STATUS CHARACTERISTICS AND EXPECTATION STATES:

A PROCESS MODEL[*]

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I. Introduction.

In task groups generally it is found that power and prestige are un-
equally distributed; that various components of power and prestige (such as
participation rates, influence, evaluations of contributions) are highly
correlated; and that, once having emerged, power-prestige orders are quite
stable, resisting change (Bales, et al., 1951; Bales, 1953; Bales and Slater,
1955; Harvey, 1953; Heinecke and Bales, 1953; Sherif, White and Harvey, 1955;
Short and Strodtbeck, 1963; Strodtbeck, 1951; Strodtbeck, 1954; and Whyte,
1943). In those task groups in which there are prior status differences,
differences, for example, in age, sex, occupation, or color, it is repeatedly
found that differences in power and prestige correspond to differences in
status (Caudill, 1958; Hurwitz, Zander, and Hymovich, 1953; Katz, Goldston,
and Benjamin, 1958; Katz and Cohen, 1962; Mishler and Tropp, 1956; Strodtbeck
and Mann, 1956; Strodtbeck, James, and Hawkins, 1957; Torrance, 1954; Zander
and Cohen, 1955; and Ziller and Exline, 1958). Caudill, for example, found
that in a series of sixty-three consecutive morning rounds in a small psychiatric
hospital, the head administrator participated more than the chief resident,
the chief resident more than other residents, the most passive resident more
than the nursing supervisor, the nursing supervisor more than other nurses,
and the ancillary personnel (social workers, occupational therapist) about
as much as nurses (Caudill, 1958, Chapter 10). If the sixty-three sessions
are divided into three equal periods, the same order persists stably in each
period except that the position of the ancillary personnel fluctuates slightly.

Two facts are particularly interesting about the effects of prior status differences. First, whatever they are due to they are not due to direct, personal experience of other group members. For the same result is observed even if the group members have never previously met. Torrance, for example, instructed temporary B-26 crews, composed of a pilot, navigator, and gunner, who were not previously acquainted; to estimate the number of dots scattered on a card. (The card displayed a very large number of small dots haphazardly arranged.) The pilot, who was also air crew commander, had more influence on the decision than the navigator, who in turn had more influence than the gunner. The same result was obtained for three other tasks (Torrance, 1954). Second, prior status differences in the group correspond to the distribution of power and prestige even where they do not have any obvious or direct bearing on the group task. Often, of course, prior status differences, even in ad hoc settings, are of a kind that naturally affect interaction, as when highly prestigeful mental health specialists have more influence than less prestigeful specialists in a discussion of mental hygiene issues (Hurwitz, Zander, and Hymovich, 1953). But the effect is not always of so obvious a kind. One of Torrance's four tasks, for example, required his air crews to construct a joint story that would describe what was taking place in an ambiguous picture taken from a projective test. It is not self-evident that the pilot should have, either as a consequence of his training or of his predictable task-abilities, any projective story-telling skills; but even for this task the pilot influenced the final story more than the navigator, the navigator influenced it more than the gunner (Torrance, 1954). Thus it has been repeatedly found that

When task groups are differentiated with respect to some status characteristic external to the task situation, this differentiation determines the observed power and prestige order within the group, whether or not the members have previously known each other or the external characteristic is related to the group task.

In a previous paper (Berger, Cohen, and Zelditch, 1965) we have explained this result in the following way: (1) In a task situation, the observed distribution of power and prestige, for example the distribution of performance outputs, or of evaluations of task-contributions, can be regarded as a function of underlying beliefs about relative abilities to perform the task (Berger and Snell, 1961); if, for example, an actor, p, believes another actor, o, is better at the task than he himself is, and if he is committed to his group's success at the task, then he will defer to o's suggestions. (2) While such expectations can arise from direct experience of others, they can also be embodied in stereotyped beliefs about people who have particular states of a status-characteristic; if, for example, p is male and o is female, p may assume, even without knowing o personally, that he is better than o at whatever task they are to perform. (3) In situations in which p and o are to work together to accomplish a collective task, and in which they care about the successful outcome of the task, there will be some pressure on the actors to assign expectation states to each other; for example, p will want to know how seriously to take suggestions made by o. (4) If p and o differ in status, and there is no other basis for assigning expectations about performance except this difference, then beliefs embodied in the status-characteristic become a basis for assigning expectations. (5) Even if the task requires an ability that is not part of the stereotyped conceptions that p and o have of

each other, the status-characteristic will become significant in the situation because it has a halo effect; it tends to become diffuse, to generalize. (6) In either case, therefore, whether the task requires a wholly new ability or not, because the status-characteristic determines assignment of expectations, and expectations determine the observed distribution of power and prestige, we will find that the power-prestige order corresponds to the prior status differences.

This formulation is sufficient to account for results like those of Strodtbeck and Torrance, but it is applicable essentially to non-process experiments. In the present paper we propose to extend it, so that we are able to describe an action process through which, step-by-step, the status-characteristic determines the allocation of performance expectations. This extension is significant, first in that it provides a way of precisely testing some of the basic assertions in our formulation, second in that it is a model applicable in an important class of interactive settings. But it should be understood that the model is in no sense exhaustive, there are other interactive settings in which the effects of prior status differences are apparent, in which prior status differences in fact function in the way we have just claimed that they do, but in which the action process itself is different.

In Section II we summarize our previous formulation: there we define a diffuse status-characteristic, show how it comes to determine performance expectations in specific task situations, and, finally, show how performance expectations determine the observed distribution of power and prestige. In Section III the way in which we propose to extend this formulation is described.

In Section IV we formalize the model developed in Section III. This is
followed by a technical appendix, in which questions of estimating and
testing the model are considered.

II. Basic Concepts and Assumptions.

The idea of a diffuse status-characteristic has already been developed
in Berger, Cohen, and Zelditch, 1965 and Zelditch, Cohen, and Berger, 1965.
Here we only summarize the main features of the definition and emphasize
those aspects of it that are particularly relevant to this paper.

It will be recalled that, <u>first</u>, characteristics like age, sex, ethnicity,
or color, are symbolically rather than intrinsically significant. "Black"
in itself means nothing; what is important about color is what it stands for
in the minds of many people. <u>Second</u>, associated with status-characteristics
are sets of fairly specific beliefs, such as "Negroes are musical." But <u>third</u>,
such specific beliefs tend also to generalize to the actor as a whole, rather
like a halo effect, so that one is able not only mathematically, or mechanically,
or verbally; one is also simply "able" in a way that is quite general and in-
definite. <u>Fourth</u>, states of a status-characteristic stand for evaluations
of people as well as beliefs about them; these evaluations are also given to
the specific and general beliefs associated with the characteristic.

We employ the following notation: D is used to refer to status-characterist
D_x to refer to its states. In this paper we talk of characteristics as
having two states, so that $x = a$ or b. For example: though occupation is
a characteristic having many states, we arbitrarily lump some of these so that

we might have, say, white-collar and blue-collar occupations. C is used to refer to specific characteristics (such as mathematical, or mechanical ability) C_x to its states (x = a, b). States are differentially evaluated if one is positively and one negatively evaluated; for, limiting ourselves to two states, we have only two values as well. A _set_ of states of specific characteristics is represented by γ_x (where again x = a, b). The generalized state that, like a halo effect, also comes to be associated with states of D, is represented by GES_x (for _general expectation state_). We mean by a diffuse status-characteristic, then,

Definition 2.1. A characteristic D is a _diffuse status-characteristic_ if and only if

(1) the states of D are differentially evaluated, and

(2) to each state, _x_, of D there corresponds a distinct set γ_x of specifically associated evaluated states of characteristics, and

(3) to each state, _x_, of D there corresponds a distinct general expectation state, GES_x, having the same evaluation as the state D_x.

In this definition the term "specifically associated" refers to those states that are understood as a matter of socially accepted belief to be re-lated to states of D. If C_x is specifically associated with D_x, then an actor p will attribute C_x to another, say o, if told that o possesses state D_x. For example, p may expect himself to be better at solving mathematical puzzles than o if p is male and o is female; in that case, in p's eyes ma-thematical ability is associated with sex.

Note that a state and its value are carefully distinguished, since it

is possible to negatively evaluate the higher state of a characteristic.
For example, high aggressiveness is sometimes negatively evaluated. And,
of course, the high and low states of a specific characteristic may not be
differentially evaluated at all. High ability to solve mathematical puzzles
may be positively evaluated by some, not evaluated at all by others; not
that it would be negatively evaluated, but rather it would have no evaluative
significance.

Whether, for a particular actor in a particular situation, a given charac-
teristic is a diffuse status-characteristic or not, is of course an empirical
question. In each case in which our theory is to be applied we must first
ask: does p differentially evaluate the states of D? Does he have specific
beliefs about those who possess different states of D? Does he believe those
who possess one state of D to be superior to those who have the other, simply
because they possess state D_x? Social class, for example, is a diffuse
status-characteristic in a community if the white-collar class is thought,
ipso facto, to be more worthy, smarter, more moral, more industrious, more
energetic, and in fact altogether superior in almost every way that counts
in the community, to the blue-collar class.

If a diffuse status-characteristic embodies beliefs about actors that,
in the absence of direct experience or personal knowledge of a particular
actor, can stand in place of such experience, we naturally will want to ask
in what situations such beliefs come to determine interaction. Four con-
ditions appear to be important.[1] Hereafter we will take these four conditions
as defining what we mean when we use the expression "the situation S."

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[1]The conditions we describe here are sufficient, but they do not
necessarily exhaust the possible situations in which D becomes significant.

First, we will assume that there is a collective, valued task, T; that is, a task that requires p and o to act together in order to achieve some task-outcome, say T_a, that is more positively evaluated than some other outcome, T_b. P is therefore committed to "success" at the task and must take the behavior of o into account in achieving that success.

Second, we may think of the task as requiring an ability C, with states C_a and C_b. We will say that C is instrumental to T, if one state of C increases the likelihood that p achieves one of the outcome states of T while the second state of C increases the likelihood that p achieves the second outcome state of T. If not instrumental, C is independent of T. We assume that if C_a is instrumental to T_a, and T_a is the positively valued outcome of T, then C_a is the positively evaluated state of C, while C_b is negatively evaluated.

