

Theory and Formalization: Some Reflections on Experience*

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*I describe in this paper some of my efforts in developing formal theories of social processes. These include work on models of occupational mobility, on models to describe the emergence of expectations out of performance evaluations, and on the graph theory formulation of the Status Characteristics theory. Not all models have been equally significant in developing theory. However, the graph theory formulation **has** played a central role in the growth of the Expectation States program. It has been involved in the generalization of theories, the integration of theories, and in the construction of highly sensitive tests of theories that would be impossible without the inferential capacities of formalization.*

Throughout my career, my primary research goal has been to develop abstract and general theories of different types of interpersonal processes and in particular developing theories that evolve, proliferate and grow. It is in this context that I have come to view formalization as being instrumental to achieving this goal.

There was very little in my graduate training in sociology at Harvard in the beginning of the 1950s that prepared me for work on formal theory. While there was much talk about the future prospects of formalization, and Bush and Moesteller were beginning their collaboration on learning models, few individuals at Harvard during that time were actually trying to develop formal theory in sociology.

DARTMOUTH AND MOBILITY MODELS

My first real exposure to the idea of formal theory and formalization came with my appointment at Dartmouth in 1954. I arrived at Dartmouth at the same time as John Kemeny. John Kemeny, an extremely talented individual, was a man with a mission. His mission was to develop new mathematics—mathematics based on the specific substantive needs and the specific substantive problems found in the social sciences. To realize that objective, he was in the process of assembling a group of bright young mathematicians including J. Laurie Snell, Gerald L. Thompson, and Robert Z. Norman to work with him. I was very impressed with this group of researchers and with the work they were doing, and I soon became involved with these activities.

In 1956, in collaboration with J. Laurie Snell, I worked on applying finite Markov Chain theory to the study of social mobility—in particular a class of Markov Chains representing what we called equal exchange processes. Finite state Markov Chain theory is a probability theory that describes the evolution of a process as it moves from state to state in a system through time. For example, in the case of occupational mobility one might take the states of the system to be various occupational classes and the process of concern the movement of individuals from the occupational class of their fathers to their own in a unit generation. In such a model, two assumptions are crucial. First, predictions of the proba-

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bilities of moving to some future state depend only on the knowledge of the present state of the system, e.g., father's occupational class. Second, the probabilities of moving from one state to another through a unit of time is the same for all relevant time periods, e.g., the mobility process is stable through the time periods under investigation.

Fundamentally, the questions Snell and I were concerned with were of the most basic nature, such as: What is required to represent adequately the mobility process with this formal theory? How do we represent the process if the probabilities of moving from one occupational class to a second are not stable through time? How do we handle the problem of differential birth rates associated with different occupational classes? Moreover, under what conditions will the combining of occupational classes continue to represent a Markov process if finer specification of classes is taken to be the Markov process? We presented some of the results of our research in a paper on equal exchange processes, Berger and Snell (1957) and in the section on mobility theory in Kemeny and Snell's well-known book on *Finite Markov Chains* (1960).

At the time that we worked on these issues in the 1950s, all these questions seemed interesting, important and, for the most part, hard to solve. It was not clear, however, that they were all substantively significant problems. To begin with, the mobility process we sought to describe was obviously the outcome of many different processes such as changes in the occupational structure, changes in the birth and death rates of different occupational classes, as well as changes in the mobility process itself. As I saw it at the time, in modeling mobility we were **not** dealing with the outcome of some unitary process. Second, there was very little in the way of substantive theory at the time that we could use. Therefore, our modeling was not theory-driven. We were trying our best to represent the mobility process as adequately and faithfully as we understood the process, and we had a limited amount of empirical information to work with. However, it was already clear that more than a straightforward application of Markov Chain theory was required in order to represent the mobility process (Berger and Snell 1961). What is perhaps worth noting is that many of the interesting problems we dealt with were primarily mathematical problems, such as the mathematical conditions for the combining of occupational classes or the mathematical conditions of equal exchange, rather than sociologically significant problems. However, we both did learn from this very early attempt at formalization, and in that sense, it was personally a profitable enterprise. However, by the early 1960s, I had turned my attention to a very different set of research problems, and both Snell and I left this area of research and neither of us ever returned to it.¹

EXPECTATIONS STATES PROGRAM AND EARLY MODELS

By 1960, I was heavily involved in work on Expectation-States theory, which had started with my thesis (Berger 1958). On the most general level, I was concerned with how behaviors and the evaluation of behaviors in status homogeneous groups led to the formation of expectations—and how these expectations in turn led to the formation of interaction hierarchies in these groups.

