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ABSTRACT

This paper presents concepts and principles pertinent to the development of cross-level and multilevel theory in organizational science by addressing a number of fundamental theoretical issues. It describes hierarchy theory, systems theory, and mixed-level models of organization developed by organizational scientists. Hierarchy theory derives from the notion that complex systems exhibit hierarchical structure--a pattern of relations among levels--and offer a framework for cross-level predictions of organizational processes and activities. Systems theory describes similar characteristics of structure, process, and function shared by different entities. It can be used to derive organizationally relevant generalizations that include isomorphisms and processes operating at different echelons. Mixed-level models include composition models, cross-level models, and multilevel models. Issues of level in organizational research are a new frontier and expand the model of organizational science by integrating research areas and providing specific models of organizational behavior. An extensive bibliography is included. (MD)

Theories of Levels in Organizational Science

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Theories of Levels in Organizational Science

There is increasing concern with issues of level in organizational science. Advocates of a multi-level approach to the study of organizations cite both disciplinary dynamics and organizational changes as the reasons behind this trend. Roberts, Hulin and Rousseau (1978) argue that multi-level research is a natural consequence of the establishment of organizational science as a discipline in its own right, integrating the traditional levels of study in its parent disciplines of administration, psychology and sociology. Moreover, increased differentiation in organizations due to bureaucratization and technological change gives rise to the need for research including both cross-level and cross-unit assessments. Elsewhere (Rousseau, in press), I have argued that although interest in the role of level in organizational science has increased, the result has been expansion of empirical research to include issues at several levels, but little theory development. This paper presents concepts and principles pertinent to the development of cross-level and multi-level theory in organizational science. Drawing on hierarchy theory, systems theory, and the mixed-level models of organization developed by organizational scientists, it proposes some generalizations about the effects and relations among levels that are pertinent to organizational research.

Issues of level constitute a new frontier. Miller (1978) likens the status of levels in science to that of species in Darwin's day. Roberts et al. (1978) have called the simultaneous consideration of factors at multiple levels the new paradigm of organizational science. Nonetheless, it is necessary to also acknowledge that the development of theory incorporating multiple levels is "simultaneously one of the most frustrating and promising areas (Vorhees, 1983, p. 24)." Reasons for this frustration include the difficulties in establishing the comparability of concepts linked to different levels (e.g., perceived climate versus organizational climate), concern with possible anthromorphizing of individual-level processes to those at higher levels (e.g., individual versus organizational learning), and the very general nature of many axioms from

systems theory that have made some applications self-evident or superficial.

To propagate this new paradigm in organizational research, a number of fundamental theoretical issues must be addressed. First, criteria must be specified to establish whether seemingly comparable concepts reflect parallel processes across levels. Second, the nature of hierarchical relations among organizational components needs explication. Are branch banks, functional departments, and corporate divisions on the same or different hierarchical levels? Are government agencies, corporate offices, and parent companies comparable? Can level be specified in an absolute sense? Third, how are lower and higher levels bound together? What factors or conditions operate in the effects that phenomena from one level have on another level? Through what rules or principles can we formulate predictions regarding the strength and scope of cross-level effects? Answers to these and other challenging questions might, to some extent, exist in several disparate areas of study. This paper reviews and integrates these to help answer these questions.

Three basic sources of information on the relations of phenomena at different levels are hierarchy theory, systems theory, and existing conceptualizations of level within organizational science. Both hierarchy and systems theory offer a generic perspective on the nature of levels. In a general sense, systems theory addresses the similarities between levels while hierarchy theory focuses on the differences. Organization-specific models have emerged somewhat independently of these theories (though some cross-fertilization is evident). These three approaches are described here to try and address some of the fundamental issues pertinent to an organizational theory of levels.

Hierarchy theory

Hierarchy theory addresses the specific effects and functions of levels in systems. It is perhaps the only area in the biological and social sciences focusing primarily on the nature and function of levels. Hierarchy theory derives from the general notion that

complex systems exhibit hierarchical structure (Simon, 1973), a pattern of relations among levels that can be characterized by a set of axioms (Vorhees, 1983). Simon (1973) described hierarchical structure as a set of Chinese boxes where opening any one box reveals a whole set of other boxes, each of which contains another set in turn. A hierarchy, in this sense, is not a sequence or a complete ordering but is a partial ordering of "boxes"—a tree.

