Extensions of Power-Dependence Theory:
The Concept of Resistance*

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Abstract

Power-dependence theory is critically examined and found to possess several deficiencies, in particular a reliance on invalid interpersonal utility comparisons. A means is proposed for overcoming these deficiencies by reformulating power-dependence theory using concepts derived from a formal model of negotiation based on mathematical decision theory.

According to Cook and Emerson (722), the emergence of social theories of exchange has resolved problems which have proven intractable for economic theories of exchange. The problems Cook and Emerson have tackled include the well-known bilateral monopoly problem described by Edgeworth in 1881, and the problem of accounting for the effects of equity and related nonrational motivations upon exchange processes and outcomes. Thus one objective of social exchange theory is to overcome difficulties created by the excessively rationalistic models of decision-making employed by classical microeconomists and others.

An aim of this paper is to explore the conceptual problems arising when strict rational decision models are employed in accounts of social interaction. In particular the focus will be on the indeterminacy of the terms of exchange in bilateral monopoly systems for classical microeconomics and on the closely related but more general problem of indeterminacy of outcome in nonzero-sum cooperative games for classical game theory. In addition, a critique of the resolution of this problem proposed by Emerson and Cook is given.

A second aim is to describe a recent development in mathematical bargaining theory (Coddington; Harsanyi, b; Heckathorn, c; Young) which provides a means of resolving the indeterminacy problem while avoiding

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1206
the difficulties afflicting power-dependence theory. Based on this development, a reformulation of power-dependence theory is proposed.

The Indeterminacy Problem

The indeterminacy problem was clearly defined and extensively discussed by economists in the latter part of the nineteenth century, and remains a frequent topic for discussion in economic texts. It has also received attention from several exchange theorists (e.g., Blau; Cook and Emerson; Emerson, c; Kuhn).

The analysis Edgeworth proposed represents early treatments. Dealing primarily with bilateral monopoly systems, that is, two monopolists bargaining with one another, Edgeworth demonstrated that microeconomic theory could specify a range within which each one's output and price must fall. This range of prices and outputs falls on the contract curve in a graph known as the Edgeworth box. However, Edgeworth could not say where on that curve the price and output would fall. His analysis was indeterminate.

When translated into modern terms, the problem Edgeworth encountered was this: if both monopolists are individually rational, each will accept a settlement only if it would not leave him or her worse off than no exchange. In the graph depicted in Figure 1, point "C," termed the "conflict point," represents the point of no exchange. If monopolist E (ego) is individually rational he or she could only agree to outcomes to the right of point C, and A (alter) could only accept outcomes above point C. Therefore, only outcomes in area XYC are individually rational. These outcomes compose what Edgeworth termed the contract zone. If the further requirement is added that the monopolists be jointly rational, implying that the terms of exchange must be efficient (i.e., Pareto optimal) in that no outcome other than that agreed upon must be simultaneously preferred by both monopolists, the outcome set is further constrained. Only those outcomes lying along the upper boundary of the contract zone, line XY, are jointly rational. These outcomes lie along Edgeworth's contract curve and form a set termed the negotiation set, N. All outcomes in the negotiation set are both individually and jointly rational. Where in the negotiation set agreement would occur, Edgeworth could not say. Thus the outcome of bargaining between such monopolists is indeterminate.

In practice, of course, no indeterminacy occurs in bilateral monopoly. Only in theoretic models do economic actors become afflicted by indeterminacy. As Edgeworth recognized, exchanges in actual systems occur through negotiation.

Each point on the contract curve corresponds to a different division of the benefits of exchange. At one extreme, point Y in Figure 1, the profits
all flow to ego. That outcome, following Kalai and Smorodinsky, is termed ego’s best hope, Be. The other extreme point of the contract curve, X, corresponds to alter’s best hope, Ba. Obviously, both monopolists cannot achieve their best hopes. Points X and Y do not coincide. One or both must make concessions, that is, accept a settlement less preferred than the best hope, or agreement is impossible. In its most general terms, bargaining is the process of allocation of concessions leading either to agreement (e.g., agreement to accept one of the outcomes in the negotiation set), or to confrontation (e.g., no exchange owing to insufficiency of concessions and the breakdown of negotiations). It is the process of bargaining—the process of making concessions and seeking concessions from others—which Edgeworth demonstrated exceeds the scope of microeconomic decision-making models. In other words, bargaining was shown to be an intrinsically irrational process, if rationality means individual and joint rationality as defined above. For the principles of individual and joint rationality merely require that some agreement—any agreement—be reached, so long as it falls on the contract curve. Hence these principles say nothing about how concessions are to be allocated.
Edgeworth abandoned the indeterminacy problem by choosing to define economics exclusively as the study of rational behavior, leaving study of "the objectionable arts of higgling" (30) to other disciplines. In his judgment that the indeterminacy problem was insoluble by economic means, Edgeworth was followed by a long line of other economists, e.g., Bohm–Bawerk, Bowley, A. M. I. Henderson, Nicol, Pigou, Stackelberg, Stigler, Tintner, and P. Samuelson.

The indeterminacy problem would be of little general interest to social scientists were it restricted to exchanges among pairs of strictly rational monopolists. However, its extension is far more general. First, it arises not only when actors are profit maximizers, but when they maximize any criterion variable such as utility, payoff, value, or inclusive fitness. The problem remains fundamentally the same, whether best hopes are computed in money, utility, or another criterion variable (e.g., altruists' judgments about another's best interests) so long as actors' best hopes correspond to incompatible outcomes.

Second, the indeterminacy problem arises not only if actors are rational maximizers, but also if their rationality is "bounded," in the sense of Simon. If actors are satisfiers rather than maximizers, they strive to achieve, not a unique best hope, but rather a range of outcomes one could term their "satisfactory hopes." However, the generic problem remains essentially unchanged, for it is not necessarily the case that any feasible outcome will be satisfactory to both actors, and thus there remains the possibility that exchange will require one or both actors to accept a less than satisfactory outcome, that is, someone may be required to make concessions to avoid blocking exchange. In other words, the problem of accounting for concession-making remains.

Third, the indeterminacy problem arises in virtually all social systems because the fundamental interest structures which produce indeterminacy in bilateral monopoly are themselves practically universal. For if social systems are placed on a continuum of interest structures varying from strict competition (i.e., zero-sum games where actors possess only opposed interests) to strict cooperation (i.e., games where actors possess only complementary interests), virtually all social systems lie on intermediate points of the continuum where actors combine competitive and cooperative interests (e.g., Brickman). That is, the systems correspond to mixed motive games, games where opposed interests mingle with complementary interests. Strict competition is empirically quite rare (except in parlor games) since even the most bitter of opponents typically possess residual cooperative interests, if only to avoid mutual destruction. Strict cooperation is also rare, for even the most harmonious cooperators typically differ on the details of cooperation. For example, even the ideal loving couple may differ over the allocation of odious household duties or over judgments about where collective interests lie. Hence most social inter-
actions contain mixtures of motives where actors combine common interests in some form of cooperation—for example, avoiding a mutually costly war—and opposed interests regarding how to cooperate, such as incompatible best hopes about the terms of exchange or the division of disputed border territories. In other words an element of bargaining enters into virtually all interactions.

