CHAPTER 1

A Multilevel Approach to Theory and Research in Organizations
Contextual, Temporal, and Emergent Processes
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Organizations are multilevel systems. This axiom—the foundation of organizational systems theory—is reflected in the earliest examples of organizational theory, including the Hawthorne Studies (Roethlisberger & Dickson, 1939), Homans's theory of groups (1950), Lewin's field theory (1951), sociotechnical systems theory (Emery & Trist, 1960), Likert's theory of organizational effectiveness (1961), Thompson's (1967) theory of organizational rationality, and Katz and Kahn's (1966) social organizational theory, to name but a few. Further, this axiom continues to provide a foundation for virtually all contemporary theories of organizational behavior. Yet, despite the historical tradition and contemporary relevance of organizational systems theory, its influence is merely metaphorical. The system is sliced into organization, group, and individual levels, each level the province of different disciplines, theories, and approaches. The organization may be an integrated system, but organizational science is not.

There are signs that this is beginning to change, that we are moving toward the development of an integrated conceptual and
A Multilevel Approach to Theory and Research in Organizations

methodological paradigm for organizational science. We have witnessed the evolution, over the last two decades, of multilevel frameworks that have well-developed conceptual foundations and associated analytic methodologies. Organizational science is moving toward the development of a paradigm that can bridge the micro-macro gap in theory and research. We are witnessing the maturation of the multilevel paradigm in organizational science. As with all maturation, however, the process has not proceeded without pain. The roots of the multilevel perspective are spread across different disciplines and literatures, obscured by the barriers of jargon, and confused by competing theoretical frameworks and analytic systems. Although there are some explicit efforts to specify general multilevel frameworks for organizational science (e.g., Dansevere, Ansoff, & Yammarino, 1984; House, Rousseau, & Thomas-Hunt, 1995; Klein, Dansevere, & Hall, 1994; Roberts, Hulin, & Rousseau, 1978; Rousseau, 1985), real and apparent differences among the frameworks have created the impression of little common ground (e.g., George & James, 1994; Klein, Dansevere, & Hall, 1995). Further, the best way to evaluate multilevel theories (e.g., George & James, 1993; Yammarino & Markham, 1992) and establish emergent constructs (e.g., James, Demaree, & Wolf, 1993; Koslowski & Hattrup, 1992; Schmitz & Hunter, 1989) is much contested. No single source exists to cut across these differences and to guide the interested researcher in the application of multilevel concepts. This contributes to confusion and limits the development of a multilevel theory. Accordingly, a review of the current literature is likely to leave those who are tempted to test multilevel theories intrigued yet confused—inspired yet wary.

Our goal in this chapter is to help resolve this confusion by synthesizing and extending prior work on the development of multilevel theory and research for organizations. The chapter is organized into three sections. In the first section, we review the theoretical roots of the multilevel perspective as it relates to theory building and research in organizations. The epistemological foundation and several basic assumptions for the levels perspective are rooted in general systems theory (von Bertalanffy, 1968) and related variants. Early and enduring applications of the levels perspective to research on organizational characteristics and organizational cli- mate had a formative impact on the development of the levels perspective and continues to exert considerable influence.

In the second section, we clarify, synthesize, and extend basic principles to guide multilevel theory development and to facilitate empirical research. We first provide principles to guide the development of multilevel theory. We discuss theoretical issues pertaining to the origin and direction of phenomena across levels. We also provide guidelines for the identification, specification, and analysis of the degree of coupling or linkage of phenomena across levels. With this theoretical foundation in place, we next examine and illustrate how to specify and operationalize multilevel models. Critical issues focus on establishing an alignment among levels of theory, constructs, and measures. We also specify different types of levels models, examine implications for research sampling, and provide an overview of data-analysis issues.

In the third section, we extend multilevel organizational theories by drawing particular attention to relatively neglected bottom-up processes. Many organizational theories are implicitly or explicitly top-down, addressing the influence of macro levels (for example, organization or group characteristics) on micro levels (for example, individuals). Such models focus on contextual factors at higher levels that constrain and influence lower-level phenomena. Bottom-up models describe phenomena that have their theoretical origin at a lower level but have emergent properties at higher levels (for example, psychological and organizational climate, individual and team effectiveness, individual and organizational learning). Models of emergence have been largely restricted to isomorphic composition processes, which has limited the development of bottom-up multilevel theory and research. We elaborate discontinuous, configural compilation processes and describe how they allow the conceptualization of alternative manifestations of emergence. We use this perspective to extend extant models of emergence. We develop a typology of emergence to illustrate and explain several alternative models that range from isomorphic composition to discontinuous compilation. We are hopeful that these alternative models of emergence will stimulate and guide research on these central but neglected multilevel phenomena.
Foundations for Multilevel Theory in Organizations

Conceptual Underpinnings

General Systems Theory

General systems theory (GST) has been among the more dominant intellectual perspectives of the twentieth century and has been shaped by many contributors (e.g., Ashby, 1952; Boulding, 1956; Miller, 1978; von Bertalanffy, 1972). Systems concepts originate in the "holistic" Aristotelian worldview that the whole is greater than the sum of its parts, in contrast with "normal" science, which tends to be insular and reductionistic. The central goal of GST is to establish principles that generalize across phenomena and disciplines—an ambitious effort that is aimed at nothing less than promoting the unity of science.

Systems principles are manifest as analogies or logical homologies. Logical homologies represent identical concepts (that is, isomorphism), and parallel processes linking different concepts (that is, homology), that generalize to very different systems phenomena (von Bertalanffy, 1972). For example, it is noted that open systems counteract the second law of thermodynamics—entropy—by importing energy and information from the external environment, and transforming it, to maintain homeostasis. Feedback and servo-mechanisms are the basis for the purposeful responses of cybernetic systems. Organizational systems are proposed to have analogous structures and processes (e.g., Katz & Kahn, 1966; Miller, 1978).

Whether one takes a more macro (Parsons, 1956, 1966) or micro (Allport, 1954) perspective, the influence of GST on organizational science has been pervasive. Unfortunately, however, that influence has been primarily metaphorical. The bureaucratic—open systems-machine metaphor is contrasted with a contingent—closed systems-living organism metaphor. Although metaphor has important value—virtually all formal theory is rooted in underlying metaphor (Morgan, 1983)—lack of specificity, formal identity, and precise definition can yield truisms that mislead and fail the test of science (Pinder & Bourgeois, 1982; Bourgeois & Pinder, 1983). GST has exhibited heuristic value but has contributed relatively little to the development of testable principles in the organi-
Macro researchers tend to deal with global measures or data aggregates that are actual or theoretical representations of lower-level phenomena, but they cannot generalize to those lower levels without committing errors of mis specification. This renders problematic the drawing of meaningful policy or application implications from the findings. For example, assume that we can demonstrate a significant relationship between organizational investments in training and organizational performance. The intuitive generalization—that one could use the magnitude of the aggregate relationship to predict how individual performance would increase as a function of increased organizational investments in training—is not supported, because of the well-known problem of ecological inference. Relationships among aggregate data tend to be higher than corresponding relationships among individual data elements (Robinson, 1950; Thornthwaite, 1939). This fact continues to be a significant difficulty for macro-oriented policy disciplines—sociology, political science, economics, education policy, epidemiology—that attempt to draw individual-level inferences from aggregate data.

Micro researchers suffer from an opposite problem, which also makes the desire to influence human resource management policy difficult. We may, for example, be able to show that individual cognitive ability increases individual performance. However, we cannot then assert that selection systems that produce higher aggregate cognitive ability will necessarily yield improved organizational performance. Perhaps they will, but that inference is not directly supported by individual-level analyses. Mis specifications of this sort, however, are not unusual (Schmidt, Hunter, McKenzie, & Muldrow, 1979). Such "atonic fallacies," in which organizational psychologists suggest team- or organization-level interventions based on individual-level data, are common in our literature.

A levels approach, combining micro and macro perspectives, engenders a more integrated science of organizations. House and colleagues (1995) suggest the term meso because it captures this sense that organizational science is both macro and micro. Whatever it is called, we need a more integrated approach. The limitations that the organizational disciplines suffer with respect to influencing policy and applications can be resolved through the development of more complete models of organizational phenomena—models that are system-oriented but do not try to cap-
Overview

Although interest in the development and testing of multilevel models has increased in recent decades, there have been relatively few efforts to provide multilevel theoretical frameworks for organizational researchers (e.g., House et al., 1986; Rouse, 1986). Our research examines the gaps between contextual levels and the need for organizational scholars to develop and apply multilevel models. The design of the study is to "think macro" but not "think micro." Our research is guided by the idea that multilevel models are needed to guide the development of research and evaluation of multilevel models.

In the first part of this section, we describe the multilevel model in the context of climate and behavior. In the second part, we provide guidance for developing multilevel models in the context of the individual level. The question we examine is central to the development of research on the consequences of contextual levels among constructs, including, for example, the consequences of organizational climate for work outcomes (e.g., theory of change, or pathways). We provide principles to guide the interested researcher through the theoretical and methodological landscape.
The principles we derive are intended to be general guidelines applicable to most circumstances; they are not immutable laws. We acknowledge at the outset that the complexity of the issues involved in multilevel theory makes exceptions to the general principles inevitable. In such cases, theory takes precedence—that is the one overarching principle.

Principles for Multilevel Organizational Theory Building

This section describes fundamental theoretical processes that provide the underpinnings for developing multilevel theories. We hope to assist readers in emulating and extending the best of current multilevel thinking. Toward this end, we highlight established principles and consider provocative new possibilities for multilevel theory building and research. For ease of presentation, we present central principles of multilevel theory building and research organized around the what, how, where, when, and why (and why not) of multilevel theoretical models.

What
On what should multilevel theory building and research focus? The possibilities are virtually endless, reflecting the full breadth of organizational processes, behavior, and theory. Nevertheless, a few guidelines regarding the process of choosing a focus for study are possible. First, we urge scholars to begin to fashion their theoretical models by focusing on the endogenous construct(s) of interest. What phenomenon is the theory and research attempting to understand? The endogenous construct, or dependent variable, drives the levels, constructs, and linking processes to be addressed by the theory. Too frequently, researchers begin theory development with the antecedents of interest: “These are interesting constructs; I wonder how well they predict generic outcomes.” Such an approach invites the development of a trivial or misspecified theory. Without careful explication of the phenomenon of interest, it is exceedingly difficult to specify a meaningful network of potential antecedents.

A Multilevel Approach to Theory and Research in Organizations

Principle: Theory building should begin with the designation and definition of the theoretical phenomenon and the endogenous construct(s) of interest.

Second, multilevel theory is neither always needed nor always better than single-level theory. Micro theorists may articulate theoretical models capturing individual-level processes that are invariant across contexts, or they may examine constructs and processes that have no meaningful parallels at higher levels. Similarly, macro theorists may develop theoretical models that describe the characteristics of organizations, distinct from the actions and characteristics of organizational subunits (groups, individuals). Although we think that such phenomena are likely to be rare, in such cases multilevel theory building is not necessary.

