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Meng Zhang
Queensland University of Technology, m.zhang@qut.edu.au

Guy G. Gable
Queensland University of Technology

Mary Tate
Victoria University of Wellington

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Overview of the Multilevel Research Perspective: Implications for Theory Building and Empirical Research

Meng Zhang
School of Information Systems
Queensland University of Technology
m.zhang@qut.edu.au

Guy G. Gable
School of Information Systems
Queensland University of Technology

Mary Tate
School of Information Management
Victoria University of Wellington

Abstract:

A multilevel perspective in information systems (IS) research helps researchers to understand phenomena simultaneously at multiple levels of analysis. In understanding and employing the multilevel perspective, researchers may face challenges in relation to the value contribution, the terminology, and the critical differences between multilevel and single-level research. To address the challenges, we synthesize contemporary thinking on the multilevel perspective. In particular, we clarify the various value contributions of the multilevel perspective, offer a consistent terminology for conducting multilevel research, and holistically overview the guidelines in relation to specifying, operationalizing, and testing theoretical models. This tutorial helps researchers to holistically understand the multilevel perspective to allow them to more deeply appreciate the nuanced assumptions underlying the perspective. Thus, this paper contributes by helping researchers to more effectively and more flexibly engage in multilevel research.

Keywords: Multilevel Research Perspective, Multilevel Theorizing, Multilevel Perspective, Multi-Level Research, Multilevel Paradigm, Multilevel Theory, Multilevel Model, Multilevel Analysis, Research Methods.

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1 Introduction

Information systems (IS) phenomena often span multiple levels of analysis (e.g., system users, work groups, organizations, and supply chains) (Zhang & Gable, 2017; Bélanger, Cefaratti, Carte, & Markham, 2014; Burton-Jones & Gallivan, 2007). By paying attention to multiple levels of analysis, researchers can use a multilevel research perspective to build theory or interpret data more effectively. However, researchers who plan to carry out multilevel research may face several challenges. First, guidance on research methods often does not address issues associated with multiple levels of analysis, so researchers may be less familiar with the rationale for adopting the multilevel perspective. Second, the literature provides inconsistent terminology for the multilevel perspective, which engenders potential confusion (Burton-Jones & Gallivan, 2007; Gallivan & Benbunan-Fich, 2005). Third, the literature lacks clarity about how the multilevel perspective resembles or differs from single-level research.

To address these challenges, we overview the multilevel (research) perspective in this paper. We proceed as follows: in Section 2, we clarify the value and contribution of the multilevel perspective. In Section 3, we offer consistent terminology for conducting multilevel research. In Section 4, we consolidate guidelines for multilevel research and emphasize the differences between multilevel research and single-level research. Finally, in Section 5, we conclude the paper. We hope the paper can help to reduce the effort required to understand, adopt, and apply the multilevel perspective.

Despite the various ways in which researchers have interpreted the multilevel perspective, we focus on the multilevel perspective only from the organization science paradigm (Mathieu & Chen, 2011). We do so primarily because the IS discipline accepts the multilevel perspective from the organization science paradigm more than any other perspective (e.g., Kane & Labianca, 2011; Rai, Maruping, & Venkatesh, 2009). Rooted in the systems paradigm (e.g., Von Bertalanffy, 1968; Katz & Kahn, 1966; Miller, 1978), the organization science paradigm focuses on simultaneously examining similar phenomena or observations at different levels of analysis (e.g., how groups and organizations similarly respond to external threats (Staw, Sandelands, & Dutton, 1981)).

Furthermore, although one can use the multilevel perspective in research other than quantitative research, we focus on quantitative research because quantitative research constitutes a large portion of IS research. This scope decision also concurs with previous discussions on the multilevel perspective (e.g., Zhang & Gable, 2017; Bélanger et al., 2014; Burton-Jones & Gallivan, 2007). We also focus on quantitative research because researchers not developed the multilevel perspective for qualitative or interpretivist research as much as they have for quantitative research. For instance, research has not adequately addressed how to use qualitative evidence to test a multilevel theory.

2 Recognizing and Understanding the Value and Contribution of Multilevel Research

A multilevel perspective refers to “an approach to theory development that considers the relevance of multiple levels of analysis” (Zhang & Gable, 2017, p. 203). Table 1 lists examples of multilevel research in the IS discipline. As Table 1 shows, one can use the multilevel perspective to address a diverse range of topics related to using and managing information systems with qualitative or quantitative data. Multilevel studies have made useful contributions to advance knowledge in IS.