To assert that bargaining is a near universal feature of interactions might appear to entail a view of social actors as Machiavellian plotters seeking personal gain at the expense of others. Such is not the case. Rather, it grants that a certain element of give and take, a certain amount of mutual accommodation and compromise is required to avoid conflict in even the most harmonious interactions. Nor does the statement require that overt bargaining, sequences of offers and counteroffers, be discoverable in all interactions. Overt bargaining varies greatly in its distribution among and within societies, occurring frequently in some contexts and infrequently in others. That is not disputed. But bargaining may be tacit as well as overt, where tacit bargaining means the allocation of concessions in the absence of overt bargaining. For example, tacit threats of minimal compliance and a wide variety of other passive-aggressive tactics exist by which subordinates can tacitly bargain with their nominal superiors in even the most rigidly authoritarian bureaucracies. In a world of mixed motive interactions, concessions are always and necessarily allocated in some manner, for best hopes do not coincide. Therefore, some or all individuals must necessarily receive outcomes less preferred than their best hopes. Overt bargaining is only one of many means by which concessions are allocated.

In sociology the concession process has been analyzed primarily by exchange theorists. Many exchange theorists have merely made note of the indeterminacy problem in stating that the practical resolution of indeterminacy depends on the bargaining power of the actors, and have not specified the precise referents of that term (e.g., Blau; Kuhn).

Among contemporary exchange theorists, only Cook and Emerson (724) propose a resolution of this problem. Their solution is based on Emerson's (a) earlier formulation of power-dependence theory. They view their social exchange model as complementary to economic exchange models, in that the former provides solutions to problems the latter have found intractable, including the bilateral monopoly problem and the effects of equity and related processes (e.g., status consistency) on exchange outcomes.

Let us then examine power-dependence theory's proposed resolution of the indeterminacy problem. According to Emerson (a), the power of actor E over actor A equals the dependence of A upon E. In the absence of alternative exchange opportunities, (as in bilateral monopoly) an actor's dependence varies directly with the profit from the exchange, i.e., the value of what is received less the value of what is given up. Cook and Emerson, it should be noted, treat "value" as equivalent to the terms
“utility” and “preference for” (723-4). Thus, where Pe is actor E’s utility from the exchange, and Ce is utility from conflict (no exchange), his or her dependence is Pe – Ce, i.e., the difference between the utilities from exchange and conflict. According to Cook and Emerson, an equilibrium point occurs at the outcome where both actors’ power (or equivalently, both dependencies) are balanced, i.e., at the outcome yielding equal utility increments to the actors. In the above terms, that outcome satisfies the expression Pe – Ce = Pa – Ca.

The flaw afflicting this theory is that it requires interpersonal utility comparisons of an invalid type, i.e., direct quantitative comparisons of actors’ utilities. Virtually the entirety of modern utility theory holds that such comparisons are not meaningful, for utility scales are defined as unique only up to a positive linear transformation (Homans; Luce and Raiffa). That is, choice of the unit and the zero point for each individual’s utility scale is arbitrary. Consequently one person’s magnitude of utility increase cannot be compared directly with another’s, since that comparison would depend on the arbitrary choice of unit for each person’s scale (what Cook and Emerson term the “unit value”:723). Therefore, actors’ dependencies are not interpersonally comparable.

In order to see why interpersonal utility comparisons are invalid, consider the following two games. In Game 1 persons E and A are told that they will receive one dollar if they can agree how to divide it between them. If they fail to agree, they receive nothing. If Pe is E’s payoff from the division, and Ce his payoff from disagreement, E’s dependence level, De is the difference between Pe and Ce, i.e., De = Pe – Ce. For example, if Pe equals $0.60, A’s dependence is 0.60 – 0 = 0.60. In this game, Emerson’s equi-dependence point (i.e., the balance point) occurs at the outcome where De = Da = 0.50. That is, E and A divide the dollar equally.

Consider now a second game. Assume first that play A is an Austrian who will be paid in schillings at the rate of fifteen schillings per dollar. Otherwise Game 2 is identical to Game 1. As before, player E’s dependence is Pe – Ce. However, since A is paid in schillings his dependence is 15Pa – 15Ca, where Pa and Ca are denominated in dollars.

This game’s equi-dependence outcome is for player E to receive 94¢, and player A to receive 6¢. Had player A been so unfortunate as to be paid in Italian lire, he would have received less than 1¢. Obviously something is wrong with a theory for which currency denomination largely determines bargaining power.

It might seem that this difficulty could be overcome by insisting that all payoffs be denominated in the same currency. In that case, the equi-dependence outcome is always an equal division of money in games like that described above. However, for Cook and Emerson, the terms of the dependence equation are not monetary units, they are utility units or, equivalently, value units. It cannot be assumed (except arbitrarily) that each
individual values money equally, yet that assumption would be implicit in a decision to compute dependencies using a standardized monetary unit.

The issue of which currency provides the denomination for an individual’s payoffs is analogous to the classical utilitarian’s effort to discover the value unit, the “utile,” which would provide the basis for interpersonal utility comparisons. In Game 1, where a dollar was assumed to be worth an equal number of value units to both players (since dollars served as the value unit) power-dependence theory predicts an equal division. In Game 2, where a dollar was assumed to be worth one value unit to player $E$, and fifteen value units to player $A$, a 15/1 division to $E$ and $A$ respectively was predicted. More generally, in games like those described above, where $V_E$ and $V_A$ are the value units of players $E$ and $A$ respectively, the prediction is a $V_A/V_E$ division of the valued resource to $E$ and $A$. Just as the classical utilitarian’s concept of the sum of social utility is now known to be meaningless because that sum depends on each arbitrary choice of a unit to express each individual’s utility, so the concept of an equi-dependence outcome is meaningless since it also depends on the arbitrary choice of a value unit for each individual.

