TRANSCENDING GENERAL LINEAR REALITY

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This paper argues that the dominance of linear models has led many sociologists to construe the social world in terms of a "general linear reality." This reality assumes (1) that the social world consists of fixed entities with variable attributes, (2) that cause cannot flow from "small" to "large" attributes/events, (3) that causal attributes have only one causal pattern at once, (4) that the sequence of events does not influence their outcome, (5) that the "careers" of entities are largely independent, and (6) that causal attributes are generally independent of each other. The paper discusses examples of these assumptions in empirical work, considers standard and new methods addressing them, and briefly explores alternative models for reality that employ demographic, sequential, and network perspectives.

A growing chasm divides sociological theory and sociological research. While the general linear model and other new techniques have reshaped empirical work, renewed acquaintance with the classics has transformed theory. These contradictory transformations have bred acrimony; Collins (1984) has sought to reduce social statistics to the status of a substantive theory, while Blalock (1984a: 138ff.) accuses theorists of proliferating vague alternatives. To a certain extent, old and irremediable philosophical differences separate the two groups; the debate has been taken up by interactionists (Blumer 1931, 1940, 1956), macro-theorists (Coser 1975), and many others over the years. But the split did not assume its current proportions until the challenging and once-laborious mathematics of linear and characteristic equations became computerized. Quantitative work has since come to dominate central disciplinary journals (Wilner 1985), while theoretical and qualitative work has increasingly founded its own journals and/or chosen book form.[1]

In this paper I identify one intellectual source for disagreement between theorists and empiricists. I shall argue that there is implicit in standard methods a "general linear reality" (GLR), a set of deep assumptions about how and why social events occur, and that these assumptions prevent the analysis of many problems interesting to theorists and empiricists alike. In addition to delineating these assumptions, I shall consider alternative methods relaxing them. The paper closes with a brief discussion of three alternative sets of methodological presuppositions about social reality. Through this analysis, I aim not to renew pointless controversies, for I believe the general linear model (GLM) is a formidable and effective method. But I argue that the model has come to influence our actual construing of social reality, blinding us to important phenomena that can be rediscovered only by diversifying our formal techniques.[2]

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[1] That commodification is central to methodological preeminence is easily demonstrated. Blalock's text (1960) is the classic sociological source on regression and other methods currently commodified in SPSS and similar packages. A contrasting source on uncommodified methods applying mathematical techniques to sociology is Coleman (1964). In the 1966–1970 period, Blalock had 162 citations to Coleman's 117 in Science Citation Index. The figures for later years are: 1971, 54 to 39; 1975, 117 to 24; 1980, 121 to 24; 1984; 104 to 15. The very fact that Coleman's excellent book has never been reprinted testifies to the same fact.

One caution should be raised concerning terminology throughout the paper. The labels "theorist" and "empiricist" (or "methodologist") are arbitrary polar terms designed to refer quickly to ideal-typical positions. They do not, obviously, embody a formal sociology of sociology.

[2] Much of theorists' disaffection with methods reflects not opposition to quantification, but to the common belief that standard linear models are the only possible formalization for theories. Although there are other approaches, few have wide application (see Freese [1980] and Freese and Sell [1980] for reviews of formal sociological theorizing). Most classic work on theory and theory construction (e.g., Hage 1972; Abell 1971; even Stinchcombe 1968) has employed the GLR view of social reality. I should note that I assume throughout that theory exists to provide comprehensible and logically rigorous accounts of facts. Definitions of comprehensibility, logicality, and facticity are of course debatable. Some theorists believe that empiricists' "facts" are uninteresting or artifactual while some empiricists believe that theorists' theories are incomprehensible and esthetic. But despite their disagreements about content, the two sides

I. GENERAL LINEAR REALITY

The phrase "general linear reality" denotes a way of thinking about how society works. This mentality arises through treating linear models as representations of the actual social world. This representational usage can be opposed to the more cautious use of linear models in which the analyst believes that some substantive causal process logically entails patterns of relations between variables, patterns which can then be tested by that model to discover whether the actual state of affairs is consistent with the substantive mechanism proposed. These two uses will be called the representational and entailment uses, respectively. The discussion of section II will outline precisely what theoretical assumptions are implicit in representational usage. To begin the analysis, however, we must first sketch the mathematics of the model.

The general linear model makes some variable dependent on a set of antecedent variables up to an error term:

$$y = Xb + u \qquad (1)$$

Lower case letters here represent vectors and upper case ones matrices. The row dimension of y,u, and X is the number of cases observed (m), while the column dimension of X and row dimension of b is the number (n) of antecedent variables. We can disregard the constant term without loss. In formal terms, the model is a linear transformation from R(n) into R(1). The transformation itself makes no assumptions about causality or direction; any column of X can be interchanged with y if the appropriate substitution in b is made. Using the transformation to represent social causality, however, assumes that y occurs "after" everything in X. In cross-sectional application, use of the model postulates a "causal time" that takes the place of actual time. (For an elegant analysis of time in such models, see Robinson 1980).

That the range of the linear transformation has but one dimension is a constraint imposed by problems of estimation. One can easily conceive a general-form GLM:

$$X(t) = X(t-1)\,B + U \qquad (2)$$

Here the index embeds the variables in actual time. Each succeeding value of *each* variable reflects a unique mix of all the antecedents. B becomes a square matrix of dimension n, and the full transformation is thus from R(n) into R(n). This more general GLM underlies most panel studies, although the relevant coefficients can be estimated only by deleting on theoretical grounds some fraction of the dependence this model postulates. Loosely, this second model envisions the situation as a school of fish (the cases) swimming in some regular pattern (the transformation) through a multidimensional lake (the variable or attribute space).

To use such a model to actually represent social reality one must map the processes of social life onto the algebra of linear transformations. This connection makes assumptions about social life: *not* the statistical assumptions required to estimate the equations, but philosophical assumptions about how the social world works. (For a polemical analysis of the statistical assumptions, see Leamer 1983.) Such representational use assumes that the social world consists of fixed entities (the units of analysis) that have attributes (the variables). These attributes interact, in causal or actual time, to create outcomes, themselves measurable as attributes of the fixed entities. The variable attributes have only one causal meaning (one pattern of effects) in a given study, although of course different studies make similar attributes mean different things. An attribute's causal meaning cannot depend on the entity's location in the attribute space (its context), since the linear transformation is the same throughout that space. For similar reasons, the past path of an entity through the attribute space (its history) can have no influence on its future path, nor can the causal importance of an attribute change from one entity to the next. All must obey the same transformation.