Finally, theorists may also find it impractical to develop multilevel models for processes, relationships, and outcomes new to organizational science; that is, when tackling phenomena previously unexplored in the organizational literature, a theorist may find it helpful to initially act as if the phenomena occur at only one level of theory and analysis. In this way, a theorist temporarily restricts his or her focus, putting off consideration of multilevel processes for a period. Huselid's work (1995) on strategic human resource management provides an example. Huselid has documented organization-level relationships among human resource practices, aggregate employee outcomes, and firm financial performance, but what are the cross-level and emergent processes—the linkages of individual responses to human resource practices—that mediate the relationship between organizational human resource practices and organizational performance? The time is now ripe for such multilevel theory building (Ostroff & Bowen, Chapter Five, this volume).

Having acknowledged that there may be instances in which multilevel models may be unnecessary, we also offer the following caveat: given the nature of organizations as hierarchically nested systems, it will be difficult in practice to find single-level relations that are unaffected by other levels. The set of individual-level phenomena that are invariant across contexts is likely to be very small. Similarly, the set of group- or organization-level phenomena that are completely uninfluenced by lower levels is also likely to be
small. Failure to account for such effects when they exist will yield incomplete or misspecified models.

PRINCIPLE: Multilevel theoretical models are relevant to the vast majority of organizational phenomena. Multilevel models may, however, be unnecessary if the central phenomena of interest (a) are uninfluenced by higher-level organizational units, (b) do not reflect the actions or cognitions of lower-level organizational units, and/or (c) have been little explored in the organizational literature. Caution: Proceed with caution!

How

By definition, multilevel models are designed to bridge micro and macro perspectives, specifying relationships between phenomena at higher and at lower levels of analysis (for example, individuals and groups, groups and organizations, and so on). Accordingly, a multilevel theoretical model must specify how phenomena at different levels are linked. Links between phenomena at different levels may be top-down or bottom-up. Many theories will include both top-down and bottom-up processes.

Top-down processes: contextual influences. Each level of an organizational system is embedded or included in a higher-level context. Thus individuals are embedded within groups, groups within organizations, organizations within industries, industrial sectors within environmental niches, and so on. Top-down processes describe the influence of higher-level contextual factors on lower-levels of the system. Fundamentally, higher-level units may influence lower-level units in two ways: (1) higher-level units may have a direct effect on lower-level units, and/or (2) higher-level units may shape or moderate relationships and processes in lower-level units.

An organization has a direct effect on the behavior of individual employees when, for example, its culture determines the accepted patterns of employee interaction and work behavior (for example, how formally employees address each other, or the extent to which employees question their supervisors’ directives). An organization has a moderating effect on lower-level relationships when the relationship between two lower-level constructs changes as a function of organizational context. Thus, for example, the relationship between employees’ conscientiousness and performance may vary across organizational contexts. In contexts that provide autonomy and resources, conscientiousness may be associated with performance. However, contexts low on autonomy and resources are likely to constrain the effects of conscientiousness on performance, hence the relationship will be weak.

PRINCIPLE: Virtually all organizational phenomena are embedded in a higher-level context, which often has either direct or moderating effects on lower-level processes and outcomes. Relevant contextual factors and effects from the higher level should be incorporated into theoretical models.

Bottom-up processes: emergence. Many phenomena in organizations have their theoretical foundation in the cognition, affect, behavior, and characteristics of individuals, which—through social interaction, exchange, and amplification—have emergent properties that manifest at higher levels. In other words, many collective constructs represent the aggregate influence of individuals. For example, the construct of organizational culture—a particularly broad and inclusive construct—summarizes the collective characteristics, behaviors, and values of an organization’s members. Organizational cultures differ insofar as the characteristics, behaviors, and values of organizational members differ.

Bottom-up processes describe the manner in which lower-level properties emerge to form collective phenomena. The emergence of phenomena across increasingly higher levels of systems has been a central theme of GST. Formative efforts to apply GST focus on the structure of emergence—that is, on the higher level, collective structure that results from the dynamic interactions among lower-level elements. The broad system typologies of Boulding (1956) and Miller (1978) attempt to capture the increasingly complex collectivities that are based on lower-level building blocks of the system. Thus, for example, interactions among atoms create molecular structure, or interactions among team members yield team effectiveness. This perspective views an emergent phenomenon as unique and holistic; it cannot be reduced to its lower-level elements (e.g., Danerou et al., 1984).

A more contemporary perspective, one that has its roots in GST, derives from theories of chaos, self-organization, and complexity, and it views emergence as both process and structure. This
proposition attempts to understand how the dynamics and interactions of lower-level phenomena generate higher-level collective phenomena and vice versa. The proposition suggests that the collective phenomena are emergent properties of the lower-level processes. This is achieved through a process of self-organization, where the lower-level processes interact in complex ways to produce new, higher-level structures and patterns.

(James, 1982; Kofod & Harrop, 1992). It indicates that both continuous and discrete changes over time and space, as well as interactions between different elements, contribute to the emergence of collective phenomena at higher levels. The proposition emphasizes the importance of considering the overall system when analyzing phenomena, as it provides insights into the relationships between different levels and the emergence of new properties.
specify the focal entities—the specific organizational levels, units, or elements—relevant to theory construction. Suppose, for example, that a theorist is interested in the difference of unit climate on individual actions. What is the level of interest? For example, is it group climate? division climate? organizational climate? the climate of the informal friendship network? In the passages that follow, we will first explore the nature of organizational units as evoked by multilevel theory and then describe processes that determine the strength of the ties that link organizational levels or units.

Nature of organizational units. All but the smallest organizations are characterized by differentiation (horizontal divisions) and integration (vertical levels). These factors yield myriad entities, units, or levels. In organizational research, levels of theoretical interest focus on humans and social collectivities. Thus individuals, dyads, groups, subunits, and organizations are relevant levels (units, or entities) of conceptual interest. This structure is hierarchically nested so that higher-level units encompass those at lower levels.

Many writers (Brown & Kozlowski, 1997; Freeman, 1980; Glick, 1985; Hannan, 1991, Simon, 1975) assert the importance of using formally designated units and levels for specification; for example, leadership research typically defines the "leader" as the formal unit manager. Generally speaking, formal units can be defined with little difficulty, although there can be exceptions, where unit boundaries or memberships are fuzzy.

Yet organizations are social systems in which people define their own informal social entities (Katz & Kahn, 1966). A variety of phenomena may define units or entities that do not correspond with formal unit boundaries. For example, vertical dyad linkage (VLD) theory (Green, 1976) posits the formation of in-and outgroups as distinctive entities within a formal unit. Rentch (1990) demonstrates that patterns of social interaction across formal units influenced consensus on organizational activities that informal entities affect. Specification is based on experience rather than on careful consideration. This can be problematic when the phenomena of interest are examined within formal units but are driven by informal processes that yield nonuniform patterns of dispersion (Brown & Kozlowski, 1997). Therefore, levels and units should be consistent with the
nature of the phenomenon of interest (Campbell, 1958; Freeman, 1980).

**PRINCIPLE:** Unit specification (formal versus informal) should be driven by the theory of the phenomena in question. Specification of informal entities that cut across formal boundaries, or that occur within formal units and lead to differentiation, requires careful consideration.

Determinants of the strength of ties linking organizational levels or units. One overgeneralization of the systems metaphor is that everything is related to everything. In reality, some levels and units are much more likely than others to be strongly linked, through what Simon (1975) refers to as bond strength. The theorist needs to choose appropriate units and levels or risk a misspecified or ineffective theory. Bond strength and related concepts help to explain what is likely to be connected across levels, and why.

Simon (1969, 1975) views social organizations as nearly decomposable systems. In other words, limited aspects of the larger system can be meaningfully addressed without compromising the system's integrity. A social organization can be conceptualized as a set of subsystems composed of more elemental components that are arrayed in a hierarchical structure. The linkage among levels—individual, group, and organizational—and subsystems is determined by their bond strength, which refers to the extent to which characteristics, behaviors, dynamics, and processes of one level or unit influence the characteristics, behaviors, dynamics, and processes of another level or unit (Simon, 1973). The greater the implications of one unit's actions for another unit, the greater the strength of the bond linking the two units. Therefore, meaningful linkages increase in strength with proximity and inclusion, and they decrease in strength with distance and independence.

Other researchers have used similar concepts to express the same basic principle. Weick (1976) uses the concept of coupling to reference decomposable subsystems. House and colleagues (1995) describe inclusion as the proportion of a lower-level unit's activities that are devoted to a higher level; units that are highly included will be more closely linked to the higher level. Kozlowski and Salas (1997) use the term embeddedness to describe how lower-level phenomena are aligned with contextual factors and processes that originate at higher levels in the organizational system; alignment reflects strong bonds or inclusion across levels. Technostructural factors such as organizational goals, technology, and structure, as well as enabling processes such as leadership, socialization, and culture, influence embeddedness. From an interactionist perspective, Indik (1968) and James and Jones (1976) assert that strong interactions between levels require propinquity of structure and process and alignment of content. Constructs and processes implicated in bond strength, coupling, inclusion, and embeddedness will be more strongly linked across levels for relevant units.

This has obvious implications for models that incorporate multiple levels or units. Proximal, included, embedded, and directly coupled levels and units exhibit more meaningful relations than distal levels or loosely coupled units. Moreover, the content underlying constructs at different levels has to have some meaningful connection. For example, work-unit technology and structure exhibit cross-level effects on individuals because they constrain the characteristics of jobs (Kozlowski & Farr, 1988; Rousseau, 1978a, 1978b). The levels are coupled and the content is meaningfully related in a common network of relations. In contrast, the potential effects of organization-level strategy on individual jobs is likely to be quite small. This does not mean that strategy has no effect; rather, its effects are mediated through so many intervening levels, units, and content domains that direct effects are likely to be very difficult to detect at the individual level because bond strength is weak and the focal content is not meaningfully related. The effects of strategy are likely to be indirect.

**PRINCIPLE:** Linkages across levels are more likely to be exhibited for proximal, included, embedded, and/or directly coupled levels and entities.

**PRINCIPLE:** Linkages are more likely to be exhibited for constructs that tap content domains underlying meaningful interactions across levels.

Time is rarely a consideration in either single-level or multilevel organizational models (House et al., 1995), yet it is clearly the case that many if not most organizational phenomena are influenced and shaped by time. Here we explore three ways in which time may
be incorporated into a multilevel model, increasing the rigour, complexity, and effectiveness of multilevel theory building.

A given phenomenon may appear to originate at a higher or lower level according to the theoretical assumption about the current time point in the organization or the context in which the phenomenon occurs. Understanding the dynamics of organizational change is therefore critical for developing or changing organizational culture. In effect, individual and organizational level change is driven by a constant process of development or change in organizational culture. As such, organizational change is essentially a continuous process that involves the interaction of different levels and contexts.

