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Participation in Heterogeneous and Homogeneous Groups: A Theoretical Integration[1]

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This article presents a theoretical formulation that integrates, within the framework of expectation states theory, theories of the emergence of power-and-prestige orders in status-heterogeneous and homogeneous task-oriented groups. A model based on this theoretical formulation is constructed and used for predicting participation rates in open interaction settings. The article explores the fit of the model to data from both status-heterogeneous and status-homogeneous groups.

INTRODUCTION

In a recent paper on models of participation in status-heterogeneous groups, which follows up on earlier work (Skvoretz 1981; Smith-Lovin, Skvoretz, and Hudson 1986), John Skvoretz (1988) evaluates data from six-person discussion groups, collected by Lynn Smith-Lovin et al. (1986), in which the gender compositions of the groups are systematically varied from all male to all female. The author's conclusion after assessing the goodness of fit of a number of models to the data is that, while there is an undeniable gender effect, none of the models capture the effect adequately. This result highlights a serious gap in theoretical work on power-and-prestige orders and interaction in task-oriented small groups.

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How power-and-prestige orders emerge through interaction in status-homogeneous groups is fairly well understood. Similarly, how gender and other status characteristics structure the power-and-prestige order in status-heterogenous groups is also well-known. However, the issue of how these two processes interact, as they must in any setting where there are actors of the same and different status categories at the same time, has been relatively neglected. We propose to fill this gap by integrating theories from two different branches of the expectation states program—the evaluation-expectation branch and the status characteristics branch. We formulate a theory that can account for the emergence of power-and-prestige orders in both heterogeneous and homogeneous groups and captures the feedback of behavior on expectations. Through this theory we explain how behavior can modify status-based power-and-prestige orders with a single and uniform set of concepts and assumptions. We also derive from this theory a model for the prediction of participation rates in discussion groups and evaluate its fit to data from heterogeneous and homogeneous groups.

Since the early documentation by Robert Bales et al. (1951) of the rapid emergence of power-and-prestige orders in status-homogeneous task-oriented groups studied under laboratory conditions, a considerable amount of work has gone into the theoretical analysis of the emergence of status orders in such groups (Bales 1955; Mazur 1973; Berger and Conner 1974; Berger, Conner, and McKeown 1974; Farraro and Skvoretz 1988). Similarly, work on the mathematical modeling of participation rates, which are taken to be a primary indicator of power-and-prestige positions of actors in these groups, has also been extensive (Stefan and Mishler 1952; Coleman 1960; Horvath 1965; Leik 1967; Kadane and Lewis 1969; Fişek 1974). Of this work, that of Berger and his associates are within the framework of the expectation states theoretical research program (Berger 1974) and constitute the evaluation-expectation branch of the program. These theories provide an account of how, in status-homogeneous groups, behavior patterns called cycles or unit action sequences lead to the formation of expectations, which in turn structure the power-and-prestige order.

The other branch of the expectation states research program that is relevant to our current problem is the status characteristics branch. The theory of status characteristics and expectation states (Berger, Cohen, and Zelditch 1966; Berger et al. 1977) is concerned with the effects of diffuse and specific status characteristics on the emergence of power-and-prestige orders in heterogeneous groups. The mathematical version of the theory (Berger et al. 1977) incorporates a formalism that provides guidelines for extending the theory (cf. Berger et al. 1985; Berger, Fişek, and Norman 1989), and that facilitates the construction of specific mathe-

matical models. It is this formulation that we will use as the basis of our proposed integration.

The task of integrating the evaluation-expectation and status characteristic branches of expectation states theory within the framework of the mathematical formulation involves three major conceptual issues. The first is obtaining a *conceptualization and formal representation of behavior elements* that fits into the status characteristics framework. The second is the inclusion of *legitimation processes* (Ridgeway 1988; Ridgeway and Berger 1988), which we believe to be relevant to our concerns, within the same theoretical framework. And the third is the development of a *new measure of expectations,* other than expectation advantage, which can be applied to behaviors involving more than two actors at the same time.

THEORETICAL CONSIDERATIONS

A Representation of Behavior Elements

Our analysis of behavior uses the concepts of Joseph Berger and Thomas L. Conner (1969, 1974). Task-oriented behavior in the small group can be conceptualized as falling into one of four categories: (1) *Performance output* is an act that is either a problem-solving attempt or an attempt to orient or guide the group's task-performance process. (2) *Action opportunities* are socially distributed chances to perform. (3) *Positive reactions* and (4) *negative reactions* are statements of positive and negative evaluations of performance outputs, respectively.

The simplest interaction cycle or unit action sequence consists of an initial action opportunity, a performance output, and a final reward action. In general, interaction cycles are considerably more complicated than this basic cycle. However, complex cycles can be broken down or "parsed" into sets of basic cycles. An important feature of an interaction cycle is whether it involves accepted or rejected acts. A sequence including a performance output by one actor and a positive reward action by another actor directed to the first is an example of an interaction cycle with accepted acts. Negative reward actions imply rejection of acts. The important point about cycles of accepted acts is that they reflect agreement between the actors involved since the acts are being mutually accepted. This mutuality of acceptance is the basis on which social structures are built.[2]

Our basic contention is that, as interaction in a newly formed group proceeds, behavior cycles will come to occur in stable patterns. Thus

[2] For an extensive discussion of interaction cycles see Berger and Conner (1974).

looking at the interaction between two actors we may find that one is frequently producing performance outputs, and the other is reacting with positive reward actions. It is such patterns that have power-and-prestige implications; they are of special interest for our purposes, and we introduce the concept of behavior interchange pattern to describe them.

A *behavior interchange pattern,* which we will call a behavior pattern for short, is a set of interaction cycles or unit sequences such that all actors involved in the interaction accept the acts, and all cycles have the same power-and-prestige significance with respect to the actors. Thus, the pattern of one actor frequently producing performance outputs and the other(s) reacting with positive reward actions is a behavior interchange pattern that indicates a higher power-and-prestige position for the first actor relative to the other(s). Note however that it is also possible to have a behavior pattern such that one actor produces a great many performance outputs, which another actor dismisses with an occasional word with the first actor assenting. Such a pattern obviously implies a lower power-and-prestige position for the first actor and a higher one for the second. The significance of the pattern is more in the content of the interaction than in its quantity.