Third, we assume that p has not assigned specific states of C to himself or O, nor has such an assignment been provided as an initial condition of situation S.

Fourth, we assume that p and o possess different states of a single status-characteristic D, so that D is a basis of discrimination between p and o in situation S.

In such a situation, we will say that the diffuse status-characteristic is activated if and only if the specifically associated sets of states and the general expectation state GES_x, that are associated in the actors' minds with D_x, are attributed by p to the actors in the situation. This is meant to formulate as exactly as we can the idea that the characteristic and the beliefs associated with the characteristic become significant to the actors and become part of a meaningful response that the actors have to each other. What we have, of course, is a situation in which there is some pressure to assign states of C to actors, that is to attribute expectation states

to them, but no basis for doing so. Since beliefs about states of D are
capable of being viewed as "experience" which embodies knowledge about how actor
will behave, D becomes a basis from which expectations can be inferred.

Assumption 2.1. (Activation). D is activated in task situation S if
            T is a differentially evaluated, collective task, and
            D is a basis of discrimination between p and o in S.

If D is activated in the situation S, and C is the characteristic in-
strumental to T in that situation, then either C has already been specifically
associated with D or it has not. If it has, then assignment of states of C
is immediate, since activation means that the characteristics allocated to
D are attributed to actors. For example: Hurwitz, Zander, and Hymovich (1953),
require mental health specialists to discuss a mental health problem. Some
are "eminent specialists" in the field, while others are not. We can in this
setting assume that the specific characteristic is already associated with
states of the diffuse characteristic.

If it has not been specifically associated with states of D, C might be
very similar to a characteristic that has. Or it might even be well-known
to be irrelevant to D; that is, the social definition that forms part of p's
beliefs about D might explicitly regard C as independent of, or dissociated
from, D. But here we are particularly interested in the situation in which
there has been no prior relation specified at all. A close parallel is
Torrance's projective story task, in which officers and enlisted men combine
to tell a story based on an ambiguous stimulus. In this case, even though
C has not previously been associated with states of D, we shall believe that

the burden of proof will be on anyone to show that D is <u>not</u> relevant to C.

<u>Relevance</u> here means that possession of the state of one characteristic is

a basis for anticipating possession of a state of a second characteristic.

Actors will want to know who is good and who poor at the task; if there are

general expectation states associated with D, they will become relevant to C.

<u>Assumption</u> 2.2. (Burden of Proof). If C has not been previously associated
with or dissociated from D, and D is activated in S, and D
is the <u>only</u> basis for discriminating p and o, then D will
become relevant to C in S.

It is, of course, natural to suppose that states of C when they are

assigned, will be assigned to p and o so as to accord with their states of

D and GES. We will call such an assignment <u>balanced</u>.

<u>Definition</u> 2.2. (Balance). Two relevant or associated states are balanced
in S, if and only if they have the same evaluation.

And,

<u>Definition</u> 2.3. (Balance). A status structure is balanced in S, if and
only if all its relevant or associated states are balanced.

For example, if p is a college senior and o is a high school freshman,

then to attribute a positively evaluated ability to p and a negatively evaluated

ability to o will be balanced. To attribute a negatively evaluated ability

to p and a positively evaluated ability to o would be <u>imbalanced</u>.

<u>Assumption</u> 2.3. (Assignment). If p and o possess differentially evaluated
states of D, and D is relevant to C in S, p will assign
in S states of C to himself and o that are balanced with
the states of D that he and o possess.

We have, now, a set of assumptions that will explain how states of C

are attributed to p and o in the absence of any information in the experimental

situation itself that would be grounds for assigning expectations. Either D
is already associated with C and conveys some information to p and o about
who should do well and who poorly; or D is not already associated with C but
the general expectation state associated with D is seen as relevant in the
situation and conveys similar information. How will this affect the inter-
action that takes place?

Consider first a situation in which there is no D to distinguish actors
at all, but we have a valued, collective task--say the Bales' conference
setting (1953). We may think of each actor as having certain opportunities
to act, as when p is asked by o what he thinks about a given problem; if,
given this opportunity, p seizes the chance to act, we may say that he makes
a problem-solving attempt; if, on the other hand, p does not take the oppor-
tunity offered, but instead allows o an action-opportunity, then we may find
that p praises, agrees with, or shows some kind of reaction to o's behavior,
which we will call a unit-evaluation ("unit", to distinguish evaluation of a
particular act from the more general evaluations of states of characteristics);
if p does make a problem-solving attempt, and then tries to have o change
his own views in the direction of p's suggestions, we can speak of an in-
fluence attempt, and if p succeeds we can speak of the exercise of influence.
If we choose these as the selected features of interactionthat are of most
interest from the point of view of the present theory, the whole set of actions
taken together can be called an observable power-prestige order.[2]

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[2]A standardized experimental situation has been developed in which these
concepts are operationalized. The situation is structured so that, for ex-
ample, action opportunities, agreements and disagreements on unit acts, and

It will be recalled that certain uniformities in the distribution of
power and prestige are regularly observed: first, they are almost always un-
equally distributed; second, each component is highly correlated with the
other; third, differences in power-prestige are correlated with influece over
the final decision (Bales et al., 1951; Bales, 1953; Strodtbeck, 1951; Strodt-
beck, 1954). A parsimonious way of accounting for these facts is to regard
the observable power-prestige order as a function of a hypothetical, underlying
performance-expectation structure (Berger and Snell, 1961). If C is instrumen-
tal to task T, the expectations associated with the states C can be ordered
as "high" and "low", where the high state is that which increases the likeli-
hood that p achieves the positively evaluated outcome and the low state is
that which increases the likelihood that p achieves the negatively evaluated
outcome of T. And we have,

Assumption 2.4. (Basic Expectation Assumption). If C is instrumental to T
and if specific performance expectations for C are attribu-
ted by p to himself and o in S, the observable power-prestige
order in S will tend to be an increasing function of these
attributed states.

By the expression in Assumption 2.4, "will tend to be an increasing
function of these attributed states," we mean that the rates of received
action-opportunities, performance-outputs initiated, positive unit evaluations
received, and successful influence attempts, will tend to be greater for the

communicated unit evaluations can be controlled, and successful influence
studied as dependent behavior. Thus, in general the different types of be-
havior associated with the power and prestige order of the task-oriented
group can be studied while the remaining behavior types are experimentally
controlled. This situation is related to the process model discussed in
Section III and IV and will be referred to as the expectation action
situation.

actor to whom the high state of C is attributed than the actor to whom the low state of C is attributed.

Note that, because they are all functions of the same underlying factor, all of the observable components of the power-prestige order will be correlated. That they will be differentiated, however, is a consequence of additional assumptions into which we need not venture far here, since they are for the moment outside the scope of our defined objectives. (See, however, Berger and Snell, 1961, and Section III of this paper.)

We have now the following explanation of the Strodtbeck-Torrance type of experiment: There are two possible situations, in one of which C has already been specifically associated with states of D, in the other of which it bears no prior relation to D.

In the first case, C is instrumental to the collective task, T, and one outcome of T is more valued than another. The experimental conditions are such as to activate D, and external diffuse status-characteristic, since actors have no previous personal knowledge of each other and there is no basis for discriminating one from another in the immediate task situation except D. By activating D, since C is already associated with it, actors are able to attribute performance-expectation states to themselves and others. The observed power-prestige order will be a function of the states they assign. If we assume that the high state of the performance characteristic is the positively evaluated state, and is the state associated with the positively evaluated state of D, conditions that appear usually to be satisfied, we will find that the distribution of observed power and prestige will tend to coincide

with the distribution of the diffuse status-characteristic.

An example of the first kind of situation we want to distinguish is reported by Zander and Cohen (1955), who formed "committees" of college students who were to discuss how to dispose of a gift to their school made by an anonymous donor. Into each committee Zander and Cohen introduced two students, one identified as a Dean and one as a freshman, though the two did not themselves know how they had been identified to the other students. Interviewed after brief discussions with their committees, Deans, more than the freshmen, reported that other students were attentive to and readily agreed with their ideas.

In the second case, in which no prior relation has been specified between D and C, we have as in the first case that C is instrumental to the collective task T, T is valued, but actors have no idea what state of C to attribute either to p or to o. D is activated because there is no basis other than the diffuse status-characteristic, either in the situation or from past knowledge of each other, to discriminate the "able" from the "unable" actors. Even though there is no reason to suppose that D is relevant to C, since they have not previously been socially defined in relation to each other, we believe the burden of proof is on the actors to show that D is not relevant (Assumption 2.2). This simply expresses the generalizing power of the GES states. If relevant, D becomes a basis for attributing states of C to actors. States of C will be assigned in such a way that they accord with, or are balanced with, states of D. Having attributed states of C to actors, the performance-expectations they hold for each other will determine the distribution of observable power and prestige. If the high state of C is the positively evaluated

state, then the distribution of power and prestige that is observed will tend
to coincide with the distribution of the diffuse status-characteristic.

The clearest example of the second kind of situation is Torrance's pro-
jective discussion task (Torrance, 1954). It will be recalled that, among
Torrance's four tasks, one called for air crews to construct a joint story
about an ambiguous picture taken from a projective test. In both temporary
and permanent air crews, the pilot had the greatest influence, the navigator
was next, and the gunner had the least influence over the crew story. We
argue that this result cannot be explained by supposing that "projective story
telling" skills are associated, in the minds of the subjects, with air crew
position or air force rank. The idea of a general expectation state and the
burden of proof assumption alone can account for it.

This completes our first task, which was to construct a theory relating
diffuse status characteristics to an observed power and prestige order and
as a consequence to explain the results obtained by Strodtbeck, Torrance, and
others. The theory that we have constructed is deliberately formulated so
as to exist independent of any particular process of attribution of per-
formance expectations. That is, the theory presumes that attribution must
always occur in an action setting of one kind or another but it does not
specify that action setting. Hence, we envisage the possible investigation
of a wide variety of settings and consequently possible construction of
many process models. However, we have as our present objective the consi-
deration in some detail of only one particular kind of action setting and we
intend as our second main task to specify precisely in that setting one

process by which status characteristics determine performance expectations. This task we undertake in Section III.

