AN EXPECTED VALUE MODEL OF SOCIAL EXCHANGE OUTCOMES

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ABSTRACT

A new approach to social exchange is developed and illustrated. The approach carries forward a line of work on power structures that was initiated with French's formal theory of social power. The approach moves beyond the rank-order prediction of actors' resource outcomes that is characteristic of extant social exchange hypotheses, and provides baseline predictions of the amount of resources each actor is expected to acquire through social exchange. Under baseline assumptions, the approach provides a simple account of the literature's intriguing findings that the most centrally located actors in exchange networks do not necessarily acquire the most resources via exchange processes. The baseline predictions of the approach provide a null hypothesis against which the merits of more refined alternative hypotheses can be assessed. I illustrate how the baseline assumptions may be relaxed by introducing a formal hypothesis in which an actor's bargaining behavior is related to the actor's vulnerability to exclusion from social exchange. For the several cases that were examined, the hypothesis does a credible job of predicting actors' absolute amounts of acquired resources.

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INTRODUCTION

In the formal theory of social power proposed by French (1956), and in Cartwright's (1965) integration of the literature on interpersonal leadership and control, social power is defined as potential interpersonal influence and a power structure describes the pattern of opportunities for direct interpersonal influences among a set of actors. Along the lines of this approach, Friedkin (1986) suggested that predictions about a power structure's outcomes could be derived in the form of *expected values,* that is,

$$E(y_i) = \sum_{i=1}^{K} P(\mathbf{R}_i)\, y_i,$$

where $\mathbf{R}_i$ is one the K possible networks of interpersonal influence that might occur in a power structure, $P(\mathbf{R}_i)$ is the probability of $\mathbf{R}_i$, and y_i is an outcome of $\mathbf{R}_i$. The outcome of interest to Friedkin was consensus; however, he also illustrated the applicability of the approach to predicting structural outcomes (e.g., dominant coalitions) and patterns of disagreement in a network of power.

Here, I generalize Friedkin's (1986) *expected value model* of social power by allowing power structures to represent opportunities for interpersonal transactions other than interpersonal influence. In this more general approach, a power structure might indicate an opportunity for information flow, social support, or social exchange. I then develop and illustrate the application of this expected value model to networks of social exchange.

A considerable body of theoretical work and experimental findings has developed on network exchange phenomena.[1] The prevailing theoretical agenda of the recent work has been to construct a measure of point-centrality that, when applied to a network of potential exchanges, correctly predicts the resources actors acquire through negotiated agreements in these networks (Bonacich, 1987; Cook and Emerson, 1978; Cook, Emerson, Gillmore, and Yamagishi, 1983; Emerson, 1969, p.396; Markovsky, Willer, and Patton, 1988; Marsden, 1983 and 1987; and Stotle and Emerson, 1977). Substantial controversy has developed in the pursuit of this agenda (Cook, 1982, p. 188; Cook, Gillmore, and Yamagishi, 1986; Markovsky, Willer, and Patton, 1990; Willer, 1986; and Yammagishi and Cook, 1990).

For reasons that are developed in the present work, pursuit of a general structural index of social power is not likely to be fruitful. Instead, I argue that many of the problems that presently engage social exchange theorists are addressable from an expected-value approach to social exchange outcomes. First, from baseline assumptions, the approach correctly predicts actors' rank order for the resources they acquire through social exchange; in particular, the approach explains the experimental findings on certain networks in which the seemingly most central actors do not acquire the most resources. Second, the approach is not limited to rank-order predictions; it predicts the observed amount of resources acquired by actors through social exchange and allows a judgment (predicated on baseline assumptions) on whether these predictions are noteworthy. Third, the approach is sufficiently general that it accommodates different regimes of social exchange: negative exchanges, positive exchanges, multiple exchanges, mixed exchanges, and resource flows. Fourth, and finally, the approach provides an intellectual framework that (a) contributes to disentangling and clarifying certain complex theoretical issues and (b) points to areas where additional formal development of social exchange theory might be undertaken. To illustrate this last point, I introduce a formal hypothesis on the relationship of actors' bargaining behaviors and vulnerabilities to exclusion from social exchange. For the several cases that were examined, this hypothesis does a credible job of predicting actors' absolute amounts of acquired resources.[2]

EXPECTED VALUE MODEL OF SOCIAL POWER

In this section, a general description of the approach is provided, so that it may be viewed as applicable to a variety of social processes, including social influence, social exchange, social support, and information flow. There are five steps involved in deriving predictions about the expected values of a power structure's outcomes. These steps are described in tandem with a simple illustration (Table 1).

Delineation of the Power Structure

The approach starts with the delineation of a power structure as a pattern of opportunities for relational events among a set of actors. The power structure of a population is represented as either a graph or digraph with lines connecting actors whenever there is a positive probability of some type of relational event. The occurrence of a line indicates that the particular event is possible; the absence of a line indicates that the event is not possible. Whether the power structure consists of directed or undirected lines will depend on the type of relational event. In the case of social influence and information flow, the relation will be directed. In the case of social exchange, the relation may be undirected if it simply represents the occurrence of a negotiated agreement between two actors about a division of available resources.

Depending on the relation under consideration, a path of power lines such as $i \to j \to k \to l$ may or may not be meaningful. For example, if the relation is interpersonal influence, such a path will indicate an opportunity for indirect

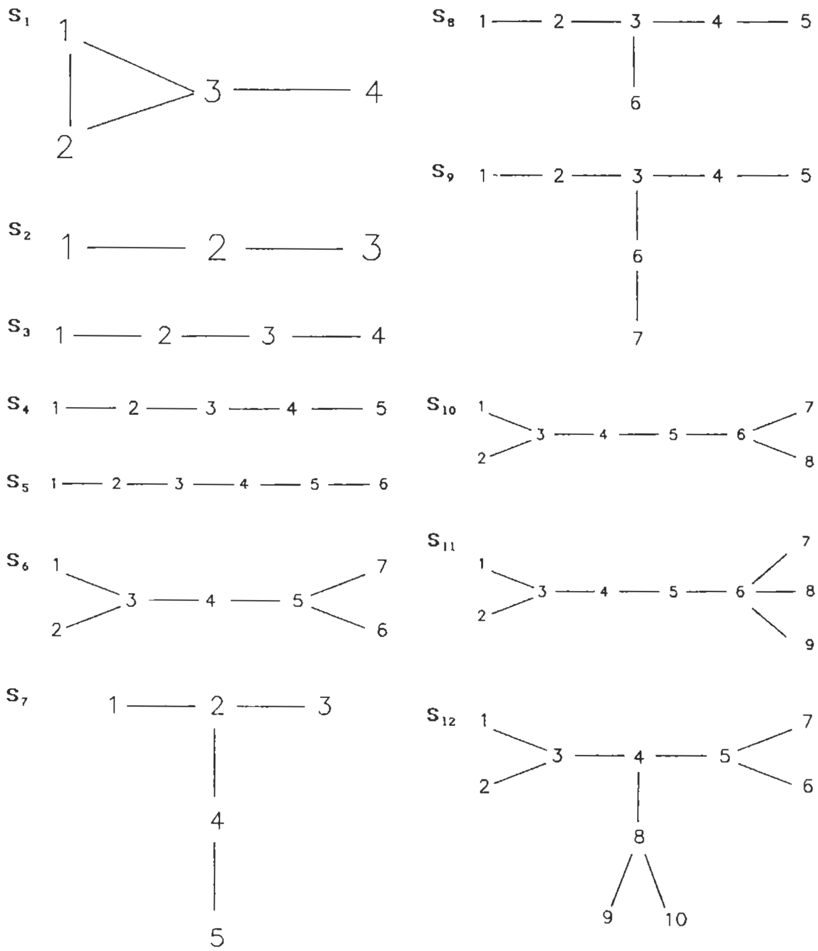


Figure 1. Networks

influence via intermediaries. However, if the relation is a negotiated agreement, the path may not imply agreement between nonadjacent actors.

Various power structures comprised of undirected lines are illustrated in Figure 1. I concentrate initially on S_1, a network consisting of four positions {1,2,3,4} and four lines {1-2,1-3,2-3,3-4}.

