60	1.000	9	0.767
	4	0.867	9	0.750	6	0.883
	25	0.617	5	0.833	0	1.000
	25	0.817	15	0.567	0	1.000
	57	0.900	0	1.000	17	0.683
	51	0.817	28	0.617	13	0.783
	32	0.617	5	0.867	21	0.533
	0	1.000	4	0.850	21	0.633
	56	0.933	60	1.000	11	0.833
	60	1.000	60	1.000	22	0.617
4	0	1.000	8	0.767	9	0.700
	15	0.500	14	0.867	9	0.717
	23	0.700	0	1.000	17	0.667
	5	0.867	10	0.717	20	0.583
	0	1.000	4	0.867	0	1.000
	6	0.867	27	0.483	21	0.600
	10	0.400	1	0.950	22	0.433
	6	0.817	11	0.767	20	0.550
	20	0.683	16	0.667	21	0.583
	5	0.967	26	0.550	14	0.617
	2	0.933	60	1.000	3	0.900
	0	1.000	7	0.767	2	0.917
	23	0.617	8	0.733	0	1.000
	10	0.717	17	0.500	0	1.000
	43	0.567	0	1.000	10	0.800
	60	1.000	42	0.650	7	0.750
	18	0.667	4	0.867	21	0.533
	0	1.000	48	0.967	18	0.617
	60	1.000	60	1.000	13	0.850
	60	1.000	60	1.000	59	0.967

Block	Pairing					
	MF		MM		FF	
	Coop.	Imit.	Coop.	Imit.	Coop.	Imit.
5	0	1.000	5	0.900	12	0.717
	9	0.700	45	0.667	10	0.717
	9	0.833	0	1.000	15	0.717
	4	0.867	17	0.600	16	0.717
	0	1.000	3	0.900	0	1.000
	53	0.783	33	0.617	24	0.600
	12	0.783	0	1.000	16	0.633
	1	0.967	8	0.767	11	0.700
	11	0.717	26	0.583	11	0.667
	22	0.667	7	0.750	17	0.500
	3	0.967	60	1.000	3	0.900
	6	0.817	3	0.900	6	0.867
	10	0.683	8	0.767	0	1.000
	3	0.917	12	0.633	0	1.000
	44	0.617	0	1.000	22	0.617
	60	1.000	26	0.400	6	0.833
	12	0.767	4	0.900	21	0.517
	0	1.000	60	1.000	15	0.633
	60	1.000	60	1.000	10	0.883
	60	1.000	60	1.000	60	1.000
6	0	1.000	5	0.833	8	0.750
	9	0.767	25	0.700	11	0.617
	7	0.800	0	1.000	15	0.700
	3	0.900	11	0.667	16	0.733
	0	1.000	2	0.933	0	1.000
	40	0.550	32	0.583	18	0.717
	4	0.917	0	1.000	22	0.583
	0	1.000	5	0.867	12	0.650
	25	0.733	18	0.617	20	0.667
	18	0.867	7	0.817	6	0.800
	0	1.000	60	1.000	0	1.000
	17	0.817	18	0.783	12	0.783
	27	0.383	6	0.800	18	0.417
	2	0.950	13	0.667	0	1.000
	52	0.767	0	1.000	13	0.717
	60	1.000	25	0.350	7	0.833
	23	0.483	4	0.867	18	0.583
	0	1.000	60	1.000	12	0.617
	60	1.000	60	1.000	39	0.783
	60	1.000	60	1.000	60	1.000

b. Expt. 2

Block	Pairing			
	MM		FF	
	Coop.	Imit.	Coop.	Imit
1	20	0.552	28	0.483
	15	0.603	25	0.534
	24	0.534	14	0.638
	19	0.500	31	0.603
	20	0.466	25	0.569
	18	0.603	23	0.603
	28	0.569	22	0.569
	34	0.569	29	0.586
	23	0.638	13	0.690
	23	0.517	17	0.552
2	25	0.167	31	0.750
	10	0.667	17	0.633
	21	0.600	21	0.683
	15	0.667	42	0.717
	1	0.967	12	0.600
	58	0.967	28	0.617
	21	0.500	23	0.533
	60	0.967	58	0.967
	59	0.950	7	0.750
	59	0.983	21	0.517
3	28	0.067	38	0.783
	10	0.700	17	0.633
	23	0.683	15	0.583
	9	0.683	25	0.517
	19	0.567	21	0.483
	60	1.000	17	0.567
	31	0.700	17	0.650
	60	1.000	60	1.000
	60	1.000	0	1.000
	60	1.000	19	0.467