III. Assignment of specific performance expectations.

In this section we shall construct a set of assumptions describing one action process through which specific performance expectations come to be attributed to actors. Definitions and assumptions from Section II will provide the initial status conditions of the situation. Given this initial status situation, we shall describe a specific task and inter-action situation, in which the process of assignment takes place. Given these three sets of conditions, respecting status, task, and interaction, we will be able to describe exactly a sequence of actions that takes place in the defined situation, and show how, as a consequence of these actions a given actor, p, assigns the states of C to himself and others. We shall also show how, after the assignment of states to actors, the assignment of states itself can be seen as determining the further course of the action process.

A. Initial status situation

The first set of conditions that we must specify have to do with the status situation in which actors find themselves at the outset of the process. We will talk of only two actors, p and o. The situation is viewed from p's point of view, and there are two objects of his orientation in the situation: himself, p', and the other, o. We assume that the following conditions are given: (1) there is a valued collective

task, T, one state of which is positively evaluated by p and o, so that to achieve that state represents "success", while the other state is negatively evaluated, representing "failure"; (2) there is a specific performance characteristic, C, instrumental to T; (3) the states of C have not been previously attributed to p' and o, nor previously associated with states of status characteristic D; and (4) there is a diffuse status characteristic, D, with respect to which p and o are differentiated.

If these conditions are given, assumption 2.1 leads us to conclude that D will be activated, so that p will attribute to p' and o the GES associated with their states of D. Either p believes that he himself is generally superior and o generally inferior, or the reverse. And, although p will not know which state of C either he or o possesses, assumption 2.2 leads us to conclude that D will be relevant to C--that is, p will believe that possessing a given GES is not independent of possessing a given state of C.

We may conveniently represent this situation in the following way. Allow the sign "+" to represent any positive or high expectation (general or specific) and "-" any negative or low expectation; and allow 0 to represent an unformed expectation. Let any expectation state with respect to a given characteristic be represented by an ordered pair with expectations for self in first position and expectations for other in second position. Thus [+-] means that p has high expectations for self, low for other, with respect to some specified characteristic. In order to distinguish general from specific expectations, enclose the former in braces { } and the

latter in [ ] brackets. Now: there are only two possible states in which

the process, from p's point of view, can start; for either p is superior

and o inferior, or the reverse; and expectations about C are not yet formed,

even though general expectations are relevant. The process must therefore

begin either in the state $\{+-\}$ [00] or $\{-+\}$ [00]--where general expectation

states are written first, and the specific performance characteristic is

that characteristic to which GES is relevant.

B. Task and interaction conditions

We will assume that in this initial status situation p is confronted

with an an n-step decision process, which in an experiment can be iden-

tified with n identical trials. At each decision step p and o must each

make a binary choice, say between the two alternatives A and B. The

decision, however, is a multi-stage decision: for, after making a preli-

minary selection of one of the two alternatives, actors are required to

exchange information about their choices and then to come to a final

decision. We envision a situation in which the process of exchanging

information about preliminary decisions is controlled by the experimenter,

so that, for example, we can manipulate subjects' beliefs that they agree

or disagree in their preliminary decision. Throughout we will restrict

ourselves to the special case in which p' and o are in continual disagreement.

At each decision step, finally, p is led to believe that there is one

"correct" and one "incorrect" alternative, but he is not provided with an

objective standard by which he can determine which alternative is correct.

P is assumed to believe (and in an experiment would have to be made to believe

by the experimenter's instructions) that only his final decision counts.

Further, the question of where his final decision comes from has been defined

to him as being of minimal or no importance. In other words, p is primarily

motivated to take that alternative which he thinks is correct, whether it is

his own preliminary decision or the preliminary decision of o.[3]

Now, given this sort of task, these interaction conditions, and the

initial status situation, our problem is to describe a process by which the

states of the specific performance characteristic C, and thus specific

self-other performance expectations, come to be attributed by p to him-

self and o. The process will have two general features: (1) it will

relate the actions of p at each decision step to his assignment of specific

expectations to self and other, and (2) it will, conversely, relate attributed

self-other expectations to the actions of p at each decision step. We

also divide the task of constructing this process in two parts: for,

first, we want to construct a set of action possibilities, which permit

us to specify exactly every possible path from the starting to the terminal

state of each decision step; second, we will want to assign probabilities

to each event, hence each path, in this set of action possibilities.

For the sake of clarity of exposition and ease of expression we separate

the discussion of these two parts, undertaking to define action possibilities

in the next sections, Sections C and D, and assigning probabilities in

Section E.

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[3] We distinguish a person-oriented situation, in which p wants to do well
himself, from a task-oriented situation, in which p wants the best answer
to a problem, regardless of source. Here we assume p is task-oriented.

C. Action possibilities

We have a situation in which p begins in one of two states, $\{+\}$ [00] or $\{-+\}$ [00], depending upon his state of the characteristic D. The task and interaction conditions are so structured that on each step of the process, p must make a preliminary decision in which he is required to choose which of two alternatives (say A or B) is more likely to be the correct one. In the case that p has initially evaluated the alternatives, his choice, is determined by those evaluations and we have,

Assumption 3.1. At any stage of the process: if p positively evaluates one alternative and negatively evaluates the second, then p will select the first and reject the second.

But p must make a choice even if he has not initially evaluated the alternatives. If p has not initially evaluated alternatives, but is never- theless required to make a choice, we assume that he will still come to evaluate positively the alternative he selects and evaluate negatively the alternative he rejects. We reason that the experimenter has defined the situation in such a way that p believes there is a correct answer. It is p's task to be correct. And when he selects an alternative, that alter- native will be viewed by o and by the experimenter as the alternative p believes to be correct. Therefore, p will come to feel that he is respon- sible for making correct decisions, and will want to see the alternative he has chosen as in fact the correct one. Hence, if p has not evaluated alternatives before making his choice,

Assumption 3.2. At any stage of the process: if p required to accept
one alternative as correct and reject the second as
incorrect, then p will differentially evaluate alter-
natives.

The principal significance of 3.2. is that p is assumed to believe

(and must be made by experimental instructions to actually believe) that

he has discovered some plausible basis for choosing one alternative rather

than another. He is not, for example, convinced that his choice is a

"guess", that if he obtained the correct answer it was purely a matter of

chance. In both cases we shall call the structure of the situation at

this initial stage p's preliminary choice structure. A digraph representing

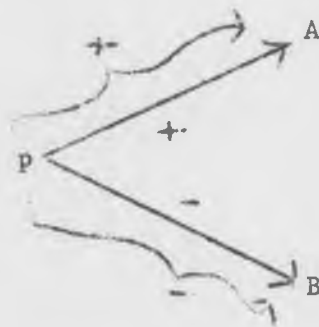the process at this initial stage is given in Figure 1.

Figure 1. P has positively evaluated and selected alternative A
and negatively evaluated and rejected alternative B.
Directed lines indicate evaluations, which can be posi-
tive (+) or negative (-). Directed braces indicate in
this case, selection (+) or rejection (-). (In this and
in all subsequent digraphs the labelling of A and B is
arbitrary.)

Once the preliminary choice structure has been completed and p's

decision made, p exchanges information with o and discovers, under the

conditions we are imagining, that o's preliminary decision disagrees

with that of p. We shall call the situation where p and o have selected
different alternatives an <u>act</u> <u>of</u> <u>disagreement</u> and we reason that it can
only imply for p that he and o have assigned different evaluations to
the alternatives, and, therefore, that he and o had different prelimi-
nary choice structures.

<u>Assumption</u> 3.3. At any stage of the process: P associates an act of
disagreement between self and other with differences
in evaluations of alternatives by self and other.

Again the point that is important is that p does not just assume o
was guessing when he made his choice. Just as p himself is assumed to
positively evaluate the alternative he has selected and to negatively
evaluate the alternative he has rejected, so too we expect p to believe
that <u>o</u> was not guessing, that o in fact also positively evaluated the
alternative <u>he</u> selected and negatively evaluated the alternative <u>he</u>
rejected. Confronted with disagreement, therefore, p believes that o
has also evaluated the alternatives, but differently.

P's conception of the situation at this new stage of the decision
step is represented by the digraphs in Figure 2. Note that now we have
a <u>self-other</u> choice structure, a graph that contains both p's choices
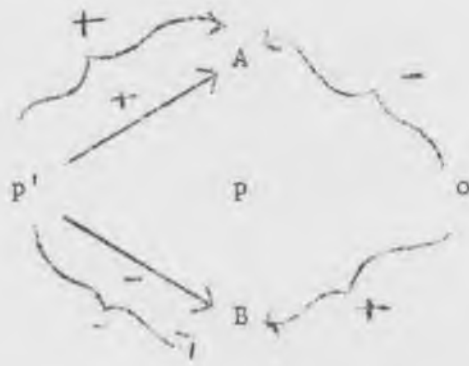and o's choices, as seen from p's point of view.

Figure 2a. P is given the information that o disagrees. The letter p' stands for p as an object of orientation to himself. (Note: Relations originating from p' represent p's perceptions of his own preliminary decision, which are now objects of orientation to p just as o's preliminary decision is.) P <u>views himself</u>, as well as o, as having selected and rejected certain alternatives.
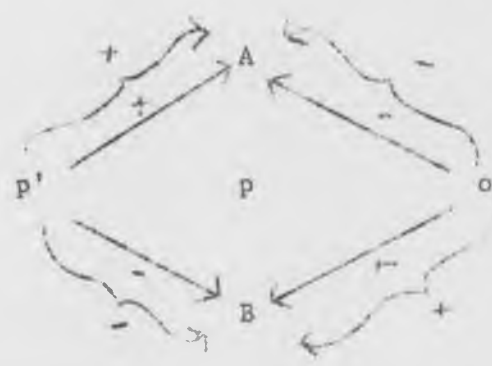
Figure 2b. P associates an act of disagreement with different evaluations of alternatives by himself and other. Evaluations from o to A and B represent inferences p makes on the basis of the observable choice structure shown in 2a.

Now p is forced to make a final decision. We conceive that there are probably two activities going on simultaneously, or possibly alternating with each other, at this stage. P probably is trying to decide <u>which</u> alternative is right and which wrong, A or B, and also <u>who</u> is right and who is wrong, p' or o. P might either decide about persons first, or about alternatives first; but he must in some way make a choice. At this stage of the process, of course, p's expectations about the specific performance characteristic do not provide any basis for choice. In fact, we will want to see how, as a <u>consequence</u> of making a final decision there is some impetus to assign states of C to p' and o.