Hierarchies of concrete things reflect the principle that the bond strength between units is greatest for units at the same level, that is, for those closest to each other. Bond strength decreases as the number of levels between units increases. It is the sharp gradation in bond strength between units that causes systems to appear hierarchical and behave so (Simon, 1973, p. 9). Hierarchies are formed by the vertical separation of low-levels of bond strength from higher levels.

The concept of nearly decomposable systems developed by Simon (1973) is based on the effects of variations in bond strength characterizing hierarchies. This concept implies that we can build a model of our focal unit (department, subunit, subsystem) at the level we choose to observe while ignoring the detailed structure and dynamics of the next level down as well as those of the next level up. We can do so according to hierarchy theory because the processes occurring at the next level down occur more rapidly than do those at the focal level and within an equilibrium that will not alter conditions and processes at our focal level. Moreover, processes at the next higher level are likely to appear constant in relation to the more rapid dynamics of our focal level. Increases in the size of a work group or changes in its division of labor generally occur more rapidly than the growth or differentiation of the department or subunit in which it is located. The basic premise here is that the time scale for processes at any level 1 will be significantly slower than the time scale for processes at level 1+1 (the immediate lower level; Vorhees, 1983).

The property of near decomposability allows for vertical segregation of hierarchical levels. Its horizontal counterpart, loose horizontal coupling, holds that the behavior of any given subsystem is relatively independent of other subsystems at the same or lower levels. This independence is a function of the degree of differentiation among subsystems at a given level. Differentiation of elements in subsystems impacts the stability and evolution these subsystems experience. Simon's (1973, pp. 7-8) tale of the watchmakers illustrates the point:

> "Two watchmakers assemble fine watches, each watch containing ten thousand parts. Each watchmaker is interrupted frequently to answer the phone. The first has organized his total assembly operation into a sequence of subassemblies; each subassembly is a stable arrangement of 100 elements, each watch a stable arrangement of 100 subassemblies. The second watchmaker has developed no such organization. The average interval between phone interruptions is a time long enough to assemble about 150 elements. An interruption causes any set of elements that does not yet form a stable system to fall apart completely. By the time he has answered about eleven phone calls, the first watchmaker will usually have finished assembling a watch. The second watchmaker will almost never succeed in assembling one—he will suffer the fate of Sisyphus: as often as he rolls the rock up the hill, it will roll down again."

The moral of the story is that there is adaptive advantage to hierarchies, elements of subsystems can retain their organization when other subsystems are under stress or suffer setbacks. Thus, GM-Oldsmobile can continue to operate effectively, producing popular American car models despite declines in Chevrolet sales.

Although near vertical decomposability and loose horizontal coupling address the segregation of levels and units within levels for purpose of analysis, it is also desirable to study the impacts that phenomena at one level have on another—which have been labeled cross-level effects (Rousseau, in press). The direction of influence determines the type of effects possible. Higher-level systems affect lower level ones predominately through control mechanisms. Patee (1973) argues that all forms of management and control exist between two hierarchical levels. Control implies constraints over activities and processes, determining the upper and lower bounds of the lower level's range of stability

or equilibrium. Control mechanisms are exerted whenever the lower level departs from equilibrium (e.g., too much or too little output or activity on the part of an organ in the human body or a work group within a department). Departure from equilibrium is the means by which lower levels influence higher ones. The cross-level impact of lower level processes on higher ones occurs when the lower-level system acts in an irregular or unpredictable manner moving outside its equilibrium. Under conditions of lower-level equilibrium, hierarchy theory holds that it is unnecessary to study lower-level processes when we seek to understand a higher level. But irregularities in lower-level processes and their cross-level impact can tell much about the nature of the higher-level system and its control functions. Departures from equilibrium can occur with increases in the size and division of labor within the focal unit. In such instances, organizations often increase their horizontal differentiation—grouping the tasks lower level units perform by function or expertise to increase the supra-unit's ability to monitor and evaluate subordinate performance (Daft & Bradshaw, 1980; Jones, 1983).

Based on the concepts of bond strength, near-decomposability, and loose horizontal coupling, a number of organizationally-relevant generalizations can be derived from hierarchy theory:

(1) Hierarchical systems evolve more rapidly than non-hierarchical systems with the same N elements. This speed of evolution means that hierarchies can respond to changing environments more quickly.

(2) Bond strength is greater between units closer (i.e., with fewer intervening levels) in the hierarchy. This force of attraction and influence is greater among proximal levels and is reflected in a higher degree of interaction among these levels. Thus cross-level effects are likely to be stronger between units at proximal levels.

(3) Time scale for higher-level processes is slower than for lower level ones, implying that assessment strategies for higher and lower levels should differ. The activities and outcomes of higher levels might require description and assessment

over longer periods of time than lower-level ones.

