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ABSTRACT

Thirty students were formed into ten triads, each of which participated in a series of 48 games generated by the combination of eight power structures with six payoff levels. The game paradigm presented each player with the option of attacking or not attacking one of the other two players in this triad. The game procedure, apparatus and design are fully described. It was found that the power structure of the triad, the position in certain of these structures, and the type of local norm that develops all affect the propensity to engage in conflict in which at most one person can achieve his goal, and in which it is possible for all to fail. The study of more complex conflict is encouraged. (TL)

THE EFFECT OF POWER STRUCTURES ON THE PROPENSITY TO INITIATE CONFLICT IN A TRIAD

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Abstract

Eight different triadic power structures were presented to ten groups of subjects within a gaming paradigm context. The game presented each player with the option of attacking or not attacking one of the other two players. The analysis indicated that propensity to attack was a function of power structure.

INTRODUCTION

With the widespread occurrence of conflict within and among nation-states, the study of conflict and its reduction have become important areas of research. Although war is the most obvious type of conflict, it is by no means the only type with confrontations in the ghettos and on college campuses, the cold war, and political conventions all exhibiting some form of conflict. Despite the fact that conflict is relatively easy to identify, it is not a discrete entity but represents a continuum over which there exists various levels of severity.

The more cooperative end of this conflict continuum is represented by situations in which every participant can achieve his goal independently of the remainder of the participants (a zero conflict situation). This type of no conflict occurs in the world in activities such as the composing and performing arts. Because this situation is relatively uninteresting, it has generated little research.

Anchoring the extreme conflictive end of the conflict continuum is what Cole and Phillips (1969) have labeled ucIative or pure conflict. The basic requirement for this type of conflict to exist is for all the participants in a situation to perceive their goals to be incompatible with each other. These goals must be indivisible and thus at most one person can achieve his goal, and it is possible that all may fail. While very rare in the world, this type of conflict is exhibited in such events as a duel to the death or a nuclear war.

Although conflict is quite prevalent throughout the world, the difficulties encountered in performing controlled studies are quite obvious. To avoid the problems of direct study, various indirect means have been employed. Some examples of the indirect approach are historical analyses of events prior to wars (Azar, 1970; and Holsti, North & Brody, 1968), simulation by electronic computer (Hermann & Hermann, 1969, and Guetzkow, 1962), and laboratory games (Scodel & Minas, 1960; Sermat & Greyovich, 1966; and Cole & Phillips, 1967).

In the laboratory, various gaming paradigms have been employed to study the complete range of conflictive behavior. Games such as the prisoner's dilemma and chicken reflect the more cooperative types of situations while the more extreme type of conflict is replicated by an experimental paradigm initially introduced by Shubik (1954) and subsequently named the "truel" by Willis and Long (1967). It was employed in its present form initially by Cole (1969) as a three person laboratory duel. The term uelative was derived from the root "uel" present in both words "truel" and "duel".

This game consists of a series of moves with each move consisting of each of the three players taking a specified number of points from one of the other players. The points taken away from a player belong to no one and are taken out of the game. When a player loses all of his points, he is out of the game. The game is ended when only one player has points remaining. This player is designated the winner. If no player has points remaining i.e., all of the players remaining are eliminated simultaneously, then there is no winner. The goals of the participants are incompatible (each wants to win) and the goal is indivisible (only one can be a winner).

Phillips, Cole & Hartman (1970), Cole (1970), and Hartman (1971) have employed the triad in examining pure conflict. In these studies, it was shown that the power structure of the triad had a great effect on the propensity to attack the stronger of one's two attack choices. This finding coupled with the problem of how potential relative situations become pure relative situations led to the present research. (A potential relative situation is defined as one in which the goals of the participants can be defined to be either compatible or incompatible, thus this situation can lead to pure conflict or pure cooperation.) All of the above studies were only concerned with a player's attack choice whereas the present study deals with a player's choice between attack and pass.