Delineation of the Sample Space

The sample space of the power structure consists of the different **R**-networks that might occur in the context of the power structure, where **R** is a pattern of interpersonal influence, social exchange, social support, or information flow. I refer to the sample space of a power structure as *unrestricted* if it contains all the possible **R**-networks: if the number of lines among actors in the power structure is v, then a maximum of 2^v alternative, labeled, **R**-networks are possible. Table 1 illustrates the sixteen members $\{\mathbf{R}_1, \mathbf{R}_2, \ldots, \mathbf{R}_{16}\}$ of the unrestricted sample space of $\mathbf{S}_1$.

Unrestricted sample spaces may contain a large number of members. For example, in a power structure with 25 lines, there are over 33 million **R**-networks in the unrestricted sample space. However, *restrictions* on the sample space will reduce the number of its members. The restriction may be empirical; that is, certain possibilities are never observed and so they are eliminated. The restriction may be theoretical; that is, certain possibilities cannot occur on theoretical grounds. The restriction may be experimentally imposed; that is, certain possibilities are not allowed to occur under the conditions of an experiment. Later, I show how the conventional designs of social exchange experiments entail important restrictions on the sample spaces of power structures.

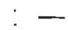
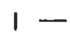
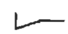
Relative Frequency of R-Networks

Next, the probability of occurrence of each **R**-network in the sample space is determined. These probabilities can be determined in various ways:

(a) In the absence of data or theory, it may be assumed that each **R**-network is independent and equally likely.
(b) The probability of each **R**-network may be based on their observed relative frequencies in a large sample of realizations, for example, trials of an experiment on a fixed power structure.
(c) The probability of each network may be derived from a model of the emergence of **R**-networks. Or,
(d) The probability of each network may be analytically derived from information on the probabilities of line activation in the power structure.

For a simple illustration of the analytical approach, assume that the lines in power structure $\mathbf{S}_1$ are independent and that the probability of line activation is .60 for each of the four lines {1-2,1-3,2-3,3-4}. It follows that the probability of occurrence of each $\mathbf{R}_i$ is the product of the probabilities for the relational events that have produced the network; that is, the probability of $\mathbf{R}_i$ is $p^u\ (1 - p)^{v-u}$ where u is the number of lines in $\mathbf{R}_i$, v is number of lines in the power structure,

Table 1. Illustration of the Approach for Power Structure $\mathbf{S}_1$

Unrestricted Sample Space			$P(\mathbf{R}_i)$	*Outcomes*	
$\mathbf{R}_i$	*Power Lines*	*Network Image*		Isolate Count	Majority Coalition
	1 1 2 3				
	2 3 3 4				
$\mathbf{R}_1$	0 0 0 0		.0256	4	0
$\mathbf{R}_2$	0 0 0 1		.0384	2	0
$\mathbf{R}_3$	0 0 1 0		.0384	2	0
$\mathbf{R}_4$	0 0 1 1		.0576	1	1
$\mathbf{R}_5$	0 1 0 0		.0384	2	0
$\mathbf{R}_6$	0 1 0 1		.0576	1	1
$\mathbf{R}_7$	0 1 1 0		.0576	1	1
$\mathbf{R}_8$	0 1 1 1		.0864	0	1
$\mathbf{R}_9$	1 0 0 0		.0384	2	0
$\mathbf{R}_{10}$	1 0 0 1		.0576	0	0
$\mathbf{R}_{11}$	1 0 1 0		.0576	1	1
$\mathbf{R}_{12}$	1 0 1 1		.0864	0	1
$\mathbf{R}_{13}$	1 1 0 0		.0576	1	1
$\mathbf{R}_{14}$	1 1 0 1		.0864	0	1
$\mathbf{R}_{15}$	1 1 1 0		.0864	1	1
$\mathbf{R}_{16}$	1 1 1 1		.1296	0	1
Expected Values				.784	.763

Notes: $P(\mathbf{R}_i) = p^u\,(1-p)^{v-u}$, where $p = .60$, u is the number of relations in $\mathbf{R}_i$ and v is number of relations in the power structure $\mathbf{S}_1$.
The number of isolates is a count of the actors in $\mathbf{R}_i$ who are not related to any of the other actors.
The occurrence of a majority coalition is defined as the presence of a connected subgraph in $\mathbf{R}_i$ that includes a majority of the actors.

and $p = .60$. Table 1 illustrates the calculations. The probability of $\mathbf{R}_1$ is $.60^0(.40)^4 = .0256$, where none of the four power lines is active; the probability of $\mathbf{R}_2$ is $.60(.40)^3 = .0384$, where one of the four power lines is active; and so forth.[3]

Outcomes of R-Networks

Fourth, the outcome(s) for each of the **R**-networks in the sample space is (are) determined. The outcome may be some feature of the structure of $\mathbf{R}_i$: its density, diameter, connectivity category, point centralities, bundle sizes, and so forth; see Harary, Norman, and Cartwright (1965) for the definitions of these structural features. The outcome also may be derived from a process model. Friedkin (1986), who dealt with a power structure comprised of lines of possible interpersonal influence, applied a process model of opinion formation to each of the $\mathbf{R}_i$. In Friedkin's application, the outcome was either 1 or 0, indicating, respectively, consensus or its absence in a particular $\mathbf{R}_i$.[4]

Table 1 illustrates two structural outcomes that may be ascertained by visual inspection of the sample space of the power structure $\mathbf{S}_1$. The number of isolates is a count of the actors in $\mathbf{R}_i$ who are not tied to any of the other actors. The occurrence of a majority coalition is defined as the presence of a connected subgraph in $\mathbf{R}_i$ that includes a majority of the actors in the power structure.

Expected Values

Finally, the expected values of the power structure's outcomes are computed. Th se expectations are weighted averages of the values of the outcomes for the **R**-networks, where each outcome is weighted by the probability of occurrence of the **R**-network:

$$E(y_i) = \sum_{i=1}^{K} P(\mathbf{R}_i)\, y_i \,, \tag{1}$$

where $P(\mathbf{R}_i)$ is the relative frequency of **R** in a sample space comprised of K networks and y_i is an outcome of $\mathbf{R}_i$. In Table 1, the expected values for the number of isolates and the occurrence of a majority coalition are .784 and .763, respectively.

An expectation is an indicator of the central tendency of the distribution of outcomes for the set of **R**-networks that may arise from the power structure; in the special case of a binary {0,1} outcome, the expectation is simply the probability of the outcome. If the sample space of the power structure contains relatively few **R**-networks, then it is possible to carry out the computation exactly; for each **R**-network in the sample space, a product is formed of the relative frequency of the **R**-network and the outcome, and these products are summed to form the expectation of the outcome. When the sample space of the power structure is large, the expectations may be estimated from a suitable sample of **R**-networks.

In terms of the expected values it generates, the model permits comparisons among actors in the same or different power structures. The predictions of the model may or may not be obvious depending on the particular application. It is noteworthy that the model will generate predictions where intuition cannot process the implications of a complexly configured power structure. Whether the model forwards counterintuitive conclusions in simple power structures is an open question with an answer that may vary with the application.

APPLICATION TO SOCIAL EXCHANGE

In this section, an expected-value model of social power is developed for a type of resource exchange relation that has been the focus of considerable experimental work during the past several decades: an interpersonal network comprised of two-party transactions where each transaction provides one actor in the transaction with a fraction of some amount of resources and the other party in the transaction with the remaining fraction. Initially, a baseline model for such networks will be developed and illustrated. Derived from elementary assumptions about exchange processes, this baseline model generates expected values for exchange outcomes against which the merits of more refined assumptions will be assessed.

Delineation of the Power Structure

The power structure is defined as a network comprised of (a) points that represent collective or individual actors, and (b) undirected lines that represent potential exchanges (Emerson, 1962, and 1972a, p. 56; and Cook and Emerson, 1978, fn 9). The presence of a line between two actors indicates that a particular exchange *may* occur, and the absence of a line indicates that a particular exchange *cannot* occur. This definition is consistent with Emerson's (1972b, p.70) definition of an exchange network as a "set of three or more actors each of whom provides opportunities for transactions with at least one other actor in the set" and with Cook, Emerson, Gillmore, and Yamagishi's (1983, p. 277) definition of an exchange relation as "a set of historically developed and utilized exchange opportunities" so that "the set of exchange relations is properly viewed as a subset of exchange opportunities."