There are, of course, ways of relaxing some of these assumptions within standard methods, all of them at substantial cost in interpretability. But it is striking how absolutely these assumptions contradict those of the major theoretical traditions of sociology. Symbolic interactionism rejects the assump-

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agree that theory aims to explain why facts are what they are. I shall also assume that the basic criterion of rigor is logical formalism. Although there are many types of logic, I wish to exclude esthetics as the basic criterion of theory and the correlated notion that much theory is in principle unformalizable.

tion of fixed entities and makes the meaning of a given occurrence depend on its location—within an interaction, within an actor's biography, within a sequence of events. Both the Marxian and Weberian traditions deny explicitly that a given property of a social actor has one and only one set of causal implications. Marx's dialectical causality makes events produce an opposite as well as a direct outcome, while Weber and the various hermeneutic schools treat attributes as infinitely nuanced and ambiguous. Marx, Weber, and work deriving from them in historical sociology all approach social causality in terms of stories, rather than in terms of variable attributes. To be sure, Marx and Weber discuss variable attributes in some of their purely conceptual writing, but their most currently influential works are complex stories in which attributes interact in unique ways—the *Protestant Ethic,* the *General Economic History,* the *Eighteenth Brumaire,* and even much of *Capital.*

The contrast between these assumptions and those of GLR suggests that theorists may reject empirical sociology because of the philosophical approach implicit in representational use of the GLM. In the rest of this paper, I shall consider the assumptions of that use, drawing examples from work by some of the best exponents of the GLM. For each assumption, I will discuss its nature, the attempts made to relax it within standard methods, and the types of alternative methods extant or possible. My focus throughout on the problems with GLR and the potentialities of its alternatives does *not* imply any derogation of its very great successes, and in particular any derogation of the studies I use as examples. But by exploring the theoretical limits of the GLM, I hope to suggest new lines of development in empirical sociology.

II. THE FUNDAMENTAL ASSUMPTIONS

A. Fixed Entities with Attributes

A central assumption of the GLM is that the world consists of entities with attributes. Entities are fixed; attributes can change. In practice, standard empirical work overwhelmingly concerns biological individuals, governmental units, and other entities considered to be "stable" by common cultural definitions. The GLM is less often applied to social groups like occupations, professions, and social movements whose members and social boundaries are continually changing.

The entities/attributes model for reality can best be understood by contrasting it with its most common alternative, the central subject/event model. A historical narrative is organized around a central subject (Hull 1975). This central subject may be a sequence of events (the coming of the Second World War), a transformation of an entity or set of entities into a new one (the making of the English working class), or indeed a simple entity (Britain between the wars). The central subject includes or endures a number of events, which may be large or small, directly relevant or tangential, specific or vague. Delineating a central subject and the relevant events—the task of colligation (McCullagh 1978)—is the fundamental problematic of classical historiography.

Precisely the same phenomena are organized by the entities/attributes and central-subject/event approaches, but in different ways. Consider the problem of the spread of the multidivisional form (MDF) among American firms (see Fligstein 1985). There is a set of entities—the firms—which at any given moment have fairly clear boundaries. Firms can be thought of as having properties—size, rate of asset increase, domination by certain kinds of individuals, business strategies. We can imagine generalizing across the "cases" in terms of these "variables" and asking about the relation of the variables to the use of MDF. Yet we could also think about the history of a given "area" of firms, say the utilities area. We will see some entities in that area disappear through merger, others appear through internal differentiation and separation. Firm sizes will fluctuate through this appearance and disappearance as well as through variation in continuous entities. Some dominant individuals will control certain firms continuously, while other leaders will move from one firm to another through the mergers and divisions. Strategies will come and go, shaped by interfirm contagion and by period events like the depression. The histories of individual firms will be seen to follow unique paths shaped by the contingencies of their environments. In such a view, what GLR saw as variables describing entities become events occurring to central subjects.

This example shows a profound difficulty with the fixed entities approach; it ignores entity change through birth, death, amalgama-

tion, and division. One way the MDF can arrive is through merger; yet merger removes entities from the sample and replaces them with new ones. It is not merely a strategy (Fligstein 1985:383), but an event changing the sample frame. The social science of demography does indeed deal with appearance and disappearance of entities, and demographic models are now being applied to organizations in the work of the Stanford school of organizational ecologists (for a review see Carroll 1984). Yet the event history models so applied are essentially simple GLMs treating rates of change (usually of organizational death) as dependent variables and using a log-linear group of independent variables to predict them. Entities are grouped in synthetic cohorts and existence becomes yet another variable attribute to be predicted. Moreover, while such demographic methods address the appearance/disappearance problem, they do not address the merger/division problem in any formal way.

Classical demography also provides preliminary models for the other major problem with treating entities as fixed, the fact that names often stay the same while the things they denote become different. This problem is most evident in the situation of exchange between aggregate entities.

Consider the attempt of Simpson et al. (1982) to estimate the ability of occupations to recruit and retain cohorts of workers. The entities analyzed are occupations, characterized by the attributes of 1) strength, skill, and educational requirements, 2) product markets, industrial dispersion, and sex-specific growth, 3) earnings and earning growth potential, and 4) unionization or licensure. The dependent variable is an occupation's relative retention of a twenty-year age cohort, measured by the ratio of the odds of a cohort member's being in that occupation in the base year to those odds twenty years later, suitably standardized for death, relative occupational growth, and so on. Four twenty-year time-frames are analyzed, starting in 1920, 1930, 1940, and 1950.

There are two central problems with this daring design. First, the occupations themselves do not denote a constant body of work or activities. Simpson et al. have addressed this by excluding groups for which census classifications are not commensurate throughout the period. But this rules out, for example, the occupations reshaped by technology—a substantial fraction of the occupational structure, and a fraction that may in fact be determining what happens to the rest. Yet even those remaining in the sample changed drastically. Accounting, for example, began this period as a solo profession doing public auditing and ended it as a bureaucratized one doing nearly as much work in taxes and corporate planning as in auditing. The name stayed the same; the thing it denoted did not.

Second, the original cohort members present in an occupation after twenty years are not necessarily the same individuals who were in it at the outset. Evans and Laumann (1983) have shown that even the professions have extraordinarily high turnover and that they continue to recruit until well into middle age. Thus, the individuals aggregated under the labels are not necessarily the same individuals at one time as at another. Retention is confused with migration. Moreover, the cohort barriers are so wide that as each cohort ages twenty years, some individuals go from the start of their careers to their career midpoints, while others go from midpoint to near retirement. The cohorts—themselves presumed entities like the occupations—are thus no more coherent entities than are the occupations themselves.

