USE OF MULTIDIMENSIONAL UNCERTAINTY IN COALITION FORMATION RESEARCH

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IN COALITION FORMATION RESEARCH

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PREFACE

This study is concerned with the use of multiple sources of subject uncertainty in a set of coalition formation experiments. The purpose of the study is to provide a research methodology that will better generalize to coalition behavior found outside the laboratory. Three models are offered to explain the study's results.

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CHAPTER I

INTRODUCTION

Coalitions play an important role in social interactions. Whether the situation is a business meeting, political convention, or simply a social gathering, coalitions are formed to meet the needs of people. Basically, a coalition represents the combining of two or more individuals' resources in an effort to secure some mutually desirable goal.

One goal of a coalition may be self-protection. By uniting resources, members of a coalition might be able to prevent the harm or exploitation of its individual members by a hostile force. Civil rights groups and the early labor unions serve as examples of self-protection coalitions.

A second goal a coalition could serve is that of competition. Through a coalition, it could become possible to gain a desired outcome in the face of competition from an opponent who could defeat the coalition members individually. An example of a competitive coalition is that of two countries forming a military alliance against a powerful third country in order to possess some "neutral territory."

A third goal of coalitions is that of preserving status quo. Status quo coalitions serve to prevent undesirable changes from occurring to some situation common to its members. White home-owner groups which have opposed the racial integration of their neighborhoods are an example of a status quo coalition.

Whatever the purpose of a coalition, its potential members may consider four criteria before deciding whether or not to join the coalition. One major criterion is estimated probability of obtaining the desired outcome individually. If a person believes he or she is capable of acquiring an outcome without assistance, then that person is not likely to join a coalition.

Even if a person believes he or she is capable of individual success, a second criterion to take into account is the ability to overcome the opposing efforts of a coalition. The person able to achieve success in some outcome even in competition with a coalition is not likely to be motivated to join a coalition. Thus, the first two questions the prospective coalition members asks is, "Can I accomplish what I seek without assistance?" (related to criterion 1), and, "Can I accomplish what I seek in the face of opposition from a coalition?" (related to criterion 2). If the answer to either of these questions is "No," then there should exist some motivation to join a coalition.

A third criterion is the effect of the coalition's influence on outcomes. In terms of influencing some outcome, coalitions function in either a deterministic or probabilistic fashion. A deterministic coalition assures its members of success. The probability of obtaining the desired outcome for a deterministic coalition equals one. The probabilistic coalition is formed to increase the chances of its members to obtain a desired outcome over that of the members' solitary efforts. The chance of a probabilistic coalition's success is always less than one.

The fourth criterion involves the obtained outcome or payoff the individual expects to receive for his or her participation in a coalition. The more profitable an individual believes the payoff will be, the more likely that person is to enter into a coalition.

The second two relevant questions asked in this regard by the prospective coalition member are: "How likely is the potential coalition to succeed in its goal?" (related to criterion 3), and, "How will the outcome (payoff) be distributed?" (related to criterion 4). Notice that answers to the first two questions (from criterias 1 and 2) determine whether a person seeks to join a coalition or pursue his or her goal alone. Answers to the second two questions indicate to the prospective coalition member a preferable coalition partner. Though people may not always use the set of four criteria discussed here, they

are presumed to follow some deliberate decision process when faced with the opportunity to form a coalition.

Social psychologists have long been interested in the dynamics of coalition formation. Two questions commonly addressed by social psychologists have been: "What decision criteria do people use in forming coalitions?" and, "How do coalition members determine the terms of payoff distribution in the event of successfully obtaining their goal?" In the following section, the coalition formation theories most relevant to the present study are presented. The articles reviewed consist of the major social psychological theories on coalition formation. After the literature review, a critique of the current coalition formation research methodology used to test the discussed theories has been presented.

CHAPTER II

RELEVANT COALITION FORMATION LITERATURE

A variable commonly studied in coalition research has been the distribution of resources among members of a triad. The resources of triad members have frequently been identified by the letters A, B, and C. Those letters served to identify resources used by the triad members to acquire the desired outcome. For basic coalition formation, decision criteria , and coalition predictions have usually been studied for the A > B > C, A < (B + C) resource situation. The reasons for focusing on this particular situation in the present study are twofold. First, it is with this situation that theories show the greatest divergence in their predictions about coalitions. Second, the majority of coalition formation research (the present study included) has used the A > B > C, A < (B + C) resource distribution situation.

Caplow's Models

The work of Caplow (1956) has been recognized for presenting the first social psychological theory of coalition formation. Caplow's 1956 theory presented the variable of interpersonal control as the major determinant of

coalition behavior. Under this model, individuals decide to form a coalition on the basis of the amount of control each would have over other members in the triad. Individuals were said to prefer a coalition which maximized their control over other triad members while it minimized the amount of control exercised over them.

Caplow (1956) predicted that in a resource situation where $A > B > C$, $A < (B + C)$, the coalitions of AC and BC had an equal probability of occurring. Caplow predicted that the person weakest in resources would be sought after as the preferred coalition partner by other members of the triad. A coalition between individuals B and C represented a revolutionary coalition. The revolutionary coalition was so named because it enabled the two weaker members of a triad to "overthrow" the strongest individual. If under the same resource distribution, a coalition formed between individuals A and B the coalition was identified as conservative. According to Caplow, an A and B coalition retained the initial power hierarchy. Within the coalition, individual A continued to "dominate" individual B, and the excluded individual C remained the weakest person in the triad. While a coalition between individuals A and C was acknowledged by Caplow, it was not classified in his theoretical work. The final determination of which coalition would be formed, according to Caplow, depended on the inducements the stronger A or B each offered C.

Given Caplow's (1956) assumption that triad members were solely motivated by the opportunity for interpersonal control, A and B prefer a coalition with C because it would enable either one of them to control the other members of the triad. A or B could control C by right of their individually superior resources, while the triad member excluded from the coalition would be controlled through the combined strength of the coalition. Without additional inducements, C would have no preference for either A or B. In either the AC or BC coalition, C would control the excluded triad member and be controlled by the coalition partner.

In 1959, Caplow expanded his coalition model to take into account situational variables on coalition formation strategies. Caplow introduced three situational coalition strategies which were defined as follows:

> Continuous: Here the object of a coalition is to control the joint activity of the triad and to secure control over awards which are found within the situation itself.
>
> Episodic: The membership of the triad is stable, and the contest for power continues over an extended time, but the object of a coalition is to secure an advantage in the episodic distribution of rewards which occur periodically and under predetermined conditions.
>
> Terminal: The coalition is directed toward a single redistribution of power, terminal, either because it dissolves the triad or because it leads to a state of equilibrium which precludes further distribution (p. 489).

The example of a continuous coalition situation would be the situation in which a group of three friends select

their social activities through majority sentiment. A triad of professors involved in the acquisition and division of research funding for their individual projects would be a situation providing motivation for episodic coalitions. Finally, a scenario in which the United States, Russia, and China engage in all-out nuclear warfare would illustrate an appropriate situation for the formation of a terminal coalition.

In predicting coalitions based on the nature of the resource situation and situational strategy conditions, Caplow (1959) stated that for the resource situation $A > B > C$, $A < (B + C)$, overlapping coalition patterns occur in the Continuous and Episodic coalition situations. For Continuous coalition situations, coalitions between AC and BC are predicted the most likely to occur. In an Episodic coalition situation, all possible coalitions (AB, AC, and BC) have an equal probability of occurring. Caplow indicated interpersonal control was important only in Continuous coalition situations. Individuals in Episodic coalition situations concentrate on forming coalitions which maximize their share of the reward. For the terminal situation, Caplow predicted that no coalition would form.

Minimum Resource Theory

Caplow's (1956, 1959) work has served as a background against which other social psychological coalition theories

were developed. One such theory that evolved from Caplow's models was the Minimum Resource Theory of Gamson (1961). The Minimum Resource Theory was designed to predict coalitions in groups where $N \geq 3$ and estimate the payoff distribution among coalition members.

The predictions which resulted from Minimum Resource Theory were based on two assumptions: First, the coalition containing the minimum amount of resources necessary to obtain the payoff will be the most likely to form. Second, payoff distribution will be based on the parity concept. This means that members of a successful coalition expects a payoff proportional to the resources they contribute to the coalition. Thus individuals seek to identify and join the coalition which maximizes their resource contribution and expected payoff share, according to Minimum Resource Theory. For the $A > B > C$, $A < (B + C)$ resource situation, Gamson (1961) predicted that coalitions would probably form between triad members B and C. Such a coalition contains the minimum necessary resources used to obtain the payoff while maximizing each member's expected parity-based payoff share.

Bargaining Theory

Komarita and Chertkoff (1973) designed the Bargaining Theory of coalition behavior. Unlike the theories of Caplow or Gamson, Bargaining Theory considers the effect of successive experiences on coalition behavior. Related

research has found that payoff distribution between coalition allies shifted or fluctuated over a series of experimental coalition trials. The theory states that the stronger coalition member sought to distribute payoff according to parity; payoff share proportional to contributed resources. The weaker coalition member is assumed to advocate a payoff distribution based on the concept of equality, with the payoff being divided evenly between the two coalition members. Bargaining theory holds that the distribution norm differences are resolved by two conditions. First, coalition members negotiate from overlapping expected maximum and minimum acceptable payoff ranges. Second, the threat of a dissatisfied coalition ally leaving to form a new coalition provides motivation for coalition members to accommodate one another. Bargaining Theory states that, over successive coalition formation trials, individuals form coalitions and payoff agreements which minimize the probability of either coalition member "defecting" or leaving to form a new coalition with the excluded triad member.

A major assumption of the Bargaining Theory is that triad members attempt to form a coalition with another member whose expected range of payoff distribution most closely matches their own. In their discussion of the $A > B > C$, $A < (B + C)$ resource situation, the authors predicted that the most likely coalition would consist of B-C. This prediction is based on the assumption that

individuals B and C have the least conflict in terms of their respective expected payoff shares. The next most likely coalition was predicted to form between individuals A and C. The least likely coalition was predicted to be the A-B formation.

Weighted Probability Model

Shortly after presentation of the Bargaining Theory, Komarita (1973) proposed the Weighted Probability model of coalition behavior. Komarita made four theoretical assumptions. First, minimum winning coalitions will form in the absence of incentives to maximize joint outcomes. Second, the difficulty of forming a coalition increases monotonically as a function of group size. Third, the expected reward for an individual in a coalition is proportional to the probability of that person's being included in a winning coalition. Fourth, if two or more coalitions have the same expected reward, an individual will attempt to form a coalition in which all members are relatively equal in resources (Komarita, 1973).

