AN EXAMINATION OF THE POWER INVERSION EFFECT IN THREE-PERSON MIXED MOTIVE GAMES

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ABSTRACT

AN EXAMINATION OF THE POWER INVERSION EFFECT
IN THREE-PERSON MIXED MOTIVE GAMES

by Steven G. Cole

One of the phenomenon predicted by the theories which have attempted to describe behavior in a three person mixed-motive situation is the power inversion effect. The present paper examined the power inversion effect as it relates to both the truel, i.e., a three person duel, and the triadic coalition formation situation.

Due to the paucity of studies dealing with the truel, there is a lack of data to support the power inversion effect in that situation. On the other hand, the coalition formation situation has been studied extensively over the last decade and the power inversion effect has been reported by virtually every study.

The focus of the coalition research has been on the deterministic coalition formation situation -- those situations in which some unit or combination of units will win with probability one. The probabilistic coalition situation -- those situations in which no unit or combination of units will win with probability one -- has been virtually ignored. This study extended coalition formation theory to explain individual behavior in the probabilistic situation.

To test the proposed theory, the present study utilized a truel

game paradigm. Four conditions were examined: (1) A deterministic truel which allowed coalitions, (2) a deterministic truel which did not allow coalitions, (3) a probabilistic truel which allowed coalitions, and (4) a probabilistic truel which did not allow coalitions.

The main hypothesis was that the power inversion effect would be replaced by the strength is strength effect in the probabilistic coalition formation situation. It was also predicted that power inversion effect would be observed in the truel situations in which no coalition was allowed to form and in the deterministic coalition formation situation. The results supported the main hypothesis. However, the support was weakened by the fact that the power inversion effect was not observed in the deterministic coalition formation situation.

The power inversion effect was observed in the propensity to attack the stronger of the other two players in the truel situations and in the coalition formation situations in which coalitions did not form. However, it was not observed in the relative chance for survival. A theory based on the relative disparity of strengths was proposed which predicts that the power inversion effect, with respect to distribution of attacks, will occur in the truel situation as long as the strengths of the participants are not equal. When the relative chance of survival is considered, the power inversion effect will be a function of the relative strength of the strongest player.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Introduction

One of the prominent phenomena predicted by the theories which have attempted to describe behavior in a three person mixed-motive situation[1] is that the person who is the "strongest" with respect to initial resources is often functionally the weakest. This phenomenon, referred to as the "strength is weakness" effect, has been predicted by theories which deal with coalition formation (Caplow, 1956; Gamson, 1961a) as well as theories which deal with the truel, i.e., a three person duel (Shubik, 1954). However, the literature has virtually ignored the fact that in many cases the person who is the "weakest" with respect to initial resources is functionally the strongest, i.e., the "weakness is strength" effect. It is sensible to think of these two effects as sub-phenomena of a more general "power inversion" effect.

The present paper examined the power inversion effect as it relates to both the truel and the triadic coalition formation situation. Due to the paucity of studies dealing with the truel, there is a lack of data to support the power inversion effect in that situation. On the other hand, coalition formation has been studied extensively over the last decade and the power inversion effect has been reported by almost every study. Therefore the major portion of the present paper concentrated on coalition research.

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[1] The mixed-motive situation is defined as a situation in which (1) there is no outcome which will maximize the payoff to all of the participants, and (2) at least two of the participants can increase their payoff by cooperative activity.

For this study " a coalition is the joint use of resources to determine the outcome of a decision in a mixed-motive situation involving more than two units." (Gamson, 1964, p. 85) Coalition theory and research, which is included within the boundary condition of this definition, has focused on the deterministic coalition formation situation -- those situations in which some unit or combination of units will win with probability one. The probabilistic coalition situation -- those situations in which no unit or combination of units will win with probability one -- has been virtually ignored. The present paper extends coalition formation theory to explain individual behavior in the probabilistic situation.

Since the present study proposed to examine the power inversion effect in the truel as well as in the coalition situation, the experimental game paradigm was based on the truel. Although it was kept as similar as possible, the basic truel was manipulated so that the following four conditions were examined: (1) a deterministic truel which allowed coalitions, (2) a deterministic truel which did not allow coalitions, (3) a probabilistic truel which allowed coalitions, and (4) a probabilistic truel which did not allow coalitions.

Truel Theory and Research

The truel was first discussed by Shubik (1954) and is based on the concept of a three person duel. It is well known that in a duel, two individuals attempt to eliminate each other and the winner is that person who survives. The truel is a similar situation which differs only in that three individuals participate. In the pure truel no explicit coalitions may form. This does not, however, exclude

the formation of implicit coalitions. In fact, in the truel situation it is often the case that two of the participants may increase their chance of survival by eliminating the third participant first and then attempting to eliminate each other.

Shubik proposed a theory to account for the outcome of the truel situation which was based on the presupposition that participants in a truel will act rationally. Although the possibility of implicit coalitions was noted by Shubik, he restricted his theory so that it did not allow explicit coalitions. One of the major predictions of his theory was that in some truel situations the power inversion effect would be observed. As an illustration, Shubik offered the following example. Person A, person B, and person C were each allowed to fire one shot at one of the other two. Person A had an 80% chance of hitting the person that he chose to shoot, person B had a 70% chance of hitting the person that he chose to shoot, and person C had a 60% chance of hitting the person that he chose to shoot. The rationalistic point of view assumes that each individual wishes to survive and will therefore shoot at that individual who poses the greatest threat to his survival. Shubik adopted this point of view and computed the probabilities of survival for each individual in each of the six possible firing orders. The following mean chances of survival for each individual were obtained: A=.260, B=.488, and C=.820. It is apparent from these results that the strongest person has the least chance to survive and that the weakest person has the best chance to survive. This illustration of the power inversion effect supports the hypothesis that power inversion is predicted in

some truel situations, and that those truel situations in which power inversion is predicted are a function of the relative strength of the individuals involved. Therefore, "in a noncooperative environment it apparently does not pay to be slightly stronger than the others for this invites action against oneself." (Shubik, 1954, p.45)

Only two empirical studies (e.g., Willis & Long, 1967; Cole & Phillips, 1967b) have examined the truel situation. Although the Willis and Long study utilized the truel situation, the subjects each had a 100% chance of hitting whichever player they chose to attack. Since the players were all of equal strength, an examination of the power inversion effect in the Willis and Long study was impossible. Therefore, the Cole and Phillips study furnished the only empirical data dealing with power inversion in the truel.

Cole and Phillips used Caplow's (1956) Type 5 triadic situation, i.e., A>B>C, A<(B+C), which means that player A had greater power than player B, player B had greater power than player C, and player A had less power than players B and C combined. An examination of the number of times each player was attacked and who attacked him on all moves of each game, particularly on the initial move of each game, revealed evidence for the power inversion effect. That is, it was found that (1) player A was attacked a significantly greater number of times by both players B and C than either players B or C were attacked by each other; and (2) player C was attacked significantly less by players A and B than they were attacked by each other. However, in the truel situation which was examined every player could successfully attack the player of his choice with probability one,

while in the situation which was discussed by Shubik the probability of successfully attacking the player of his choice was different for each member of the triad. Furthermore, Cole and Phillips allowed coalitions to form which may have added some aspects to the situation which differentiated it from the pure truel.

Coalition Formation: Relevant Theories and an Evaluation[2]

The study of coalition formation has taken two forms characterized primarily by the nature of the task which the subjects are required to perform. One form, represented by the studies by Mills (1954), Strodtbeck (1954), and Torrance (1955), presents a group discussion task in which a coalition is said to have formed if two subjects come to an agreement. The procedure utilized by Mills (1954) offers an excellent illustration of the type of group discussion task that has been used. Mills asked the members of a triad to pretend that they were on a "military review court sitting on the case of Billy Budd." (p. 658) Mills used two confederates to manipulate the situation and noted with whom the subjects agreed as an index of coalition formation behavior. The other form of coalition research, characterized by Caplow (1956), Vinacke and Arkoff (1957), and Gamson (1961a), deals with situations in which the subjects play a mixed-motive game. The data is examined to determine if a manipulation of the initial resources effects the outcome of the game, how the game is played, or both. The first type of coalition studies

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[2]For a more extensive review of the coalition theories and research see Appendix C.

(coalitions in a group discussion task) has been thoroughly reviewed by Marie L. Borgatta (1961) and will not be discussed in this paper. The present paper will focus on the second form of coalition studies, i.e., those dealing with mixed-motive games.

Caplow's (1956, 1959) theory of coalition formation provided the impetus for the theories which have subsequently been proposed. Table 1 presents Caplow's eight triadic types and the coalitions which are predicted by the four major theories of coalition formation, i.e., Control Theory (CT), Minimum Resource Theory (MRT), Minimum Power Theory (MPT), and Anticompetitive Theory (AT). CT was developed by Caplow (1956, 1959). MRT, which was developed by Gamson (1961a) is a refinement of CT. MPT is based on game theory and was proposed by Gamson (1964). AT was first proposed by Gamson (1964) and was later revised by Phillips and Nitz (in press).

The eight triadic types presented in Table 1 were based on the relative power of the members of the triad. For example, in the Type 5 triad, player A has more power than player B, and player B has more power than player C; but player A has less power than player B and player C combined. Subsequent research has defined power to be equivalent to the amount of resources controlled, and resources have been defined as weights assigned to each member of the triad such that some critical quantity of those weights is necessary to control the distribution of the payoff.

Table 1

Caplow's eight triadic types and the coalitions which are predicted by the four major theories.

	Type of Triad	Coalitions predicted by CT	MRT	MPT	AT* A	AT* B
1	A=B=C	any	any	any	any	any
2	A>B, B=C, A<(B+C)...	BC	BC	any	BC	AB or AC
3	A<B, B=C.....	AB or AC	AB or AC	any	BC	AB or AC
4	A>(B+C), B=C.....	none	---	none	none	none
5	A>B>C, A<(B+C).....	AC or BC	BC	any	AB or BC	AC
6	A>B>C, A>(B+C).....	none	---	none	none	none
7	A>B>C, A=(B+C).....	AB or AC	---	AB or AC	AB	AC
8	A=(B+C), B=C.....	AB or AC	---	AB or AC	AB or AC	AB or AC

* A = the predicted coalitions when the payoff is equally divisible.
B = the predicted coalitions when the payoff is not equally divisible.

Control Theory

Control theory defines the term control as the ability to dominate the other members of the triad. For example, if one member of a triad has some part in determining the outcome of the situation and another member does not, then the first member is said to have control[3] over the second. Moreover, if two members of a triad have some part

[3]This type of control is similar to "fate control" (Thibaut & Kelley, 1959) in that once a coalition has formed, the fate of the isolate is determined.

in determining the outcome of the situation, then the stronger member, i.e., the member with the larger resource weight, is said to have control over the weaker member, i.e., the member with the smaller resource weight. The major assumption of CT is that each member of the triad will attempt to gain control over both of the other members if possible. If he cannot control both of the other members, he will attempt to control only one. Therefore, in the triadic types which do not contain an all powerful member, i.e., a dictator, coalitions will form. Which coalition will form is determined by the relative power of the members of the triad. For example, consider the Type 5 triad. Since A>B>C, player A is indifferent with respect to B and C as coalition partners because he can gain control of both of the other members by forming a coalition with either player B or player C. However, player B must form a coalition with player C if he is to gain control over both of the other members of the triad. An appraisal of player C's power reveals that he must form a coalition to gain control over one of the other members of the triad. Therefore, player C has no preference between player A and player B. As a result CT predicts that either AC or BC coalitions will form in the Type 5 triad.

Minimum Resource Theory

MRT is based on the assumption that the "parity norm" will be salient, i.e., "any participant will expect others to demand from a coalition a share of the payoff proportional to the amount of resources which they contribute to a coalition." (Gamson, 1961a, p. 376) As a result, each member of the triad will attempt to form the winning coalition to which he contributes the greatest share of the resources,

i.e., the "cheapest winning coalition." MRT also assumes that reciprocal partner preferences are necessary before a coalition will form. The combination of the parity norm and the requirement of reciprocal partner preferences results in predictions which are more precise than the predictions of CT. For example, the fact that in the Type 5 triad player A wishes to form a coalition with player C does not mean that AC coalitions are predicted in the Type 5 triad. Similarly, the fact that player B wished to form a coalition with player C does not mean that BC coalitions will form. The critical factor is which player does player C prefer as a coalition partner. Since player C would contribute a larger share of the resources to a BC coalition than he would to an AC coalition, and since both coalitions are winning coalitions, it is predicted that player C would prefer player B as a coalition partner. As a result, MRT predicts that BC coalitions will form in the Type 5 triad.

A comparison of CT and MRT reveals that there are situations in which only MRT predicts the power inversion effect. For example, consider the Type 5 triad. Although CT predicts that the "weakest" player (C) will be included in all coalitions, it does not predict that the "strongest" player (A) will be excluded from all coalitions. In fact, CT predicts that player A will be included in 50% of the coalitions. Therefore, the "weakness is strength" effect is predicted, but the "strength is weakness" effect is not. Thus by definition CT does not predict the power inversion effect in the Type 5 triad. On the other hand, MRT predicts that both the "strength is weakness" effect and the "weakness is strength" effect will be observed in the

Type 5 triad. Thias is, player A will not be the preferred coalition partner of either of the other two players, and player C will be the preferred coalition partner of both of the other two players. As a result, player A will not be included in any predicted coalitions, i.e., "strength is weakness", and player C will be included in every coalition, i.e., "weakness is strength." Therefore, the power inversion effect is predicted by MRT.

Minimum Power Theory

MPT is based on the assumption that the participants in a coalition situation utilize a rational strategy to maximize their control over the outcome. It is also assumed that the real power of each participant is accurately perceived by all of the participants in a given situation. The rational strategy which the subjects are assumed to utilize is based on the real power of the members of the triad. Real power as defined by MPT is different from power as defined by CT. That is, MPT utilizes the Shapely (1953) notion of pivotol power. In triadic coalition situations the pivotol power of an individual is equivalent to the number of winning coalitions which he may enter.

If the notion of pivotol power is utilized, only three power relationships can occur in the triad: (1) all three members are of equal power, i.e., any two members can coalace and control the outcome, (2) one member is all powerful, or (3) one member has veto power. MPT predicts that if all members of a triad are of equal power, then all possible coalitions will be equally likely; if one member of a

triad is all powerful, no coalition will form; and if one member of a triad has veto power, he will be included in every coalition. An examination of the Type 5 triad reveals that all three members of the triad are of equal power. Therefore, MPT predicts that all coalitions are equally likely in the Type 5 triad.

Anticompetitive Theory

AT was first suggested by Gamson (1964); however, it was based on the results of a series of studies by Vinacke and his students. (Vinacke, 1959, 1962; Bond & Vinacke, 1961; Uesugi & Vinacke, 1963; Vinacke, Crowell, Dien, & Young, 1966). Vinacke (1959) hypothesized that "female subjects might be much less concerned with winning and more oriented toward social and ethical considerations -- i.e., try to avoid an aggressive display of power and attempt rather to be 'fair' to everyone." (p. 344) This hypothesis and subsequent research lead Gamson (1964) to postulate that an "anticompetitive norm" exists and that as a result "coalitions will form along the lines of least resistance in bargaining." (p. 90) Therefore, Gamson's AT predicts that coalitions will form between players who are equal in resources.

An extension of AT (Phillips & Nitz, in press) suggests that the predictions of which coalitions will form should be based on the divisibility of the payoff as well as the initial distribution of resources. That is, if the payoff can be divided equally, the coalition which requires the least bargaining is between the members of the triad who have the smallest resource differences. On the other hand, if the payoff cannot be divided equally, the least bargaining

will be required for the coalition which includes those members of the triad who have the greatest resource difference. Therefore, if the payoff can be divided equally, coalitions will form between the members who are the most similar with respect to resources. If the payoff cannot be divided equally, coalitions will form between those members who are the most dissimilar with respect to resources. It is apparent that AT predicts that when the payoff is equally divisible AB and BC coalitions are equally likely in the Type 5 triad. On the other hand, if the payoff is not equally divisible, AC coalitions are predicted.