It is possible to modify the triad in such a way as to produce a potential relative situation. By allowing the players to share winning by dividing the monetary reward associated with winning, and by allowing the players to pass instead of attacking, the game becomes one of potential relative conflict. This game, therefore, allows the study of situations that can lead to pure conflict or pure cooperation through the study of the propensity to engage (pass or attack) in pure conflict.

In examining potential relative conflict situations, two dimensions seem to be of importance. (1) the power structure within the triad and (2) the monetary reward for winning. Caplow (1956, 1959, and 1968) has shown that there are eight possible power structures within any triad. These structures are presented in Table 1 with the three participants labeled A, B, and C. To determine the effect of payoff, six different payoff levels were tested. These payoffs ranged in increments of five cents from 15 to 40 cents for the winner or winners of the game to share.

Table 1

The Eight Power Structures In Triads Identified by Capl...

Type	Power Structure	
1	A = B = C	
2	A > B = C	A < (B + C)
3	A < B = C	
4	A > B = C	A > (B + C)
5	A > B > C	A < (B + C)
6	A > B > C	A > (B + C)
7	A > B > C	A = (B + C)
8	A > B = C	A = (B + C)

Method

Subjects: Thirty students at Michigan State University participated in the experimant. These subjects were recruited through an advertisement in the campus newspaper which offered money for participating in a motivational research program. The subjects were guaranteed one dollar an hour plus whatever they won while playing the game. The thirty subjects were formed into ten groups of three on the basis of each subject's free time in which he was able to participate. Each group participated in two two hour sessions with the second session occuring exactly one week after the first. To ensure that the subjects returned for the second session, they were not paid for either session until the end of the second.

Procedure: At the beginning of the experiment, the instructions in the appendix were read to the subjects and all questions were answered. Hartman (1971) has shown that the first few games in an experiment similar to the present are played differently than the later games. To avoid these apparent learning affects, the 48 experimental games produced by the eight power structures and the six payoff levels were preceded by three practice games. There was no payoff for these games and the all equal power structure was used.

At the start of each game, each player was assigned 20 points (with the exception noted in Table 2) and also a certain ability to remove points belonging to the other players. This differential ability of the players to remove points is the operationalization of power described by Caplow. The numbers in Table 2 represent the ability of the strongest, second strongest, and weakest player (labeled A, B, and C respectively and called power position) to take points away from any other players. As an example in the second power structure, the strongest player can remove

Table 2

Each Player's Ability to Remove Points
for Each Power Structure

Power Structure	Ability to Remove Points Player		
	A	B	C
1	6	6	6
2	8	5	5
3	7	7	4
4	11	3	3
5	8	6	4
6	11	6	1
7	10	5	2
8*	10	3	3

*In this power structure, each subject began with 18 points instead of 20.

eight points on any move while Player B and Player C can remove five points each.

Along with the points and the ability to remove points, each player was assigned a label from the set of nonsense syllables VAF, ZEJ, and YOV. This was done to reduce any effects due to players names and to ensure anonymity throughout the experiment.

On each move of the game, each player received a cue indicating that he must attack or pass. After all of the players had indicated their choices, the points were removed from the scoreboard and the process was repeated. The game ended when one of two events occurred: (1) two or more players were eliminated or (2) those players not yet eliminated all passed for three consecutive attack rounds. In case one, the remaining player received all of the payoff unless there was no survivor in which case no one received any of the payoff. In case two, the players split the payoff in proportion to the number of points they had remaining.

Apparatus: The subjects played the games in an 81/2 X 16' room which was surrounded on three sides by a U shaped viewing room. A one way mirror and an intercom allowed the experimenter to keep constant surveillance on all of the activity in the experimental room. Figure 1 presents a top view of the placement of the experimental apparatus.

A table divider was used to minimize variance as a result of face to face interaction. It was designed to divide a 21/2' X 61/2' table into three sections so that the subjects could not see each other.