The Weighted probability model does not directly consider the A > B > C, A < (B + C) resource situation. The theory's emphasis is upon the effects group size and quantity of alternatives available to group members had on coalition behavior. Murnigham (1978) has reported three ways in which the Weighted probability model differs from other social psychology coalition formation theories.

First, the expected reward is said to be determined by the quantity and size of coalition alternatives, rather than by the quality of coalition choices. Second, the model is considered applicable to coalition situations in which the resources of participants are not specified. Third, the Weighted probability model is capable of making exact predictions for the probabilities of different coalition configurations.

The predictions of the Weighted probability model were based on studies of tetradic and pentradic groups. Through coalitions formed in a triadic situation were not specifically dealt with, the model's first assumption gave some indication of likely coalitions. Komarita's (1974) definition of a "Minimum winning coalition" as one in which deletion of any member would cause the loss of the payoff, the most likely coalition under the $A > B > C$, $A < (B + C)$ resource situation would be B-C.

Anticompetitive Model

The "Anticompetitive" Theory discussed by Gamson (1964) originated from the studies of Bond and Vinacke (1961) and Uesugi and Vinacke (1963). The Anticompetitive Theory considers gender differences in the strategies for playing a mixed-motive coalition formation game. The conclusions reached from the articles are that males use an exploitive, competitive style of play, while female subjects seem more motivated to maintain good social

relations over maximizing their own individual playoffs. With its strong focus on sex differences in coalition behavior, the Anticompetitive Theory has little to say concerning the influence of initial resource distribution on coalition formation. The authors of both studies did note that the initial coalitions formed consisted of the "weaker players" competing against the "stronger players."

It was found when a cumulative score game situation was used that, as subjects' scores were summed over trials, there was a strong tendency for the two players behind the leading scorer to ally, regardless of their initial resources. This finding received support from an earlier study conducted by Vinacke (1969) investigating the effect of cumulative scores on triadic coalition formation. Thus, the findings of Anticompetitive research give tentative support to the prediction of a BC coalition in an $A > B > C$, $A < (B + C)$ resource situation.

Expected Utility Model

The Coalition Expected Utility Model (Wahba, 1972b) states that, when the success of a coalition is uncertain, individuals seek to form coalitions with the highest utility. Wahba (1972b) defines coalition success uncertainty as a situation in which the probability of success for any given coalition is greater than zero and less than one. The expected utility is seen as a value resulting from the subjective evaluation of the consequences

of a given coalition's success or failure. Coalition Expected Utility theory evaluates the A > B > C, A < (B + C) resource distribution situations under three conditions: First, it is assumed that the probability of success for any coalition is greater than zero and less than one. Second, the probability of coalition success is assumed to be positively related to coalition strength. Third, the utility of a coalition's success is assumed equal to one, while the utility of a coalition's failure is equal to zero. Under the stated conditions, the stronger the coalition, the more likely is success in obtaining the payoff. Although not specifically stated, there is an indication that payoff distribution is assumed to be parity-based. Wahba predicts that for A > B > C, A < (B + C) resource situation, the AB coalition is the most likely to be formed. The least likely coalition to form is one between individuals B and C. Research involving the Coalition Expected Utility model has reported data indicating that, "Coalitions with higher probability of success and lower gains were preferred over coalitions with higher gains and lower probability of success" (Wahba, 1972b, p. 675).

General Research Findings

The majority of coalition research has reported results which indicate that the individual with the greatest amount of resources is excluded from winning coalitions

(e.g., Chertkoff, 1970; Chertkoff & Esser, 1977; Collins & Raven, 1969; Gamson, 1964; Komarita & Meek, 1978; Murnighan, 1978; Stryker, 1972). This paradoxical "strength is weakness" effect was labelled the "power inversion" effect by Cole (1969). The power inversion effect referred to the significant preference for the weakest triad member as a coalition partner by the other triad members. In terms of experimental results the power inversion effect was manifested in the formation of winning coalitions which included the weakest triad member and excluded the strongest triad member. Notice that out of the six coalition theories presented earlier, only Wahba's (1972b) coalition, Expected Utility theory, specifically predicted that the weakest triad member would be excluded from "winning" coalitions.

CHAPTER III

GENERAL CRITIQUE OF CURRENT COALITION RESEARCH

Lack of External Validity

Observations of coalitions formed in field or "real life" settings frequently consist of what has been termed "Conservative" coalitions by Caplow (1956). Thus, in "real life," coalitions have been formed for the purpose of maintaining status quo. Businessmen form conglomerates to control a market, senior politicians band together to vote down controversial bills, and popular children form cliques which serve to exclude less popular children from various social activities. The common use of phrases such as "the rich get richer, while the poor become poorer" and the power of the "bandwagon" effect reflect the lay-person's awareness of "conservative" coalitions. The frequent prediction and reporting of "power inversion" effects (Cole, 1969) and lack of theories predicting "conservative" coalitions has led to criticism of coalition research as lacking external validity.

Commonly Used Coalition Research Paradigms

The criticism of the absence of external validity in current coalition research has been based on evaluation of the experimental methodologies used. Social scientists have primarily used two research paradigms to study coalition behavior. Those two paradigms have been the "political convention" and "parcheesi-board" methodologies.

The political convention paradigm involved the assignment of different voting strength to subjects. The $A > B > C$, $A < (B + C)$ resource situation would be represented by assigning subject A four votes, subject B three votes, and subject C two votes. Subjects involved in political convention studies were expected to role play politicians working the nomination of their own or a sympathetic "candidate" as the "party's choice for an upcoming general election." In order to "win" the nomination, a hypothetical "candidate" must obtain a simple majority of the available votes. The payoff or reward for successful nomination efforts was depicted as some number of jobs provided for the subject's "constituents."

For the parcheesi-board paradigm, subjects were assigned tokens of different advancement ability. For the $A > B > C$, $A < (B + C)$ resource situation, subject A's token had a movement of four spaces per turn, subject B's token had a movement of three spaces per turn, and subject C's token had a movement of two spaces per turn.

Subjects were informed that they were playing a game in which the object was to reach the finish line on the game board first, either individually or as part of a coalition. At the beginning of a trial, each player placed his token on the starting line. For each turn, the experimenter threw a die and subjects advanced their tokens according to their respective movement ability times the number from the die throw. The reward or payoff for winning the game involved either points, imaginary money, or small amounts of real money.

Unlike the political convention paradigm, which made coalition formation at the onset of a trial mandatory, the parcheesi-board paradigm allowed subjects to form coalitions during any turn of an experimental trial or to form no coalitions at all. The experimental procedure was such that, as in the case of political convention studies, any coalition would win. This was accomplished by having a coalition (represented by one token) advance its token a number of spaces equal to the sum of spaces moved by the individual coalition members prior to their union. If, for example, on turn one the experimenter threw a two on the die, subject A would advance eight spaces, subject B would advance six spaces, and subject C would advance four spaces. At the beginning of turn two, subjects B and C form a coalition. The experimenter identifies B's token as the coalition token and removes C's token from the board. The coalition token would then be

advanced 10 spaces, the total of B's and C's prior advancement, from the point reached by subject B in the previous round. Such a procedure resulted in a situation where a coalition could form at any point during a trial and reach the finish line first.

Central to both the political convention and parcheesi-board paradigms was the payoff distribution negotiations between coalition members. The common method was to have potential coalition members bargain for payoff distribution in some confidential fashion, i.e., notes, meeting in a room away from the excluded triad member, or lighted message boards. Frequently, experimenters focused upon the result of negotiations rather than the process of negotiating.

Restrictions Common to Current Research Paradigms

Komarita and Meek (1978) have presented five restrictions common to current coalition research paradigms:

1. Decision makers are individuals rather than groups of individuals (or committees) who must reach consensus before decisions are made.

2. Decisions are based on a single issue (or criterion) rather than multiple issues as in political or diplomatic negotiations.

3. The prize is constant (the same) for all 'winning' coalitions.

4. All decision makers are motivated to maximize on this criterion, and social motives

such as guilt, sympathy, altruism, and so forth, play a negligible role in the coalition process.

5. There is perfect information among the decision makers regarding the weights (resources, power, votes, etc.) of each of the other decision makers and how these weights are combined to determine the outcome (p. 393).

This author believes that the effect of the aforementioned paradigmatic restrictions has severely limited the generality of present coalition research findings to coalition behavior that occurred in "real life" situations.

Lack of Research Involving Experience and Uncertainty Variables

In the author's opinion, two variables commonly found in real life coalition situations have been underrepresented in the present body of coalition formation research. The first variable, continuity, involves the interdependent nature of coalition agreements and behaviors of coalition members working toward their goal. Under the major coalition research paradigms, coalition formation has typically been perceived as discrete behavior. Experimental coalition trials were usually designed to be independent of one another and effectively terminated once a coalition agreement had been reached.

A small body of research has been conducted investigating the effect of experience on coalition formation (Chertkoff, 1966; Chertkoff & Esser, 1977; Levinsohn, 1976; Vinacke, 1969). The general conclusion of the

studies was that the strongest triad member became more likely to be included in winning coalitions and meet his or her payoff expectations when successive experimental trials were presented as interdependent.

The second variable which has received little systematic attention in coalition research has been the influence of uncertainty on coalition formation. A fraction of coalition research has attempted to incorporate the real life variable of uncertainty in coalition research (Ashour, 1973; Barnett, 1972; Caldwell, 1971; Chertkoff, 1966; Folkes & Weiner, 1977; Simpson & Punwani, 1975; Wahba, 1972a, 1972b, 1972c; Wilke, Heertens, & Steur, 1973).

With the exception of the Wilke et al. (1973) study, the results of a coalition research involving an uncertainty variable reported a "strength is strength" effect. When experimental conditions were such that the probability of success for any coalition was less than one and greater than zero, there was a significant preference shown toward having the strongest individual as a coalition partner by the two weaker triad members. Review of the current literature which dealt with uncertainty undercovered two drawbacks which limited the generality of results.

Critique of Available Coalition Research Involving Uncertainty Variables

One drawback was the definition of uncertainty as a

unidimensional concept. Each of the available studies defined uncertainty as the probability an existing coalition has of obtaining its goal. At present there has been no systematic research effort made to investigate the effects multivariate forms of uncertainty could have on coalition behavior. Realistically, individuals who find themselves in potential coalition situations often lack full information in several areas. Examples of real life uncertainty factors include: The exact distribution of resources in the situation, the motives of potential opponents or coalition partners, and subsequent behaviors of opponents and coalition partner(s) as they work toward their goal. It is the absence of knowledge in such areas which gives real life coalition formation an aspect of multidimensional uncertainty.

A second drawback present in current uncertainty coalition research was the diversity in the experimental manipulations designed to produce uncertainty. Ashour (1973) used a dice game in which the experimenter threw a pair of dice five times for the coalition and five times for the excluded individual. The sums of the dice throws were multiplied by the respective weights of the coalition and the excluded individual. The individual or coalition that possessed the highest total was declared the winner.