In an essay relating power-dependence theory to operant psychology, Emerson (c, 63) acknowledged the reliance of his theory on interpersonal utility comparisons. Though no means were proposed for specifying utility scale units, an operational procedure was introduced for identifying balanced relationships. According to Emerson (c, 51), operant principles imply that any actor $E$’s dependence $D_E$, which corresponds in operant terms to the strength of the conditioned reinforcer, governs his probability of initiating interaction $I_e$, that is, $I_e$ varies directly with $D_E$. According to Emerson (c, 63) this implies that in a balanced relation (i.e., a relation where $D_E = D_A$), initiations by each party are equally probable (i.e., $I_e = I_a$), and in an imbalanced relation, the probabilities are unequal (i.e., if $D_E \neq D_A$ then $I_e \neq I_a$). Therefore, whereas balance or imbalance are conceptually defined in terms of dependencies, they are operationally defined in terms of initiation probabilities.

Emerson’s formulation fails to resolve the utility scaling problem afflicting his theory, for it does not follow mathematically that if each individual’s dependence ($D$) is directly related to his initiation probability ($I$), the equi-dependence outcome must coincide with the equi-probability outcome. Consider by way of illustration the depiction of a two-person game in Figure 2. The horizontal axis represents the payoff received by player $E$, and the vertical axis represents the players’ dependencies and initiation probabilities. As is apparent by inspection, player $E$’s dependence $D_E$ and initiation probability $I_e$ fulfill the requirement that they be directly related to one another. Indeed, $D_E$ and $I_e$ are directly proportional to one another. Similarly, Player $A$’s dependence and initiation probability are directly related. Nonetheless, the equi-dependence point and the equi-
Dx: Player X's dependence, X = (E,A)
Ix: Player X's initiation probability, X = (E,A)

Figure 2. DEPENDENCIES AND INITIATION PROBABILITIES IN A GAME. (Though each player's dependency is directly related to his/her initiation probability, the equi-probability point does not coincide with the equi-dependence point. Hence the former cannot serve as an empirical indicator for the latter.)

probability point do not coincide. As this demonstrates, even were it granted that the operant principles are true on which Emerson based his conclusion that D and I must be directly related, nonetheless empirical determinations of I can reveal nothing about the identity of the equi-dependence point.

It might seem that this difficulty could be resolved if dependencies are defined as identical to initiation probabilities, for then the outcomes wherein le = la and De = Da would necessarily coincide. However, such a formulation would risk appearing arbitrary, for it could not be justified by operant or decision theoretic principles. Furthermore, were this formulation adopted, power-dependence theory's predictive capability would be jeopardized, for operant theory provides no means for predicting initiation probabilities. There are no general theoretic principles from which they can be computed. Rather, they must be empirically estimated in each exchange system by repeatedly observing interaction so as to compute the proportion of times each actor initiates interaction when given the opportunity. Finally, it must be noted that in empirical evaluations of power-dependence theory (e.g., Cook and Emerson; Emerson, b) no effort was made to mea-
sure dependencies by way of initiation probabilities. Instead, dependencies were computed merely by allowing points in experimental games to serve as the value unit. Consequently, Emerson's (c) proposal to establish comparability among utility scales was not adopted in practice.

This criticism of power-dependence theory does not imply that all forms of interpersonal utility comparisons are invalid. Classical game theory and most of its contemporary off-shoots employ cardinal utility scales, and ratios of differences between such utilities can be compared across individuals. For example, it can be accurately asserted that one individual values receiving a given object twice as much as another object, while a second individual values receiving both objects equally. Such comparisons do not depend on the choice of a unit or a zero point for each individual's utility scale.

It should also be noted that mathematical decision theorists are not universally agreed that utility scales should be conceived as unique only up to a linear transformation. Several mavericks (for example, Braithwaite, and most notably John Harsanyi) claim that under certain conditions stronger comparisons can be made validly. However to establish this stronger comparability among utility scales, they have introduced a variety of quite complex means for specifying utility scale units so as supposedly to establish direct comparability. They did not merely assume that a conveniently selected resource, such as points in an experimental game, or money can be relied on to possess units corresponding to universally shared utility scale units.

Bargaining theorists have developed several models which resolve the indeterminacy problem without resorting to invalid utility comparisons. For example, one set of models (Heckathorn, c; Kalai and Smorodinsky; Raiffa) when described in power-dependence terms, requires that equilibrium occur in a two-person game not at the supposed equi-dependence point but at the point where the ratio of actors' dependencies equals the ratio of their best hopes, i.e., at the outcome satisfying the expression $De/Da = (Be - Ce)/(Ba - Ca)$. These models imply that aspiration levels, as expressed in the best hopes of individuals, affect their relative bargaining power. Alternatively, the Nash (a, b) and related models (Harsanyi, a, b; Roth, b) specify the outcome which maximizes the product of the actors' dependencies, i.e., the outcome satisfying $\text{Max}[De \times Da]$. Aspiration levels do not enter into those models as a determinant of bargaining power. Since both types of bargaining models identify equilibrium points in a manner wholly unaffected by changes in value units, both provide a theoretically coherent alternative to power-dependence theory.

Finally, it should be noted that the utility scaling problem afflicts not only power-dependence theory, but also the equity rule as formulated by Cook and Emerson. That rule requires individuals to gain equal utilities
from the interaction. Using that rule, the identity of the equitable outcome depends on the arbitrary choices of value units for each individual.

Mathematical Bargaining Theory

A number of bargaining models have been proposed by decision theorists. These fall into four rather rough categories. Game theoretic models consist of a set of axioms which serve to identify one outcome of each game as the game's solution (e.g., Nash, a, b; Raiffa; and Kalai and Smorodinsky who converted Raiffa's solution to a set of axioms). Second, a number of concession models have been proposed, generally by economists. These focus on the process by which individuals decide whether and when to offer concessions (e.g., Cross; Hicks; Pen; Zeuthen). Third, manipulative models deal with the tactical aspects of negotiation such as the use of bluffs, bridge-burning, and the "nibble" (e.g., Schelling; Walton and McKersie). Fourth, synthetic models have been proposed which take into account two or more of the above phenomena (e.g., Harsanyi, a, b, who synthesized the Nash and Zeuthen models; Roth, a, who further elaborated Harsanyi's model; and the resistance model—Heckathorn, c—which synthesizes the Raiffa/Kalai/Smorodinsky model with a concession mechanism and account of manipulative bargaining). (For summaries of this literature see Bartos; Coddington; Luce and Raiffa; Rubin and Brown; Young.)