Block	Pairing			
	MM		FF	
	Coop.	Imit.	Coop.	Imit.
4	28	0.067	48	0.767
	23	0.700	15	0.533
	19	0.617	22	0.767
	12	0.633	41	0.800
	9	0.733	27	0.417
	60	1.000	20	0.583
	52	0.867	36	0.633
	60	1.000	60	1.000
	60	1.000	9	0.733
	60	1.000	18	0.433
5	28	0.067	46	0.867
	60	1.000	14	0.583
	14	0.617	26	0.700
	8	0.750	36	0.700
	7	0.900	20	0.517
	60	1.000	16	0.617
	39	0.483	50	0.817
	59	0.967	60	1.000
	60	1.000	7	0.767
	60	1.000	19	0.433
6	28	0.067	42	0.867
	60	1.000	16	0.583
	11	0.733	21	0.767
	8	0.767	40	0.817
	47	0.800	18	0.550
	60	1.000	16	0.533
	24	0.567	60	1.000
	59	0.967	60	1.000
	60	1.000	14	0.533
	60	1.000	22	0.433

Appendix V111

Questionnaire data : raw scores

a. Expt. 1

Q1. MM	Q1. FF	Q2. MM	Q2. FF
4	6	2	6
4	6	6	5
6	5	2	4
4	5	5	5
2	5	4	5
4	6	4	5
4	5	4	2
2	4	4	5
5	4	2	4
2	5	4	5
5	5	4	3
5	4	3	5
6	5	5	4
5	5	5	2
5	4	5	5
4	6	4	5
6	6	4	5
4	5	4	3
5	5	4	5
6	6	2	5
1	6	5	5
6	5	5	4
5	6	3	4
5	6	5	5
4	6	3	2
4	6	2	4
5	6	5	5
5	4	5	5
6	5	4	4
6	4	4	4
6	6	4	5
6	6	4	5
6	6	4	5
6	6	3	2
6	5	6	5
6	5	5	3
5	6	5	5
6	5	1	4
5	1	5	1
6	4	5	4

Q3. MM	Q3. FF	Q4. MM	Q4. FF
4	1	4	1
5	1	5	4
2	1	5	5
3	5	3	5
2	5	6	5
1	2	2	5
2	5	5	3
5	3	5	3
3	4	5	5
1	1	6	2
1	3	6	4
1	1	6	4
4	4	5	4
3	1	5	4
1	1	2	2
3	1	6	5
3	3	4	5
2	2	2	5
1	5	5	4
3	6	6	5
1	1	1	5
1	1	6	5
2	3	4	4
4	2	5	6
1	1	5	6
4	2	5	5
3	1	4	6
3	1	5	4
6	1	6	4
5	4	3	5
6	5	6	5
6	1	5	5
5	1	6	5
4	1	3	5
6	6	5	4
6	1	5	5
5	1	5	5
5	1	5	2
1	6	4	6
1	2	4	4

Q5.

	MM	FF
	5	5
	5	3
	5	4
	4	2
	4	5
	4	4
	4	4
	2	2
	5	3
	2	5
	4	6
	6	2
	2	4
	1	1
	1	3
	2	2
	3	4
	2	2
	1	4
	4	6
	4	6
	4	4
	2	3
	2	5
	4	5
	3	3
	6	6
	5	4
	6	4
	4	5
	6	5
	6	6
	5	2
	4	6
	5	2
	6	4
	5	3
	2	4
	5	1
	5	4

b. Expt. 2

	MM.	FF.
Q1.	6	4
	3	1
	6	1
	6	2
	6	5
	5	5
	4	5
	5	4
	6	5
	5	5
	4	5
	6	6
	6	5
	4	5
	6	6
	4	5
	6	3
	4	5
	5	6
	6	5
Q2.	5	5
	4	4
	1	2
	5	4
	3	4
	2	2
	3	4
	5	3
	3	1
	5	3
	5	5
	5	5
	5	6
	4	3
	4	5
	3	5
	4	4
	4	5
	3	4
	2	4

Q3.

MM	FF
6	4
1	1
6	1
6	1
6	6
6	6
5	1
6	1
6	3
6	2
6	6
5	4
1	5
1	3
6	6
5	4
2	3
5	2
1	2
6	2

Q4.

2	5
6	2
5	2
5	4
6	4
2	1
6	6
2	5
5	5
5	2
6	5
1	5
3	4
3	3
5	4
5	5
6	6
6	2
5	5
5	5

Q5.

MM	FF
4	4
3	1
6	1
6	2
5	4
6	6
4	5
5	4
6	4
6	3
5	6
5	1
3	1
6	4
1	2
4	4
4	2
4	4
1	1
2	5

c. Expt. 3

Q1.