If p is not able to decide who is right, he is still required to choose between the alternatives. Applying assumptions 3.1 and 3.2 to this stage we reason that p will come to differentially evaluate A and

B, and will select and reject them in accord with his evaluations. There
are two possibilities. Either p continues to view his preliminary choice
as correct, or p changes his evaluations of the alternatives and makes
a selection that accords with o's preliminary decision. We will call
these final decisions the observed response process and define:

Definition 3.1. P makes a P-response at any stage of the process if
                 his final selection of an alternative is the same as his
                 preliminary selection. P makes an O-response at any
                 stage of the process if his final selection of an alter-
                 native is the same as o's preliminary selection.

Whichever alternative p finally chooses, we reason that the outcome
of his choice is to assign unit evaluations to the persons, p' and o. (A
unit evaluation is an evaluation of p' or o's performance on a given step
of the process.) Further, his assignment of unit evaluations will coincide
with the evaluations p has made of the alternatives. Thus, for example, if
he makes a P-response then he will come to believe that "I was right and o
was wrong". If he makes an O-response he will come to believe that "I was
wrong and o was right".

In terms of the digraphs of p's self-other choice structure, this
is equivalent to assuming that p will complete his self-other choice
structure so that the digraph is balanced in the meaning of the term
given by Cartwright and Harary (1956).

If p is able to decide who is right then we argue that p will evaluate
the alternatives in accord with this decision and, applying assumption 3.1,
that p will make a P or an O response which is consistent with these evaluations.

Thus, whether p first evaluates alternatives or first evaluates persons

he will complete his choice structure in a balanced manner. Both possi-

bilities are taken into account in the following assumption.

Assumption 3.4. At any stage of the process: If p assigns positive and
negative evaluations to alternatives or to persons, he
will complete his self-other choice structure in a
balanced manner.

Two possible ways of arriving at a final complete and balanced struc-

ture are shown in Figures 3 and 4. Figure 3 is an example of the first process

described in assumption 3.4, in which alternatives are evaluated, then persons;

figure 4 is an example of the second process covered by assumption 3.4, in

which persons are evaluated, then alternatives. [Note: Relations originating

from p (rather than p'), in the center of the figure, represent p's actions
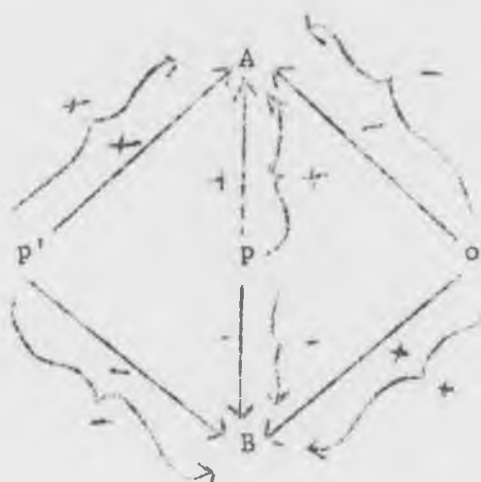
in making his final decision.]

Figure 3a. P makes a P-response, again selecting (and positively evaluating) alternative A and rejecting (and negatively evaluating) alterna-ive B. Final choices are shown on he central vertical axis of the digraph.
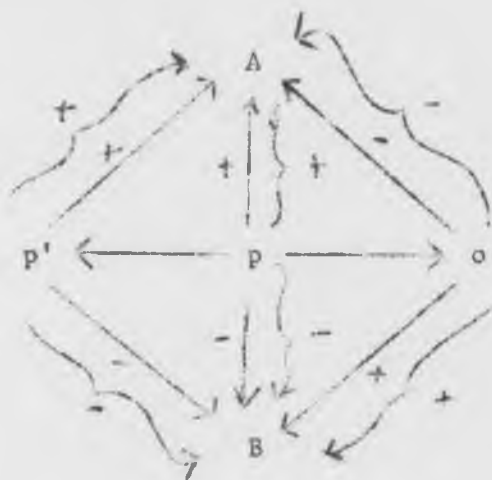
Figure 3b. P completes the self-other choice structure in a balanced manner by evaluating p' positively and o negatively.
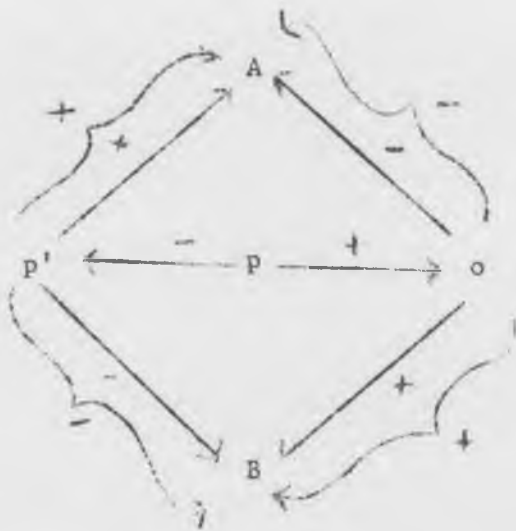
Figure 4a. P decides that he is
incorrect and o is correct, thus
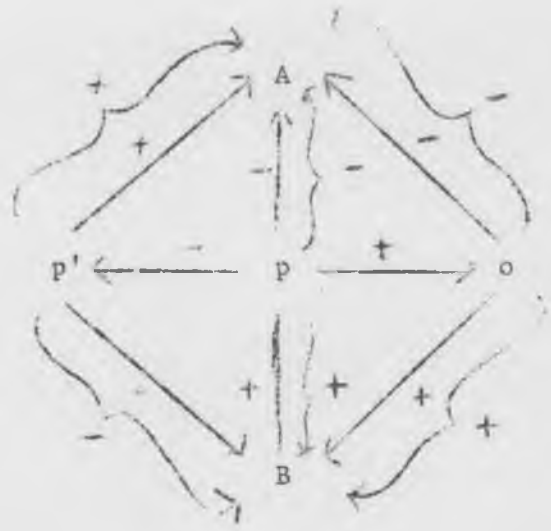assigning positive and negative
unit evaluations to p' and o.

Figure 4b. P completes the self-
other choice structure in a balan-
ced manner by selecting and posi-
tively evaluating o's preliminary
choice and by rejecting and nega-
tively evaluating his own preli-
minary choice.

Now consider the effects of this completed choice structure on p's

assignment of states of C to self and other. The assignment of unit

evaluations to p' and o, as an outcome of the resolution of dis-

agreement, has two important consequences. First, p may be led to believe

that he and o possess different states of C. Second, p may be led to

believe that he and o possess particular states of C, specifically those

that are balanced with the unit evaluations p has made. For example, from

the fact that, "I was right and he was wrong in this instance," p may be

led to believe, "We differ in this ability, and I am better at this task

than he is." Thus, as a result of differential unit evaluations the

possibility now exists that p will assign differentially evaluated states of

C to self and other, states of C that are in balance with p's unit evaluations.

But the assignment of states of C depends also on the diffuse status

characteristic D. For, from assumption 2.3 (page 10) we are led to expect

that assignment of states of C will occur only if they are balanced with

general expectation states attributed to p' and o on the basis of their

respective states of D. If p is in the expectations state $\{ +- \}$ [00], he

may entertain the possibility that "I am better on this ability than he is,"

if in a particular instance he has concluded, "I was right and he was wrong."

But if in a particular instance he has concluded "I was wrong and he was right,"

a possibility not precluded by our theory, we do not believe he will entertain

the idea that "He is better at this task than I am." In our view, the

resolution of disagreements on a given step in the process will lead to an

assignment of specific performance expectations only if such an assignment will

simultaneously balance unit evaluations and general expectation states.

Hence,[4]

Assumption 3.5. At any stage of the process: If p assigns unit evalu-
                 ations to persons, then the possibility exists that p
                 will also assign those states of C which balance with
                 his assignment of unit evaluations if and only if such
                 assignment is in balance with his assigned general
                 expectation states.

Let us consider the import of these assumptions for some specific

cases. Consider a p in a $\{ +- \}$ [00] expectation state who makes a P-response

on a given trial. By assumption 3.4, and the definition of P-response, he

---

[4] It is not intended at present that this assumption apply necessarily to
cases other than where p and o possess different states of D and where D is
activated. The process might operate quite differently in situations where,
for example, p and o both possess the high state of the characteristic D.

will assign a positive unit evaluation to self and a negative unit evaluation
to other. By assumption 3.5, there now exists a possibility that p will
assign the positively evaluated state of C to self and the negatively evaluated
state of C to other, since an assignment is consistent with both his unit
evaluations and his assignment of general expectation states to self and
other. Thus p may change his expectation state from $\{+-\}$ [00] to $\{+-\}$ [+-].
By a similar line of reasoning, the possibility exists for a p who starts
out in a $\{-+\}$ [00] expectation state, and makes an O-response to change his
expectations to $\{-+\}$ [-+].

Consider, on the other hand, a p who initially is in a $\{+-\}$ [00] state
and makes an O-response. By assumption 3.4 and definition of an O-response,
he will assign a negative unit evaluation to self and a positive unit evalu-
ation to other. But any assignment of states of C which balance with p's
unit evaluations will be imbalanced with the GES's that have been attributed
to p' and o. Hence, by assumption 3.5, such an assignment of states of
C cannot take place. Although we assume that p in this situation may be
under some pressure or tension, we expect him to remain in a $\{-+\}$ [00]
state as a result of this sequence of events. By a parallel line of
reasoning, we expect a p who is initially in a $\{-+\}$ [00] state and makes
a P-response to continue in a $\{-+\}$ [00] state.

Now suppose that, as a result of events at earlier stages of the
process, p has in fact assigned states of C to self and other. What can
we say about his behavior at later stages of the process? For example,
consider a p who, on a given step of the decision-making process is in a

$\{+-\}$ [+-] expectation state, faces a disagreement with o, and makes a
P-response. By assumption 3.4 p assigns positive unit evaluations to self
and negative to other. Such an assignment is consistent with his assign-
ment of states of C. We expect, therefore that his specific performance
expectations will continue unchanged to the next step of the process. By
a similar line of reasoning we argue that a p who on some step of the process
is already in a $\{-+\}$ [-+] expectation state, who faces a disagreement, and
who then makes an O-response, maintains his expectation state into the next
step of the process.