One might handle such problems by disaggregation. But this is the counsel of despair. Both occupation and cohort do have some sort of reality, some sort of causal power. To disaggregate and model the occupations as properties of individuals would forfeit any sense of occupations' reality as structures. The classic answer to such multilevel problems is ecological regression (for a review see Blalock 1984b). But to assign coherent group-level terms to individuals—as is standard ecological practice—is completely impossible. The individuals don't stay in the same aggregates over time, and the aggregates themselves change—both by migration of their members and by change in emergent properties like type of work. These transformations make ecological parameters meaningless.

Some writers have noted the possibility of combining demographic and attribute methods to deal with such problems. In such methods, underlying demographic dynamics provide members—with their own attributes—to an emergent level of aggregates,

which in turn have *their* own attributes (see e.g., Coleman 1964:162ff). Event history methods (see Tuma and Hannan 1984) to some extent so mix demographic and attribute models. On the theoretical side, a number of writers have argued that iterative processes of interaction between micro-level units in fact provide the structure that is macrostructure (Cicourel 1981: Giddens 1984; Collins 1987). Thus, there are a variety of preliminary attempts to address these issues, but clearly much work—both theoretical work on the formal structure of central-subject/event approaches and mathematical work on how to realize them—is required to develop this area further.

B. Monotonic Causal Flow

Between the various attributes of entities that it analyzes, GLR assumes that causality flows either from big to small (from the contextual to the specific) or between attributes of equivalent "size." Cause can never flow from small to large, from the arbitrary to the general, from the minor event to the major development. This assumption has several constituent parts.

The assumption of monotonic causal flow begins with the assumption of "constant relevance." A given cause is equally relevant at all times because the linear transformation, in most models, doesn't change over time periods (because the reestimation required is impractical). Of course, the B matrix of the general GLM *can* change, but GLR practitioners seldom take the position, common in historical writing, that "at time t, x was important, while later, the conjuncture of things made y more important." That kind of thinking—in which B is mostly zeroes and the non-zero elements differ from iteration to iteration—is not common. The first constituent of the monotonic causal flow assumption is thus the assumption, not necessary but nearly universal, of constant relevance.

Within this presumed constant relevancy structure, the GLM assumes necessarily that if a cause changes, so does its effect. But this means that if a causal variable fluctuates over a period of two weeks, a GLM cannot allow it to determine something that fluctuates over a period of two years. It can study the "contextual" effect of the latter on the former, using cross-sectional data to discover how different levels of "context" affected the behavior of the more rapidly fluctuating variable. But once context is removed, the use of linear models implies the assumption that causes and effects have meaningful fluctuation *over the same period.* This assumption has in turn become a GLR assumption, a theoretical belief in what I shall call the unity of time-horizon. ("Time-horizon" denotes the minimum length of time in which a *meaningful* change in a variable can be observed.) GLR allows contextual effects of various levels down to a uniform "basic" level for causal effects, but refuses any reversal of this hierarchy—any causing of the large by the small, the enduring by the fleeting.

The uniform time-horizons assumption can most easily be seen in time series analyses, where a simple GLM is estimated on a single entity using successive years as different cases. Consider the problem of distinguishing the effects of government revenue and expenditure policies on the distribution of income in society. According to Devine (1983), neoconservatives see the state as reacting to the rising expectations of a pluralist populace, while Marxists see the state balancing between rewarding the dominant classes and purchasing the complaisance of the dominated ones. Liberals by contrast view the state as technocratically motivated and lacking any intent to redistribute income. Measuring income distribution with the capital/labor income ratio, Devine predicts it with several prior attributes of the society: 1) the prior income ratio, 2) "controls" for inflation, unemployment, unionization, real GNP growth, and minimum wage, and 3) federal fiscal flows—revenue and expenditures for military personnel, for veterans benefits, for "technoscale" (military research and procapital infrastructure) and for "human scale" (transfer payments, education, and other collective goods). The federal fiscal flows are taken to measure intent, operationalizing the three theoretical frameworks of neoconservatism, Marxism, and liberalism. Devine's temporal structure for estimation is quite complex: inflation, real GNP growth, and unemployment are measured contemporaneously with the dependent variable: prior income ratio is measured the year before: unionization, revenue, and expenditures for military personnel, veterans, and "technoscale" are measured two years before. "Human scale" is split; the transfer payments

are measured contemporaneously, while the collective goods are lagged two years. Devine specifies this complex lag structure after finding that simpler versions (e.g., lagging all fiscal variables for one year) produced less stable estimates. He justifies this choice with the argument that the longer lag "allows for adequate diffusion of state spending and extractive capacity (614)," except in the case of transfer payments, where the effect is immediate.

The problem with the whole approach is that the values of these measures at any given time are not freely variable. Annual inflation and GNP growth are linked in "recessions" that take several years to grow and die. Because laws link "human scale" payments to entitled populations, those payments fluctuate with demographic changes in age and other entitlement variables, which in turn reflect events ranging in size from the two-decade baby boom to much shorter fluctuations in unemployment. Military spending reflects wars and other foreign policy ventures again of widely varying durations. Thus, the observed values of the various "independent" variables at any given time (subject of course to the lag structure) are linked in arbitrary ways to their values at other times, the linkage being provided by the structure of what a historian would call "events." Because of this linkage, one cannot regard the independent variables as measures of the state's various intents, nor the dependent variable as a measure of the realization of those intents. The independent variables don't really stand for the state's free expression of its intents, but rather for what it can intend *given* the various events it finds itself within. One could imagine measuring these events with moving averages processes, but the "width" of the moving averages would have to change with the temporal duration of the events involved. Thus the linkages of various yearly levels of variables into larger "events" undermines studies assuming uniform time-horizons, as do nearly all empirical uses of the GLM. Events of equivalent causal importance just don't always take the same amount of time to happen.

In fact, the problem is not limited to time series studies. Consider the cross-sectional problem of understanding the relation between wife's outside employment and marital instability. Booth et al. (1984) have studied this process in 2034 married couples aged under 55 years, measuring the following attributes of the marriages:

> 1) "controls"—husband education, wife education, years married, number of children under 18.
>
> 2) roughly five "steps" to marital problems a) hours wife worked, b) other income and wife income, c) marital division of labor and spousal interaction, d) marital disagreement and marital problems, and e) marital happiness and marital instability.