MM	FF
5	5
3	6
5	5
3	6
6	5
5	5
6	5
5	5
6	5
5	6
4	6
6	5
6	6
6	6
6	5
5	6
6	5
3	1
6	4
6	5

Q2.

MM	FFF
4	4
2	4
4	3
4	4
2	3
4	3
5	6
5	3
4	5
5	5
2	4
4	5
6	5
6	5
4	6
4	4
5	5
5	2
6	5
3	4

Q3.

5	6
3	5
4	1
5	2
4	5
5	3
6	4
4	5
2	5
5	4
3	5
1	6
6	1
6	5
6	6
6	6
6	1
6	3
1	5
1	4

Q4.

MM	FF
6	2
2	6
5	5
5	6
6	4
6	3
6	5
6	3
3	5
6	6
5	5
6	2
5	6
5	6
4	3
6	2
6	2
5	6
1	4
2	5

Q5.

4	6
1	1
6	2
1	6
5	1
1	5
5	5
6	2
3	5
6	5
3	6
2	5
6	6
6	6
6	5
6	5
5	4
6	1
1	3
2	6

d. <u>Expt. 4</u>

a) Male E.

Q1.

MM	FF
5	6
5	5
4	5
6	6
5	5
6	5
6	5
6	1
5	5
6	3
6	6
6	2
6	5
5	4
1	5
6	4
3	6
6	2
	5

Q3.

MM	FF
1	6
3	1
4	2
3	6
4	6
6	1
6	4
5	4
5	2
6	1
6	1
6	1
5	6
5	6
1	1
1	1
6	6
6	2
	5

Q2.

MM	FF
4	4
5	3
4	4
5	2
5	4
5	5
5	2
5	2
4	4
5	4
4	3
4	4
5	6
2	3
3	3
1	4
2	3
5	3
	5

Q4.

MM	FF
1	1
5	3
6	6
6	5
3	4
5	6
1	5
6	1
4	2
5	3
2	1
4	5
3	5
2	2
5	5
2	6
5	2
6	6
	3

Q5.

MM	FF
5	6
6	3
2	5
6	6
6	5
5	3
5	3
5	2
5	4
6	4
6	2
6	1
5	6
2	3
6	3
6	1
6	6
4	4
	2

Q2.

MM	FF
4	2
4	6
5	5
2	5
3	3
2	5
5	3
2	4
5	3
4	4
4	2
3	6
3	4
4	3
5	5
	4
	6
	5
	3

b) Female E

Q1.

MM	FF
4	6
4	6
4	6
5	6
5	5
5	6
5	5
6	6
6	6
6	4
6	6
5	5
6	6
6	5
5	2
	6
	5
	6
	6

Q3.

5	6
3	6
5	6
1	4
5	1
5	4
5	2
6	6
6	6
6	6
6	6
1	3
5	4
6	4
1	4
	6
	4
	1
	1

e. Expt. 5

Q4.

MM	FF
6	4
5	6
6	6
5	2
5	5
1	4
6	4
1	5
4	2
4	6
3	1
3	6
4	2
3	5
4	6
	5
	5
	5
	5

Q1.

MM	FF
5	6
5	1
1	5
2	2
5	5
5	6
4	2
4	5
6	5
2	4
2	6
6	6
6	4
5	5
5	5
5	5

Q5.

3	5
4	6
3	6
1	3
4	5
3	5
6	5
1	6
6	6
5	4
6	5
5	4
6	5
4	3
1	3
	6
	6
	5
	6

Q2.

5	4
3	5
5	5
5	5
3	5
6	4
1	4
1	3
5	4
5	4
4	5
5	6
3	4
2	3
5	1
4	1

Q3.	MM	FF
	6	1
	4	3
	1	5
	1	3
	2	5
	1	6
	1	1
	5	2
	1	3
	1	1
	3	6
	6	1
	5	5
	4	4
	5	2
	6	1

Q4.	5	4
	6	5
	5	5
	4	5
	5	6
	5	6
	4	3
	5	4
	5	2
	4	4
	5	5
	6	6
	3	4
	3	3
	6	3
	3	4

Q5.	MM	FF
	4	3
	2	4
	1	4
	5	3
	5	5
	6	6
	6	2
	6	4
	6	3
	5	4
	5	6
	6	4
	6	6
	5	4
	5	2
	6	2

f. <u>Expt. 6</u>

Q1.	5	1
	4	2
	6	5
	6	5
	5	4
	2	5
	5	6
	6	6
	5	5
	5	1
	1	5
	6	4
	5	5
	5	5
	6	6
	6	6
	2	4
		6

Q2.	MM	FF	Q4.	MM	FF
	3	3		5	4
	5	4		2	2
	3	4		6	6
	1	4		5	6
	2	6		2	5
	4	5		1	6
	4	4		6	2
	4	5		5	5
	3	5		4	2
	5	2		6	5
	2	5		1	1
	4	5		6	4
	1	2		6	5
	4	6		4	6
	1	4		3	6
	2	5		3	6
	5	4		6	4
		5			2