Evaluation of Theories

Reference to Table 1 indicates that the Type 5 triad (A>B>C, A<(B+C)) is the only triadic situation which differentiates between the four theories. That is, for the Type 5 triad CT predicts that AC and BC coalitions are equally likely, MRT predicts that BC coalitions will form, MPT predicts that all coalitions are equally likely, and AT predicts that if the payoff is equally divisible, AB and BC coalitions are equally likely and if the payoff is not equally divisible, AC coalitions will form. Most of the research on coalition formation has examined the Type 5 triad. As a result, the following comparison of the theories will concentrate on how well the data obtained from the research on Type 5 triads is predicted by each of the four theories. However, where it is deemed important, the data from other triadic types will be reported.

The early research on coalition formation in the triad

(Vinacke & Arkoff, 1957; Vinacke, 1959; Chaney & Vinacke, 1960; Bond & Vinacke, 1961) seemed to support CT. At the same time, there was a general refutation of MPT. However, the fact that there was a tendency for more BC coalitions than AC coalitions to form in the Type 5 triad could not be accounted for by CT. MRT, on the other hand, does account for this effect. Furthermore research subsequent to Gamson's (1961a) development of MRT (Vinacke, 1962; Uesugi & Vinacke, 1963; Chertkoff, 1966; Vinacke, Crowell, Dien, & Young, 1966; Cole & Phillips, 1967a, in preparation; Phillips & Nitz, in press; Cole, Nitz, & Phillips, in preparation) has shown support for MRT. That is, most of the research has shown some support for the hypothesis that the parity norm is salient in the coalition situation. Moreover, a power inversion effect has appeared in almost every study. Thus MRT has proven to be the most reliable theory which has been proposed to account for behavior in the coalition situation.

AT has been supported to some extent by most of the research which has examined feminine behavior in the coalition formation situation. (Vinacke, 1959, 1962; Bond & Vinacke, 1961; Uesugi & Vinacke, 1963; Cole & Phillips, in preparation; Cole, et. al., in preparation). The support for AT has been manifest in the strategy which seems to be employed by females. There is a consistant tendency for females to employ a strategy which results in a weaker power inversion effect than is obtained in the situations which use all male triads.

Research which has attempted to test AT as it relates to masculine behavior has concentrated on the Type 2 and Type 3 triads

(Phillips & Nitz, in press). The results of the Phillips and Nitz study supported MRT over AT; however, an indication that an "anti-competitive norm" may exist was noted.

Since AT has received sufficient support to indicate that an anticompetitive norm is operating in the coalition situation, it is necessary to account for the resulting effect. However, it is not felt that the effect of the anticompetitive norm is strong enough to necessitate a theory based on it. It is proposed that a better method of acknowledging the existence of an anticompetitive norm would be to extend MRT so that it accounts for the possibility that there are individuals who do not wish to strictly maximize their share of the reward. Instead, they desire to divide the reward as "fairly" as possible. Therefore, in those triads which include one or more individuals who play a strategy based on the anticompetitive norm, the coalitions which form may not be a function of the parity norm. They may be a function of the anticompetitive norm and in some cases, both norms combined. For example, consider the Type 5 triad in which the strategies of player A and player B are dictated by the parity norm and in which player C's strategy is a function of the anticompetitive norm. MRT predicts that players A and B will both prefer player C as a coalition partner. If the payoff can be divided equally, player C would prefer player B and a BC coalition would be predicted. However, if the payoff can not be divided equally, player C would prefer player A and an AC coalition would be predicted. In many situations this could account for those coalitions

which occur and are not predicted by MRT.

There are two major criticisms of MRT which are evident to the present writer. One criticism of MRT which can be made of most psychological theories, is that the predictions are too strong. This results from the fact that if MRT is strictly interpreted, only BC coalitions are predicted to form in the Type 5 triad. However, there have been no studies which have reported only BC coalitions. Two attempts to rectify this criticism, i.e., Chertkoff (1967) and Shelly and Phillips (1966) have proposed to do so by developing a mathematical model. Both the Shelly and Phillips model and the Chertkoff model are based on the assumption that the probability that a simultaneous reciprocal contact will occur is an important variable to consider when determining which coalitions will form. Both models have had some success but neither the Chertkoff model nor the Shelly and Phillips model was able to satisfactorily account for the coalitions which form.

The second major criticism of MRT is that the boundary conditions are too narrow. This is indicated by the fact that there are variables that weaken the power inversion effect which have not been taken into account by MRT. In order to extend MRT so that it will cover a wider range of situations, it is necessary to examine those variables.

One procedural variable which has weakened the power inversion effect is the use of cumulative score. (Vinacke, 1959, 1962; Kelley & Arrowood, 1960; Cole & Phillips, in preparation). The studies which have examined cumulative score had the subjects play a series

of games in which the score for each subject at any point in the series of games was the amount of the payoff that he had accumulated. The winner was the player who accumulated the most points over all games. It is suggested that the amount of the payoff that each subject had accumulated at any point in the series of games must be considered when the relative strengths of the members of the triad are determined. In all games after the first game the strength of each member of the triad is a combination of his assigned resources plus his accumulated rewards. Therefore, in the first game the power inversion effect is manifest by the propensity to form coalitions between the two members of the triad who are weakest with respect to assigned resources. However, as the series of the games progresses, the tendency is for coalitions to form between the two players who are behind in accumulated score (Vinacke, 1959, 1962). This indicates a continuance of the power inversion effect with the strength of each member of the triad being determined by his accumulated rewards rather than his assigned resource weight. Therefore, MRT can account for the effects of cumulative score by redefining the concept of resources.

Previously a <u>resource</u> has been defined as a weight assigned to each player in a game such that the distribution of the payoff is determined by some critical quantity of that weight. It is suggested that a given weight which is assigned to an individual player is a value on some <u>resource dimension</u>. The <u>total resources</u> of the players in a given situation consist of values on a combination of resource dimensions, i.e., <u>multiple resource dimensions</u>. Therefore, one of

the key variables which MRT must consider is the concept of multiple resource dimensions.

One manipulation which has removed the power inversion effect from the coalition situation is found in a study by Chertkoff (1966). Chertkoff used the "political convention paradigm"[4] for the study of coalitions in the triad. However, he manipulated the probability of future success by varying the probability that a coalition would win the election after it had won the nomination. In addition he made the payoff contingent upon winning the election. The Type 5 triad was examined in all conditions, i.e., A>B>C, A<(B+C). In all three experimental conditions, if player B or C won the nomination, he had a .5 probability of success in the national election. If player A won the nomination, his probability of winning the national election was .5, .7, or .9, depending upon the condition. A control condition was used in which the probability of future success was not a feature. In the control condition the power inversion effect was reported. However, in the conditions in which player A had a .5 or a .7 probability of future success the power inversion effect was weakened,

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[4]In the political convention paradigm each subject plays the part of a delegation chairman at a political convention. Each subject is assigned a given number of votes at the beginning of the convention. For each subject the object is to acquire as many "jobs" for his faction as he can. To acquire "jobs" the subjects must form a coalition which can win the nomination. The number of "jobs" that each subject acquires if he has entered into a winning coalition depends on the division of the "jobs" that the two subjects who formed the coalition agree upon. If a subject is not in a winning coalition, he receives no "jobs" for his faction. (Gamson, 1961b)

i.e., the distribution of preferred coalition partners was not different from what would be expected by chance. In the condition in which player A had a .9 probability of future success the power inversion effect was nonexistant. That is, a "strength is strength" effect was reported. Moreover, as the probability of future success increased the parity norm became more salient. This was indicated by the tendency for the player with the highest probability of future success to demand and receive a larger share of the payoff.

An attempt to explain why the results vary when the probability of future success is manipulated leads to a differentiation of probabilistic and deterministic situations. Probabilistic situations are those in which no unit or combination of units will win with probability one. Deterministic situations are those situations in which some unit or combination of units will win with probability one. Prior to Chertkoff's study the theories and research had all focused on the deterministic situation. However, Chertkoff's study extended the research on coalition formation to the probabilistic situation.

Subsequent to Chertkoff's study only one study (Vinacke, Lichtman, & Cherulnik, 1967) has examined the differential effects resulting from the probabilistic and deterministic nature of the coalition formation situation. The major finding of the Vinacke, et. al., study was that there is a propensity to "gamble" in the probabilistic situation, i.e., there is a tendency to play without forming a coalition. Moreover, the propensity for a subject to play the game alone increases as the probability that he will win alone increases.

As a result of the research which has examined the probabilistic

situation, it is apparent that behavior in the probabilistic situation differs from behavior in the deterministic situation. Therefore, any theory which offers a comprehensive explanation of behavior in the coalition formation situation must consider the probabilistic situation as well as the deterministic situation.

Research on coalition formation has consistently reported the power inversion effect in those situations for which it is predicted. However, as has been noted, Chertkoff (1966) replaced the power inversion effect with the "strength is strength" effect by making the payoff contingent on chance. That is, rather than designing the situation so that any coalition would win, Chertkoff designed the situation so that each coalition had a different probability of winning.

A consideration of the possible effects of the probabilistic and deterministic aspects of the coalition situation indicated that two types of coalition situations must be accounted for. The first type was the deterministic situation and was defined as those situations in which some unit or combination of units will win with probability one. The second type was the probabilistic situation and was defined as those situations in which no unit or combination of units will win with probability one. The present study extended the theories on coalition formation from the deterministic situation which has been the focus of previous coalition theories to the probabilistic situation which has been virtually ignored.

Extension of MRT

As a base for a theory that is applicable to the probabilistic situation the assumptions and definitions of MRT were adopted. In essence this means that the parity norm and the requirement of reciprocal partner preferences are presumed to be in effect in the probabilistic situation as well as in the deterministic situation.

However, the "cheapest winning coalition" is not a useful concept in the probabilistic situation, since, in the probabilistic situation there is no "cheapest winning coalition." This follows from the definition of the probabilistic situation which rules out any *a priori* "winning coalitions" as defined by Gamson (1961a), i.e., a coalition with sufficient strength to dictate the terms for the distribution of the payoff. Since there can be no "winning coalition", there can be no "cheapest winning coalition."

The major assumption which was added to MRT so that it would predict behavior in the probabilistic situation was that in all situations the members of a triad will form the coalition which maximizes their chance of winning. Therefore, in the probabilistic situation the parity norm, although salient, has little effect in determining which coalition will form. Rather, the uncertainty of the situation fosters a need for security which will be designated the "security norm".

Since any coalition will win with probability one in the deterministic situation, the members of the coalition will be secure, i.e., will win, regardless of which coalition is formed. In the deterministic situation the only manifestation of the security norm is that the members of the triad will form coalitions. The coalition that is preferred will be a function of the parity norm. As a result, if for any two possible coalitions, the probability of their winning is one, each player will prefer the coalition to which he contributes the largest share of the resources.

The probability of winning is what determines the strength of

the players in a probabilistic situation and no player or coalition is guaranteed to win. Therefore, the security norm will be salient in the probabilistic situation and will influence preferred coalitions. If coalitions have different probabilities of winning, each player will prefer that coalition which maximizes his chance of winning. In order to maximize his chance of winning each player must form a coalition with the stronger of the other two players. Thus, it is apparent that the strong member of the triad will be included in all preferred coalitions in the probabilistic situation while the weak man will be the least preferred coalition partner. This means that in the probabilistic situation the "strength is strength" effect is predicted as opposed to the power inversion effect which is predicted in the deterministic situation.

Even though the security norm will be salient in the probabilistic situation with respect to the preferred coalition, the parity norm will remain salient for the division of the payoff. This hypothesis is made because of the reasoning that the greater preference for the strong member of the triad as a coalition partner will give him a better bargaining position. Therefore, he will demand and receive the largest share of the payoff.

Hypothesis

As a result of the data which have been collected in the past few years, it was predicted that in the deterministic situation which allowed coalitions the power inversion effect would be observed. However, it was predicted that in the probabilistic situation which allowed coalitions the "strength is strength" effect would be observed.

That is, in the probabilistic situation each member of the triad will wish to form that coalition which maximizes his chance of winning. Therefore, he will prefer that coalition which maximizes the strength of the coalition relative to the isolate. As a result the stronger of the other two members of the triad will be the preferred coalition partner and the "strength is strength" effect will appear.

A further prediction was that in both the deterministic and probabilistic pure truel situations, and the coalition situations in which no coalitions formed, the power inversion effect would be observed. This followed from the assumption that the players would attempt to eliminate those players who had the best chance to win, since by this strategy each player would maximize his chance of winning. As a result the weaker attack choice[5] would be attacked the least and the stronger attack choice[6] would be attacked the most, i.e., power inversion. The final prediction was that the parity norm would be salient in both situations which allowed coalitions.

Specifically, the hypotheses tested in the present research were:

(1) In the probabilistic coalition formation situation each player prefers the stronger of the other two players as a coalition partner, resulting in AB coalitions being the most frequent.

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[5]The weaker attack choice for player C is player B, and the weaker attack choice for players A and B is player C.

[6]The stronger attack choice for player A is player B, and the stronger attack choice for players B and C is player A.

(2) In the deterministic coalition formation situation each player prefers the weaker of the other two players as a coalition partner, resulting in BC coalitions being the most frequent.

(3) In the pure truel situations and those games in which coalitions were permitted but not formed the power inversion effect would appear in the following manner. First, there would be a propensity for each player to attack the stronger of the other two players, and second, player A would win significantly fewer games than player B, and player B would win significantly fewer games than player C.

(4) The parity norm would be evident in both the probabilistic and deterministic situations which allowed coalitions. That is, the division of the payoff would tend to approximate the ratio of the resources contributed to the coalition by its members.

Method

Subjects. The subjects were 255 male undergraduate volunteers who received course credit for their participation. In addition, they were informed that they would have a chance to win $10 if they participated in the experiment.

Apparatus. The apparatus for the game was 45 white poker chips; three wooden tokens, one inscribed with an A, one inscribed with a B, and one inscribed with a C; and a die. Plain white 3" X 5" scratch pads were used for all communication, and clipboards were used to allow the communication to remain secret.

Game Design. The structure of the basic game was as follows. Each of the players began the game with 15 chips. The position that each subject played was determined by chance, i.e., each subject drew a token (marked either A, B, or C) from a hopper and played the game in the position indicated on the token. The rules of the game required that each player take away a given number of chips from one of the other two players on each move. Player A took away 4 chips, player B took away 3 chips, and player C took away 2 chips. All of the chips that were removed were taken out of the game and did not belong to any of the players. Each player wrote down the letter of the player he wished to attack and gave the message to the experimenter on each move. At no time was a player's choice known before every player had made his choice, i.e., the moves in the game were simultaneous. The players were told who had attacked whom after the experimenter had received the choices from all of the players.

Procedure. Four conditions were examined: (Dc) a deterministic

game which allowed coalitions, (D) a pure truel deterministic game, (Pc) a probabilistic game which allowed coalitions, and (P) a pure truel probabilistic game. The same basic truel game was used to keep the conditions as similar as possible while varying enough to allow the game to be defined as either deterministic or probabilistic.

Eighty-five triads participated in the experiment. Five triads (one Dc, one D, two Pc, and one P) were discarded either because the subjects had previous knowledge about the experiment or because two of the subjects in a triad knew each other. Therefore, there were twenty triads in each condition. Each triad played one game. Communication was limited, i.e., all messages were written and directed toward the experimenter. A pre-game questionnaire was administered to provide a measure of the subjects acceptance of the implied power structure. (See Appendix A for the details of the pre-game questionnaire)

In the Dc and D conditions, each player took chips away on every move. In the Pc and P conditions, whether a player took chips away or not was determined by chance, i.e., each player rolled a die after he had decided which player to attack, if the die came up even he took the chips away, if the die came up odd he did not take the chips away. This meant that each player had a 50% chance of taking chips away on each move in the Pc and P conditions.

In the Dc and Pc conditions each subject was given a chance to form a coalition prior to the actual play of the game. They were asked to indicate on a form provided (see Appendix A), whether they

wished to form a partnership or not, and if so with whom. If two of the subjects indicated a reciprocal preference, they were given two minutes in another room to reach an agreement on how to divide the payoff. The payoff was a $10 prize which the winner or winning coalition in each game had a chance to win in a raffle. If no agreement could be reached in that two minutes, the game was played as a truel.

If an agreement was reached, the partnership started the game with 15 chips and the power to take away the number of chips which was equal to their combined power, i.e., an AB partnership could take away 7 chips, an AC partnership could take away 6 chips, and a BC partnership could take away 5 chips. This meant that in the Dc condition any partnership was guaranteed to win. In the Pc condition, although a partnership did have a better chance to win than a lone player, a partnership was not guaranteed to win. For example, if an AB partnership formed in the Pc condition it had a 50% chance of removing 7 chips while C, the isolate, had a 50% chance of removing 2 chips. The expected number of trials for an AB partnership to eliminate player C was 3 while the expected number of trials for C to eliminate an AB partnership was 8.