Hours wife worked was (apparently) measured over a three-year period, the income variables over a one-year period, and the remaining "process" variables by scales at the time of study. The various "steps" in the process of marital instability are set up in a classic path diagram (following the order just given), and are supported by causal narratives such as:

> marital interaction may be decreased by wife's employment. Household tasks that used to be handled by the wife while the husband was at work may cut into time previously allotted to joint activities. (Booth et al. 1984:569)

The model assumes that these various attributes of marriages fluctuate over equivalent time periods, or that the attributes earlier in the list fluctuate more slowly than those later. Yet in fact there is no conceptual reason to think that employment rates fluctuate more slowly than do, for example, marital problems or marital happiness. One can easily imagine a long period of gradually increasing marital instability in which episodes of wife employment punctuate attempts to reinstate a traditional division of labor. It *is* conceptually reasonable to expect wife employment to fluctuate at the same rate as wife income, but many of the other time-horizon assumptions in this "process" are erroneous. These problems compound the sequence problems to be discussed below. When attributes of entities fluctuate over different periods, it becomes impossible to specify the causal or temporal order that they actually follow. Moreover, the act of aggregation in GLR study further assumes that these attributes have similar time-horizons in all cases—for example, that one marriage's instability fluctuates at the same rate as another's.[3]

[3] One consequence of the montonic causal flow

As a levels assumption, the time-horizon assumption bears directly on the micro/macro issue. GLR requires all causes to lie either on one temporal level, or on levels that decrease in the same direction as causality flows. Recent theoretical writing on the micro/macro problem objects strenuously to such a view (see various essays in Alexander et al. 1987). Collins (1981) has taken a basically aggregate approach to the problem, but Giddens (1984) and others have emphasized the role of micro-iterations in creating macro entities. It is clear that such relations can be formalized only within different methodological approaches, as in the work of Heise (1979) or in the work inspired by the dissipative structure theory of Prigogine (see Schieve and Allen 1982).

Not only do these causal flow assumptions disable GLR-type analysis of microgeneration of macrostructure, they also prevent GLR from recognizing small events that assume decisive importance because of given structural conditions. Pascal tells us that if Cleopatra's nose had been a little shorter, the whole face of the earth would have changed. GLR cannot envision such occurrences. A few models for addressing them are being developed, such as threshold models (Granovetter 1978). Attempts to treat sudden events within a continuous-variable, GLR-type framework have had mixed success (for an example, see Schieve and Allen 1982:c. 8)

C. Univocal Meaning

To its restrictions on the relations between variable attributes GLR adds restrictions on the individual attributes. For many theorists, the most problematic assumption of GLR-based empiricism is its insistence that a given attribute have one and only one effect on another attribute within a given study. Theorists commonly treat terms like anxiety or wealth as having multiple meanings within the same explanation. The recent renewal of hermeneutic approaches in social theory gives this reservoir of meaning infinite depth. In strict contrast GLR restricts our attention to one causal meaning of a given variable on another.

This contrast is well illustrated by Kohn and Schooler's (1982) work on the reciprocal effects of job conditions and personality. The authors wish to show how flexibility and independence on the job determine and are determined by personality flexibility and strength, both at a given time, and (by assumption) over the individual's career. Kohn and Schooler's personality constructs are ideational flexibility (operationalized with an earlier-developed scale), self-directedness, and distress. The two latter constructs are developed by factor analysis out of separate indicators as follows:

> self-directedness is reflected in not having authoritarian conservative beliefs, in having personally responsible standards of morality, in being trustful of others, in not being self-deprecatory, in not being conformist in one's ideas, and in not being fatalistic. . . . Distress is reflected in anxiety, self-deprecation, lack of confidence, nonconformity, and distrust (Kohn and Schooler 1982:1276)

The two factors have a mild negative correlation. Kohn and Schooler go on to apply full-information maximum-likelihood methods to estimate reciprocal causal lines between the two, estimating the path from distress to self-directedness at $-.08$, and its reverse at $-.25$. They conclude that "If one of the three dimensions of personality is pivotal, it is self-directedness" (1280).

Contrast with this Freud's analysis of the relation between anxiety (distress) and ego independence (self-directedness). Freud argued that anxiety symptoms signified danger to the ego. In response to some danger, the ego invoked repression to block dangerous instinctual impulses. (In the Kohn and Schooler case, such an impulse might be rage against a constricting workplace.) For Freud, repression had two exactly contradictory effects; 1) it exercised and supported ego control by diverting the threatening feelings into symptom formation but 2) it forfeited ego control by placing the repressed material solely under the logic of the id. Since that logic decreed that subsequent impulses, responding to different situations, would nonetheless follow similar lines of development, new and different dangers (e.g., in the workplace) would nonetheless lead to similar symptomatic results, with a consequent *loss*

assumptions is that every GLM study is implicitly a panel design. By modeling certain variables as causally subordinate to others, cross-sectional GLMs assume that the subordinates have had time to equilibrate to changes in their causes. On the implicit stochastics of cross-sectional models, see Tuma and Hannan 1984:89ff.)

of feeling of ego control. (Freud 1936:11–28; 1963b; on contradictory instincts see 1963a: 97ff.) The Freudian theory suggests simultaneous and contradictory causal relations from anxiety to self-dependence. No theorist would want to forego the dual pathways, because the two contradictory effects will probably generate two different causal sequences. Nonetheless, summation is the standard methodological solution, a solution particularly problematic in the case of contradictory effects, where sums are likely to be small and statistically insignificant.

Michael Burawoy's (1979) trenchant Marxian analysis of the Kohn and Schooler situation illustrates a different pair of simultaneous, contradictory causal paths within it.

> Thus, the internal labor market bases itself in a complex of rules, on the one hand, while expanding the *number* of choices on the other. Nor should these choices be belittled by saying that one boring, meaningless job is much the same as any other. The choice gains its significance from the material power it gives to workers in their attempts to protect themselves from managerial domination. Workers have a very definite interest in the preservation and expansion of the internal labor market, as the most casual observation of the shop floor would demonstrate. Moreover, it is precisely that interest that draws workers into the bidding system and generates consent to its rules and the conditions they represent, namely, a labor process that is being emptied of skill. (Burawoy 1979:107–108.)

Here, the psychological attributes flexibility and self-determination simultaneously increase both worker control and management dominance. These two different effects can only partially be separated by saying that the former is short run and the latter long run, for in fact they are nearly simultaneous.

As these examples show, perhaps no other assumption of the GLR seems as inimical to classical theory as that of univocal meaning. Recognition of multiple meanings is central for sociological methodology because complexity of meaning is central for the qualitative theories currently dominant. (See, e.g., Giddens 1982:c.1.) The most common empirical solution of the multivocality problem is to disaggregate by finding intervening indicators that differentiate the causal paths. But not only is this procedure not always possible, it also moves the causal focus from antecedent to intervening variables, a shift theorists may reject.

There are several formal ways to address the problem. One might assume that each variable produces an ensemble of effects on another and that some other process chooses which of these will obtain in the particular case. (In the Freudian example, such a model governs the choice of particular symptom formation.) If the determining process is endogenous, then the multiple meaning problem becomes the interaction problem; some combinations lead to one type of outcome, others to another (see sections E and F below). If the determining process is exogenous, one can perhaps model it directly.