The conception of a behavior pattern as a set of cycles or unit action sequences raises certain questions: How many cycles are necessary to make up a set? How consistent must the cycles be in terms of their status significance? We believe both questions to be of an empirical nature. The number and degree of consistency of cycles required to constitute a behavior pattern will be affected by a large number of factors, such as the content of the interaction, the degree of structural development, and the context of the group. Given these considerations, an operational definition of the concept can be given only for specific situations. But for our purposes a theoretical definition is sufficient, and we define the concept from the points of view of the actors involved. That is, for a set of cycles to be a behavior interchange pattern, the actors involved must recognize that one actor has a superior behavior pattern and the other an inferior behavior pattern. Actors may not articulate the notion, and they need not even give it conscious thought, but they will recognize the pattern at some level of perception. Given these considerations we define the term as below.

DEFINITION 1. A behavior interchange pattern is a set of task behavior cycles or sequences involving two or more actors, in which the acts are mutually accepted and in which the sequences are consistent in their power-and-prestige significance.

A behavior pattern is made up of two complementary parts, a positive part and a negative part. Thus, when a behavior pattern is established between two actors, one possesses the superior, or positive part, and the

other the inferior, or negative part. Therefore, a behavior pattern is a basis of discrimination between actors. By the same token, behavior patterns also enter into status-organizing processes like other status elements and combine with other status elements in the formation of aggregated expectation states. We use the symbols $b(+)$ and $b(-)$ in the graphic representation of status situations to represent the two parts of behavior patterns. The two parts are connected by a dimensionality relation that represents both their linkage and opposition to each other.

A second basic concept, that of a *status typification* (cf. Berger and Luckmann 1966), provides the linkage of behavior patterns to the task. Status typifications are classifications of behaviors into differentially evaluated types or states. Status typifications are abstract conceptions of what high- and low-status behaviors are like and are socially constructed. Dual terms like "leader-follower" and "initiator-reactor" are expressions of these abstract constructions. We represent the two typification states as $B(+)$ and $B(-)$. Typification states are relevant to states of abstract task ability, which are induced elements in the theory of status characteristics and expectation states. Behavior-pattern parts are obviously relevant to typification states, and the basic theoretical idea is that, when behavior patterns occur in a group, typification states become salient and provide paths linking actors to the task.

The ideas we have presented are simple and straightforward, so much so that one might question the necessity of their being treated formally as we propose to do. However, their formal treatment within the same framework as status characteristics enables us to analyze situations in which intuitive understanding of status processes is not possible.

Legitimation

The need to include legitimation dynamics in the current integration stems from the literature on gender differences in task-performing groups (see Meeker and Weitzell-O'Neill [1985] and Wagner [1988] for reviews of this literature). An important finding is that females have trouble assuming leadership roles and exhibiting leadership behaviors. This is true not only for mixed gender groups but for all-female groups. Ridgeway (1988) has suggested that, in all-female groups that function in male-dominated social contexts, the diffuse status characteristic gender becomes salient and prevents the females from assuming leadership roles. The idea that diffuse status characteristics have moral and normative expectations as well as task-performance expectations associated with them (Berger et al. 1966; Berger, Rosenholtz, and Zelditch 1980) has always been a part of the conceptual armory of expectation states theory.

Within the expectation states framework two theories have elaborated the ideas necessary for the treatment of legitimation dynamics. Reward-expectations theory (Berger et al. 1972, 1985) describes and explains how status characteristics lead to the formation of reward expectations in status situations. Ridgeway and Berger in their theory of legitimation (1988) argue that high- and low-valued status positions can be treated as instances of positively and negatively valued reward objects. From this perspective, the legitimation process can be described in terms of the expectations that are formed for actors possessing, on the basis of all their salient external status characteristics, high- and low-valued status positions in the group. Their basic argument is that the greater the differentiation that develops in the group between expectations for high- and low-valued status positions, given that these expectations are consistent with those for task performance, the greater the likelihood that the power-and-prestige order becomes a legitimate one.

Behavior patterns are intrinsically relevant to legitimation processes because, as well as conveying status information, they show actors validating other actors' power-and-prestige positions. The importance of validation in legitimation processes has been clearly demonstrated by the works of Zelditch and his associates (Zelditch and Walker 1984; Walker, Thomas, and Zelditch 1986).

Our conception of how the legitimation of the power-and-prestige order occurs through the emergence of behavior patterns in an informal task group of previously unacquainted individuals involves two key theoretical notions: as actors interact, behavior patterns will begin to appear; these patterns tend to form a configuration that will be (1) "clustered" and (2) "transitive." By clustered we mean that the initial behavior patterns to appear will involve a small subset of actors rather than be distributed among many. The first behavior pattern to be established between two actors, A and B, with A possessing the superior part, has the effect of raising A's and lowering B's status with respect to all the other actors. Therefore, A is more likely than any other actor to produce performance outputs, to be addressed, or to be given an action opportunity. That is, A is the actor who is most likely to be involved in the next behavior pattern to emerge in the situation. On the other hand, not only is B less likely to produce performance outputs than the other actors, but also B is likely to be the target of actors who are behaving strategically. Therefore, B is also more likely than the other actors to be involved in the next behavior pattern to emerge. Thus, at any time, a new behavior pattern is more likely to involve an actor who was involved in a previous behavior pattern than an actor who was not involved. Therefore, behavior patterns will tend to be clustered among a subset of actors rather than scattered among the entire set.

By saying that the configuration of behaviors will be transitive, we mean that, if actor A and actor B possess the positive and negative parts of a behavior pattern, respectively, and if actor B and actor C similarly share the positive and negative parts of a behavior pattern, then, if actor A and actor C share a pattern, actor A will possess the positive part, and actor C will possess the negative part. That is, the actors can be linearly ordered in terms of their possession of behavior patterns. It is reasonable to assume that, if A observes B deferring to himself or herself and C deferring to B, A is unlikely to defer to C.[3]

The properties of clustering and transitivity present a picture of power-and-prestige order formation in which a "nucleus" or "core" forms and increases to a reasonable size—large enough to serve as a decision-making body or an executive for the group. The same properties also make it probable that the core will have an internal structure such that there will be one actor with a number of positive and no negative parts of behavior patterns. This actor may become the legitimate leader of the group. Whether this will come about will depend on the actor's amount of support, that is, the number of positive pattern parts the actor possesses, and the actor's reward expectations. The amount of support necessary will depend on situational factors, and the reward expectations will depend on the status characteristics of the actor. We should point out that this process is only one of many ways in which the power-and-prestige order of a group may be legitimated, but that this process is particularly relevant to informal task groups of previously unacquainted individuals.