(4) Forms of management and control operate between different hierarchical levels, implying that the nature of control will be influenced by the hierarchical conditions described above. One such implication is that higher levels closer to the focal level will exert greater influence than more distant levels. Another implication is that horizontal differentiation, that is, increases in the number of hierarchical levels, is itself a cross-level control mechanism.

In sum, hierarchy theory offers a framework from which to derive cross-level predictions regarding organizational processes and activities. Hierarchical structure gives rise to conditions producing cross-level effects.

Systems Theory

The contribution of general systems theory to our understanding of levels lies fundamentally in the concept of multi-level models, where certain basic mechanisms are presumed to be parallel or isomorphic from one level to another. As presented by Miller (1978), systems theory describes "important uniformities (p. 26)," that is, characteristics of structure, process, and function shared by qualitatively different entities (cells, organs, organisms, groups, organizations, societies, and supranational systems).

It should be noted that what here is called a multi-level model corresponds to propositions that Miller (1978, p. 90) has called cross-level. The present paper reserves the term cross-level for models of relationships involving variables at different levels. Multi-level models, as used here, describe relations at one level that are generalizable to other levels. The search for multi-level models of activity has just begun. Miller argues that multi-level generalizations across levels are new to science; much in the way that cross-species generalizations were new in Darwin's day (p. 90-91). In specifying a series of multi-level generalizations, Miller indicated the degree of confidence he has in each postulation—an unusual caveat for a theorist, indicative of the emergent nature of the multi-level perspective.

In the most rudimentary form, one such multi-level generalization is that the more components a unit has the greater the number of levels it contains (Berelson and Steiner, 1964; Miller, 1972; Anderson and Warkov, 1961). The basis for making such generalizations is the notion that there are critical uniformities across levels in the nature of the components (individuals and groupings of individuals) that lead to similar structures and processes. Support for this view is provided by Parsons (1951) who argued for similarity in structure and process across levels in his functional model of social action. This concept of parallel attributes and dynamics across levels is not new to organizational science. Nonetheless, there are two distinctive contributions to a theory of levels that derive from a systems theory view of multi-level models: the concept of isomorphism and the distinction between levels and echelons.

Isomorphism is the uniformity of any structure, process, or function across levels. Also referred to as formal identity (Miller, 1978, p. 4, 26-28), it is demonstrated when the functional relationships underlying processes at different levels of concrete systems (groups and organizations) or constructs at different levels in abstract systems (models and theories) are equivalent. In a group or organization, the principle of entropy gives rise to the need for new inputs (new energy in the form of additional members and resources) to perpetuate both informal social groupings and firms. In a theory, constructs such as inter-group and inter-organizational conflict can be functionally equivalent if (1) the underlying model holds that both forms of conflict are a function of the same properties, such as the <u>interdependence</u> between units and <u>differentiation</u> in their goals and priorities, and (2) empirical data support this. The condition of isomorphism is a prerequisite for a multi-level model. Uniformity in constructs and processes across levels must exist before relations among variables at different levels can be presumed parallel. From the concept of isomorphism follows a criterion for establishing that functional equivalence exists: Isomorphism exists where equivalent

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functional relations underly a concrete structure or process or an abstract construct. In other words, it exists where the underlying causal process or model is the same from one level to another.

Systems theory also assigns a special meaning to the concept of level, which may be useful in the formulation of theory. In general parliance, the term level is defined as a position, place, or standard in social, moral, or intellectual matters (Oxford English Dictionary, 1971) and implies a hierarchical relation among things. Miller (1978, p. 25) describes levels as hierarchies of systems, where despite the existence of parallel or isomorphic properties, qualitative differences exist from one system to another. For example, a society or nation is a living system composed of organizations and other lower level systems. A supernational system comprises two or more societies, where some control is exerted by the supernational system over these nations. Similarly, groups and organizations differ qualitively in Miller's terms in that groups do not have an internal formal hierarchical structure, although organizations do (as indicated in formal organization charts). What differentiates groups from organizations is that the organization has echelons, or hierarchical subgroups such as positions in an organization's chain of command. Levels are qualitatively different entities, where the components comprising one system level differ from those of another (groups contain individuals, organizations contain groups and individuals). Echelons, on the other hand, reflect hierarchical positions within a system or level. Using this distinction, we can describe the relationship of a parent company to its subsidiary in terms that recognize that both are the same level or type of system with similar internal processes and functions but at distinct echelons. It is important to note that hierarchy theory does not explicitly employ the distinction between level and echelon. Most if not all of its propositions (e.g., Vorhees, 1983) appear to address echelons. Its axioms seem to accommodate the notion of qualitatively different types of living systems by describing relations among proximal echelons as high frequency and relations among the more distant system levels

as being low frequency. Therefore, relations among phenomena at different levels should be weaker than those at different echelons within the same level or system type.