A second general approach insists on allowing more than one effect at once. There is some work relevant to this problem within the network framework. Several writers have combined structural models based on different rating methods into complex models for relations between various units of analysis. This is, implicitly, a disaggregation strategy. (For an example, see Boorman and White 1976.) Another disaggregation approach is to separate the two effects temporally. Thus, Cantor and Land (1985) have recently conceptualized the effects of unemployment on crime as a negative effect through opportunity (more people are home to protect their goods) and a positive one through motivation (people without work must turn to crime). They separate the effects by arguing that institutional support systems buffer the latter effect, which is thus estimated at a one-year time lag. Finally, certain forms of non-metric analysis may support the direct inclusion of multiple effects (see Katzner 1983); these may be the only approaches that do not require disaggregation. A few authors, notably Hayward Alker (Alker 1982, 1984; Alker, Bennett and Mefford 1980; Mefford 1982), have followed the lead of Schank and Abelson's (1977) artificial intelligence approach to modeling processes of understanding, aiming directly at replicating complex understandings.

In defense of current methods, we should recognize that the multiple meaning problem is in part a problem of presentation and emphasis. Even the most complex of multiple causal relations (e.g., "determination in the last instance" in the writings of Poulantzas [1975] and Althusser [Althusser and Balibar 1970]) must in fact be disassembled into constituent relations to be logically interpreted. The theorists' style with such con-

cepts is to retain their unity and treat them as causally ambiguous or complex. The methodologists' style is to disaggregate and treat the variables indicating the various causal paths as the independent variables of interest. Yet while methodologists need not recognize the "essentially subjectivist" position that human affairs are in principle non-formalizable, it is clear that serious work must be done on the problem of univocality.

D. The Absence of Sequence Effects

The preceding GLR assumptions, which concern causality as mediated through variable attributes of entities, are completed by a set of assumptions about independence between entities, attributes, and time periods. These latter are not quite as inherent to the GLM itself as are the entity assumptions, but insuperable difficulties of estimation and modeling have made them, de facto, constitutive assumptions of the GLR way of thought. The first of these independence assumptions concerns sequence.

A fundamental assumption of GLR is that the order of things does not influence the way they turn out. According to the general GLM, the state of entity x(1) at time $t+1$ (that is, the pattern of its attributes at $t+1$) is determined by applying the transformation matrix B to its state at time t; how it got to that present is not relevant to its current future. Such an assumption challenges fundamental theoretical intuitions about human events (see, e.g., Kamens 1985). The whole idea of narrative history is that the order of things matters, an idea that undergirds the interactionist and ethnomethodological paradigms as well (see Gallie 1968; Sacks, Schegloff, and Jefferson 1974; Sudnow 1971).

The sequence assumptions of GLR are in fact quite complex, depending on whether we are concerned with the "causal" sequence of the variables within a cross-sectional application of the simple GLM or the temporal sequence of states of entities in the general one. To see the assumptions about cross-sectional causal sequences, consider the problem of relating the racial mix of an industrial sector to its productivity (for details, see Galle, Wiswell, and Burr 1985). Each sector can be described by the following properties: 1) capital expenditures per worker, 2) mean educational level of workers, 3) mean age of workers, 4) percent of blacks among workers, and 5) productivity. These properties are observed in the early 1960s and in 1972; annualized rates of change are then created for all but age. The cross-sectional models treat the productivity rate as depending on all the others within time period and the over-time models use the change rates to predict both change in productivity and productivity in 1972.

The authors believe their cross-sectional GLM allows them to make conclusions about the productivity of black workers; they assume that black workers as individuals have or lack productivity and that their being recruited to an industrial sector then affects the productivity of that sector. But it may well be that in some cases more or less productive *sectors* needed labor when labor market conditions favored hiring black workers, whether the latter have an inherent productivity or not. In some sectors, that is, the causal arrow is undoubtedly reversed. But the GLM must assume that the sequence of variables is the same in every sector (case). Here, that means assuming that the dependent variable is dependent in every case. In more complex path models, it means assuming that the paths of causality are the same in every case. Although carefully noted in the first large-scale application of path analysis to social data (Blau and Duncan 1967:167), this radical simplification has been ignored since. Worse yet, familiarity with the GLM has led many of us to believe that reality actually works this way, that causality must always be in one direction across all cases.

The temporal situation is quite similar. Consider the problem of understanding the relation between personal unemployment and criminal behavior (for details, see Thornberry and Christenson 1984). The entities are individuals and their attributes are two variables integrated over one year periods—their percent of time unemployed and their number of arrests. Data cover the years from age 21 to age 24, and include some exogenous variables not of interest here. The authors take a general GLM approach, deleting a few coefficients to achieve identification. Each path is "justified" by a little causal story. For example:

> 1) Unemployment reduces commitment and involvement with conventional activities and hence leads to criminal activity. "A person may be simply too busy doing conventional things to find time to engage in deviant behavior."

(Hirschi 1969, quoted in Thornberry and Christenson 1984:400)

2) Crime creates further barriers to conventional means to success, among which is employment. "Employers, for example, ought to be less willing to provide jobs to current and former offenders" (Thornberry and Christenson 1984:401).

These causal paths aggregate a set of stories. Thus, individual A commits a first crime and goes on to a serious criminal career, never looking back, never bothering to seek legitimate work. Individual B spirals in an ever deepening circle of greater unemployment and more crime each year. C goes wrong at the start (perhaps because of a random crime or perhaps because unemployment drove him to crime), but is then frightened by the criminal justice system and never errs again. Each of these stories comprises several one-step theoretical elements of the kind just given, linked into a sequential story. But aggregating these sequences throws away the narrative patterns that link the elements into individuals' stories. Suppose everyone who has *two* consecutive years of many crimes becomes a permanent criminal. A general GLM with a one-year transformation period cannot see that, because the past at time $t-1$ is not relevant to the future at $t+1$ except through its influence on the present of time t.

A central assumption of GLR, then, is that the order of things does not make a difference. In the first place this means assuming that the "more causally powerful" attributes are the same in every case. In the second, it means assuming that the particular observed sequence of attributes over time does not influence their ultimate result. Unlike most GLR assumptions, this sequence assumption has seen some serious study (Abbott 1983; Abell 1987).

