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SESSION I
ADDRESS

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Computer controlled research on bargaining and coalition formation

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Described in this paper is a research paradigm, written as a set of computer programs, to conduct on-line bargaining and coalition formation experiments within the characteristic function game framework. The structure of the paradigm is outlined, an example is presented and discussed, and further extensions of the program are briefly discussed.

Ten years ago, while I was painstakingly preparing for my qualifying examinations as a graduate student in psychology, a valuable and fascinating book was recommended to me to read, a book that some of you may have heard of and others may have even studied. I am referring to the book, *Games and Decisions*, by Luce and Raiffa (1957), that has done an outstanding job of communicating in a nontechnical and lucid language the central ideas of game theory and related decision making models. It is unfortunate that some social and behavioral scientists, while citing the book in their publications, have not read it thoroughly; it is even more unfortunate that these persons, and even many of the ones who have attempted to scrutinize the book closely, have stopped reading it after the first six chapters, in which the basic ideas of two-person game theory are presented. This is mere conjecture on my part, not an unshakable conclusion, and is drawn from examining the voluminous literature on experimental games. Large portions of this work are uninspiring and unimaginative, ignoring many of the critical comments and suggestions made by Luce and Raiffa in their book. Moreover, most of it is devoted to a narrow subset of conflict and cooperation situations, those involving only two participants.

For reasons that I cannot clearly remember now, but, which I am sure, had nothing to do with the formal requirements for my qualifying examinations, I continued my reading, perhaps somewhat superficially, beyond the first six chapters, and was immediately rewarded. There are , in particular, two statements in the book that have stimulated my interest in coalition formation and have indirectly led to the research I wish to discuss with you today. I have looked both of them up. The first says: "However, it has long been recognized in sociology, and in practical affairs, that between two-person situations and those involving three or more persons there is a qualitative difference which is not as simple as the difference between 2 and 3 [Luce & Raiffa, 1957, p. 134]." This difference has to do with the formation of coalitions, which are possible when there are more than two participants but not otherwise. If a situation of conflict and cooperation includes two players only, where a player may represent a consumer, a firm, a financial institution, a government agency, or even a whole nation, only a single, trivial coalition is possible, namely, the coalition between the two players. If the interests of the two players are diametrically opposed, forming the coalition cannot be of benefit to both of them. Whatever one of them gains the other necessarily loses. If, however, the interests of the two players are partially opposed and partially coincident, and especially when preplay communication and negotiations are allowed or agreements are binding and enforceable by the rules of the game, then the coalition between the two players might be to their mutual benefit. Examples from labor-management disputes, trade regulations between two countries, and marital conflicts make this point quite obvious.

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The conflict situation changes drastically when the number of players exceeds two (Rapoport, 1971). Various coalitions may now be formed to allocate a prespecified reward among their members, or to force their will upon an individual player or a subset of players. In that case, questions arise as to which coalitions are expected to form, depending upon the rules of the game, the resources of the players, and the personalities of the players, as well as questions pertaining to how the payoffs accruing to the various coalitions are expected to be apportioned among their members. Von Neumann and Morgenstern (1947) devoted about two-thirds of their monumental work to the latter question and related issues. Their work on n-person games has benefited economic theory and has seen a remarkable revival during the last 10 years or so (see, e.g., Lucas, 1971). But even before learning about the recent developments in n-person game theory, in particular the work by Aumann, Maschler, and their collaborators on the bargaining set (Aumann & Maschler, 1964), kernel (Davis & Maschler, 1965), and related models, I accepted Luce and Raiffa's assessment of the importance of n-person game theory to the social and behavioral sciences, which is summarized succintly in the second citation that I have promised to give you: "It is here, more than in two-person theory, that game theory as a part of social science, though not as a part of mathematics, will stand or fall [Luce & Raiffa, 1957, p. 157]."