Based on the concepts of isomorphism, echelons, and levels, systems theory can be used to derive organizationally relevant generalizations, including:

(1) Isomorphism across similar constructs in organization theory can be inferred when the same functional relation or causal model underlies the constructs at each level,

(2) Though quantitatively different processes can operate at different echelons, these are likely to be less divergent than processes at different levels. Moreover, functional equivalence of structures and processes across levels are more likely to occur across echelons within an organization (departments and divisions) than across system types (groups and organizations).

Empirically Derived Organizational Models of Level

Concern over issues of level in organization science stems from such disparate problems as choice of the appropriate level of study, use of aggregated data, and understanding the effects of context on behavior. Though approached from diverse theoretical and methodological perspectives, these problems and attempts to solve them have now generated enough insight to create a need to systematize what organizational scientists know about level. A general typology of analytic models might be useful here to help us understand the role level has played in organizational research and to guide future research to a more comprehensive understanding of level in organizational behavior. A typology is needed to describe the various ways analytic models can mix or combine phenomena at different levels. As such, the typology presented here labels these models "mixed level," to reflect the fact that each involves variables from more than one level.

Insert Table 1 about here

Table 1 describes the basic forms that mixed-level models can take, including: composition, cross-level, and multi-level models. A theory in organizational behavior can contain elements of any or all of them. The models described here are ideal or pure types.

Composition Models. Composition models specify the relationships between variables at different levels presumed to be functionally similar. These models are rooted in general systems theory's concern with the nature of what seems to be functionally comparable processes at different system levels, among qualitatively different living systems (organs, organisms, groups, and societies). Such organization-relevant constructs as satisfaction and morale and individual and organizational learning represent functionally similar pairs. A composition model specifies the nature of the similarity (e.g., isomorphic, partial functional identity, etc.). When some, but not all, functional elements are equivalent we have a partial functional identity. Individual satisfaction and group morale might have a partial functional identity; each has an affective component but only morale implies the existence of group cohesion and identification (Jewell and Reitz, 1981).

In his discussion of a composition theory for climate, James (1982) uses a functional relationship to specify how a construct operationalized at one level (psychological climate) is related to "another form of that construct (p. 219)" at a different level (organizational climate). Simply put, James argues that when the definitions of climate at the individual and unit levels are the same, psychological and organizational climate represent the same construct (p. 221). The condition required for equivalent definitions to exist at both levels is, according to James, perceptual agreement among members of a unit. When unit members perceive the unit in the same way, sharing assignment of psychological meaning, perceptual agreement and therefore functional equivalence between these two climate constructs exist.

The approach advanced by James to determining isomorphism (shared definition) is similar though not identical to that proposed by the systems theorists who first employed the concept. Rapoport (1972, pp. 46-47), argues that:

> "Two mathematical systems are said to be isomorphic to each other if one-to-one correspondence can be established between the elements of one and those of the other. Isomorphism between two mathematical systems induces a conceptual isomorphism between the concrete systems they represent. In other words, two concrete systems can be said to be conceptually isomorphic to each other if both can be represented by the same mathematical model."

Thus isomorphism exists where there is not only agreement on conceptual definitions but also in the mathematical or causal models specifying each variable.

Not all composition models postulate isomorphisms. Individual and group learning involve psychologically similar processes, each resulting from individual level cognitive functions. Yet, if we compare the learning curve of a single individual to that of a group, one difference is striking: the individual-level curve is discontinuous with an abrupt improvement in performance at some point, the aggregated group curve is smooth. The reason for this difference is that the point of greatest improvement for individuals differs. Some people learn more quickly than do others. The point of accelerated learning is smoothed out at the group level because individual differences in learning can cancel each other out. Though similar, individual and group-level learning are not entirely the same because individual differences are constant at one level and variable at the other. Hence, the functional specification of these two learning constructs differs.