Each subject had a communication terminal located directly in front of him in his section of the table divider. In the upper left hand corner of the communication terminal was a green ready light which was the cue

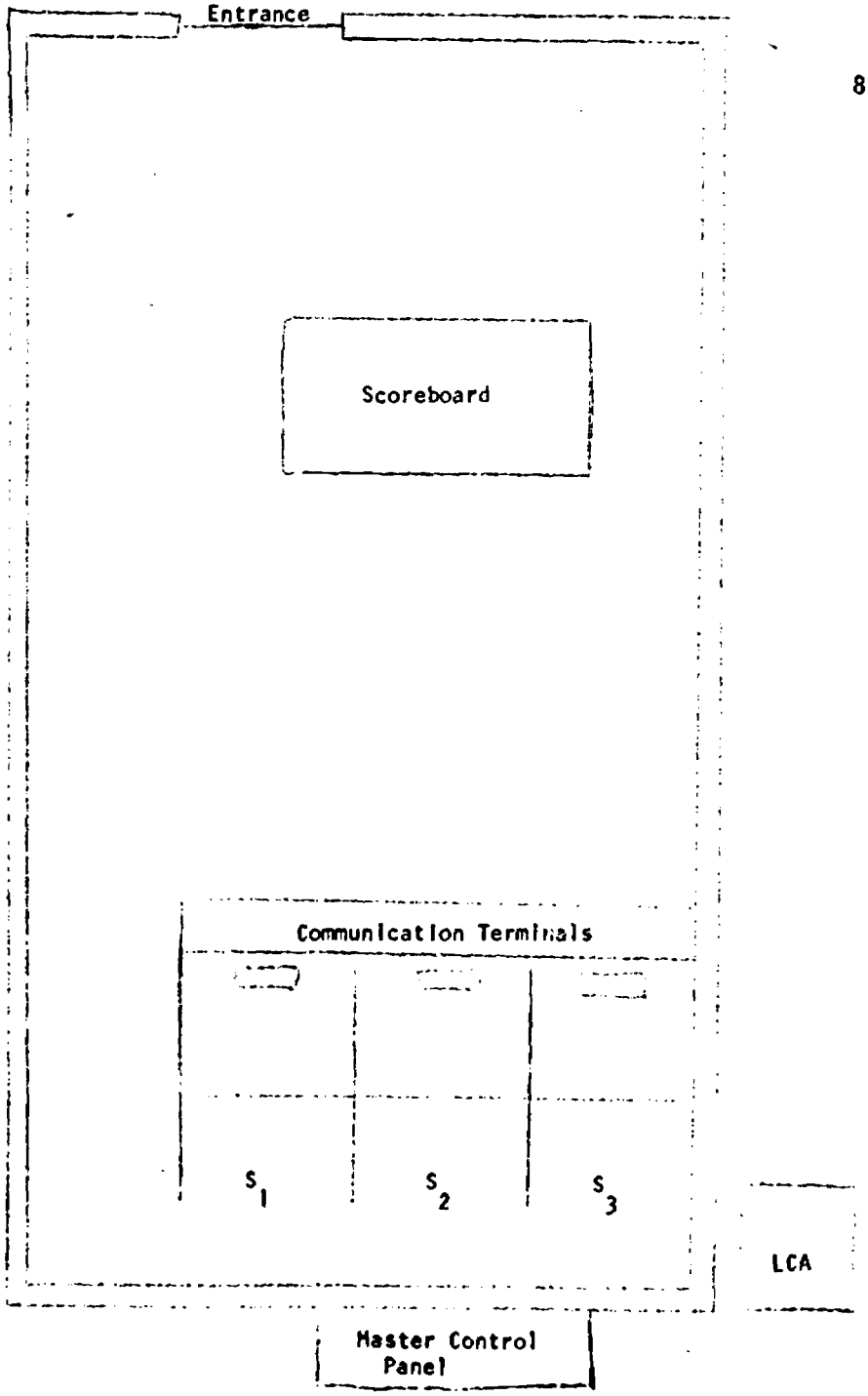

Figure 1. Overhead View of the Experimental Apparatus

for the subject to make his choice to attack or pass. Three lights above the three labels allowed the experimenter to communicate to the subjects which player he was during any game. Three switches below the labels allowed each subject to indicate his attack choice. The switch below his own label was used to indicate a pass.