A number of methods permit specific forms of sequential dependence. ARIMA models allow a variable to depend on its own past as well as on past random disturbances, although usually restricting attention to one entity and one variable (Box and Jenkins 1976. Reverting to my earlier metaphor, this is like following one fish's complete path through the lake.) Markov models for sequential data divide the attribute space into a limited number of states (parts of the lake) and specify the likelihood of moves from each state to any other. If the number of states is small, the future can be made to depend on the *sequence* of n past states, although the number of transitions to be estimated for such models rises with the nth power of the original number of states (see Bishop, Feinberg, and Holland 1975). Although such nth order Markov processes operationalize theoretically important concepts of time, they are in fact rare (but see Brent and Sykes 1979). In particular, the recent florescence of event history models—which are discrete-state, continuous-time Markov models—has not to my knowledge involved use of information on the exact sequence of past states to predict current and future developments (for a general review see Tuma and Hannan 1984).[4]

Theorists and empirical workers alike have called for methods that can classify or cluster sequential data, such as the histories of individuals, occupations, and revolutions (see, e.g., Stinchcombe 1978). For sequences of unique events in continuous or discrete time, various forms of uni- and multi-dimensional scaling have long been used (Hodson, Kendall, and Tautu 1971). Abbott (1985) has applied them to the sequence of events in the histories of professions. Sequences of repeating events may be analyzed by optimal matching methods; Abbott and Forrest (1986) have recently applied them to sequential cultural rituals and argued for their general applicability to social data. Although both scaling and matching methods work with intercase distances and hence force small samples, they provide a serious start on the problem of identifying common sequences.[5]

E. Casewise Independence and Related Assumptions

Other independence assumptions of the GLR concern cases and variables. Although com-

[4] I have not mentioned another general sequence method, dynamic programming. Most solvable dynamic programming problems are handled by making Markovian assumptions for the back solutions. See Puterman (1978). I should also note that there are multivariate ARIMA models (e.g., Tiao and Box 1981), although considerable interpretation is involved in their use.

[5] In addition to Abbott's sequence work (1983, 1984, Abbott and Forrest 1986), there is an alternative, more formal analysis of sequences in Abell's recent work (1984, 1987, Proctor and Abell 1985), which employs homomorphisms to measure sequence resemblance. Demographers are generally handling sequencing by enumeration, rather than by the direct approaches adopted by Abbott and Abell (see, e.g., Hogan 1978; Alexander and Reilly 1981; Marini 1984). An interesting sequential formalism of interaction is Heise (1979).

monly seen as statistical assumptions, these are also conceptual presuppositions. The first is that there is not "excessive" dependence between elements in a given row of the data matrix X. By increasing parameter variance, collinearity makes the GLM unable to distinguish the effects of variables closely related to each other. The GLR proscription of collinearity directly violates the view, common among theorists, that social determinants lie in closely related bundles; Weber's causal concept of "elective affinity" (Howe 1978) and his related notion of ideal types (Weber 1949:89–104) are the most obvious examples. Another celebrated bundling controversy pits elitists against pluralists over the degree to which different bases of status tend to parallel one another.

In formal terms, the collinearity problem concerns the "level" of variation. Highly correlated independent variables can be treated as aspects of a single variable through factor analysis and other forms of scale construction. But the GLM falters if variables like income have causal functions simultaneously as members of "emergent attributes" like general status and as independent variables. Hence GLR as a view of reality tends to limit not only entities (see section A), but also variables to one level, unlike many theoretical conceptions.

Correlated error terms are a second statistical problem with conceptual implications. Correlated errors usually arise through temporally or spatially structured data. They can be remedied, up to a point, by the use of special estimators. Behind the issue of error correlation, however, is a conceptual problem with a long history—Galton's problem of distinguishing effects of diffusion *between* units from effects of similar mechanisms *within* units. In fact, the standard remedies for serial correlation require theoretically postulating its exact structure; there are no purely statistical grounds (beyond the esthetic criterion of parsimony) for distinguishing between different temporal autocorrelation models. As for space, only now are substantial models for spatial autocorrelation combined with local causation being developed (Loftin and Ward 1981, 1983; Hubert, Golledge, and Costanzo 1982). Spatial autocorrelation makes it even more evident that the correlated error problem is ultimately conceptual, not statistical.[6]

Perhaps the most important independence assumption of GLR, however, involves the casewise independence of the dependent variable, assumed in the assertion that the independent variables determine the dependent variable up to an error term. A wide variety of sociological theories treat dependent variables as structurally constrained. In such theories independent variables are sufficient to explain the dependent up to an error term only *given* the necessary conditions specified by the constraints.

Versions of the constrained-dependent-variable problem are common. Thus, Peterson and Hagan (1984) study the effect of race, education, marital status, class, age, and a host of other factors on criminal sentencing, using simple GLM specifications for two dependent variables. The first is the probability of sentencing (a probit model), the second the length of sentence. The units of analysis are drug offenders sentenced between 1963 and 1976 in a particular Federal District. The constraint lies in the availability of prison cells. The independent variables freely determine sentence and length *once* availability is taken into account, availability being itself a function of past sentencing procedures, among other things. Availability may operate only as a general limit with a similar effect on all cases. But more often sentence severity will vary in different cases and at different times because of varying likelihoods that certain sentences can actually be served.

Some of the many possible constraints on dependent variables have received serious study. Most such study has separated the problem of specifying constraint from that of analyzing causal mechanisms once the constraint is given. For example, the structural and exchange mobility literature specifying the constraints on occupational achievement

[6] The standard source on spatial autocorrelation is Cliff and Ord (1981). Methods that originated in the study of atomic, unrelated individuals run an obvious risk of ignoring contagion, particularly spatial contagion. When sociologists move from the realm of largely disconnected individuals to networks of actors (e.g., from estimating the effect of education on social status to analyzing the reasons for the survival of newspapers [Carroll and Delacroix 1982]), the newly central contagion effects disappear because the models hide them. Yet contagion effects are among the central determinants of behavior, as network studies (e.g., Coleman, Katz, and Menzel 1966) tell us.

is generally separate from the status attainment literature describing achievement itself. (For summaries see Boudon [1972]; Sobel [1983]. The two topics are separate sections in Blau and Duncan [1967] and Featherman and Hauser [1978]). Simply distinguishing the constraints of structural mobility from the free motion of exchange mobility has proved perplexing, and Sobel, Hout, and Duncan (1985) have recently proposed adding the third concept of "unreciprocated mobility." Some have followed the reverse path of specifying constrained *attributes* influencing mobility (Yamaguchi 1983). A more detailed approach to constraint has been taken in Harrison White's vacancy models and related Markovian mobility models (for reviews see Stewman 1976; Tuma and Hannan 1984).

A considerable methodological literature treats social structure as itself causal, reasoning that social causes must move along lines connecting individuals. The network literature takes this approach, as do a variety of formal mathematical models—for markets (White 1981), for justice systems (Padgett 1985), and for power in general (Marsden 1983). Methodologies addressing this problem include blockmodeling (White, Boorman, and Breiger 1976; Boorman and White 1976;), multidimensional scaling (Laumann and Pappi 1976), and other formal network models (Burt 1982).