Caldwell (1971) used the parcheesi-board paradigm; the variable of uncertainty was achieved by deletion of

the rule which permitted the coalition a "free" move equal to the sum of its members' prior advancement. If an individual had developed a substantial lead prior to the formation of an opposing coalition, that person could still reach the finish line first.

Chertkoff (1966) modified the political convention paradigm so that information on each candidate's chance of future success was included as a variable. The experimenter determined the success or failure of the coalition randomly drawing from a set of "win" or "lose" slips which were proportional to the probability of success given to the particular coalition. If coalition AB had a 70 percent chance of success, then the experimenter drew from a set of 10 slips containing seven win and three lose messages.

A deck of playing cards served as the randomizing element in Wahba's (1972a, 1972b, 1972c) coalition research. The coalition and individual played a card game in which the object was to obtain the majority of 26 available "tricks." The coalition members alternately drew from a standard deck of 52 playing cards. The values of the cards were multiplied by the weights possessed by the coalition and third individual. A trick was won by the party with the highest total for that turn.

Wilke et al. (1973) used dice throwing to introduce the element of uncertainty into a parcheesi-board paradigm. A die was thrown to determine if a party was

permitted to advance during a turn, then, if permitted, thrown again to determine the distance of advancement. Parties advanced the number spaces indicated through multiplying their assigned weights by the number that appeared on the die thrown.

Barnett (1972) and Folkes and Weiner (1977) provided no information on the procedures used to incorporate an (outcome) uncertainty as an independent variable in coalition research. Simpson and Punwani (1975) only mentioned that dice were used as the randomizing method.

Closing Comments

Efforts to broaden the generality of coalition literature, represented by research on the effects of continuity of coalitions and uncertainty variables, have been tempered by two factors. First, the small number of available studies in both areas limit the generalizations which can be made to uncontrolled field situations. Second, the absence of a consistent operational definition for the uncertainty variable has made acquiring reliability evidence difficult. It was the opinion of the author that the development of a coalition research paradigm which systematically incorporated the variables of continuity and multidimensional uncertainty would be useful in improving the generality of future coalition literature.

CHAPTER IV

PURPOSE OF PRESENT STUDY

The purpose of the present study was to investigate the effects of continuity of coalitions and multidimensional uncertainty on coalition behavior. The methodology involved represented a departure from more traditional coalition research paradigms. The result desired from the study was development of a methodology that would extend the ability of coalition research to generalize to the complexity of real life coalition behavior. The present study was designed to incorporate five independent variables into a series of experimental coalition situations. The five independent variables were: (1) coalition negotiations method, (2) selection of opponent, (3) initial resource distribution information, (4) coalition length, and (5) mutual cooperation payoff distribution.

The independent variables were presented in a series of studies which ranged from conditions of high to low subject "uncertainty" in terms of resource information and outcome possibilities. After a study had been conducted, chi-square analysis of the data determined the course of the research project. The experimental series was constructed so that rejection of the null hypothesis led to

studies which contained greater subject uncertainty. Results which failed to reject the null hypothesis led to a subsequent study which provided subjects with less uncertainty. Greater detail on the sequence of studies has been presented in the Methods Section.

Description of Present Study's Paradigm

The basic research paradigm involved the use of a mixed-motive card game known as Cosmic Encounter. At the start of a game subjects were each given a set of five "bases," four cards, and 20 tokens. The object of the game was to obtain a total of five bases from other subjects. Bases were represented by locations on the gameboard. The card sets consisted of three competitive or "attack" cards of differing numerical values and one cooperative or "compromise" card. The tokens were used to increase the numerical value of a competitive effort and to indicate possession of a base gained from another subject.

There were two ways to gain a base from another subject--first, by playing a higher attack card than the one played by the defending subject. Tokens could be used to increase the value of an attack card. This is discussed in the following section on multiple resources. A second method of acquiring bases was through the mutual play of compromise cards. When two subjects played compromise cards during a game round they could agree to

exchange bases, thus both would acquire one of the five bases needed to win. The rules of the game permitted two or more subjects to win simultaneously through cooperative play.

The game was also permitted the formation of coalitions. The benefit of forming a coalition was that members of the coalition pooled their token resources. This allowed both members of the coalition to have greater token value to add to any attack card either should play against the excluded subject. A precise discussion of the game mechanics has been presented in the Methods Section. It should be noted that the research game setting contained five features which conceptually parallel "real life" coalition situations: 1) multiple resources, 2) continuity of coalition behavior, 3) dyadic mixed-motive interactions, 4) interdependence of game rounds, and 5) multiple payoffs.

Multiple Resources

The first feature, multiple resources, was reflected in the use of token values and attack card values to determine initial strength. Subjects added the points assigned to their individual playing pieces or tokens to the number found on the "attack" card played. The weights given the subjects' tokens reflected the $A > B > C$, $A < (B + C)$ resource distribution. As the game commenced the number of bases acquired also served as an indicator

of subject strength. Under those studies in which coalitions lasted a single game round (study three, three-C, and four-D), the number of bases acquired by each subject became an important factor in determining the relative strength of the triad members. It was possible in some studies for subjects to be presented with a complex picture of known resources (token values and acquired bases) and unknown resources (relative attack card strength, with the attack values established by cards randomly distributed by the experimenter). Such a situation could lead to subjects' making coalition decisions at a level of complexity not frequently present or permitted in currently reported experiments.

Continuity of Coalition Behavior

The Continuity factor referred to the necessity of subjects to actively pursue their goals following the formation of a coalition. Subjects had to invest tokens and use the attack and compromise cards in efforts to defend their own bases while they sought to acquire the bases of others. Subjects had to decide whether to form a coalition or seek to obtain their goals independently. Once a game was underway, possible decisions subjects had to make included whether to play an attack or compromise card. If an attack card was used, some attack value needed to be selected for play. In the case of a mutual compromise situation, the offensive and defensive players

needed to decide whether to agree to the payoff terms or lose tokens. In those studies involving single round coalitions, a subject had to choose to make coalition offers to, or accept coalition offers from, a previous opponent. The availability of complex decision problems was intended to create a situation which subjects could find interesting and challenging.

Dyadic Mixed-Motive Game Elements

The third feature, that of dyadic mixed-motive game elements, added a dimension of uncertainty rarely found in coalition research. Through skillful and fortuitous play of attack and compromise cards, a subject could do well against the strongest of coalitions. In the same vein, coalitions could show a poor second to their opponent due to careless and stereotyped card play. With the inclusion of mixed-motive elements, subjects were motivated to attend to the conditions of play and behaviors of each other.

Interdependent Game Rounds

The fourth feature of the research paradigm, interdependent game rounds, involved the relation of consecutive game rounds. Simply stated, the results of one game round influenced the play of the next. During a game, subjects were likely to lose tokens and become weaker in the attacks they make. Conversely, the bases gained in previous game

rounds could effect the willingness of a subject to compromise or attack on following rounds. A subject's relative strength as determined by the numbers of bases acquired and current attack ability could alter his perception of the desirability of forming or breaking a coalition. The factor of resource attrition in the game reflected a similar relationship between goal-seeking efforts and available resources found in natural situations.

Multiple Payoffs

The fifth and final feature of the present research paradigm was multiple payoffs. Three forms of payoff or reward were incorporated as part of the research design. The first type of payoff, acquired bases, resulted from subjects carrying out successful attacks or mutual compromises. The acquired bases represented a short-term cumulative payoff which served to determine the winner(s) of a single game.

The second form of payoff involved the points associated with acquiring bases. Each base acquired either through attack or compromise efforts was worth 100 points. These points were distributed according to the manner in which a base was acquired. For successful attacks, single players received the full 100 points; coalitions divided the 100 points between themselves as per payoff distribution agreement. Successful mutual compromises led to the points being evenly divided between the offensive and

defensive players or between all members of the triad. The method of payoff distribution through mutual compromise was presented to subjects during orientation to conditions of play. As an added incentive to form coalitions, coalition members who succeeded in defending one of the member's bases were allowed to exchange bases and divide 100 points according to their payoff agreement. The points gained by subjects were accumulated over the course of the entire research project.

The third form of payoff used in the research design came in the form of monetary prizes awarded to the subjects who possessed the three highest point totals. Although the relationship between the three forms of payoffs was positive, it was possible for a subject to acquire the greatest number of bases throughout the project, yet fail to qualify for a cash prize. It was this condition and the subjects' informed awareness of it which encouraged careful considerations of the long-term effects of their game strategy. The subjects' ignorance of their relative standing in accumulated points during the studies may have contributed to a general sense of uncertainty during the game. It was concluded that the uncertainty of relative standing would be a diffuse variable and function in a random manner. For this reason it was not isolated for study.

Closing Comments

Although the present study sought to move closer to a full understanding of naturally occurring coalition behavior, it was not intended to provide a fully realistic simulation of real life coalition situations in the laboratory. Rather, the project sought to investigate the effects of variables thought to exist outside traditional laboratory studies, but previously under-investigated. This goal was to be accomplished through the use of a coalition research game situation intended to be highly interesting and involving for subjects.

CHAPTER V

METHOD

Subjects

The subjects for this study were 45 male college students recruited from introductory psychology courses taught during the 1981 Spring semester at a southwestern university. They were randomly selected from sign-up sheets distributed to introductory psychology sections. The subjects received extra credit points and had the opportunity to compete for three monetary prizes. For the initial study, the subjects were randomly assigned to 15 triadic groups. In the subsequent studies, the subjects were assigned to triadic groups in which no subject had prior experiences with either of the other two subjects.

Apparatus

The apparatus of the present research consisted of materials taken from a commercial card game known as "Cosmic Encounter." For the purposes of the experiment the following playing materials were used:

1. Hexagons: Three planet systems, each with five bases and a central section used to hold tokens lost during play.

2. Tokens: Three sets of 20 colored tokens. The colors used were blue, green, and yellow.

3. Discs: Three sets of four discs, colored to match the tokens.

4. The Deck: Twenty-one cards, including 18 "attack" cards with numerical values of "20," "12," "10," "8," "6," and "4" (three of each) and three "compromise cards" on which were written the statement: "COMPROMISE make deal or take consolation."

5. Hyper-Space Cone: A cardboard playing piece used to indicate the offensive and defensive players during a turn.

6. Token Value Cards: Cards indicating that each token possessed by a player has a numerical value of either two, three, or four points.