In what follows, the resistance model (Heckathorn, c) will be discussed, as it illustrates one manner in which mathematical bargaining theory can provide an alternative to power-dependence theory. However, it must be emphasized that various bargaining models are currently considered viable. Indeed, the number of different approaches to the bargaining problem has been growing rather than diminishing during the past decade.2

A founding basis of the resistance model is the acceptance of Edgeworth's conclusion that bargaining exceeds the scope of strict rational models of decision-making, that is, models which view individuals as rational maximizers. A new decision principle is introduced to describe bargaining behavior, termed the "equi-resistance principle" (Heckathorn, c, 270). This principle is conceived as subordinate to the principle of rational maximizing in that the former principle is activated as a guide to behavior only when the scope of the latter principle is exceeded.
Resistance

The core of the proposed model is a conception of concession-making as governed by actors' resistances to concession-making. An actor is conceived as manifesting a quantity of resistance to an outcome which depends directly on the cost of concessions it requires, and inversely on the costliness of conflict (Heckathorn, c, 269). Thus each person's concession-making is conceived in terms of his or her resistance scale, a scale assigning a calculable degree of resistance to each feasible outcome.

An actor's resistance to any given outcome is formally defined as follows: where an outcome yields actor E the pay-off or utility \( P_e, C_e \) is the utility from conflict, and \( B_e \) his or her best hope (i.e., the utility from the preferred outcome which is also at least weakly preferred to conflict by the other), the actor's degree of resistance to the outcome \( R_e \) is given by the expression

\[
R_e = \frac{B_e - P_e}{B_e - C_e}.
\]

In this expression, the numerator corresponds to the costliness of concessions required by that outcome, for it represents the degree to which its utility \( P_e \) falls below the actor's best hope utility \( B_e \). The denominator corresponds to costliness of conflict, for it indicates the difference between the best hope and conflict. Any actor's resistance to his or her best hope outcome is necessarily zero since the concession cost is zero. The actor does not resist agreeing. Degree of resistance increases progressively as less preferred outcomes are considered. Resistance becomes total (unity) with an outcome equally preferred to conflict. According to the model, a bargainer's reaction to any outcome depends crucially on resistance to it. In cases of total resistance, that is, \( R \geq 1 \), the actor will never agree to it; if the person is nonresistant, i.e., \( R \leq 0 \), he or she will necessarily agree to it; and if resistance is positive but not total, that is, \( 0 < R < 1 \), the actor may or may not agree to it depending on factors specified below.

The assessment of an actor's strategic position may be conceived in terms of his or her resistance scale. Furthermore, how the actor assesses the other's strategic position may be viewed as a judgment about the degree of the other's resistance to each alternative outcome, that is, as an attribution of a resistance scale to the other. It is important to note in this context that no invalid interpersonal utility comparisons are assumed by this procedure of conceiving actors as attributing resistance scales to one another. For an attractive mathematical feature of resistance scales is their invariance by positive linear transformations of utility scales. Resistance is a dimensionless term. Multiplying all of an individual's utilities by a positive constant, or adding a constant to them, leaves that individual's resistance scale unaltered. For example, whether payoffs are denominated in dollars,
schillings, or lire, resistances remain unchanged. In Game 1 above, player E's best hope is to receive the entire dollar (i.e., $Be = 1$), and conflict yields zero (i.e., $Ce = 0$). Therefore, resistance to receiving say, 60¢ (i.e., $Pe = 0.6$) is: $Re = (1 - 0.6)/(1 - 0) = 0.4$. Similarly, where $E$ is paid in schillings, resistance is: $Re = (15 - 9)/(15 - 0) = 0.4$. Hence, whether paid in dollars or schillings, E's resistance is identical. As a result, it is not necessary to know an actor's value unit in order to compute his or her resistance. Therefore, no invalid interpersonal utility comparisons are required for actors to estimate others' resistance scales. Second, it should be noted that the model does not assume that individuals ever in fact attribute resistance scales to one another. Rather, it proposes merely that bargaining behavior can be understood as though actors make such attributions.

Because resistances are interpersonally comparable, those of different individuals can be plotted on the same scale. For example, Figure 3 represents a game where players $E$ and $A$ will divide a quantity $M$ of a valued resource, if they can decide how to divide it between them. If they fail to agree on a division, they do not receive any of the resource, and they incur penalties. In the game depicted, the players have an opportunity to divide $\$1$ (i.e., $M = 1$), and their costs of disagreement are $\$3$ and $\$2$ for $E$ and $A$ respectively (i.e., $Ce = -3$, $Ca = -2$). The horizontal axis represents the contract curve expressed as the proportion of $M$ received by $E$. The vertical axis represents players' resistances. (This game's fundamental structure corresponds to experimental Games 3 and 4 in Heckathorn, a.)

The Equi-Resistance Principle and the Resolution of Indeterminacy

Actors' resistances during complete information bargaining may be conceived as operating somewhat like opposing forces. That is, when incompatible offers are made, the bargainer who is least resistant to the other's offer yields by offering concessions until the other becomes the lesser resistant. When both bargainers are equally resistant to the other's offer, they both offer concessions. The equilibrium between offers and counter-offers is reached only when both bargainers' resistances are equal and minimal. In a dyadic game with players $E$ and $A$ and a set of feasible outcomes $U$, the game's solution is defined formally by the payoff vector $P' = (P'e, P'a)$ satisfying the expression

$$Re(P') = Ra(P') = \min \{Re(P) \mid Re(P) = Ra(P), \ P \in U\}. \quad (2)$$

It is at that point that the model predicts agreement when bargainers possess complete information. The minimal equi-resistance outcome, it should be noted, can be shown to be unique in fixed threat bargaining systems. Under conditions of full information in two-person games, it coincides with the solution of the Kalai–Smorodinsky model, and it was
Figure 3. RESISTANCE SCALES OF PLAYERS E AND A IN A RESOURCE DIVISION GAME WITHOUT SIDE PAYMENTS, WHERE PLAYERS RECEIVE A QUANTITY M OF A VALUED RESOURCE IF THEY AGREE HOW TO DIVIDE IT BETWEEN THEM. If they disagree, they incur costs. Player E's cost of disagreement is three times the resource's value to him/her (i.e., $C_e = -3M$), and A's cost of disagreement is twice the resource's value to him/her (i.e., $C_a = -2M$). The solution awards 43% of the resource to player E.

According to this model, agreement in full information bargaining occurs at the outcome $P'$ to which bargainers are equally and minimally resistant. Equivalently, it occurs at the point on the contract curve, $N$ where resistances are equal (Figure 2), that is, $P'$ satisfies the expression

$$P' = \{ P \mid R_e(P) = R_a(P), P \in N \}.$$  

(3)
This conclusion is termed the *equi-resistance principle*, and it constitutes a decision principle which plays a functionally analogous role in the resistance model to utility maximization in conventional decision theories.

In the game depicted in Figure 3, where $S_1$ is to be divided, and disagreement costs for $E$ and $A$ are $3$ and $2$ respectively, the equi-resistance outcome awards $43\times$ to $E$ and $57\times$ to $A$, for at that point $R_e = (1 - 0.43)/(1 - 3) = 0.14$, and $R_a = (1 - 0.57)/(1 - 2) = 0.14$. By contrast, the Nash model awards zero to $E$ and $1$ to $A$. These allocations are stable regardless of the value units attributed to each player.