Following the research in my thesis, I worked on the problem of developing simple experimental techniques for manipulating the actors' self-other expectations and on the problem of developing a standardized experimental situation in which to study expectations processes. I was convinced that if we were to make progress in the study of expect-

¹We were not, of course, the first researchers to apply Markov Chain theory to social mobility. The idea for such applications appears to have been developed independently by S. J. Prais (1955) in England and by Blumen, Kogan and McCarthy (1955) in the United States. We were perhaps the first to propose that equal exchange processes as we conceptualized them were important in mobility processes (see Sobel, Hout and Duncan (1985)).

tation states processes, we needed new experimental techniques and new observational procedures.

At the same time that I was working on these techniques and observational procedures, I also worked on developing Markov Chain models to describe the emergence of expectations in highly controlled task situations. In general terms, the objective of these models was to **detail** the process by which the actor's evaluations of behavior and changes in those evaluations led to the formation of specific self-other expectation states. Most of these models were finite-state Markov chains (Berger, Conner and McKeown 1969).

My colleagues, my students, and I worked on these models during the early and mid-1960s. While these models did contribute to the development of the program, there were problems connected with using them. The states in the chain were identified with underlying self-other expectation states, so that behavior was a function of **both** behavior and states. This created difficulties for us in being able to use simple analytic estimation procedures. Keep in mind that simulation procedures were just coming into serious use. More important, we concluded that these models were providing us with limited information that we could use in developing our more general expectation state theories. This was probably due to the highly restricted interaction conditions for which these models were formulated. However, these models eventually led to important subsequent models developed by others in which states are identified with various types of evolving status structures, and where the concern is the emergence of expectations and observable power and prestige orders in open interaction situations (Fisek 1974; Skvoretz and Fararo 1996).²

THE 1977 GRAPH FORMULATION

All during this period from 1960 to the early 1970s, my colleagues and I continued to develop expectation states theory. By this time, it had evolved into a theoretical research program. As such, it consisted of a set of interrelated theories, a body of relevant empirical research and a body of applied research. By the mid-1970s, there were four major branches in the program: (1) the *Power and Prestige* theory (Berger 1958; Berger and Conner 1969, 1974), (2) the *Status Characteristics* theory (Berger, Cohen and Zelditch 1966, 1972; Berger and Fisek 1974), (3) the *Status Value Theory of Distributive Justice* (Berger, Zelditch, Anderson and Cohen 1968, 1972) and (4) the *Source* theory (Webster and Sobieszick 1973). What is common to all these theories is a concern for the conditions and processes by which individuals form expectations for themselves and others, the maintenance of those expectations once formed, and the consequences of these expectations for interpersonal behavior. Within this general concern, these theories differ in terms of the specific substantive problems they address as can be seen in Table I, which presents a brief description of these concerns as well as those of some of the other major theories in the program.³ However, major changes in the structure and the evolution of the Expectation States program occurred with the development of what we refer to as the graph formulation.

Throughout the 1960s and into the 1970s, I kept looking for some way of representing the different types of status situations and reward situations I was interested in. In the process, I developed diagrams during this period to visualize these situations, diagrams to think with, diagrams to reason with. There were a number of sources for these diagrams including the Cartwright and Harary balance diagrams and Lewin's life-space figures.

²Other models relevant to the program were developed during the 1960s and 1970s. Of particular interest was a gain-loss decision-making model that was used to investigate the relation between structural decision-making rights and influence under different expectation state conditions (see Camilleri and Berger (1967)).

³For a further description of different branches of the program on expectation states theory, see Turner and Wagner (1998).