Game Preparation

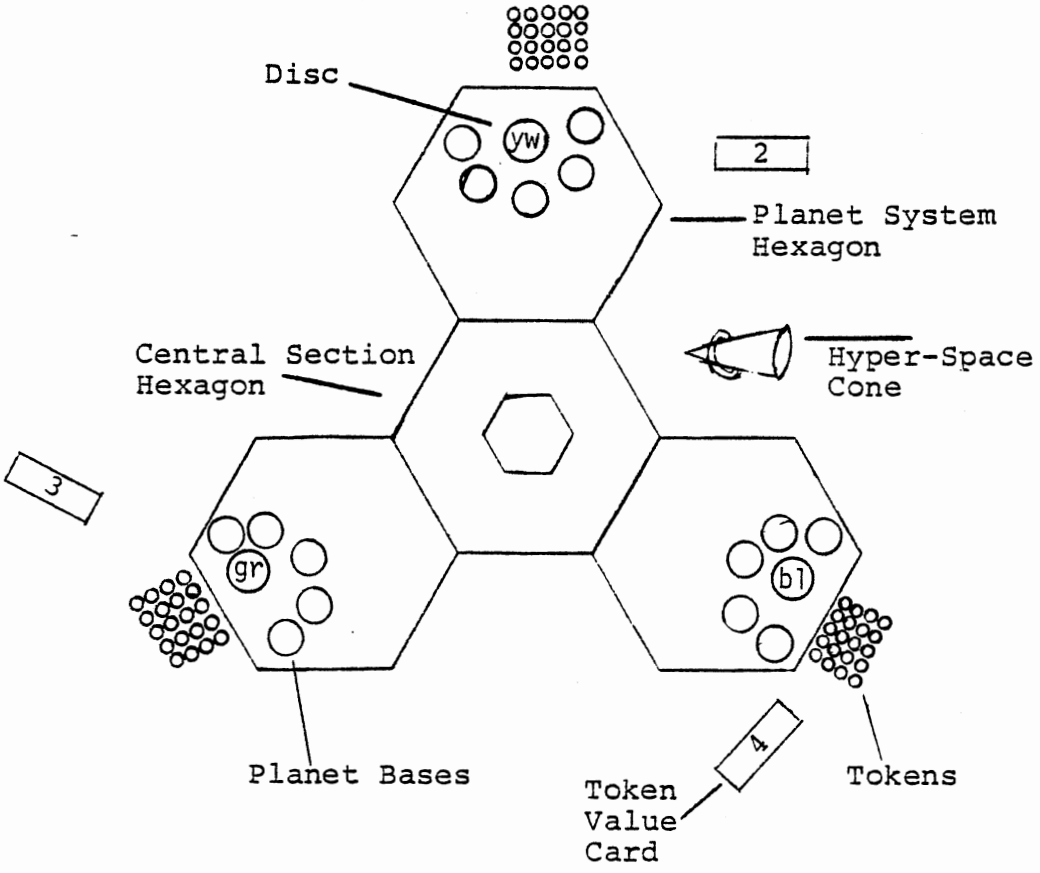
Prior to the arrival of subjects a basic set up procedure was used.

1. Construction of Gameboard: The control section was placed in the middle of the table. Planet system hexagons were placed, base side out, to alternate edges of the central section (see Figure 1).

2. Assigning Seating Positions: The names of the subjects participating in a given game session were written on 3 x 5 cards. The cards were then placed face down, shuffled, and each one placed behind one of the planet system hexagons. The cards were then turned up and the subjects seated according to the results as they arrived at the laboratory.

3. Assigning Disc and Token Colors: A blue, green, or yellow disc was taken, placed face down, and shuffled. The discs were distributed among the planet system hexagons and turned over, exposing the discs' colors. The three sets of 20 tokens were then distributed to the matching discs.

4. Assignment of Token Values: The experimenter took three cards on which were written the



BL = Blue

GR = Green

YW = Yellow

Figure 1. Initial Game Board Set-Up

statements: "Each token is worth 4 points," "Each token is worth 3 points," and "Each token is worth 2 points." The cards were shuffled face down and then distributed one to each of the planet system hexagons. The cards were then exposed and the values of the subjects' token assigned according to the results (see Figure 1).

5. Initial Distribution of Game Cards: For the experiments actually conducted in the research project, each subject started a game with a hand of four cards. Each set of cards included three "Attack" cards with values of "20," "12," and "8," respectively, and one "Compromise" card (see Figure 2).

6. Recording of Pre-Game Information: Prior to the arrival of subjects, the following information was recorded: Subjects' names, assigned token colors, assigned token values, and values of "Attack" cards. The information on coalition formation and payoff distribution was not collected until after the subjects' arrival (see Appendix A).

Basic Game Procedure

Each experimental game session was divided into two trials. In the first trial subjects were seated according to the results of the pre-game session assignment. Subjects were given copies of the general game instructions to read (Appendix B). The experimenter would read the general instructions aloud while the subjects followed along. During this orientation the experimenter demonstrated how the playing pieces were used and possible results of play.

After presentation of the general instructions and dealing with any resulting questions, the experimenter would distribute copies of special instructions. The special instructions indicated the combination of experimental

Figure 2. Subjects' Initial Card Set for Studies One and One-A

variables to be used in a particular study (Appendix C). The experimenter read through the special instructions and indicated how they effect game play. Subjects were allowed to keep copies of the general and special instructions during a game session to refer to in case of questions.

Trial one of each game session was started by having subjects negotiate for coalitions and payoff shares. The experimenter determined which of the three subjects would make the first offer. This was done by shuffling three colored discs matching those of the subjects. One disc was selected and the subject's disc color that matched was allowed to open coalition negotiations with the subject of his choice.

Depending upon the conditions presented in the special instructions, the negotiations were carried out either verbally or through written messages. In the case of verbal negotiations, the subject making the offer would present his terms verbally in the presence of the third subject. For example, the "blue" subject might have said, "Green, let's form a coalition; I'll take 50 points and you take 50 points for each base we take." The subject who was the target of the offer also responded verbally. Response options were: "Yes, I agree to your terms," "No, here's my counter offer . . .," and "No, I do not want to form a coalition with you." Should the special instructions require that negotiations be written,

the subjects were provided with forms designed for that purpose (Appendix D).

If the first subject was unable to form a coalition with the subject of his choice, then the resulting two discs were shuffled and the disc exposed determined which of the other two subjects was allowed to make a coalition. Should the second subject selected be unable to negotiate a coalition, then the third subject was allowed to make a coalition offer. In the case that all three subjects had been unable to establish a coalition, the three discs were used to start the process over again. Once a coalition was formed, the experimenter recorded the terms of the coalition on the sections of the data sheet designed for that purpose (Appendix A).

After the negotiation and formation of a coalition, the experimenter started the first trial of a game session by randomly selecting one of the subjects as the first offensive player. Once the trial was underway, the experimenter acted as referee and recorded details on a "Game Round Data" sheet (Appendix E). For the second trial, the token value distribution remained the same as it was in trial one. The second trial is played under the conditions presented in the special instructions for study one (Appendix C). Subjects were permitted to reopen coalition negotiations after which the second trial was started. At the end of the second trial, the experimenter reported the cumulative scores of the subjects for the

game session. Each subject was informed of the time and location of his next game session appointment. Finally, the experimenter reemphasized the need for confidentiality on the part of the subjects.

Independent Variables

The specific instructions for each study presented the combination of the five independent variables involved in that particular experiment. Described as "Special Instructions for Study . . .", those sheets described the versions of the independent variables subjects were playing under at the time. The five independent variables were labelled Resource Distribution, Communications, Defensive Player Selection, Coalition Length, and Ally's Compromise Involvement. Each variable had versions which either enhanced subject uncertainty or reduced it.

Depending on the degree of initial uncertainty prescribed by a study, the appropriate combination of uncertainty-enhancing and reducing variable definitions were presented. The combinations ranged from no use of uncertainty-enhancing variables (study one-A) to all five variables being defined in uncertainty-enhancing terms (study three). When variables were intended to serve uncertainty-enhancing functions, their descriptions were as follows:

1. Resource Distribution: Players will receive a set of four cards consisting of three "Attack" cards and one "Compromise" card. The attack cards will be randomly distributed from a deck

of cards which have a value range from 30 to 4 (not used in present study).

2. Communications: Players will secretly negotiate for coalitions and payoff shares through the use of negotiation checklist sheets.

3. Defensive Player Selection: As the offensive player, an individual turns over one of several discs; the player whose tokens match the disc color becomes the defensive player.

4. Coalition Length: After each game round, coalitions can either be reconfirmed or new ones formed.

5. Ally's Compromise Development: If the offensive and defensive players mutually play "Compromise" cards, the ally retrieves his token and is not involved in the outcome of the situation.

When variables were introduced to reduce uncertainty, the following descriptions were given:

1. Resource Distribution: All players receive an identical set of cards consisting of one compromise card and three attack cards which have numerical values of 20, 12, and 8, respectively.

2. Communications: Players will openly and verbally negotiate for coalitions and payoff shares.

3. Defensive Player Selection: As the offensive player, an individual selects the player who is not his coalition partner as the defensive player.

4. Coalition Length: Once a coalition has been formed, it continues for the remainder of the game.

5. Ally's Compromise Involvement: If the offensive and defensive players simultaneously play compromise cards and agree to compromise, each player receives an outside base and 33 points. If no agreement is reached in one minute, all players lose three tokens.

Control Procedures

From an overview of previous coalition research and

evaluation of the current design, several potential confounding variables were identified and controlled for in the paradigm. At the beginning of a two-game experimental session, subjects were randomly assigned token colors, weights, and seating positions. The triadic groups were arranged so that no two subjects played against each other more than once. Each study contained a control condition in which subjects played a game under the conditions found in study one. Subjects played the first trial under the experimental conditions dictated by the study and one game under the conditions of study one, which became a control condition. The inclusion of study one game conditions in every experiment conducted enabled a check on the influence of playing experience on coalition behavior.

Subjects were not permitted to talk except as required by the experimental conditions in three areas: 1) coalition negotiation, 2) defensive player indication, and 3) mutual compromise decisions. The experimenter informed subjects that communications outside of those aforementioned areas were forbidden. In the role of game referee, the experimenter enforced the rule and restricted communications during each session. In a related concern, subject communications outside of the experimental setting were strongly discouraged by the experimenter. Subjects were informed that dissemination of their point standings or other experimental details would result in their expulsion from the project and forfeiture of the opportunity

to compete for the available monetary prizes. An additional control was provided through a post-experimental test (Appendix F). One function of the test was to serve as a manipulation check of the perception of token weights. Further discussion of the post-experimental test has been presented in the Data Analysis Section.