In all four conditions the game was over when only one player or partnership had chips remaining. The winner or winning partnership received a chance to win $10 in a raffle.

After the game was completed all of the subjects were requested to fill out a post-game questionnaire. (See Appendix A)

In addition, to ascertain whether there was any effect due to the subjects perception of the experimenter, the subjects were asked to evaluate the experimenter on a 19 scale semantic differential. (See Appendix A) The subjects were also asked to complete the "Survey of Interpersonal Values" (Gordon, 1960). This was utilized to determine whether there were any effects that were due to personality differences.

Results

Results Relevant to Hypothesis 1

Hypothesis 1 predicted that in the Pc condition each player would prefer the stronger of the other two players as a coalition partner resulting in AB coalitions being the most frequent.

Table 2 presents a who-to-whom matrix for offers in the Pc condition. An analysis by chi-square supported the hypothesis that the stronger of the other two players would be the preferred coalition partner in the probabilistic situation ($X^2 = 8.43$, $p<.05$). Further support for the "strength is strength" hypothesis was observed in the significant difference in number of offers received by each player. ($X^2 = 11.29$, $p<.01$). Player A received more offers than player B and player B received more offers than player C. Since only three coalitions were formed (2 AB coalitions and 1 BC coalition), a test of the second part of hypothesis 1, i.e., AB coalitions will be the most frequent, was not feasible.

Results Relevant to Hypothesis 2

Hypothesis 2 predicted that in the Dc condition, each of the players would prefer the weaker of the other two players as a coalition partner, resulting in BC coalitions being the most frequent.

Table 2 presents a who-to-whom matrix for offers in the Dc condition. An analysis by chi-square indicated that there was no significant difference from chance expectancy with respect to who preferred whom as a coalition partner ($X^2 = 3.25$, $.50>p>.30$). Further refutation of the power inversion hypothesis was observed in

the distribution of offers received, i.e., the distribution of offers received did not differ from chance expectancy. An examination of type of coalitions formed revealed 6 AB, 2 AC, and 2 BC coalitions. Although an accurate statistical evaluation of the situation is not feasible because of the small number of coalitions that were formed, it seems clear that the power inversion hypothesis was not supported.

The data in Table 2 suggested that there was a tendency for the preferred coalition partner to be the same in the Pc and Dc conditions. Since the Pc and Dc conditions were independent, the coalition partner preference in the Dc condition was compared with the coalition partner preference in the Pc condition by computing an F-ratio of the chi-squares (Lindquist, 1956, p. 39). The F-ratio implied that there was no significant difference in preferred coalition partner in the Pc and Dc conditions (F=2.59, NS). Chi-squares to test the hypothesis that each player makes the same number of offers in the Pc and Dc conditions revealed a significant difference between players in the Pc condition (X^2 = 7.23, $p<.05$), but no significant difference between players in the Dc condition (X=.37, $.90>p>.80$). An F-ratio of chi-squares indicated that there was a significant difference between the distribution of number of offers made in the Pc condition and the distribution of number of offers made in the Dc condition (F=9.62, $p<.05$). Although there was no significant difference between the total number of offers made in the Dc condition and the total number of offers made in the Pc condition, there was a significant difference between total number of coalitions formed in the Pc condition and total number of coalitions formed in the Dc condition (X^2=3.88, $p<.05$).

Table 2

Who-to-whom matrix for offers in the Pc and Dc conditions

		Pc					Dc				
		Recipient					Recipient				
		A	B	C	T_1	X^2	A	B	C	T_1	X^2
Offerer	A	0	5	0	5	5.00**	0	8	3	11	2.27
	B	7	0	2	9	2.78	8	0	5	13	.69
	C	10	7	0	17	.65	8	6	0	14	.29
						8.43**					3.25
	T_2	17	12	2	31		16	14	8	38	
		$X^2_{T_1} = 7.23$**					$X^2_{T_1} = .37$				
		$X^2_{T_2} = 11.29$*					$X^2_{T_2} = 2.73$				

$X^2_{T_3} = 1.67$

*p<.01

**p<.05

$X^2_{T_1}$ tests the hypothesis that each player makes the same number of offers. (df=2)

$X^2_{T_2}$ tests the hypothesis that each player received the same number of offers. (df=2)

$X^2_{T_3}$ tests the hypothesis that the total number of offers in the Dc condition equals the total number of offers in the Pc condition. (df=1)

Results Relevant to Hypothesis 3

Hypothesis 3 predicted that in the pure truel situations and in those games in which coalitions were permitted but did not form, the power inversion effect would appear in the following manner. First there would be a propensity for each player to attack the stronger of the other two players; and second, player A would win significantly fewer games than player B, and player B would win significantly fewer games than player C. Table 3 presents the frequency with which attacks were directed toward the stronger and weaker player for conditions Dc, D, Pc, and P on each trial.

To test hypothesis 3 adequately would have required that the relative strengths of each member of each triad be determined for each trial. To accurately determine the relative strengths of each member of each triad on a trial by trial basis would have required that the number of chips that the players had remaining on a given trial be taken into consideration. Since such an analysis would have been prohibitive, the analysis of the data on a trial by trial basis was conducted as if the number of chips that the players had remaining on any given trial had no effect on the relative strengths of the players. Therefore, the analysis of the attack data for initial trial was the only analysis which was based on an accurate assessment of the disparity of relative strengths. For all other trials the initial strength of each player was taken as his strength on that trial.

An examination of the data in Table 3 revealed a significant power inversion effect on the initial trial in each condition, i.e.,

Table 3

Table 3

Frequency with which attacks are directed toward the stronger and weaker players for each condition on each trial[1].

	Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dc	Stronger	26	20	16	13	4									
	Weaker	4	10	14	11	2									
	X^2	16.13***	3.33	.13	.17	--									
D	Stronger	41	39	33	31	9									
	Weaker	19	21	27	17	6									
	X^2	8.07**	5.40*	.60	4.08*	.73									
Pc	Stronger	39	36	31	35	29	30	26	21	11	10	5	9	1	2
	Weaker	12	15	20	16	22	18	13	15	8	3	5	1	2	1
	X^2	14.29***	8.65**	2.37	7.08**	.96	3.00	4.33*	1.00	.58	1.87	--	6.40*	--	--
P	Stronger	38	37	39	38	31	35	21	12	11	5	7			
	Weaker	22	23	21	22	26	19	21	12	7	4	2			
	X^2	4.27*	3.27	5.40*	4.27*	.44	4.74*	--	--	.89	--	--			
	X^2_a= df=3	6.28	1.00	1.77	1.50										
	X^2_b= .18 df=2														
	X^2_c= .06 df=1							1.81		.40		.04			

*p<.05
**p<.01
***p<.001

Note: X^2_a tests the hypothesis that the distribution of attacks is the same in all conditions on the first four trials.

X^2_b tests the hypothesis that the distribution of attacks is the same in the D, Pc, and P conditions on trial 5.

X^2_c tests the hypothesis that the distribution of attacks is the same in the Pc and P conditions on trials 6-9.

[1]Only those triads which did not form coalitions were examined in the Dc and Pc conditions.

the stronger player was attacked more often than the weaker player. A trial by trial analysis revealed that there was no significant power inversion effect on any trial after the initial trial in the Dc condition. In the D condition there was a significant power inversion effect on trials 2 and 4. In the Pc condition there was support for the power inversion hypothesis on trials 2, 4, 7, and 12. In the P condition the power inversion hypothesis was supported on trials 3, 4, and 6.

To further test the power inversion hypothesis a sign test was used to examine all trials for each condition. If the strong man was attacked more than the weak man a plus was assigned to the trial. In the Dc and D conditions, there were five pluses in five trials. The probability that this would have occurred by chance was less than .05. In the Pc condition there were 12 pluses in 14 trials ($p<.01$), and in the P condition there were 9 pluses in 11 trials ($p<.01$)

To compare the distribution of attacks between the four conditions, a chi-square was computed on all trials in which the expected attack frequencies were greater than 5. (see Table 3) This meant that all four conditions were compared on the first four trials, conditions D, Pc, and P were compared on trial 5, and conditions Pc and P were compared on trials 6-9. With the exception of the initial trial ($X^2= 6.28$, $.10>p>.05$) the chi-squares revealed no indication that there was any difference between conditions with respect to the distribution of attacks. When the initial attack data for the combined Dc and Pc conditions were compared with the initial

attack for the combined P and D conditions, a significant difference was observed (X^2= 4.95, p<.05, df=1).

The second part of hypothesis 3, i.e., that player A will win fewer games than player B and that player B will win fewer games than player C, was partially supported by the data. Table 4 presents the number of games won by each player in each condition. An analysis by chi-square revealed support for the "weakness is strength" hypothesis in the Dc condition (X^2= 8.33, p<.02), however, the power inversion effect was not reported in any condition. An examination of Table 4 indicated that there mignt be a difference between coalition and no-coalition situations in the distribution of games won. Therefore, F-ratios of the chi-squares were computed between the Dc and D conditions, the Dc and Pc conditions, the Pc and P conditions, and the D and P conditions. The resulting F-ratios revealed a significant difference between the Dc and D conditions (F= 69.42, p<.01) and no other significant differences. The significant difference between the Dc and D condition and the lack of a significant difference between the Pc and Dc conditions or the D and P conditions was taken as support for the suggestion that a difference may exist between the conditions which allowed coalitions and those that did not allow coalitions. As a result the data from the Pc and Dc conditions were combined and the data from the P and D conditions were combined. A chi-square on the combined data indicated that there was a non-significant tendency for the power inversion effect to appear in the truel situations which allow coalitions (X^2= 5.82, .05<p<.10). However, there was apparently no power inversion effect

Table 4

Games won by players A, B, and C when not in a coalition

Condition	A	B	C	X^2
Dc	2	0	7	8.33**
D	5	6	6	.12
Pc	2	6	6	2.28
P	7	5	7	.42
				11.17
Combined Data				
Dc & Pc	4	6	13	5.87
D & P	12	11	13	.17

*p<.05
**p<.02
***p<.01

F-ratios

Dc/D	69.42***
Dc/Pc	3.65
Pc/P	5.43
P/D	3.50
Dc & Pc/D & P	9.81*

in the pure truel situations if number of games won was the only data considered. An F-ratio was computed to test the hypothesis that the distribution of games won in the combined Dc and Pc conditions is the same as the distribution of games won in the P and D conditions. The hypothesis was rejected ($F= 9.81$, $p<.05$).

Results Relevant to Hypothesis 4

Hypothesis 4 states that the "parity norm" would be evident in both the probabilistic and deterministic situations which allowed coalitions. That is, the division of the payoff would tend to approximate the ratio of the resources contributed to the coalition by its members.

An analysis of the desired share of the payoff (desired payoff), what each player expected the other player to desire (expected payoff), and the final agreement as to the division of the payoff (final payoff) rejected the hypothesis that the parity norm would be salient in both the Dc and Pc conditions. Table 5 presents the frequency with which the parity split and equal split were reported as the desired payoff and the expected payoff as well as the frequency with which the final payoff approximated the parity split or the equal split. Fifty-fifty splits were classified as equal splits, and the parity splits were classified as those splits which were not 50/50 splits and in which the member of the coalition who contributed the most resources received the larger share of the payoff. There were no cases of non 50/50 splits in which the member of the coalition who contributed the most resources received the smaller share of the payoff. Chi-squares computed on this data revealed that with the

Table 5

Frequency with which the desired share of the payoff (desired payoff), the share of the payoff the other player is expected to desire (expected payoff), and the final division of the payoff (final payoff) approximated the parity split or was an equal split in the Pc and Dc conditions.

	Dc			Pc		
	Parity split	Equal split	X^2	Parity split	Equal split	X^2
Desired payoff	6	32	17.79*	8	23	7.25*
Expected payoff	5	33	20.63*	7	24	9.19*
Final payoff	2	8	3.60	2	1	-----

*p<.01

exception of the final payoff there was a significant tendency ($p<.01$) for an equal split in both the Dc and Pc conditions. Moreover, there was a non-significant tendency toward an equal split of the final payoff in the Dc condition ($X^2=3.60$, $.10>p>.05$). There was an insufficient amount of data to compute a chi-square for Pc-final payoff.

Results Relevant to Perceived Relative Power

To ascertain whether the subjects perceived player A to be the strongest player before the game began, each subject was asked to fill out a pre-game questionnaire. The questionnaire asked two questions: (1) "Which player do you think has the best chance to win?", and (2) "Which player would you choose to be, if you had your choice?" A significant positive correlation between the answers to the two questions in all conditions was obtained ($r=.79$ in Dc and D conditions, .59 in the Pc condition, and .80 in the P condition, $p<.0005$ for all conditions). Therefore, only question number 1 was used to determine which player was preferred prior to the game. A similar question on the post-game questionnaire was analyzed to determine which player was preferred after the game had been played. Table 6 presents the frequency with which player A was the preferred position before and after the game was played. Analysis by chi-square indicated that player A was also the preferred position after the game had been played in conditions Dc, Pc, and P.

Since the post-game data were not independent of the pre-game data, a three factor analysis of variance design with repeated measures was employed (Weiner, 1962, p. 337) to test the pre-game post-game changes in position preference. Table 7 presents the summary table for the analysis of variance. There was a significant effect due to the

Table 6

Frequency with which A was the preferred player or one of the other players was the preferred player in each condition before and after the game was played.

	pre-game			post-game		
	A	Other	X^2	A	Other	X^2
Dc	50	10	67.50*	34	26	24.07*
D	42	18	36.30*	21	39	3.20
Pc	56	4	86.70*	36	24	39.20*
P	46	14	50.70*	31	29	22.76*

*p<.001

note: Expected cell frequencies are A=20, Other=40 for the pre-game data and A=15, Other=45 for the post-game data.

The differential expected frequencies result from the fact that a "no preference" choice was offered on the post-game questionnaire and was not offered on the pre-game questionnaire.

deterministic vs. probabilistic manipulation ($F= 3.59$, $p<.05$), and the coalition vs. no-coalition manipulation ($F= 10.59$, $p<.01$) as well as a significant difference between the pre-game and post-game data ($F= 77.70$, $p<.001$). There were no significant interactions between these variables.

Table 8 presents the means and standard deviations for the data used in the analysis of variance. An examination of Table 8 reveals that (1) there was a tendency to prefer player A more in the probabilistic situation than in the deterministic situation both before and after the game was played, (2) there was a tendency to prefer player A more in the coalition situation than in the no-coalition situation both before and after the game, and (3) there was a tendency to prefer player A more before the game than after the game in all conditions.

Results Relevant to Individual Differences

To ascertain the effects of the personality variables that were measured, a product-moment correlation was computed between each of the six scales on the personality inventory and the dependent variables in each of the four experimental conditions. Three out of 156 correlations computed were significant, i.e., in the Pc condition "recognition" was negatively correlated with winning ($r= -.37$, $p<.003$) as well as with amount won ($r= -.34$, $p<.009$) and "independence" was positively correlated with the amount won ($r= .27$, $p<.039$). Table 9 presents the correlations between the dependent variables and the individual difference measurements for all conditions. The small number of significant correlations between the dependent variables and

Table 7

Summary of the analysis of variance on the preferred playing position before and after the game is played.

Source	SS	df	MS	F
Between Subjects	63.97	239		
A(Deter. vs. Prob.)	1.01	1	1.01	3.95*
B(Coal. vs. no-coal.)	2.70	1	2.70	10.59**
AB	.08	1	.08	.29
Subject within groups	60.18	236	.26	
Within Subjects	44.00	240		
C(Pre. vs. Post)	10.80	1	10.80	77.70***
AC	.01	1	.01	.06
BC	.00	1	.00	.00
ABC	.21	1	.21	1.50
C X Subj. Within groups	32.98	236	.14	

*p<.05 **p<.01 ***p<.001

Table 8

Means and standard deviations for the pre and post game preferences of player position[a]

	Pre-Game				Post-Game			
	Deterministic		Probabilistic		Deterministic		Probabilistic	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Coalition	.833	.373	.933	.251	.567	.494	.600	.490
No Coalition	.700	.458	.767	.423	.350	.476	.517	.500

[a]N = 240 60 replications per cell

the personality traits which were measured was accepted as an indication that those individual differences which were measured had a very slight effect on either the strategies which were employed in the game or the outcome of the game. A further indication of the lack of a meaningful effect due to individual differences was obtained from the analysis of the 19 scale semantic differential with which the subjects were asked to evaluate the experimenter. (See Appendix A) A principal-axis factor analysis with a varimax rotation (Williams, 1967) collapsed the 19 scales to three factors, i.e., Factor 1, sociability; Factor 2, capability; and Factor 3, emotionality. (See Appendix B) An examination of the correlation of each of the three factors with the dependent variables (Table 9) revealed that 1 out of 78 correlations was significant, i.e., Factor 3 correlated negatively with who was attacked in the D condition ($r = -.29$, $p < .031$). Because of the virtual lack of observed effects due to individual differences, there was no attempt to correct for those effects in the analyses of the data.