F. Independence of context

A final independence presupposition of GLR is that the causal meaning of a given attribute cannot, in general, depend on its context in either space or time. Its effect does not change as other variables change around it, nor is its causal effect redefined by its own past. Mathematically, this assumes that the matrix B of coefficients in the general GLM does not depend either on X(t) or on X(t−1),X(t−2), etc. In actual GLM practice, this dependence is often allowed. The contemporaneous dependence is expressed by interaction terms; the past dependence by lag terms and change scores. But these techniques have their drawbacks, as we shall see. The GLM can consider only a narrow range of such effects, and GLR as a way of thinking about the world does not really incorporate them at all.

As an example, consider Bradshaw's (1985) analysis of dependent development in Africa. A series of GLMs are here used to investigate a recursive "story" of dependent development that unfolds as follows:

> Multinational firms ally with indigenous elites to promote economic growth (E) and the development of a modern sector (M). This alliance can be seen in the impact of foreign investment (I), trade dependence (D), primary product specialization (P), and commodity concentration (C) on state expansion (X). The combination of growth and development leads to economic inequality (Q), which in turn leads to social turmoil (T).

Eight linear models are run—three with T as dependent, two each with E and M as dependent, and one with X as dependent. E and M prove highly stable over the two time periods analyzed (1960 and 1977), while T is quite volatile. X has some (small) effect on E, M, and T in 1977, although this is probably due to its dependence on E (and perhaps M) in 1960. It is clear that some of these variables receive their meaning from their context. Thus, as Bradshaw notes (1985:202), if the state is expanding (X) *and* has the (foreign) resources (I) to transform the economy in a way rewarding to itself and the investors who support it, then E, M, and T will increase more than they would if either condition—state development or external investment—were absent. With either condition absent, the situation will not differ from that with both absent. One might alternatively theorize, however, that strong state development (X) and external investment (I) would lead to strong police and military forces (unmeasured), which could prevent turmoil (T) by threat alone—a suppressor effect contrasting to the conduciveness effect previously hypothesized. Such interactions are normally handled with multiplier terms in GLMs, a practice that renders the lower-order coefficients in the equation completely arbitrary, and that requires exceedingly delicate handling (Allison 1977; Southwood 1978).

Although the GLM itself can handle a few interactive effects or temporal dependencies when used with suitable care, GLR as a way of thinking has a harder time with them. In a detailed analysis of substantive models for interaction, Southwood (1978) shows the extraordinary complexity of even two variable interactions when they are envisioned with proper care. With nine variables involved, and even a few particular interactive specifications considered, the models implied here

surpass visualization. They mean that the sixty points describing the thirty cases at the two points in time make a particular shape in the nine-space of variables, with some specific deviation from regularity in that shape for each specific interaction. However straightforward the inclusion of multiplier terms in equations may be, the conceptual leap of imaging them is prodigious indeed.

Yet complex interactions permeate, indeed they define any real historical process. For a historian would define the place of, say, primary product specialization in any one of these countries in terms of the conjuncture of other variables at the time. Thus, in describing the impact of these variables on agricultural policy—a relative of Bradshaw's modern sector size—Bates (1981:128) says the following:

> Palm oil in Southern Nigeria in the 1960s was produced in a nation where marketing boards had been set up by the government in association with merchant interests. Government revenues derived from export agriculture, and popular demands for government services were strong; local processors consumed a growing share of the industry's output; farmers had few alternative cash crops, and production was in the hands of small scale, village-level farmers. The industry was subject to a high level of taxation. Only when farmers began to abandon the production of palm oil for other crops, and when the government found different sources of revenue, did the government relent and offer higher prices for the crop.
>
> The production of wheat in Kenya offers a striking contrast. Historically, the marketing board for wheat had been set up by the producers themselves, and prosperous indigenous farmers had played a major role in the nationalist movement which seized power in the post-independence period. The government derived a relatively small portion of its revenues from agriculture; farmers had attractive alternatives to the production of wheat; consumers had a strong preference for wheat products and alternative sources of supply lay in far distant markets. Wheat production was dominated by a relatively small number of very large farmers; and elite-level figures had direct financial interests in wheat farming. The result was a set of policies providing favorable prices for wheat products and extensive subsidies for farm inputs.

The attributes of Kenya and Nigeria come together in this discussion into two different conjunctures that produce strikingly different agricultural policies. It is the conjuncture that produces the results, not the superposition of interaction effects on fundamental "main" effects of the independent attributes. There really is no general causal story that Bradshaw can capture in a set of path models and that can in turn be modified by particular interactions. There are only the thirty particular stories. Even though the passage above does not give a particularly detailed or subtle historical account, it describes a situation that cannot be envisioned in GLR terms. The meanings of each attribute of each country are determined by the ensemble at the time. To return to the analysis of section A above, social life happens in events—which can be seen as ensembles of particular values of attributes—rather than in a free play of attributes on each other.[7]

III. TRANSCENDING GENERAL LINEAR REALITY

The general linear model is a powerful tool for empirical research. And effective users recognize that there is, in fact, no warrant for treating it as a model for social causality. Rather, the GLM tests substantive models of social reality on the assumption that those models entail linear regularities in observed data. The substantive models involved need not take the point of view I have called general linear reality.

But in practice the GLM has generated a theoretical "back-formation." Many sociologists treat the world as if social causality actually obeyed the rules of linear transformations. They do this by assuming, in the theories that open their empirical articles, that the social world consists of fixed entities with variable attributes; that these attributes have only one causal meaning at a time; that this causal meaning does not depend on other attributes, on the past sequence of attributes, or on the context of other entities. So distinguished a writer as Blalock (1960:275) has written "These regression equations are the 'laws' of a science." To say this is to reify an entailed mathematics into a representation of reality.

Throughout this paper I have discussed some alternative methods that deal with some

[7] The fictitious character of main effects was well understood during the creation of modern inferential statistics, but has been quite forgotten. For a sobering discussion, see Traxler (1976) concerning Neyman's objections to the idea of main effects.

of the problems designated as interesting by theorists but excluded by GLR. I would like here to briefly present the theoretical positions that underlie these alternative methods. Each of course makes assumptions about the fully complex reality of the theorists, but each ignores different things than does GLR. All follow the same general strategy of relaxing one or more of the stringent philosophical assumptions here analyzed.

A. The Demographic Model of Reality

The demographic model principally relaxes the first, fundamental assumption of GLR, that of fixed entities with variable attributes. It allows entities to appear, disappear, move, merge, and divide. Demographic methods easily handle problems involving the appearance and disappearance of entities, and, as I noted above, these methods can in principle be combined with attribute-based methods to handle some of the central difficulties of entities/variables methods. Demographic methods are weaker with merger and division, however; even marriage is classically treated not as an amalgamation of two individuals, but as a state change in the life of one of them. Indeed, rather than presenting GLR-based methods with improved means for modeling the flow of entities, demography seems to be moving towards use of GLR models for state changes under conditions when entities can be assumed fixed (e.g., Rosenfeld 1983; Morgan and Rindfuss 1985).