When the power-and-prestige order is legitimated, the actors come to behave as though they had socially defined status positions, positions that have normative rights, privileges, and duties associated with them. Obviously the top, or leadership, position is of special importance in a legitimate order, as the leader is assigned special executive rights. In particular, the leader has the right to address the group as a whole, and this has significant implications for the patterns of participation in the group.

[3] The assumption as well as the previous argument, which assumes that the three actors A, B, and C are not discriminated by status characteristics, is motivated by results presented by Chase (1982). Farraro and Skvoretz (1988) have presented a formal analysis of Chase's results and formulated a general theory of dominance orders. At the same time, although we know of no application of social learning theory to interaction patterns in small groups, it is clearly the case that these assumptions are consistent with the general principles of that theory as well (Rotter 1954; Bandura 1977).

An Expectation Measure for Multiactor Situations

Expectation states theory normally speaks of the power-and-prestige position of an actor with respect to a single other actor, and the measure of relative expectations is the *expectation advantage,* which is defined as the difference between the actor's expectations for self and those for the other. However, for multiactor situations such as the ones we are concerned with, this measure is not appropriate since an actor can be simultaneously interacting with more than one other actor. Therefore, we need a measure that can place an actor on the expectation dimension with respect to a number of other actors simultaneously. We proceed as follows.

The model generates actors' expectation values, which are measured on a scale running from minus one to plus one. While such scaling reflects the qualitative significance of expectations, it makes multiple comparisons difficult to formulate algebraically. Therefore, we begin by adding one to each expectation value, making them all nonnegative. We can then formulate a measure by dividing each of these new values by their sum over all the interactants in the situation. These operations can be symbolically expressed as below.

$$s_i = \frac{1 + e_i}{\sum_{j=1}^{n} (1 + e_j)}.$$

The measure s represents what we call "expectation standing," with the subscript identifying the actor in question. The e's stand for expectation values for the actors, and n is the number of actors in the situation. The s represents the proportion of the total expectations in the situation for an actor and thus places an actor on the expectation dimension relative to all others in the group.

THEORY AND MODEL

Given the theoretical considerations of the previous sections we can formulate an extension of the theory of status characteristics and expectation states that applies to multiactor, status-heterogeneous, and status-homogeneous situations. We first formulate a general theory and then construct a specific model based on the theory for Bales-type discussion groups.

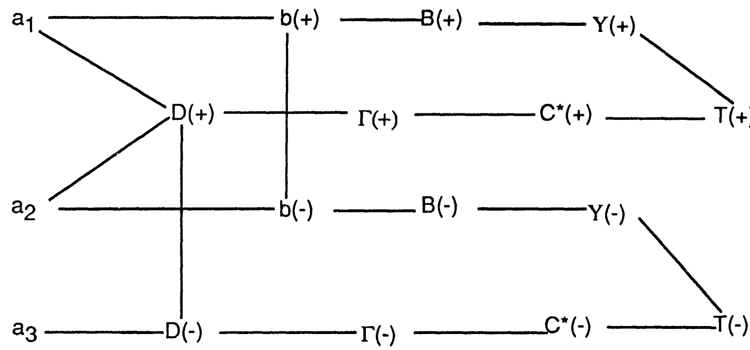

FIG. 1.—A situational structure with two male actors with a behavior pattern between them and a female actor. All unsigned lines are positive.

The Theory

The scope of the formulation covers collectively oriented task groups. The task must be valued, and the actors must take each others' behaviors into account in performing the task. The actors may, or may not, be discriminated by diffuse or specific status characteristics. We refer to a situation that fulfills these conditions as an *S* situation. We construct a graph diagram to represent the structure of an *S* situation (see fig. 1). This diagram is constructed from the point of view of one particular actor. However, at this point we assume that there is consensus, so that the structure is the same from the points of view of all the actors in the situation.[4] Actors and status elements, such as states of status characteristics that are salient in the situation, are represented as points in the graph structure. Three relations, represented by signed lines in the graph, can hold between these elements: actors may *possess* states of status characteristics, and a state of one status characteristic may be *relevant* to a state of a different status characteristic. Possession and relevance are "positive" relations. The third relation, which is "negative" and is called *dimensionality,* holds between the two differentially evaluated states of the same characteristic possessed by actors in the situation, such as male and female, indicating their linkage and opposition. The graph of the situation always contains two elements that represent outcome states: these are $T(+)$ and $T(-)$, success and failure at the task, respectively. Two other points representing the high and low states of the

[4] Situations where actors have different points of view of a given situation are, obviously, of special substantive interest. However, the modeling of such situations is something to be attempted in the future after we model the simpler situations where there is consensus.

instrumental ability (i.e., the ability that is necessary for successful task performance) are also in the graph of the situation, and these elements are relevant to the similarly signed task outcome states. Thus, the initial graph of any S situation consists of a set of unconnected points representing the actors in S, two task outcome states, and two states of the instrumental ability, $C^*(+)$ and $C^*(-)$, which are relevant to the outcome states.

The initial structure is completed through the *salience* and *burden-of-proof* processes. There are two conditions under which status characteristics become salient—when they are initially relevant to the task or when they discriminate between the actors in the situation. It should be noted that salience is a theoretical state and not a question of visibility. A status characteristic that does not satisfy these conditions is not predicted to become salient even though it is highly visible. Similar conditions need to be stated for the salience of behavior patterns.

There are many theoretically reasonable relations that may obtain between the salience of status characteristics and behavior patterns. Until we learn more about these elements we apply the principle of providing relevant information to the salience of behavior patterns as well. A behavior pattern, $b(+)$ and $b(-)$, will become salient if it provides new status information in the situation. If two actors are discriminated by a status characteristic, and a behavior pattern consistent with the status difference emerges, that outcome is consistent and provides no new information. If, however, the emergent behavior pattern is inconsistent with an existing status characteristic difference, then the pattern will become salient. Similarly, when actors are not discriminated by status characteristics, behavior patterns provide new bases of status differentiation, and therefore they will become salient.[5]

ASSUMPTION 1*: *The salience of behavior interchange patterns.* Given a behavior interchange pattern that occurs between an actor and one or more other actors, the states of the behavior interchange pattern will become salient (i) if the actors are not discriminated by other status elements or (ii) if the parts of the behavior interchange pattern are inconsistent with status elements that discriminate the actors.