Two simplifying assumptions are made about a power structure's actors and their potential transactions:

Assumption A_0: The actors in a power structure are assumed to be *rational actors* who seek to maximize their net receipt of resources over any set of transaction opportunities provided to them.

Later, the assumption of rational action is replaced by operational statements describing the type of action that is assumed to occur.

Assumption A_1: A power structure is assumed to be *stable* with respect to its configuration of potential exchange transactions.

Thus, a power structure is considered stable even with changes in the identities of the actors who occupy the different positions in the network.[5]

A power structure may be described as an $n \times n$ symmetric matrix $\mathbf{S} = [s_{ij}]$, where $s_{ij} = 1$ if there is the possibility of an exchange between actor i and actor j, and $s_{ij} = 0$, otherwise. Figure 1 illustrates some of the power structures that have been studied in experiments on social exchange.

Delineation of the Sample Space

The sample space of the power structure is comprised of the K different networks of exchange transactions $\{\mathbf{R}_1, \mathbf{R}_2, \ldots, \mathbf{R}_K\}$ that might occur in the context of the power structure. Previously, I suggested that different sample spaces may be defined on the same power structure via restrictions on the domain of $\mathbf{R}_i$. Three types of restrictions are discussed, two of which are common in experimental work on social exchange. Regardless of the particular restriction, it is assumed that each of the $\mathbf{R}_i$ in a sample space is *maximal* with respect to the number of transactions:

> *Assumption A_2*: It is assumed that each **R**-network in the sample space of a power structure is *maximal* in that no other feasible transaction could occur.

Rational actors (see assumption A_0) will not absent themselves from exchange opportunities.

Experimental work on social exchange has dealt mainly with *negative* exchange where actors are limited to one exchange on each trial of an experiment. Figure 2 illustrates this type of sample space for power structure $\mathbf{S}_9$. While the unrestricted sample space of this structure contains $2^6 = 64$ members, under the negative exchange regime the feasible sample space is comprised only of the four **R**-networks displayed in Figure 2.

Social exchange theorists have defined *positive* exchange as a situation in which an exchange with one actor is contingent upon an exchange with another actor. However, a more precise definition of positive exchange is required for an unambiguous delineation of its sample space. An illustration of a suitable definition might be that exchanges only occur among actors who reach a collective (three-party) agreement and that actors may not be a member of more than one three-party agreement; thus, a sample space may be defined in terms of the different triads with two or three lines that might arise among the actors in a power structure. The sample space of $\mathbf{S}_9$, based on this regime of triadic combination, is also illustrated in Figure 2.

Experiments on social exchange have sometimes allowed actors to participate in more than one exchange without imposing any rule of triadic agreement such as entertained in the positive exchange situation (Markvosky, Willer, and Patton, 1988). These multiple exchange situations are referred to as e-exchange regimes: the 1-exchange regime is equivalent to negative social exchange; the 2-exchange regime allows actors to participate in *at most* two exchanges with diffferent actors; the 3-exchange regime allows actors to participate in *at most* three exchanges with different actors; and so on. The sample space of $\mathbf{S}_9$ for the 2-exchange regime is illustrated in Figure 2.

A noteworthy feature of the three regimes just discussed is that their sample spaces are nonoverlapping; that is, any $\mathbf{R}_i$ appearing in the sample space of one of these regimes does not appear in the sample spaces of the other regimes. There are 13 different $\mathbf{R}_i$ in the three sample spaces, a number that does not exhaust the membership of the unrestricted sample space of $\mathbf{S}_9$; thus, there is room for other regimes that would provide additional nonoverlapping sample spaces for this power structure.

Cook, Emerson, Gillmore, and Yamagishi (1983, p. 277) have suggested that a sample space might be defined that consists of a mixture of different exchange regimes; for example, the sample space of a mixed regime might encompass all three sets of $\mathbf{R}_i$ shown in Figure 2. They also suggest that **R**-networks based on mixed regimes are more common in natural settings than are pure regimes. A formal typological analysis of sample space restrictions would be useful, as would better theory about conditions that affect the sample spaces of naturally occurring power structures (Cook, 1982; Cook et al., 1983; Emerson, 1981; Markovsky, Willer, and Patton, 1988; and Yamagishi, Gillmore, and Cook, 1988).

Relative Frequency of Exchange Networks

The expected-value model requires a theoretically or empirically based determination of the probability of each of the **R**-networks in the sample space of a power structure. Ideally, the required probabilities would stem from a formal model of the social exchange process.[6] In experimental work, where data on a large number of trials is gathered, these probabilities can be estimated by the relative frequencies of the observed **R**-networks; this is illustrated later.

In the absence of probability estimates based on data or theory, a rudimentary baseline assumption may be employed:

> *Assumption* A_3: Each **R**-network in the sample space of the power structure is *equally* likely.

Accordingly, the probability of a particular **R**-network is simply the reciprocal of the size of the sample space, that is, $P(\mathbf{R}_i) = 1/K$.

Based on assumption A_3, Table 2 illustrates the probabilities of the $\mathbf{R}_i$ for power structure $\mathbf{S}_9$ under the various sample space restrictions described in Figure 2. Four networks are possible under the 1-exchange regime and three are possible under the 2-exchange regime; hence, the probabilities of the **R**-networks are uniformly 1/4 in the 1-exchange regime and 1/3 in the 2-exchange

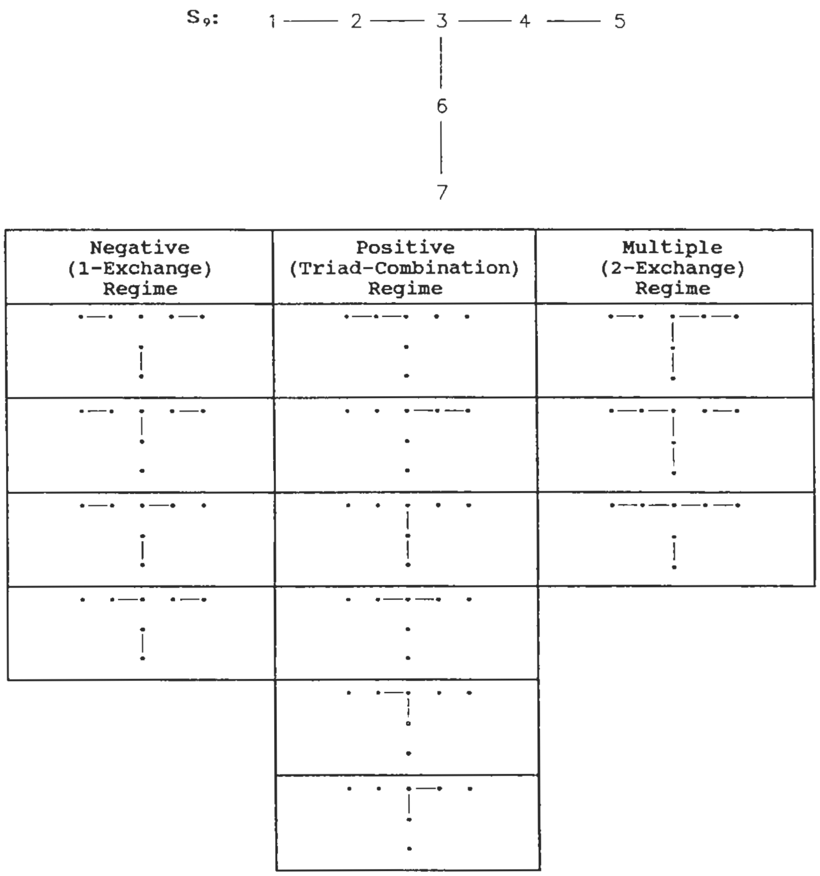


Figure 2. Illustrative Sample Spaces of Power Structures $\mathbf{S}_9$

regime. Six networks are possible under the triad-combination exchange regime; hence, the probability of each network is 1/6.