In essence, the equi-resistance principle resolves the indeterminacy problem by treating any bargainer as able to overcome his or her internal resistance to concession-making only if the other would apparently sustain an equal or greater resistance by his or her doing so. This principle consequently can be employed to define the subset of outcomes which any actor $E$ would consider to be an acceptable result of bargaining. This subset is termed ego's *agreement set* $A_e$, and it contains all outcomes $P$ to which the actor’s resistance $R_e(P)$ is equal to or less than the other’s perceived resistance $E_e(R_a(P))$. Expressed formally, any actor $E$’s agreement set is defined by the expression

$$A_e = \{P \mid R_e(P) \leq E_e(R_a(P)), P \in U\}. \quad (4)$$

The limit of the actor’s agreement set defines the limit of concession-making. In effect, the player stands firm, refusing acceptance of any outcome outside $A_e$ even if the concessions required by that outcome would be less costly than conflict. Consequently in this model actors are viewed as drawing the line beyond which they will refuse to offer further concessions in the manner described by equation (4).

For an outcome to become a negotiated solution, it must be acceptable to all bargainers. It must lie within all agreement sets. The subset of outcomes defined by the intersection of agreement sets is termed the *zone of agreement* $Z$, that is,

$$Z = A_e \cap A_a. \quad (5)$$

In the case of complete information, the agreement zone $Z$ can be shown to consist of the singleton set containing the minimal equi-resistance outcome $P'$.

**Conflict**

A weakness of power-dependence theory is its failure to provide a formal account of the origins of conflict. That model seeks to specify only how concessions will be allocated, assuming that enough concessions have been offered to make agreement possible. It does not explain why efforts to
reach agreement frequently fail, even when all parties involved know that conflict would harm everyone.

Here it should be noted, the term "conflict" is used to refer to confrontations in mixed motive situations. In this sense not all violent interchanges are conflict. For example, professional boxers fighting for money or juvenile gang members who fight to earn a reputation for toughness are not examples of conflict. In such cases, the material or symbolic rewards earned from fighting may more than compensate for occasional bruises, so the fight is preferred to noncombative outcomes. This is not to suggest that no element of negotiation exists in such cases. For example, there may be negotiations regarding the limits of allowable force, and in that case a confrontation (i.e., conflict) consists not of the fight itself, but of escalation during the fight to greater levels of force. Fights which are not confrontations generally assume one of two forms: either the cost of fighting for both parties is comparatively small, and compensatory benefits exceed losses from the fight, so there is a cooperative interest in fighting; or a power imbalance exists which is so great that the more powerful can easily sweep aside the resistance of the less powerful, as does a cat who devours a struggling mouse. The situation in effect corresponds to a zero-sum game.

When viewed using the resistance model, conflicts result from certain types of misperceptions. The process of bargaining entails each actor manifesting resistance, and seeking to ascertain the other's resistance. A bargainer has an interest in appearing highly resistant to conceding-making, for example, by exaggerating the costliness of concessions to him—or herself. For in this way the other becomes willing to make more concessions, i.e., the other's agreement set is expanded to include outcomes increasingly preferred by the actor. Manipulation and manufacture of information to achieve these aims are prominent features of many bargaining processes.

Since bargainers have interests in misrepresenting their resistances, it should neither be surprising that self-serving claims are typically treated skeptically, nor that bargainers are often incorrect when assessing others' resistance scales. In that case, the theoretically expected outcome is typically not the minimal equi-resistance solution $P'$. If bargainers underestimate each other's degree of resistance, their agreement sets fail to overlap, making agreement impossible, thereby producing conflict (Figure 4) (Heckathorn, c, 272–3). An example would be two countries engaged in a border dispute where each believes that it could easily win a war resulting from the dispute and dismisses the other's belligerent statements as frightened empty bluffs. In that case, each would be willing to make only minor concessions and expect massive concessions to be forthcoming. There could be no jointly acceptable cooperative outcome. Expressed more precisely, the intersection of agreements sets, the zone of agreement $Z$ is the
empty set $\emptyset$. That is the condition under which the model predicts conflict. This conclusion agrees with Hicks' contention that conflict results from error.4

A Reformulation of Power-Dependence Theory

The utility scaling problem afflicting power-dependence theory can be overcome if dependencies are appropriately normalized. That is, dependence $D$ can be replaced with dependence normalized to aspirations $D^*$ which is defined, for any actor $E$, as follows
\[ D^*e = \frac{D_e}{B_e - C_e} = \frac{P_e - C_e}{B_e - C_e}. \]

The advantage of the normalization of dependence is that \( D^* \) is invariant under positive linear transforms whereas \( D \) is not. Consequently, changes in the value unit or zero point of utility scales leave normalized dependencies unaltered. For example, in the above dollar division game, if \( E \)'s payments are denominated in dollars and he receives 50\( \epsilon \), his normalized dependence is: \( D^*e = (0.5 - 0)/(1 - 0) = 0.5 \); and if \( E \) is paid in schillings it is: \( D^*e = (7.5 - 0)/(15 - 0) = 0.5 \). Hence currency of payment is irrelevant to normalized dependencies, and consequently the identity of the normalized equi-dependence point \( D^*e = D^*a \), is unaffected by value unit changes. Normalization of dependence to aspiration also affects derived concepts such as cohesion which is defined as the mean of actors' dependencies. Normalized cohesion \((D^*e + D^*e)/2\) is one \((1)\) if actors simultaneously attain their best hopes, zero \((0)\) if conflict occurs, and intermediate between one and zero when an agreement requiring concessions is reached. Degree of imbalance in a relationship, defined as the absolute value of the differences between actors' dependencies, can be similarly normalized, as \(|D^*e - D^*a|\).