The burden-of-proof assumption of the core theory describes how salient status elements that are not connected to the task at the outset become connected. The name reflects the basic principle that unless a status element is explicitly dissociated from the task, it will come to be connected to the similarly signed task outcome state; that is, positive

[5] We use asterisks after the assumption numbers to indicate assumptions that are meant to be taken in conjunction with the assumptions of the Berger et al. (1977) original formulation with the same number.

elements will become relevant to success and negative elements will become relevant to failure, even if indirectly. The same principle applies to behavior patterns. When they become salient, the status typification states, B(+) and B(−), to which they are relevant, became activated, and through the burden-of-proof process these states become relevant to like-signed states of abstract task ability.

ASSUMPTION 2*: *The burden of proof through status-typification states.* Given that a behavior interchange pattern is salient, its relevant status-typification states will be activated. These states will become relevant to similarly evaluated states of abstract task ability, and the latter will become relevant to similarly evaluated outcome states of the task.

The sequencing of the structure-completion assumption of the core theory describes how the salience and burden-of-proof assumptions operate to further complete the situational structure as new actors become interactants and new status characteristics become salient in the situation. We need to add to this assumption that the structure will be further completed as new behavior interchange patterns emerge in the situation. Each new behavior pattern, if it becomes salient, will result in structure development, and expectations will be changed or modified.

Behavior patterns, unlike status characteristics, are temporal in nature. That is, they refer to behavior that occurs over time, and a salient behavior pattern need not be observable at all times. We believe that once a behavior pattern is established and becomes salient it will remain salient even if it is not observable. However, a new behavior pattern that reverses the parts of the actors may become salient, in which case the older pattern is replaced. Thus, if there is a salient behavior interchange pattern such that actor A defers to actor B but over time a new behavior interchange pattern emerges such that actor B defers to actor A, it is not so much that a new status element has been added to those existing, but that a status element has been changed. The new pattern replaces the old, and the earlier pattern is no longer a part of the structure.

ASSUMPTION 3*: *Structure completion of behavior patterns.* Every time a new behavior interchange pattern becomes salient, the structure will be further completed. If a new behavior interchange pattern emerges in which the pattern parts possessed by two actors are reversed, then lines joining the actors with these new pattern parts are added to the graph structure replacing the old possession lines, which are dropped.

Figure 1 shows a situational structure with two male and one female actors designated as a_1, a_2, and a_3. The task is not sex typed, but the diffuse status characteristic, gender, which we designate by D in our diagrams, discriminates between the actors and therefore becomes salient in the situation. A behavior pattern, represented by $b(+)$ and $b(-)$,

between the two males has emerged, and the behavior pattern and its typification states, represented by $B(+)$ and $B(-)$, also become salient as the two males, a_1 and a_2, are not discriminated by a status characteristic. Since the diffuse status characteristic is not initially relevant to the task, it becomes task connected through the activated states of generalized expectations represented by $\Gamma(+)$ and $\Gamma(-)$, and the structure is completed.

Given the graph structure we determine the lengths and signs of the paths connecting each actor to the task outcome states.[6] In this example, actor a_1 is connected to the positive task outcome state ($T[+]$) by two positive paths of four lengths and to the negative outcome state ($T[-]$) by two positive paths of five lengths for a total of four positive paths. We assume that the strength, or the contribution to expectations, of each path is given by a function $f(i)$, where i is the length of the path. The function yields values in the range (0,1) and is a decreasing function of path length. The formation of aggregated expectation states assumption describes how expectations for actors can be computed from the strengths of the paths connecting them to the task outcome states.

ASSUMPTION 4: *Formation of aggregated expectation states.* If an actor x is connected to the task outcome states by sets of positive and negative paths, these paths will first be combined within like-signed subsets to yield a positive-path value e_x^+ and a negative-path value e_x^- in the following fashion. Given strengths $f(i), \ldots, f(n)$ and $f(i'), \ldots, f(n')$ of paths within the positive-path subset and negative-path subset, respectively, then:

$$e_x^+ = 1 - [1 - f(i)] \ldots [1 - f(n)],$$
$$e_x^- = -\{1 - [1 - f(i')] \ldots [1 - f(n')]\}.$$

The aggregated expectation state is then given by

$$e_x = e_x^+ + e_x^- .$$

The important point to note is that behavior interchange patterns enter into the formation of aggregated expectations exactly as other status elements do and combine with them in the formation of expectations. This unified treatment of different status elements allows us to capture the entirety of the "expectations-to-behavior-to-expectations" cycle within one formulation. We can now describe the emergence of power and prestige orders on the basis of status characteristics, behavioral feedback, and the combination of both status characteristics and behavior. In this way the formulation can be used to explain and to predict behavior in both heterogeneous and homogeneous groups.

[6] For a detailed description of path counting see Berger et al. (1977).

Expectation standings are assumed to be the determinants of the power-and-prestige order. We present below a version of the basic expectation assumption, formulated for more than two actors.

ASSUMPTION 5: *Basic expectation assumption.* Given that p has formed aggregated expectation states for self and others, p's power-and-prestige position will be a direct, continuous function of p's expectation standing in S.

This assumption has been stated in general terms, and we express these concepts in functional form when we construct specific models. However, before we undertake specific model construction, legitimation effects need to be included in the formulation. We believe that, if a sufficiently large number of actors establish behavior patterns with respect to one other actor such that the one actor possesses the positive pattern part in all cases, then they will all come to behave as though that actor was their legitimate leader. We believe that this can happen provided that the others in the group do not hold expectations that the top actor, on the basis of all his salient external status characteristics, will possess a low-valued status position in the group (Ridgeway and Berger 1988).

AUXILIARY ASSUMPTION 1: *Legitimation on the basis of behavior patterns.* Assume that a sufficiently large subset of actors have formed low–high behavior patterns with respect to the top actor in the power-and-prestige order. Assume further that the actors in the group do not hold expectations that the top actor will possess a low-valued status position in the group. The actors will come to behave as if the top actor's power-and-prestige position is a legitimate one.

This assumption is called the "legitimation on the basis of behavior assumption" because, as we have noted before and as the literature suggests (Ridgeway and Berger 1988), legitimation of the power-and-prestige order can come about in different ways. The implication of the assumption is that legitimation results in a change for the top actor in how expectations are translated to behavior. As the previous discussion suggests, this change is of special importance for the behavior of the top actor in the power-and-prestige order as he or she takes on a leadership role. The assumption tells us that the prediction function has to have a different form for groups with and without legitimated power-and-prestige orders.