Table I. Expectation States Theory

<i>Theory</i>	<i>Phenomenon of Concern</i>
Power and Prestige	The emergence and maintenance of differentiated power and prestige orders in groups not initially differentiated in status.
Status Characteristics and Expectation States	The formation of expectation states based on socially established status characteristics and the maintenance of power and prestige orders in status-differentiated groups.
Distributive Justice	The creation of normative reward expectations and the meanings of different types of social justice and injustice that arise from the relation of these expectations to the actual allocation of rewards.
Sources of Evaluations	The formation of expectations and its effects on behavior based on the evaluations of actors who possess legitimated rights to evaluate others.
Evolution of Status Expectations	The evolution of actors' status expectations as they move through different task situations with different others. Generalizes the status characteristics theory.
Reward Expectations	The interrelations of status, task, and reward expectations and the inequalities created by these interrelations. Partially integrates research from distributive justice and status characteristics branches.
Behavior-Status	Theories and models integrating research from the power and prestige and the status characteristics branches.
Evaluations-Expectations	Integrates research from status characteristics and source theory branches.
Legitimation	The process and conditions under which power and prestige orders are legitimated or delegitimated. Based on research from reward expectations and status characteristics branches.
Sentiments and Status	The interrelation of affect and sentiment processes with status and expectation state processes.
Multiple Standards	The processes and conditions under which multiple standards are used to maintain prevailing status distinctions.
Status Construction	The processes and conditions under which institutionalized status characteristics are socially constructed and diffused through society.

For a long time, these diagrams were just that—diagrams to help us in our reasoning, diagrams to visualize complex status and reward situations, diagrams to work with. However, we were looking for more. What we were looking for was, in the sense of Toulmin (1953), a formal representational system in terms of which we could make rigorous inferences about interpersonal status and reward situations. In general terms, we knew what we

wanted to have represented in such a system. On the basis of my work, particularly with Hamit Fisek and earlier work with Bernard Cohen and Morris Zelditch, we had built up a set of abstract concepts about status processes including concepts on diffuse and specific status characteristics and concepts to capture the idea that status elements often differ in their degree of relevance to group tasks and group goals. In addition, we had built up theoretical principles that describe the conditions in which status characteristics become significant to actors in their immediate situation; that describe how such actors combine the information from multiple status characteristics, say race, gender, and occupation, in forming expectations for themselves and others; and that describe how these expectations manifest themselves in the behavior of the actors in the situation (see in particular, Berger and Fisek (1974); and Berger, Cohen and Zelditch 1966, 1972). I think the important point here is that there was extensive substantive preparation on the theoretical level prior to formalization. And I might add that by this time there was an extensive body of experimental research that was relevant to status processes. This included the results of 12 experiments (involving some 57 experimental conditions) carried out in the standardized experimental situation.

However, it was still not clear how these heuristic diagrams could be made into mathematically meaningful structures. By 1970, I had interested Bob Norman, a graph theorist, in this problem, and for the next few years we would meet periodically to work on it. The breakthrough came in the summer of 1974 when for the first time the three of us—Fisek, Norman and I—worked together on this problem. As a result of this work, we translated our heuristic diagrams into mathematically meaningful structures. Our notion of the degree (or strength) of task relevance, for example, was reconstructed from more primitive concepts and the strength of relevance of an activated status element was conceptualized as a decreasing function of the length of the status path connecting the element to the task goal. Our combining argument was rigorously reformulated as the *principle of organized subsets* which argues that **all** valued status information that has become significant to the actor in the situation is combined so as to take into account the sign of the status information (positive or negative) and its degree of task relevance (or weight) in the situation. In addition, we were also able to develop an initial strategy for estimating parameters and testing our formulation. It took two years to refine these results and determine whether our formulation, overall, was consistent with the observations from the twelve experiments with which we had started. Happily, it was.

We had come up with a formal representational system in Toulmin's sense of that idea in terms of which (a) we could describe and make specific predictions for a broad range of different types of status situations and (b) we could describe and also make general predictions for important classes of such status situations (see Berger, Fisek, Norman and Zelditch 1977; and Humphrey and Berger 1981).