Description of Research Strategy

The research methodology involved the use of a set of studies presented in a decision tree format (see Figure 3). At the conclusion of each study the first trial coalition data obtained from the 15 groups were subjected to chi-square goodness-of-fit analysis. The question asked at the conclusion of any study was: "Did the first trial coalitions reflect a systematic pattern of results?" The answer to that question determined the next step in the research sequence. Should a study produce data that indicated a systematic pattern of first trial coalitions? The subsequent study was one which contained more uncertainty variables. If a study produced non-systematic results, then the following study contained fewer uncertainty variables. The 45 subjects were reassigned to unique groups of 15 from one step in the decision tree to the next. Thus, all of the subjects were exposed to the same experimental throughout the research project.

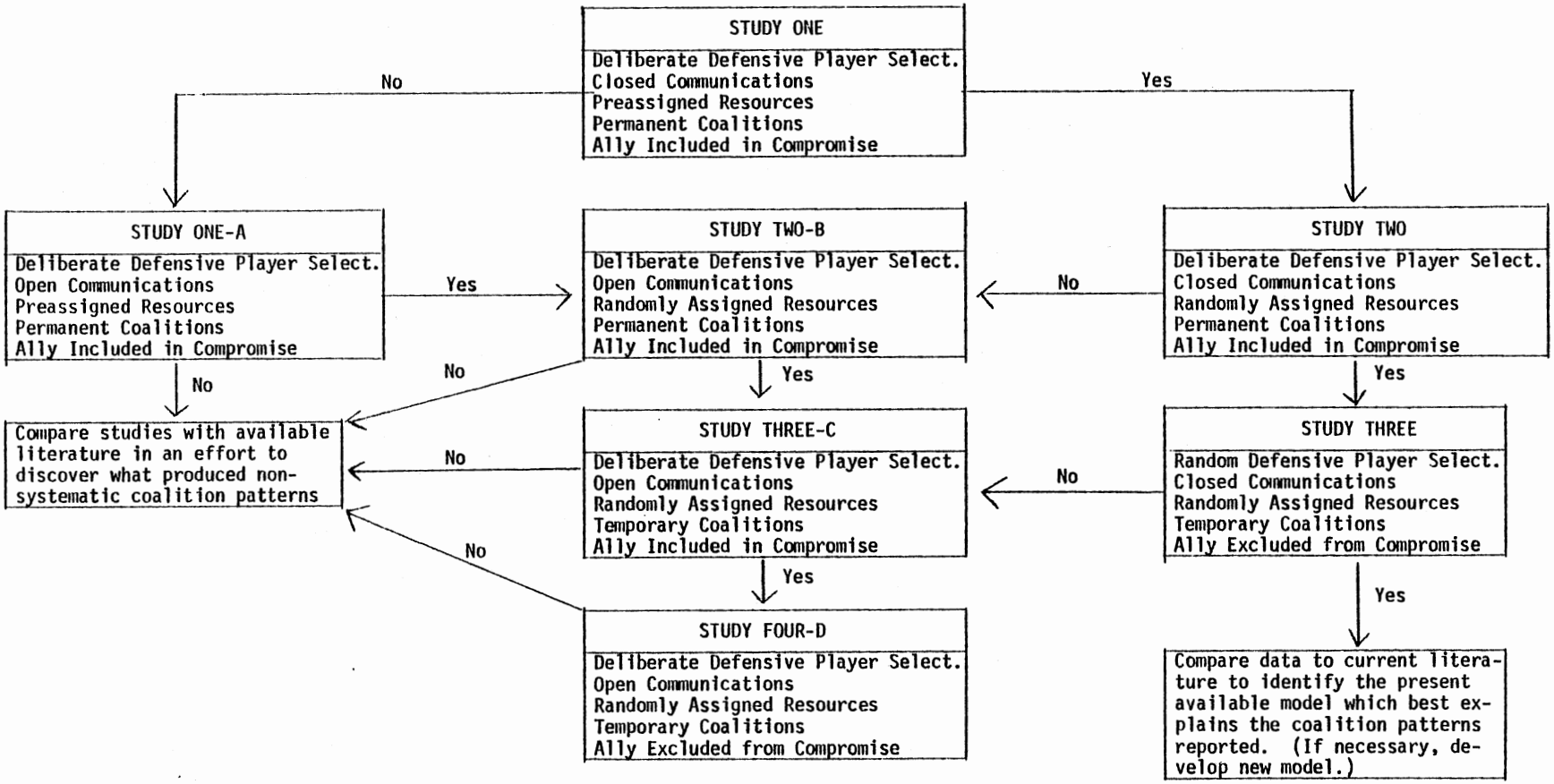


Figure 3. Experimental Sequences of Research Project

Experimental Sequences

The potential experimental patterns consisted of three main study sequences. Each sequence began with study one. The first sequence was made up of studies one, two, and three (Figure 3). In study one, the single initial element of subject uncertainty was the closed coalition negotiations format. Through the use of written messages, individuals secretly negotiated for coalitions and payoff distribution terms. The subject excluded from a negotiation was uninformed as to the payoff distribution used by the bargaining individuals. At the start of each game, players received equivalent sets of attack cards and one compromise card. The players were informed of the initial equality of their card hands. Coalitions lasted an entire game. The coalition ally was involved in the outcome of mutual compromise situations for both offensive and defensive players.

In addition to the closed communications format, study two included the random assignment of attack cards. With the random assignment of attack cards, subjects were unaware of their exact competitive strength in relation to each other. The selection of opponent, coalition length, and coalition ally's involvement in mutual compromise situations were the same as the conditions of study one.

Study three presented subjects with the greatest degree of uncertainty to be found in any of the research

project's experiments. Coalition negotiations were closed. Attack cards were randomly assigned to subjects. The selection of opponent for the offensive player was randomly determined. Coalitions had a mandatory length of a single game round. The coalition ally was not involved in the outcome of mutual compromise situations.

The second sequence consisted of study one and one-A (Figure 3). If the results of study one reported a nonsystematic pattern of coalition formation, then study one-A was conducted. The results of study one-A determined whether the experimental sequence was terminated or branched into sequence three. The experimental conditions in study one-A presented subjects with the lowest initial subject uncertainty to be found in any of the potential studies. All of the conditions present in study one were duplicated in study one-A, with the exception of communication mode. Communications between subjects in study one-A were to be verbal, giving the potential coalition opponent full and open access to the coalition negoatiations and payoff distribution agreements.

The third sequence was a set of five studies. This set was comprised of studies one, one-A, two-B, three-C, and four-D (Figure 3). The third experimental sequence represented a moderate pattern of uncertainty variable manipulations. This was in contrast to the increasingly uncertain game conditions of sequence one and the absence of initial uncertainty present in sequence two. For the

third experimental sequence to be conducted. an initial finding of nonsignificant coalition patterns for study one had to be followed by a consistent set of systematic coalition patterns. Studies two-B, three-C, and four-D each contain deliberate selection of opponent and closed communications. The three studies differed on their combinations of attack card distribution method, mandatory coalition length, and coalition ally's involvement in mutual compromise outcomes.

Study two-B randomly assigned attack card values to subjects. Coalitions lasted the entire game and the coalition ally shared in the outcome of any mutual compromise situation. Study three-C differed from study two-B in the mandatory coalition length. For study three-C new coalition agreements could be made after each game round. A game round consisted of each subject serving as an offensive player through a single cycle. After every game round the existing coalition could be continued or new agreements made between triad members. This condition permitted subjects to "defect" from a coalition to form a countercoalition with a previous opponent.

The final study of the third sequence, four-D, was equivalent to study three-B with the exception of the coalition ally's involvement in mutual compromise outcomes. Under study four-D the coalition ally did not share in the potential costs or rewards of a mutual compromise situation. With its random distribution of attack card values, short mandatory coalition length, and

exclusion of coalition ally from mutual compromise outcomes, study four-D presented subjects with the greatest number of dimensions of uncertainty in the third sequence. The three experimental sequences presented here represented relatively straightforward result patterns.

After the completion of each study, the data were analyzed in reference to the question: "Did the results indicate nonrandom patterns of coalition formation?" The response to that question determined if the next step was to continue in a given experimental sequence, shift to an alternate line of studies, or conclude the research project. The following material was intended to describe the contingencies associated with various statistical findings.

Contingencies for Selection of Study Sequences

The results of study one decided whether sequence one or two was pursued. Statistically significant findings led to an initiation of sequence one. Random coalition formation reported in study one shifted the direction of research to sequence two. Once sequence one was underway, any nonsignificant finding resulted in a shift from the study which reported the nonsignificant results to a parallel point in sequence three. For example, if data from study two presented random behavior, the subsequent experiment became study two-B.

The report of nonsignificant results for study one led to experimental sequence two. The decision made at the conclusion of study one-A was whether sequence three was initiated or the research project ended. Finding nonrandom coalition behavior under the conditions of study one-A resulted in the pursuit of sequence three. No further experiments were conducted if the data of study one-A presented statistically nonsignificant results.

Once experimental sequence three commenced, any nonsignificant finding terminated the line of research. Each study that reported nonrandom coalition patterns led to the next experiment, ending with study four-D. The results of study four-D decided which one of two possible research evaluation directions was taken. Should analysis of study four-D's data yield random results, the experiments were compared to available coalition theories in an effort to identify the factors that contributed to the absence of systematic coalition patterns.

In the event that systematic coalition patterns were reported for study four-D, current coalition literature was to be examined in an attempt to identify the best fitting model. If no satisfactory coalition model could be located, then a model would be developed and proposed to deal with the present research. It should be noted that the two evaluative strategies were not mutually exclusive. The research evaluation descriptions given here were intended to point out the different analytical orientations suggested by the possible statistical outcomes.

Completion of any one of the three experimental sequences represented varied degrees of success in utilizing a multidimensional definition of uncertainty in coalition research to produce systematic behavior. The completion of sequence one represented the greatest degree of success. Completion of sequence two reflected the least success. Sequence three and the remaining possible study combinations of the three research lines indicated moderate success in the use of a multidimensional definition of uncertainty in coalition research. The number of studies that the present research project could have involved were two, three, four, or five. Each set of studies reflected how effectively different elements of uncertainty could be incorporated as part of coalition research while still producing systematic behavior.

Conceptual Hypotheses

Beginning with experimental sequence one (Figure 3), it was predicted that studies one and two would report B-C or revolutionary coalitions. Study three, with its high degree of multidimensional uncertainty, was predicted to produce A-B (conservative) or A-C (other) coalitions. Results from study one-A in sequence two were expected to indicate the formation of the revolutionary coalitions frequently reported in deterministic coalition research. Under sequence three, predictions of

revolutionary coalition patterns were made for studies two-B and three-C. A conservative pattern of coalitions was predicted for study four-D. Although the chi-square goodness-of-fit test served as the sole form of analysis for initial data, the option existed for other statistical tests to be used as needed for clarification of significant preliminary findings.