The Specific Model

The formulation is quite general. Within its scope conditions, the effects of a number of situational variables may result in quite different configurations of behavior patterns. Different kinds of groups operating under

different conditions can develop linear structures, segmented structures, incomplete structures, or even no stable structures at all. Furthermore, different kinds of power-and-prestige behaviors may be different functions of expectation standing. Therefore, it is necessary to construct specific models for given types of groups and given kinds of power-and-prestige behaviors by making additional assumptions about the process of emergence of behavior patterns and the functional relationship of behavior to expectations. We will now construct such a specific model for predicting participation rates in the Bales group setting.

The pertinent features of the Bales group setting are that it is a laboratory situation where a number (usually 2–12) of previously unacquainted subjects are given a discussion task, such as a human relations case, and are asked to reach a group decision in a limited amount of time. The subjects have no expectations for extended interaction as a group and therefore are unlikely to have a high level of personal investment in the group.

The time limitation forces the group to develop a structure quickly, and the need to reach a group decision, coupled with the relative lack of personal investment, works against status struggles, although they do occur. These conditions also make it unlikely that behavior patterns develop inconsistently with any existing status characteristic differences or that established behavior patterns get reversed during a group session. Furthermore, the fact that behavior patterns can be observed by all actors makes it unlikely that behavior patterns emerge in intransitive configurations. At the same time, the literature on Bales groups suggests that power-and-prestige orders appear very quickly and are usually linear (Bales et al. 1951; Fişek and Ofshe 1970). We therefore make the simplest assumption that will generate a unique pattern consistent with these points.

Specific Model Assumption 1. In the Bales group setting the configuration of behavior patterns develops in a transitive manner consistent with salient status characteristics and is fully completed.

Full completion of the configuration of behavior patterns refers to those patterns that can be salient, that is, those between initial status equals. The assumption is obviously a simple first approximation, but, given the values of the function $f(i)$, it enables us to compute expectations for all actors in a given situation. We use the function values, given in table 1, which have been theoretically generated by making assumptions about the shape of the function $f(i)$ (Fişek, Norman, and Nelson-Kilger 1989).[7]

We next need to estimate the size of the core group necessary to generate a legitimate power-and-prestige order. Our approach to this estima-

[7] These calculations are available from the authors on request.

TABLE 1

THEORETICALLY DERIVED PATH STRENGTHS

Path Lengths	Path Strengths
2	.6321
3	.3175
4	.1358
5	.0542
6	.0211

tion problem is quite informal: we look for a reasonable assumption rather than apply formal estimation procedures. Table 2 below gives the rates of participation of the top two initiators for groups of three to eight actors for the original Bales data (Bales 1970).

The top part of the table gives the total rates of participation and displays a trend that was one of the earliest to be noted in studies of Bales groups (Bales et al. 1951): the difference in participation rate between the top two actors increases with group size. However, our discussion of legitimation suggests that it would be more appropriate to look separately at rates of addressing the group as a whole and addressing individuals because leadership is more likely to be manifested in addressing the group as a whole. The rest of the table gives the rates for addressing the group as a whole and as individuals separately. Very much in line with our account of legitimation, the trend of the differences between the two top actors is enhanced when rates of speaking to the group as a whole are considered, but this trend disappears when rates of addressing individuals are considered. Furthermore, the trend is not linear but resembles a step function. The difference in rates is small for groups of three and four actors, increases dramatically for groups of five, and then remains essentially constant. This is again consistent with our account of legitimation and suggests that legitimate leadership may become possible in groups of five.

In formulating prediction functions, one would normally think in terms of parameterized functions so that the effects of variables, other than the independent variable, on the dependent variable can be captured. There is no question that the degree of differentiation in the rates of participation will be affected by contextual variables such as degree of task orientation and the importance of the task. However, we shall start out by trying the simplest possible functions, even if they involve no parameters.

Since the legitimation assumption implies that the functional relation of expectation standing to behaviors will change with legitimation, we

TABLE 2

PARTICIPATION RATES OF THE TWO TOP ACTORS IN THE ORIGINAL BALES GROUPS BY GROUP SIZE

	GROUP SIZE					
ACTOR	3	4	5	6	7	8
Total:						
One	.444	.322	.469	.431	.431	.398
Two	.327	.289	.219	.188	.152	.166
To group:						
One	.512	.365	.707	.621	.638	.577
Two	.272	.291	.119	.131	.087	.090
To individuals:						
One	.393	.296	.271	.288	.247	.249
Two	.363	.288	.302	.231	.209	.229
N	26	89	9	18	15	8

need two different functions: one function for predicting rates of speaking to the group as a whole when the power-and-prestige order is legitimated and another function for predicting the other rates of participation.

Considering the relationship between expectation standings and participation rates in general, the simplest possible functional relationship is that of equality. Both variables are measured in the same interval (0,1), they both sum to one for a given group, and the substance of the relationship is that the greater the expectation standing, the greater the participation rate. Therefore, we use the identity function in the simpler case, that is, for rates in groups without legitimated orders and for rates of speaking to individuals in groups with legitimated orders. However, something a little more complicated is called for in predicting the rates of speaking to the group as a whole in groups with legitimated orders. When addressing the others as a single entity, the leader is interacting with them as if they were a single individual with status typical for their numbers. The "massed" other's expectation standing is simply expressed as the arithmetic mean of the expectation standings of the others. To obtain the leader's and the others' total share of speaking to the group as a whole from these two expectation standings, we normalize them so that they sum to one. The total share of the others can then be allocated among them in proportion to their expectation standings. These ideas are summarized in the assumption below.

SPECIFIC MODEL ASSUMPTION 2. In the Bales group setting an actor's rate of participation will be equal to the actor's expectation stand-

ing, except for the rate of speaking to the group as a whole in groups with legitimated power-and-prestige orders, in which case the rate for the leader will be given by

$$g_1 = \frac{s_1}{s_1 + \frac{1 - s_1}{n - 1}},$$

and for the others by

$$g_i = (1 - g_1)\frac{s_i}{1 - s_1}, i = 2, \ldots, n.$$

The first formula gives the leader's rate of addressing the group as a whole. The fraction in the denominator is the mean expectation standing of the others in the group: since expectation standings sum to one, one minus the leader's expectation standing gives the sum of the others' expectation standings, and $(n - 1)$, where n is the number of actors in the group, is the number of others. Thus, the first formula is the normalization of the leader's expectation standing with the mean expectation standing of the others in the group. The second formula gives the rates for the other members: $(1 - g_1)$ is the others' total share, and the second factor is the actor's expectation standing renormalized by leaving out the leader's expectation standing. This assumption completes the specific model, and we can now predict participation rates for Bales group settings where actors may, or may not, be discriminated by status characteristics.