The distinction between the two perspectives just sketched does not have to do with which one represents the "true" model of organizational culture, but rather how different models can be integrated into a comprehensive understanding of organizational phenomena. The distinction is important because it allows us to specify the temporal assumptions under which the phenomenon in question can be studied. In a theoretical context, for example, a multilevel model may be used to explore the effects of top-down interventions on organizational culture, while a multilevel model may be used to explore the effects of bottom-up interventions on organizational culture. In both cases, the multilevel approach allows us to specify the temporal assumptions under which the phenomenon can be studied.
One implication of this effect of time scale is that phenomena at different levels may manifest at different points in time. For example, when a team of colleagues has proposed that team performance is influenced by the level of the relationship (Damasio, 1992, 1995).

Accordingly, environmental processes must be considered during the design of research. Further, evidence has been gathered that environmental processes related to the team's environment (Kozlowski et al., 1992) can influence team performance, mediated by other factors such as task characteristics or team composition. Therefore, it is crucial to consider the influence of these processes on the team's performance. The influence of team membership on team performance can be complex, with factors such as team composition, task characteristics, and team processes playing a role. As a result, it is important to consider the influence of these factors when designing and evaluating team performance.
Constructs in Multilevel Theory

Principles for Model Specification: Aligning Constructs, Measures, Models, Design, and Analyses

Many of the controversies and problems associated with multilevel research are based on misspecifications or misalignments among the constructs, measures, models, designs, and analyses. For instance, the top-down approach, which assumes that all levels are equally important, often results in ignoring the unique characteristics of the individual units. Such a top-down approach may lead to the neglect of the bottom-up perspective, which emphasizes the importance of individual-level factors. Moreover, the use of aggregated data can lead to measurement bias and ecological fallacies, as well as the loss of important information that is unique to individual units.

To address these issues, researchers should consider the following principles:

1. **Constructs**: Aligning constructs at different levels is crucial. Constructs at the lower level should be aligned with measures at that level, and constructs at the higher level should be aligned with measures at that level. This alignment helps ensure that the constructs capture the intended phenomena at each level.

2. **Measures**: Measures should be carefully selected to reflect the constructs at the appropriate level. For example, individual-level measures should reflect individual differences, while group-level measures should reflect group-level characteristics.

3. **Models**: Models should be specified to account for the hierarchical structure of the data. This typically involves using multilevel models, which can account for the dependencies within and between levels.

4. **Designs**: Designs should be chosen to address the research questions effectively. For example, if the research question is about individual differences, a design that allows for the assessment of individual-level variability is necessary.

5. **Analyses**: Analyses should be conducted to test the hypotheses and evaluate the models. This typically involves using statistical methods that can handle the hierarchical structure of the data, such as multilevel regression, mixed-effects models, and structural equation modeling.

By considering these principles, researchers can enhance the validity and reliability of their multilevel research, leading to more accurate and meaningful results.
PRINCIPLE: The theorist should explicitly specify the level of each construct in a theoretical system.

In specifying the level of a construct, the theorist must build a targeted theory, or “minitheory,” of the phenomenon, explicating where, when, and how the construct forms and is manifest. Many phenomena in organizations have their theoretical origins in the cognition, affect, and behavior of individuals but emerge through compositional or compilational processes, to manifest as higher-level phenomena. A given construct may be an individual-level construct in some circumstances and a unit-level construct in others. When a theorist specifies that a construct originates at the individual level and manifests at a higher level, the theorist must explicate when, how, and why this process occurs. The theoretical foundation for emergent effects must be at the level of origin. When psychological and social-psychological phenomena are emergent at higher levels, the researcher needs to distinguish the level of theoretical origin and the level at which the focal construct is manifest—the level of the construct. The researcher must also explain the theoretical process that yields higher-level emergent levels in the conditions in which the higher-level construct exists or does not exist. This is essential to determining an appropriate means of assessing and representing the emergent higher-level construct.

PRINCIPLE: When higher-level constructs are based on emergent processes, the level of origin, the level of the construct, and the nature of the emergent process must be explicitly specified by the theory.

We elaborate further in what follows, explaining links between the previously described principles of multilevel theory (what, where, when, how, why, and why not) and the definition, explication, and measurement of theoretical constructs. Our quarrel with much of the existing theoretical literature on organizations is not that authors are too complex in characterizing the multiple, even shifting, levels of their constructs but just the opposite: that, too often, authors’ conceptualizations of the theoretical processes and levels of their constructs lack important detail, depth, and complexity. We now consider different types of higher-level constructs and address the implications for measurement.

Types of unit-level constructs. Unit-level constructs describe entities composed of two or more individuals: dyads, groups, functions, divisions, organizations, and so on. In the organizational literature, many problems and controversies revolve around the definition, conceptualization, justification, and measurement of unit-level constructs. The “level” of many higher-level constructs (cultural, leadership, or participation, for example) is often debated. The debate is due in part to the potential for these constructs to emerge from lower-level phenomena.

To help resolve the controversies and confusion that often surround the definition, meaning, and operationalization of unit-level constructs, we distinguish three basic types:

1. Global unit properties
2. Shared unit properties
3. Configural unit properties

Global unit properties differ from shared and configural unit properties in their level of origin. Global unit properties originate and are manifest at the unit level. Global unit properties are single-level phenomena. In contrast, shared and configural unit properties originate at lower levels but are manifest as higher-level phenomena. Shared and configural unit properties emerge from the characteristics, behaviors, or cognitions of unit members—and their interactions—to characterize the unit as a whole. Shared and configural unit properties represent phenomena that span two or more levels. Shared unit properties are essentially similar across levels (that is, isomorphic), representing composition forms of emergence. In contrast, configural unit properties are functionally equivalent but different (that is, discontinuous), representing compilation forms of emergence. Configural unit properties capture the variability or pattern of individual characteristics, constructs, or responses across the members of a unit. We elaborate in what follows, and then we discuss how the nature of a unit construct influences its measurement.

Global unit properties. Global constructs pertain to the relatively objective, descriptive, easily observable characteristics of a unit that originate at the unit level. Global unit properties do not originate
in individuals' perceptions, experiences, attitudes, demographics, behaviors, or interactions but are a property of the unit as a whole. They are often dictated by the unit's structure or function. Group size and unit function (marketing, purchasing, human resources) are examples of global properties. There is no possibility of within-unit variation because lower-level properties are irrelevant; indeed, any within-unit variation is most likely the result of a procedure that uses lower-level units to measure the global property. If, for example, group size is the size of their group, someone has simply miscounted. Unit size has an objective standing apart from members' characteristics or social-psychological processes. In contrast, "perceived group membership" is an entirely different type of construct.

Shared unit properties. Constructs of this type describe the characteristics that are common to—that is, shared by—the members of a unit. Organizational climate, collective efficacy, and group norms are examples of shared unit-level properties. Shared unit properties are presumed or hypothesized to originate in individual unit members' experiences, attitudes, perceptions, values, cognitions, or behaviors and to converge among group members as a function of attraction, selection, attrition, socialization, social interaction, leadership, and other psychological processes. In this way, shared unit properties emerge as a consensual, collective aspect of the unit as a whole. Shared unit properties are based on composition models of emergence, in which the central assumption is one of isomorphism between manifestations of constructs at different levels; the constructs share the same content, meaning, and construct validity across levels. When researchers describe and study shared unit properties, they need to explain in considerable detail the theoretical processes predicted to yield restricted within-unit variance with respect to the constructs of interest: How does within-unit consensus (agreement) or consistency (reliability) emerge from the individual-level characteristics (experiences, perceptions, attitudes, and so on) and interaction processes among unit members?

Configural unit properties. Constructs of this type capture the array, pattern, or configuration of individuals' characteristics within a unit. Configural unit properties, like the shared properties of a unit, originate at the individual level. Unlike shared unit properties, however, configural unit properties are not assumed to coalesce and converge among the members of a unit. The individual contributions to configural unit properties are distinctly different. Therefore, configural unit properties have to capture the array of these differential contributions to the whole. Configural unit properties characterize patterns, distribution, and/or variability among members' contributions to the unit-level phenomenon. Configural unit properties do not rest on assumptions of isomorphism and coalescing processes of composition but rather on assumptions of discontinuity and complex nonlinear processes of composition. The resulting constructs are qualitatively different yet functionally equivalent across levels.

Configural unit properties are relatively rare in the organizational literature, but they are not rare in organizations. We can distinguish two types of configural unit properties: descriptive characteristics, which reference manifest and observable features, and latent constructs, which reference hypothetical and unobserved properties of the unit in question. Descriptive characteristics are straightforward. For example, diversity—the extent to which unit members' demographic characteristics are dissimilar—is a configural descriptive unit property. However, whereas diversity is a manifest unit characteristic, it most likely has effects through latent constructs that tap underlying psychological differences (e.g., Milliken & Martins, 1996). For example, diversity in unilevel sex or age are descriptive characteristics that may be linked to unit-level variability for the constructs of attitudes and values.

Unit-level conceptualizations of constructs are often configural. For example, the combination of team members' abilities or personality characteristics constitutes the configural properties of the unit (Moreland & Levine, 1992). Configural constructs may also capture the pattern of individual perceptions or behavior within a unit. For example, team performance is often regarded as a global property of the team, yet when individual team members perform different but interdependent tasks, team performance may be conceptualized as a configural construct; team members do not engage in identical behaviors (Kozlowski et al., 1999). Finally, network characteristics (for example, network density) are configural insofar as they depict the pattern of the relationships within a unit (or
network) as a whole (Brass, 1995). Configural unit properties are based on compilation models of emergence (e.g., Kozlowski et al., 1999). When studying configurial unit properties, researchers need to explain in detail the theoretical processes by which different individual contributions combine to yield the emergent unit property—that is, how are the individual origins represented in the summary, pattern, configuration, or array of the unit-level property?

PRINCIPLE: Theorists whose models contain unit-level constructs should indicate explicitly whether their constructs are global unit properties, shared unit properties, or configurial unit properties. The type of unit-level construct should drive its form of measurement and representation for analyses.

Levels of Measurement
Basic issues. The level of measurement is the level at which data are collected to assess a given construct. Individual-level constructs should, of course, be assessed with individual-level data. Unit-level constructs, in contrast, may be assessed with either unit-level or individual-level data. When unit-level constructs are assessed with unit-level measures, an expert source (a subject matter expert, for example, or an objective archive) provides a single rating of each unit. When unit-level constructs are assessed with individual-level measures, unit members provide individual-level data (for example, individual ratings of climate, or individuals' reports of their own demographic characteristics), which are subsequently combined in some way to depict the unit as a whole. Rousseau (1985, p. 51) advises researchers to measure unit-level constructs with global (that is, unit-level) data whenever possible: "Use of global data is to be preferred because they are more clearly linked to the level of measurement, avoiding the ambiguity inherent in aggregated data." Klein and colleagues (1994, p. 210) note that when a researcher uses "a global measure to characterize a group, he or she lacks the data needed to test whether members are, indeed, homogeneous within groups on the variables of interest." Accordingly, Klein and colleagues (1994, p. 210) recommend that researchers use global measures to capture unit-level constructs only when the level of the construct is "certain" or "beyond question." Here, we elaborate on Rousseau's (1985) and Klein and colleagues' (1995) admonitions, advising that the level of measurement should be determined by the type of the unit-level construct.