Outcomes of Exchange Networks

Outcomes relevant to exchange theory include (a) the amount of resources acquired by each actor in a **R**-network, (b) the particular division of resources for each of the exchanges in a **R**-network, and (c) the structural features of a **R**-network. The capacity of an actor to acquire more resources than other

Table 2. Baseline Outcomes for Power Structure $\mathbf{S}_9$

$\mathbf{R}_i$	$P(\mathbf{R}_i)$	Outcomes												
		Actor Resource Receipts							Exchange Occurrences					
		1	2	3	4	5	6	7	1–2	2–3	3–4	4–5	3–6	6–7
(a) 1-Exchange Regime														
$\mathbf{R}_1$	1/4	0	12	12	12	12	12	12	0	1	0	1	0	1
$\mathbf{R}_2$	1/4	12	12	0	12	12	12	12	1	0	0	1	0	1
$\mathbf{R}_3$	1/4	12	12	12	12	12	12	0	1	0	0	1	1	0
$\mathbf{R}_4$	1/4	12	12	12	12	0	12	12	1	0	1	0	0	1
Exp. Values		9	12	9	12	9	12	9	3/4	1/4	1/4	3/4	1/4	3/4
(b) Triad Combination Exchange Regime														
$\mathbf{R}_1$	1/6	12	12	12	0	0	0	0	1	1	0	0	0	0
$\mathbf{R}_2$	1/6	0	0	12	12	12	0	0	0	0	1	1	0	0
$\mathbf{R}_3$	1/6	0	0	12	0	0	12	12	0	0	0	0	1	1
$\mathbf{R}_4$	1/6	0	12	12	12	0	0	0	0	1	1	0	0	0
$\mathbf{R}_5$	1/6	0	12	12	0	0	12	0	0	1	0	0	1	0
$\mathbf{R}_6$	1/6	0	0	12	12	0	12	0	0	0	1	0	1	0
Exp. Values		2	6	12	6	2	6	2	1/6	1/2	1/2	1/6	1/2	1/6
(c) 2-Exchange Regime														
$\mathbf{R}_1$	1/3	12	12	24	24	12	24	12	1	0	1	1	1	1
$\mathbf{R}_2$	1/3	12	24	24	12	12	24	12	1	1	0	1	1	1
$\mathbf{R}_3$	1/3	12	24	24	24	12	12	12	1	1	1	1	0	1
Exp. Values		12	20	24	20	12	20	12	1	2/3	2/3	1	2/3	1

actors in the power structure should be distinguished from the actor's negotiated resource exchange ratios; the two outcomes are not necessarily associated. For example, in *e*-exchange regimes where actors are allowed multiple exchanges, a strategically placed actor may acquiesce to unfavorable exchange ratios (undercutting competitors) in order to amass relatively greater amounts of resources.

A particular $\mathbf{R}_i$ describes a pattern of exchanges but does not stipulate the outcome of each exchange in the pattern. Ideally, the prediction of exchange outcomes is based on a refined model of the bargaining process and is evaluated against a baseline model that assumes no knowledge of the putative process. The egalitarian norm, which stipulates an even split of available resources among parties to an agreement, is the obvious candidate for a baseline approach (Cook and Emerson, 1978, p. 723; and Molm, 1981):

> *Assumption A_4*: If a_{ij} is the amount of resources that might be divided between actors i and j, then a transaction between i and j will net each actor one-half a_{ij}.

The outcomes of this baseline assumption are illustrated in Table 2, for each of the three sample space restrictions that were described in Figure 2.

Outcomes may be transparent structural features of the **R**-network, rather than derived outcomes. For example, suppose that the probabilities of the separate exchanges are not theoretically determined and that one is concerned with predicting the most probable exchanges of a power structure (Markovsky, Willer, and Patton, 1988; and Willer and Patton, 1987). For each of a power structure's possible exchanges, the pertinent outcome is whether or not the exchange occurs in a **R**-network. Table 2 also illustrates this.

Expected Values

Our final step is computing the expected value(s) of the outcome(s). Expected values are illustrated in Table 2 where, for each sample space restriction on power structure $\mathbf{S}_9$, baseline expectations are provided for (a) the amount of each actor's resources and (b) the likelihood of each of the six exchange transactions.

In power structure $\mathbf{S}_9$, the relative magnitude of the resource expectation for actor 3, who appears in the most central position, depends on the particular sample space restriction. In the 1-exchange regime, actors 2, 4, and 6 are expected to acquire more resources than actor 3. The situation is reversed in the triad-combination and 2-exchange regimes.

It is *not only* an actor's *position* in a power structure that determines the actor's relative advantage (Molm, 1990; and Bacharach and Lawler 1981). Actors' resource expectations also depend on the sample space of the power structure; evidently, alternate sample spaces can switch actors' rank-order advantage (Markovsky, Willer, and Patton, 1988; and Yamagishi, Gillmore, and Cook, 1988). In addition, of course, actors' resource expectations may be affected substantially by departures from the egalitarian norm of fifty-fifty splits of resources.

THE NEGATIVE EXCHANGE REGIME

Social exchange theorists have been forced to discard conventional measures of network centrality, such as those described by Freeman (1979), and to develop new measures that are more consistent with their empirical findings. To illustrate the problem that has engaged social exchange theorists, consider again the power structure $\mathbf{S}_9$ shown in Figure 2; experimental findings indicate that actors 2, 4, and 6 acquire more resources than actor 3, who appears in the most central location according to conventional measures of network centrality. Since the discovery of this structural anomaly (Cook and Emerson, 1978, pp. 726-727; and Cook et al., 1983), researchers have found similar anomalies for a variety of networks under the 1-exchange regime. The expected value model's *baseline* explanation of these structural anomalies is simply that certain "off center" actors may be relatively advantaged by virtue of a greater relative frequency of participation in exchange transactions.

Thus far, I have shown that, under baseline assumptions, the expected value model of social power correctly predicts the rank order of actors' acquired resources in $\mathbf{S}_9$. Table 3 provides another illustration of actors' baseline resource expectations under the 1-exchange regime. The power structure is $\mathbf{S}_{12}$, a network of ten actors that, like $\mathbf{S}_9$ was studied by Cook et al. (1983). The sample space of $\mathbf{S}_{12}$ consists of 20 **R**-networks; instead of presenting images of these networks, I have listed the lines that comprise each of them. The baseline assumptions are those previously illustrated in Table 2: (1) the $\mathbf{R}_i$ in the sample space are equally likely and (2) the exchange agreements uniformly entail an even division of 24 resource units.

Table 3 shows that the resource expectation of actor 4, who appears most structurally central, is less than those of actors 3, 5, and 8. Again, this prediction is consistent with experimental findings. The relatively high expectations of actors 3, 5, and 8 occur because these actors are involved in *all* possible exchange networks that might arise from the power structure, while actor 4 is sometimes excluded from exchange.

Under the same set of baseline assumptions, Table 4 gives the resource expectations of actors in all the networks of Figure 1. The model's predictions concerning positions with the highest resource expectations appear consistent with available experimental evidence, with the possible exception of $\mathbf{S}_7$. In a study of $\mathbf{S}_7$, Markovsky, Willer, and Patton (1988, p. 227) observe the rank

Table 3. Baseline Outcomes for Power Structure $\mathbf{S}_{12}$

Sample Space 1-Exchange Regime	*P*(**R**$_i$)	*Actor Resource Receipts* 1	2	3	4	5	6	7	8	9	10
$\mathbf{R}_1${4-5, 1-3, 8-10}	.05	0	0	12	12	12	0	0	12	0	12
$\mathbf{R}_2${4-5, 1-3, 8-9}	.05	12	0	12	12	12	0	0	12	12	0
$\mathbf{R}_3${4-5, 2-3, 8-10}	.05	0	12	12	12	12	0	0	12	0	12
$\mathbf{R}_4${4-5, 2-3, 8-9}	.05	0	12	12	12	12	0	0	12	12	0
$\mathbf{R}_5${5-7, 3-4, 8-10}	.05	0	0	12	12	12	0	12	12	0	12
$\mathbf{R}_6${5-7, 3-4, 8-9}	.05	0	0	12	12	12	0	12	12	12	0
$\mathbf{R}_7${5-7, 1-3, 4-8}	.05	12	0	12	12	12	0	12	12	0	0
$\mathbf{R}_8${5-7, 1-3, 8-10}	.05	12	0	12	0	12	0	12	12	0	12
$\mathbf{R}_9${5-7, 1-3, 8-9}	.05	12	0	12	0	12	0	12	12	12	0
$\mathbf{R}_{10}${5-7, 2-3, 4-8}	.05	0	12	12	12	12	0	12	12	0	0
$\mathbf{R}_{11}${5-7, 2-3, 8-10}	.05	0	12	12	0	12	0	12	12	0	12
$\mathbf{R}_{12}${5-7, 2-3, 8-9}	.05	0	12	12	0	12	0	12	12	12	0
$\mathbf{R}_{13}${5-7, 3-4, 8-10}	.05	0	0	12	12	12	12	0	12	0	12
$\mathbf{R}_{14}${5-6, 3-4, 8-9}	.05	0	0	12	12	12	12	0	12	12	0
$\mathbf{R}_{15}${5-6, 1-3, 4-8}	.05	12	0	12	12	12	12	0	12	0	0
$\mathbf{R}_{16}${5-6, 1-3, 8-10}	.05	12	0	12	0	12	12	0	12	0	12
$\mathbf{R}_{17}${5-6, 1-3, 8-9}	.05	12	0	12	0	12	12	0	12	12	0
$\mathbf{R}_{18}${5-6, 2-3, 4-8}	.05	0	12	12	12	12	12	0	12	0	0
$\mathbf{R}_{19}${5-6, 2-3, 8-10}	.05	0	12	12	0	12	12	0	12	0	12
$\mathbf{R}_{20}${5-6, 2-3, 8-9}	.05	0	12	12	0	12	12	0	12	12	0
Expected Values		4.8	4.8	12	7.2	12	4.8	4.8	12	4.8	4.8