Similar issues characterize the distinction between individual behaviors and unit-level rates of these behaviors. Suicide, absenteeism, and turnover change their distributions and possibly their meaning when we move from individual behavior to unit rates (Hulin and Rousseau, 1980). The causal factors giving rise to turnover rates (e.g., economic growth) and need not be the same as for individual turnover (e.g., dissatisfaction, high reward expectations). Additionally, shifts from behaviors to rates of behavior can introduce such factors described in hierarchy theory as differential time

frames and changing intensity of frequencies which alter the nature of the phenomena studied. Composition models must address the effects of hierarchical structure on functional relations.

Like composition theories, cross-level and multi-level models specify the relationships between constructs across levels. However, cross-level and multi-level models address the relationships between distinct constructs, those having different meanings and nomological networks. Each specifies the relationship between heterogeneous constructs from different levels.

Cross-level models. Cross-level theories specify causal models of the effects phenomena at one level have on those at another. At the heart of these theories are the assumptions organizational scientists make about the connections between higher and lower levels, the forces of attraction and inclusion, and the conditions under which influence proceeds upward or down; in short, assumptions about the operation of hierarchical structure in organizations. These theories can take three forms (Table 1). In one form, independent and dependent variables are on different levels. A second type of cross-level model involves unit-level moderators of lower level relationships. A third type of cross-level model occurs when comparative effects are postulated where x (which equals $X - \bar{X}$) effects a dependent variable. All these types of cross-level models reflect assumptions regarding the nature of hierarchy in organizational systems, which will be discussed below.

Cross-level Model 1. Much cross-level research explores the direct effect of contextual characteristics on behavior. Technology, structure, (Rousseau, 1977), climate (Drexler, 1977), departmental membership (Herman & Hulin, 1972) company policy (Siehl & Martin, 1982) are contextual factors that have been linked to individual-level responses. Cross-level organizational research began largely as an attempt to overcome the narrow intra-level explanations of behavior characteristic of previous research. Linked to ecological psychology (Barker, 1968) cross-level research was conducted mainly

by psychologists concerned with incorporating situational factors in models of behavior. Thus, cross-level theory has tended to address how higher-level characteristics affect lower-level processes.

This downward orientation is not a requirement of a cross-level model. Rather, it reflects the more pervasive influence of social settings on individuals than of individuals on settings (Barker, 1968). This emphasis is consistent with the controlling role of higher levels over lower ones as specified in hierarchy theory. Organizational research linking horizontal differentiation to attempts to control lower-level outputs (e.g., performance reliability, quantity and quality) exemplifies the cross-level nature of management control mechanisms as well as the direct effect of unit characteristics on member responses typical of Cross-Level Model 1, e.g., Jones, 1983). Conceivably, however, components can at times exert a greater influence on the units of which they are a part than vice versa. In hierarchy theory, such effects constitute irregularities or departures from equilibrium. In systems theory, upward-oriented cross-level effects reflect the perspective of emergentism, a range of theories conceptualizing society as a whole emerging from pre-existing individuals as parts and as continuing to depend upon them for its existence and nature (Bahm, 1983). This bottom-up view contrasts with the perspective of structualism which begins at the top and works down by assuming that parent structures underly all phenomena such that the behaviors of parts cannots be understood without specifying the structured wholes of which they are a part (e.g., Laszlo, 1972; Bahm, 1983). Organizational research has tended to be less concerned with the influence a single individual or different types of individuals might exert on the organization than it has been with the perhaps more typical effect of organizations on individuals. However, upward-oriented cross-level models may be valuable in explaining phenomena such as whistleblowing, change agency, and problem solving.

Behling (1978) argues that in its own way the study of organizations is unique in that it is concerned primarily with the relations among phenomena at different levels.

Treating organizational study as a multi-level field, Behling sheds new light on familiar constructs by viewing them at different levels. He suggests that motivational research on the effort - performance relationship might involve the cross-level study of how individual action effects the organization. Thus, cross-level models can involve upward (individual → organization) as well as downward (organization → individual) relations. But, it must be noted that these two forms of cross-level models represent distinct conceptualization of hierarchy. Structualism and emergentism must be reconciled to accommodate the empirical evidence organization science has generated.

One body of research exploring the effects of contextual variables on lower-level responses has employed what is called the "WABA methodology (for "within-and-between-group analysis"). Using an analysis of variance model, researchers (e.g., Dansereau & Dumas, 1977) examine the extent to which variation associated with between-unit differences and unit membership is sufficient to support one of the alternative hypotheses that: (1) the contextual unit effects individuals uniformly (whole effect hypothesis), (b) context effects individuals differently (part effect hypothesis), (c) systematic differences within and between units are so great that the unit is not a meaningful focus of analysis (special null hypothesis), or (d) only error variance exists within and between units (traditional null hypothesis). This framework conceptualizes the level of analysis (e.g., the individual) as part of a whole (the unit) and evaluates whether it is empirically meaningful to view the individual as a whole entity or as a part of another larger whole. It also can evaluate whether a particular unit is a meaningful level at which to explore cross-level effects. Important here is the concept of special null which holds that true cross-level effects may not be identifiable because the proper unit has not been studied (e.g., the department, instead of the work group). In a multi-level field of study such as organizational science, it is important to recognize that the level of analysis may be as important as the variables one chooses to study.