It would be possible to standarize dependence to aspiration in any number of different ways, any of which would render dependence invariant under positive linear transforms, for example, \( De/(Be - Pe) \) or \( De/((Be - Pe)^2/(Pe - Ce)) \). The proposed normalization (equation 6) has several advantages as compared to such alternatives. First, it better preserves the spirit of the original dependence concept, since \( D \) and \( D^* \) are positively linearly related. Further, Cook and Emerson use examples of games in their work which fall within the restricted class of games where the normalized equi-dependence outcome happens to coincide with the unnormalized equi-dependence outcome, and where consequently normalization is predictively irrelevant. Their games consist of players who bargain for a fixed number of points (i.e., \( Pe + Pa \) from agreement is a constant), and the number of points at stake in the game is equal for each player (i.e., \( Be - Ce = Ba - Ca \)). Though in such games the normalization procedure leaves unchanged Cook and Emerson's predictions, normalization is predictively significant for games lacking the above two special properties. For example, the nonnormalized equi-dependence outcome of the game in Figure 3 is for \( E \) to receive 100 percent of the valued resource, while \( A \) receives 0 percent. By contrast the normalized equi-dependence outcome is a 43/57 allocation to \( E \) and \( A \) respectively. Cook and Emerson's failure to recognize the utility scaling problem may have resulted from their failure to explore their theory's predictions in varying types of games. Alternatively, it might be suggested that their exclusive focus on a restricted class of games constituted a tacit normalization procedure equivalent to that proposed here.
A notable feature of reformulated power-dependence theory is that its predictions coincide with those made by resistance theory for complete information systems. That is, the normalized equi-dependence point is also the equi-resistance point, as is easily demonstrated. The equi-resistance point satisfies the expression

\[ Re = Ra. \]  

Consequently, 

\[ 1 - Re = 1 - Ra \]  

which can be expanded to

\[ \frac{Be - Ce}{Be - Ce} - \frac{Be - Pe}{Be - Ce} = \frac{Ba - Ca}{Ba - Ca} - \frac{Ba - Pa}{Ba - Ca} \]  

and rearranged as

\[ \frac{Be - Ce - Be + Pe}{Be - Ce} = \frac{Ba - Ca - Ba + Pa}{Ba - Ca} \]  

This expression reduces to

\[ \frac{Pe - Ce}{Be - Ce} = \frac{Pa - Ca}{Ba - Ca} \]  

which is the expression for the normalized equi-dependence point,

\[ D*e = D*a. \]  

Hence the equi-resistance point and the normalized equi-dependence point are shown as identical. The proposed normalization procedure thereby creates a convergence of power-dependence and resistance theory, a convergence which reveals the exceedingly close association between theories of negotiation and power. Expressed in bargaining terms, a theory of power provides an account of the social allocation of concessions, and power refers to the capacity to extract concessions.

**Bargaining in Exchange Networks**

Thus far in this paper, attention has been centered on a rather artificial case, pure bilateral monopoly. Wholly isolated dyads are of course rare, since actors in bilateral exchanges are virtually always surrounded by alternative exchange partners, mediators, and other interlopers. Consequently, social exchange typically occurs embedded within complex and extensive networks of exchange. Let us then briefly examine some of the implications of resistance theory for the analysis of exchange when alternatives to the dyad are present, including an analysis of several points at which resistance theory's conclusions differ from those of power-dependence theory.
For power-dependence theory, power within a relationship is importantly affected by the availability of alternative (i.e., negatively connected) exchange opportunities. Similarly, for resistance theory, alternatives are fundamental determinants of power. However, the two theoretic approaches differ somewhat in the mechanisms by which alternatives affect power. Cook and Emerson (723) introduce in their definition of dependence the principle that dependence and availability of alternatives are inversely related. Further, since they define dependence and power as inversely related, this principle implies that any individual's power within a relationship varies directly with the availability to him or her of alternatives. Hence a direct relationship between power and alternatives is entailed by their definitions of power and dependence. By contrast, for resistance theory the relationship between power and alternatives is more variable. Whether or to what extent a person's power is enhanced by availability of alternatives depends both on the nature of the relationship and the alternatives to it. Analytically, the effects of alternatives on a relationship are conceived in terms of the alternatives' impact on aspirations and conflict payoffs within the relationship, and thereby on the relationship's negotiation set. These, in turn, affect actors' resistances within the relationship and thus alter the relationship's power balance.

When viewed in bargaining theoretic terms, introducing alternatives into a given relationship may have any of four qualitatively distinct effects upon it. These effects are importantly conditioned by the anticipated payoff from the alternative exchange, or to use Thibaut and Kelley's term, on the comparison level of alternatives, \( CL_{alt} \). (In this regard, resistance and power-dependence theories agree. See Cook and Emerson, 723-7, and Emerson, c.) One possible effect, as Cook and Emerson recognize, is that an actor's power within the relationship is enhanced by acquisition of the alternative. This occurs for resistance theory if an actor acquires a new exchange alternative whose comparison level falls between (a) his or her conflict payoff in the relationship (in other words, the payoff from no exchange), and (b) his or her best hope, that is, for actor \( E \), \( Be > CL_{alt} > Ce \). For example, assume that actors \( E \) and \( A1 \) will receive 100 valued points if they can agree upon a division, and that \( E \) is then given the alternative of exchanging with \( A2 \) for a payoff of 60. The introduction of the \( E;A2 \) alternative affects the \( E;A1 \) relationship in several ways. First, it increases \( E \)'s conflict payoff in the \( E;A1 \) relationship from \( Ce = 0 \) in the absence of the alternative to \( Ce = 60 \), since disagreement with \( A1 \) now leaves \( E \) able to earn 60 from exchange with \( A2 \). More generally, when an actor's payoff from forgoing exchange within a relationship is less than his or her comparison level of alternatives, the latter constitutes that actor's conflict point within the relationship. Because of the increase in \( E \)'s conflict payoff, \( E \)'s resistance vis-à-vis \( A1 \) is enhanced, from \( Re = (Be - Pe)/(Be - Ce) = (100 - Pe)/(100 - 0) \) to \( Re = (100 - Pe)/(100 - 60) \). In theoretic terms the
effect is to reduce the size of the $E;A1$ relationship’s negotiation set. Since a negotiation set by definition contains only outcomes which are no worse than conflict for any bargainer, outcomes in which $E$ earns less than 60 are dropped. By implication, outcomes in which $A1$ earns more than 40 are also eliminated. The scope for bargaining is thus reduced, from a range of payoffs to $E$ of 0 to 100, to a range of 60 to 100. Further, introduction of the alternative changes not merely $E$’s resistance, but also that of $A1$. This occurs through a reduction in $A1$’s aspirations. Recall that a player’s best hope is defined as his or her most preferred outcome in the negotiation set. In the absence of alternatives, $A1$’s best hope would be 100. However, as was seen above, the effect of the alternative is to eliminate from the $E;A1$ negotiation set outcomes where $A1$ earns more than 40, so $A1$’s best hope declines to that level. That, in turn, reduces $A1$’s resistance from $R_{a1} = (B_{a1} - Pa_{1})/(B_{a1} - Ca_{1}) = (100 - Pa_{1})/(100 - 0)$ to $R_{a1} = (40 - Pa_{1})/(40 - 0)$. The enhancement of $E$’s resistance, and the reduction of $A1$’s resistance shifts the relationship’s equi-resistance point to $E$’s advantage, from a 50/50 division to an 80/20 division to $E$ and $A1$, respectively.