RESEARCH PARADIGMS FOR COALITION FORMATION

A few years later, Jim Kahan, a social psychologist sharing my interest in coalition formation and bargaining, and myself decided to collaborate, form a two-person coalition, which has maintained its stability and viability ever since, and start a rigorous experimental program for studying these processes. Quite naturally, we began our study with a thorough review of the sociological and psychological literature on coalition formation, the theoretical part of it dating back at least to Simmel (1902), and the experimental evidence dating from the mid-1950s (Vinacke & Arkoff, 1957). Our review, which did not take long to complete, was not particularly helpful. It uncovered several social psychological theories of coalition formation espoused by Caplow, Gamson, Chertkoff, and others which were not only restricted in scope, but also lacked the degree of rigor, preciseness, and predicatability that we have strongly preferred. The experimental work that had been meticulously collected failed to provide conclusive support for any of these theories. A recent paper by Chertkoff suggests that this state of affairs has hardly been changed since the time of our review. Comparing several theories to one another, Chertkoff has concluded that, even for the somewhat restricted class of coalition formation tasks to which these theories apply, "a completely satisfactory theory of coalition formation has yet to be proposed [Chertkoff, 1971, p. 382]."

Our review of the research paradigms designed to study coalition formation has been even more discouraging. Most of the experiments on coalition formation, especially the ones employing triads, have followed the Parchisi board format described in Caplow (1968). In this game format, the three players each move counters around a Parchisi board at a rate determined by a chance mechanism in conjunction with E-imposed multiplicative weights, typically referred to as resources. The first player to reach the goal-square on the board is declared to be the winner. If two players form a coalition, their counters are combined and move as one counter with a multiplicative weight equal to the sum of the weights (resources) of the members of the coalition. Each of the three players signals which of the other players he would like to enter into coalition with, and if there is a mutual choice, a coalition is formed. Allocation of the rewards, typically a fixed reward regardless of which player or coalition wins the game, is decided upon by members of the coalition after it has tentatively formed, in a manner often not reported explicitly (e.g.,Vinacke, Crowell, Dien, & Young, 1966).

It has been our contention (Kahan & Rapoport, in press) that the Parchisi board is inadequate for the study of coalition formation for three major reasons. First, the paradigm has been limited to games with a fixed reward for each coalition. As such, it is insensitive to the fact that different coalitions in real life may well command different desirable rewards. A decision as to which coalition to join is typically based on such considerations. In political negotiations, although a simple majority vote does determine most situations, it is a political fact of life that the greater the majority, the more power the ruling coalition possesses. However, even in well defined settings, it is sometimes difficult to aquire information about what exactly the various parties are striving for. Outcomes are not measured objectively, and one often needs to know the utility of various possible outcomes to all parties in order to predict what parties will form a winning coalition, advocating what policies, and with what payoff to which. These utilities may depend upon ideological considerations, or questions pertaining to the legitimacy of the government. In democratic forms of rule, the greater the proportion of citizens represented in government, the greater the legitimacy of the government, and presumably the greater the joint utility shared by the members of the winning coalition. In game-theoretic terms, then, our first objection to the Parchisi-board paradigm is that it misrepresents many, if not most, coalition formation situations, which might be more adequately modeled as nonzero-sum games.

The second disadvantage of the paradigm is that it allows personality variables to have a greater effect on the bargaining process and its outcome, since all players are face-to-face throughout the experiment (Chertkoff,

1971). One may anticipate large individual differences in personality variables that determine assertiveness, bargaining skill, greediness, or interact with various social norms, such as equity. These variables may be expected to affect strongly or even override the effects of differences in resources, rewards, and other situational variables. Allowing personality variables to affect bargaining and coalition formation might have been considered an advantage of a research paradigm if these variables had been properly isolated or studied, and could be experimentally controlled. Unfortunately, progress in this direction has been very slow. Even in two-person game experiments, personality effects have been sufficiently elusive to render the overall results equivocal (Terhune, 1970).

The third, and most important, objection against the paradigm is that it strictly separates the process of coalition formation from the allocations of rewards. Clearly, when the very reason for forming a coalition is to increase a player's gains, he will consider the amount of gains that he may obtain from different coalitions before deciding which coalition to join. Negotiations may take place with different parties simultaneously, and offers may be carefully weighed one against the other, then discarded or tentatively maintained, before final agreements are reached. This vital part of the bargaining process is entirely neglected in the Parchisi paradigm.