Individual-level constructs. Individual-level constructs should, as already noted, be assessed at the individual level. For example, individuals may complete measures of their own job satisfaction, turnover intentions, self-efficacy, psychological climate, and so forth. In some cases, one or more experts may provide assessments of the characteristics of other individuals. This procedure can be used when the characteristic is observable, or when the informant has unique access to relevant information (Campbell, 1955; Seldier, 1974). A supervisor may describe his or her individual subordinates' performance behavior, an observer may record individual demographic characteristics, or a researcher may use archival records to assess individuals' ages, tenure, or experience. In each case, data are assigned to individuals and are considered individual-level data. Issues of measurement quality are, of course, still relevant.

Global properties. The measurement of unit-level variables is often more complex and more controversial. Least complex and least controversial is the measurement of the global properties of a unit. By definition, global properties are observable, descriptive characteristics of a unit. Global properties do not emerge from individual-level experiences, attitudes, values, or characteristics. Accordingly, there is no need to ask all the individuals within a unit to describe its global properties. A single expert individual may serve as an informant when the characteristic is observable, or when the informant has unique access to relevant information. Thus a vice president for sales may report his or her company's sales volume, a CEO may report a firm's strategy, or a manager may report a unit's function. Although these examples each use an individual respondent, the data are considered global unit-level properties.

Shared properties. In contrast, shared properties of a unit emerge from individual members' shared perceptions, affect, and responses. The theoretical origin of shared properties is the psychological level, and so data to assess these constructs should match the level of origin. This provides an opportunity to evaluate the composition model of emergence underlying the shared property;
that is, the predicted shared property may not in fact be shared, in which case the data cannot be averaged to provide a meaningful representation of the higher-level construct. Therefore, the data to measure shared unit properties should be assessed at the individual level, and sharedness within the unit should be evaluated. Given evidence of restricted within-unit variance, the aggregate (mean) value of the measure should be assigned to the unit. Several empirical examples of this approach to the conceptualization, assessment, and composition of unit-level constructs can be found in the literature (e.g., Campton, Newkirk, & Higgins, 1993; Hofmann & Stetter, 1996; Kozlowski & Hults, 1987). This approach ensures both that the data are congruent with the construct’s origin and that they conform to the construct’s predicted form of emergence, thereby avoiding misalignment.

**Configural properties.** When a construct refers to a configural property of a unit, the data to assess the construct derive from the characteristics, cognitions, or behaviors of individual members. Individual-level data are summarized to describe the pattern or configuration of these individual contributions. As before, theory—the conceptual definition of the emergent construct—drives the operationalization of the measure. Configural properties emerge from individuals but do not coalesce as shared properties do. Thus a researcher, in operationalizing the configural properties of a unit, need not evaluate consensus, similarity, or agreement among individual members except to rule out coalescence. The summary value or values used to represent the configural property are based on the theoretical definition of the construct and on the nature of its emergence as a unit-level property using various techniques may be used to represent, capture, or summarize configural properties, including the minimum or maximum, indices of variance, profile similarity, multidimensional scaling, neural nets, network analyses, systems dynamics and other nonlinear models, among others. The mean of individual members’ characteristics is generally not an appropriate summary statistic to depict a configural unit property, although it may be combined with an indicator of variance or dispersion (Brown et al., 1996). In the absence of within-unit consensus, means are equifinal, ambiguous, and questionable representations of higher-level constructs.

**A multilevel approach to theory and research in organizations**

**PRINCIPLE:** There is no single best way to measure unit-level constructs. The type of a unit-level construct, in addition to its underlying theoretical model, determine how the construct should be assessed and operationalized. As a general rule, global properties should be assessed and represented at the unit level. Shared and configural properties should be assessed at the level of origin, with the form of emergence reflected in the model of data aggregation, combination, and representation.

Establishing the construct validity of shared properties. The assumption of isomorphism that is central to the conceptualization of shared constructs requires explicit consideration. There are two primary issues relevant to testing models with one or more shared unit properties:

1. Establishing the measurement model
2. Evaluating the substantive theoretical model

The issue of the measurement model addresses the construct validity of aggregated lower-level measures as representations of higher-level constructs. It is generally addressed through examining patterns of within-group variance. Consensus- or agreement-based approaches—for example, $r_{agg}$—evaluate within-group variance against a hypothetical expected-variance (EV) term. Agreement is examined for each shared property measure for each unit: a construct-by-group approach. Consistency- or reliability-based approaches—for example, ICC(1), ICC(2), and within-and-between analysis (WABA)—evaluate between-group variance relative to total (between and within) variance, essentially examining interrater reliability for each shared property across the sample; a construct-by-sample approach (Kozlowski & Hattrep, 1992; Bliese, Chapter Eight, this volume).

These different treatments have been the source of some debate (e.g., George & James, 1993; Yammarino & Markham, 1992). Consensus approaches treat issues 1 and 2 as distinct (e.g., James, Demaree, & Wolf, 1984; James et al., 1993; Kozlowski & Hults, 1987; Kozlowski & Hattrep, 1992). The strength is that construct mispecification, for any construct in any group, is avoided. The disadvantage is that there may be insufficient between-group variance for model evaluation, and this problem will not be revealed.
until data analysis. Consistency-based approaches treat the issues as more unitary (e.g., Yammarino & Markham, 1992). The strength is that both within and between variance are considered in the computation of reliability, and so aggregated measures also have adequate between variance for the evaluation of substantive relations. The disadvantage is that some constructs may not actually have restricted variance in some groups, and so there is some potential for construct misspecification, which may be masked in the construct-by-sample approach.

We assert that consideration of both within-group and between-group variance is critical. However, the particular approach chosen is a matter of consistency with one's theory and data. Both approaches have different strengths and drawbacks. In the appropriate circumstances, either of the approaches is acceptable; there is no universally preferable approach.

PRINCIPLE: The assumption of isomorphism of shared unit properties should be explicitly evaluated to establish the construct validity of the aggregated measure. The selection of a consensus- or consistency-based approach should be dictated by theory and data; no approach is universally preferable.

Data source, construct, and measurement levels. Individuals as sources of data play different roles in measuring the three different types of unit constructs. This observation highlights the distinction between the data source, one hand, and the level of the construct and its measurement, on the other. For example, a knowledgeable individual may act as the data source for a global unit property such as size, function, or strategy, but in such a case the level of measurement is not considered the individual but rather the unit as a global entity.

A single informant may provide the data to measure the configurational or distributional properties of a unit when the properties are directly and reliably observable, or when the informant has unique access to relevant information. For example, a supervisor may report the distribution of males and females in a unit. A manager may report unit members' tenure, thus providing the data necessary for the calculation of a unit's variability with respect to tenure. Individual-level performance data may be reported by a team leader to assess the configuration of team performance. In these examples, the configurational construct is a unit-level construct even though the source is a single expert.

In contrast, a single individual may rarely if ever serve as the data source regarding a shared property of the construct. For example, it is generally not appropriate to use single informants (for example, a supervisor or a CEO) to assess unit or organizational climate; climate originates as individual interpretations and emerges via social interaction, and single informants are not uniquely situated to know the inner interpretations of multiple perceivers. Thus assessment should model the theory regarding the origin and nature of the construct.

PRINCIPLE: Individuals may serve as expert informants for higher-level constructs when they can directly observe or have unique knowledge of the properties in question. As a general rule, expert informants are most appropriate for the measurement of global unit-level properties and observable (manifest) configurational properties. They are least appropriate for the measurement of shared properties and unobservable (latent) configurational properties.

Item construction. Several authors have provided guidelines for item construction, primarily for the measurement of shared properties. In general, the advice is to focus respondents on description as opposed to evaluation of their feelings (James & Jones, 1974) and to construct items that reference the higher level, not the level of measurement (James, 1982; Klein et al., 1994; Rousseau, 1986). In practice, research has tended to use items framed at both the individual level (data source) and at higher levels. Recently, Chan (1998) distinguished these practices as representing different composition models of the constructs in question. For example, Chan views climate items referencing self-perceptions (for example, "I think my organization...") as constructs distinct from items that tap the same content but reference collective perceptions (for example, "We think the organization...")—what he refers to as "reference shift consensus."

Research that has tested the merits of this advice is, however, very limited. Klein, Conn, Smith, and Sorra (1998) have found that survey items referencing the unit as a whole (for example, "Employees"
work here is rewarding") do engender less within-group variability and more between-group variability than comparable survey items that reference individual experiences and perceptions (for example, "My work here is rewarding"). However, many climate researchers assessing shared unit properties have used self-referenced items and have demonstrated meaningful within-unit consensus (e.g., Koolwijk & Hult, 1987; Ostroff, 1993; Schneider & Bowen, 1985). It may well be the case that item content is critically important to the unit of reference. Perhaps climate-related content (for example, "I think the reward system . . .") that taps the broader work environment may be more robust to differences between self-reference versus collective reference. The perspective, whether the self or the larger unit, may be largely the same, whereas content that taps more variable properties (for example, "My job is . . .") may be more sensitive to the point of view incorporated in the item.

Clearly, more empirical work is needed to establish which item characteristics are critical to construct fidelity and which ones are not essential. In the meantime, we suggest that researchers employ measures consistent with the conceptualization of their constructs, using unit-level referents, if possible, to assess shared unit-level constructs. However, without more definitive empirical evidence, we do not encourage this as a litmus test and do not offer a principle. We do encourage more empirical research on guidelines for the construction of items to assess emergent constructs.

Types of Multilevel Models

Theoretical models describe relationships among constructs. A multilevel perspective invites—indeed, necessitates—special attention to the level of the constructs united within a theoretical model. In this section, we build on the preceding section by describing broad types of models distinguished by the levels of the constructs they encompass, as well as by the links they propose among constructs. Model specifications are illustrated in Figure 1.1. Following our description of basic models, we note further complexities in the creation of multilevel models.

Single-level models. Single-level models, as their name suggests, specify the relationship between constructs at a single level of theory.
42. Multi-level Theorizing, Research, and Methods in Organizations

A multi-level approach to theory and research in organizations may engender changes in the image of the organization to include three levels: the individual level, the group level, and the organizational level. The individual level consists of the person's psychological, behavioral, and social characteristics. The group level consists of the collaborative activities within a group, such as team work, leadership, and decision making. The organizational level consists of the structure, policies, and procedures that influence the behavior of individuals and groups. This approach recognizes that organizations are composed of interconnected levels, and that the behavior at one level is influenced by the behavior at another level. Therefore, it is important to consider how changes at one level can affect behavior at another level.
may have a great deal of influence if his or her group members’ average amount of education is relatively low (few graduated from high school), or very little influence if his or her group members’ average amount of education is relatively high (most have post-graduate degrees). Thus the relationship between an individual’s education and his or her influence in a group depends on the individual’s relative standing with his or her group’s degree of education. Frog-pond models of this type, we should note, may be categorized in different ways in levels typologies. We have classified frog-pond models as cross-level models, but we recognize that frog-pond models do not evoke unit-level constructs in the same way that the other cross-level models already described. The “group average” specified in a frog-pond model is not conceptualized as a shared property of the unit. Indeed, were the construct predicted to be shared within each group, then it would make no conceptual or empirical sense to assess individual standing on the construct relative to the mean—the hallmark of frog-pond models (X – the group mean of X). Nor is the “group average” considered a global property of the unit; perhaps the group average, in combination with deviations, may be considered a configurational property of the unit. This insight is subtle and complex, but it may help clarify why the frog-pond effect has been classified by some scholars as a distinct phenomenon or even as a distinct level of analysis. Just as we have created a distinct category for configurational unit-level properties—unit properties that are characteristics of the unit but are neither global nor shared (isomorphic)—so others (e.g., Klein et al., 1994; Danielscu & Yammarino, Chapter Ten, this volume), in their conceptualizations, have designated frog-pond (heterogeneous or parts) models as a distinctive level.