In fact, to develop a general demographic reality that has strength comparable to that of GLR requires extensive theoretical and methodological work. Methods that would sustain inquiry in this broad demographic sense require the serious conceptualization and measurement of complex entity processes, of what I earlier called "central subjects." We need rigorous concepts for how to delimit and measure social *actors*—how to separate social names and the things behind them; how to limit central subjects to a single level of interaction; how to specify that level of interaction. We need to decide how to define *events*—not simple ones like organizational death, but complex ones like organizational transformation, in which members of entities change even while the variable properties of the entity itself change. For once we relax the fixed entities assumption, admitting first simple events like appearance and disappearance then complex ones like merger or transformation, we advance directly towards redefining the social world in terms of central subjects to which events happen. This move towards a story-based model of the social world will ultimately force us to a sequential view of reality.

B. The Sequential Model of Reality

A sequence-based, central subject/event approach reverses nearly all the GLR assumptions. It assumes, first of all, that the social world consists of fluctuating entities, accepting the demographic model just outlined. It deliberately makes order and sequence effects central. Moreover, it emphasizes the transformation of attributes into events. Thus, it interprets "30% of the cohort recruited by a certain occupation is retained after 20 years" not by comparing it to retention rates in other occupations, but by comparing it to previous and later rates in the same one; meaning is determined by story, not by scales that abstract across cases. The sequential model also avoids the assumptions about monotonic causal level. Extremely minor events (e.g., an assassination) can have large consequences because of their location in a story.[8]

The central conceptual task of the sequence approach, cognate with the conceptualization/measurement task of standard methods, is the colligation of events; how to separate hypothetical "events' (like hypothetical "concepts" in standard methods) from the occurrences used to indicate them; how to choose observed occurrences so as to best indicate the course of events. A large literature in the philosophy of history deals with the problem of colligation—the problem of defining commonly acceptable units and of grouping numbers of occurrences under a single general action (for surveys see McCullagh 1978; Olafson 1978:c.3). But there is little in social science beyond Abbott's (1984) brief

[8] In practical terms, methods studying sequential realities arise out of a common empirical situation particularly difficult for the GLM: the situation in which we are interested in how a process unfolds over time and in which there are relatively few (from 20 to 200) cases, with a large and heterogeneous collection of data available on them. Such situations include the comparative histories of organizations, of professions, of revolutions, of international policies, and dozens of other areas.

study of the practical problems of measurement with social sequence data.

The sequence model of reality does make the same kinds of assumptions about casewise independence as does GLR. Abbott's (1985) analyses of professionalization sequences, for example, are flawed by the assumption that each profession develops independently of the others, a proposition he has vigorously denied in other contexts (e.g., Abbott 1988). Perhaps the lone form of sequential analysis addressing the casewise dependence issue squarely remains White's (1970) vacancy chain model.

C. The Network Model of Reality

A third basic alternative to GLR emphasizes the relaxation not of the entities and sequence assumptions, but rather of the independence assumptions. The network/structure literatures reject these assumptions, focusing directly on the lines along which causes must flow rather than on the particular states and relations of the various causes. Although network models make the same kinds of entity assumptions as GLR and lack in most cases the historical structuring of the sequence approach, they embrace synchronic contingencies that GLR, as well as the demographic and sequential approaches, must ignore. Since the network literature is large and well-developed, my aim here is merely to identify it as embodying an alternative conception of social causality. The interested reader can refer to numerous reviews of it elsewhere. (See, e.g., Marsden and Lin 1982; Knoke and Kuklinski 1982; Burt 1982.)

IV. CONCLUSION

This paper has argued that sociological theory and methods are divided by the unnecessarily narrow approach to causality implicit in the dominant methods in the discipline. Although analysts studying social structure through network data and workers studying entity processes through demographic methods have quietly developed alternatives, all too often general linear models have led to general linear reality, to a limited way of imagining the social process. My aim in making this argument, as I said at the outset, is not controversial. But since the paper has elicited strong and even hostile response, I shall address in closing some particular objections.

The chief objections of theorist colleagues have been (1) these problems are well-known and (2) even empirical work of the kind I here recommend is not really possible within "human sciences." Although I have by no means read the entire theoretical literature, the rejections of empiricism I have seen do not in fact lay out the arguments I have made here, but take objection 2 as their principal ground (e.g., Giddens 1979, c. 7; 1982, c. 1). The "human sciences" position is indeed a deeper objection, one that would require many pages to consider. My working answer is that (1) certain eminent and undeniably interpretive practitioners of the human sciences are ardent formalizers (e.g., Barthes 1974) and (2) in fact interpretation and formalization interpenetrate in all parts of this and other disciplines. After all, most of the formal work I have cited on social sequences has been largely inspired by history and literary criticism.

Quantitative colleagues have also objected (1) that the philosophical assumptions analyzed here are well known, but in addition (2) that my alternatives are limited in applicability, and (3) that I should not present alternatives until they are better developed. I think all three of these judgments are mistaken. First, I have not seen these kinds of discussions in standard methodological sources. Lieberson's brilliant book (1985) deals with some of these issues, but never really leaves the philosophical framework of entities and variables. As for sequences, Abbott's (1983) review of prior sociological work found virtually nothing and Abell (1987) has found little since. Careful practitioners of the GLM undoubtedly recognize the problems I have written about; Lieberson is an example. But to say that any of these problems is in the active consciousness of working sociologists belies the plain evidence of our major journals.

As for the limited applicability of my alternatives, that is only apparent. The wide applicability of the GLM is itself an appearance, a consequence of the paradigm through which quantitative sociology apprehends reality. Alternatives seem applicable only to special cases, as Kuhn says, because our current methods prevent our seeing the myriads of situations to which they apply. It is not that "there are certain special kinds of data to which sequence methods are appropriate." On the contrary. One can argue on the theoretical foundation of symbolic interaction-

ism that a sequence-based methodology is the only one proper for the vast majority of social explanation.

Finally, one cannot require that alternative methods should not be considered until fully developed. The GLM did not emerge fully developed in Blalock or Duncan, much less in Sewall Wright; it became a full paradigm through a long process of development, criticism, and growth. To ask that alternatives achieve that development instantaneously is to deny the possibility of alternatives.

I have of course merely sketched the barest outlines of those alternatives here. But I hope thereby to have begun a serious consideration of the relation between methods and theory that can replace the shrill denunciations we sometimes hear.

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