On the other hand, consider the case of a p who on some step of the
process is in a $\{+-\}$ [+-] state, who faces a disagreement and who then makes
an O-response. By assumptions 3.3 and 3.4, and the definition of O-response,
he assigns a negative unit evaluation to self and a positive unit evaluation
to other on this step. This creates an imbalance, and the question arises
whether this will affect his assignment of states of C. But if p were to
change his assignment of states of C, in order to bring about balance with
unit evaluations, he can only create, as a consequence, imbalance with his
assignment of general expectation states. By assumption 3.5 this reassignment
of states could not occur. Therefore we do not expect a p who has moved
to a $\{+-\}$ [+-] state and then made an O-response to change his expectation
state. Similarly we do not expect a p who has moved to a $\{-+\}$ [-+] state
who makes a P-response to change his expectations. Thus, one of the very
important consequences of our assumptions is that if p at some step of the
process once enters either a $\{+-\}$ [+-] or $\{-+\}$ [-+] expectation state, under

continual disagreement, he will remain in that state from that time on.

That p has assigned specific performance expectations at some stage of the process affects not only his expectation state from that time on; there is also the fact that now there is some basis for the assignment of unit evaluations where before there was not. Given that p has already assigned states of C to self and other, we can assume that this assignment will in turn affect how p assigns unit evaluations to persons in this self-other choice structure. For,

Assumption 3.6.   At any stage of the process: if p has already assigned positively and negatively evaluated states of C to self and other, then he will tend to assign positive and negative unit evaluations to p' and o in balance with his assignment of states of C.

Several important implications of assumption 3.6 should be noted. First, once p has assigned states of C to self and other, his process of making final decisions is more likely to be structured in the order: who is right and then what is right than was true before he assigned states of C. Second, taken together with earlier assumptions, 3.6 implies that a p in a {+-} [+-] state will be more likely than a p in a {+-} [00] state to make P-responses whereas a p in a {-+} [-+] state will be more likely than a p in a {-+} [00] state to make O-responses. In general, we assume p will not make responses that are imbalanced with his expectation states; thus, assumption 3.6 is crucial to understanding how the process comes to be self-maintaining.

D. An alternative formulation of assumption 3.6.

There is a plausible, more general formulation of assumption 3.6
that would allow for a more rapid process of assignment than the one we
have described. We have assumed that an individual in a $\{+-\}$ [00] state
or a $[-+]$ [00] state, when faced with the dilemma of a disagreement, has
no person basis for deciding who is correct before he decides which alter-
native is correct. Given our present knowledge it would be equally plausible
to assert that the general expectation states associated with the states of
D are themselves sufficient to provide a basis for deciding who is correct
and who incorrect. In that case, we might assume that unit evaluations of
persons precede evaluations of alternatives, and that the self-other choice
structure even at this early stage of the process will be completed so as to
balance with general expectation states. The effect of this in general would
be to make the $\{+-\}$ [00] and $\{+-\}$ [+-] states (or equivalently the $\{-+\}$ [00]
and $\{-+\}$ [-+] states) more nearly alike with respect to the likelihood of a
P- or an O-response than is the case in the formulation we have given in
section C. The alternative form of assumption 3.6 would be as follows,

Assumption 3.6.* At any stage of the process: if p has already assigned
positive and negative states either of general expectations
or of C, then he will tend to assign positive and negative
unit evaluations of persons in balance with his assignement
of states of general expectations or C.

Thus if only general expectation states have been assigned by p to
self and other, which is true at the initial stages of the process, these
expectation states will already affect how p assigns unit evaluations

to p' and o. Further if both general and specific states have been assigned
there is no question as to the manner in which unit evaluations are to be
assigned under assumption 3.6*. For by assumption 3.5 general and specific
states can come to be assigned if and only if the general and specific
expectation states are themselves in balance.

In what follows we will use assumption 3.6 but we will indicate, where
appropriate, differences in specific predictions between assumption 3.6 and
assumption 3.6*.

E. Assigning probabilities

The assumptions of Section C enable us to completely specify the
possible sequences of events, for any p on the nth step of the assignment
process, and the possible states that p might be in at the start of the
nth + 1 step. To each possible event we now want to assign a probability.[5]
For convenience we label expectation states in the following manner:

1 = ⟨+-⟩ [00]

2 = ⟨+-⟩ [+-]

3 = -+ [00]

4 = ⟨-+⟩ [-+]

From the assumptions we have made so far it is clear that there is
a possibility of a P-response, or alternatively of an O-response, for a p

_____

[5] It should be remarked at this point that the manner in which the next set
of assumptions are stated and even the fact that one can assign probabilities
to events anticipates a mathematical model such as the one which is described
Section IV.

in every one of the four possible expectation states. We will use the letter χ_i (where i = 1, 2, 3, 4, the index denoting the expectation state) to represent the probability of a P-response, and $\bar{\alpha}_i = 1- \alpha_i$, to represent the probability of an O-response. The assigned probabilities, then, are:

Assumption 3.7. Whatever p's expectation states and responses on the first n-1 steps, if p is in the ith expectation state on the nth step of the process, then he will make a P-response with probability α_i or an O-response with probability $\bar{\alpha}_i$.

The α_i are underived quantities in our theory and are determined experimentally. The most important feature of assumption 3.7 is that these probabilities do not depend on what step in the process we happen to be at. They depend only on p's expectation state and therefore are assumed to be the same for every step of the process. There are two further underived quantities: For a p in state 1 on the nth step of the process, there is some probability that he will, if he makes a P-response, move to state 2 to begin the nth + 1 step; correspondingly, for p in state 3 there is some probability that if he makes an O-response, he will move to state 4 to begin the nth + 1 step. Roman letters r and d denote these probabilities, respectively. Probabilities that states 1 or 3 are not changed, i.e., that p remains in those states, will then be $\bar{r} = 1 - r$, and $\bar{d} = 1 - d$.

Assumption 3.8. Whatever p's expectation states and responses on the first n-1 steps, if p is in expectation state 1 on the nth step of the process and makes a P-response, he will move to state 2 with probability r or remain in state 1 with probability $\bar{r}$.

Assumption 3.9.   Whatever p's expectation states and responses on the first
                  n-1 steps, if p is in expectation state 3 on the nth step of
                  the process and makes an O-response, he will move to state
                  4 with probability d or remain in state 3 with probability
                  d̄.

The principal force of assumptions 3.8 and 3.9 is that the probabilities

of transition from state to state depend only on p's expectation state at the

nth step, together with his response on that step. Thus, changes in expecta-

tions do not depend on the whole past history of the expectation process.

Furthermore, assumptions 3.8 and 3.9 assert that the probabilities r and d

are the same at every step of the process; they are not seen to change as

the process itself advances.

Finally: in section C, where we have specified the set of action

possibilities that can occur at any stage of the process, we sometimes

assumed that only one possibility could occur. For example, although the

response alternatives ordinarily allow both a P- and an O-response, when p's

choice structure assigns a positive evaluation to p' and a negative evaluation

to o, and O-response is not possible. Furthermore, once p is in expectation

state 2 or 4 we no longer permit any possibility of changing expectation state.

In such cases we may speak of a unique alternative at a given stage of the

process, and,

Assumption 3.10. At any stage of the process: given a unique alternative for
                  p, that alternative occurs with probability 1.

To illustrate how the assumptions about the action space, together

with the assumptions about assigning probabilities, completely define the

process of assignment, Figure 5 shows the structure of the nth step of the process starting from any expectation state. For example, Figure 5a shows a step in the assignment process for an actor starting in state 1. Disagreement, experimentally controlled, occurs with probability 1. The disagreement is resolved with a P-response with probability α_1. If a P-response occurs, p changes his expectation state to state 2 with probability r. If p changes his expectation state, the nth+1 step of the process begins with p in state 2 (Figure 5b), from which state he may make a P-response with probability α_2 or an O-response with probability $\bar{\alpha}_2$, but from which in either case he does not change expectations. Figures 5c and 5d may be read in the same straightforward manner.

Figure 5. P's action space on the nth and n+1 step
of the process, given p in any of the four
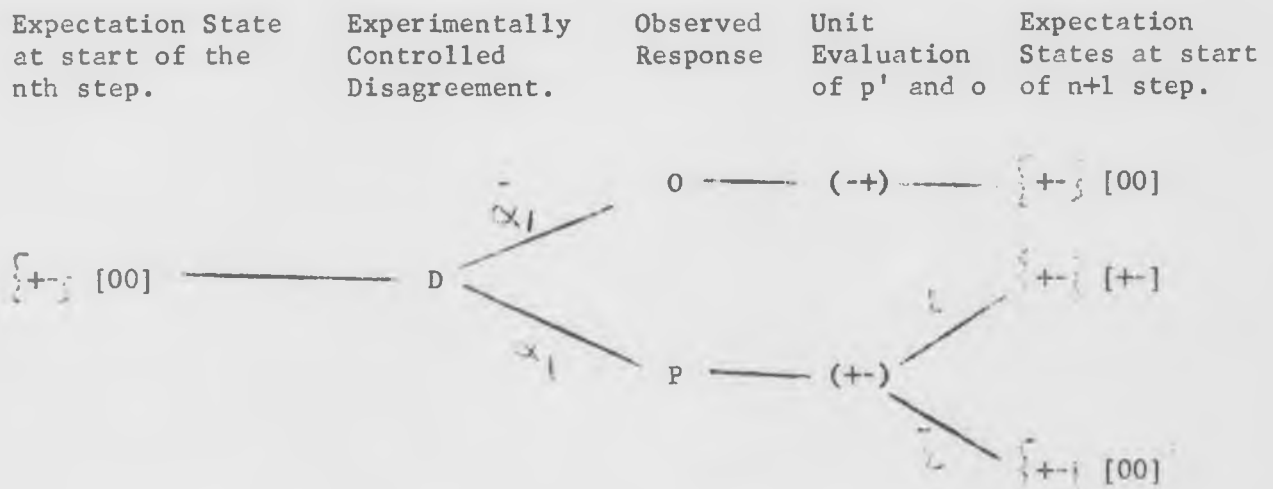expectation states on the nth step.