Table 4. Baseline Predictions for Figure 1 Power Structures

Power Structure	Actors, Resource Receipt Expectations									
	1	2	3	4	5	6	7	8	9	10
S_1	8	8	12	4						
S_2	6	12	6							
S_3	6	12	12	6						
S_4	8	12	8	12	8					
S_5	6	12	9	9	12	6				
S_6	5	5	12	6	12	5	5			
S_7	4	12	4	12	8					
S_8	8	12	12	12	8	4				
S_9	9	12	9	12	9	12	9			
S_{10}	4	4	12	9	9	12	4	4		
S_{11}	4	4	12	10	9	12	3	3	3	
S_{12}	5	5	12	7	12	5	5	12	5	5

order $2 > \{4,5\} > \{1,3\}$, while the present baseline prediction is $\{2,4\} > 5 > \{1,3\}$. I return to this interesting case after introducing a more refined approach to actors' bargaining behaviors.

A REFINED MODEL

Under baseline assumptions for the 1-exchange regime, actors' resource expectations are never more than one-half of the available resources; for example, in Table 4, where actors negotiate a division of 24 units, the resource expectation of an actor cannot exceed 12 units. This upper limit holds for any distribution of $P(\mathbf{R}_i)$ under the 1-exchange regime. Hence, these baseline assumptions do not explain empirical findings that actors in certain positions of a power structure typically acquire substantially more resources than these baseline expectations. In order to explain these findings, we must relax the assumption of fifty-fifty splits in exchanges.

The success of the expected value model in predicting actors' rank-order resource outcomes is a point in its favor, and so is its manifest failure (under baseline assumptions) to account for actors who acquire substantially more resources than expected. Extant social exchange hypotheses have dealt strictly with rank-order predictions; hence, the field has not been in a position to assess and refine ideas about how actors acquire *particular amounts* of resources.

Building on the thesis that the size of actors' offers are inversely related to the relative frequency of their exclusion from social exchange, the assumption of an egalitarian split of available resources (i.e., A_4) can be replaced with a more refined approach to the bargaining process.[7] The proposed refinement, $A_{4.1}$, involves a set of assumptions dealing with (a) actors' initial offers and

(b) how actors reconcile inconsistent offers. I use the notation $A_{4.1}^{(1)}$, $A_{4.1}^{(2)}$, $A_{4.1}^{(3)}, \ldots, A_{4.1}^{(7)}$, to refer to the constituent parts of $A_{4.1}$.

The first of these constituent assumptions predicts actor *i*'s initial offer to actor *j* as a function of the dependency of actor *i* on actor *j*:

Assumption $A_{4.1}^{(1)}$: The amount of available resources initially offered by actor *i* to actor *j* is governed by an asymptotic function

$$f_{ij} = a_{ij} - b_{ij} (c_{ij})^{100d_{ij}}, \tag{2}$$

where $a_{ij} > 1$ is the amount of available resources, f_{ij} is the amount of these available resources that actor *i* initially offers to actor *j*, $0 < b_{ij} < a_{ij}$ and $0 < c_{ij} < 1$ are coefficients, and $0 \leq d_{ij} \leq 1$ is the actor *i*'s dependency on actor *j*.

Assumption $A_{4.1}^{(2)}$: The dependency of actor *i* on actor *j* is the probability that actor *i* is excluded from an exchange and that the two actors do not exchange with each other.[8]

Thus, actor *i* is assumed to be dependent on actor *j* because of the association between actor *i* being excluded from exchange and actor *i* not exchanging with actor *j*. Under 1-exchange regimes, this formulation of an actor's dependency simplifies to the vulnerability of the actor to exclusion (i.e., the probability that the actor is excluded from an exchange); hence, under this regime an actor makes the same initial offer to all possible transaction partners.[9] It is under multiple-exchange regimes that an actor's dependency and initial offers may vary for different transaction partners.

The curve (2) rises from $a_{ij} - b_{ij}$; that is, when actor *i* is least dependent on actor *j* ($d_{ij} = 0$), the predicted initial offer of actor *i* is an amount that is less than the available resources. As actor *i*'s dependency on actor *j* increases (i.e., as $d_{ij} \to 1$), the predicted offer approaches the asymptote a_{ij}, which is the total available resources.

A priori values for the coefficients $\{b_{ij}, c_{ij}\}$ may be derived under two assumptions:

Assumption $A_{4.1}^{(3)}$: Actors who are minimally dependent will offer only one unit of their available resources, and

Assumption $A_{4.1}^{(4)}$: Actors who are maximally dependent will offer all but one unit of their available resources.

From the first assumption, $b_{ij} = a_{ij} - 1$. From the second assumption, $f_{ij} = a_{ij} - 1$ when $d_{ij} = 1$. Hence,

$$c_{ij} = \left[\frac{1}{a_{ij} - 1}\right]^{\frac{1}{100}}$$

For example, given 24 units of a resource, $c_{ij} = .969$ and some of the predicted initial offers are:

d_{ij}	0	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{3}{5}$	$\frac{4}{5}$	1
f_{ij}	1	12	17	19	21	22	23

Next, we must consider what happens when two actors' offers are inconsistent; the offers of two actors, i and j, are inconsistent if their personal claims on available resources ($a_{ij} - f_{ij}$ and $a_{ij} - f_{ji}$, respectively) do not sum to the amount of the available resources:

Assumption $A_{4.1}^{(5)}$: If the sum of actors' personal claims exceed the amount of available resources, they are assumed to split the difference and settle on the average of their two offers.

Assumption $A_{4.1}^{(6)}$: If both actors want less than one-half of the available resources, they are assumed to evenly divide the available resources.

Assumption $A_{4.1}^{(7)}$: Finally, there is somewhat complex situation where one actor wants one-half the resources or more, the other wants less than one-half the resources, and the sum of their personal claims is less than the amount of available resources; in this case, it is assumed that the unclaimed portion of the available resources is allocated to the actor with the lower of the two personal claims.

Table 5 gives the predictions of the refined model under the 1-exchange regime for the power structures shown in Figure 1. The rank order of the refined model's predictions are consistent with those of the baseline model; however, in comparison to the baseline predictions, some actors' resource expectations have been considerably elevated or depressed as a consequence of imbalanced exchange ratios.