Table 9

Correlations between the dependent variables and the individual difference measurements in the Dc, D, Pc, and P conditions

		Personality Inventory*						Experimenter Evaluation**		
		S	C	R	I	B	L	1	2	3
Dc	Player	-.08	.20	.05	-.24	-.06	.10	-.15	.08	.00
	Preferred partner	.01	.16	.00	-.03	-.06	-.05	-.12	-.10	-.22
	Desired share	.02	.13	.01	-.02	-.07	-.05	-.11	-.11	-.21
	Expected share	.01	.18	.01	-.05	-.06	-.07	-.13	-.07	-.23
	Final share	-.02	-.03	.00	.09	.02	-.06	.00	.00	-.12
	Attacked	-.03	-.03	-.10	.19	.01	-.10	.10	.13	-.17
	Coalition	-.08	.09	.05	.02	-.15	.06	-.05	.07	-.17
	Won-Lost	-.01	-.06	.14	-.02	-.06	.02	-.08	-.01	.00
	Amount won	-.02	-.01	.15	-.04	-.07	.04	-.07	-.03	.09
D	Player	.01	-.10	.08	-.04	.02	-.07	.15	.23	-.04
	Attacked	-.10	-.10	-.11	-.11	.13	.00	-.29[d]	-.24	.01
	Won-Lost	-.13	-.13	-.14	.11	.14	.06	-.04	-.09	.07
	Amount won	-.13	-.13	-.14	.11	.14	.06	-.04	-.09	.07
Pc	Player	.18	-.15	-.06	.02	.06	.06	-.04	-.22	.11
	Preferred partner	.05	-.05	-.21	.04	.22	-.08	-.12	-.20	-.06
	Desired share	.03	-.03	-.21	.04	.22	-.07	-.11	-.19	-.07
	Expected share	.03	-.07	-.22	.06	.24	-.08	-.12	-.21	-.04
	Final share	-.07	.21	-.21	.06	.12	-.11	-.08	.05	-.21
	Attacked	-.09	.03	.07	.03	-.17	.14	-.03	.00	-.01
	Coalition	-.13	.13	-.09	.04	.05	-.01	.01	.03	-.21
	Won-Lost	-.06	.20	-.37[a]	.25	.21	-.25	.05	-.03	.17
	Amount won	-.04	-.12	-.34[b]	.27[c]	.20	-.25	.07	-.04	.22
P	Player	.15	-.14	.07	.16	-.15	-.03	-.07	-.10	-.07
	Attacked	.01	.08	.02	-.02	-.04	-.01	.13	.20	-.04
	Won-Lost	.01	-.07	-.07	.05	.08	.08	.05	.13	-.05
	Amount won	.01	-.07	-.07	.05	.08	.08	.05	.13	-.05

a $p<.003$ 2-tailed
b $p<.009$ 2-tailed
c $p<.039$ 2-tailed
d $p<.031$ 2-tailed

*S=Support C=Conformity R=Recognition I=Independence B=Benevolance L=Leadership

**Factor 1= Sociability
Factor 2= Capability
Factor 3= Emotionality

Discussion

Implications Relevant to Coalition Research

The main hypothesis of this study was that the power inversion effect, which has been reported in previous coalition research, would be replaced by a "strength is strength" effect in the probabilistic coalition formation situation. The results with respect to preferred coalition partner in the Pc condition supported the main hypothesis. (Table 2) However, contrary to what was expected, the power inversion effect was not observed in the control condition, i.e., the Dc condition. In fact, although it was not significant, the distribution of preferred partner choices in the Dc condition reflected a "strength is strength" effect. Furthermore, there was no significant difference between preferred coalition partner in the Dc and Pc conditions. Considering the data, it is apparent that a slight "strength is strength" effect was obtained in the Dc condition

Since the results of the Dc condition contradict MRT predictions for the deterministic situation, it is necessary to consider the possible determinants of the effects that were observed. In the Dc condition there was a minimal winning coalition for each triad and a cheapest winning coalition for each member of each triad. Thus, the Dc condition clearly fell within the boundary conditions of MRT. Therefore, the winning coalition to which he contributed the greatest share of the resources should have been preferred by each player in the Dc condition. It has been noted that such was not the case. In fact, there is some indication that the preferred coalition was

that coalition which controlled the most resources, i.e., the coalition which is predicted for the probabilistic situation. This, added to the fact that the parity norm was not salient (Table 5), would seem to question the applicability of MRT to situations based on a deterministic truel and in which coalitions are allowed.

It was not only the predictions of MRT, however, on which the expectations for the Dc condition were predicted. Cole and Phillips (in preparation) supported the predictions of MRT in a study which utilized a paradigm based on the deterministic truel. Moreover, they obtained the power inversion effect in both preferred partner choices and final coalitions formed and the parity norm was salient. As a result of the contradictions between the data obtained in the present study and the Cole and Phillips study, the procedures of the two studies were compared. The comparison resulted in the following theory as to why the power inversion effect was not reported in the Dc condition of the present study.

The proposed theory is based on the divisibility of the salient payoff. The major difference between the present study and the Cole and Phillips study appears to be the saliency of the experimenter determined payoff. Cole and Phillips required that each triad play three games with a $10,000 play money payoff for each game. The winner of the series of games was the player who accumulated the most money over the three games. Therefore, the experimenter determined payoff, i.e., the $10,000 in play money, was extremely salient. That is, winning the series of three games depended upon the amount

of the payoff that each player could obtain in each game. Im the present study each triad played only one game. The payoff for the present study was the chance to win $10 in a raffle (to take place in the future). Each winning player or coalition had one chance in eighty of winning the raffle and thus receiving the payoff. Since the probability of receiving the payoff after winning the game was only 1/80, and the recipient of the payoff would not be known for approximately two months, the subjects did not believe that they would be lucky enough to obtain the monetary payoff.[7] Therefore, in the present study the salient payoff was not the experimenter determined payoff. Instead it was the satisfaction of winning the game.

In the Cole and Phillips study it was possible to accept less than half of the payoff for each game and still win the series of games. Therefore, winning just one game was not important. What was important was to try to form a coalition with the player who would offer the best deal. As a result the parity norm was salient, the weaker of the other two players was the preferred coalition partner, and the predictions of MRT were supported.

On the other hand, in the present study the salient payoff, i.e., the satisfaction of winning the game, was of necessity shared equally. Therefore, having decided to form a coalition, and thus,

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[7]Informal discussions with the subjects after the game had been played tend to support this reasoning.

having decided to accept an equally shared payoff, the decision to split the $10 equally was merely a convenient method of getting the bargaining session out of the way. Since any coalition would win with probability one, and the parity norm was not applicable, it is suggested that once a player had decided to form a coalition, the partner that he selected was chosen at random.

The preceding argument offers a feasible interpretation of the results that were obtained in the Dc condition. Moreover, it reveals that although some of the results of the present study were not anticipated by the extended version of MRT, they were not inconsistent with that theory. It should be noted, however, that further research will be necessary to test the proposed interpretation.

At the present time the argument that the results of the Pc condition are a function of the payoff as well as the probabilistic nature of the game cannot be refuted. Nevertheless, it is proposed that the divisibility of the payoff does not effect the results of the probabilistic situation. Instead, the security norm is salient throughout the contact process, thus, the anticipated payoff will have no effect on coalitions or contacts. Some support for this hypothesis results from the non-significant tendency for the strong man to be preferred more as a coalition partner in the Pc condition than in the Dc condition. However, the hypothesis that the security norm is the salient determinent of preferred coalition partner in the probabilistic situation will require further research.

The slight "strength is strength" effect in the Dc condition

weakens the support for the hypothesis that the "strength is strength" effect is a function of the probabilistic situation. Because of the results in the Dc condition, an adequate test of the hypothesis that the "strength is strength" effect is a function of the probabilistic situation has yet to be conducted. Moreover, the hypothesis that the power inversion effect is a function of the deterministic situation will require further research. The fact remains that the probabilistic condition of the present study, Chertkoff's (1966) study, and the Vinacke, et. al. (1967) study, are the only studies which have utilized a probabilistic game in a triadic coalition formation situation. Chertkoff's study and the present study, obtained a statistically significant "strength is strength" effect, and Vinacke, et. al., did not report data which allows the "strength is strength" hypothesis to be examined. All of the other studies dealing with coalition formation have been deterministic and virtually all of them have reported the power inversion effect. In addition, none of them have obtained a significant "strength is strength" effect. Therefore, it is argued that research to date indicates that the "strength is strength" effect and the power inversion effect are a function of the probabilistic-deterministic nature of the situation.

Unlike previous studies which have reported that coalitions were formed virtually every time that they were allowed, the present study obtained only 13 out of a possible 40 coalitions. There are indications that the small number of coalitions formed was partially

an artifact of (1) the requirement that reciprocal contacts had to be made before coalitions could be formed, and (2) the requirement that only one attempt to form a coalition was permitted per game. However, the differential number of coalitions in the Pc and Dc conditions indicates that there is another factor that has some effect on number of coalitions formed. The results of the Vinacke, et. al., (1967), study suggest that such a factor is the tendency for the subject to "gamble", to risk winning on his own. The small number of coalitions formed in the present study may also have been a function of the tendency to gamble. The reason that significantly fewer coalitions were formed in the Pc condition than in the Dc condition apparently rests on the differential propensity for player A to gamble in the probabilistic and deterministic games. A non-significant tendency for player A to gamble more in the Pc condition than in the Dc condition was noted. This probably resulted from the fact that in the Pc condition player A had a chance to win if a coalition formed against him while in the Dc condition, a BC coalition would win with probability one. Therefore, in the Dc condition player A had to take into account the possibility that the other two players could form a coalition and leave him the loser.

Implications Relevant to Truel Research

Shubik's (1954) theory that the power inversion effect would appear in the pure truel situation was partially supported. That is, in the present study the stronger player is the more frequently

attacked player and the weaker player is the less frequently attacked player.[8] (Table 3) However, the hypothesis that player A would win significantly fewer games than player B and that player B would win significantly fewer games than player C was not supported. (Table 4)

Shubik anticipated the possibility that the strong man could win regardless of the precentage of the time that he was attacked. Moreover, he noted that "if the disparity of relative strengths is great enough, then it is possible to find situations in which the strongest player does actually have the best chance for survival." (p. 45) Although the preceding statement may imply that there are also situations in which the strong man has an equal chance of survival, it is felt that a more explicit statement should be made. Therefore the following theory is proposed.

The basic assumption of the proposed theory is that truel situations are ordered along a continuum which is based on the disparity of relative strengths. The disparity of relative strengths will be defined as the differential ability of the three individuals in a truel situation to control the outcome of that situation. The proposed continuum would extend from those situations in which all three participants in the truel are equal in strength to those situations in which one member of the truel had complete control, i.e., one member has dictatorial powers.

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[8]The stronger attack choice for player A is player B, and the stronger attack choice for players B and C is player A.

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It is predicted that the power inversion effect, i.e., the propensity to attack the stronger man and refrain from attacking the weaker man will appear in the interpersonal interaction within the truel as long as the relative strengths of the participants are not equal. The degree to which the power inversion effect will occur in the interpersonal interaction will be a function of the disparity of the relative strengths of the participants. At that point on the continuum at which all participants are of equal strength, the power inversion effect will not be observed. However, as the disparity of relative strengths increases the power inversion effect will become stronger. The increase in the power inversion effect will continue until it reaches its maximum strength at that point on the continuum at which the strongest member of the truel has complete control of the situation, i.e., the dictator point. At no point on the continuum will the propensity to attack the weaker of the two attack choices be observed. These predictions are illustrated in Figure 1.

The power inversion effect with respect to relative chance for survival in the truel is different from the power inversion effect for the freferred attack choice. However, it is obviously dependent upon the preferred attack choice. Figure 2 presents a graph which indicates the predicted probability that the strongest member of the truel will survive as a function of the disparity of relative strengths.

At that point on the continuum at which all participants are

Figure 1. The predicted probability that the stronger of the other two members of a truel will be attacked based on the disparity of relative strengths.

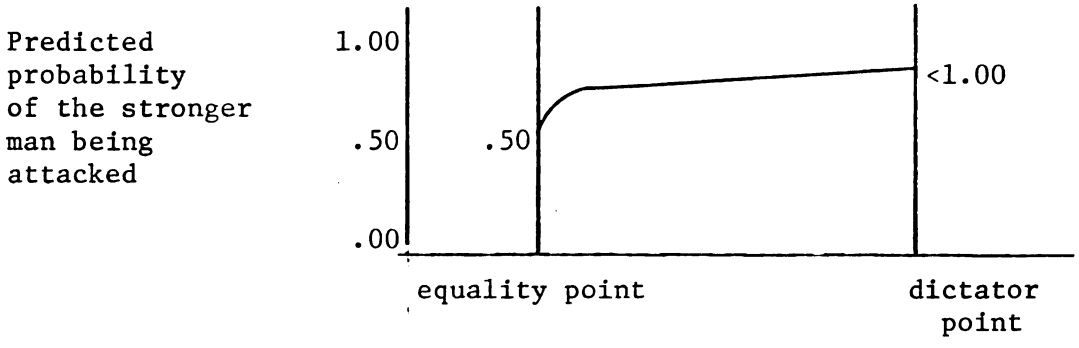
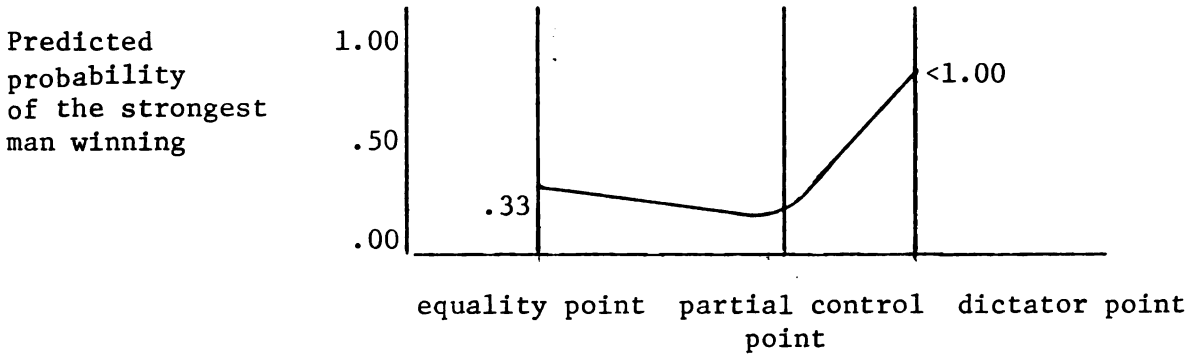


Figure 2. The predicted probability that the strongest member of a truel will win based on the relative disparity of strengths



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of equal strength, they should each have an equal chance for survival, i.e., no power inversion effect will occur. However, as the disparity of relative strengths increases the power inversion effect, as observed in the probability that the strongest member of the truel will survive, will increase. At a point on the continuum, prior to the point at which the strong player has complete control of the outcome, the strong player has enough relative strength to permit him to partially control the outcome. That point is designated the partial control in Fig. 2. At the point immediately preceding the partial control point the power inversion effect will reach its maximum strength. The reasons why the maximum power inversion effect is found just prior to the partial control point are (1) at that point the strongest member of the truel is the preferred attack choice of the two weaker members, and (2) he is not strong enough to overcome the attacks of the other members of the truel. Between the partial control point and the dictator point, the power inversion effect will decrease due to the fact that the strong member of the truel is in a position which allows him to partially overcome the attacks of the other members of the truel. That is, as the relative strength of the strongest member of the truel increases, he gains more control over the outcome. At the dictator point he has complete control over the outcome.