Cross-level research on the effects of higher level phenomena on lower-level

responses suggests that the behaviors and attitudes of members can be explained by unit characteristics—estimates of accountable variance range from 10% to 30% (Herman & Hulin, 1972; Rousseau, 1977, 1978). It is noteworthy that in these studies, the focal unit is individuals within departments. Estimates of accountable variance can be expected to be lower than these if the relationship of individual responses to division or organizational characteristics are examined—a result of decreasing bond strength across levels in hierarchy theory. Variation in the proportion of variance accountable by unit characteristics might also be a function of the degree to which the individual is a member of more than one unit or social role (e.g., organization, family, or social groups). Allport's (1962) concept of partial inclusion might be an important factor in understanding cross-level effects. The more included is an entity (individual, group, or organization) in a higher-level unit, the stronger any cross-level effect should be. Inclusion, therefore, is a limiting condition on direct cross-level relations.

Cross-level Model 2. Another frequent type of cross-level model is found in the study of contextual factors as moderators of individual-level relationships. Moderator analysis traditionally is concerned with the role played by individual differences in the relationship between such variables as the predictors and criteria of selection research (Ghiselli, 1956, 1960). In organization-level research, technology (Woodward, 1958, 1965) and environment (Lawrence & Lorsh, 1969) have moderated the relationship between structure and organizational effectiveness. However, moderators need not be at the same level as those variables whose relationship they moderate. Factory settings (Hulin and Triandis, 1981), performance/reward contingencies (Cherrington, Reitz and Scott, 1971), and environmental uncertainty (Duncan, 1972) are contextual factors that appear to moderate relationships at lower levels. In the form of contextual moderators, cross-level research has been with us for quite some time in the field of organizational study and has provided empirically-derived models of behavior (e.g., Blood & Hulin, 1967). White's (1978) review of the role of individual differences as moderators of the job

quality—worker response relation contains examples of some "individual difference" variables that are actually contextual moderators. Rural versus urban plant location and city size have been found to moderate the individual-level impact of job quality on employee attitude.

As a basis for cross-level theory, contextual moderators do have one great weakness: they are often atheoretical and wholly empirically derived. Research based on contingency theories, as in the areas of leadership and organization design, is an exception (e.g., Lawrence & Lorsch, 1969). Nonetheless, moderator variables almost by definition are not the major subject of interest in the research involving them. Rather, moderators tend to be sought out when a relationship proves to be difficult to replicate across studies. Moderators often are the post hoc result of the study of other variables. Thus, there has been little theoretical elaboration of the moderating effect of context on lower level relations. The sparseness of conceptual work addressing the role of cross-level moderators is somewhat surprising given that the study of moderators arose in organizational research out of the difficulties inherent in generalizing from one setting or condition to another relations occurring at the same level. Very likely, cross-level moderators operate by affecting variables at the focal level that, in turn, operate on the relationship of interest. In the case of unit-level performance/reward contingencies (Cherrington et al., 1971) performance causes satisfaction through the effect of contingencies on the perceived probability of performance leading to rewards. The unit-level moderator here might cause a lower level condition that is essential to the functional relation of interest. Cross-level moderator relationships might therefore ultimately depend on a direct effect of processes at one level on those at another (as described in Cross-Level Model 1).

Cross-Level Model 3. With the possible exceptions of research on social justice and equity, little organizational research investigates comparative processes (individual differences from group standards where $x'(x = X - \bar{X})$ is the independent variable). However, models of organizational behavior examining the effects of deviance or

difference from a group average would be cross-level in nature (see Firebaugh's (1980) discussion of frog pond effects).

Multi-level models.