CHAPTER VI

DATA ANALYSIS

Data on the coalition formation process were collected in an effort to evaluate the effects of multidimensional uncertainty. Measures of the coalition formation process consisted of information of the token weights of subjects involved in coalition negotiations, payoff distribution offers and responses, and the final pre-game agreement for each trial. This material was recorded on the negotiation form and data sheet (Appendixes A and D). For each game round, data were recorded identifying the offensive and defensive players, their respective token weights (including coalition ally), the cards played, and the outcome of the round (Appendix E).

Coalitions were categorized as either "revolutionary" (B-C), "conservative" (A-B), or "other" (A-C). At the completion of a study, the resultant coalition patterns were subjected to a chi-square goodness-of-fit test. With two degrees of freedom, the critical chi-square value required to reject the null hypothesis at the .05 level was 5.991.

Due to time constraints and availability of subjects, the number of groups available for analysis was 15. Thus, the expected (null) frequency for each coalition category

was five groups per coalition type. A possible effect of the small number of groups was to bias the results of the following chi-square analyses toward a conservative direction.

Analysis of the first trial coalition patterns for each study was conducted for two purposes. First, the results of first trial coalitions determined the subsequent step in the research project (Figure 3). Second, the number of studies with significant first-trial coalition patterns would indicate the degree to which multidimensional uncertainty could be used in the research project. The more studies conducted, based on first-trial analysis, the more elements of uncertainty that have been successfully incorporated into the research setting.

Second trial coalition patterns were also subjected to chi-square goodness-of-fit analysis. Due to the dependent nature of second trial coalitions, the chi-square goodness-of-fit analyses for these second trial coalition patterns were intended to serve only a descriptive purpose.

At each study's conclusion, the coalitions formed were assigned to groups which represented revolutionary, conservative, and other coalition formations. Once data had been collected for the 15 triadic groups, a chi-square analysis was conducted comparing the actual outcome with a uniform distribution (i.e., five coalitions in each category). This analysis was to discover any significant patterns, and to determine whether they were revolutionary, conservative, or other.

Analysis which led to a significant chi-square value indicated a "yes" decision in the project experimental sequence (see Figure 3). The finding of any systematic coalition patterns was considered sufficient justification for increasing the dimensions of uncertainty.

Nonsignificant chi-square analysis results led to a "no" path being taken on the research contingency design (Figure 3). The decision to reduce dimensions of uncertainty would be taken following data which showed no systematic preference for any of the three coalition formations. With two degrees of freedom available, the chi-square value that represented $P < .05$ was 5.991. Data analyses which reported chi-square values equal to, or greater than, the critical value of 5.991 led to rejection of the null hypothesis.

Analysis of First-Trial Coalitions

The chi-square value reported for the first trial coalitions of study one was .4. The chi-square value reported by study one failed to reject the null hypothesis. As the experimental conditions of study one failed to produce systematic first trial coalition patterns, the subsequent study was study one-A. After completion of study one-A, the chi-square analysis of first trial coalitions produced a chi-square value of 1.2. The reported value reflected a slight tendency for "conservative" (A-B) coalitions to occur less frequently than "revolutionary" (B-C)

or "other" (A-C) coalitions. Since the chi-square value was lower than the critical value, the research project was ended after study one-A (Table I).

TABLE I

COALITION PATTERNS*

		A-B	B-C	A-C
Study One				
Trial #1				
	Fo	5	6	4
	Fe	5	5	5
	X^2 =	0	.2	.2 = .4
Trial #2				
	Fo	4	8	3
	Fe	5	5	5
	X^2 =	.2	1.8	.8 = 2.8
Study One-A				
Trial #1				
	Fo	3	6	6
	Fe	5	5	5
	X^2 =	.8	.2 +	.2 = 1.2
Trial #2				
	Fo	4	6	5
	Fe	5	5	5
	X^2 =	.2	.2	0 = .4

*Critical value = 5.991, df = 2, α = .05.

Analysis of Second-Trial Coalitions

Analysis of the second trial coalitions for study one resulted in a chi-square value of 2.8. Study one's second trial coalition pattern reflected a slight, though nonsignificant, tendency for subjects to select "revolutionary" (B-C) coalitions (Table I). The distribution of second trial coalitions in study one-A produced a chi-square of .4. This value reflected an absence of any indication of systematic coalition choices based on token weights.

Analysis of Payoff Distribution Agreements

The payoff distribution data were analyzed in much the same fashion as the coalition formation data. Payoff distribution agreements were divided into three categories. The first category, equity, consisted of those coalitions which chose to divide the 100 points gained per base 50-50. The second category, parity, included the coalitions which divided the 100 point payoff in a fashion proportional to the initial weights of the coalition members. The third category, inverse parity, contained coalitions which agreed to distribute payoff in a manner inverse to the initial weights of the coalition allies.

The results for each study were subjected to chi-square analysis and evaluated actual outcomes to the expected (null) distribution of five coalitions under each

distribution format. The results were evaluated against a critical value of 5.991. The purpose of payoff distribution analysis was to provide descriptive information on the norms found acceptable by coalition allies during the project.

It could be argued that the decision to assign equal expected (null) frequencies to the three payoff categories could introduce a powerful conservative bias into the chi-square analyses. As presented, the expected (null) frequencies ignore the many potential non-equality-based payoff distributions which could have occurred in the course of the experiment. Omitting the possibility of 100-0 payoff agreement, as it would not have been a valid "division" of points, there were potentially 98 non-equality-based payoff distributions available for the 15 groups' use. One method of calculating the expected (null) frequencies which reflected the numerous non-equality-based payoff agreements possible was to multiply the number of groups by the probability of each payoff division.

Under this probabilistic method, an equality-based-payoff distribution had a one in 99 or .01 chance of randomly occurring. Both parity and inverse-parity-based payoff distributions had a 49 out of 100 or .49 chance of randomly occurring. Thus, using the correction formula mentioned above, the expected (null) frequencies for the parity, equality, and inverse parity categories would have been 7.35, .15, and 7.35, respectively. While this method

would have taken into account the full range of possible payoff agreements, it presented two problems. One, use of this probabilistic method would have resulted in an expected (null) frequency of considerably less than five for a category. This would have resulted in a violation in the commonly accepted practice of having minimum expected (null) frequency of five observations per cell. Two, review of coalition formation literature, did not support the probabilistic method payoff agreements. If anything, the available literature suggests a bias in favor of equality-based payoff agreements. This probabilistic model has been presented as an alternative to the more conservative method used in the evaluation of payoff agreements reached during the experiment.

In each experimental trial, a significant number of coalitions agreed to distribute payoff on the basis of equality (P=.05). The difference in token weights between coalition allies did not appear to have any systematic influence on the payoff distribution agreements reached by subjects involved in coalitions (Table II).

Analysis of Post-Experimental Test

After completion of the research project, subjects were recalled for a post-experimental questionnaire (Appendix F). The nine item questionnaire was designed to assess subjects' perceptions of the critical game elements of token weights, coalition configurations, and

payoff distributions. In addition to the general information provided, the questionnaire served as a manipulation check for the research paradigm's ability to present perceivably different coalition resource situations. The chi-square goodness-of-fit analyses presented in Table III were based on a sample of subjects who attended the debriefing meeting and award of cash prize awards meeting.

TABLE II

PAYOFF DISTRIBUTION*

	Parity		Equality		Inverse Parity	
Study One						
Trial #1						
Fo	2		13		0	
Fe	5		5		5	
X^2 =	1.8	+	12.8	+	5	= 19.6
Trial #2						
Fo	2		11		2	
Fe	5		5		5	
X^2 =	1.8	+	7.2	+	1.8	= 10.8
Study One-A						
Trial #1						
Fo	1		13		1	
Fe	5		5		5	
X^2 =	3.2	+	12.8	+	3.2	= 19.2
Trial #2						
Fo	3		11		1	
Fe	5		5		5	
X^2 =	.8		7.2	+	3.2	= 11.2

*Critical value = 5.991; df = 2, α = .05.

TABLE III

POST-EXPERIMENTAL QUESTIONNAIRE

Item Number	Response Alternatives A	B	C	D	X^2 Score
1*	22 88%	1 4%	0	2 8%	53.24
2*	7 28%	2 8%	2 8%	14 46%	15.48
3*	15 60%	2 8%	0	8 32%	21.88
4**	12 48%	4 16%	9 36%		3.92
5**	13 52%	5 20%	7 28%		4.16
6**	11 44%	5 20%	9 36%		2.24
7*	2 8%	1 4%	12 48%	10 40%	14.84
8*	12 48%	2 8%	2 8%	9 36%	12.28
9*	2 8%	11 44%	1 4%	11 44%	14.52

*For items 1-3, 7-9: df = 3, $P \leq .05 = 7.82$.

**For items 4-6: df = 2, $P < .05 = 5.991$. These items had only three response alternatives.

It should be noted that the frequencies reported in Table II are dependent. This dependency is due to the common experiences faced by the subjects. All subjects underwent the same experimental conditions. It is also important to mention that a review of the game session

outcomes found that all coalitions were successful in winning the games played. Thus, the perceptions reported by the subjects may be dependent upon the common witnessing of victorious coalitions on the part of the respondents. The information obtained from the post-experimental test was presented in the forms of response percentages and chi-square goodness-of-fit values (Table III).

Items one through three and seven through nine (Table III) were evaluated against the critical value 7.82 ($df = 3$, $\alpha = .05$). Items four, five, and six were evaluated against a critical value of 5.991 ($df = 2$, $\alpha = .05$).

Responses to Post-Experimental Test

Item one read, "If you had the opportunity to select the token value you were to add to the attack card played, which one would you pick?" Four alternatives were available; choices "A," "B," and "C" represented the token values four, three, and two, respectively. Alternative "D" indicated a "doesn't matter" response to the question. The chi-square values reported for the four alternatives were: "A" ($X^2 = 39.69$), "B" ($X^2 = 4.41$), "C" ($X^2 = 6.25$), "D" ($X^2 = 2.89$). The results indicated a strong preference for the token value of four points, represented by alternative "A." There was also a strong tendency to avoid alternative "C," which was the choice of token value of two points.

Item two, "Which token value combination was most likely to be found in a coalition?" presented four response possibilities. The alternatives were: "A. 4 and 3," "B. 3 and 2, "C. 4 and 2," and "D ('all equally possible')." The chi-square values for item two were: "A" (X^2 = .09), "B" (X^2 = 2.89), "C" (X^2 = 2.89), and "D" (X^2 = 9.61). The response pattern noted that a significant number of subjects believed that all token value combinations had an equal probability of occurring.