The results of the present paper indicated that there was no difference between the situations in which a coalition did not form when allowed and the pure truel situations with respect to strategies

employed, i.e., both types of situations (Table 3) reported a significant propensity to attack the stronger attack choice. However, when the distribution of games won was examined, there was a significant power inversion effect in the combined Pc and Dc conditions which was not observed in the combined P and D conditions. (Table 4) The fact that the games were seemingly played the same and that the outcomes were different posed an interesting question. One possible resolution of this dilemma is given below.

In the Pc and Dc conditions the subjects were given a chance to form a coalition. Those situations pertaining to the effect in question were the ones in which the subjects chose to play the game as a truel. However, because the subjects were given the chance to form a coalition, they realized that two players could form an implicit coalition and overpower the third. They also realized that player A had the greater power to remove chips. Therefore, on the first move players B and C formed an implicit coalition which was reflected by a significantly greater propensity to attack the stronger attack choice on the initial move in the Pc and Dc conditions than was observed in the pure truel situation. Some support for the above reasoning was found in the attack data given in Table 3 of the results section. A chi-square comparing the combined Pc and Dc initial trial attack data with the combined P and D initial trial attack data revealed that the propensity to attack the stronger attack choice was significantly greater in the conditions which allowed coalitions than in the pure truel conditions. This supports the hypothesis that in the situations which allowed coalitions,

players B and C formed an implicit coalition to attack player A on the initial trial. After the initial trial there was no difference between the conditions which allowed coalitions and those that did not allow coalitions with respect to the propensity to attack the stronger attack choice. This probably resulted from the confounding of the power of each individual after the initial trial. On every trial after the initial trial the power of each individual is a combination of the number of chips he has remaining as well as his ability to remove chips. The greater initial propensity to attack the stronger attack choice in the Pc and Dc conditions resulted in a distribution of chips which favored the weakest player. Therefore, a non-significant power inversion effect was observed in the Dc and Pc conditions.

In the P and D conditions each player attempted to maximize his chance of winning. Since they had not been offered the opportunity to form an explicit coalition, they did not consider the possibility of forming an implicit coalition. Instead, they devised strategies based on their individual power. The major strategy was for each member of the truel to attack the stronger attack choice and eliminate him before he eliminated them. This is reflected by the significant tendency to attack the stronger attack choice over all trials. However, another strategy on the initial trial would be to attack the weaker attack choice in hopes of drawing fewer reprisals from the stronger attack choice. It is proposed that in the P and D conditions some individuals employed the second strategy on the initial move. As a result, the distribution of chips on the second trial

did not favor the weakest member of the truel to the extent that they did in the Pc and Dc conditions. Therefore, the distribution of games won did not differ from chance expectancy. The differential distribution of chips on the second trial which resulted from the significantly different propensity to attack the stronger attack choice on the initial trial was the critical difference between the truels in which coalitions did not form when allowed and the pure truels.

Implications Relevant to Perceived Relative Power

An examination of the pre-game and post-game questionnaires revealed that there was a significant preference for player A both before and after the game. (Table 7) However, player A was the preferred position significantly more before the game was played than after the game was played. (Table 7) It is suggested that the observed difference in player preference before and after the game indicated that the subjects became more aware of the true power distribution with experience. In other words the subjects learned that because of the mechanics of the situation the true power of each player was a function of the propensity of the other players to attack him as well as his ability to take chips away.

While the preceding reasoning accounts for the differences which were observed between the pre-game and the post-game player preferences, it does not account for the fact that player A was preferred more in the probabilistic conditions than in the deterministic conditions or that player A was preferred more in the coalition

situations than in the no-coalition situations. Moreover, the fact that the preference for player A was manifest before the game was played indicates that it was not a function of experience. That no significant interactions were revealed by the analysis of variance indicates that the effects due to the probabilistic vs. deterministic manipulation and the coalition vs. no-coalition manipulation were not changed by playing the game. Therefore, the subjects initial perception of the situation was the critical factor. A conjecture as to the possible determinents of the subjects perceptions is given below.

Since all of the conditions are based on the truel, the perception of the pure truel situations will be considered first. Player A was perceived as the strongest player in both the P and D conditions because of the fact that he could take away the most chips. This is indicated by the answers given to the pre-game question which asked the subjects to explain why they preferred the player that they did. Virtually every subject that preferred to be player A gave the fact that he could take away the most chips as his answer. The difference between the P and D conditions was probably due to the fact that whether player A was successfully attacked in the P condition depended on luck while player A was successfully attacked at will in the D condition. This meant that even if players B and C both attacked player A in the P condition he had a chance to withstand the attack. However, in the D condition if player A was attacked by both B and C on the first three moves he was out of the

game. Therefore, player A was perceived to be stronger in the P condition than he was in the D condition.

Assuming that the probabilistic vs. deterministic manipulation has the same effect in the coalition and no-coalition situations, it is suggested that the perception of player A in the Dc and Pc conditions would be at the same level as the perception of player A in the D and P conditions if no coalitions were allowed. However the fact that position A was preferred significantly more in the coalition condition than in the pure truel conditions suggests that the perceived strength of player A in the Pc and Dc conditions was based on some factor in addition to his chance of survival. It is proposed that this factor was the attractiveness of player A as a coalition partner. Evidence that player A was an attractive coalition partner follows from the fact that he was frequently chosen as a coalition partner in both the Pc and Dc conditions. This attractiveness added to his perceived power in both the Pc and Dc conditions. Due to the cumulative nature of the perceived strength, the order with which player A was preferred in the four conditions was Pc, Dc, P, and D.

Summary and Conclusion

The power inversion phenomenon has figured prominantly in theories which have discussed mixed-motive triadic groups. Power inversion occurs when the relative chance of survival is ordered so that the "weakest" member of the triad has the best probability of surviving and the "strongest" member of the triad has the least probability of surviving. Moreover, the power inversion effect tends to occur in two separate mixed-motive situations: (1) The pure truel situation, i.e., a three person duel which does not allow coalitions, and (2) triadic coalition formation situations. Although the pure truel situation has been virtually ignored by researchers the same is not true of the coalition formation situation. Moreover, the power inversion effect has been reported in virtually every study of coalition formation.

Given the appropriate boundary conditions Minimum Resource Theory (MRT) predicts the power inversion effect in the triadic coalition situation. However, studies which have examined the situations outside of the boundary conditions of MRT question it's generality. The area of coalition research which examined the effects of cumulative score can answer the question of generality by redefining the concept of resources to include multiple resource dimensions. Thereby, the boundary conditions of MRT are extended and the situations which employ a cumulative score can be accounted for. Prior to the present paper MRT had not been extended to include the area of coalition research which deals with the probabilistic situation, i.e., a situation in which no unit or combination of units will win

with probability one.

In this paper an extension of MRT to the probabilistic situation was proposed. MRT originally postulated that the parity norm would be salient for determining preferred coalitions. The parity norm assumes that the participants in a triadic situation will expect the other members of that triad to demand a share of the payoff which is equal to the share of the resources they contributed to the coalition. The prediction that the winning coalition with the fewest resources will be preferred, follows.

Since no coalition can win with probability one in the probabilistic situation, there is no winning coalition as defined by MRT. It was proposed that because there is no winning coalition in the probabilistic situation the security norm takes precedence over the parity norm. As a result, the extended version of MRT predicts that the participants in the probabilistic situation will prefer to form that coalition which will maximize their chance of winning. Extended MRT leads to the main hypothesis of this paper, i.e., the power inversion effect will be replaced by the "strength is strength" effect in the probabilistic situation.

The results supported the main hypothesis. However, the support was weakened by the fact that the power inversion effect was not obtained in the deterministic coalition formation situation. An explanation based on the assumption that the salient payoff could not be divided other than equally was offered. It was suggested that the parity norm was not salient because the payoff could only

be divided equally and any coalition would win. As a result, the distribution of coalition partner preferences did not differ from chance expectancy.

It was proposed that the results of the probabilistic coalition situation were not effected by the divisibility of the payoff. This followed from the hypothesis that in the probabilistic situation the security norm is salient. Therefore, the fact that the payoff could only be divided equally had no effect on which coalition was preferred. However, to adequately examine this hypothesis, further research will be necessary.

Shubik (1954) proposed a theory to account for behavior in the pure truel. The theory was based on game theory and assumed that the participants in a truel situation played a rational strategy. The power inversion effect was predicted for those situations in which the strongest member of the truel was only slightly stronger than the other two members. The present study examined both the pure truel situation and the truel situation in which coalitions were allowed but did not form. It was hypothesized that the power inversion effect would be supported in all of the truel situations which were examined.

The stronger attack choice was attacked significantly more often than the weaker attack choice in all of the truel situations. When relative chance for survival was examined, the power inversion effect was observed in the conditions in which coalitions were allowed but did not form. However, it was not observed in the pure truel

situations. This observed difference appeared to be a function of the initial attack choice. Therefore, it was postulated that in the coalition formation situations the suggestion that two members of the triad could ally and eliminate the third member resulted in implicit alliances between the two weaker participants on the initial attack. As a result, the weakest member of the triad gained an advantageous position with respect to remaining resources. Moreover, the strongest member of the triad was left in a disadvantageous position with respect to remaining resources. Therefore, the weakest member of the triad won the most games and the strongest member of the triad lost the most games.

In the pure truel situation the power inversion effect was not observed with respect to relative chance for survival. A theory based on the relative disparity of strengths was proposed which predicts that the power inversion effect, with respect to distribution of attacks, will occur in the pure truel situations as long as the strengths of the participants are not equal. However, when the relative chance for survival is considered the power inversion effect will be a function of the relative strength of the strongest player. As the strength of the strongest player increases relative to the other players he will gain more control over the outcome and the power inversion effect will disappear.

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Appendix A

Experimental Materials

Instructions for the Dc condition

As you have probably guessed from the name of the experiment, I am attempting to determine how people play games. For this reason I will keep track of each move that is made.

To begin the game you will each be given 15 poker chips. (pass out poker chips) Before the game begins you will each draw a token from this hopper. (demonstrate) The letter on the token will indicate which position you will play. The winner of the game will be the player who has chips remaining when the other players' chips are gone. As a reward for winning the game the winner will participate in a raffle which will be held near the end of the term. There will be 80 games played in all, and therefore there will be 80 winners. Since the prize for the raffle will be $10, if you win the game you will have one chance out of 80 to win $10.

The rules of the game are simple. Each player will be required to take away a given number of chips from the player of his choice on each move. Player A must take away four chips, player B must take away three chips and player C must take away two chips. With one exception, you must take away the total number of chips that you are required to take away, and on each move you must take them away from only one of the other players. The exception to the rule would occur when the player that you choose to take chips away from has fewer chips remaining than you are required to take away. In this case, you can take all of the chips away from that one player, however you are still not permitted to take chips away from the other

player on that move. You will indicate on the paper provided (show paper) the player that you wish to take chips away from on each move. You will give the paper to me, and I will remove those chips which you have indicated. All chips that are removed are taken out of the game and do not belong to any of the players. When a player has no chips remaining, he is no longer allowed to participate in the game.

An added feature of the game is that, if you want to, you will be allowed to form a partnership before the actual play of the game starts. If a partnership is formed, it starts the game with 15 chips; but it is required to take away the number of chips which is equal to the combined strength of its two members. This means that an AB partnership must take away 4+3, 7 chips; an AC partnership must take away 4+2, 6 chips; and a BC partnership must take away 3+2, 5 chips. The player who is not in the partnership starts the game with 15 chips and must take away the number of chips that he was required to take away before the partnership was formed, that is player A must take away 4 chips, player B must take away 3 chips, and player C must take away 2 chips. (pass out information cards) The information on this card gives you a summary of the strength of each partnership and the strength of each individual player.

To form a partnership, you will indicate on the paper provided (show paper) the player that you wish to form a partnership with. If that player also indicates that he wishes to form a partnership *with* you, you will be given two minutes in another room to discuss the terms of the partnership. The terms of the partnership will

describe how the $10 payoff will be divided if the partnership wins both the game and the raffle. If you cannot reach an agreement about how the payoff should be divided in that two minutes, the game will be played with no partnerships.

The game will end when only one player or partnership has chips remaining. If only one player has chips remaining, he will participate in the raffle. If a partnership is left with chips remaining, both players names are placed on one raffle ticket and if they win the raffle they will divide the $10 according to the terms of the partnership.

Since I want to be sure that you understand how to play the game, I will now answer any questions that you have.

Information Card for the Dc Condition

The following information was centered on a white 5" x 8" note card. One each was given to players A, B, and C.

Each player will take away the following number of chips:

Player	# of chips
A	-4 chips
B	-3 chips
C	-2 chips

Each partnership will take away the following number of chips:

Partnership	# of chips
AB	-7 chips
AC	-6 chips
BC	-5 chips

Instructions for the D condition

As you have probably guessed from the name of the experiment, I am attempting to determine how people play games. For this reason I will keep track of each move that is made.

To begin the game you will each be given 15 poker chips. (pass out poker chips) Before the game begins you will each draw a token from this hopper. (demonstrate) The letter on the token will indicate which position you will play. The winner of the game will be the player who has chips remaining when the other players' chips are gone. As a reward for winning the game the winner will participate in a raffle which will be held near the end of the term. There will be 80 games played in all, and therefore there will be 80 winners. Since the prize for the raffle will be $10, if you win the game you will have one chance out of 80 to win $10.

The rules of the game are simple. Each player will be required to take away a given number of chips from the player of his choice on each move. Player A must take away four chips, player B must take away three chips, and player C must take away two chips. With one exception, you must take away the total number of chips that you are required to take away, and on each move you must take them away from only one of the other players. The exception to the rule would occur when the player that you choose to take chips away from has fewer chips remaining than you are required to take away. In this case, you can take all of the chips away from that one player, however you are still not permitted to take chips away from the other

player on that move. You will indicate on the paper provided (show paper) the player that you wish to take chips away from on each move. You will give the paper to me, and I will remove those chips which you have indicated. All chips that are removed are taken out of the game and do not belong to any of the players. When a player has no chips remaining, he is no longer allowed to participate in the game. (pass out information cards) This card gives you the number of chips that each player is required to take away on each move. The game will end when only one player has chips remaining, and he will participate in the raffle.

Since I want to be sure that you understand how to play the game, I will now answer any questions that you have.

Information Card for the D Condition

The following information was centered on a white 5" x 8" note card. One each was given to players A, B, and C.

Each player will take away the following number of chips:

Player	# of chips
A	-4 chips
B	-3 chips
C	-2 chips

Instructions for the Pc condition

As you have probably guessed from the name of the experiment, I am attempting to determine how people play games. For this reason I will keep track of each move that is made.

To begin the game you will each be given 15 poker chips. (pass out poker chips) Before the game begins you will each draw a token from this hopper. (demonstrate) The letter on the token will indicate which position you will play. The winner of the game will be the player who has chips remaining when the other players' chips are gone. As a reward for winning the game, the winner will participate in a raffle which will be held near the end of the term. There will be 80 games played in all, and therefore there will be 80 separate winners. Since the prize for the raffle will be $10, if you win the game you will have one chance out of 80 to win $10.

The rules of the game are simple. Each player will have a 50% chance of taking away a given number of chips from the player of his choice on each move. Player A has a 50% chance of taking four chips away, player B has a 50% chance of taking three chips away, and player C has 50% chance of taking two chips away. On each move each player is required to indicate the player that he wants to take chips away from. With one exception you must take away the total number of chips that you are required to take away, and on each move you must take them away from only one of the other players. The exception to the rule would occur when the player that you choose to take chips away from has fewer chips remaining than

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you are required to take away. In this case you can take all of the chips away from that player, however you are still not permitted to take chips away from the other player on that move.

On each move of the game you will indicate on the paper provided (show paper) the player that you wish to take chips away from. You will give the paper to me and I will then have you cast a die to determine if you get to take those chips away. If the die comes up even you will get to take the chips away. If the die comes up odd, you will not get to take the chips away. All chips that are removed will be taken out of the game and will not belong to any of the players. When a player has no chips remaining, he will no longer be allowed to participate in the game.

An added feature of the game is that, if you want to you will be allowed to form a partnership before the actual play of the game starts. If a partnership is formed, it starts the game with 15 chips and it has a 50% chance to take chips away. The number of chips which it will take away is equal to the combined strength of its two members, that is, an AB partnership will take away 4+3, 7 chips; an AC partnership will take away 4+2, 6 chips; and a BC partnership will take away 3+2, 5 chips. The player who is not included in the partnership still has a 50% chance of taking chips away and he will take away the same number of chips that he would have taken away before the partnership formed, that is, A will take away 4 chips, B will take away 3 chips, and C will take away 2 chips. (pass out information cards) This card gives you a summary of the number of chips that each

individual player will take away and the number of chips that each partnership will take away.