Q3.			Q5.		
	5	1		6	5
	6	2		6	1
	5	2		3	6
	5	5		6	6
	2	6		6	5
	1	6		2	6
	4	1		4	1
	4	1		6	6
	5	1		5	2
	6	3		4	1
	1	2		6	4
	5	1		5	1
	5	6		1	2
	5	6		3	1
	1	6		3	1
	6	6		5	5
	6	1		2	1
		2			2

Appendix 1X

Co-operation : raw scores (Expt. 2)

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	20	25	28	28	28	28
		15	10	10	23	60	60
		24	21	23	19	14	11
		19	15	9	12	8	8
		20	1	19	9	7	47
	31	18	58	60	60	60	60
		28	21	31	52	39	24
		34	60	60	60	59	59
		23	59	60	60	60	60
		23	59	60	60	60	60
FF	0	28	31	38	48	46	42
		25	17	17	15	14	16
		14	21	15	22	26	21
		31	42	25	41	36	40
		25	12	21	27	20	18
	31	23	28	17	20	16	16
		22	23	17	36	50	60
		29	58	60	60	60	60
		13	7	0	9	7	14
		17	21	19	18	19	22

Appendix X

Pooled data for Expt. 1 and Expt. 2

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad, the communication opportunity and the incentive.

Incentive	Pairing	Communication Opportunity	Trial Blocks					
			1	2	3	4	5	6
none (Expt. 1)	MM	0	19.2	11.8	7.8	7.2	14.0	8.6
		31	10.4	18.4	17.8	18.4	16.6	19.4
	FF	0	18.8	15.4	13.0	11.0	10.6	10.0
		31	20.4	10.6	6.4	3.0	6.2	8.6
financial (Expt. 2)	MM	0	19.6	14.4	17.8	18.2	23.4	30.8
		31	25.2	51.4	54.2	58.4	55.6	52.6
	FF	0	24.6	24.6	23.2	30.6	28.4	27.4
		31	20.8	27.4	22.6	28.6	30.4	34.4

b) Analysis of variance summary for number of co-operative choices for Sex (2 levels) x Communication (2 levels) x Incentive (2 levels) over Trial Blocks (6 levels)

Source	df	sum of squares	mean square	F	P
Between dyads					
Sex (B1)	1	1815.00	1815.00	2.32	0.13
Communication (B2)	1	3572.82	3572.82	4.56	0.04
B12	1	5320.42	5320.42	6.79	0.01
Incentive (B3)	1	20093.40	20093.40	25.65	0.00008
B13	1	437.40	437.40	0.56	0.53
B23	1	3067.35	3067.35	3.92	0.05
B123	1	1260.42	1260.42	1.61	0.21
Error B123	32	25067.93	783.37		
Within dyads					
Trial Blocks (W1)	5	471.38	94.28	1.10	0.32
W1B1	5	871.15	174.23	2.18	0.06
W1B2	5	1021.73	204.35	2.56	0.03
W1B12	5	1595.43	319.09	3.99	0.002
W1B3	5	2689.85	537.97	6.72	0.00005
W1B13	5	109.95	21.99	0.27	0.93
W1B23	5	431.40	86.28	1.08	0.37
W1B123	5	193.03	38.61	0.48	0.79
Error W1B123	160	12800.07	80.00		

Appendix X1

Imitation : raw scores (Expt. 2)

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	0.552	0.167	0.067	0.067	0.067	0.067
		0.534	0.600	0.683	0.617	0.617	0.733
		0.603	0.667	0.700	0.700	1.000	1.000
		0.500	0.667	0.683	0.633	0.750	0.767
		0.466	0.967	0.567	0.733	0.900	0.800
	31	0.569	0.500	0.700	0.867	0.483	0.567
		0.603	0.967	1.000	1.000	1.000	1.000
		0.569	0.967	1.000	1.000	0.967	0.967
		0.638	0.950	1.000	1.000	1.000	1.000
		0.517	0.983	1.000	1.000	1.000	1.000
FF	0	0.483	0.750	0.783	0.767	0.867	0.867
		0.534	0.633	0.633	0.533	0.583	0.583
		0.638	0.683	0.583	0.767	0.700	0.767
		0.603	0.717	0.517	0.800	0.700	0.817
		0.569	0.600	0.483	0.417	0.517	0.550
	31	0.603	0.617	0.567	0.583	0.617	0.533
		0.690	0.750	1.000	0.733	0.767	0.533
		0.569	0.533	0.650	0.633	0.817	1.000
		0.586	0.967	1.000	1.000	1.000	1.000
		0.552	0.517	0.467	0.433	0.433	0.433