Item three, "Which of the following coalitions was most likely to win a game (take five bases)?" listed four possibilities: "A (4 and 3)," "B (3 and 2)," "C (4 and 2)," and "D ('all were equally likely to win')." The results of response pattern analysis were: "A" (X^2 = 12.25), "B" (2.89), "C" (6.25), and "D" (X^2 = .49). The reported chi-square values noted that subjects thought that the coalition of token values four and three was most likely to "win" a game.

The responses to item four, "If your tokens had a value of two points each, which of the other two players would you have preferred as a coalition partner?" showed no significant response pattern. The alternatives for item four were: "A (the one whose tokens were worth four points each)," "B (the one whose tokens were worth three points each)," and "C (either choice would be equally good)." Respective chi-square values for alternatives "A," "B," and "C" were 1.62, 2.25, and .05, respectively.

Analysis of responses to item five, "If your tokens had a value of three points each, which of the other two players would you have preferred as a coalition partner?" failed to reject the null hypothesis. The alternatives were: "A (the one whose tokens were worth four points each)," "B (the one whose tokens were worth two points each)," and "C (either choice would be equally good)." The reported chi-square values for alternatives "A," "B," and "C" were 2.62, 1.33, and .21, respectively.

Item six, "If your tokens had a value of four points each, which of the other two players would you have preferred as a coalition partner?" For response "A. (the one whose tokens were worth three points each)" the chi-square value was .86. Response "B (the one whose tokens were worth two points each)" had a chi-square value of 1.33. The "C" responses, "either choice would be equally good," had a chi-square value of .05.

Items seven through nine were concerned with hypothetical divisions of 100 payoff points between two players. The situations were varied according to the token values possessed by the players. Item seven read, "In a coalition between players having token values of four and three, a fair division of the 100 payoff points would be": Alternatives were: "A. 4 gets 60; 3 gets 40." "B. 4 gets 40; 3 gets 60." "C. 4 gets 50; 3 gets 50." "D. Whatever the players decide on." The overall chi-square value for responses to item seven rejected the null

hypothesis (X^2 = 14.82, critical value for three degrees of freedom P .05 = 7.82). None of the individual response alternatives produced a chi-square value large enough in itself to account for the significant result. There was a tendency for students to indicate a preference for an equality-based payoff distribution. The chi-square values for response alternatives to item seven were: "A" (X^2 = 2.89), "B" (X^2 = 4.41), "C" (5.29), and "D" (2.25).

Item eight described a payoff distribution situation between subjects having token values of three and two. The choices for item eight were: "A. 3 gets 50; 2 gets 50." "B. 3 gets 60, 2 gets 40." "C. 3 gets 40; 2 gets 60." "D. Whatever the players decide on." As in the case of item seven, the responses to item eight produced a significant overall chi-square value (X^2 = 12.28, $p \leq .05$ = 7.82). The results of item eight also duplicated those of item seven in that, while no individual response choice produced a significant chi-square value, there was a slight preference for an equality-based payoff distribution. This preference was reflected in the reported chi-square values for item eight. The respective values were: "A" (X^2 = 5.29), "B" (X^2 = 2.89), "C" (X^2 = 2.89), and "D" (X^2 = 1.21).

The payoff distribution situation in item nine involved players possessing token values of four and two points, respectively. The payoff distribution choices presented to subjects were: "A. 4 gets 80, 2 gets 20."

"B. 4 gets 50; 2 gets 50." "C. 4 gets 40; 2 gets 60." "D. Whatever the players decide on." Consistent with the results of items seven and eight, item nine reported a significant overall chi-square value ($X^2 = 14.52$), without any single answer category being responsible for the rejection of the null hypothesis. The chi-square values reported for item nine were: "A" ($X^2 = 2.89$), "B" ($X^2 = 3.61$), "C" ($X^2 = 4.41$), and "D" ($X^2 = 3.61$). Unlike items seven and eight, the response pattern of item nine did not suggest as strong a preference for the equality-based payoff distribution.

Closing Comments on the Post-Experimental Test

In making closing comments of the results of the post-experimental test, four areas of game concern were considered: 1) personal token preference, 2) coalition dynamics, 3) coalition partner preference, and 4) payoff distribution preference. For item one, which covered the subjects' personal preference for an assigned token weight, there was a clear desire for being assigned the most "powerful" token weight. Items two and three presented two aspects of coalitions in the study: probability of occurrence and utility or likelihood of success. Subjects indicated that while all coalition combinations had an equal probability of forming, the A-B coalition was perceived as the most likely to "win" the game.

Items four, five, and six presented situations in which the subjects' own token weight varied and required them to select between two hypothetical players on the basis of token weights they supposedly possessed. For those three items no systematic preference was reported in the selection of hypothetical coalition partners. One explanation suggested by these results was that subjects felt that other variables were important in the decision to form a coalition.

The items seven, eight, and nine were concerned with one variable which could have had an impact on the coalition partner preference decision, both in the actual game and the hypothetical test situations. The last three items of the post-experimental test involved the division of payoff between the three possible coalition combinations, A-B, B-C, and A-C, in the $A > B > C$, $A < (B + C)$ setting. In the actual experimental and post-experimental test, these combinations were represented by token weight combinations of 4-3, 3-2, and 4-2, respectively. The results of the three items noted a substantial departure from the expected (null) frequencies of responses. However, no single form of payoff distribution (equality, parity, or inverse parity) was clearly indicated as being preferred by the respondents. The pattern of responses tentatively argue that respondents believed that both "equality" or 50-50 divisions and "whatever players decided upon" distributions would be satisfactory.

CHAPTER VII

DISCUSSION

The absence of systematic coalition patterns for studies one and one-A led to the termination of the research project after the completion of experimental sequence two. The nonsignificant findings for experimental sequence two represented a failure in the attempt to produce systematic coalition behavior under conditions of multidimensional uncertainty. Three models are offered below in an effort to explain the lack of systematic coalition preferences for studies one and one-A. After the presentation of each model, an evaluation is made as to how well the particular model could explain the results of the coalition distribution, payoff agreement, and post-experimental questionnaire analyses. The three explanatory models presented to account for the experimental results are the "utter confusion" model, the "pure rationality" model, and the "distraction" model.

The "Utter Confusion" Model

The first model, which represents the null hypothesis, is the "utter confusion" model by Gamson (1964). The utter confusion explanation would hold that the experimental

manipulations were simply ineffective. According to this model, subjects were so baffled by the experimental conditions that they based their formation of coalitions on some randomly constructed criteria. The idea that subjects were confused and thus made nonsystematic coalition choices would account for the results of coalition pattern and payoff agreement analyses with equality being the "safe" choice.

The utter confusion model does not explain the preferences stated for token weights, hypothetical winning coalitions, and coalition partners found in the post-experimental questionnaire data. Analysis of the post-experimental questionnaire indicated a "strength is strength" viewpoint on the part of subjects. Subjects indicated a preference for the hypothetical game situations that placed them in the strongest position available. The subjects reported the desire to be assigned the "A" weight in the $A > B > C$, $A < (B + C)$ token resource distribution. In predicting the winner of a hypothetical game, the A-B coalition was selected as most likely to succeed. In those items which varied the subjects' own token weight and asked them to select the preferred coalition ally by token weight (items 4, 5, and 6), the person having the greater of the two token weights available was indicated. The following two models, "pure rationality" and "distraction" have been constructed by

the author in an effort to provide viable alternative explanations for the data results.

The "Pure Rationality" Model

The second model, "pure rationality," provides an argument completely contradictory to that given by the utter confusion model. Pure rationality would hold that subjects fully understood the experimental conditions presented during studies one and one-A. Given the A > B > C, A < (B + C) token weight distribution and the low levels of multidimensional uncertainty found in experimental sequence two, the pure rationality model would lead to two assumptions: 1) subjects believed that any coalition would be a winning coalition, and 2) since any coalition formed would win, token weights were not a critical factor in coalition formation. Subjects operating from a purely rational viewpoint would be satisfied with any coalition, regardless of the token weights involved. Thus, as in the utter confusion model, all coalitions had an equal probability of occurring. The difference between the two explanations was that while utter confusion would hold that all coalitions had an equal probability of occurrence due to random decision processes, pure rationality would argue that the equal probability of coalition formations was based on the subject's perception that all coalitions had an equal probability of winning. The pure rationality model handles the coalition

distribution results as well as providing a more complete explanation of payoff agreement results and responses to the payoff items on the post-experimental questionnaire. Under the assumptions of the model, each member of a coalition contributes equally; therefore, any payoff should be distributed on the basis of equality. The purely rational model failed to explain the preferences indicated by subjects who responded to the post-experimental questionnaire. The assumptions of pure rationality would lead to the prediction that no preference for token weight, hypothetical winning coalitions, or coalition partner would have been reported.

The "Distraction" Model

The third model, "distraction," can be applied to all of the data reported in experimental sequence two. The distraction model would argue that the dynamics of the experimental game setting act to distract players from careful consideration of the token weight distribution variable. As mentioned at the conclusion of the introduction section, one of the goals of the research paradigm was to present an experimental task that subjects found interesting and challenging. The explanation drawn from the distraction model would be that subjects were so caught up and interested in playing the mixed-motive card game, that the formation of a coalition based on token weights was seen as preliminary to the experimental task.

Since the importance of token weights was submerged by concerns of game playing strategy, the decisions to form coalitions could have been made without much consideration as to the effect the token weights would have on the game outcome. The distraction model could deal with the coalition patterns and the payoff agreements analyses. With the contribution of token weights de-emphasized by other aspects of the game, no coalition would be seen as having more utility than another. This belief would lead to the decision for coalitions to select equality as their payoff distribution mode. Unlike the utter confusion and pure rationality models, the distraction model may also explain the "strength" preferences reported from the post-experimental questionnaire data. The post-experimental questionnaire represented an independent event in the course of the research project. It was conducted approximately one week after the final trial was run. The items served to avoid the distraction effect by isolating the variable of token weight. When presented with only token weight as a coalition decision criteria, subjects showed a significant preference for "strength." These findings indicated that subjects were neither confused concerning the influence of token weights on the game, nor did they take the rational view that all coalitions were equal. Subjects' recognition of the relative values of token weights and coalition formation through their responses to the questionnaire lends support to the

distraction argument. Of the three models, it is the author's belief that the distraction explanation best accounts for the experimental results.

Concluding Remarks

Though the distraction model could account for the nonsignificant coalition formation results, the explanation still suggests that the findings were produced by an ineffective presentation of the experimental variable. While observations of subjects' behavior during the game trials rated a high level of interest and involvement in the study, the factor of token weights was ignored. For future research involving the use of a multidimensional definition of uncertainty, the author suggests that more emphasis be given to the importance of the initial resource distribution.

The suggestion of future research raises a question that is difficult for an experiment that reports nonsignificant results to address: "Should further research be conducted in this area?" Despite this research project's failure to produce systematic coalition behavior under conditions of multidimensional uncertainty, it is the conclusion of this author that research in this area should continue. Given the paucity of research on coalition behavior under conditions of uncertainty, future research should search for information on the generality of traditional coalition theories to naturally occurring coalitions.