Expectation State at start of the nth step.	Experimentally Controlled Disagreement.	Observed Response	Unit Evaluation of p' and o	Expectation States at start of n+1 step.

Figure 5a. P starts step in state 1.

Expectation State at start of nth step.	Experimentally Controlled Disagreement	Observed Response	Unit Evaluation of p' and o	Expectation State at start of n+1 step.

{+-} [+-] ——————— D

{-} ɑ̄
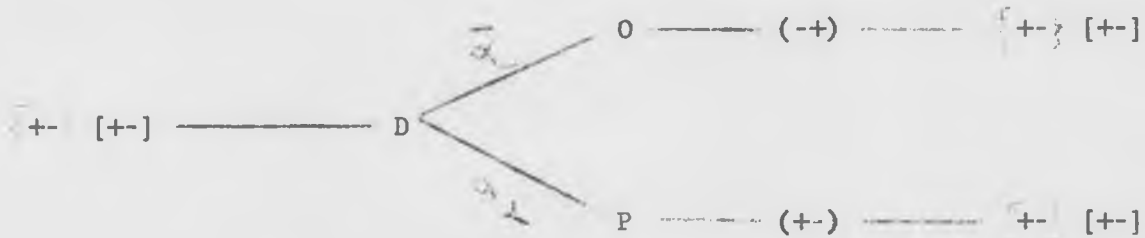O ——— (-+) ——— {+-} [+-]

ɑ
P ——— (+-) ——— {+-} [+-]

Figure 5b. P starts in state 2. In view of assumption 3.6 we might reverse the order in which the observed response and unit evaluations occur; since, however, they are in 1:1 correspondence it makes no difference in which order they occur in the figure.
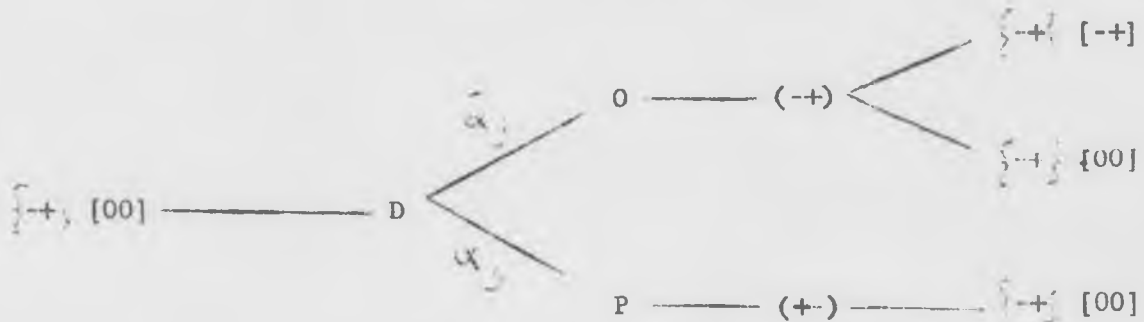
{-+} [00] ——————— D

ɑ̄
O ——— (-+)
{-+} [-+]
{-+} [00]

ɑ
P ——— (+-) ——— {-+} [00]

Figure 5c. P starts in state 3.

{-+} [-+] ——————— D

 σ̄₄
O ——— (-+) ——— {-+} [-+]
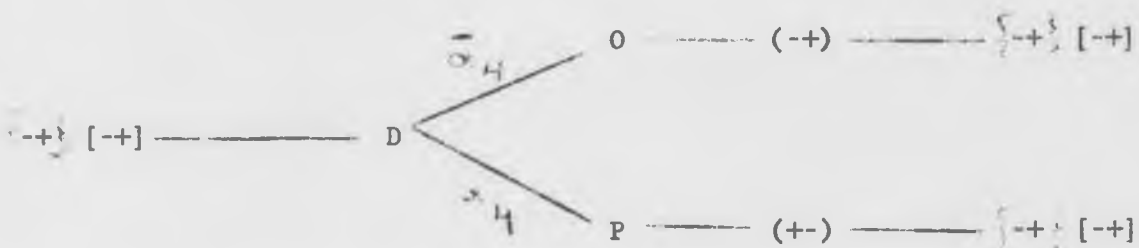
ɑ₄
P ——— (+-) ——— {-+} [-+]

Figure 5d. P starts in state 4. Again the order in which unit evaluations and observed response occurs might be reversed without altering the outcome.

IV. Formalization of the Allocation Process.

In formalizing our theory we take as the basic units of analysis the four types of expectation patterns p can hold, and the two types of resolution behavior in which he can engage, i.e., making a P response or making an O-response.

As the n-step process proceeds, the subject makes a sequence of P- or O-responses and moves through the basic expectation states $+-$ [00], $+-$ [+-], $-+$ [00], $-+$ [-+]. We assume that movement through the expectation states can be described by means of a Markov chain whose states are the four expectation patterns. To specify this chain we must specify the transition probabilities P_{ij}; that is, the probability that the subject moves to state j on the nth + 1 step of the process given that he is in state i on the nth step. We compute these probabilities by making use of the assumptions of Section III, which determine the possibilities and probabilities of p's action space. The structure of this action space has been represented in Figure 5. From the tree diagrams in Figure 5, we can determine the transition matrix P, for the expectation process. We shall refer to this Markov chain as the expectation process.

Matrix of One-step Transition Probabilities for the Expectation Process

	nth + 1 step			
	$+-$ [00]	$+-$ [+-]	$-+$ [00]	$-+$ [-+]
$+-$ [00]	$(1-\alpha_1 r)$	$\alpha_1 r$	0	0
$+-$ [+-]	0	1	0	0
$-+$ [00]	0	0	$(1-\alpha_3 d)$	$\alpha_3 d$
$-+$ [-+]	0	0	0	1

P, nth step

Table 1

During the course of p's decision-making process this expectation

process is not observed. The expectation states have the function of

theoretical constructs in our model.[6] In general terms what is being

assumed in this, and other expectation models, is the following pattern

of events. At all times p is in an expectation state, and given a

situational event--such as a disagreement with o--his response to that

event is determined by the expectation state he is in. Thus, his expectations

will affect the way he responds to his environment. But there is another

crucial facet to this relation between p and his environment; namely, the

effect of his response on the expectation state he is in. In general,

p's response may (1) have no effect on his expectation state--as in the

case where he moves from a $+-$ [00] state to a $+-$ [00] state; or (2) it

may "disconfirm" his expectation state--as when he makes a P-response

and pressures are generated on p which may result in change of state, for

example, moving from a $+-$ [00] to a $+-$ [+-] state; or (3) it may

"confirm" his existing expectation states--as when he makes a P-response

and moves from a $+-$ [+-] to a $+-$ [+-] state. Thus in terms of our

model, p's behavior is described as a probabilistic function of his

expectation state--given a situational event; and p's expectation state

is in turn a probabilistic function of his behavior--given a particular

response to his environment.

At the initial step of the process, we know p's general expectation

_____

[6]Cf. Berger, Cohen, Snell, and Zelditch, 1962.

state and assume that he has not assigned states of C to himself and o;
hence p by assumption is either in $\{+-$ [00] or $\{-+\}$ [00]. For the
remainder of the process, p's expectation state is unknown and unobservable,
so that we are interested in reasoning from his observable response
process to his expectation process and, in turn, from the expectation
process to his response process. We now turn our attention to this
problem.

The transition matrix P can be partitioned into four submatrices;
a matrix P_1, describing the expectation process for the states $\{+\cdot\}$ [00]
and $\{+-\}$ [+-]; a matrix P_2, for the process involving the states $\{-+\}$ [00]
and $\{-+\}$ [-+]; and two zero matrices M and N which, respectively, describe
the process from states 1 and 2 to 3 and 4, and 3 and 4 to 1 and 2. As a
consequence of our assumptions, P_1 and P_2 may be used independently in
describing the behavior of p; whether P_1 or P_2 is applicable depends upon
p's initial state of D, which is always known. M and N are not relevant
to our problem of describing p's behavior.

For convenience, P_1 is presented below. All observations to be
made about P_1 can be translated to comparable observations about P_2.
P_1 represents the one-step transition probabilities of a two-state Markov
chain for the expectation process for a p who enters S with the positi-
vely evaluated state of the diffuse status characteristic. In using P_1
(or P_2), we assume that the response of the subject depends only on the
expectation state he holds on the nth step and not, for example, on his
response on the nth - 1 step. The effect of his responses on the nth - 1

step is already represented in our model by the expectation state he
has moved to on the nth step, given his prior response.

Matrix of One-step Transition Probabilities for Expectation Process involving
States $\{+-\}$ [00] and $\{+-\}$ [+-]

nth + 1 step

$$
P_1 = \quad
\begin{array}{c}
\text{nth} \\
\underline{\text{step}}
\end{array}
\quad
\begin{array}{c}
\{+-\}\ [00] \\
\{+-\}\ [+-]
\end{array}
\qquad
\begin{array}{cc}
\{+-\}\ [00] & \{+-\}\ [+-] \\
\left(\begin{array}{cc}
(1-\alpha_1 r) & \alpha_1 r \\
0 & 1
\end{array} \right)
\end{array}
$$

Table 2

In fact, P_1 is an absorbing Markov chain, representing the fact that,
under continual disagreement, we expect p to eventually end up in an
expectation state compatible with the interaction process, and, once
there, to remain. While our model predicts that p will be absorbed into
an expectation state, it does not predict that p will absorb into a P
or O-response. It predicts that once p is in the absorbing expectation
state $\{+-\}$ [+-], he will make P-responses with probability α_2 and O-responses
with probability $\bar{\alpha}_2$. This can be easily seen by reviewing the tree diagram
of p's action space for these states shown in Figures 5a and 5b, Section III.