Appendix X11

Co-operation : raw scores (Expt. 3)

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	29	12	7	4	2	4
		22	15	3	13	56	52
		45	38	28	46	32	39
		5	1	38	60	60	60
		26	24	27	37	54	53
	31	41	58	60	60	60	60
		40	44	31	5	14	5
		25	58	60	60	60	60
		24	58	60	60	60	60
		35	38	25	36	55	60
FF	0	27	32	38	23	18	22
		22	10	2	2	0	0
		19	49	38	24	51	36
		27	17	8	38	60	60
		17	11	14	11	7	8
	31	29	23	11	13	9	6
		42	60	60	60	60	60
		57	60	60	60	60	60
		25	14	14	13	9	8
		16	59	60	60	60	60

Appendix XIII

Pooled date for Expt. 2 and Expt. 3

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad, the communication opportunity and the sex of the experimenter

Sex of E	Pairing	Communication Opportunity	Trial Blocks					
			1	2	3	4	5	6
F (Expt.2)	MM	0	19.6	14.4	17.8	18.2	23.4	30.8
		31	25.2	51.4	54.2	58.4	55.6	52.6
	FF	0	24.6	24.6	23.2	30.6	28.4	27.4
		31	20.8	27.4	22.6	28.6	30.4	34.4
M (Expt.3)	MM	0	25.4	18.0	20.6	32.0	40.8	41.6
		31	33.0	51.2	47.0	44.2	49.8	49.0
	FF	0	22.4	23.8	20.0	19.6	27.2	25.2
		31	33.8	43.2	41.0	41.2	39.6	38.8

b) Analysis of variance summary for number of co-operative choices for Sex of subject (2 levels) x Communication (2 levels) x Sex of E (2 levels) over Trial Blocks (6 levels)

Source	df	sum of squares	mean square	F	p
Between dyads					
Sex of S (B1)	1	3204.70	3204.70	2.63	0.11
Communication (B2)	1	14554.84	14554.84	11.95	0.002
B12	1	2808.50	2808.50	2.31	0.14
Sex of E (B3)	1	731.50	731.50	0.60	0.55
B13	1	49.50	49.50	0.04	0.84
B23	1	28.70	28.70	0.02	0.87
B123	1	3060.20	3060.20	2.51	0.12
Error B123	32	38977.93	1218.06		
Within dyads					
Trial Blocks (W1)	5	3891.72	778.34	5.56	0.0002
W1B1	5	963.72	192.74	1.38	0.24
W1B2	5	2100.19	420.04	2.10	0.01
W1B12	5	942.22	188.44	1.34	0.25
W1B3	5	221.32	44.26	0.32	0.90
W1B13	5	305.82	61.16	0.44	0.82
W1B23	5	495.22	99.04	0.71	0.62
W1B123	5	578.22	115.64	0.83	0.53
Error B123	160	22418.10	140.11		

Appendix XlV

Co-operation : raw scores (Expt. 4)

a) Male E.

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	45	44	54	48	43	47
		32	39	30	37	23	29
		34	33	33	31	29	31
		31	9	3	45	60	60
		25	20	11	8	5	12
	31	31	24	14	17	20	24
		58	60	60	60	60	60
		43	60	60	60	60	60
		25	51	45	43	43	42
		23	58	60	60	60	60
FF	0	17	18	11	15	7	13
		22	48	33	41	37	40
		33	17	21	19	7	7
		26	20	18	14	16	16
		25	19	34	30	29	31
	31	26	20	23	21	26	20
		32	59	60	60	60	60
		23	24	22	14	11	9
		21	60	60	60	60	60
		15	4	0	0	0	0

b) Female E

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	41	31	31	32	32	34
		40	48	47	48	43	30
		14	18	34	24	37	29
		25	26	60	60	60	60
		50	60	60	60	60	60
	31	29	47	40	27	18	50
		13	59	60	60	60	60
		31	36	52	52	54	42
		51	60	60	60	60	60
		18	58	60	60	60	60
FF	0	26	40	31	29	26	60
		21	37	60	60	60	60
		24	13	15	56	48	44
		31	41	28	20	24	23
		21	21	49	60	60	60
	31	29	60	60	60	60	60
		25	29	23	26	17	28
		40	46	38	33	46	39
		25	58	60	60	60	60
		58	60	60	60	60	60