Multi-level models are distinct from models of composition or cross-level phenomena. Broad in scope, multi-level models postulate relationships among variables which apply at two or more levels. These models assume formal identity between constructs across levels and therefore require specification of composition models before they can be tested. This requirement of formal identity differentiates multi-level models from analogies. As Pinder and Bourgeois (1982) point out, it is one thing to say that the organizational decision process is like a garbage can, and another to say that it is one. Metaphors are inherently imprecise and open to interpretation, making rigorous specification and testing difficult. It should be noted here that though general systems theory is referred to throughout this paper, one major criticism of it is its proponents' reliance on analogies and interesting similarities in place of specificity and detailed predictions (Berrien, 1975). The framework described here assumes that formal identity of constructs has been established when multi-level models are developed.

Parsons' (1951) work provides a fairly elaborate example of multi-level theory. Using roles and clusters of roles as building blocks, Parsons explored the effects of rewards and power on the actions of individuals and their aggregates. His models employ these same constructs across levels to explain how action is motivated in both individuals and in collectivities. Terms like "value-orientation," "role expectation" and "goals" (p. 203) are presumed to be meaningful across levels. In specifying the relationships among his framework's basic constructs, Parsons' (p. 203) notes:

> "It should go without saying that these considerations apply to any collectivity, no matter how small a part of a total society it forms. This fundamental structural homology between the total society and sub-collectivities within it is one of the most important aspects of the structure of social systems."

This statement constitutes a succinct description of a multi-level theory.

Multi-level models exist in the propositions that organizational scientists have

applied to individual, group, and organizational activites. Parkinson's (1957) tongue-in-cheek foray into organizational analysis produced a "law" (or more accurately a set of propositions) that has been tested at the individual (Bryan & Locke, 1967) as well as at the organizational levels (Anderson & Warkov, 1961). As another example, Thompson's (1967) basic notion that power is derived from controlling uncertainty applies both to individuals with expertise others lack but need, and also to groups so placed in the organization's workflow that under conditions of uncertainty they make strategic choices on which the well-being of others depends. Thompson took a basic premise that reducing uncertainty is essential to the creation of organizational rationality and generated hundreds of propositions, some referring to individual actors and others to group or organizational processes. These propositions derive from the pervasive effect the search for rationality has on organizational processes, an effect that may be termed a "dynamic" in the sense of its use by Katz and Kahn (1978).

In his discussion of the theory behind the WABA methodology, Yammarino (1981) argues that the multiple levels of analysis characteristic of organizational science are not necessarily independent views of human beings. Since individuals comprise dyads, groups, and organizations, common behavioral determinants across levels are plausible. Further, all organizational units can be viewed simultaneously as parts and as wholes, characterized by both integrity and dependency. According to Yammarino (1981, p. 11):

> . . . "every time a whole unit of analysis is found at one level of analysis (i.e., one perspective on human entities), there is a <u>potential</u> (italics in the original), when viewed at the next higher level of analysis (i.e., a "broader" perspective on human entities), that either unit parts or whole units could also occur. It also follows that unit parts at one level of analysis have the <u>potential</u> to occur as whole units at the next lower level of analysis (i.e., a "narrower" perspective on human entities)".

This part/whole notion is akin to Koestler's (1969) concept of <u>holon</u> and, as in the case of the WABA approach, can be used to generate not only a framework for testing cross-level effects, but also a model of multi-level relations as well.

In what is expressly identified as a multi-level analysis, Staw, Sandelands, & Dutton

(1981) explore parallel processes shaping how individuals, groups, and organizations cope with adversity and identify a general threat-rigidity effect. While previous models emphasized organizational and not individual and group reactions to adversity (see Smart and Vertinsky (1977) for an exception) Staw et al. reasoned that all three levels experience adverse environmental events ("threats"). Their analysis focuses on patterns of threat responses observed at each level and their essential similarity across levels. At all three levels, threat appears to produce a restriction of information flow and a narrowing of the behavioral or response repetoire, providing support for a generalized threat-rigidity effect. Staw et al. provide an integration of research at different levels that yields a multi-level model.

Staw et al. employ what they term the "systems metaphor" (p. 517) in describing how threat may induce system rigidity through its activation of internal control mechanisms. Compatible with a systems perspective, this multi-level analysis is the product of both recognition of patterns of relations across levels and attention to the composition or meaning of the threat and rigidity constructs. In this and other formulations of multi-level hypotheses we see the application of the general systems theory principle of "important uniformities."

The Convergence of Three Perspectives on Levels

As described above, organizational research is rich in descriptions of the relations among phenomena at different levels. Despite the relative independence of developments in systems and hierarchy theory from trends in organizational research, there is a good deal of overlap in the issues studied and a great potential for cross-fertilization. Systems theory concepts of isomorphism and multi-level modeling are represented in organizational behavior as are hierarchy theory concerns with shifts in the nature and intensity of phenomena as we move across levels. Moreover, the study of issues of level in organizations affords the opportunity for empirically-derived models of level, a potential contribution to both systems and hierarchy theory.