This game illustrates a difference between the normalized and un-normalized concepts of dependence which is worthy of note. For Cook and Emerson, to acquire an alternative affects only the actor’s own dependence. By contrast, an actor’s normalized dependence is sensitive not merely to his or her own alternatives, but also to the alternatives available to potential exchange partners. The normalized dependence of the actor who acquires an alternative is affected through changes in his or her conflict payoff. For example, in the above game $E$’s conflict payoff increases from 0 to 60 as a consequence of the alternative. As a result, $E$’s normalized dependence falls from $D^{e} = (Pe - Ce)/(Be - Ce) = (Pe - 0)/(100 - 0)$ to $D^{e} = (Pe - 60)/(100 - 60)$. In this game, not merely $E$’s dependence but also that of $A1$ changes as a result of $E$’s alternative. That occurs because of a change in $A1$’s aspirations. The limit of any actor’s aspiration level is determined in part by the alternatives available to others. Recall, for example, that in the above game $A1$’s best hope fell from 100 to 40 after $E$ gained the alternative of an $E;A2$ exchange. Such a change in aspiration level, in turn, produces an opposite change in $A1$’s normalized dependence, as in the above game, since $A1$’s best hope declines from 100 to 40, his or her normalized dependence increases from $D^{a1} = (Pa_{1} - Ca_{1})/(B_{a1} - Ca_{1}) = (Pa_{1} - 0)/(100 - 0)$ to $D^{a1} = (Pa_{1} - 0)/(40 - 0)$. Normalization of the dependence concept thus increases that concept’s responsiveness to the structure of alternatives within the exchange network.

A second effect which an alternative may have on a relationship is to render exchange within it irrational. This occurs if the alternative is so attractive that its comparison level exceeds its recipient’s best hope within the relationship, that is, for actor $E$, $CL_{ate} > Be$. For example, assume that in the above game $E$’s alternative was to receive 150 in exchange with $A2$. 
That would eliminate all outcomes from the $E;A1$ negotiation set in which $E$ earns less than 150, thereby emptying that set. Consequently, a rational basis for exchange between $E$ and $A1$ is destroyed by the introduction of the alternative.

A third potential effect of the introduction of an alternative is to leave the relationship unaffected. This occurs if the alternative is so unattractive that its comparison level equals or falls below its recipient's conflict payoff in the relationship, that is, for actor $E$, $CL_{alt} \leq Ce$. Here, opting for the alternative produces no gain, even if the choice within the relationship is conflict.

Finally, a fourth possible effect of an alternative’s introduction is to eliminate totally the scope for bargaining within the relationship. That occurs if the alternative’s comparison level exactly equals the recipient’s best hope, that is, for actor $E$, $CL_{alt} = Be$. As an example of such a game, let us consider a case where $E$ and $A1$ both possess alternatives. Assume as before, $E$ and $A1$ will receive 100 if they can agree upon a division, and that $E$’s alternative is to exchange with $A2$ for a gain of 60, and $A1$’s alternative is to exchange with $A3$, for a gain of 40. The effect of $E$’s alternative is to eliminate from the $E;A1$ negotiation set outcomes where $E$ earns less than 60, and consequently also eliminates outcomes where $A1$ earns more than 40. The effect of $A1$’s alternative is to further eliminate from the negotiation set outcomes where $A1$ earns less than 40, thereby leaving only a single element, a 60/40 division to $E$ and $A1$ respectively. Hence, the joint effect of $E$ and $A1$’s alternatives is to reduce the negotiation set to a singleton set, a set of a single element. Such games have an interesting utility structure, for in them players’ conflict payoffs and best hopes coincide. For example, $E$’s conflict payoff is 60, because that is his or her alternative’s comparison level and it exceeds the payoff from no exchange; and $E$’s best hope is also 60, for that is his or her award from the most preferred and only element of the negotiation set. When this identity occurs, the actor’s resistance becomes undefined, since the denominator of his or her resistance function has become zero. For example, in the above game $E$’s resistance function is $Re = (60 - Pe)/(60 - 60)$. Such games are not, in the technical sense, bargaining games. For in them no concessions are required for exchange to occur, as players can all simultaneously attain their best hopes. These, then, are games which are devoid of bargaining. However, it must be noted that for bargaining to be eliminated in this manner, there must be a very highly precise coordination of players’ comparison levels of alternatives. For if comparison levels are too high (e.g., in the above game if the sum of $E$ and $A1$’s comparison levels exceeds 100), the negotiation set becomes empty and the rational basis for exchange is lost; and if comparison levels are set too low (e.g., in the above game, if the sum of $E$ and $A1$’s comparison levels is less than 100), the negotiation set retains multiple elements and bargaining remains. Consequently there are theoretic rea-
sons to suppose that games with singleton negotiation sets should be empirically rare, unless some definite social mechanism can be established by which comparison levels are coordinated. Such a mechanism, that is, competition within a perfectly competitive market, is discussed below.

In sum, an examination of the theoretic effects of introducing alternative reward sources into a relationship indicates that if there is an effect, it is to narrow or eliminate the scope for bargaining. It might seem, therefore, that the scope for bargaining might be progressively eliminated in exchange networks by the accumulated action of alternative exchange opportunities. Theoretically, that would require the negotiation sets of each ongoing exchange to have been reduced to singleton sets.

Exchange networks have indeed been described where that shrinkage of negotiation sets is found. The best known example of a bargaining-free exchange network is the perfect market of classical microeconomics, where a producer can sell any quantity at the market price, but at a higher price can sell nothing. Similarly, a consumer can purchase any quantity at the market price, but at a lower price can buy nothing. Hence, the negotiation set of the producer/consumer relationship contains only a single element, exchange at the market price.

Of course, in actual markets bargaining is never wholly eliminated, since markets are invariably tainted by *oligopolistic imperfections*, wherein producers cooperate to raise prices rather than behaving atomistically, and *monopsonistic imperfections*, wherein consumers unite to reduce prices. Bargaining then arises at two points within the market, among competing ologopolies and monopsonies (e.g., between labor unions and management), and also within each coalition regarding how the costs and benefits of cooperation are to be distributed (e.g., among cartel members regarding allocation of production cut-backs).