To form a partnership, you will indicate on the paper provided (show paper) the player that you wish to form a partnership with. If that player also indicates that he wishes to form a partnership with you, you will be given two minutes in another room to discuss the terms of the partnership. The terms of the partnership will describe how the $10 payoff will be divided if the partnership wins both the game and the raffle. If you cannot reach an agreement about how the payoff should be divided in that two minutes, the game will be played with no partnerships.

The game will end when only one player or partnership has chips remaining. If only one player has chips remaining, he will participate in the raffle. If a partnership is left with chips remaining, both players' names are placed on one raffle ticket and if they win the raffle they will divide the $10 according to the terms of the partnership.

Since I want to be sure that you understand how to play the game, I will now answer any questions that you have.

Information Card for the Pc Condition

The following information was centered on a white 5" x 8" note card. One each was given to players A, B, and C.

Each player has a 50% chance of getting to take away the following number of chips:

Player	# of chips
A	-4 chips
B	-3 chips
C	-2 chips

Each partnership has a 50% chance of getting to take away the following number of chips:

Partnership	# of chips
AB	-7 chips
AC	-6 chips
BC	-5 chips

Instructions for the P condition

As you have probably guessed from the name of the experiment, I am attempting to determine how people play games. For this reason I will keep track of each move that is made.

To begin the game you will each be given 15 poker chips. (pass out poker chips) Before the game begins you will each draw a token from this hopper. (demonstrate) The letter on the token will indicate which position you will play. The winner of the game will be the player who has chips remaining when the other players' chips are gone. As a reward for winning the game the winner will participate in a raffle which will be held near the end of the term. There will be 80 games played in all, and therefore there will be 80 separate winners. Since the prize for the raffle will be $10, if you win the game you will have one chance out of 80 to win $10.

The rules of the game are simple. Each player will have a 50% chance of taking away a given number of chips from the player of his choice on each move. Player A has a 50% chance of taking four chips away, player B has a 50% chance of taking three chips away, and player C has a 50% chance of taking two chips away. On each move each player is required to indicate the player that he wants to take chips away from. With one exception you must take away the total number of chips that you are required to take away, and on each move you must take them away from only one of the other players. The exception to the rule would occur when the player that you choose to take chips away from has fewer chips remaining than you are required

to take away. In this case you can take all of the chips away from that player; however you are still not permitted to take chips away from the other player on that move.

On each move of the game you will indicate on the paper provided (show paper) the player that you wish to take chips away from. You will give the paper to me, and I will then have you cast a die to determine if you get to take those chips away. If the die comes up even you will get to take the chips away. If the die comes up odd you will not get to take the chips away. All chips that are removed will be taken out of the game and will not belong to any of the players. When a player has no chips remaining, he will no longer be allowed to participate in the game. (pass out information cards) This card gives you the number of chips that each player will take away on each move. The game will end when only one player has chips remaining, and he will participate in the raffle.

Since I want to be sure that you understand how to play the game, I will now answer any questions that you have.

Information Card for the P Condition

The following information was centered on a white 5" x 8" note card. One each was given to players A, B, and C.

Each player has a 50% chance of getting to take away the following number of chips:

Player	# of chips
A	-4 chips
B	-3 chips
C	-2 chips

Form on which the players in the Dc and Pc conditions indicated partner preference, desired payoff, and expected payoff.

I am Player A B C (circle one).

If you would like to form a partnership, complete the following statements.

I would like to form a partnership with player A B C (circle one).

I think that my share of the $10 should be _____.

I think that the player I choose will expect _____ as his share of the $10.

Males

Game Experiment #4

Data Sheet

Position

Condition

Dc D Pc P

	A	B	C
Made an offer to			
Expected share of payoff			
Share of payoff in final agreement			
Move #	A attacked	B attacked	C attacked

Condition

Dc D Pc P

Game Experiment #4
Pre-game Questionnaire

Before you draw to determine which of you will play in which position, I would like you to answer the following two questions.

1. Which player do you think has the best chance to win the game?

A B C
(circle one)

Why?

2. Which player would you choose to be, if you had your choice?

A B C
(circle one)

Condition

Dc D Pc P

Game Experiment #4
Post-game Questionnaire

1. Did you know anything about the experiment before you came in the room? If so, what?

2. How would you rate the length of the game?

1	2	3	4	5
too short				too long

3. How interesting was the game?

1	2	3	4	5
very dull				very interesting

4. Was the game fair? If not, please state your reasons.

5. How easy was it to understand the rules of the game?

1	2	3	4	5
very easy				very difficult

6. How hard did you try to win?

1	2	3	4	5
not at all				very hard

7. Did you know either of the other two players before today? If you did, how well did you know him?

1	2	3	4	5
not at all				very well

8. Which player would you rather be?

A B C No Preference

(circle one)

Why?

9. What did you think I was trying to study with this experiment?

INSTRUCTIONS

This questionnaire will require you to evaluate the experimenter on a series of descriptive scales. Please base your evaluation on your impression of the experimenter. On the following page of this questionnaire you will find a set of scales. You are to rate the experimenter on each of the scales in order.

Here is how you are to use these scales:
If you feel that the experimenter is very well defined by the word on one end of the scale, you should place your check-mark as follows:

BIG ___X___:_____:_____:_____:_____:_____:_____ LITTLE

or

LITTLE _____:_____:_____:_____:_____:_____:___X___ BIG

If you feel that the experimenter is quite well defined by the word on one end of the scale (but not extermely well), you should place your check-mark as follows:

BIG _____:___X___:_____:_____:_____:_____:_____ LITTLE

or

LITTLE _____:_____:_____:_____:_____:___X___:_____ BIG

If the experimenter is only slightly defined by the word on one end of the scale (but is not really neutral), then you should check as follows:

BIG _____:_____:___X___:_____:_____:_____:_____ LITTLE

or

LITTLE _____:_____:_____:_____:___X___:_____:_____ BIG

The direction toward which you check, of course, depends upon which of the two ends of the scale best defines the experimenter in your opinion. If you consider the experimenter to be neutral on the scale, i.e., both sides of the scale are equally associated with the experimenter, or if the scale is completely irrelevant, then you should place your check-mark in the middle space.

IMPORTANT: (1) Place your check-marks in the middle of the spaces, not on the boundaries.
(2) Be sure you check every scale for every concept - do not omit any.
(3) Never put more than one check-mark on a single scale.

RATIONAL	_____:_____:_____:_____:_____:_____:_____	INTUITIVE
KIND	_____:_____:_____:_____:_____:_____:_____	CRUEL
LIBERAL	_____:_____:_____:_____:_____:_____:_____	CONSERVATIVE
REPUTABLE	_____:_____:_____:_____:_____:_____:_____	DISREPUTABLE
RELAXED	_____:_____:_____:_____:_____:_____:_____	TENSE
SUCCESSFUL	_____:_____:_____:_____:_____:_____:_____	UNSUCCESSFUL
BELIEVEING	_____:_____:_____:_____:_____:_____:_____	SKEPTICAL
RUGGED	_____:_____:_____:_____:_____:_____:_____	DELICATE
GOOD	_____:_____:_____:_____:_____:_____:_____:	BAD
STRONG	_____:_____:_____:_____:_____:_____:_____	WEAK
SOCIABLE	_____:_____:_____:_____:_____:_____:_____	UNSOCIABLE
INTELLIGENT	_____:_____:_____:_____:_____:_____:_____	UNINTELLIGENT
RESPECTFUL	_____:_____:_____:_____:_____:_____:_____	DISRESPECTFUL
YOUNG	_____:_____:_____:_____:_____:_____:_____	OLD
MASCULINE	_____:_____:_____:_____:_____:_____:_____	FEMININE
HARMONIOUS	_____:_____:_____:_____:_____:_____:_____	DISSONANT
CURIOUS	_____:_____:_____:_____:_____:_____:_____	INDIFFERENT
CLEAN	_____:_____:_____:_____:_____:_____:_____	DIRTY
EMOTIONAL	_____:_____:_____:_____:_____:_____:_____	UNEMOTIONAL

Appendix B

Factor Analysis of Experimenter Evaluation Data

The Factor Analysis of the Experimenter Evaluation Data

The "Factor A" program published by the Computer Institute for Social Science Research at Michigan State University (Williams, 1967) was employed to perform the factor analysis. "Factor A performs principle axis factor analysis and analytic orthogonal rotations (Quartimax and Varimax) of the principle axis solution."* (Williams, 1967, p. 1) Both Quartimax and Verimax rotations were computed. The factors resulting from the Verimax rotation were selected as the most logically interpretable factors. As a result, the 19 scales on the experimenter evaluation form were collapsed to the following three factors.

Factor 1: Sociability

Scales	factor loadings
Kind - Cruel	+ 0.7403
Relaxed - Tense	+ 0.4274
Reputable - Disreputable	+ 0.7260
Successful - Unsuccessful	+ 0.6416
Believing - Skeptical	+ 0.5375
Good - Bad	+ 0.6876
Sociable - Unsociable	+ 0.5552
Intelligent - Unintelligent	+ 0.4871
Respectful - Disrespectful	+ 0.6033
Harmonious - Dissonant	+ 0.4238

Factor 2: Capability

Scales	factor loadings
Rational - Intuitive	- 0.5323
Liberal - Conservative	+ 0.5361
Rugged - Delicate	- 0.6167
Strong - Weak	- 0.4925

*Reference: Harmon, H. Modern Factor Analysis, University of Chicago Press, 1960.

Factor 3: Emotionality

Scales	factor loadings
Curious - Indifferent	+ 0.6030
Emotional - Unemotional	+ 0.8617

A fourth factor was disregarded because the factor loadings split between it and Factor 1 on all except two scales, i.e., the Masculine - Feminine and Young - Old scales. The subjects consistently perceived the experimenter to be young and masculine. Therefore, the fourth factor did not indicate a differential evaluation of the experimenter. In addition to disregarding the fourth factor, the Clean - Dirty scale was disregarded because it loaded equally on three of the four factors.

Appendix C

A Review of Theories and Research Relevant to Coalition Formation in the Triad

A Review of Theories and Research Relevant to Coalition Formation in the Triad

Coalition Defined

One of the prerequisites for understanding coalition formation research is a basic understanding of the term coalition. Gamson (1964) has suggested that a coalition is "the joint use of resources to determine the outcome of a decision in a mixed-motive situation involving more than two units." (p. 85) Although the present writer acknowledges that an explicit definition of a coalition is necessary for the purpose of conducting meaningful research, it is felt that Gamson's definition is too restrictive. A more workable definition of a coalition is one that is much less restrictive, i.e., an alliance of two or more distinct social units, in opposition to one or more outside units, in an attempt to determine the outcome of a given situation. One of the prerequisites on which the suggested definition is based is that there is no reason to limit coalitions to mixed-motive situations. Admittedly, one area of coalition research has dealt strictly with the mixed-motive situation. However, to restrict coalitions to the mixed-motive situation is not acceptable to the present writer because it eliminates one of the two forms of coalition research which has emerged since the early 1950's, e.g., coalitions in a group discussion task (Borgatta, 1961; Borgatta & Borgatta, 1962, 1963; Strodtbeck, 1955; Torrance, 1954; Mills, 1954). The second prerequisite on which the suggested definition is based is that at least two social units must be involved in a coalition.

While Gamson may imply this prerequisite with the requirement that more than two units must be involved in a coalition, he does not specify the type of units that may coalace. To clarify this, the second prerequisite was established. It is meant to explicitly exclude from the coalition situation those situations in which a social unit joins forces with another type of unit. For example, if a man utilizes a river current to carry him to a designated spot downstream, we cannot say that he has formed a coalition with the current. It is important to note that the requirement that at least two social units must be involved in a coalition does not imply that the opposition which is basic to the next prerequisite must be a social unit. In fact, the third prerequisite, that some opposition to the coalition must exist, does not limit the type of opposition in any way. It does state that an opponent, i.e., a unit which potentially prevents some combination of one or more other units from determining the outcome of a given situation is a necessary prerequisite for a coalition. The proposed definition with its interpretation of an opponent is explicit without being unduly restrictive. The forth prerequisite that there must be an attempt to determine the outcome of a given situation, was included because of the belief that before a coalition will form there must be some purpose for that coalition. A further reason for including the fourth prerequisite was the need to include only those situations in which social units have joined together to utilize their combined resources toward reaching some concrete goal. Implicit in this

prerequisite is the requirement that the goal to be reached cannot be reached by sociality per. se.

Evolution of Coalition Theories

The last decade has seen a growing interest in the study of coalition formation in the triad. The impetus for this research was provided by Caplow (1956) in his original theory of coalitions in triadic situations. Caplow based his theory on the work of Simmel (1950) which was written around the turn of the century and research by Mills (1954), Strodtbeck (1954), and Torrance (1955) which examined coalition formation in a group discussion task. However, Caplow's theory provided the initial incentive for the research on coalition formation which has examined the mixed-motive game situation.

Control Theory. Caplow's (1956) theory, which will be referred to as control theory (hereafter designated CT), was based on the following four assumptions:

1. Members of a triad may differ in strength. A stronger member can control[1] a weaker member and will seek to do so.

2. Each member of the triad seeks control over the others. Control over two others is preferred to control over one other. Control over one other is preferred to control over none.

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[1]CT defines control as the ability to dominate the other members of the triad. For example, if one member of a triad has some part in determining the outcome of a situation and another member does not, then the first member is said to have control over the second. Moreover, if two members of a triad share in determining the outcome of the situation, then the stronger member, i.e., the member with the larger resource weight, is said to have control over the weaker member, i.e., the member with the smaller resource weight.

3. Strength is additive. The strength of a coalition is equal to the sum of the strength of its two members.

4. The formation of coalitions takes place in an existing triadic situation, so that there is a precoalition condition in every triad. Any attempt by a stronger member to coerce a weaker member into joining a non-advantageous coalition will provoke the formation of an advantageous coalition to oppose the coercion. (p. 489)

Six different triadic situations in terms of initial power relationships were proposed by Caplow. In the Type 1 situation the initial strength of all three members is equal (A=B=C). In Type 2, two of the members are of equal strength and the third member is slightly stronger (A>B, B=C), and A<(B+C). In Type 3, two of the members of the triad are initially stronger as well as equal while the third member is weaker (A=B, B>C). In Type 4, two of the members are equal and their combined strength is less than the strength of the third member (A>(B+C), B=C). The Type 4 triad has been described as a dictator situation (Gamson, 1961a). In Type 5, no two members of the triad are of equal strength but the combined strength of any two members is greater than the strength of the third (A>B>C, A<(B+C)). In Type 6, no two members of the triad are of equal strength, but one member has a greater initial strength than the other two combined (A>B>C, A>(B+C)). Like the Type 4 triad, the Type 6 triad represents a dictator situation. Based on the initial assumptions, CT makes the following predictions about which coalitions would form in each of the six triadic situations: Type 1, any; Type 2, BC; Type 3, AB or AC; Type 4, none; Type 5, AB or AC; and Type 6, none.

Caplow (1959) extended CT so that it covered two new situations. Type 7 was the situation in which all members are unequal, but one

member is equal to the other members combined. (A>B>C, A=(B+C)). Type 8 is the situation in which one member is equal to the other members combined and two of the members are equal (A=(B+C), B=C). In both of these situations, the most powerful individual (A) is said to have veto power (Gamson, 1961a). CT predicts that in both Type 7 and Type 8 situations AB or AC coalitions will be equally likely.

One of the assumptions of CT is that the member of the triad who has the least power is often preferred as a coalition partner by both of the other members of the triad. As a result he becomes the "chooser" (Caplow, 1959); and as the chooser, he becomes the strongest member of the triad in a functional sense. This phenomenon is referred to as the "weakness is strength" effect.

Caplow (1959) suggested that depending on the circumstances one of two assumptions about what is taking place in a coalition situation is correct. The two assumptions are: (1) "the 'chooser' in a triad seeks the maximum advantage or minimum disadvantage of strength relative to his coalition partner," or (2) "the 'chooser' in a triad seeks to maximize the strength of the coalition in relation to the excluded member." (p. 492) It is apparent that the two assumptions result in different predictions. For example, in the Type 5 triad, if assumption number one is correct, CT predicts that BC coalitions will be prevalent. However, if assumption number two is correct, AC coalitions will prevail. Although the two assumptions result in differential predictions, Caplow offered no suggestions as to the circumstances which would determine the assumption to be applied. Nevertheless, the two assumptions have proven to be useful

in subsequent theories.