Homologous multilevel models. These models specify that constructs and the relationships linking them are generalizable across organizational entities. For example, a relationship between two or more variables is hypothesized to hold at the individual, group, and organizational levels. Such models are relative rarities. The most commonly cited example of such a model is Staw, Sandelands, and Dutton’s (1981) model of threat rigidity. Staw and his colleagues posit that the way in which individuals, groups, and organizations respond to threat is by rigidly persisting in the current response. By arguing for parallel constructs and homologous linking processes, they have developed a homologous multilevel model of threat-rigidity effects. However, the model has not been tested empirically, its propositions are open to debate (e.g., House et al., 1995), and its attention to construct composition is limited. Lindsley, Brass, and Thomas’s model (1995) of efficacy-performance spirals is an excellent example of a homologous multilevel model that carefully attends to the composition of its constructs. However, we know of no empirical test, in the published organizational literature, of a fully homologous multilevel model.

Given their generalizability across levels, homologous multilevel models are, at their best, uniquely powerful and parsimonious. At their worst, however, multilevel homologies may be trite. A search for parallel and generalizable constructs and processes may so reduce and abstract the phenomenon of interest that the resulting model may have little value at any level. The basic notion that goals influence performance at the individual, group, and organizational levels may be valid but not, at least in its bare-bones formulation, very interesting or useful. A hypothesis that is readily applicable to many levels may be a very basic hypothesis, indeed. In the literature there are examples of efforts to develop and apply homologous multilevel models to organizational behavior (e.g., Kuhn & Beam, 1982; Tracy, 1989), although these models have had little influence on theory or research. Thus the theorist must be aware of the tension inherent in the construction of multilevel models: good ones have the potential to advance and unify our field, but weak ones offer little to our understanding of organizational phenomena.

Sampling in Multilevel Research
Sampling within and across units. When testing individual-level theoretical models, researchers endeavor to ensure that their samples contain sufficient between-individual variability to avoid problems of range restriction. Sampling issues in multilevel research are more complex but comparable. In testing unit-level theoretical models (for example, the relationship between organizational climate and organizational performance) and mixed-level models containing unit- and individual-level variables (for example, the relationship of organizational human resources practices and individual organizational commitment), researchers must endeavor to
ensure that their samples show adequate variability on the con-
structs of interest, at all relevant levels in the model. Thus, for exam-
ple, it may be inappropriate to test a cross-level model linking a
group construct to an individual outcome in a single-organization
sample. If a higher-level organizational characteristic constrains
between-group variability, it will yield range restriction on the mea-
sure of the group construct and preclude a fair test of the model.
Unfortunately, this problem is all too common in levels research.

In testing models containing shared unit-level constructs, re-
searchers must endeavor to obtain samples showing within-unit ho-
mogeneity and between-unit variability on the shared constructs.
Thus, for example, if a theoretical model asserts that units develop
shared norms over time and that these norms influence unit-level
or individual-level outcomes, then a test of the model requires
units in which individuals have worked together for a considerable
period; newly formed task groups, for example, would provide an
inappropriate sample for the study. The researcher’s sampling
goal, then, is to obtain experienced units showing shared norms
that differ between the units. Alternatively, a researcher may ex-
plicitly model and gather data to test the hypothesis that the length
of time unit members have worked together predicts the emer-
gence of shared norms, which in turn influence unit-level or indi-
vidual-level outcomes. In this scenario, the researcher’s sample
should contain units showing substantial variability in the length
of time that unit members have worked together. This strategy al-
 lows a researcher to test the variable (time that unit members have
worked together) hypothesized to engender the emergence of
shared norms. The outcome measure for this hypothesis, then, is
not the level or nature of a shared norm but the extent to which the
norm is shared (or, conversely, its dispersion across group
members).

The collection of data to test a multilevel model, or even a sin-
gle unit-level model, is thus likely to be labor-intensive and
time-consuming. It is not enough to sample many people in one
organization. The multilevel researcher, whose variables include
measures of shared and configural constructs, must sample many
people in many units that are nested in many higher-level units.
In other words, multilevel research generally necessitates sampling
several organizations, units within these organizations, and indi-

Principle: In the evaluation of unit-level or mixed unit-level and individual-
level theoretical models, the sampling strategy must allow for between-unit
variability at all relevant levels in the model. Appropriate sampling de-
sign is essential to an adequate test of such models.

Sampling across time. In the section on theoretical principles (see
"Principles for Multilevel Organizational Theory Building," pp. 21–
25), we highlighted the importance of time, as well as its general
neglect in theory construction for processes that link different lev-
els. However, temporal considerations are important not only for
theory; they are also essential to research design. Two issues are
central: differential time scales across levels, and entrainment.
The first issue, differential time scales across levels, concerns
the fact that higher-level and lower-level phenomena operate on
different time scales. In general, lower-level phenomena change
more quickly, whereas higher-level phenomena tend to change
more slowly, and so it is easier to detect change in lower-level en-
tities. This means that top-down cross-level relations, if present, can
be readily detected with cross-sectional and short-term longitudi-
nal designs. In related fashion, emergent phenomena generally
need longer time frames to unfold and manifest at higher levels,
and so bottom-up emergent effects require longitudinal designs.

Principle: Time-scale differences allow top-down cross-level effects to be
meaningfully examined with cross-sectional and short-term longitudi-
nal designs. Bottom-up emergent effects necessitate long-term longitudi-
nal or time-series designs.

The second issue, entrainment, concerns the fact that the links
between some phenomena are cyclical; that is, the strength of a link
may vary over time and will be detectable only during periods of en-
trainment. Therefore, a theory that includes entrained phenomena
necessitates a very carefully timed research design that can sample
relevant data during periods of entrainment. To the extent that
such a theory represents an effort to evaluate entrainment as a
process, the design must also be capable of sampling relevant data during periods when the phenomena are not entrained.

**PRINCIPLE:** Entrainment tightly links phenomena that are ordinarily only loosely connected across levels. Sampling designs for the evaluation of theories that propose entrained phenomena must be guided by theoretically specified time cycles, to capture entrainment and its absence.

**Analytic Strategies**
Several techniques are available for the analysis of multilevel data: analysis of covariance (ANCOVA) and contextual analysis using ordinary least squares (OLS) regression (e.g., Moosholder & Bedeian, 1983); cross-level and multilevel OLS regression; WABA (Dansereau et al., 1984); multilevel random-coefficient models (MRCM), such as hierarchical linear modeling (HLM; Bryk & Raudenbush, 1992); and multilevel covariance structure analysis (MCSA; Muthen, 1994).

The techniques differ in their underlying theoretical assumptions and are designed to answer somewhat different research questions. Therefore, no single technique is invariably superior in all circumstances; rather, the choice of an analysis strategy is dependent on the nature of the researcher's questions and hypotheses. Here we see again the primacy of theory in dictating the resolution of levels issues. The best way to collect and the best way to test multilevel data will depend on the guiding theory. The more explicit and thorough the guiding theory, the more effective data collection and analysis are likely to be. We provide a brief overview of these analytic approaches here but direct the reader to later chapters in this volume for in-depth consideration of contextual and regression analysis (James & Williams, Chapter Nine), WABA (Dansereau & Yammarino, Chapter Ten), and multilevel random-coefficient models (Hodmann, Griftn, & Gavin, Chapter Eleven).

**ANCOVA and contextual analysis.** Among the earliest approaches to the analysis of cross-level data were adaptations of ANCOVA and the use of OLS regression to conduct contextual analysis (Firebaugh, 1979; Moosholder & Bedeian, 1983). The ANCOVA approach is used to determine whether there is any effect on an individual-level dependent variable that is attributable to the unit, beyond the effect accounted for by individual differences. Essen-

tially, this approach treats the individual-level variables as covariates and then uses unit membership as an independent variable to determine how much variance is attributable to the unit. Unit membership as a variable accounts for all possible remaining differences across units. Therefore, this approach cannot identify the specific constructs relevant to unit membership that are actually responsible for observed differences among groups; such effects are unexplained. Nevertheless, to the extent that there are any differences attributable to the grouping characteristic, this approach will capture it (Firebaugh, 1979).

The regression approach to contextual analysis typically uses aggregation and/or disaggregation to specify contextual constructs of interest. Although it is typically used to determine the effects of one or more higher-level contextual constructs on an individual-level dependent variable, it is actually flexible with respect to level. "Clastic" contextual analysis includes individual-level predictors and unit means on the same predictors, to assess the relative amounts of variance attributable to the unit (Firebaugh, 1979). To the extent that unit means on the variables of interest account for variance beyond that explained by their individual-level counterparts, a contextual effect is demonstrated. This approach generally explains less variance than ANCOVA because the substantive unit variables are usually a subset of the total group composite effect, but it does identify the unit characteristic responsible for differences. Note that the aggregation process in classic contextual analysis is typically atheoretical (that is, no theoretical model of emergence is modeled), and isomorphism is not evaluated.

**Cross-level and multilevel regression.** In the organizational literature, OLS regression has been adapted to examine cross-level and multilevel effects and is quite flexible with respect to the type of model it can evaluate. Contemporary uses of this approach treat aggregation as an issue of construct validity (James, 1982; Koizowski & Hatrup, 1992) so that a model of emergence is first evaluated before individual-level data are aggregated to the group level (e.g., Koizowski & Hult, 1987; Ostroff, 1993). Therefore, with respect to the specification and measurement of construct types, this approach is relevant to the issues we have discussed in this chapter. Once the measurement model of the higher-level (aggregated)
HLM is probably the most familiar. HLM analysis assumes hierarchically organized, or nested, data structures of the sort that are typically encountered in organizations: individuals nested in units, units nested in organizations, and organizations nested in environments. Models of theoretical interest typically represent multiple levels of data. For instance, many cross-level models involve an outcome variable at the lowest level of analysis, with multiple predictors at the same and higher levels. HLM is well suited to the handling of such data structures.