Appendix XV

Analysis of Pooled data for Expts. 2 - 4

Analysis of variance summary for number of co-operative choices for Sex of E (2 levels) x Communication Opportunity (2 levels) x Sex of S (2 levels) over Trial Blocks (6 levels) with a random E factor nested within Sex of E (Expts. 2 - 4)

Source	df	sum of squares	mean square	F	P
Between dyads					
Sex of E (A)	1	1665.08	1665.08	0.33	0.62
Comm^{n}. (B)	1	18750.00	18750.00	31.93	0.04
AB	1	192.53	192.53	0.33	0.62
Sex of S (C)	1	6735.01	6735.01	12.99	0.08
AC	1	492.08	492.08	0.95	0.43
BC	1	2066.70	2066.70	1.17	0.39
ABC	1	710.53	710.53	0.40	0.59
Within dyads					
Trial Blocks (D)	5	7052.43	1410.49	15.84	0.0002
AD	5	1203.68	240.74	2.70	0.08
BD	5	3184.40	636.88	7.23	0.004
ABD	5	83.82	16.76	0.19	0.96
CD	5	693.19	138.64	3.91	0.03
ACD	5	678.18	135.64	3.82	0.03
BCD	5	819.70	163.94	2.24	0.13
ABCD	5	621.82	124.36	1.70	0.22
Random factor					
E's/Sex of E (F)	2	9990.47	4995.23	4.22	0.02
BF	2	1174.35	587.17	0.50	0.62
CF	2	1036.57	518.28	0.44	0.65
BCF	2	3529.62	1764.81	1.49	0.23
DF	10	890.38	89.04	0.73	0.69
BDF	10	880.40	88.04	0.72	0.70
CDF	10	354.68	35.47	0.29	0.98
BCDF	10	732.53	73.25	0.60	0.81
G	64	75709.87	1182.97		
DG	320	38868.13	121.46		
Total	479	178116.10			

Appendix XV1

"Competition scores" : pooled data (Expts. 2 - 4)

Sex of E		MM	FF
M	Expt. 4	32	30
		31	21
		26	34
		15	27
		17	31
		33	40
		31	28
		16	20
		25	33
		13	32
F	Expt. 4	5	35
		33	21
		42	36
		17	28
		21	22
		5	33
		32	26
		36	32
		11	34
		17	32

Sex of E		MM	FF
		28	23
		33	32
		38	33
		35	24
F	Expt. 2	40	24
		37	35
		33	32
		43	38
		35	21
		39	42
		25	29
		50	22
		30	29
		39	36
M	Expt. 3	19	34
		31	32
		44	27
		33	29
		35	38
		9	36

Appendix XV11

Co-operation : raw scores (Expt. 5 and Expt. 6)

a) Expt. 5

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	33	40	41	38	55	54
		37	40	37	28	31	33
		60	60	60	60	60	60
		53	54	50	58	50	56
	31	34	59	60	60	60	60
		38	57	55	47	42	37
		31	20	57	60	60	58
		58	60	60	60	60	60
FF	0	9	24	25	17	19	28
		17	13	19	12	10	15
		25	23	60	60	60	60
		17	3	11	1	5	0
	31	18	26	20	26	28	26
		7	10	8	2	0	0
		26	37	44	41	60	60
		22	8	16	20	17	14

b) Expt. 6

Pairing	Communication Opportunity	Trial Block 1	2	3	4	5	6
MM	0	29	22	20	5	14	9
		22	12	14	11	19	9
		14	14	16	11	11	13
		22	6	8	49	60	60
		20	7	20	58	60	60
	31	24	17	13	17	7	14
		22	17	18	4	15	10
		36	27	31	20	18	30
		41	58	60	60	60	60
FF	0	19	14	17	11	19	14
		25	26	31	21	21	12
		28	19	16	33	33	42
		33	25	36	29	30	29
		30	27	16	19	16	16
	31	22	18	18	13	18	23
		22	58	60	60	60	60
		20	58	60	60	60	60
		27	26	22	20	37	27

Appendix XVlll

Pooled data for Expt. 2 and Expt. 5

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad, the communication opportunity and the culture of the subject