Minimum Power Theory. Immediately following Caplow's proposal of CT it was suggested that an equally viable theory of coalition formation could be based on the assumption that the participants in a coalition situation utilize a rational strategy to maximize their control over the outcome (Vinacke & Arkoff, 1957). This theory which was developed within the framework of game theory was later referred to as "minimum power theory" (Gamson, 1964). One of the major assumptions of "minimum power theory" (hereafter designated MPT) is that the real power of each participant is accurately perceived by all of the participants in a given situation. Moreover, real power as defined by MPT is different from power as defined by CT. That is, MPT utilized the Shapely (1953) notion of pivotol power. In three person mixed-motive situations the pivotol power of an individual is determined by the number of times he can form a winning coalition. If the concept of pivotol power is applied to triadic situations, only three power relationships can occur: (1) all three members can be of equal power, i.e., any two members can coalace and control the outcome; (2) one member can be all powerful, i.e., the dictator situation; and (3) one member can have veto power. MPT predicts that in the situation in which all three members are equal in power every coalition will form, and in the situations in which one member has veto power the coalition will include the member with veto power.

Minimum Resource Theory. Minimum resource theory (hereafter designated MRT) had its beginnings with Caplow's (1956) original CT and was later developed to its present state by Gamson (1961a).

Gamson limits the sphere of applicability of MRT to situations which meet the following conditions:

1. There is a decision to be made and there are more than two social units attempting to maximize their share of the payoff.

2. No single alternative will maximize the payoff to all participants.

3. No participant has dictatorial powers, i.e., no one has initial resources sufficient to control the decision by himself.

4. No participant has veto power, i.e., no member must be included in every winning coalition. (p.347)

Providing that the situation falls within the sphere of applicability, the following information is required in order to predict which coalition will form: (1) the relevant resources and what proportion of those resources are controlled by each player; (2) the payoff for each condition, specifically, the payoff that is associated with the winning coalition; (3) the propensities to form coalitions with the other players regardless of initial resources controlled; (4) the effective decision point, i.e., the amount of resources which are sufficient to control the decision as to how the rewards will be distributed.

To understand the basic predictions of MRT it is necessary to define a "minimal winning coalition" and the "cheapest winning coalition." "A minimal winning coalition is a coalition such that the defection of any member will make the coalition no longer winning. The cheapest winning coalition is that minimal winning coalition with resources closest to the decision point." (Gamson, 1961a, p. 376) Although the preceding definition could be interpreted to mean that only one

cheapest winning coalition can exist per triad, the present paper adopts the interpretation that each member of the triad has a cheapest winning coalition.

The basic postulate of MRT is the "parity norm", and is stated in the form of a general hypothesis:

> Any participant will expect others to demand from a coalition a share of the payoff proportional to the amount of resources which they contribute to a coalition. (Gamson, 1961a, p. 376)

Combining the maximization boundary condition and the parity norm results in the prediction that each player will choose to form the coalition which maximizes the ratio of his resources to the total resources of the coalition. However, a further boundary condition is that the total payoff must remain constant regardless of which coalition forms. Thus, MRT predicts that the cheapest winning coalition will be preferred, if the total payoff is held constant.

The final assumption of the theory is that reciprocal strategy choices are required before a coalition will form. Reciprocal strategy choices are present only in those situations where two of the individuals are required members in each others cheapest winning coalition. For example, consider a situation in which the distribution of resources is A=4, B=3, and C=2. In this situation, for A the cheapest winning coalition would be an AC coalition, for B the cheapest winning coalition would be a BC coalition, and for C the cheapest winning coalition would be a BC coalition. It is apparent that in this case B and C have reciprocal strategy choices and a BC coalition would be predicted by MRT.

When MRT is applied to Caplow's eight triadic types, the following coalitions are predicted: Type 1, any; Type 2, BC; Type 3, AB or AC; and Type 5, BC. Type 4 and Type 6 are not applicable because they contain a dictator, and Type 7 and Type 8 are not applicable because one member has veto power.

One aspect of MRT which differentiates it from CT is that in addition to the "weakness is strength" effect which is predicted by CT, MRT predicts a "strength is weakness" effect. That is, the weaker of the other two members of the triad is always the preferred coalition partner. Since the strongest member of the triad is never a preferred coalition partner, he becomes the weakest member of the triad in a functional sense, i.e., "strength is weakness." The reasoning on which the differentiation between the "strength is weakness" effect and the "weakness is strength" effect is based follows. MRT predicts that the strongest member of the triad will never be preferred as a coalition partner by the "chooser". Contrary to this, according to CT the strongest member of the triad will be the preferred coalition partner of the chooser 50% of the time. Therefore, in the relevant triadic situations MRT predicts that the strongest member of the triad will not be included in any of the coalitions while CT predicts that he will be included in 50% of the coalitions. The "weakness is strength" effect is manifest in both CT and MRT due to the fact that the weakest member of the triad is a member of all predicted coalitions for both theories.

Anticompetitive Theory. Anticompetitive theory (hereafter designated AT) was first suggested by Gamson (1964), however, it was

based on the results of a series of studies by Vinacke and his students. (Vinacke, 1959, 1962; Bond & Vinacke, 1961; Uesugi & Vinacke, 1963; Vinacke, et. al., 1966). Vinacke (1959) hypothesized that "female subjects might be much less concerned with winning and more oriented towards social and ethical conditions -- i.e., try to avoid an agressive display of power and attempt rather to be 'fair' to everyone." (p. 344) This hypothesis and subsequent research led Gamson (1964) to believe that an "anticompetitive norm" exists and that as a result coalitions will form along the lines of least resistance in bargaining." (p. 90) Therefore, Gamson's AT predicts that coalitions will form between players who are equal in resources.

An extension of AT (Phillips & Nitz, in press) suggests that the predictions as to which coalitions will form should be based on the divisibility of the payoff as well as the initial distribution of resources. If the payoff is equally divisible the coalition which requires the least bargaining is between the members of the triad who have the smallest resource differences. If the payoff is not equally divisible, the least bargaining will be required for the coalition which includes those members of the triad who have the greatest resource difference. Therefore, if the payoff is equally divisible, the predicted coalition will form between the members who are the most similar with respect to resources; and if the payoff is not equally divisible, the predicted coalition will form between those members who are the most dissimilar with respect to resources.

Utter-Confusion Theory. The last theory or "antitheory" to be

discussed was proposed by Gamson (1964). He chose to call it "utter-confusion theory." Gamson suggested that there was a need for this theory to deal with those situations in which the participants are in a state of confusion and are not able to make rational decisions. As an example, he cites political conventions where such things as "missed telephone calls" can influence which coalitions will form. Although Collins and Raven (in press) seem to agree with Gamson, the present writer feels that the suggested need for utter-confusion theory is unfounded. It is admitted that chance happenings can influence the formation of coalitions. However, an implied boundary condition in the previously mentioned theories is that the subjects understand the "rules of the game" and "Utter-confusion Theory" is based on the assumption that the subjects do not understand the "rules of the game." Therefore, the optimal conditions for testing Utter-confusion Theory would be to give the subjects no information at all but to simply ask them whom they would like to form a coalition with. In such a situation, Utter-confusion Theory predicts random choice, and it is possible that its predictions may be supported if such an experiment were run. Such a situation is, however, psychologically uninteresting. Furthermore, even though the theories to date do not account for all of the data, the present writer believes that to rely on such theories as Utter-confusion Theory would unnecessarily retard the progress of coalition research.

Evaluations of Theories

Much research has been done in an attempt to test the theories

which have been discussed in the immediately preceding section of this paper. Before the relevant research is examined in an attempt to determine which theory best explains the data, Caplow's eight triadic types and the coalitions that are predicted by each theory will be summarized. The predictions of the theories are delineated in Table 1.

An examination of Table 1 reveals that the only triadic type that differentiates between the four theories is the Type 5 triadic situation, i.e., A>B>C, A<(B+C). In the Type 5 situation, Control Theory predicts that AB and BC coalitions are equally likely, MRT predicts BC coalitions will form, MPT predicts that all coalitions are equally likely, and anticompetitive theory predicts that if the payoff is equally divisible AB or BC coalitions will be equally likely and if the payoff is not equally divisible AC coalitions will form. Because of this unique feature of the Type 5 triad and the fact that virtually all of the relevant research has examined it the present review of the literature will concentrate on the data obtained from the examination of the Type 5 triad. However, where it is deemed important, data from other triadic types will be utilized. The utilization of the Type 5 triad is not meant to imply that the other triadic types are not equally as important or that the Type 5 triad has been the only triadic type examined. It does mean that the present writer believes that a greater understanding of coalition research can be reached by concentrating on the Type 5 triad rather than considering the data for all of the eight triadic types which have been delineated.

Table 1

Coalitions predicted by the four theories of coalition formation in the triad for the eight triadic types delineated by Caplow

	Type of Triad	Coalitions Predicted by CT	MRT	MPT	AT* A	AT* B
1	A=B=C	any	any	any	any	any
2	A>B, B=C, A<(B+C)..	BC	BC	any	BC	AB or AC
3	A<B, B=C	AB or AC	AB or AC	any	BC	AB or AC
4	A>(B+C), B=C	none	---	none	none	none
5	A>B>C, A<(B+C)	AC or BC	BC	any	AB or BC	AC
6	A>B>C, A>(B+C)	none	---	none	none	none
7	A>B>C, A=(B+C)	AB or AC	---	AB or AC	AB	AC
8	A=(B+C), B=C	AB or AC	---	AB or AC	AB or AC	AB or AC

*A = the predicted coalitions when the payoff is equally divisible.

B = the predicted coalitions when the payoff is not equally divisible.

Minimum Power Theory. In general MPT has been refuted by the coalition research which has been conducted to date. (e.g., Vinacke & Arkoff, 1957; Vinacke, 1959, 1962; Phillips & Nitz, in press; Cole & Phillips, in preparation) That is the prediction that all coalitions are equally likely in the Type 5 triadic situation has not been reported.

Kelley and Arrowood (1960) suggested that if the procedure were simplified and more fully explained, the subjects would acquire an adequate understanding of the true power relationship within the triad. As a result, they would play a more rational strategy. Therefore, they designed an experiment based on the pachisi paradigm[2] in which all triads played a lengthy series of

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[2]Since the pachisi paradigm has subsequently been used extensively in coalition formation studies, a detailed description of the paradigm and the procedure for using it as taken from Vinacke and Arkoff (1957) follows: "Apparatus for the experiment consisted of a modified pachisi board. Only the exterior lanes of the board were used, and the spaces of these lines were numbered consecutively making a total of 67 spaces. The object of the game was to reach 'home' first. The winner was awarded a prize of 100 points. In the event of a coalition, the prize was shared in a manner agreed upon by the allies. A single die, cast by the experimenter, was used. Each player's move was determined by the weight inscribed on the counter he drew from a hopper; he was entitled to move forward the number of spaces equal to his weight times the number shown by the die. All of the players started from the same home base and moved simultaneously, that is, every player moved each time the die was thrown. At any time during the game, any player, in return for a promise of a specified portion of the prize, could form an alliance with any other player. In this case, the allies immediately pooled their strengths and proceeded to a position equal to their combined acquired spaces; in further throws they moved forward according to their combined weights (times the die). Once an alliance was formed, it was considered permanent for that game. Any player could concede defeat when his position appeared hopeless." (p. 408)

games in the Type 5 triadic situation only. The power relationship within each triad was kept constant across all games.

Kelley and Arrowood argue that due to the simplified nature of the instructions and of the overall game some subjects perceived the real power structure very early. This was suggested by the fact that the number of the various types of coalitions in the first three trials combined did not differ significantly from what would be predicted by MPT. However, there are two aspects of the Kelley and Arrowood procedure which accounts for the results without recourse to MPT. These two aspects are (1) each subject remained in the same power position throughout the experiment, i.e., the power relationship was permanent, and (2) the subjects were instructed to accumulate as many points as possible over trials, i.e., the payoff was cumulative. The combination of these two aspects adds a second resource dimension to the situation. That is, on the first trial the subjects have only the initial resource weights, i.e., one resource dimension, on which to base their strategy. However, on all subsequent trials the strategy is based on the initial resource weights, i.e., the first resource dimension, plus the amount of payoff that each subject has accumulated, i.e., the second resource dimension. Therefore, at the beginning of any trial after the first the relative power of each player would be determined by what had happened on the previous trials.

The suggestion that a second resource dimension was salient after the first trial is supported by studies which have examined the effects of cumulative score in the coalition situation (Vinacke,

1959, 1962; Bond & Vinacke, 1961; Uesugi & Vinacke, 1963; Cole & Phillips, in preparation). Vinacke (1959) obtained data which indicated that over three games the two weakest players with respect to initial resources tend to ally against the stronger. However, there was a tendency for the two strongest members of the triad to coalace in the third game. Further support for the suggestion that the use of cumulative score adds a second resource dimension results from a study by Vinacke (1962). He observed that in the first game of the cumulative score condition, BC coalitions were prevalent in the Type 5 triadic condition; however, by the third game there were more AB coalitions formed than BC coalitions. Moreover, in a condition which utilized a discrete payoff, BC coalitions were formed significantly more often than AB coalitions in each of the first three games. A comparison of the cumulative score and discrete payoff conditions in the third game indicates that the cumulative score does have an effect. However, the effect is not highly visible if the data for the first three games is combined as was done by Kelley and Arrowood.

The results of the Cole and Phillips study (in preparation) indicate that the effect of cumulative score is even more pronounced if the subjects remain in the same power position over games. That is, by the second game in the Cole and Phillips study there were more AB coalitions formed than AC or BC coalitions. Since Kelley and Arrowood utilized the permanent power relationship, their results are more likely to be an artifact of the experimental design than a

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consequence of the fact that the subjects perceived the true power relationship and played a rational strategy.

As a result of the Kelley and Arrowood study, Vinacke, Crowell, Dein, and Young (1966) designed an experiment which was proposed to determine "the influence of information about opposing views of the power pattern on the behavior of triads." (p. 181) Specifically, they wanted to know if giving the players a knowledge of the true power relationship in the triadic situation would result in their using the rational strategy which is predicted by MPT.

Since Kelley and Arrowood had critized the original pachisi paradigm for being too complicated, Vinacke, et. al. attempted to simplify the procedure. However, they did not simplify the procedure to the extent that Kelley and Arrowood had. For instance, based on the results of previous research (e.g., Vinacke, 1959, 1962), Vinacke, et. al. decided that keeping the players' weights constant over games would result in a loss of interest in the game and a tendency for the players who were behind in any game after the first game to form a coalition. For this reason, resource weights were randomly assigned before each game. Moreover, discrete rather than cumulative score was used. The method which Vinacke, et. al. used to simplify the situation was to inform some of the subjects that the true power of each player was equal.

The games were played in two sections. The first three games were replications of the original pachisi paradigm and were referred to as the learning period. The last three games (the second section) were played under the information condition. Prior to the second

section, randomly selected subjects were given instructions which informed them of the two alternative strategies: (1) any two players will win if they form a coalition, hence the initial power makes no difference, and (2) the two weaker players can defeat the stronger player if they form a coalition. "In one set of triads, these explanations were given to one member, in a second set to two members, and in a third set to all three members." (p. 183) The results refuted MPT in all conditions except the condition which examined all male triads and in which all three members of the triad received the information about the true power relationship.

Since virtually all of the research to date has refuted the predictions of MPT, it is felt that MPT should be rejected as a major theory of coalition formation. However, it is not felt that it should be forgotten. That is, there are aspects of coalition formation research which indicate that some of the assumptions of MPT may prove useful in developing an acceptable theory of coalition formation. For instance, the assumption that the subjects play a rational strategy may prove to be an important part of any new theory which is developed. Moreover, the structure of MPT, i.e., the quantitative approach, would result in a more precise presentation of any theory which is proposed.