The logic of HLM involves a simultaneous two-stage procedure. Level 1 analyses estimate within-unit intercepts (means) and slopes (relations). To the extent that unit intercepts and/or slopes vary significantly across units, Level 2 analyses treat them as outcomes. Thus, Level 2 analyses model the effects of unit-level predictors on unit intercepts and slopes so that effects on intercepts are indicative of direct cross-level relations, and effects on slopes are indicative of cross-level moderation. HLM relies on a generalized least squares (GLS) regression procedure to estimate fixed parameters, and on the EM algorithm to generate maximum-likelihood estimates of variance components. This provides many statistical advantages over analogous OLS regression–based approaches (Hofmann et al., Chapter Eleven, this volume).

An in-depth description of these techniques is beyond the scope of this chapter; assumptions, applications, and differences among the techniques are addressed elsewhere in this volume. However, we will note here that all these techniques have the potential to be misused in an atheoretical attempt to establish the "level at which effects occur. We reiterate that the conceptual meaning of higher-level aggregations (however they are statistically determined) must have a priori theoretical foundation.

**Principle:** There is no one, all-embracing multilevel data-analytic strategy that is appropriate to all research questions. Particular techniques are based on different statistical and data-structure assumptions, are better suited to particular types of research questions, and have different strengths and weaknesses. Selection of an analytic strategy should be based on (a) consistency between the type of constructs, the sampling and data, and the research question; and (b) the assumptions, strengths, and limitations of the analytic technique.
Extending Models of Emergent Phenomena

Some of the most striking and perplexing emergent phenomena are those in which highly integrated collective behavior emerges over time from the interaction of simple elements. This chapter explores the nature of such emergent phenomena, with the emphasis on the concept of emergence based on isomorphism. In particular, we discuss the role of isomorphism in the emergence of group behavior, and the extent to which it is possible to predict the emergence of such behavior from the properties of the individual elements.

Caution: Parents are encouraged to supervise their children as they read this book. The content may be inappropriate for some readers, and may provoke discussions about the nature of emergent phenomena and the role of isomorphism in their development. 

Conceptual Goals

Our goal is to extend the ideas presented in the previous section, and to provide a more comprehensive understanding of the processes that give rise to emergent phenomena. We will do this by focusing on the role of isomorphism in the emergence of group behavior, and by exploring the extent to which it is possible to predict the emergence of such behavior from the properties of the individual elements. 

Contribution

There are three principal contributions of this work. First, we show that the concept of isomorphism is central to the understanding of the processes that give rise to emergent phenomena. Second, we provide a more comprehensive understanding of the role of isomorphism in the emergence of group behavior. Finally, we demonstrate the potential of isomorphism as a tool for predicting the emergence of such behavior from the properties of the individual elements.
Theoretical Underpinnings of Emergence

What is Emergence?

Emergence is an emerging scientific field that explores the properties of complex systems that cannot be reduced to the properties of their individual components. It is a fundamental concept in science, particularly in biology, ecology, and computer science, and it is also relevant to psychology and sociology. Emergence is the phenomenon of a system's properties that are not present in its parts or in any of its component parts considered individually. These properties emerge from the interactions between the parts of the system.

The concept of emergence is crucial in understanding how complex systems behave. For example, in a biological system, such as a flock of birds, the collective behavior of the flock emerges from the interactions between the individual birds. Similarly, in a computer network, the traffic patterns emerge from the interactions between the individual devices.

The study of emergence has implications for many fields, including psychology and sociology. In psychology, the concept of emergence can be applied to the study of group behavior, where the collective behavior of a group emerges from the interactions between individual members. In sociology, the concept of emergence can be applied to the study of social systems, where the collective behavior of a society emerges from the interactions between individuals.

The research on emergence is still in its early stages, and there is much to be discovered about the mechanisms that underlie emergence. However, the study of emergence is important for understanding how complex systems work and for developing new technologies and methods for analyzing and predicting the behavior of complex systems.
group diversity (other characteristics) all represent emergent properties that have no direct or indirect links to the ideas, interests, and values represented by individuals as they are exposed to the force of the formal structure. This is because the emphasis on formal structure in organizations is such that it often obscures the role of informal communication processes and dynamics.

These forces, in combination with formal structure, work flows, and social processes, create a complex web of interactions that shape common perceptions (Kodraskj & Hall, 1997). Socialization in organizations helps to create a shared understanding of how to do things (Ouchi, 1980), and the process is not straightforward. Different socialization processes can lead to different outcomes, depending on the context and the individuals involved.

Emergence is a key concept in understanding organizations. It refers to the idea that the whole is greater than the sum of its parts. In other words, the interactions between individuals in an organization create something new and unique. This is why understanding the dynamics of formal and informal communication processes is essential to understanding organizational behavior.

One of the key factors that influence the emergence of behavior in organizations is the structure of the organization itself. Organizational structure affects the way people communicate and interact, and this can have a significant impact on the overall effectiveness of the organization.

In this context, it is important to understand the role of formal and informal communication processes. Formal communication processes are those that are established and controlled by the organization, while informal communication processes are those that occur outside the formal structure of the organization. The interaction between these two sets of processes is crucial in shaping the overall behavior of the organization.

Understanding the dynamics of formal and informal communication processes is crucial to understanding organizational behavior and the emergence of behavior in organizations. This is because these processes are the underlying forces that drive the behavior of individuals in the organization.
Further, diversity in an organization—with respect to organizational members' demographic characteristics, work experiences, education, and so on—may foster organizational creativity and innovation. In these ways, dyads create differences and discontinuities, shaping compilation forms of emergence that are characterized by irregularity, nonuniformity, and configuration.

Emergence varies in process and form. As already noted, interaction dynamics can lead to variation in the ways in which a high-level phenomenon emerges; that is, a given phenomenon, such as team performance, can arise in a variety of different ways, even in the same organization. Individual characteristics, cognition, affect, and behavior are constrained by their context. Over time, interaction dynamics acquire certain stable properties; stable structure emerges from a dynamic process. Katz and Kahn (1966) describe this as recurrent patterns of interaction. Thus the emergence of a collective phenomenon is the result of a dynamic unfolding of role exchanges (Katz & Kahn, 1966), ongoings (Allport, 1954), or compilation processes (Kozlowski et al., 1999) among individuals. It is from these dynamics that a stable collective pattern emerges.

Morgeson and Hofmann (1999a) describe Allport's notion of ongoin as a recurrent pattern representing the intersection of individual action in its context. Individual ongoings encounter one another, creating interaction events. Subsequent interactions solidify a recurrent event cycle, which represents the emergence of a stable collective phenomenon. Similarly, Kozlowski and colleagues (1999) describe how team performance complex upward from individual behaviors and workflow transactions: individuals work out transaction patterns that regulate dyadic work flows, and as these dyadic exchanges stabilize, team members develop extended workflow networks that stabilize around routine task demands. Greick and Hackman (1990) characterize these stable patterns in teamwork as habitual routines.

However, because emergent phenomena are based on patterns of interaction, even small changes in individual behavior or dyadic interaction can yield big changes in the nature of emergence. For example, Kozlowski and colleagues (1999) also propose that task environments can change dramatically and unpredictably. Unexpected shifts, and the novel tasks they present, necessitate adaption of team networks, an adaptation that is based on individuals and dyads developing alternative work flows. In this model, team performance and adaptability emerge across levels from individual action and dyadic transactions, creating enormous flexibility in the formation of adaptive work-flow networks that may resolve the novel situation. The implication is that collective phenomena may emerge in different ways under different contextual constraints and patterns of interaction. Emergence is often equifinal rather than universal in form.

This important implication of our conceptualization of emergence sets our framework apart from others: a given phenomenon or construct domain does not necessarily have to exhibit a universal form of emergence; that is, a given emergent phenomenon may be the result of composition processes in one situation and of compilation processes in another. A consideration of the examples shown in Figure 1.2 illustrates this point. Consider, for example, how personality makeup can differ across teams (Jackson, May, & Whitney, 1995; Moreland & Levine, 1992). Teams may be characterized by the high homogeneity indicative of personality composition, or by the heterogeneity indicative of personality composition. There is no a priori theoretical reason to suppose that one or the other is a universal form for the way in which team personality emerges.

Consider collective cognition, for example. The construct of shared mental models (Klimoski & Mohammed, 1995) assumes that team members hold identical mental representations of these collective task. In contrast, alternative conceptualizations assume that team members' mental models have compatible configurations but are not necessarily identical. Group members have somewhat different mental representations of their collective task, based on their specific roles within the team. Members' different mental representations fit together in a complementary way, like the pieces of a puzzle, to create a whole that is greater than the sum of its parts (Kozlowski, Gully, Salas, & Cannon-Bowers, 1996). Similarly, collective knowledge may be conceptualized as the sum of individual knowledge; more nonredundant information is better, and collective knowledge is the sum of the parts. Alternatively, collective knowledge may be conceptualized as configurational spirals: some individual knowledge is more useful than other knowledge; useful knowledge is selected and crystallized, and it then attracts
Figure 1.2. Theoretical Underpinnings of Emergence.

<table>
<thead>
<tr>
<th>Emergent Process</th>
<th>Composition</th>
<th>Compilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variation in Emergence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality similarity</td>
<td></td>
<td>Personality diversity</td>
</tr>
<tr>
<td>Shared mental models</td>
<td></td>
<td>Compatible mental models</td>
</tr>
<tr>
<td>Classical decision making (single optimal solution)</td>
<td>Naturalistic decision making (multiple solutions)</td>
<td></td>
</tr>
<tr>
<td>Pooled team performance</td>
<td></td>
<td>Adaptive team networks</td>
</tr>
<tr>
<td>Organizational learning (sum of individual knowledge)</td>
<td></td>
<td>Organizational learning (knowledge spirals)</td>
</tr>
</tbody>
</table>

Theoretical Assumptions

- Model: Isomorphism vs. Discontinuity
- Elemental contribution:
  - Type: Similar vs. Dissimilar
  - Amount: Similar vs. Dissimilar
- Interaction process and dynamics:
  - Stable vs. Irregular
  - Low dispersion vs. High dispersion
  - Uniform vs. Nonuniform
- Combination: Linear vs. Nonlinear
- Emergent representation: Convergent point vs. Pattern

The point of these examples is that given phenomena may emerge in different ways. A variety of contextual and temporal constraints operate to influence interaction dynamics among individuals, which in turn shape the emergent form, yet the dominance of composition models based on isomorphism has tended to limit consideration to shared models of emergence, and to the dichotomous presence or absence of emergence (Brown & Kozlowski, 1997). Theory needs to be able to capture the rich complexity of emergence rather than limiting emergence to universal conceptualizations that often do not exist.

Theoretical Assumptions

Our framework is formulated around theoretical distinctions between ideal forms of composition and compilation, considered in earlier sections of this chapter. Here we turn our attention to three sets of overlapping assumptions, shown in Figure 1.2, that are useful for more finely distinguishing these alternative forms of emergence. The assumptions include the following elements:

1. The theoretical model of emergence, and the type and amount of elemental contribution implicated by the model.
2. The interaction process and dynamics that shape the form of emergence.
3. The resulting combination rules for representing the emergent form.

At the risk of some redundancy, we will outline these assumptions and apply them to the contrasting of composition and compilation forms of emergence. We will then present a typology, using the assumptions to distinguish alternative forms of emergence ranging between composition and compilation ideals.