SINCE 1977 AND THE GRAPH FORMULATION

Since 1977, when it was first published, the graph formulation has played a major role in the further growth of the program. To begin with, it has been involved in further extensions of the Status Characteristic theory. For example, it has been involved in the generalization of the theory to deal with the evolution of status expectations as the actor moves through different task situations involving different others (see Berger, Fisek and Norman 1989).

Second, the formal theory has been involved in the integration of different branches of the program. An example of this is the *Reward Expectation States* theory by Berger, Fisek, Norman and Wagner (1985) in which ideas and concepts from the Status Value Theory of

Distributive Justice (Berger, Zelditch, Anderson and Cohen 1972) are integrated with those of the Status Characteristics theory to describe the process by which reward expectations are formed in status situations. Other examples of such integrations are the *Behavior-Status* theory by Fisek, Berger and Norman (1991), Balkwell (1991) and Skvoretz and Fararo (1996); the *Evaluations-Expectations* theory by Fisek, Berger and Norman (1995); and most recently the *Legitimation* theory by Berger, Ridgeway, Fisek and Norman (1998) (see Table I).

Third, using the formalized theory, we were able to construct extremely sensitive experimental tests of the Status Characteristics theory. Let me briefly describe one such example. As already observed, according to the principle of organized subsets actors combine **all** status information that has become salient in their immediate situation to form expectations for themselves and others. There are other theoretically reasonable principles that have been proposed such as status canceling principles where actors are seen to “cancel” oppositely signed and equally weighted items of status information and Lenski balancing principle where actors are seen to eliminate inconsistent status information in forming expectations for each other (Lenski 1966). Discriminating among these principles is difficult, as we believe that there are social situations where any two of these principles generate the same predictions and there are social situations where they all generate the same predictions.

Using the formalized status characteristics theory we can determine the conditions where these different principles predict similar outcomes and where they predict contradictory outcomes. With this information we can construct and carry out what Platt (1964) calls an experiment with strong design where outcomes that are consistent with one principle are at the same time inconsistent with other principles. These principles, for example, make markedly different predictions for the **magnitude** of status differentiation that will emerge for particular social conditions. Observations supporting the predictions of one principle, therefore, will be disconfirming of the predictions of the alternative principles.

The logic of this task is of some interest. It involves translating each of the non-status principles—Lenski balancing and different types of canceling into the concepts of status characteristics theory. This means formulating Lenski balancing and different types of canceling in the mathematical language of the graph formulation. Since all other assumptions of the Status Characteristics theory remain unchanged, each principle so formulated allows us to create a variant of the Status Characteristics theory. We then use the formal theory to determine the **particular** conditions that will provide a strong test of these principles. This task is inconceivable without the machinery of the formal theory (see Berger, Norman, Balkwell and Smith 1992).

CONCLUSION

On the basis of my personal experiences, my most general conclusion is that not all formalizations have been of equal theoretical significance and in particular of equal significance for developing substantive theory that grows. From the standpoint of theoretical significance and theoretical growth, the most effective formalization I have been involved with is the 1977 graph formulation of the Status Characteristics theory. It built upon an extensive set of pre-existing theoretical ideas and principles, and it could be assessed immediately against an extensive body of pre-existing relevant empirical research. Since its construction, it has played a central role in the further evolution of the expectation states program. In particular, it has been the basis for all the integrations that have been constructed of the different branches of the program. I think this fact highlights, most sharply, the *integrative* function of formalization.

However, what is particularly worth noting is that rigorous but non-formalized unit theories, with their relevant bodies of empirical research **continue to emerge** anew within the program. Important recent examples of this are the *Status Construction* theory developed by Ridgeway (1991), Webster and Hysom (1998) and others; the theory of *Multiple Standards* developed by Foschi (1989, 1992, 1996); and theories on *Sentiment and Status* developed by Shelly (1993), Lovaglia and Howser (1996), and Driskell and Webster (1997).⁴ I believe that such theories provide the **bases** and **resources** for further formalization. When they are formalized, concepts undergo change and principles undergo change. The result is a new theory, one with which we can address problems—such as discriminating status processing principles—in a manner that clearly would be impossible without the inferential capabilities of a formalized theory.

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⁴For an initial formalization of theories of sentiment and status, see Fisek and Berger 1998.

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