Control Theory vs. Minimum Resource Theory. The early research on coalition formation in the triad (Vinacke & Arkoff, 1957; Vinacke, 1959; Chaney & Vinacke, 1960; Bond & Vinacke, 1961) seemed to support CT. However, the tendency for significantly more BC coalitions than AC coalitions to form in the Type 5 triad could

not be accounted for by CT. MRT on the other hand, does account for this effect. That is, MRT predicts that BC coalitions will be prevalent in the Type 5 triad. Therefore, while CT served its purpose as a pioneer theory in coalition formation it has been replaced by MRT. However, a recent extension of CT by Chertkoff (1967) suggests that CT is still very much a part of coalition theory.

Chertkoff proposed that the predictions of CT should take reciprocal partner preferences into account. Therefore, the probability that two players will contact each other is an important variable when predictions as to who will form coalitions are made. For example, consider the Type 5 triad. CT predicts that player A will contact player B 50% of the time, and player C 50% of the time; player B will contact player C 100% of the time and player A 0% of the time; and player C will contact player A 50% of the time and player B 50% of the time. As a result the probability that an AB coalition will form is .5 x 0, therefore, no AB coalitions are predicted; the probability of AC coalitions forming is .5 x .5, therefore, AC coalitions are predicted 25% of the time; and the probability of a BC coalition forming is 1.0 x .5, therefore BC coalitions are predicted 50% of the time. If the subjects are allowed to repeat this process until reciprocal contacts are made, the final distribution of coalitions would be in a ratio of 2 BC coalitions to each AC coalition and there would be no AB coalition. While this does not accurately predict the distribution of coalitions which have been reported in the various studies, it is as accurate as MRT. Therefore, to determine which theory best fits the coalition

situation the process by which coalitions are formed as well as the outcome of the coalition situation must be examined.

To examine the process of coalition formation Shelly and Phillips' (1966) assumption that there are two disjoint segments (the social contact segment and the bargaining segment) within the coalition process, will be utilized. To simplify the comparison of CT and MRT, only the Type 5 triad will be examined. The question to be answered is: "What are the differences between the predictions of MRT and CT within each segment of the coalition formation process. If CT is supported in the contact segment player A will contact players B and C equally often, player B will contact player C only, and player C will contact players A and B equally often. However, if MRT is supported, the "strength is weakness" effect should be observed in the contact phase, i.e., each player should contact the weaker of the other two players. The comparison of predicted results in the bargaining segment of the coalition process reveals no apparent differences between MRT and CT. Since all of the contact data after the initial contact is complicated by extraneous factors such as who each player has contacted previously and why a coalition has not formed, only the initial contact data will be examined.

Two studies report the initial contact data in the Type 5 triad, i.e., Chertkoff (1966) and Cole and Phillips (in preparation). Both Chertkoff and Cole and Phillips report that in the Type 5 triad each player initially contacts the player who has the smaller resource weight significantly more often than the player who has the larger resource weight, i.e., "strength is weakness." Therefore MRT

is supported with respect to the contact segment of the coalition formation process in the Type 5 triad.

Further support for MRT over CT is reported in a series of studies conducted by Phillips and his students, (Cole & Phillips, 1967a; Phillips & Nitz, in press; Cole, Nitz, & Phillips, in preparation.) The relevant studies have used a "political decision questionnaire"[3] to examine the contact segment of the coalition formation process and have concentrated on the Types 1, 2, 3, 4, and 8 triadic situations. Therefore, the data which they have

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[3]The political decision questionnaire (PDQ) allowed subjects to indicate their initial preference for a coalition partner and was worded as follows:

> "Assume you are the manager for a candidate in a political party convention. There are a total of 300 votes among the delegates, and at least a majority (151) of these are required to win the nomination. Your man, Candidate A, has _____ votes pledged to him, Candidate B has _____ votes, and Candidate C has _____ votes. Which of the other two candidates, B or C, will you approach first to try to make a deal?"
>
> B C
> (circle one)

The preceding item was the first item on each form. There were ten items in all. Candidate A was assigned 33 different voting values, however, only the situations in which A had more than 75 votes were reported. On all items either B or C was assigned a number of votes which was equal to A's and the third candidate was assigned a number of votes so that A + B + C = 300.

obtained adds to the support of MRT which has been reported in the Type 5 triad. That is, with the exception of the Type 1 and Type 4 triadic situations those situations in which contacts have been examined report a significant "strength is weakness" effect. In the Type 1 triad all members are equal and there can be no "strength is weakness" effect by definition. The Type 4 triad contains a dictator so it is not covered by MRT.

To further examine the merits of MRT, the hypothesis that the parity norm will be salient was examined. Various studies have examined the saliency of the parity norm by comparing the number of times the payoff is split on a 50/50 basis with the number of times the payoff is split so that the larger share of the payoff is obtained by the member of the coalition who contributed the larger share of the resources. (e.g., Vinacke & Arkoff, 1957; Vinacke, 1959; Cole & Phillips, in preparation). In general they have reported that the parity norm is salient. However, while the number of 50/50 splits is small in those coalitions in which the players are not equal, it is also true that the number of times that an exact parity split is obtained is small. Thus, the parity norm does seem to effect which coalition is preferred but the division of the payoff does not accurately reflect the parity norm.

As a result of the comparison of MRT and CT, MRT has emerged as the most acceptable of the two theories. However, one other theory, i.e., anticompetitive theory (AT), remains to be examined.

Anticompetitive Theory vs. Minimum Resource Theory. AT has

been supported to some extent by most of the research which has examined behavior in the coalition formation situation (Vinacke, 1959, 1962; Bond & Vinacke, 1961; Uesugi & Vinacke, 1963; Cole, Nitz, & Phillips, in preparation). This support for AT has been manifest predominantly in the strategy which is employed by females. That is, females tend to consistently employ a less competitive strategy than males. Although the feminine strategy is consistently different than the masculine strategy, it is not statistically different. As a result, the predictions of MRT have continued to account for the process and outcome of the relevant coalition situations even though they have been weakened somewhat by the feminine strategy.

Chaney and Vinacke (1960) and Amidjaja and Vinacke (1965) examined the effects of need for achievement and need for nurturance on the strategy employed in a coalition situation. The predictions of MRT were supported regardless of the motivational factors involved. However, an effect similar to what has been noted between males and females was observed between males high in need for nurturance and males high in need for achievement. Those males who were high in need for nurturance played a somewhat less competitive strategy than those males who were high in need for achievement, although the resulting strategy was not significantly less competitive. The effects attributed to need for achievement and need for nurturance in the male triads were not observed in the female triads (Amidjaja & Vinacke). This adds more support for the hypothesis that there is a

systematic difference in the strategies employed by the two sexes. Moreover, it suggests that the effects of personality variables need to be examined more carefully. That is, measures which better examine the personality characteristics of the competitive and anticompetitive strategies should be developed.

Geiss (1964) studied the coalition situation with respect to how it was played by high machiavellians as compared to medium and low machiavellians. The data indicated that high machiavellians, i.e., individuals who are willing and able "to use guile, deceit, and other opportunistic strategies in interpersonal relations in order to manipulate others," (p. 1) are successful in their attempts to manipulate others. Since Geiss does not report the coalition data, MRT and AT cannot be compared. However, Dawson and Phillips (unpublished data) report that high machiavellians prefer to form the weakest coalition even when it is not a winning coalition. An examination of verbalized strategies (Cole & Phillips, 1967a) reveals that many subjects do not consider the fact that a coalition has no way of obtaining some of the votes which are promised to the isolate. Therefore, the high machiavellians, being more competitive, may attempt to form the coalition to which they contribute the most votes with the plan of subsequently attempting to seduce votes from the isolate. By such strategies a losing coalition can be transformed into a winning coalition and the high machiavellians would receive more of the payoff than they would by forming a winning coalition in the first place.

The connection between the studies which examined sex differences (i.e., Vinacke, 1959, 1963; Bond & Vinacke, 1961; Uesugi & Vinacke, 1963; Cole, et. al., in preparation) and those which examined personality differences (i.e., Chaney & Vinacke, 1960; Geiss, 1964; Amidjaja & Vinacke, 1965) is apparent. That is, the saliency of the anticompetitive norm may be the result of underlying personality variables rather than sex differences per. se. Therefore, AT may apply to males depending upon their personalities.

In a recent study designed to compare the predictions of MRT, MPT, and AT, Phillips and Nitz (in press) obtained results which supported MRT. However, some support for a weakened version of AT was reported, i.e., in those situations in which the payoff is not equally divisible 'the probability of contacting a given person is reduced by some factor if that person is similar in terms of resources." (p. 10) The weakened version of AT is a modification of MRT. However, it is important because it allows for the suggestion that an anticompetitive norm may exist.

Further support for MRT over AT is found in a study by Cole and Phillips (1967a). Since there were some subjects who did not follow the predictions of MRT, they administered the PDQ and then asked the subjects to verbalize the reasons why they chose the candidate that they did. An analysis of those verbalizations supported MRT over AT. More than 85% of all strategies were based on the strong-weak dimension rather than the same different dimension, and better than half of the strategies verbalized were the ideal

MRT strategy.

Since AT has found sufficient support to indicate that an anticompetitive norm may be operating in the coalition situation, the effects of the anticompetitive norm need to be accounted for. However, it is not felt that the effects of the anticompetitive norm are strong enough to necessitate a special theory to explain it. It is proposed that a better method of acknowledging the existence of an anticompetitive norm would be to extend MRT. MRT should take into account that there are individuals who do not wish to maximize their share of the reward. Instead they attempt to divide the reward as "fairly" as possible. Therefore, in those triads which include one or more individuals who play a strategy based on the anticompetitive norm the predicted coalitions may not follow from the parity norm. In many situations this could account for those coalitions which occur and are not predicted by MRT.

Criticisms of MRT. There are two major criticisms of MRT which are evident to the present writer. One criticism, which is true of most psychological theories, is that the predictions are too strong. For example, if MRT is strictly interpreted only BC coalitions are predicted in the Type 5 triad. A search of the coalition literature failed to uncover any studies which observed only BC coalitions in the Type 5 triad. The second criticism is that the boundary conditions of MRT are too narrow. By this it is meant that there are too many valid coalition situations which are outside the scope of MRT.

There have been two attempts to rectify the first criticism, i.e., Chertkoff (1967) and Shelly and Phillips (1966). Both attempts have proposed to do so by developing a mathematical model. The basis for both models is the differential propensity of each member of a triad to prefer each of the other members of the triad as a coalition partner. Chertkoff's model has already been discussed with respect to CT for which it was offered. Moreover, it was shown that even though MRT makes less accurate predictions than Chertkoff's revision of CT, the assumptions upon which MRT is based are supported by the data concerning the process of coalition formation. Therefore, Chertkoff's model has been refuted.

Shelly and Phillips (1966) base their model on the probability of a simultaneous reciprocal contact as computed from the data. In order for a simultaneous reciprocal contact to occur two members of the triad must contact each other on the same trial. A trial is defined as "that unit of the contact segment of the process in which each person makes one contact." (p. 1) Subsequent development of the model has resulted in predictions which are more accurate than the predictions of MRT in the situations in which simultaneous reciprocal contacts are required. However, the state of the model requires further development. Even though the two models which have been proposed are not adequate, it is suggested that before an adequate theory of coalition formation is developed the contact probabilities of each member of the triad will have to be considered.

The second criticism of MRT, i.e., that the boundary conditions are too narrow, results from studies which have examined coalition situations outside of the scope of MRT. Studies which have fallen outside of the boundary conditions of MRT (e.g., Kelley & Arrowood, 1960; Stryker & Psathas, 1960; Psathas & Stryker, 1965; Chertkoff, 1966) have consistently failed to report results similar to those studies which have remained within the boundary conditions of MRT. Since the studies are outside of the scope of MRT, it is not surprising to discover that MRT does not accurately predict their results. However they must be examined prior to any further attempt to develop a theory of coalition formation which will not be subject to the criticism that its boundary conditions are too narrow.

The study by Kelley and Arrowood (1960) falls outside of the scope of MRT due to the fact that after the first game has been played the power of each member of a triad is determined by more than one resource dimension. That is, the power of each individual is determined by the amount of the payoff which he has accumulated as well as the assigned resource weight, i.e., there are two relevant resource dimensions. As has been stated previously, this interpretation has been supported by research, i.e., Vinacke (1959, 1962), Vinacke, et. al. (1966), Cole and Phillips (1967b). The key concept to be considered in such a situation is the concept of multiple resource dimensions. A resource has been defined as a weight assigned to each player in a game such that the distribution of the payoff is determined by some critical quantity of that weight.

However, the weight assigned to an individual player is in reality a value on some resource dimension. Moreover, the total resources of the players in a given situation may be composed of more than one resource dimension which are not necessarily assigned to the players. Thus, the concept of multiple resource dimensions must be considered if the criticism of narrow boundary conditions is to be overcome.

Stryker and Psathas (1960) and Psathas and Stryker (1965) fell outside of the scope of MRT because they introduced contention between the appropriate subjects by informing them that they had been enemies of long standing, and could not form a coalition. In one condition, contention was introduced between the weak man and one of the strong men; in another condition, the contention was between the two strong men; and in another, there was no contention. The introduction of the contention factor makes it impossible to interpret the Stryker and Psathas studies within MRT. Even so, it is suggested that the relevance of the contention factor should be carefully examined before it is considered in an attempt to increase the boundary conditions of MRT.

Of the studies which fell outside of the scope of MRT, only one (Chertkoff, 1966) reported results which were strikingly different from the predictions of MRT. Chertkoff used the political

convention paradigm[4] for the study of coalitions in the triad. However he added a second resource dimension by manipulating the probability of future success. This was accomplished by varying the probability that a coalition would win the election after it had won the nomination. The Type 6 triad was examined in all conditions. In all three experimental conditions players B and C had a .5 probability of future success in the national election. Player A's probability of future success varied between .5, .7 and .9 depending on the condition. A control condition was used in which the probability of future success was not a factor. In the control condition the "strength is weakness" effect was reported. However, in the conditions in which player A had a .5 and .7 probability of future success, the power inversion effect was weakened, i.e., the distribution of preferred coalition partner was not different from chance expectancy. In the condition in which player A had a .9 probability of future success the power inversion effect was replaced by the "strength is strength" effect, i.e., AB coalitions were preferred. Moreover, as the probability of future success increased the parity principle

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[4]In the political convention paradigm each subject plays the part of a delegation chairman at a political convention. Each subject is assigned a given number of votes at the beginning of the convention. For each subject the object is to acquire as many "jobs" for his faction as he can. To acquire jobs the subjects must form a coalition which can win the nomination. The number of jobs that each subject acquires if he has entered into a winning coalition depends on the division of the jobs that the two subjects who formed the coalition agree upon. If a subject is not in a winning coalition, he receives no jobs for his faction. (Gamson, 1961b)

became more salient. This is indicated by the tendency for the player with the highest probability of future success to demand and receive a larger share of the payoff.

An attempt to explain why the results vary when the probability of future success is manipulated leads to a differentiation of the probabilistic and deterministic[5] situations. Prior to Chertkoff's study the theories and research had all focused on the deterministic situation. However, Chertkoff's study extended the research on coalition formation to the probabilistic situation. As a result any attempt to develop a theory of coalition formation must take the probabilistic situation as well as the deterministic situation into account.

Subsequent to Chertkoff's study only one study has examined the effects of the probabilistic and deterministic aspects of the coalition situation. (Vinacke, Lichtman, & Cherulnik, 1967). The major finding of the Vinacke, et. al. study was that there is a propensity to gamble on winning all of the payoff in the probabilistic situation, i.e., there is a tendency to play without forming a coalition. Moreover, the propensity for a participant to play

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[5]Probabilistic situations are those in which no unit or combination of units will win with probability one. Deterministic situations are those situations in which some unit or combination of units will win with probability one.

the game alone increases as the probability of that participant winning alone increases.

In conclusion it is proposed that MRT has the basic assumptions which are necessary for a theory of coalition formation. However, for MRT to adequately predict behavior in all coalition formation situations the scope of MRT must be increased by considering three factors. The first factor requires an acceptance of the presupposition that the anticompetitive norm is salient for certain individuals. Therefore, the possibility of the anticompetitive norm effecting the process and outcome of the coalition formation situation must be considered. Secondly, MRT must redefine the concept of resources to include multiple resource dimensions. The third variable to be considered is that the probabilistic and deterministic nature of a given coalition formation situation must be accounted for. Although future research may point out other variables which must be considered, at the present time an extended version of MRT which considers the anticompetitive norm, the concept of multiple resource dimensions, and the probabilistic vs. deterministic aspects of a given coalition situation, will cover those situations which by standards of current research, are of major importance.