A scoreboard which contained information concerning the number of points and ability to remove points for each player was located eight feet in front of the subjects. The three labels were listed in a vertical line to the left of center of the scoreboard. On the right side of the labels, three rows of twenty lights indicated the number of points for the respective players. A sequence of four white and one blue light was used to facilitate computation of these points by the subjects during the game. When a point was removed from a player, a light was turned off on the scoreboard.

The number of points that a player position could remove was displayed by a rear screen projector immediately to the left of the labels. Each digit projected by the rear screen projector was approximately 4" X 2 1/2".

A laboratory control apparatus (LCA) which consisted of solid state logic circuits wired to a 32" X 50" programmable MAC panel (Mendelsohn, in preparation) was the central control apparatus for the experiment. The LCA was programmed to provide the experimental manipulations which were applicable at any given time. It also calculated the number of points remaining for each player after every trial and controlled this display on the scoreboard.

The experimenter had access to a master control panel. From this

control panel, the experimenter had complete control over the scoreboard and the player's communication terminals. Due to the location behind the one way mirror, the experimenter and master control panel were out of sight to the subjects. This separation of the experimenter from the subjects allowed the use of three experimenters in no particular order. Each experimenter learned the use of the panel and kept conversation with the subjects at a minimum.

Design: The 48 games generated by the combination of eight power structures with six payoff levels were presented in a random but constant order for all groups. Each subject appeared in each power position twice within each power structure over the six payoff levels such that the sum of the payoffs for the two games in each power position for any power structure was 55 cents. (For example, a player would be in the strongest power position for a payoff of 15 cents and also for a payoff of 40 cents.) This procedure made it possible for each player to have the same expected payoff within each power structure and thus throughout the entire experiment.

Each group played 48 games in the first two hour session and 48 in the second session. The second session, however, was a variation of the first session and has no bearing on the present study.

Results and Discussion

There were four interesting results from this study. The first two were that power structure had a significant effect on the probability of passing while payoff did not. The third finding was significant power position by power structure interaction but no significant main effect for power position. The final result which was both the most interesting and the most unexpected, was the significant effect for groups.

Table 3 presents the analysis of variance for the probability of passing for power structure and payoff using the group as the unit of analysis. To determine the cause of the significant effect for power structure ($p < .005$) the mean probability of passing for each power structure was tabulated. These means are presented in Table 4 as the row marginals. Table 5 presents the results of Tukey's "honestly significant difference" procedure for differences between treatment levels. (Winer, 1962) As the table indicates, the only power structure significantly different from any other was power structure I (all equal).

The above finding indicates that the only power structure which had any effect in producing passing behavior is the all equal power structure. This analysis also indicates that payoff had no effect on the propensity to pass, however, this could be caused by the limited range of payoffs used in the study.

A significant power structure by power position interaction was found in the analysis presented in Table 6. This analysis was possible to perform only after payoff was found not to have any effect on passing behavior. For this analysis, payoff was dichotomized into low (15 - 25 cents) and high (30 - 40 cents). This dichotomization resulted in each player appearing

Table 3

Analysis of Variance for Power Structure and Payoff Using Groups as the Unit of Analysis

Source	df	MS	F
Between Groups	9	.22	
Within Groups			
Power Structure (A)	7	.063	3.84*
A X Groups	63	0.016	
Payoff (B)	5	0.015	
B X Groups	45	0.014	
A X B	35	0.014	
A X B X Groups	315	0.013	

*$p < .005$

Table 4

The Mean Probability of Passing for Each Power Position
in Each Power Structure and Combined for Each Power Structure

Power Structure	Player A	B	C	Combined
1	.131	.131	.131	.131
2	.093	.042	.042	.059
3	.038	.038	.156	.077
4	.026	.055	.055	.045
5	.053	.028	.065	.048
6	.015	.067	.107	.063
7	.061	.078	.115	.084
8	.050	.076	.076	.067

Table 5

Values for Tukey's Procedure for Differences between Treatment Levels.