Model and elemental contribution. Composition and compilation are distinguished by their underlying theoretical models. Composition is based on a model of isomorphism, whereas compilation is based on a model of discontinuity. Isomorphism and discontinuity represent
differing conceptualizations with respect to the nature and combination of the constituent elements that constitute the higher-level phenomenon.

Isomorphism essentially means that the type and amount of elemental content—the raw material of emergence—are similar for all individuals in the collective. In other words, the notion of isomorphism is based on an assumption that all individuals perceive climate, for example, along the same set of dimensions, or that all team members possess mental models organized around the same content. In addition, isomorphism means that the amount of elemental content is essentially the same for all individuals in the collective. In other words, the climate or mental model is shared. Hence, within-unit convergence (that is, consistency, consistency, homogeneity) is central to composition. Morgeson and Hofmann (1999a, 1999b) describe this similarity in the type and amount of elemental content as structural equivalence. Thus isomorphism allows the theorist to treat a phenomenon as essentially the same construct at different levels (Rousseau, 1985). Note that isomorphic constructs are also functionally equivalent. That is, they occupy the same roles in multilevel models of the phenomenon; they perform the same theoretical function (Rousseau, 1985).

Discontinuity means that either the amount or type of elemental content is different, or both the amount and type are different. The notion of discontinuity is based on an assumption that the kinds of contributions that individuals make to the collective are variable, not shared and consistent. Essentially, there is an absence of structural equivalence in the nature of the elemental content and in the ways in which it combines (Kozlowski, 1998, 1999; Morgeson & Hofmann, 1999a, 1999b). Nevertheless, there is functional equivalence because the constructs perform the same role and function in models at different levels (Rousseau, 1985), as we shall explain.

The elemental content comes from a common domain—performance, personality, cognition—but the nature of individual contributions can be quite different. For example, baseball players contribute qualitatively different types and amounts of individual performance to accomplish team performance. The pitcher pitches, fielders field, and batters hit. In any given game, some will excel and others will make errors. Different dominant personality traits characterize each team member. Team members possess different but compatible mental models of the game. Therefore, variability and pattern are central to composition. Because the diverse elemental content is drawn from a common domain and contributes to a similar collective property, there is functional equivalence across levels. This functional equivalence allows the theorist to treat compositional properties as qualitatively different but related manifestations of the phenomenon across levels (Kozlowski, 1998, 1999; Morgeson & Hofmann, 1999a, 1999b).

Interaction processes and dynamics. The hallmark of composition forms of emergence is convergence and sharing. In climate theory, for example, a variety of constraining forces have been proposed that are thought to shape the emergence of a shared collective climate. Individuals are exposed to homogeneous contextual constraints—common organizational features, events, and processes (James & Jones, 1974). They develop individual interpretations of these characteristics, yielding psychological climate. ASA processes operate to narrow variation in psychological climate (Schneider & Reichers, 1983). Interpretations are filtered and shaped by leaders (Kozlowski & Doherty, 1989). Individuals interact, communicate perspectives, and iteratively construct a common interpretation. Variations in individual interpretations dissipate as a collective interpretation converges. This is an incremental process that, over time, promotes stability, characterized by reduced dispersion as outliers are trimmed and by increased uniformity as perceptions are pushed to a consensus point. An equilibrium is achieved.

The hallmark of composition forms of emergence is variability and configuration. Team performance requires that individuals coordinate and dynamically combine distinct individual knowledge and actions. The emergence of team performance is largely shaped by work-flow interdependencies—that is, the linkages that connect individual performance in the team work system (Brass, 1981). Consider once again the performance of a baseball team. There are any number of ways in which team members, working together, can achieve a particular score. They may excel because power hitters recurringly hit home runs. They may have a stable of good but not exceptional hitters; by consistently getting players on base the team is able to accumulate good scores. They may excel by
Summary of distinctions between composition and compilation. The key assumptions that distinguish composition and compilation, respectively, involve the question of whether the following elements are present.

1. Elemental (that is, individual) contributions to the high-level phenomenon are similar (intrasubstitution or dissimilar (discontinuous) in their amount, type, activity, and outcome.

2. The emergent phenomenon exhibit (low dispersion and are uniform in pattern, or interaction processes and dynamics are in dispersion, high in dispersion, and nonuniform).

3. The emergent phenomenon is represented by a linear convergent point (composition), our the emergent phenomenon is represented by a nonlinear pattern or configuration (composition).

The use of the only to determine the classification of decisions differs in emergent forms of emergence. Our typology of emergence, shown in Figure 1.3, juxtaposes composition and compilation. The three categories of emergent phenomena that are represented in the Emergent-Composition Models are described in each category, highlighting the examples with the examples regarding
### Figure 1.3. Typology of Emergence.

<table>
<thead>
<tr>
<th>Emergence Theory and Features</th>
<th>Isomorphic Composition</th>
<th>Discontinuous Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exemplar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. <strong>Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rowing crew</td>
<td>Convergent</td>
<td></td>
</tr>
<tr>
<td>Synchronized swimming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. <strong>Learning/ Knowledge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shared mental models/ knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational learning/ knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. <strong>Others</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficacy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elemental Constitution</th>
<th>Similar</th>
<th>Dissimilar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Similar</td>
<td>Similar</td>
</tr>
<tr>
<td>Amount</td>
<td>Similar to similar</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interaction Process, Combination Rules, and Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low dispersion NA</td>
</tr>
<tr>
<td>Uniform</td>
</tr>
<tr>
<td>Sum or mean (linear)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comparability</th>
<th>Similar</th>
<th>Dissimilar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>Variable</td>
<td>Dissimilar</td>
</tr>
<tr>
<td>Dissimilar</td>
<td>Variable</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Minimum/ Maximum
- Convergent
- Tug of war
- Group sales
- Shared mental models
- Group information exchange
- Collective
- Unit rates
- Convergent
- To converge
- Jazz improvisation
- Creative
- Knowledge
diversity
- Norm institutionalization
- Personality diversity
- Congruent
- Nonuniform
- Variable
- High dispersion
- Uniform
- Uniform
- Variable (nonlinear)
may reference the self ("how I perceive") or the group ("how I believe the group perceives"). The self-referenced form is described as "reflective," and the group-referenced form as "reflective," respectively. The later form is regarded as being more consistent with the constructivist view of the self. The self-referenced form may enhance self-group agreement, and be considered a "reflective" form. The group-referenced form may enhance socio-cognitive aspects of the self-construct. Empirical findings are preliminary at this point. Sometimes the item refers to a self-referenced form, and group-referenced form.

The exemplar complex is the assumption that the amount of emergent phenomenon, and other emergent phenomena involved in perception, learning, decision-making, and other cognitive processes. The exemplar complex model describes a different emergent process, based on the individual's experience of the phenomenon. Each exemplar is a type of emergent phenomenon, and the combination rules apply to each exemplar in each case. Although we have used the individual and group contexts to make the complex plausible, the model is also useful in helping to elaborate the theoretical understanding that the core representation of alternative forms of emergent phenomenon. We include exemplar complexes for the following types of emergent phenomena: (1) categorical, (2) semantic, (3) pragmatic, (4) experiential, and (5) evaluative.

The exemplar complex represents the ideal form of composition that we have discussed throughout this chapter. The exemplar complex provides a comprehensive and consistent emergent process in such a way that individual schemas contribute the same amount and type of physical attractiveness to the same amount and type of physical threat to the same amount and type of physical threat, and so forth. The exemplar complex is the model by which we describe the emergent phenomenon as emergent.

The exemplar complex is evaluated on the basis of consensus or consistency. Variability in consensus or consistency is evaluated on the basis of consensus or consistency. For example, if the exemplar complex represents the group on the highest level, the exemplar complex consists of a group of individuals sharing the same amount and type of physical threat. The exemplar complex is evaluated on the basis of consensus or consistency. Variability in consensus or consistency is evaluated on the basis of consensus or consistency. The exemplar complex represents the group on the highest level, and the exemplar complex includes all members sharing the same amount and type of physical threat. The same exemplar complex can be distinguished on the basis of consensus or consistency. The exemplar complex represents the group on the highest level, and the exemplar complex includes all members sharing the same amount and type of physical threat. The same exemplar complex can be distinguished on the basis of consensus or consistency. The exemplar complex represents the group on the highest level, and the exemplar complex includes all members sharing the same amount and type of physical threat. The same exemplar complex can be distinguished on the basis of consensus or consistency.
unique and common information that must be discussed and combined to yield a group decision. Although individuals possess both similar and dissimilar types of elemental content (that is, common and unique information), groups have been found to focus virtually all of their discussion on sharing the common information. In effect, the nature of social interaction processes constrains emergence so that only common information is discussed and used for the decision. Although there is some variation in individual contribution, the dissimilar information plays no role in the team product. The group decision is essentially an average of the shared information.

**Pooled Unconstrained Emergence**

This exemplar fully relaxes the requirement on the amount of elemental contribution, but, as before, the type of context remains similar. Here, variation in the amount of elemental contribution can be quite high. For example, research demonstrates that performance in pooled tasks can be plagued by social loafing and free riding: some individuals contribute far less to the collective when the amount of their contributions cannot be identified (Harkins, Latane, & Williams, 1980). In such circumstances, the group product may be represented as a sum or mean. However, in contrast with the previous exemplar, the group representation and the individual contribution may be dramatically different. Similarly, one conceptualization of organizational climate is based on the assumption that within-group variation in climate perceptions is random measurement error (Glick, 1985, 1988). No restriction is placed on how much variability can be eliminated through averaging.

This exemplar is also frequently used for such group descriptive variables as absence, turnover, and accidents (e.g., Hofmann & Stehrer, 1990; Mathieu & Kohler, 1990). Unit rates are typically counts of the dichotomous presence or absence of some event; additive frequency counts, although sometimes these characteristics are summarized by means, Bliese (Chapter Eight, this volume) labeled phenomena of this sort fuzzy composition because they lack the sharing that is the hallmark of composition. Other theorists have used group rates as examples of discontinuity (Rousseau, 1985), which is indicative of compilation. Therefore, these phenomena certainly represent fuzzy something; whether they are fuzzy compo-

**Minimum/Maximum Emergence**

This exemplar represents a shift from linear combination rules (that is, additive models) to nonlinear rules. Elemental contribution is based on similar content, but the amount of contribution is qualitatively distinct. Contextual factors and interaction processes constrain emergence so that the pattern across individuals is discontinuous. The standing of one individual on the phenomenon in question determines the standing of the collective. Therefore, dispersion and uniformity are not directly applicable to the conceptualization of this exemplar.