Two illustrations are provided of the steps involved in deriving predictions from the refined bargaining assumptions. The calculations are somewhat tedious; a computer program implements the approach and is available from the author upon request (Friedkin, 1991b).[10]

Table 5. Refined Predictions of Figure 1 Power Structures

Power Structure	Actor's Resource Receipt Expectations									
	1	2	3	4	5	6	7	8	9	10
S_1	5.5	5.5	20.3	0.6						
S_2	1.4	21.1	1.4							
S_3	1.4	16.6	16.6	1.4						
S_4	3.0	19.5	3.0	19.5	3.0					
S_5	1.4	19.7	5.9	5.9	19.7	1.4				
S_6	0.8	0.8	21.7	1.4	21.7	0.8	0.8			
S_7	0.6	18.7	0.6	17.0	3.0					
S_8	3.0	17.0	15.3	17.0	3.0	0.6				
S_9	4.3	18.2	4.3	18.2	4..3	18.2	4.3			
S_{10}	0.6	0.6	20.6	7.4	7.4	20.6	0.6	0.6		
S_{11}	0.6	0.6	20.3	9.2	6.7	21.4	0.4	0.4	0.4	
S_{12}	0.9	0.9	21.4	2.3	21.4	0.9	0.9	21.4	0.9	0.9

Illustration 1

Consider power structure $\mathbf{S}_9$ under the 1-exchange regime. Under the baseline assumption of equally likely **R**-networks, the actor dependencies (d_{ij}) can be determined by inspection of the four networks in the sample space (see Figure 2). For instance, the dependency of actor 1 on actor 2 (d_{12}) is .25 because there is one of the four **R**-networks in which (a) actor 1 and actor 2 do not exchange with each other and (b) actor 1 is excluded from exchange. The entire matrix of dependencies is:

$$\mathbf{D} = [d_{ij}] = \begin{bmatrix} * & \frac{1}{4} & * & * & * & * & * \\ 0 & * & 0 & * & * & * & * \\ * & \frac{1}{4} & * & \frac{1}{4} & * & \frac{1}{4} & * \\ * & * & 0 & * & 0 & * & * \\ * & * & * & \frac{1}{4} & * & * & * \\ * & * & 0 & * & * & * & 0 \\ * & * & * & * & * & \frac{1}{4} & * \end{bmatrix},$$

where each asterisk indicates that no exchange between two actors is possible.

Note that the numerical entries in any row of **D** are identical (row homogeneity in **D** is a characteristic of 1-exchange regimes). Hence, an actor will make the same initial offer to all potential exchange partners; assuming that 24 resource units are at stake in all transactions, these initial offers are $\{f_{1j}, f_{3j}, f_{5j}, f_{7j}\} = 13.5$ and $\{f_{2j}, f_{4j}, f_{6j}\} = 1$ for all j.

In $\mathbf{S}_9$, all exchanges occur between the two sets of actors {2, 4, 6} and {1, 3, 5, 7}. From assumptions $A_{4.1}^{\{5\}}$, $A_{4.1}^{\{6\}}$, and $A_{4.1}^{\{7\}}$, all exchanges involve compromises from which actors 2, 4, and 6 receive 18 units and actors 1, 3, 5, and 7 receive 6 units. Hence, the predicted outcomes for actor i in exchanges with actor j ($i < j$) are:

	1	2	3	4	3	6
	2	3	4	5	6	7
$\mathbf{R}_1$	*	18.2	*	18.2	*	18.2
$\mathbf{R}_2$	5.7	*	*	18.2	*	18.2
$\mathbf{R}_3$	5.7	*	*	18.2	5.7	*
$\mathbf{R}_4$	5.7	*	5.7	*	*	18.2

where each asterisk indicates that no exchange occurs between the two actors. Now the resource expectations of the actors may be computed; they are 4.3, 18.2, 4.3, 18.2, 4.3, 18.2, and 4.3, respectively, for the seven actors.

Illustration 2

My second illustration again concerns power structure $\mathbf{S}_9$, but this time under the 2-exchange regime. Under the baseline assumption of equally likely **R**-networks, the actor dependencies (d_{ij}) can be determined by inspection of the three networks in the sample space (see Figure 2). For instance, actor 1 is not dependent on actor 2 ($d_{12} = 0$), because in none of the three **R**-networks does the joint event occur wherein (a) actor 1 and actor 2 do not exchange with each other and (b) actor 1 is excluded from exchange. However, actor 1 is dependent on actor 3 ($d_{13} = 1/3$) because there is one network where the two actors do not exchange with each other and where actor 1 negotiates only one of the two exchanges permited to this actor. The entire matrix of dependencies is:

$$\mathbf{D} = [d_{ij}] = \begin{bmatrix} * & 0 & * & * & * & * & * \\ 0 & * & \frac{1}{3} & * & * & * & * \\ * & 0 & * & 0 & * & 0 & * \\ * & * & \frac{1}{3} & * & 0 & * & * \\ * & * & * & 0 & * & * & * \\ * & * & \frac{1}{3} & * & * & * & 0 \\ * & * & * & * & * & 0 & * \end{bmatrix},$$

where each asterisk indicates that no exchange between two actors is possible.

Note that under the 2-exchange regime for $\mathbf{S}_9$, the numerical entries in any row of **D** are not necessarily identical; thus, under this regime, an actor may make different initial offers to different potential exchange partners. Assuming that 24 resource units are at stake in all transactions, the initial offers are:

$$\mathbf{F} = [f_{ij}] = \begin{bmatrix} * & 1 & * & * & * & * & * \\ 1 & * & 16 & * & * & * & * \\ * & 1 & * & 1 & * & 1 & * \\ * & * & 16 & * & 1 & * & * \\ * & * & * & 1 & * & * & * \\ * & * & 16 & * & * & * & 1 \\ * & * & * & * & * & 1 & * \end{bmatrix}.$$

From assumptions $A_{4.1}^{(5)}$, $A_{4.1}^{(6)}$, and $A_{4.1}^{(7)}$, the predicted outcomes for actor i in exchanges with actor j ($i < j$) are:

	1 2	2 3	3 4	4 5	3 6	6 7
$\mathbf{R}_1$	12	*	19.5	12	19.5	12
$\mathbf{R}_2$	12	4.5	*	12	19.5	12
$\mathbf{R}_3$	12	4.5	19.5	12	*	12

where each asterisk indicates that no exchange occurs between the two actors.

The expected values for the seven actors are 12, 15, 38.9, 15, 12, 15, and 12, respectively. Under multiple-exchange regimes, an actor may acquire resources from several sources; it is an actor's net receipts that are of concern here. For example, actor 2 nets 12 units in $\mathbf{R}_1$ with probability 1/3, 17 units in $\mathbf{R}_2$ with probability 1/3, and 17 units in $\mathbf{R}_3$ with probability 1/3; hence, the resource expectation for actor 2 is 1/3 (12) + 1/3 (17) + 1/3 (17) = 15.

ASSUMPTIONS AND MODELS

Table 6 gives an overview of the assumptions that have been introduced and the two models that are based on them. $\mathbf{H}_0$ is the baseline model which includes the assumptions (A_3) of equally likely $\mathbf{R}$-networks and (A_4) of egalitarian (fifty-fifty) splits of resources in exchanges. $\mathbf{H}_1$ is the refined model constructed by

Table 6. Assumptions of the Models

Models:

$\mathbf{H}_0 = \{A_1, A_2, A_3, A_{4.0}\}$ $\quad$ $\mathbf{H}^*_{0,} = \{A_1, A_2, A^*_3, A_{4.0}\}$

$\mathbf{H}_1 = \{A_1, A_2, A_3, A_{4.1}\}$ $\quad$ $\mathbf{H}^*_{1,} = \{A_1, A_2, A^*_3, A_{4.1}\}$

Assumptions:

$\mathbf{A}_0$	Rational actors
$\mathbf{A}_1$	Structural stability of power structure **S**
$\mathbf{A}_2$	Maximal transaction networks ($\mathbf{R}_k$, $k = 1, K$)
$\mathbf{A}_i$	Probability density function for transaction networks
$\mathbf{A}_3$	Equally likely $\mathbf{R}_k$
$\mathbf{A}^*_3$	Observed relative frequencies
$\mathbf{A}_i$	Transaction outcomes
$\mathbf{A}_{4.0}$	Egalitarian rule
$\mathbf{A}_{4.1}$	Alternative model
$\mathbf{A}^{(1)}_{4.1}$	Funcation for initial offers
$\mathbf{A}^{(2)}_{4.1}$	Actor vulnerability (dependency)
$\{\mathbf{A}^{(3)}_{4.1}, \mathbf{A}^{(4)}_{4.1}\}$	Bounds for initial offers
$\{\mathbf{A}^{(5)}_{4.1}, \mathbf{A}^{(6)}_{4.1}, \mathbf{A}^{(7)}_{4.1}\}$	Reconciling inconsistent offers

replacing assumption A_4 with the bargaining behavior assumptions $A_{4.1} = \{A_{4.1}^{(1)}, A_{4.1}^{(2)}, \ldots, A_{4.1}^{(7)}\}$. Finally, $\mathbf{H}_0^*$ is obtained from $\mathbf{H}_0$, and $\mathbf{H}_1^*$ is obtained from $\mathbf{H}_1$, by replacing assumption A_3 with empirically observed relative frequencies for the **R**-networks; I will use these models later.