To fully describe p's behavior in S, given that we always know his
initial expectation state, we must therefore estimate the values of three
parameters α_1, r, and α_2. To do this we make use of the formal properties

of this type of Markov chain to derive theoretical quantities describing various aspects of p's behavior in S. Given empirical estimates for these quantities, empirical estimates for our parameters α_1, r, and α_2 can then be obtained. With these, the behavior of p can be probabilistically described in S. To test our model, still other theoretical quantities, logically independent of those used in estimating α_1, r, and α_2, are derived from our stochastic model. These are then compared with our predicted quantities, given estimates for α_1, r, and α_2.[7]

To illustrate the nature of one of these quantities which can be derived from our model, we shall consider a quantity which gives us the predicted sequence through time of P-responses, the "P-response curve." To obtain the P-response curve, for a subject starting out in a given expectation state, we need the mean number of P-responses on the nth trial given that p is initially in state i.

It can be shown[8] that for our model the mean number of P-responses on the nth trial if the process starts in state 1 is

(1) M_1 [# of P-responses on nth trial] $= \alpha_2 + (\alpha_1 - \alpha_2)(1 - \alpha_1 r)^n$

while the mean number of P-responses on the nth trial if the process starts in state 3 is

_____

[7] For additional discussion of estimating and testing quantities, see Appendix.

[8] See Appendix for the derivation of these two quantities.

(2) M_3 [# of P-responses on the nth trial] $= \alpha_4 + (\alpha_3 - \alpha_4)(1 - \alpha_3 d)^n$

From expressions (1) and (2) families of curves can be generated which describe the behavior of p, through time, given an initial state of the characteristic D. It should be observed that each expression is the sum of two components, and that the components on the right tend to zero as n increases. This represents one of the important consequences of our theory and model; namely that under the fixed conditions of interaction in S, p's behavior will approach a stable pattern.

To illustrate the use of these quantities, assume $\alpha_1 = \alpha_3 = .6$, $r = d = .2, \alpha_2 = .8$, and $\alpha_4 = .3$. Then from (1) and (2) we obtain specific curves for the observable responses of p, given that he is initially a $\{+-\}$ [00] or $\{-+\}$ [00] expectation state. These curves are given in Figure 6.
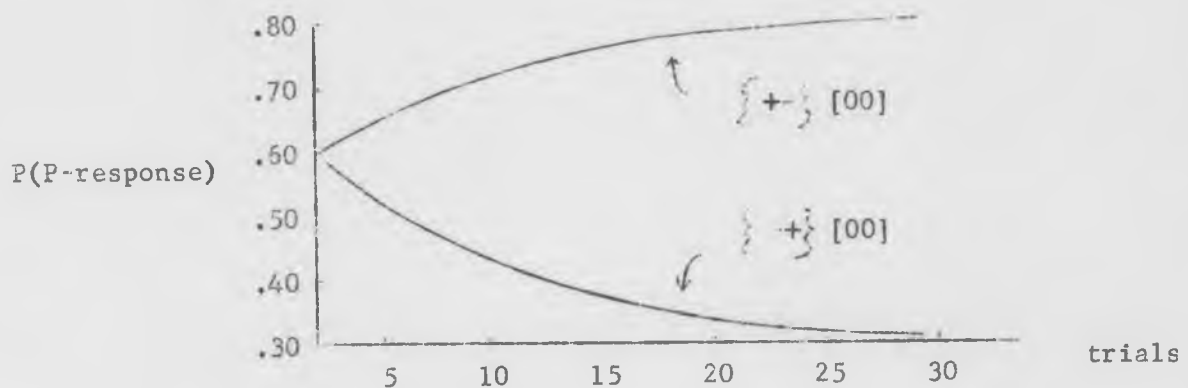

Figure 6

In general, these theoretically predicted response curves will depend only upon p's initial state and the values of the parameters in our specific interaction situation.

We can note with respect to the above examples that different response curves would have been obtained if assumption 3.6* held rather than 3.6 (assuming, of course, that all remaining assumptions hold). Assumption 3.6* would have lead us to predict that $x_1 > x_3$ and that the response curves for the starting states under the two different assumptions would differ as follows:

(1) the response curve for a p initially in a $\{+-\}$ [00] state would begin at a larger value

(2) the response curve for a p initially in a $\{-+\}$ [00] state would begin at a smaller value

(3) both curves would be flattened because the asymptotic value of each curve will not much differ from the initial value.

These changes are illustrated in Figure 7 where for each starting state the solid lines are the response curves given previously (see Figure 6) and the dotted lines are possible response curves under assumption 3.6* for $x_1 = .75$, $x_3 = .50$.
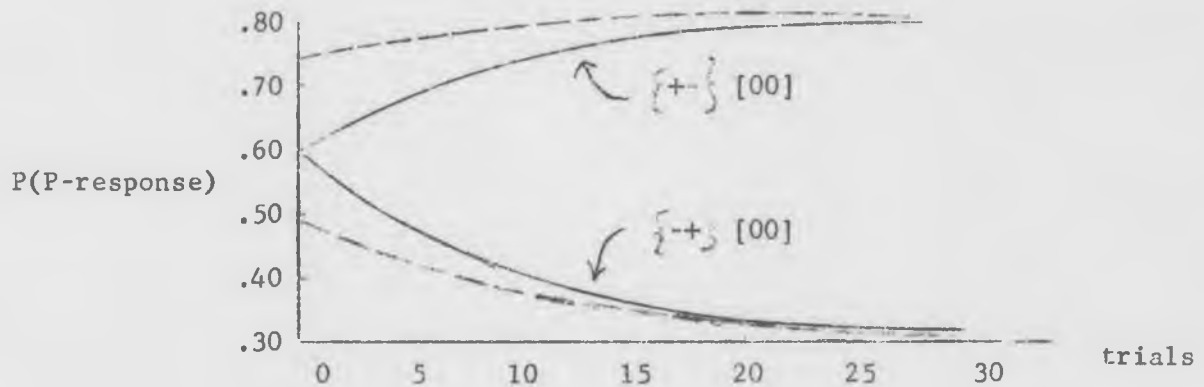
Figure 7

It is important to observe that we can empirically distinguish between the two assumptions as a consequence of our having extended the theory in a formal manner to a specific action process. Without this formalization it would have been difficult to have made precise enough predictions to have decided between the two assertions. Whether assumption 3.6* holds rather than assumption 3.6 is an open question which can now be decided by empirical test.

V. Summary

Our starting point has been experiments of Strodtbeck, Torrance, Hurwitz, Zander, and Hymovich, and others, in which actors faced with a valued, collective task, who differ with respect to characteristics like sex, color, occupation, etc., are observed to differ also with respect to power and prestige in the group, in such a way that the status differences correlate with the power-prestige differences. We reason

that: (1) Because actors care about the outcome, they are trying to discover any cue that will indicate to them who will have the best solutions; (2) such cues, in the absence of any other basis will be provided by any characteristic that has the following three properties-- it is differentially evaluated, associated with specific performance characteristics, and associated with general, or global, expectations of inferiority and superiority; (3) though initially, whatever the characteristic that is relevant to the task-outcomes, actors have not attributed specific performance expectations to each other in the situation, they will come to see the status-characteristic as relevant and use it as a basis for assigning expectations about performance of the task at hand; unless, of course, they have specific prior knowledge that the status characteristic is not relevant; (4) if the status-characteristic is seen as a basis for assigning specific performance epxectations, we expect the assignment to occur in only one way: namely, so that the general and specific expectations are balanced; (5) finally, the observed power-prestige order can be viewed as a function of the underlying expectation states, so that if these are balanced with the status-characteristic, the power-prestige order will be found to correlate with it.

We have extended this theory to a dynamic model of a specific action process through which allocation can take place. We are given as further conditions that p and o are in an n-step, multi-stage, non-veridical, decision-making situation at each step of which they are required to make a binary choice, exchange information about their choice, are experimentally

manipulated so as to discover that they disagree, and then must make a
final decision. On resolving this disagreement they will come to believe
one actor right, the other wrong; and there will be some pressure to
generalize these unit-step evaluations to ascertain the relative abilities
of the two actors at the task. This will occur only if such assignment
is balanced with the general expectation state. Once assigned, the
specific performance expectations then come to determine the action
process. The process of change in the underlying expectation states we
have formulated as a Markov chain of which the observed response process
is a probabilistic function.

The relation of the two parts, Section II and Section III, merits
some further comment. As was noted in the introduction the specific
action process we have formulated is only one of several that might be
imagined: for example, still using the expectation action situation
referred to in Section II (see footnote 1), one might have looked at an
actor p who, in making a decision, had the right to ask help of two
other actors, o_1 and o_2, who differed with respect to a diffuse status
characteristic. The observed response process would then have been a
request for help from one or the other actor, while the underlying
process would still be one in which p attributed expectations to the
other two. Hence the theory of Section II does not compel us to look
on the formulation in Section III as the one and only dynamic model
consistent with it; indeed if this were not the case one could raise
serious questions as to the usefulness of the theory.

APPENDIX

Estimation of Parameters and Testing of the Model*

I. Estimation of Parameters

We will begin estimation of the parameters of the model with estimation of α_1 and α_3. Since the estimation of both quantities is essentially identical in procedure, we will treat in detail only the estimation of α_1.

The estimation of α_1 is based on the fact that if p begins the process in state 1, he cannot change state until he makes a P-response. This means that the length of an initial run of 0-responses is a function only of α_1 and not of change-of-state parameters. Hence, it suffices to obtain an expression for the expected value of the length of an initial run of 0-responses in order to estimate α_1.

The probability that the length of an initial run of 0-responses is n trials can be found by observing that:

the probability that the length is 0 trials is α_1,

the probability that the length is 1 trial is $\bar{\alpha}_1 \alpha_1$,

the probability that the length is 2 trials is $\bar{\alpha}_1^2 \alpha_1$,

and so on

It can thus be shown that the probability that the length is n trials is given by

$$\bar{\alpha}_1^n \alpha_1 .$$

---

* The results of this section are based on work done by one of the authors and J. Laurie Snell, Department of Mathematics, Dartmouth College.