We will demonstrate the actual computational procedure in terms of one of the cases in the Bales setting that will be used in the assessment of fit. Let us consider one of the Smith-Lovin groups, the three-male/three-female group: the graph of the situation, although not complicated, is too dense to be displayed here; however, its verbal description is straightforward enough. Since gender discriminates the actors it will become salient, and since it is not relevant to the task it will become connected through the burden-of-proof process. This means that each male in the group will be connected to the task by two positive paths of four and five lengths. Similarly, each female will be connected to the task with two negative paths of the same lengths. Since the specific model assumes that behavior patterns cannot be inconsistent with status characteristic differentiation and the formulation asserts that behavior patterns consistent with status characteristics will not be salient, there will be no behavior patterns between the males and the females, but only among same-gender subsets. Since the specific model assumes complete and transitive emergence of behavior patterns, there will be one actor in each

TABLE 3

EXPECTATION STANDINGS OF THE ACTORS IN THE THREE-MALE/THREE-FEMALE SMITH-LOVIN GROUPS

Actors	Positive Paths*	Negative Paths*	Expectations	Expectation Standings
Male 1	3 × 4, 3 × 5	. . .	.454	.242
Male 2	2 × 4, 2 × 5	4, 5	.149	.192
Male 3	4, 5	2 × 4, 2 × 5	−.149	.142
Female 1	2 × 4, 2 × 5	4, 5	.149	.192
Female 2	4, 5	2 × 4, 2 × 5	−.149	.142
Female 3	. . .	3 × 4, 3 × 5	−.454	.091

* Number of paths × path length.

subset who possesses the positive parts of two behavior patterns with respect to the other two. Therefore, this actor will have four positive paths due to behavior patterns, two of four lengths and two of five lengths, connecting the actor to the task. In each same-gender subset, a second actor will possess one positive and one negative pattern part, and the third two negative pattern parts; each will be connected to the task accordingly. The paths for all six actors are given in table 3.

In this table the first column lists the positive paths, and the second column lists the negative ones. The third column gives the expectations for each actor, which we computed using the path strengths in table 1 and the combining rule. The fourth column gives the expectation standings computed from these expectations. Since this is a group in which legitimation is assumed not to occur, the expectation standings are also the predicted participation rates. That is, the model predicts that the top participator will be male with a participation rate of .242, that a male and a female will tie for the second participation rank with rates of .192, and so forth. Had this group been one where legitimation is assumed to occur, then the expectation standings would be the predictions for participations directed to individuals, and the rates for addressing the group as a whole would be obtained by applying the transformations of specific model assumption 2 to the expectation standings.

GOODNESS OF FIT

At this point we need to demonstrate that our theoretical formulation and the specific model we have constructed are consistent with the available empirical evidence. As our starting point was Skvoretz's (1988) work, the first set of data we will examine is that of Smith-Lovin et al. (1986). We have also sought data from other groups in Bales-type settings where

discrimination among actors is systematically provided by status characteristics. We have been able to find one such set of data in a set of studies carried out by E. G. Cohen and her associates (Cohen 1972; Cohen and Roper 1985) that provides data on four-person groups composed of two "high-status" and two "low-status" actors discriminated by one characteristic that is different in each study. We will also assess the fit of the model to this set of data as a further "test" of the theoretical formulation and model. Since our formulation applies to both heterogeneous and homogeneous groups we also need to explore its fit to homogeneous groups. There are a large number of published studies of homogeneous groups in the Bales setting; however, after eliminating studies outside our scope of conditions—that is, those that use appointed leaders or feature role playing instead of normal interaction and those that do not report data in usable form—few remain. Of those that do remain, the original Bales data are by far the largest body of comparable data. Therefore, we explore the fit of the model to the original Bales data as examples of homogeneous groups. Since all the data predate the construction of the model, our evaluation of goodness of fit is not a test of the model as such but an assessment of the consistency of the model with the available data. We evaluate the fit of the model to the mean rates of participation for groups of given size and composition.

Our first assessment of fit is simply the comparison of predicted and observed participation rates for each set of data, and, where possible, we use the standard error of the observed value to assess the goodness of fit. This commonsense approach has traditionally been used with participation rate models for Bales groups (see Kadane and Lewis 1969). The second step is to do a regression of the observed rates on the predicted rates. Regression analysis offers some important advantages in assessing goodness of fit. First, it provides a summary measure, R^2, for the entire data set. Furthermore, the measure has a very straightforward interpretation as the percentage of the variation explained in the observed by the predicted, and it is a commonly used measure in most quantitative work. Second, examination of the regression coefficients and the residuals can tell us about systematic biases the model might have. However, it should be noted that there is dependence in our data: if the model overpredicts a participation rate for one rank for a given group, it is going to have to underpredict another; participation rates for a given type of group sum to one. This can cause autocorrelation, and, while autocorrelation does not bias parameter estimates, it can cause inflation of R^2 (Hanushek and Jackson 1977; Judge et al. 1985). However, it is positive autocorrelation that inflates R^2, and, in our case, the structure of dependence should produce negative autocorrelation, and the Durbin-Watson statistic can give warning of positive serial autocorrelation. We reduce

the degrees of freedom of the error variance by one for each type of group in a given data set to counteract the dependence. The regressions are also weighted by the square root of the sample size for each group size and composition since within a set of data there usually are different numbers of given types of groups.

The Smith-Lovin Data

These data are from six-person groups in the Bales setting, where the sex composition of the groups has been systematically varied from all male to all female. In assessing the fit of the model to these data we encounter the following problem: our model predicts that in all-male and in five-male/one-female groups the power-and-prestige order will be legitimated, so that the participation directed to individuals and to the group as a whole should be predicted separately. But in the published data, participations directed to the group as a whole and directed to individuals are not reported separately. We need to know at least the overall proportion of acts directed to the group as a whole in order to combine the predicted to-individuals and to-group participation rates in our efforts to obtain a predicted total participation rate. Therefore, we estimate this proportion as a parameter by doing a simple grid search optimizing the fit of the regression model for these two types of groups. The estimate we obtain is that 17% of the acts are directed to the group as a whole. We use this value to generate total participation predictions for the all-male and five-male/one-female groups, and reduce the residual degrees of freedom by one in the regression analysis. Table 4 gives the observed and predicted proportions of participation for each initiation rank within each sex for these groups.