EVALUATING SELECTED ASSUMPTIONS

I now illustrate how selected components of the approach can be isolated and assessed in light of empirical data. I use data provided by Markovsky, Willer, and Patton (1988) on $\mathbf{S}_7$ under the 1-exchange regime and $\mathbf{S}_9$ under both the 1-exchange and 2-exchange regimes. These data were collected in experiments that rotated each subject through all of the positions of a network: in the case of $\mathbf{S}_7$ (with five positions) each group of subjects participated in five such rotations and in the case of $\mathbf{S}_9$ (with seven positions) each group of subjects participated in seven rotations. For each assignment of actors to positions, the experiments provided four trials; and in each trial actors sought to garner some fraction of 24 "profit points" through negotiated dyadic-level agreements. Thus, for $\mathbf{S}_7$, five groups of subjects generated 100 trials, and for $\mathbf{S}_9$, four groups of subjects generated 112 trials.

A_2 Maximal **R**-Networks

Nonmaximal networks are rare. In the 100 trials on $\mathbf{S}_7$, there were three occurrences of nonmaximal transaction networks; in the 112 trials for $\mathbf{S}_9$, there were four such networks under the 1-exchange regime and six such networks under the 2-exchange regime. Nonmaximal networks might be eliminated entirely by raising the value of the resources at stake or by simply requiring subjects to continue to negotiate until those exchanges that might occur have occurred.

A_3 Probability of an *R*-Network.

In the case of $\mathbf{S}_7$ under the 1-exchange regime, the frequencies of the maximal networks are: 3 $\mathbf{R}_1\{2\text{-}4\}$, 46 $\mathbf{R}_2\{2\text{-}3, 4\text{-}5\}$, and 48 $\mathbf{R}_3\{1\text{-}2, 4\text{-}5\}$, where $\mathbf{R}_k\{i\text{-}j, \ldots\}$ indicates the line(s) in $\mathbf{R}_k$. Here, the baseline assumption of a uniform probability distribution is obviously misleading.[11] In the case of $\mathbf{S}_9$ under the 1-exchange regime, the frequencies of the maximal networks are: 24 $\mathbf{R}_1\{1\text{-}2, 3\text{-}4, 6\text{-}7\}$; 23 $\mathbf{R}_2\{2\text{-}3, 4\text{-}5, 6\text{-}7\}$; 38 $\mathbf{R}_3\{1\text{-}2, 4\text{-}5, 6\text{-}7\}$; and 23 $\mathbf{R}_4\{1\text{-}2, 3\text{-}6, 4\text{-}5\}$. These frequencies are not consistent with assumption of equally likely **R**-networks; if A_3 were true, then the probability of observing 38 instances of $\mathbf{R}_3$ in 108 trials is approximately .01. In the case of $\mathbf{S}_9$ under the 2-exchange regime, the frequencies of the maximal networks are: 37 $\mathbf{R}_1$\{1-2, 3-4, 4-5, 3-6, 6-7\}; 39 $\mathbf{R}_2$\{1-2, 2-3, 4-5, 3-6, 6-7\}; and 30 $\mathbf{R}_3$\{1-2, 2-3, 3-4, 4-5, 6-7\}. These frequencies are more consistent with equally likely **R**-networks: under asssumption A_3, the probability of observing 30 instances of $\mathbf{R}_3$ in 106 trials is approximately .16.

Although A_3 appears seriously flawed, currently there is no formal model to replace it. Until such a model is developed, I recommend (a) using observed relative frequencies when they are available or (b) adopting assumption A_3 with the caveat that it is a likely source of error.

A_4 Egalitarianism in Bargaining Behavior

It is recognized that egalitarian agreements do not prevail in exchange transactions. Consider the more than 1000 transactions that were generated by the three experiments conducted by Markovsky, Willer, and Patton (1988). For each of these transactions, I calculated max(PAYOFF), where max(PAYOFF) is the larger of the two amounts of resources received by the actors from the transaction. Under the egalitarian norm max(PAYOFF) = 12 for all transactions; in fact, this variable is distributed as shown in Table 7.

Table 7. Empirical Findings on Transaction Outcomes

	S_7 1-Exchange Regime		S_9 1-Exchange Regime		S_9 2-Exchange Regime	
max(PAYOFF)	*Count*	*%*	*Count*	*%*	*Count*	*%*
12	77	40.31	54	16.67	237	44.72
13	24	12.57	34	10.49	98	18.49
14	14	7.33	19	5.86	45	8.49
15	6	3.14	9	2.78	11	2.08
16	4	2.09	5	1.54	16	3.02
17	1	0.52	10	3.09	6	1.13
18	8	4.19	8	2.47	13	2.45
19	4	2.09	10	3.09	5	0.94
20	2	1.05	18	5.56	4	0.75
21	2	1.05	15	4.63	10	1.89
22	1	0.52	25	7.72	11	2.08
23	31	16.23	117	36.11	73	13.77
24	17	8.90	0	0.00	1	0.19
Total	191		324		530	

Note: max(PAYOFF) is the larger of the two amounts of resources received by the actors from their transaction.

Table 8. Empirical Findings for Power Structures $\mathbf{S}_7$ and $\mathbf{S}_9$

(a) $\mathbf{S}_7$ 1-Exchange Regime

	Actors					Exchanges			
	1	2	3	4	5	12	23	24	45
PAYOFF	2	19	2	12	11	5	20	12	12
$\mathbf{H}_0^*$	6	12	6	12	12	12	12	12	12
$\mathbf{H}_1$	1	19	1	17	3	2	22	12	19
$\mathbf{H}_1^*$	1	21	1	13	11	3	21	12	13

(b) $\mathbf{S}_9$ 1-Exchange Regime

	Actors							Exchanges					
	1	2	3	4	5	6	7	12	23	34	45	36	67
PAYOFF	5	18	3	18	5	19	4	6	19	5	18	4	19
$\mathbf{H}_0^*$	9	12	8	12	9	12	9	12	12	12	12	12	12
$\mathbf{H}_1$	4	18	4	18	4	18	4	6	18	6	18	18	6
$\mathbf{H}_1^*$	5	18	3	18	5	18	5	6	20	4	18	4	18

(a) $\mathbf{S}_9$ 2-Exchange Regime

	Actors							Exchanges					
	1	2	3	4	5	6	7	12	23	34	45	36	67
PAYOFF	12	15	39	15	12	15	12	12	5	19	12	12	19
$\mathbf{H}_0^*$	12	20	24	20	12	21	12	12	12	12	12	12	12
$\mathbf{H}_1$	12	16	36	16	12	16	12	12	6	18	12	18	12
$\mathbf{H}_1^*$	12	15	39	15	12	16	12	12	4	20	12	19	12

Notes: Actor PAYOFF is the observed amount of resources an actor receives on average from the transactions in $\mathbf{R}_k$; exchange PAYOFF is the observed amount of resources actor i receives on average from transacations with actor j ($i < j$); in deriving the $\mathbf{H}_0^*$ and $\mathbf{H}_1^*$ predictions, assumption A_3 is replaced by the observed relative frequencies of the **R**-networks.

$A_{4.1}$ Dependencies in Bargaining Behavior

The available data do not describe the initial offers of actors, so that the constituent parts of assumption $A_{4.1}$ cannot be evaluated directly. Cook, Emerson, Gillmore, and Yamagishi (1983, p. 287; see also Cook and Emerson, 1978; and Molm, 1987) suggest that assumptions $A_{4.1}^{(3)}$ and $A_{4.1}^{(4)}$ may not always hold; they state, "If there are restraints on the exercise of power (e.g., equity concerns or less than fully rational negotiation), equilibrium will be reached somewhere short of... [a] maximally "exploitative" exchange ratio." Such restraints would imply that the proposed a priori solution for equation (2) may be misleading in some instances.