	1	7	8	3	6	4	2	5
1		3.88	4.41*	4.84*	5.19**	5.67**	5.90**	6.06**
7			.52	.95	1.31	1.78	2.02	2.18
8				.43	.78	1.26	1.49	1.65
3					.36	.83	1.07	1.23
6						.48	.71	.87
4							.23	.30
2								.16
5								

* $p < .05$

** $p < .01$

Table 6

Analysis of Variance for Groups, Power Structures, Payoff Level and Power Position with Subject as the Unit of Analysis

Source	df	MS	F
Between Subjects			
Group (A)	9	0.602	3.81**
Subjects within groups	20	0.158	
Within Subjects			
Power Structure (B)	7	0.134	2.89**
A X B	63	0.044	
B X Subjects within groups	140	0.046	
Payoff level (C)	1	0.046	
A X C	9	0.057	
C X Subjects within groups	20	0.026	
Power Position (D)	2	0.050	
A X D	18	0.025	
D Y Subjects within groups	40	0.061	
B X C	7	0.012	
A X B X C	63	0.028	
B X C X Subjs. within groups	140	0.028	
B X D	14	0.106	2.32***
A X B X D	126	0.036	
B X D X Subjs. within grps.	280	0.046	
C X D	2	0 107	4.14*
A X C X D	18	0.032	

Table 6 (continued)

Source	df	MS	F
C X D X Subjs. within grps.	40	0.026	
B X C X D	14	0.024	
A X B X C X D	126	0.021	
B X C X D X Subjs. within groups	280	0.030	

* $p < .05$

** $p < .01$

*** $p < .005$

in each power position once for each level (high or low) of payoff. This allowed subjects to be used as the unit of analysis and permitted the analysis for power position and group effects to be performed.

To determine the cause of the significant power position by power structure interaction, the interaction means were tabulated and are presented in Table 4. The data in the table is most easily studied by separating the power structures into those which have two players of equal power and those in which all players are disparate. (The all-equal structure is ignored). Those power structures with two equal players are structures 2, 3, 4, and 8. In power structure 4 (a dictator power structure in which the strongest player can win despite what the remaining two players do) and in power structure 8 (a veto power structure in which the strongest player can keep both of the other players from winning but loses himself in the process) the two weaker players passed more than the stronger player. In power structure 2, characterized by one strong and two equally weak players, but not a veto or dictator structure, the stronger player passed more often than the two weaker players. In power structure 3, with two equally strong players and one weak player, the weak player passed significantly more often ($p < .01$ by Tukey's procedure) than the two stronger players.

In structures with the three disparate players (structures 5, 6, and 7) the weaker a player's position the more likely he was to pass. The exception to this was power structure 5 where the strongest and second strongest were reversed in order. Again at the dictator and veto points (power structures 6 and 7) the weakest player passed much more often than the strongest player and also more often than the weakest player in non-dictator, non-veto structures.

The final result of some interest in this analysis, was the significant main effect for groups. This difference between groups in their propensity to pass indicates the emergence of local norms. It would be of interest to follow the development of these norms through the 48 games, but this was not possible since the present study was not designed to study time effects.

In summary, the power structure of the triad, the position in certain of these structures, and the type of local norm that is developed all effect the propensity to engage in relative conflict. While, at present, the practical usefulness of these results is somewhat ambiguous they do offer a basis from which to study more complex conflict.