Other research paradigms for studying bargaining and coalition formation behavior have suffered from one or more of the objections that have been raised above. Gamson (1961) developed a simulated political convention paradigm, which, in addition to being limited to games with a fixed reward for each coalition, may lead to confusion between votes, the resources variables, and the reward (Chertkoff, 1971). Moreover, it faces the problem that plagues many simulation experiments, of having players introducing variables not in the experiment but present in the simulated environment, in this case, the convention hall. Chertkoff's experiment (1971) meets our second objection, by seating Ss in partitioned booths and thus preventing face-to-face negotiations, but not our first and third objections. Some recent work by Komorita and Chertkoff (1973) shows more awareness of the problem of negotiations affecting disbursement of payoffs, but even here coalition choice and outcome determination are separated. Finally, the experimental paradigm which presents the game to the players in characteristic function form, a term to be explained below, meets the first or third objections but not the second. Maschler (1965), Riker (1967), Selten and Schuster (1968), and Buckley and Westen (in press) who employed this paradigm, have all allowed face-to-face negotiations without a systematic observation or analysis of the bargaining process.

In attempting to improve upon the design of the experiments just mentioned, and to overcome the inadequacies of the Parchisi paradigm that have been described, we have developed a research paradigm in which coalition formation is scrutinized through examination of negotiated divisions of the rewards jointly available to the members of each permissable coalition. This paradigm necessarily involves somewhat complicated experimental procedures, which were until recently not available within psychological laboratories, and have only become possible with the development of the computer as an instrument for conducting on-line experiments. In what follows, I shall first explain what a characteristic function means and then describe the computer programs in some detail.

THE STRUCTURE OF "COALITIONS"

The model for "coalitions" is the n-person characteristic function game discussed in the mathematical game-theoretic literature (e.g., Luce & Raiffa, 1957; Rapoport, 1970). Briefly described, a n-person game in characteristic function form is defined by naming all the possible nonempty subsets of the players in the game, and assigning a real number value to each one of them. Thus a three-person game is defined for three players (call them, A, B, and C) by assigning values to the following subsets of players: A, B, C, AB, AC, BC, and ABC. The value represents a measure of the utility jointly commanded by that subset in coalition against all the other players in the game. The assigned real-valued Set Function v, the number and identification of the n players, and the rules governing communication among them completely define the game. "Coalitions" is a set of programs written for the PDP-8 computer to conduct bargaining games within the characteristic function framework. Since it has been described in detail by Kahan (1970) and Kahan and Helwig (1971), only a brief description will be given here. "Coalitions" is designed to run under the supervision of the RATSS (Remote Access Time Sharing System) program for the PDP-8 developed in the Psychometric Laboratory (see Jones, Johnson, & Young, 1973, for a discursive description of RATSS, and Conrad, 1968, 1969, for a technical specification). The program allows for the simultaneous operation of eight partitions, each with its own teletypewriter, in a time-sharing mode. A partition may be considered as a separate input-output station but with its own computing power, independent of all other stations. Each player in an experiment is at a separate, addressable partition.

In the current version of "Coalitions" three games, each with up to six players, to a maximum of seven players, may be played simultaneously, with communication allowed among players of the same game, but with each game being completely independent of all other games. Typical uses would be one six-person game, two simultaneous three-person games, or one four-person game and one three-person game. The game

set and game role of individual players can be shuffled about at will. With the availability of this option sequential dependencies between successive games can be successfully eliminated. A single player will never know for sure which of his fellow-players he is playing against, much less which roles these players have played in the past or will be playing in future games.

The "Coalitions" game explicitly defines three stages in the bargaining process. The first, the *offer stage*,is that time when players explore the potentials of various coalitions. Different offers (suggestions towards division of points) are made to different possible coalitions and some ideas towards where a reasonable solution to the game might lie are formed. In this stage, players gain awareness of their relative strengths and weaknesses, and some idea of the expectations of the other players.

The second stage, termed the *acceptance stage*, begins when a set of players indicates a general agreement on a division of the points. This agreement is not binding, but it does indicate that serious consideration of the coalition proposed, with its division of the points, is in order. During the acceptance stage, the members of a tentative coalition may be interested in modifications of the agreement for that coalition as well as in what other coalitions might have in store for them. It is in this stage that various strategies and counterstrategies may become their most complex. For the student of bargaining behavior, it is the most interesting stage.

The third state, termed *ratification*, terminates the bargaining process. The members of a tentative coalition having considered an offer and seeing it through acceptance, are now willing to make it a binding agreement. Satisfaction with the proposed coalition and its division of the points is therefore indicated and, by passing into ratification, each party receives its points and the bargaining (and game playing) process is terminated.