In this table, for each group composition the first column gives the predicted participation rate, the second column the observed participation rate, and the third column the sample standard error (SE). Numbers in italic mark those predictions that are more than two SEs away from the observed. For each group composition, the males are listed first in order of their participation rank among themselves; the females are then listed in the same order. Examining the table, we note that out of the 42 predictions 10 differ from the observed by more than two SEs. It is probably the case that the sample sizes are too small to wash out individual differences, so that predictions for particular ranks are not successful. However, the model does capture the general features of the distributions, such as the fact that the proportions of participation for the top actor in all-male and five-male/one-female groups are higher than in the other groups, as predicted by the model. Therefore, we feel justified in looking further at the overall fit of the model.

TABLE 4

PREDICTED AND OBSERVED PARTICIPATION RATES IN THE SMITH-LOVIN GROUPS

	All Male			Five Male/ One Female			Four Male/ Two Female			Three Male/ Three Female			Two Male/ Four Female			One Male/ Five Female			All Female		
Rank	P	O	SE	P	O	SE	P	O	SE	P	O	SE	P	O	SE	P	O	SE	P	O	SE
1	.337	.367	.041	*.317*	.372	.016	.251	.264	.037	.242	.254	.020	*.231*	.312	.032	.213	.275	.062	.273	.292	.012
2	.209	.238	.031	*.193*	.233	.013	.204	.174	.018	.192	.220	.028	*.173*	.109	.026	.247	.271	.024	.229	.229	.011
3	*.171*	.143	.012	.159	.145	.019	.161	.134	.016	.142	.100	.028	*.220*	.299	.019	.202	.173	.025	*.187*	.216	.007
4	.133	.106	.018	.124	.122	.021	.117	.080	.022	.192	.218	.051	.173	.155	.022	.158	.151	.021	.146	.137	.013
5	*.096*	.076	.008	*.089*	.035	.011	.161	.207	.032	.142	.131	.011	*.126*	.091	.015	.113	.075	.021	.105	.086	.013
6	.056	.070	.008	.122	.094	.029	.107	.142	.050	.091	.077	.015	.077	.035	.070	.066	.056	.015	.061	.040	.015
N		5			5			4			4			5			3			4	

NOTE.—P, O, and SE stand for predicted, observed, and standard error, respectively. The significantly deviant predictions are given in italics. In each group the male actors are listed first. Regression results for the Smith-Lovin data are $R^2 = .893$ ($F[1,32] = 332.882$); $b = 1.295$ (SE = .071); constant = $-.049$ (SE = .013); Durbin-Watson statistic = 2.295 (no significant residuals).

The regression results are given in the notes to table 4. Quite obviously, the R^2 value obtained is quite high. Thus it seems that, although the model's point predictions are off in a number of cases, the model does describe the overall features of the data quite well. Examining the coefficients of the regression equation, we see that the regression coefficient is larger than one by more than two SEs and the intercept is also less than zero by more than two SEs. This indicates that the model is underpredicting the higher participation rates and overpredicting the lower rates. However, the effect is not very large. The residual plots indicate an autocorrelation effect, but the Durbin-Watson statistic is not high enough to indicate a significant first-order serial correlation and is in the negative direction.

There is one further way we can evaluate the goodness of fit of the model predictions to the data. The model predicts the rank positions of the males and the females for each gender composition, so that these orders can be compared to the observed orders. The data are reported in this form in table 5.

There are no measures of concordance for rankings in which the elements ranked are not individually identified. Therefore, we have constructed an ad hoc index the values of which are given in table 5. The index is the ratio of the correctly predicted pairwise orderings to the total pairwise comparisons, excluding the ties. The agreement between the predicted and observed orders is perfect in three cases out of five, slightly off in one case, and not very good in the fifth case. Our general evaluation is that the model does well in describing the overall distribution of participation rates.

The Cohen Situation Data

E. G. Cohen and her colleagues have conducted a series of studies to develop intervention techniques for changing expectations to counteract the negative effects of status characteristic discrimination in educational contexts (Cohen 1972; Cohen and Roper 1985). Each study in this set contains a control condition used to evaluate the effect of interventions in the experimental conditions. These control conditions meet the conditions of the Bales setting, the only difference being that in most of the studies the task is playing a board game instead of the typical Bales discussion task. However, the actors have to discuss their moves and come to a group decision as to how they are going to move the marker on the game board. The game is not competitive but cooperative, the goal being to reach the target and win as a group as quickly as possible. Each group is composed of four actors, two from a high-status category, and two from a low-status category.

TABLE 5

PREDICTED AND OBSERVED MALE/FEMALE RANK ORDERS IN THE SMITH-LOVIN GROUPS

	Five Male/ One Female		Four Male/ Two Female		Three Male/ Three Female		Two Male/ Four Female		One Male/ Five Female	
	P	O	P	O	P	O	P	O	P	O
1	M	M	M	M	M	M	M	M	F	M
2	M	M	M	F	MF	M	F	F	M	F
3	M	M	MF	M		F	MF	F	F	F
4	M	M		F	MF	F		M	F	F
5	F	F	M	M		M	F	F	F	F
6	M	M	F	M	F	F	F	F	F	F
Index	1.00		.57		1.00		1.00		.80	

We will examine data from five studies in this series. Three of these studies use the game task. Of these studies, one by Mark Lohman (1970) uses black and white junior high school students as subjects. The other two studies, by R. A. Morris (1977) and by Susan J. Rosenholtz (1977), look at the effects of a specific characteristic—reading-ability reputation. Of the four elementary school students who participate in a group, two are reputedly good readers, and two are reputedly poor readers. The remaining two studies, one by K. P. Hall (1972) and one by Marlaine E. Lockheed (1976), use a discussion task and look at male and female subjects who are teacher trainees. The participation rates observed in these groups and the model's predictions are given in table 6.

We do not have the SEs for these observed participation rates and therefore cannot evaluate the closeness of the predictions in such terms. However, the agreement between the predicted and the observed looks reasonable by visual inspection. The average difference between them is .0147; that is, it is less than 1.5%. It is interesting to note that the model predicts that the less active actor of the higher-status category and the more active actor of the lower-status category will have equal participation rates. In four of the five cases, this prediction is in good agreement with the data; in the fifth case, the Hall study, there is a fairly marked differentiation between the two actors. Despite this deviation, our evaluation is that the model describes the data quite well.