This is a conjunctive (minimum) or disjunctive (maximum) model, in which the highest or lowest value for an individual in the group sets the value of the collective attribute (Steiner, 1972). Consider, for example, group cognitive ability for a tank crew (Trim & Eden, 1985) or a football team. It is not the average level or dispersion of cognitive ability that is important, because the same sort of cognitive contribution may not be necessary for all members; as long as one person is high on cognitive ability and the rest of the team will take direction, the group as a whole can effectively assess the situation and execute the appropriate strategy. Therefore, the maximum individual-level standing on the attribute determines the standing of the collective. This emergence process is similar to the jury decision-making model, in which a lone holdout (minimum) can yield a hung jury and a miscar (Davis, 1992), or to a mountain climbing team whose performance is determined by the slowest and
Patterned Emergence

Patterns of model emergence are based on the notion of variability in the type and amount of evidence different groups of observations contribute to the emergence of the patterned form. This variability is often due to the random effects of individual differences, which can be incorporated into the model as a source of noise. The variance of emergence is based on uniform distributions, whereas the patterned form itself is based on nonuniform patterns of dispersion as seen in the distribution of whorl groups.

The variance form of emergence is based on the assumption that emergence may manifest itself as a result of the interaction between two factors: variability in the type and amount of evidence different groups of observations contribute to the emergence of the patterned form. This variability is often due to the random effects of individual differences, which can be incorporated into the model as a source of noise. The variance form of emergence is based on uniform distributions, whereas the patterned form itself is based on nonuniform patterns of dispersion as seen in the distribution of whorl groups.

For example, if we consider a group of individuals, their variability in type and amount of evidence can be represented by a distribution. If this distribution is uniform, the emergence of the patterned form can be attributed to the variability in type and amount of evidence. However, if the distribution is nonuniform, the emergence of the patterned form is due to the nonuniform patterns of dispersion as seen in the distribution of whorl groups.

The variance form of emergence is based on uniform distributions, whereas the patterned form itself is based on nonuniform patterns of dispersion as seen in the distribution of whorl groups. Therefore, the variance form of emergence can be attributed to the variability in type and amount of evidence different groups of observations contribute to the emergence of the patterned form. This variability is often due to the random effects of individual differences, which can be incorporated into the model as a source of noise. The variance form of emergence is based on uniform distributions, whereas the patterned form itself is based on nonuniform patterns of dispersion as seen in the distribution of whorl groups.
across these apparently disparate efforts to explore emergence. For example, Brown and Kozlowski (1997, 1999) posit dispersion theory, which focuses on patterns of within-group variability or the dispersion of phenomena, as opposed to the more common focus on means or convergent points. In dispersion theory, uniform patterns that evidence low dispersion are consistent with composition processes, whereas subgroup bifurcation that creates nonuniform patterns of dispersion are consistent with compilation processes. Similarly, Morgeson and Hofmann (1999a, 1999b) have made a strong case for distinguishing construct structure and function. Structural and functional identity across levels is consistent with composition processes, and functional but not structural identity across levels is consistent with compilation processes.

Using examples from the literature, Chan (1998) has developed a typology to distinguish different types of “composition” or data-aggregation models. The typology includes additive models (e.g., Glick, 1985), direct-consensus models (e.g., James et al., 1984, 1993; Kozlowski & Hatruck, 1992), referent-shift-consensus models (e.g., James, 1982; Klein et al., 1994; Rousseau, 1985), dispersion models (e.g., Brown et al., 1996; Brown & Kozlowski, 1997), and process models (e.g., Kozlowski et al., 1994, 1999; Kozlowski, Gully, McHugh, et al., 1998). The direct-consensus, additive, and referent-shift-consensus models are consistent with composition processes, whereas the dispersion and process models are consistent with compilation processes. Finally, our typology is also consistent with Steiner’s (1972) typology of group performance. In many ways, Steiner’s work is a precursor of all such typologies because it captures many of the basic combination rules that determine how individual characteristics, cognition, affect, and behavior can aggregate to represent higher-level, collective phenomena. We believe, as just discussed, that our framework is largely consistent with these other efforts. We also believe that our particular attention to the underlying processes and dynamics that shape different emergent forms enhances understanding of the moderator effects and boundary conditions affecting emergence. An appreciation of the influence of these processes will lead to more precise specification of the theory addressing emergent phenomena. We see our effort as a point of departure for guiding and pushing further theoretical elaboration.

It is interesting to us that when our effort was originally conceived, we viewed our focus on different forms of emergence, and on the processes that shape these forms, as novel. However, a number of other researchers, contemporaneous with the development of this chapter, have also started to explore emergence (Brown & Kozlowski, 1997, 1999; Brown et al., 1996; Chan, 1998; Kozlowski, 1998, 1999; Morgeson & Hofmann, 1999a, 1999b). Although this chapter is not intended as an integration of these efforts, we believe that our framework helps to make explicit the compatibilities of these apparently disparate efforts to explore emergence. For example, Brown and Kozlowski (1997, 1999) posit dispersion theory, which focuses on patterns of within-group variability or the dispersion of phenomena, as opposed to the more common focus on means or convergent points. In dispersion theory, uniform patterns that evidence low dispersion are consistent with composition processes, whereas subgroup bifurcation that creates nonuniform patterns of dispersion are consistent with compilation processes. Similarly, Morgeson and Hofmann (1999a, 1999b) have made a strong case for distinguishing construct structure and function. Structural and functional identity across levels is consistent with composition processes, and functional but not structural identity across levels is consistent with compilation processes.

Implications
We introduced this third and last section of the chapter with three intentions: to be inclusive and expansive in our consideration of alternative forms of emergence, to focus on building a theoretical foundation for different forms of emergence, and to use typology as a vehicle for explicating and elaborating on the theoretical underpinnings of emergence. We hope that, in some measure, we accomplished these goals. We believe, as we shall describe, that our framework is largely consistent with other efforts to explore emergence. We also believe that our particular attention to the underlying processes and dynamics that shape different forms of emergence can enhance understanding of the moderator effects and boundary conditions affecting emergence. An appreciation of the influence of these processes will lead to more precise specification of the theory addressing emergent phenomena. We see our effort as a point of departure for guiding and pushing further theoretical elaboration.

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Conclusion

The implementation of the proposed model of cooperative learning in...
Several of the substantive topics were selected primarily because typical treatments of these topics in the industrial and organizational literature rarely consider the implications of levels, and yet levels issues are central. When the implications of a multilevel theory are considered, new and unexplored issues are surfaced. Prime examples of such topics include selection (Schneider et al., Chapter Two, this volume), performance appraisal (DeNisi, Chapter Three, this volume), career effectiveness (Krowko et al., Chapter Four, this volume), and human resource management (Ostroff & Bowen, Chapter Five, this volume).

Other topics were selected because they necessarily embody a levels perspective, but a perspective that forces us to think beyond our current frameworks. Prime examples include cross-cultural (Chao, Chapter Seven, this volume) and interorganizational linkages (Klein et al., Chapter Six, this volume). Both chapters focus on the implications of individuals being representatives of the higher level collectivities to which they belong.

Next, there are chapters addressing each of the primary multilevel analytic methods and issues, including within-group agreement, non-independence, and reliability (Kline, Chapter Eight, this volume); the cross-level operator and contextual analysis (James & Williams, Chapter Nine, this volume); within-and-between analysis (Dasstereau & Ybarra, Chapter Ten, this volume); and hierarchical linear modeling (Hofmann et al., Chapter Eleven, this volume). In addition, we have endeavored to cut through to the heart of the assumptions, differences, and appropriate applications of these multilevel analytic techniques with a collaborative effort that combines our disparate knowledge and perspectives (Kline, Bliise et al., Chapter Twelve, this volume).

Finally, we close the book with reflective comments pertaining to the importance of the levels perspective to the deep historical roots of our science, and to the increasing centrality of levels theory in mainstream organizational theory and research (Brass, Chapter Thirteen, this volume). The multilevel perspective provides a means for us to unify our science, and creates a foundation for enhancing policy impact for the disciplines that study organizations (Rousseau, Chapter Fourteen, this volume). The authors of all these chapters have provided a wealth of ideas and actionable knowledge. We hope that these ideas, and this book, stimu-

lates those, who like us, seek a more unified and impactful science of organizations.

Notes
1. Throughout this chapter, we use the term multilevel in a generic sense, to reference all types of models that entail more than one level of conceptualization and analysis. Therefore, our use of the term multilevel references composition and compilation forms of bottom-up emergence, cross-level models that address top-down contextual effects, and homogeneous multilevel models that address parallel constructs and processes occurring at multiple levels.

2. Any effort to briefly characterize the many and myriad contributions to multilevel theory in organizations is doomed from the outset to be incomplete. We recognize that there are other lines of theory and research that have contributed to multilevel theory; many are mentioned throughout this chapter. We have chosen, however, to focus on a very early, sustained, and reasonably coherent effort that spanned many decades and many contributors. Our apologies to all others.

3. We recognize that there are alternative perspectives on organizational culture that view it as a collective construct, one that cannot be decomposed to the individual level. However, research on organizational culture has become increasingly consistent with an emergent perspective (Denison, 1996).

4. Insofar as global, shared, and configurational unit properties each describe a unit as a whole, they are "homogeneous constructs," as Klein and colleagues (1994) use the term; here, we elaborate on their typology, illuminating the variety of forms that homogeneous unit-level constructs may take.

5. Unilevel constructs may of course be compositional, as in situations where group members share identical values or the same attitudes, but we expect some characteristics, such as abilities and personality, to be more likely configurational than shared.

6. We acknowledge that the conceptualization of phenomena may entail a universal form; for example, unit climate is often conceptualized as a unit property when it is shared and as an individual property when it is not (James, 1982).

7. Our definition of discontinuous phenomena is consistent with House and colleagues (1995). Note also that these authors propose three models of relational discontinuity, involving (a) magnitude, (b) relational patterns, and (c) behavior-outcome relations. We would characterize these models as top-down contextual models, not bottom-up emergent processes. These three models illustrate (a) cross-level direct effects,


DeShon, R. P., Münzer, K. R., Kozlowski, S.W.J., Tosey, R. J., Schmidt, A., Weichmann, D., & Davis, C. (1999, April). The effects of team goal orientation on individual and team performance. In D. Steele-Johnson (Chair), New directions in goal orientation research: Extending the construct, the nomological net, and analytic methods. Symposium conducted at the fourteenth annual conference of the Society for Industrial and Organizational Psychology, Atlanta, GA.


George, J. M., & James, L. R. (1953). Personality, affect, and behavior in groups revisited: Comment on aggregation, levels of analysis, and a recent application of within and between analysis. Journal of Applied Psychology, 78, 798–804.


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**CHAPTER 2**

**Personnel Selection Psychology**

**Multilevel Considerations**

Benjamin Schneider

D. Brent Smith

William P. Sipe

History shows that great... forces flow like a tide over communities only half-conscious of that which is buffeting them. Wise statements concerning what time is thus bringing, and try to shape institutions and model men's thoughts and purposes in accordance with the change that is silently coming on.

**JOHN STUART MILL**

Industrial and organizational (I/O) psychology in general, and the subfield of personnel selection in particular, are experiencing a paradigm shift of which they may not be fully aware. The paradigm shift is from a focus on what Nord and Fox (1997) called the "essentialist individual" model of behavior to a newer focus on the organizational implications of personnel selection practices. From

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