The expected value of this probability mass function is given by

$$\sum_{n=0}^{\infty} n \, \bar{\alpha}_1^{\, n} \, \alpha_1 \, ,$$

which is a familiar form whose sum is given by

$$\frac{\bar{\alpha}_1 \, \alpha_1}{(1 - \bar{\alpha}_1)^2} \, ,$$

which can be simplified to

$$\bar{\alpha}_1 / \alpha_1 \, .$$

This means that if k is the observed mean value of the length of initial 0-response runs, then α_1 can be easily estimated by setting $\bar{\alpha}_1 / \alpha_1$ equal to k. When this is done,

$$\hat{\alpha}_1 = \frac{1}{1 + k} \, .$$

The estimation of α_3 is along similar lines, with the difference that the length of initial runs of P-responses is the quantity of interest. Hence, if c is the observed mean value of the length of initial P-response runs for a p who begins in state 3, then

$$\hat{\alpha}_3 = \frac{c}{1 + c} \, .$$

The estimation of α_2 and α_4 is somewhat more difficult. Since, as in the previous case, the estimation procedure for each parameter is

essentially identical, we will deal in detail only with α_2.

Recall from Section IV that our model of the expectation process is an absorbing Markov chain with a single absorbing state. To estimate α_2 we need only observe that once the process has reached absorption it becomes an independence trials process and the best estimate of α_2 is simply the mean proportion of responses which are P-responses while the process is in absorption. Hence the problem of estimating α_2 reduces to the problem of obtaining an estimate of how many steps it takes for the process to reach absorption. Such an estimate can be obtained by using the value of α_1 and various hypothetical values of r in carrying out simulation runs on a high-speed computer.

The final two parameters to be estimated are r and d. Again, we will describe only the estimation of r, since d is estimated in an essentially identical fashion. The simplest expression which is sufficient for the estimation of r is the expression for the expected value of the number of P-responses in N trials. Such an expression is obtained as follows. Let U_n^P (n = 0,1, ..., N-1) be a counting function which takes on the following values:

$U_n^P = 1$ if response on trial n is a P-response

$U_n^P = 0$ if response on trial n is an O-response

If $S_N^P = U_o^P + U_1^P + \ldots + U_{N-1}^P$, then the expected value of S_N^P given that the process starts in state 1, $E_1 (S_N^P)$, is the expression desired.

$$E_1 (S_N^P) = E (U_o^P + U_1^P + \ldots + U_{N-1}^P)$$

$$= E (U_o^P) + E (U_1^P) + E (U_{N-1}^P)$$

The expected value of U_n^P can be found by noting that

$$E_1 (U_n^P) = P_1 (U_n^P = 1)$$

and that

$$P_1 (U_n^P = 1) = P(U_n^P = 1/Z_n = 1) P_1 (Z_n = 1) + P(U_n^P = 1/Z_n = 2) P_1 (Z_n = 2)$$

where Z_n is a random variable which takes on the value 1 if the expectation state on trial n is state 1 and the value 2 if the expectation state is state 2.

It can be clearly seen from Figure 5, that

$$P(U_n^P = 1/Z_n = 1) = \alpha_1 \text{ and } P(U_n^P = 1/Z_n = 2) = \alpha_2 .$$

The expressions for $P_1 (Z_n = 1)$ and $P_1 (Z_n = 2)$ are obtained from the one-step transition matrix of the Markov chain which is labeled P_1;

$$P_1 = \begin{array}{cc} & \begin{array}{cc} 1 & \qquad\qquad 2 \end{array} \\ \begin{array}{c} 1 \\ 2 \end{array} & \begin{pmatrix} 1 - \alpha_1 r & \alpha_1 r \\ 0 & 1 \end{pmatrix} \end{array} .$$

It can be shown that the probability that the process is in any particular state at trial n is given by a vector π_n which is equal to $\pi_o P_1^n$ where π_o is the initial vector of the chain.[1] In this case, $\pi_o = (1\ 0)$.

———————————

[1] For a more detailed treatment of Markov chains, see Kemeny and Snell (1960)

Raising P_1 to the nth power gives

$$
P_1^n = \begin{array}{c} 1 \\ \\ 2 \end{array} \begin{pmatrix} \overset{1}{(1-\alpha_1 r)^n} & \overset{2}{1-(1-\alpha_1 r)^n} \\ 0 & 1 \end{pmatrix} .
$$

Hence

$$
\pi_n = \begin{pmatrix} \overset{1}{(1-\alpha_1 r)^n} & \overset{2}{1-(1-\alpha_1 r)^n} \end{pmatrix} .
$$

This means that

$$
P_1(Z_n = 1) = (1-\alpha_1 r)^n
$$

$$
P_1(Z_n = 2) = 1-(1-\alpha_1 r)^n
$$

hence that

$$
P_1(U_n^P = 1) = \alpha_1 (1-\alpha_1 r)^n + \alpha_2 [1-(1-\alpha_1 r)^n]
$$

Therefore,

$$
E_1(S_N^P) = \sum_{n=0}^{N-1} P(U_n^P = 1)
$$

$$
= \sum_{n=0}^{N-1} \left[\alpha_1(1-\alpha_1 r)^n + \alpha_2[1-(1-\alpha_1 r)^n] \right]
$$

$$
= N \alpha_2 + (\alpha_1 - \alpha_2) \sum_{n=0}^{N-1} (1-\alpha_1 r)^n
$$

$$= N \alpha_2 + (\alpha_1 - \alpha_2) \left[\frac{1-(1-\alpha_1 r)^N}{\alpha_1 r} \right]$$

for large N

$$E_1(S_N^P) \cong N \alpha_2 + \frac{(\alpha_1 - \alpha_2)}{\alpha_1 r} .$$

We next observe that had the process begun in the absorbed state that

$$E_A(S_N^P) = N \alpha_2 .$$

Taking the difference $E_1(S_N^P) - E_A(S_N^P) = \Delta^P$ we obtain

$$\Delta^P = \frac{(\alpha_1 - \alpha_2)}{\alpha_1 r} .$$

Using the previously obtained estimates of α_1 and α_2 and the observed values of Δ^P, we obtain an estimate of r.

II. Testing the Model

There are a great many   empirical quantities which can be used to test the model, given that we have estimates for the parameters. A quantity of particular interest is the expected value for the number of alternations in N trials. An alternation is defined for any two adjacent responses as the occurrence of either a P-response on the first and an O-response on the second or vice versa. We will define a counting function for alternations as follows:

$U_n^A = 1$ if the response on trial n is a P-response and the

response on trial n+1 is an O-response or vice versa.

$= 0$ otherwise.

Then,

$$P_1(U_n^A = 1) = P(U_n^A = 1/Z_n = 1) \, P_1(Z_n = 1) + P(U_n^A = 1/Z_n = 2) \, P_1(Z_n = 2)$$

From Figure 5 of Section III we obtain

$$P(U_n^A = 1/Z_n = 1) = \bar{\alpha}_1 \, \alpha_1 + \alpha_1(r \, \bar{\alpha}_2 + \bar{r} \, \bar{\alpha}_1)$$

$$P(U_n^A = 1/Z_n = 2) = 2 \, \alpha_2 \, \bar{\alpha}_2 \; .$$

Therefore,

$$P_1(U_n^A = 1) = (1 - \alpha_1 r)^n \, (\gamma_1 \, \bar{\alpha}_1 + \alpha_1 \, \bar{\alpha}_1 r + \alpha_1 r \, \bar{\alpha}_2) + 2[1 - (1 - \alpha_1 r)^n] \, \alpha_2 \bar{\alpha}_2 \; .$$

The above expression is itself useful and can be used to generate a response curve for alternations, i.e., the probability that an alternation occurs on the nth step of the process, which can be compared to the observed proportion of alternations at each step of the process. However, we are primarily interested in the expected value for the total number of alternations in N trials.

Hence, let

$$S_N^A = \sum_{n=0}^{N-2} U_n^A \; .$$

Then

$$E_1(S_N^A) = \sum_{n=0}^{N-2} E(U_n^A)$$

$$= \sum_{n=0}^{N-2} P(U_n^A = 1)$$

$$= \sum_{n=0}^{N-2} \left[(1-\alpha_1 r)^n \left(\alpha_1 \bar{\alpha}_1 + \alpha_1 \bar{\alpha}_1 \bar{r} + \alpha_1 r \bar{\alpha}_2 \right) + 2\alpha_2 \bar{\alpha}_2 \left[1-(1-\alpha_1 r)^n\right] \right]$$

$$= 2(N-1)\,\alpha_2 \bar{\alpha}_2 + \left(\alpha_1 \bar{\alpha}_1 + \alpha_1 \bar{\alpha}_1 \bar{r} + \alpha_1 r \bar{\alpha}_2 - 2\alpha_2 \bar{\alpha}_2 \right) \left[\frac{1-(1-\alpha_1 r)^{N-1}}{\alpha_1 r} \right]$$

which is the desired expression.

For large N we have

$$E_1(S_N^A) \approx 2(N-1)\,\alpha_2 \bar{\alpha}_2 + \frac{\left(\alpha_1 \bar{\alpha}_1 + \alpha_1 \bar{\alpha}_1 \bar{r} + \alpha_1 r \bar{\alpha}_2 - 2\alpha_2 \bar{\alpha}_2 \right)}{\alpha_1 r} .$$

Substituting estimated values for the parameters in the above expression gives a predicted value for the mean number of alternations over N trials.

Other quantities which can be used to test the model will not be derived formally. Rather they are listed below with the appropriate mathematical expressions.

(i) Assuming p starts in state 1, the mean number of times that the responses on trial n and n + 1 are both P-responses is given by

$$(N-1)\,\alpha_2^2 + \left[\alpha_1^2 \bar{r} + \alpha_1 \alpha_2 r - \alpha_2^2 \right] \left[\frac{1-(1-\alpha_1 r)^{N-1}}{\alpha_1 r} \right] .$$

(ii) Assuming p starts in state 1, the mean number of times that the responses on trial n and n + 1 are both O responses is given by

$$(N-1)\,\bar{\alpha}_2^2 + \left[\bar{\alpha}_1^2 - \bar{\alpha}_2^2 \right] \left[\frac{1-(1-\alpha_1 r)^{N-1}}{\alpha_1 r} \right] .$$

(iii) The mean number of initial P-response runs for p starting in state 1 is given by

$$\frac{\alpha_1 \bar{\alpha}_2 + \alpha_1 \alpha_2 r}{\alpha_2 (1 - \alpha_1 r)} .$$

It is generally true that these quantities are logically independent of each other and of alternations. An exception, however, is that the expression for alternations determines the sum of (i) and (ii).

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