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APPENDIXES

APPENDIX A

GAME DATA SHEET

DATA SHEET

Date:_____

Time:_____

Study #_____

Player Identification and Token Value:

Player's Name (Print)	Token Color	Token Value (Circle One)
_____	BLUE (B)	4 3 2
_____	GREEN (G)	4 3 2
_____	YELLOW (Y)	4 3 2

Values of Initially Distributed Attack Cards:

BLUE	_____	_____	_____
GREEN	_____	_____	_____
YELLOW	_____	_____	_____

Coalition Information: An alliance has been formed between (check one):

_____ BLUE and GREEN

_____ GREEN and YELLOW

_____ YELLOW and BLUE

Payoff Distribution (fill in color and points):

_____ gets _____ points per base acquired.

_____ gets _____ points per base acquired.

APPENDIX B

GENERAL GAME INSTRUCTIONS

SOCIAL PSYCHOLOGY GAME RESEARCH

GENERAL INSTRUCTIONS

OBJECT: The object of the game is to establish bases on other players' planets and accumulate payoff points. To win, a player must be the first to have five bases outside his own planet system. These bases may be on all five of one player's planets, or two may be on one player's planets and three on the other's, etc. It is possible for several players to each have a base on the same planet. Because of coalitions and deals, two or more players can win together. The payoff points (100 per base) are accumulated over games and used in awarding the monetary prizes given at the end of the research project.

GAME PREPARATION: Before starting a game, the experimenter will distribute the game materials, determine the token values, and discuss the conditions of play. The players will then negotiate for coalitions and payoff points distribution. Once a coalition has been formed, determine which player begins first.

GAME PROCEDURE: The player designated as the offensive player selects one of the other players as the defensive player according to the instructions given at the game preparation stage, by pointing the cone-shaped playing piece at one of the planets in the

defensive player's system. This is how the offensive player indicates where he intends to establish a base. The offensive player places one of his tokens on the oval-shaped section of the cone. The defensive player places one of his tokens on the designated planet base. The third player places one of his tokens alongside the token of the player he has formed a coalition with. Once all the tokens have been placed, the offensive and defensive players each play face down a card from their hands. The cards are then turned over and the outcome of the game round determined. Once the outcome has been determined, the players return the played cards to their hands (see "Consolation" for exception) and play continues to the left of the previous offensive player.

OUTCOMES OF PLAY: When the selected cards are turned over, one of three outcomes is possible.

1. ATTACK-ATTACK: If both players used "Attack" cards, then the offensive and defensive players add the value of their tokens (and that of any ally's) to the number on the Attack card played. The player with the highest total wins. In case of a tie, the defending player wins.
2. COMPROMISE-COMPROMISE: If both players used "Compromise" cards, then the offensive and defensive players have one minute to decide if they will exchange bases and accept a predetermined

payoff point distribution. Should the players fail to agree in one minute, they each lose three tokens. (Refer to the Special Instructions Sheet for details on the predetermined payoff point distribution and involvement of the third player ally in the outcome.)

3. ATTACK-COMPROMISE: If one player selects an Attack card and the other selects a Compromise card, the player using the Attack card automatically wins the game round. However, since one player was willing to compromise and had been exploited, he receives "consolation" in that the Attack card used by the winning player is replaced by one of half its value.

Winning offensive players (and any ally) place their tokens on the designated planet (establishing a base) and divide the 100 payoff points according to negotiated agreements.

Winning defensive players have simply protected one of their home bases and retain the used token for future use. Winning defensive players with an ally exchange bases with the ally (each thus establishing an outside base) and divide 100 payoff points according to the negotiated point distribution made at the start of the game.

Losing players (and any ally) discard their tokens used in the game round into the central section of the playing area.

NOTE: Players are asked not to discuss the game outside the research area or to tell other players of their cumulative game score.

APPENDIX C

EXAMPLE OF SPECIAL INSTRUCTIONS

SPECIAL INSTRUCTIONS FOR STUDY ONE

1. RESOURCE DISTRIBUTION: All players receive an identical set of cards consisting of one "Compromise" card and three "Attack" cards which have numerical values of "20," "12," and "8," respectively.

2. COMMUNICATIONS: Players will secretly negotiate for coalitions and payoff shares through the use of negotiation checklist sheets.

3. DEFENSIVE PLAYER SELECTION: As the offensive player, an individual selects the player who is not his coalition partner as the defensive player.

4. COALITION LENGTH: Once a coalition has been formed, it continues for the remainder of the game.

5. ALLY'S COMPROMISE INVOLVEMENT: If the offensive and defensive players simultaneously play "Compromise" cards and agree to compromise, each player receives an outside base and 33 points. If no agreement is reached in one minute, all players lose three tokens of their choice.

SPECIAL INSTRUCTIONS FOR STUDY ONE-A

1. RESOURCE DISTRIBUTION: All players receive an identical set of cards consisting of one "Compromise" card and three "Attack" cards which have numerical values of "20," "12," and "8,", respectively.

2. COMMUNICATIONS: Players will openly and verbally negotiate for coalitions and payoff shares.

3. DEFENSIVE PLAYER SELECTION: As the offensive player, an individual selects the player who is not his coalition partner as the defensive player.

4. COALITION LENGTH: Once a coalition has been formed, it continues for the remainder of the game.

5. ALLY'S COMPROMISE INVOLVEMENT: If the offensive and defensive players simultaneously play a "Compromise" card and agree to compromise, each player receives an outside base and 33 points. If no agreement is reached in one minute, all players lose three tokens of their choice.

APPENDIX D

NEGOTIATION FORM

Page:_____

NEGOTIATION FORM FOR COALITION

AND PAYOFF DISTRIBUTION

Date:_____

Time:_____

Study #_____

Use token color to identify yourself and other players.

FROM:_____ TO:_____

YOU TAKE ____ POINTS. I'LL TAKE ____ POINTS. = 100 POINTS.

Response:

___ YES, I agree to these terms.

___ Consider my offer (see below).

___ NO, I do not wish to form a coalition with you.

FROM:_____ TO:_____

YOU TAKE ____ POINTS. I'LL TAKE ____ POINTS. = 100 POINTS.

Response:

___ YES, I agree to these terms.

___ Consider my offer (see below).

___ NO, I do not wish to form a coalition with you.

FROM:_____ TO:_____

YOU TAKE ____ POINTS. I'LL TAKE ____ POINTS. = 100 POINTS.

Response:

___ YES, I agree to these terms.

___ Consider my offer (see below)

___ NO, I do not wish to form a coalition with you.

FROM:_____ TO:_____

YOU TAKE ____ POINTS. I'LL TAKE ____ POINTS. = 100 POINTS.

Response:

___ YES, I agree to these terms.

___ Consider my offer (see below).

___ NO, I do not wish to form a coalition with you.

FROM:_____ TO:_____

YOU TAKE ____ POINTS. I'LL TAKE ____ POINTS. = 100 POINTS.

Response:

___ YES, I agree to these terms.

___ Consider my offer (see next page).

___ NO, I do not wish to form a coalition with you.

APPENDIX E

GAME ROUND DATA SHEET

Game Round Data

Round #_____

OFFENSIVE PLAYER_____ DEFENSIVE PLAYER_____

Cards Played:

OFFENSIVE PLAYER (check one):

___ ATTACK: Add number on card ___ to Offensive (and Ally's) token value(s) ___. This equals ___ total attack strength.

___ Compromise.

DEFENSIVE PLAYER (check one):

___ ATTACK: Add number on card ___ to Defensive (and Ally's) token value(s) ___. This equals ___ total attack strength.

___ Compromise.

Outcome of Play (check one):

___ OFFENSIVE PLAYER WINS: gains 1 base and ___ points. Offensive ally (if any) gains 1 base and ___ points.

___ DEFENSIVE PLAYER WINS: protects base. If allied with another player exchanges bases with ally and receives ___ points. Ally also gains 1 base and ___ points.

___ CONSOLATION: Attack card ___ is reduced to ___. (Round down if necessary.)

___ MUTUAL COMPROMISE (check one)

___ Agreement made: Involved players each gain 1 base and ___ points.

___ No agreement made: Involved players each lose 3 tokens.

Current Status

BLUE has ___ outside bases and ___ total points.

GREEN has ___ outside bases and ___ total points.

YELLOW has ___ outside bases and ___ total points.

APPENDIX F

POST-EXPERIMENTAL TEST

POST-EXPERIMENTAL TEST

NAME: _____

1. If you had the opportunity to select the token value you were to add to the attack card played, which one would you pick?

   ___ A. 4
   ___ B. 3
   ___ C. 2
   ___ D. Doesn't matter

2. Which token value combination was most likely to be found in a coalition?

   ___ A. 4 & 3
   ___ B. 3 & 2
   ___ C. 4 & 2
   ___ D. All equally possible

3. Which of the following coalitions was most likely to win a game (take five bases)?

   ___ A. 4 & 3
   ___ B. 3 & 2
   ___ C. 4 & 2
   ___ D. All were equally likely to win.

4. If your tokens had a value of two points each, which of the other two players would you have preferred as a coalition partner?

   ___ A. The one whose tokens were worth four points each.
   ___ B. The one whose tokens were worth three points each.
   ___ C. Either choice would be equally good.

5. If your tokens had a value of three points each, which of the other two players would you have preferred as a coalition partner?

   ___ A. The one whose tokens were worth four points each.
   ___ B. The one whose tokens were worth two points each.
   ___ C. Either choice would be equally good.

POST-EXPERIMENTAL TEST (Cont.)

6. If your tokens had a value of four points each, which of the other two players would you have preferred as a coalition partner?

___ A. The one whose tokens were worth three points each.
___ B. The one whose tokens were worth two points each.
___ C. Either choice would be equally good.

7. In a coalition between players having token values of four and three, a fair division of the 100 payoff points would be:

___ A. 4 gets 60; 3 gets 40
___ B. 4 gets 40; 3 gets 60
___ C. 4 gets 50; 3 gets 50
___ D. Whatever the players decide on

8. In a coalition between players having token values of 3 and 2, a fair division of the 100 payoff points would be:

___ A. 3 gets 50; 2 gets 50
___ B. 3 gets 60; 2 gets 40
___ C. 3 gets 40; 2 gets 60
___ D. Whatever the players decide on

9. In a coalition between players having token values of 4 and 2, a fair division of the 100 payoff points would be:

___ A. 4 gets 80; 2 gets 20
___ B. 4 gets 50; 2 gets 50
___ C. 4 gets 40; 2 gets 60
___ D. Whatever the players decide on

VITA

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