Theoretically, bargaining is absent not merely in perfect markets, but also in certain other exchange networks where individuals are assumed to behave atomistically, for example, the three exchange networks discussed by Cook and Emerson. The game represented in their Figure 2a is illustrative. Simplifying somewhat, it consists of a resource bargaining game with four players, A, B1, B2, and B3, in which Player A and any single B have an opportunity to divide 24 monetarily valued points, and the remaining two Bs have the opportunity to divide 8 valued points. In essence, Cook and Emerson (727) conclude that since the power relation among Bs is balanced, the two exchanging Bs will each receive four points in the equilibrium condition, and that the remaining B and A will divide their points by awarding four to B and 20 to A in the equilibrium condition. In the A;B relationship, they say, B cannot persistently receive more than four, since were that to occur, one of the two remaining Bs could gain by offering to accept fewer points. Competition among the Bs would eventually reduce their payoff to four points in the A;B exchange. But what if
the Bs were to cooperate rather than underbid one another, either by designating one B to negotiate with A and sharing the resulting surplus profit or, if the game were played repeatedly, by taking turns exchanging with A? With that elimination of competition among Bs, the A;B relationship would come to resemble a bilateral monopoly, yielding an equilibrium payoff to B of 12, a gain of eight points of surplus profit. Consequently in this game the Bs possess a considerable incentive to act cooperatively and, thereby, to reintroduce bargaining into the exchange network. In Cook and Emerson’s experimental realization of this game, coalition formation among Bs was precluded by locating subjects at individual computer terminals. However, outside of the laboratory, suppression of cooperation is seldom so easy or effective, as is illustrated by the enforcement history of antitrust legislation and, more generally, by the well-known corruptibility of perfect markets. Consequently, though theoretic models of exchange networks have been described which are devoid of bargaining, there is no reason to suppose that bargaining is in fact ever wholly absent from actual networks. Competition within exchange networks should thus be seen not as eliminating negotiation, but as narrowing its scope to a degree which varies depending on the emergence of competition-suppressing coalitions. (For a discussion of contemporary coalition formation theory see Brahms).

Conclusions

Let us briefly examine some of the implications of replacing the conventional view of actors as rational maximizers (Blau; Homans) with one that treats them as purposive in the enriched sense of a mathematical bargaining model. Two problems should be noted. First, there is much theoretic disarray in the field of mathematical bargaining theory. This paper focused almost exclusively on a single model but additional models are viable, in particular the Harsanyi–Nash–Zeuthen model, and the Coddington–Cross model. As a result, the conventional concept of purposiveness can be enriched in several incompatible ways depending on one’s choice of bargaining model.

Second, the bargaining problem is not the only conceptual problem which afflicts formal models of decision-making when they are applied to analyze social action. For example, a huge and rather inconclusive literature has developed around the “voting paradox” and related issues regarding the formation and dissolution of coalitions (see Brams; Caplow). For other examples, see Brams and Wittman’s critique of the myopic view of actors entailed in the Nash equilibrium concept which is typically employed in game theoretic analyses, and their innovative proposal of a nonmyopic equilibrium concept; or see discussions of the difficulty of ac-
counting for decisions when each actor employs multiple decision criteria (e.g., see Gulliver, 52–60).

The incorporation of modern mathematical decision theory into sociological theory either through a reformulation of power-dependence theory or similar means (see Heckathorn, b, d) would enrich sociological theory in several ways. An achievement of game theory was to provide a common language through which psychologists, sociologists, political scientists, economists, and strategic analysts can communicate about conflict and related processes (Schlenker and Bonoma, 7–8). Mathematical bargaining theory extends this common language to permit discussions of the processes of negotiation by which concessions are allocated and conflicts arise, including means for elucidating the part played by reciprocal expectations during interaction and the intuitively irresistible but slippery issue of relative intensity of preference—who cares more in a relationship or has more at stake. Varying formulations, from the psychological principle of least interest to power-dependence theory and equity theory have addressed this issue in differing ways, and in so doing confronted the problem of interpersonal utility comparisons. The resistance concept and the normalized dependence concept both provide means for comparing preference intensity in a manner which is theoretically grounded and subject to operational formulation.

Notes
1. Mathematical bargaining theory derives from game theory. Contemporary game theory is divided into two major divisions. The best known is the theory of non-cooperative games, games where pre-play communication is absent and where consequently players act in ignorance of one another’s moves. Such games are typically represented in matrix (i.e., normal) form. A lesser known division is the theory of cooperative games, games where players are permitted pre-play communication and can enter into binding agreements. Whereas sociological applications of game theory during the sixties drew from the theory of non-cooperative games, the mathematical bargaining theories discussed here derive from the theory of cooperative games.
2. At present, the experimental evidence is mixed, so no single model can be definitively said to best describe negotiation behavior. An issue of differentiation between the Raiffa solution concept, on which the resistance model is based, and the Nash solution concept has become the subject of recent discussion (Roth, a, b). It concerns the ability to generalize to three-person and larger games. As Roth demonstrated, whereas the Nash solution generalizes straightforwardly, the Raiffa solution yields jointly irrational outcomes to some such games. Roth further argued that no solution can exist for three-person and larger games which satisfies the axioms (due to Kalai and Smorodinsky) characterizing that solution. This would seem to preclude a general application to three person and larger games of the Raiffa solution. However, it was recently shown (Heckathorn and Carlson) that Roth’s argument is incorrect. A solution concept termed the “cubic solution” exists which (a) is identical to the Raiffa solution for two-person games; (b) is different from the solution for n ≥ 3 games; (c) satisfies the Kalai–Smorodinsky axioms; and (d) necessarily yields jointly rational solutions. This solution, which was motivated by the resistance model, shows that even though the Raiffa solution does not meaningfully generalize to games larger than the dyad, a Raiffa-type solution can be
so generalized. Therefore, generalizability to three person and larger games does not differentiate the Nash from Raiffa-type solutions.

3. The term, utility, refers to any mathematical index of preference. Numerous alternative utility scales have been proposed which are based on different assumptions regarding transitivity or intransitivity of preferences, level of measurement (e.g., ordinal or cardinal) and other factors. The von Neumann–Morgenstern utility scale is most frequently employed, and is used in this paper.

4. Errors, for resistance theory, do not necessarily produce conflict. They may also produce agreements at points other than the equi-resistance point (see Heckathorn, c: 273–5). More generally, for that theory, the reciprocal expectations which arise during negotiation importantly affect its outcome, and a central result (Heckathorn, c: 275–8) is that under particular conditions, an actor’s concession limit is governed by others’ apparent expectations. That is, others’ perceived expectations attain the force of a self-fulfilling prophecy. In technical terms, the actor’s agreement set $Ae$ becomes that which he or she believes it is perceived to be $Ee(Ea(Ae))$. In such cases, the negotiated outcome depends not on the objective utility structure of the game, but on the structure of reciprocal expectations arising during interaction.

5. Cook and Emerson (723) alluded to a derivation of this principle from two propositions and a joint function, but it was not presented.

6. To simplify the discussion, the payoff from the alternative exchange in this example is assumed to be fixed and known rather than subject to negotiation. When the payoff from the alternative exchange is subject to negotiation, its comparison level is the utility the actor anticipates will be the outcome from the negotiations.

References