The vocabulary of "Coalitions" is designed to accommodate the type of bargaining behavior as described above. The basic input facility of the program is the GO AHEAD. A GO AHEAD is transmitted to a player in one of two ways, either requiring the players to speak in turn, in alphabetical order, or allowing each player to speak upon request.

Upon receiving an output command of GO AHEAD on his teletypewriter, a player is asked to type in his message. This message consits of a *keyword*, followed by parameters if necessary. There are seven legal keywords.

PASS is a keyword indicating a player's desire not to communicate to other players at that particular time.

SOLO is a unilateral and irrevokable decision on the part of a player to be placed immediately into a ratified coalition consisting of himself and no other players. In effect, he opts out of the bargaining situation and takes whatever gains he can realize by working alone.

OFFER is the basic unit of negotiations. It is used by one player to propose a division of points to a subset of players in which he is included. OFFER statements can be made publically or secretly. In the latter case, the player making the offer must specify which players are to receive information about it. If two or more OFFER statements are addressed to the same coalition or by different players, the most recent one is considered the only valid one.

REJECT is a keyword indicating displeasure with a given offer. Once an offer is rejected, it ceases to exist and must be stated again if a player wishes to reintroduce it into consideration.

ACCEPT indicates that a player likes a given offer, and finds it worth considering at the acceptance stage. It is not a binding commitment to support the offer to the ratification stage. When all of the members of a proposed coalition have accepted it, the proposal passes from the offer to the acceptance stage, and players are accordingly notified. A player may accept only one coalition at a time. If he finds himself in two coalitions at the acceptance stage at one time, he is asked via special request to choose between the two. The coalition chosen by this special input request is preserved and the other one is implicitly rejected. The results of this choice are transmitted to all of the other players.

RATIFY is a request by a player to finalize a proposed coalition, giving to each member of the coalition the points he is allocated by the proposal. RATIFY is only valid when addressed to a coalition in the acceptance state, and only after a delay, prespecified by the experimenter, has passed.

The REMARK keyword requests the opportunity to send a message that is not covered by the vocabulary of the game. This message is then transmitted verbatim to those players specified by its author. If, in a particular experiment, REMARKS are not desired, the experimenters simply do not inform the Ss of the existence of this keyword.

An Example

Table 1 presents a protocol of a three-person game. The characteristic function of this game is $v(AB) = 95$, $v(AC) = 90$, $v(BC) = 65$, and $v(X) = 0$ for any other coalition X. The protocol is of Player B. The messages typed by B have been underlined; the remaining messages have been printed by the teletypewriter. The comments, given in parentheses on the right-hand side of the table, are self-explanatory.

The protocol presented in Table 1 is real, not fabricated. The three players were undergraduate students recruited for the experiment via posted advertisements offering monetary rewards. They first participated in one 3-h familiarization session. The first hour of this session was given to written and verbal presentation of the rules of playing the game and how to operate a teletypewriter. The Ss then played practice games for the remaining 2 h under the supervision of an S.

The protocol is of Game 6 in a sequence of 20 various games played by the same Ss. It was selected because of

its shortness; most of the other games were considerably longer. The game was played in order, with A getting the first GO AHEAD, followed by B, then by C, after which it was again A's turn to play. A delay of nine messages between the arrival of the acceptance stage and the possibility of ratification was enforced by the computer program. Players were paid $.05 for each point gained in the game.

This example demonstrates that "Coalitions" overcomes the three weaknesses of experimental paradigms that I have stated above. By employing a characteristic function game, it removes the restrictions of a fixed reward for each coalition and of the separation of the process of coalition formation from the allocation of rewards. By requiring players to sit in separate cubicles and communicate with one another through teletypewriters, it eliminates the effect of variables that arise out of face-to-face contact, which are not germane to the theories being tested or are difficult to control. There are additional advantages it provides to the E. The more obvious ones are the ease of bookkeeping, automatic data recording, and the reduction in the probability of errors by the E. Paper-pushing during the experiment is reduced to nil; the E's role of messenger, so characteristic of noncomputer run bargaining games, is subsumed by the computer, and the time necessary to run the experiment is thereby shortened.