Among the contributions of these theories to organizational behavior are the

following:

(1) The establishment of criteria for identification of isomorphisms. Systems theory's specification of equivalence of functional relations as the condition for formal identity implies that causal modeling techniques (such as the confirmatory analysis approach described by James, Mulaik and Brett, 1982) are an appropriate methodology for empirical testing of functional relations. This approach could facilitate the development of composition models in organizational behavior for such constructs as climate, learning, and stress responses.

(2) Systems theory's distinction between echelons and levels argues that organizational units of the same level but at different echelons (such as departments and subsections) have greater parallels in structure, processes and function than do units from different levels (work groups and organizations) or at echelons that are far apart (departments and divisions). This premise suggests that data from cross-sectional studies combining data from departments and other lower to mid-level units might be more justified than those combining data from departments and organizations. This issue is an important one in organizational research where researchers wishing to examine the effects of unit characteristics on individuals or the relations among unit characteristics, such as technology or structure, attempt to get a large sample of units by combining data about different types of units.

(3) Hierarchy theory describes the relative differences in the time frames characterizing lower and higher level processes and suggests that organizational assessment of structure, processes, and their outcomes reflect the different time frames appropriate to the levels studied. In organizational research, it is common that assessments of organizational performance reflect a greater time interval than measures of individual performance. One may be assessed over years and the other over a period of months. The same distinction might hold for other phenomena as well. In comparison to the structure of an individual's

organizational role, organizational structure may appear to be constant. In the same time period, the latter can remain much the same while the individual is exposed to diverse role demands, which might, perhaps, conflict from one week, day, or hour to the next. The degree of stability in lower-level phenomena should be considered in the timing and duration of assessments.

(4) The adaptive responses of lower-levels are presumed to be more rapid than those of higher levels according to hierarchy theory. This potential fluctuation in lower-level phenomena has two important implications for organizational research. Evaluation studies exploring the nature and effects of change efforts should have more frequent measures of lower-level changes relative to the number of higher-level assessments made. When lower-level changes move beyond that level's range of stability, they can activate control mechanisms from higher levels. Studies of change should take into account the lower-level conditions and activities that evoke higher-level control responses, particularly when change is planned or attempted.

(5) Influence of units at different levels upon each other is a function of proximity, according to hierarchy theory. From this premise, cross-level models of organizational behavior can incorporate the hypothesis that cross-level effects vary with the distance between levels. Thus, ceteris paribus, organization-to-individual effects should be weaker than department-to-individual effects.

(6) Finally, as a function the principle of inclusion of lower-level units in higher ones, and the related social-psychological concept of partial inclusion, it can be argued that the magnitude of cross-level effects is a function of the degree of inclusion. The inclusion of an individual in a department or in an organization is a function of the number of different roles the individual has within and outside the organization and the emphasis and importance the individual assigns to membership in the department or organization (e.g., concept of central life

interests, e.g., Dubin, & Champoux, 1977). more included an individual, a group, or an organization in a higher level unit, ceteris paribus, the greater will be the cross-level impact of that unit.

Issues of level in organization research are a new frontier. They raise questions about the relation of organizational theory to other bodies of knowledge. They also expand our model of organizational science: although multi-level models as proposed by systems theory are fundamentally a reflection of the principle of parsimony, cross-level models are an expansion of the domain of variables usually considered in the explanation of a phenomenon. Hopefully, by integrating organizational research with generic theories addressing the issue of level, we will at once have both parsimony and thoroughness in the specification of models of organizational behavior.

Table 1

A typology of mixed-level models in organizational research

	Structures[1]	Assumptions
Composition Relations among nondependent variables at different levels	$X_3 \leftrightarrow X_2 \leftrightarrow X_1$	Specification of each variable's causal model
Cross-level Relations among independent and dependent variables at different levels.	$X_2 \rightarrow Y_1$ (1) $X_2 \rightarrow Z_1 \rightarrow Y_1$ (2) $(X \quad -\overline{X}) \rightarrow Y$ (3)	Degree of inclusion
Multi-level Relations among independent and dependent variables generalizing across two or more levels.	$X_3 \rightarrow Y_3$ $X_2 \rightarrow Y_2$ $X_1 \rightarrow Y_1$	Isomorphism of constructs across levels

[1] The structures represented here are examples of models meeting the defining criteria for a particular type of model.

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