Culture of S	Pairing	Comm^n. Opportunity	Trial Block 1	2	3	4	5	6
UK (Expt.2)	MM	0	19.60	14.40	17.80	18.20	23.40	30.80
		31	25.20	51.40	54.20	58.40	55.60	52.60
	FF	0	24.60	24.60	23.20	30.60	28.40	27.40
		31	20.80	27.40	22.60	28.60	30.40	34.40
USA (Expt.5)	MM	0	45.75	48.50	47.00	46.00	49.00	50.75
		31	40.25	49.00	58.00	56.75	55.50	53.75
	FF	0	17.00	15.75	28.75	22.50	23.50	25.75
		31	18.25	20.25	22.00	22.25	26.25	25.00

b) Analysis of variance summary for number of co-operative choices for Sex (2 levels) x Communication (2 levels) x Culture (2 levels) over Trial Blocks (6 levels)

Source	df	sum of squares	mean square	F	p
Between dyads					
Sex (B1)	1	15419.50	15419.50	15.64	<0.05
Communication (B2)	1	4638.86	4638.86	4.71	<0.05
Culture (B3)	1	1398.54	1398.54	1.42	>0.05
B12	1	4099.45	4099.45	4.16	>0.05
B13	1	5087.33	5087.33	5.16	<0.05
B23	1	2128.03	2128.03	2.16	>0.05
B123	1	1874.91	1874.91	1.90	>0.05
Error B123	28	27600.10	985.72		
Within dyads					
Trial Blocks (W1)	5	3149.06	629.81	7.21	<0.05
W1B1	5	380.95	76.19	0.87	>0.05
W1B2	5	1122.33	224.47	2.57	<0.05
W1B3	5	356.63	71.33	0.82	>0.05
W1B12	5	1191.21	238.24	2.73	<0.05
W1B13	5	231.91	46.38	0.53	>0.05
W1B23	5	281.81	56.36	0.65	>0.05
W1B123	5	283.52	56.70	0.65	>0.05
Error W1B123	140	12232.80	87.38		

Appendix XlX

Pooled data for Expt. 2 and Expt 6.

a) Mean number of co-operative choices per trial block as a function of the sex of the dyad, the communication opportunity and the presence of E

Presence of E	Pairing	Comm^n. Opportunity	Trial Blocks 1	2	3	4	5	6
present (Expt.2)	MM	0	19.60	14.40	17.80	18.20	23.40	30.80
		31	25.20	51.40	54.20	58.40	55.60	52.60
	FF	0	24.60	24.60	23.20	30.60	28.40	27.40
		31	20.80	27.40	22.60	28.60	30.40	34.40
absent (Expt.6)	MM	0	21.40	12.20	15.60	26.80	32.80	30.20
		31	30.75	29.75	30.50	25.25	25.00	28.50
	FF	0	27.00	22.20	23.20	22.60	23.80	22.60
		31	22.75	40.00	40.00	38.25	43.75	42.50

b) Analysis of variance summary for number of co-operative choices for Sex (2 levels) x Communication (2 levels) x Presence of E (2 levels) over Trial Blocks (6 levels)

Source	df	Sum of squares	mean square	F	P
Between dyads					
Sex (B1)	1	146.83	146.83	0.15	>0.05
Communication (B2)	1	8543.44	8543.44	8.44	<0.05
Presence of E (B3)	1	442.73	442.73	0.44	>0.05
B12	1	1245.21	1245.21	1.23	>0.05
B13	1	2462.96	2462.96	2.43	>0.05
B23	1	376.86	376.86	0.37	>0.05
B123	1	4871.02	4871.02	4.81	<0.05
Error B123	30	30368.90	1012.30		
Within dyads					
Trial Blocks (W1)	5	2461.90	492.38	4.71	<0.05
W1B1	5	171.90	34.38	0.33	>0.05
W1B2	5	1658.90	331.78	3.18	<0.05
W1B3	5	458.93	91.79	0.88	>0.05
W1B12	5	867.07	173.41	1.66	>0.05
W1B13	5	719.83	143.97	1.38	>0.05
W1B23	5	344.84	68.97	0.66	>0.05
W1B123	5	1557.75	311.55	2.98	<0.05
Error W1B123	150	15665.30	104.44		

Appendix XX

Instructions

a) Expt. 1.

"You will be making choices which have certain pay-offs. You can not by yourself control the specific pay-off for a given trial. Rather, the outcome will depend on what your partner does as well as on what you do.

Each of you has a pay-off sheet in front of you attached to the partition. The task is as follows.