Preliminary results from experiments employing "Coalitions" have been reported by Funk (1972), Horowitz and Rapoport (in press), and Kahan and Rapoport (in press). Other experiments are in progress. The experiments indicate that "Coalitions" is sufficiently flexible to handle a wide range of bargaining behaviors, through differing use of the keywords. Players find ways for expressing their intentions within the structures of the keywords, yet with subtle shades of meaning. For example, there are many ways to show displeasure with a given offer, even when the REMARK cannot be used. The first way is to simply ignore the offer. A second way is to make a counteroffer more in the direction of reasonableness. A third, fairly extreme, way is to REJECT the offer. Some Ss have used a fourth, where they make a wildly absurd offer, the equivalent of throwing one's hands up in disgust. For another example, when secret offers are allowed, players use them extensively. Early negotiations are made largely in secret, and later offers are made in public, to emphasize their sincerity. Players will also employ stalling tactics, deciding early on a communication, but making the others wait for a while until they receive it.

All of these tactical moves that our Ss have been using have obvious counterparts in the real world of negotiation. Within a fairly small set of alternative behaviors, a wide range of expression becomes possible, and much of the process of negotiation becomes open to the experimental laboratory.

Table 1

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COALITION AB IS WORTH  95 POINTS
COALITION AC IS WORTH  90 POINTS
COALITION BC IS WORTH  65 POINTS

**************************YOU ARE PLAYER B IN THIS GAME
GAME READY TO BEGIN                                    (Offer stage begins)
PLAYER A MAKES THE FOLLOWING OFFER:
A GETS  50 POINTS
B GETS  45 POINTS

GO AHEAD
REMARK AB

GO AHEAD WITH REMARK
NO FUNNY BUSINESS AND THE GAME IS OVER.   (C makes a secret offer:
I WILL ACCEPT NEXT.                        A-65, C-25)

                                          (A makes a secret offer:
GO AHEAD                                   A-60, C-30)
ACCEPT AB
                                          (Acceptance stage begins)
PLAYER B ACCEPTS OFFER BY A TO COALITION AB
A GETS   50 POINTS
B GETS   45 POINTS
ALL PLAYERS IN COALITION HAVE ACCEPTED

PLAYER C ACCEPTS OFFER BY A TO COALITION AC
A GETS   60 POINTS
C GETS   30 POINTS
ALL PLAYERS IN COALITION HAVE ACCEPTED

A CONFIRMS COALITION AC AND REJECTS COALITION AB
PLAYER A PASSES

GO AHEAD
OFFER A-65, B-30
WHO TO? AB

PLAYER B MAKES THE FOLLOWING OFFER:
A GETS   65 POINTS
B GETS   30 POINTS

PLAYER C MAKES THE FOLLOWING REMARK
CAN PROMISE TO STAY WITH B-34, C-31. CAN YOU?

PLAYER A MAKES THE FOLLOWING REMARK
SORRY I RENEGED ON FIRST OFFER. SUGGEST A-55, B-40

GO AHEAD
OFFER A-55, B-40
WHO TO? ABC

PLAYER B MAKES THE FOLLOWING OFFER:
A GETS   55 POINTS
B GETS   40 POINTS

THIS OFFER REPLACES THE PREV. ONE TO THIS COALITION
PLAYER A PASSES                           (C sends a remark to A:
                                           "I am still game")
GO AHEAD
OFFER B-30, C-35
WHO TO? BC

PLAYER B MAKES THE FOLLOWING OFFER:
B GETS   30 POINTS
C GETS   35 POINTS

PLAYER C RATIFIES COALITION AC            (Ratification stage begins)

A GETS   60 POINTS
C GETS   30 POINTS

A ACCEPTS RATIFICATION
AC IS A RATIFIED COALITION. YOU MAY NOT
MAKE STATEMENTS INVOLVING THESE PLAYER(S) ANY MORE.

PLAYER B PLAYED SOLO

B IS A RATIFIED COALITION. YOU MAY NOT
MAKE STATEMENTS INVOLVING THESE PLAYER(S) ANY MORE.

THIS GAME HAS TERMINATED
PLEASE WAIT FOR FURTHER INSTRUCTIONS
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PROPOSED EXTENSIONS

Computer programs for on-line experimentation resemble research proposals, scientific papers, and the constitution of the United States in being open-ended endeavors. With some ingenuity, effort, or persistance they may be extended or modified. "Coalitions" is not an exception to this rule. Despite its generality, its present version imposes constraints on the bargaining process, that were neither obvious nor realizable when the program was originally written. These constraints, the severity of which may be only assessed after a careful analysis of a variety of coalition formation situations in real-life, reflects our view of the basic negotiation moves in coalition formation. Our view has naturally been changing with the increasing use of the program and the continuous gathering of bargaining data

under a rich variety of experimental conditions.