An indirect method of assessing $A_{4.1}$ is to examine the goodness of fit for the predicted and observed outcomes of exchange transactions. A potential methodological problem with this approach is that a lack of fit may arise from flaws in other assumptions beside those of $A_{4.1}$. Here, the problem is not serious. Assumption A_1 on the stability of the power structure is satisfied by the experimental design. Assumption A_2 on maximal **R**-networks is satisfied by eliminating the few networks that are nonmaximal. Assumption A_3 on the relative frequency of the **R**-networks is satisfied by employing observed relative frequencies.

Table 8 gives the predicted and observed outcomes for the actors and transactions in the three experiments. The fits appear excellent. We should be impressed by a close fit only if the $\mathbf{H}_1$ assumptions offer substantially better predictions than baseline $\mathbf{H}_0$ assumptions. Here, it appears that baseline predictions are substantially improved by introducing a more refined assumption about actors' bargaining behaviors.

DISCUSSION

As Molm (1990) has most recently emphasized, social power is manifested simultaneously as a structural potential, a process, and an outcome. Moreover, these facets of social power are manifested in different types of social relations. Thus, with respect to the structure of power, we may consider networks of potential social exchanges, interpersonal influences, or information flows; with respect to the process of power, we may consider how actors negotiate social exchange agreements, how they integrate the separate interpersonal influences upon their opinions, or how information travels through the communication channels of a network; and, with respect to the outcomes of power, we may consider the emergent distributions of material resources, total interpersonal effects, or visibility.

The present paper was motivated by the idea that the formal model of social power pursued by French (1956) and Friedkin (1986) might be made more general. The model was theoretically attractive because it simultaneously involved three dimensions of social power—structure, process, and outcome—in a coherent framework; however, the applicability of the model appeared limited to social influence relations. Thus, in extending this line of formal work on social influence to touch upon social exchange phenomena, there has been a step toward a broader theoretical framework that bridges different forms of social power and types of social relations in which these forms arise.

The present approach to social power puts new light on the prevalent hypothesis that actors' resource outcomes may be predicted from their location in a network of *potential* exchange transactions. In terms of the present theoretical framework, this hypothesis has little merit and should be replaced by efforts to explain the incidence of particular patterns of social exchanges and actors' bargaining behavior in these patterns. The basis for the skepticism is that a structure of potential exchange transactions may have very different consequences for actors' resource outcomes, depending on the intervening processes that govern the distribution of actual transactions and the content of the agreements in these transactions; see the related arguments of Friedkin (1986, pp. 114-117) and compare with Molm (1990) and Bacharach and Lawler (1981).

No previous approach to social exchange outcomes has provided a formal model that predicts the absolute values of social exchange outcomes. The present approach moves beyond the rank-order prediction of actors' resource outcomes that is characteristic of extant social exchange hypotheses, and provides baseline predictions of the amount of resources each actor is expected to acquire through social exchange. Under baseline assumptions, the approach provides a simple account of the literature's intriguing findings that the most centrally located actors in exchange networks do not necessarily acquire the most resources via exchange processes.

The baseline assumptions of the model provide a null hypothesis against which the merits of more refined alternative hypotheses can be assessed. I have illustrated how the baseline assumptions may be relaxed with the introduction of a formal hypothesis about the relationship between an actor's bargaining behavior and vulnerability to exclusion from social exchange. For the several cases that were examined, the hypothesis does a credible job of predicting actors' absolute amounts of acquired resources.

The proposed expected-value model supplies a different integration of extant ideas and findings on social exchange processes, and it provides a flexible intellectual framework in which to pursue a cumulatively refined social exchange theory. The approach disentangles three theoretical subsystems toward which more refined hypotheses may be directed. The first of these subsystems concerns social exchange regimes (i.e., sample space restrictions), the second concerns the incidence of exchange networks (i.e., the likelihoods of the separate networks in the sample space), and the third concerns actors' bargaining behavior. While social exchange theorists have recognized the existence of these subsystems, and have presented some hypotheses about subsystem interrelationships, a coherent framework has been lacking which would allow an overview of these subsystems and a disentangling of their contributions to social exchange outcomes.

An expected-value model of social exchange outcomes has been latent in the literature on social exchange and its development does not represent a dramatic new direction for the field. The approach was presaged in Emerson's (1962, p. 41) reference to French's formal theory of social power as a treatment of power toward which his own work might move. Emerson, like French, viewed power as a relation that defined opportunities for interpersonal events—exchange transactions (Emerson) or interpersonal influences (French). While neither Emerson nor French carried forward the logic of this initial formulation, Emerson (1972a, p. 56) verges on the point of departure of an expected-value approach to social power when he describes an exchange relation as giving rise to opportunities which "result in transactions with probability P_{yk}." The crucial step is the idea that power structures generate sample spaces of event or transaction networks; with this cornerstone in place, the outlines of the remaining theoretical development are straightforward.

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NOTES

1. See the following work and the literature cited therein: Cook, 1982 and 1987; Cook and Emerson, 1987; Cook, Emerson, Gillmore, and Yamagishi, 1983; Emerson, 1962, 1969, 1972a,1972b, 1976, and 1981; Marsden, 1983 and 1987; Markvosky, Willer, and Patton, 1988; Molm, 1985, 1987, and 1990; Willer, 1987; Willer and Anderson, 1981; Willer, Markovsky, and Patton, 1989; Willer and Patton, 1987; and Yamagishi, Gillmore, and Cook, 1988.

2. I draw on Markovsky, Willer, and Patton's (1988) experiments for this analysis.

3. Along these lines, for $p = .50$, **R**-networks are equally likely and each network has a probability of $.50^{v} = 1/K$, where K is the number of **R**-networks in the sample space.

4. The model of consensus production employed by Friedkin (1986) has since been refined; see Friedkin (1990 and 1991), Friedkin and Cook (1990), and Friedkin and Johnsen (1990).

5. I may depart from Cook and Emerson (1978) and Cook et al. (1983) when they appear to emphasize the emergence of a stable pattern of utilized exchange opportunities. I require a stable pattern of exchange opportunities and leave open the issue of actors' commitment to one or more particular pattern(s) of these exchange opportunities.

6. Such a formal model would take into account the development of commitments among potential exchange partners: "An actor is said to be committed to another actor in the network ot the extent that choice of current exchange partners, from among alternative partners, can be predicted from previous partnerships" (Cook and Emerson, 1978, p. 728); see also Molm (1990) for a dynamic view of social exchange networks.

7. Here I build on the theory of bargaining provided by Cook and Emerson (1978, p. 727) in which they assume that actors will lower their offers when their offers are not accepted and on the similar thesis of Markovsky, Willer, and Patton (1988, p. 221; also see Willer, Markovsky, and Patton, 1989, pp. 324-328).

8. Let max(deg_i) represent the maximum number of exchanges for actor i in any of the **R**-networks. Actor i is excluded from an exchange in $\mathbf{R}_k$ if the number the actor's exchanges in $\mathbf{R}_k$ is less than max(deg_i); let A indicate this event. Let B indicate the event that actor i and actor j do not cxchange with each other in $\mathbf{R}_k$. The dependency of actor i on actor j is the probability of the joint event $d_{ij} = P(A \cap B)$ in the sample space of the power structure. I settled on this measure of dependency after eliminating several plausible alternatives that performed less well.

9. Cook et al. (1983, pp. 299-302) propose a concept of vulnerability that appears closely related to the present definition; see also Cook, Gillmore, and Yamagishi (1986) and Emerson (1978). However, in the present approach it is not strictly the number of an actor's exchange *opportunities* that determines the actor's vulnerability: the probability of an actor being excluded from exchange depends not only on the power structure, but also on (a) the sample space of the power structure and (b) the probability distribution for the $\mathbf{R}_l$ that comprise the sample space.

10. This program is designed to run on an IBM PC-XT,-AT, PS/2, or compatible computer with an 8087, -287, or -387 math coprocessor (the program will not run *without* a math coprocessor). DOS 3.3 or above is required; at least 640K of memory is recommended.

11. The similar relative frequencies of $\mathbf{R}_2$ and $\mathbf{R}_3$ are understandablc since they are *isomorphic* with respect to their pattern of exchanges; as long as the characteristics of the actors who occupy the positions in these structures do not systematically differ by position, we would not expect any marked differences in the relative frequencies of these networks.

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