You are subjects 1 and 2 respectively, as shown by the number on the bottom of your record sheet. Each of you can make one of two choices, either A or B, indicating your choice on the appropriate button in front of you. Any decision is final and you may not change your mind once you have indicated your choice by pressing the button.

The pay-offs resulting from such a move are indicated on the card in front of you. If you both choose A each of you receives 3 points. If subject 1 chooses A and subject 2 chooses B, 1 receives zero and 2 receives 4 points. However, if subject 2 chooses A and subject 1 chooses B, 2 receives zero and 1 receives 4 points. If you both choose B, each receives 1 point.

The experimenter will read off, after each move, the number of points gained by each person. Each of you will record your own gains on the record sheet in front of you. You should try to get as many points for yourself as you can. The more points you accumulate the better the result."

In addition, the following instructions were played to the subjects if the degree of communication was to be restricted during the inter-action.

"Please do not communicate with each other in any form whatsoever, unless otherwise informed by the experimenter. This includes sighing, laughing or any other form of communication. The experiment would be useless for our purposes if this is not observed".

If verbal communication was to be allowed additional instructions were given orally as follows:

1) Before trial 1 : "I have some preparation to do before we start. You can chat to each other for a few minutes, but not to me. Please remain seated". After 3 minutes, E requested subjects to "Press when you're ready."

11) After trial 31 : "We'll have a break now. You can chat to eachother for a few minutes, but not to me. Please remain seated." After 3 minutes, E requested subjects to "Press when you're ready".

111) Throughout : "You can chat to each other during the course of the session, but not to me. Please remain seated".

b) Expt. 2

"You will be making choices which have certain pay-offs. You cannot by yourself control the specific pay-off for a given trial. Rather, the outcome will depend on what your partner does as well as on what you do.

Each of you has a pay-off sheet in front of you attached to the partition. The task is as follows:

You are subjects 1 and 2 respectively, as shown by the number on the bottom of your record sheet. Each of you can make one of two choices, either A or B, indicating your choice on the appropriate button in front of you. Any decision is final and you may not change your mind once you have indicated your choice by pressing the button.

The pay-offs resulting from such a move are indicated on the card in front of you. If you both choose A each of you receives 3 points. If subject 1 choose A and subject 2 chooses B, 1 receives zero and 2 receives 4 points. However, if subject 2 chooses A and subject 1 chooses B, 2 receives zero and 1 receives 4 points. If you both choose B each receives 1 point.

The experimenter will read off, after each move, the number of points gained by each person. Each of you will record your own gains on the record sheet in front of you. <u>For every 300 points you accumulate, you will receive £1 at the end of the experiment</u>. Please do not communicate with each other in any form whatsoever, unless otherwise informed by the experimenter. This includes sighing, laughing or any other form of communication. The experiment would be useless for our purposes if this is not observed".

c) Expt. 6

"You will be making choices which have certain pay-offs. You cannot, by yourself, control the specific pay-off for a given trial. Rather, the outcome will depend on what your partner does as well as on what you do.

Each of you has a pay-off board in front of you attached to the partition. The task is as follows.

You are subjects 1 and 2 respectively, as shown by the number on the bottom of your record sheet. Each of you can make one of two choices, either A or B, indicating your choice on the appropriate button in front of you. Any decision is final and you may not change your mind once you have indicated your choice by pressing the button.

The pay-offs resulting from such a move are indicated on the board in front of you. If you both coose A each of you receives 3 points. If subject 1 chooses A and subject 2 chooses B, 1 receives 0 and 2 receives 4 points. However, if subject 2 chooses A and subject 1 chooses B, 2 receives 0 and 1 receives 4 points. If you both choose B each receives 1 point.

The pay-offs are determined by what you both choose so that the board will light up to indicate the choices you have both made. To see how this works have a practice run, observing the following procedure. First, both of you press the A button ..... the board lights up and you both get 3 points. Now, subject 1 press the A button and subject 2 press the B button .... subject 1 receives 0 and subject 2 receives 4 points. Now, subject 2 press the A button and subject 1 press the B button ..... subject 2 receives 0 and subject 1 receives 4 points. Lastly, both of you press the B button....... you both get 1 point. Always wait for the light to go off before making the next choice.

Each of you will record your own gains on the record sheet in front of you. For every 300 points you accumulate you will receive £1 at the end of the experiment.

Please do not communicate with each other in any form whatsoever unless indicated during the course of the experiment. This includes sighing, laughing or any other form of communication. The experiment would be useless for our purpose if this is not observed. However, if a buzzer sounds during the session you may have a short break. During this time you can chat to each other across the partition although you must remain in your seats. You should resume the task when the buzzer sounds again.

You may begin to make your choices now."