One of the constraints of the program is that a player may accept only one coalition at a time. If he proposes an offer to a coalition and all members of this coalition accept it, this will automatically reject any offer he has accepted earlier. It will also reject any coalition he had originated that had reached the acceptance stage. When he finds himself in two coalitions, a player must immediately choose between them. To demonstrate the latter point, consider the characteristic function presented in Table 1. Supposing the following sequence of negotiation moves has been observed:

A offers A-62, B-33.
B passes.
C offers A-62, C-28.
A accepts C's offer.
B accepts A's offer.

At this stage in the bargaining, A is in two accepted coalitions, gaining 62 points in each. But this situation is intolerable to the program. It immediately interferes with a special input message requiring A to choose between Coalitions AB and AC. But why should A be prevented from staying temporarily in two accepted coalitions, choosing between them later at the ratification stage? Presumably he is provided with this option in many real-life bargaining situations involving three or more participants. In addition to increasing the generality of the program, the experiments that we have conducted with "Coalitions" suggest that deferring the choice between two accepted coalitions to the ratification stage may also prolong bargaining and decrease the implicit cost for dissolving accepted coalitions. It is proposed, therefore, to extend "Coalitions" to the case where a formation of a Coalition X automatically rejects only offers made by one of the members of X to all the remaining members of X as well as any offer that was previously accepted only by all the members of X.

A second limitation of "Coalitions" resides in the implementation of the RATIFY statement. It arises only when the number of players exceeds three and the characteristic function allows the formation of two or more mutually exclusive coalitions. Under the present version of the program, ratification of an accepted coalition is legally possible after a delay, prespecified by some game parameters, has been passed. If several mutually exclusive coalitions are allowed to form, they may be ratified sequentially and independently of one another. Since the ratification of several mutually exclusive coalitions may not occur simultaneously, the nature of the game necessarily and substantially changes after the occurrence of the first ratification. For example, consider a four-person game with the characteristic function $v(AB) = 100$, $v(AD) = 70$, $v(BC) = 70$, $v(CD) = 40$, and $v(X) = 0$ for any other Coalition X. Examination of the characteristic function reveals that A is the most powerful member and D is the least powerful member of this quartet. Supposing the Coalitions BC and AD have been accepted by all their members. If BC were the first coalition to be ratified, D might force A to an equal split of V(AD), despite the disparity in their power, since the two are now locked in a two-person negotiated game. Indeed, for any of the four two-person coalitions first ratified, each of the remaining two players may force his coplayer to an equal split of the value assigned to their coalition.

The presently required sequential ratification of mutually exclusive, though not collectively exhaustive, accepted coalitions may be defended as adequately representing some, though not all, real-life coalition formation situations. It poses, however, a difficulty in testing game-theoretic models for coalition formation, since all of these models are static in nature, considering the formation of mutually exclusive coalitions as a simultaneous event rather than a sequential process. Until dynamic game-theoretic models for n-person games become available, this difficulty may be alleviated by requiring that ratification takes place simultaneously for all members of all the permissable mutually exclusive accepted coalitions, excluding, of course, one-person coalitions.

A third extension may be more difficult to execute, as it will certainly require a major revision of the program. "Coalitions" presently allows the play of only one characteristic function game at a time, thus restricting bargaining among the players to only a single issue. It does not permit the same set of players to bargain simultaneously on two or more separate issues, each of which is represented by a different characteristic function. But the latter situation is quite common in economics, politics, and business negotiations. Trade negotiations among three or more countries, for example, typically involve more than one commodity, with the different commodities frequently being negotiated independently of one another. An experimental study of such bargaining situations may be valuable and highly desirable. For example, consider the following two characteristic functions v_1 and v_2: $v_1(AB) = 95$, $v_1(AC) = 90$, $v_1(BC) = 65$, and $v_1(X) = 0$ for any other Coalition X, $v_2(AB) = 85$, $v_2(AC) = 90$, $v_2(BC) = 115$, and $v_2(X) = 0$ for any Coalition X, where A, B, and C in both games refer to the same three players. Allowing the players to participate in the two games simultaneously provides a method of studying whether bargaining on one issue affects bargaining on another issue, when the power structure of the players varies from one situation to another.

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