The regression results are given in the notes to table 6. The R^2 is high, even higher than that for the Smith-Lovin data. The coefficient of regression and the intercept indicate a tendency to underestimate high values and overestimate low values. This same tendency was also observed for the Smith-Lovin data; as in that earlier case, there is little

TABLE 6

Observed and Predicted Participation Rates in the Cohen Situation

	Predicted	Lohman: Two White/ Two Black	Hall: Two Male/ Two Female	Lockheed: Two Male/ Two Female	Morris: Two Good Readers/ Two Poor Readers	Rosenholtz: Two Good Readers/ Two Poor Readers
H1	.333	.330	.354	.329	.364	.364
H2	.250	.230	.205	.245	.240	.246
L1	.250	.270	.278	.248	.248	.237
L2	.167	.170	.163	.174	.147	.152
N		14	20	8	18	20

Note.—Regression results for the data are $R^2 = .935$ ($F[1,13] = 260.526$); $b = 1.140$ (SE = .071); constant = −.035 (SE = .018); Durbin-Watson statistic = 2.177 (no significant residuals).

reason to be concerned with this small effect at this stage of theoretical development. Residual plots indicate the existence of autocorrelated error; however, the Durbin-Watson statistic is not large enough to indicate a significant first-order serial effect and again is in the direction of negative autocorrelation. We have to conclude that the model fits this set of data, which includes data from groups with fairly different tasks, with different subject populations, and discriminated by different status characteristics, quite well.

The Original Bales Data

Finally, we would like to assess the fit of the model of the original Bales data (Bales 1970). Bales data are coded separately for to-individuals and to-group participations, so we can fit the model separately for the two kinds of behaviors. This enables us to evaluate the legitimation aspects of the model in direct terms. Table 7 gives the distributions of the observed and predicted participation rates.

It should be pointed out that the basic initiation rank of actors was determined using total participations by Bales. Therefore, when to-individuals and to-group participations are separated, their orderings can disagree. This can be observed for the top ranks in groups of five. Such a reversal is not consistent with our model; however, the difference in the magnitudes of the two rates is small and, given the small number of groups of this size, need not cause serious concern. In fact, the general agreement between the predicted and observed participation rates seems to be quite good by visual inspection. The mean difference between them is .015, similar to the fits of earlier models (see Kadane and Lewis 1969).

We do two separate regression analyses. One is for the total participation rates in groups with two to four actors (for these groups the model does not predict different to-group and to-individuals participation rates) and the to-individuals participation rates in groups with five to eight actors. The second is for the to-group participation rates in groups with five to eight actors. The results of these regression analyses are given in the notes to table 7.

For the first regression, the R^2 value is large. Both the regression coefficient and the intercept differ from one and zero, respectively, by about one SE. The Durbin-Watson statistic, though on the positive side, is close to two, which is the mean value under the null hypothesis. We conclude that the model fits the data well.

For the second regression, the R^2 value is even higher; however, the Durbin-Watson statistic is quite low—though not low enough to be significant (at $\alpha = .05$ with $n = 25$ the critical values of D are $D_L = 1.29$ and $D_U = 1.45$). Residual plots also indicate that there is autocorrelation;

TABLE 7

PREDICTED AND OBSERVED PARTICIPATION RATES IN BALES GROUPS

Rank	Total Participation Rates						To-Individuals Participation Rates								To-Group Participation Rates							
	Two Actors		Three Actors		Four Actors		Five Actors		Six Actors		Seven Actors		Eight Actors		Five Actors		Six Actors		Seven Actors		Eight Actors	
	P	O	P	O	P	O	P	O	P	O	P	O	P	O	P	O	P	O	P	O	P	O
1	.591	.573	.444	.444	.364	.322	.311	.271	.273	.288	.243	.247	.220	.249	.643	.707	.652	.621	.658	.638	.663	.577
2	.409	.427	.333	.327	.287	.289	.254	.302	.229	.231	.208	.209	.190	.229	.132	.119	.109	.131	.094	.087	.082	.090
3			.223	.229	.213	.228	.200	.209	.187	.185	.175	.158	.163	.158	.104	.088	.089	.084	.079	.074	.070	.090
4					.137	.161	.146	.141	.146	.136	.143	.128	.138	.125	.075	.057	.070	.075	.065	.066	.059	.066
5							.089	.077	.105	.094	.111	.115	.113	.117	.046	.029	.050	.049	.050	.053	.049	.048
6									.061	.065	.078	.077	.087	.060			.029	.040	.035	.047	.038	.048
7											.043	.064	.060	.042					.019	.034	.026	.044
8													.031	.020							.013	.013
N	41		26		89		9		18		15		10									

NOTE.—P stands for predicted and O for observed. Regression results for total (group sizes two to four) and to-individuals (group sizes five to eight) participation rates: R^2 = .978 (F[1,26] = 1,446.226); b = .972 (SE = .026); constant = .006 (SE = .007); Durbin-Watson statistic = 1.916 (no significant residuals). Results for to-group participation rates are R^2 = .989 (F[1,20] = 2,083.811); b = .956 (SE = .021); constant = .007 (SE = .006); Durbin-Watson statistic = 1.572 (significant residuals = 1).

therefore, spurious inflation of the R^2 is a distinct possibility. However, even given this precautionary note, we will still have to conclude that the fit is good and that overall the model is in good agreement with Bales's original data.

SUMMARY STATEMENT

We started out to formulate a theory that could account for the structuring of power-and-prestige orders in both status-heterogeneous and status-homogeneous groups in open interaction situations. We have done so by integrating two theories within the expectation states theory framework, the theory of status characteristics, and the theory of evolution of expectations. We have also introduced elements of legitimation dynamics into the theory. The resulting formulation, which is an extension of the mathematical version of the theory of status characteristics and expectation states, can be used to predict the power-and-prestige orderings in status-heterogeneous and, initially, status-homogeneous groups.

We have constructed a specific model, based on the theory, to predict rates of participation in Bales-type settings. We believe that this model fits the data reported by Smith-Lovin quite well. We have demonstrated that the same model also fits data on heterogeneous groups collected by E. G. Cohen and her associates. We have also shown that the model fits the original Bales data. The goodness of fit in each case, as measured by R^2, is good. It should also be noted that the model requires very little in the way of estimating empirical parameters. The only such quantities to be used in the assessment of fit presented above were the size of the core group necessary for legitimation and the proportion of to-group participations in the Smith-Lovin data. We believe our formulation, incorporating as it does the full feedback cycle of expectations to behavior and behavior to expectations, has furthered our understanding of the evolution of power-and-prestige orders and is capable of generating further empirical and theoretical research.

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