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APPENDIX

Instructions

(Once the players are seated, determine which subject is in each seating position).

As you are all aware, you will be playing a game. This game is known as the truel. As in a duel, the object of the truel is to be the sole survivor. The reward for being the sole survivor will vary from game to game with the value of the reward or payoff being announced before each game. The rules of the game are simple. You will begin each game with 18 or 20 points each. These points will be indicated by the three rows of lights on the scoreboard in front of you. On each move of the game, each player will be allowed to remove a given number of points from one of the other two players or to pass. The number of points that a player may remove will be indicated where the sixes are on the scoreboard. (Turn on scoreboard with 20 points and 6 - 6 - 6).

To facilitate scorekeeping, the three players will be labeled VAF, ZEJ, and YOV. The number immediately to the left of each label on the scoreboard indicates how many points (lights) that the player corresponding to that label may remove on each move of that game provided he attacks one of the other players. This means for the first game, player VAF can take six points (lights) away from either YOV or ZEJ, player YOV can take six points away from either VAF or ZEJ, and ZEJ can take six points away from VAF or YOV. If VAF had a seven instead of a six next to his label, he would be able to take seven points away from either YOV or ZEJ. The number of points that each player may remove by attacking will remain the same throughout any given game, however, it will change from game to game. Are there any questions to this point?

To determine which player you will be for each game, you merely look at the three lights above the player labels on the communication terminal in front of you. (Turn on terminals for all players with labels for the first game). You will be the player that corresponds to the lighted light on the communication terminal. Thus if the light above ZEJ is on, you will be ZEJ for that game; if the light above YOV is on, you will be YOV for that game; and if the light above VAF is on, you will be VAF for that game. These labels will be randomly assigned for every game so that the same player may or may not have the same labels in two consecutive games. For example, you may be ZEJ in the first game and YOV in the second or ZEJ in the first game and VAF in the second. It is possible, moreover, that you may be ZEJ in both games.

As you were informed previously, you have the option to attack or pass on every move of the game. To signal the beginning of each move, the green ready light in the upper left hand corner of your communication terminal will light. If you choose to attack a player, you push the button on your terminal that is under his label. If you choose to pass on a move, you must push the button under your own label. When you have indicated your choice, the green ready light will turn off. Once all three players have made an attack or passed, the score will be calculated and the number of points (lights) that each player has to begin the next move will be displayed on the scoreboard. As long as a player has points (lights) remaining, at the beginning of a move, he must either attack or pass on that move. Once a player has no points remaining, that is, once all of his lights have been turned off, he is not allowed to participate in the game.

Are there any questions?

The game can end in several ways. If all three palyers have no points remaining, the game will end and there will be no winner. No one will receive any part of the payoff. If all three players pass for three consecutive moves, the game will end and the three players will divide the payoff. Each of the players will receive the percentage of the payoff that is equal to the percentage he possesses of the points (lights) remaining. For example, if each player has 10 points remaining, each player would get 10/30 or 1/3 of the payoff. If one player is eliminated - has no lights - and the remaining two players pass for three consecutive moves, those two players will divide the payoff with each player receiving a percentage of the payoff equal to the percentage of points he possesses of the points remaining. For example, if they each have 10 points, they would each get 10/20 or 1/2 of the payoff. The eliminated player would receive nothing. If two players are eliminated and one player has points remaining, the game is over and the surviving player gets the entire payoff, while the eliminated players receive nothing.

Because it is important that you do not know which of the other two players has which label, please do not talk or make noises of any kind during or between games. If an error is made in calculating the score during any of the games, just say that a mistake has been made and I will correct it. It is very important that you do not identify yourself to the other players.

Are there any questions?

We will begin by having three practice games. There will be no payoff in these games since they are meant to allow you to get acquainted with the procedures and how the game is played.

The payoff for this game will be _____ nickels or _____ cents.