Kozlowski and Klein (2000) state that “multilevel theory is neither always needed nor always better than single-level theory” (p. 13), which raises questions about the multilevel perspective’s comparative advantages. Drawing from the literature (e.g., Zhang & Gable, 2017; Bélanger et al., 2014; Burton-Jones & Gallivan, 2007; Kozlowski & Klein, 2000), we summarize the potential value and contribution from the multilevel perspective in this section.

2.1 Harmonizing Different Perspectives

The IS discipline embraces theories from different perspectives (Vessey, Ramesh, & Glass, 2002; Chen & Hirschheim, 2004; Taylor, Dillon, & Van Wingen, 2010). One challenge for researchers involves harmonizing theories from such different perspectives in order to realize greater rigor and more cumulative knowledge progression (Benbasat & Weber, 1996; Taylor et al., 2010; Tate, Evermann, & Gable, 2015). Based on analyzing the IS literature, Taylor et al. (2010) characterize the IS discipline as a polycentric discipline and suggest that it has gradually split into different subdisciplines.

Table 1. Snapshot of Multilevel Research in the IS Discipline

Reference	Focal phenomenon	Knowledge contribution	Data
Lapointe & Rivard (2005)	“Resistance to information technology implementation” (p. 461) at both the individual level and the group level	Explained resistance to information technologies (IT) as an emergent, dynamic phenomenon rather than only individual behaviors	Qualitative
Rai et al. (2009)	“The success of offshore IS projects” (p. 617) at both the project level and the project-leader level (a project leader who has multiple projects)	Explained project success by considering the role of project leaders’ cultural values beyond the factors related to only the project itself	Quantitative
Turel & Zhang (2011)	“The use of online collaboration tools for virtual teamwork” (p. 62) at both the individual level and the group level	Explained IT use and its consequences beyond the dominant technology acceptance model at the individual level	Quantitative
Kane & Labianca (2011)	“The effects of IS avoidance on patient care delivered by health-care groups across three levels of analysis: the individual level, the shared group level, and the configural group level” (p. 504)	Explained the diverse effects or consequences of IS avoidance behaviors at the individual level, the shared group level, and the configural group level rather than assuming the three levels have the same behaviors	Qualitative & quantitative
Kang, Lim, Kim, & Yang (2012)	“The use of collaborative technologies (CT) and the task performance of individual users as a result of using CT” (p. 214)	Explained CT use and its consequences by integrating the adaptive structuration theory and the technology acceptance model rather than using either theory alone	Quantitative

When researchers need to develop theories from different perspectives at different levels of analysis, they may employ the multilevel perspective to understand and interrelate the diverse perspectives (House, Rousseau, & Thomas-Hunt, 1995). For example, Sarker and Valacich (2010) effectively interrelate two perspectives of group technology adoption by employing the multilevel perspective. From the first perspective, group technology adoption emerges and results from two group processes: conflict resolution and consensus generation. In the emergent processes, group members’ individual characteristics, perceptions, and attitudes play a key role in shaping group attitude. In contrast, the second perspective treats group technology adoption as determined by “the fit between the task [of a group] and the technology, as perceived by the group” (Sarker & Valacich, 2010, p. 785). To harmonize the two perspectives, Sarker and Valacich (2010) developed a multilevel model that includes individual-level constructs from the first perspective and group-level constructs from the second perspective.

When dispute arises from multiple theoretical perspectives, a multilevel perspective may facilitate theory integration to resolve the dispute (House et al., 1995; Burton-Jones & Gallivan, 2007) and, thereby, afford more comprehensive recommendations for research and practice. For example, the two theoretical perspectives of group technology adoption that Sarker and Valacich (2010) cite might point to seemingly contradictory recommendations for action. The first perspective at the individual level might suggest that groups should not include cultural and knowledge background diversity because diversity may increase group conflict and, thus, create a barrier to consensus formation. In contrast, the second perspective at the group level might suggest that groups should include a combination of diverse skills. Complementary skills and knowledge may increase a group’s capability to appropriate the technology for the group task and, thereby, increase the fit between the group task and the technology. Sarker and Valacich’s (2010) multilevel model that integrates these two perspectives allows one to understand group diversity from both perspectives jointly. Diversity might play a negative role in early stages of group technology adoption in which conflict may arise. As the group gradually resolves conflicts via group interactions and begins to work and function as a whole, diversity might contribute positively to group technology adoption.

2.2 Enriching Conceptualization of Collective Constructs

One can usefully study IS phenomena at the level of collectives such as dyads, work groups, firms, and industries. Researchers often use the term “collective constructs” to characterize attributes or properties of such collectives (Morgeson & Hofmann, 1999). One can find many collective constructs in the literature, such as group system use, group attitude toward technology adoption, and organizational memory (e.g., Kane & Labianca, 2011; Sarker & Valacich, 2010; Pavlou & El Sawy, 2010).

When conceptualizing a collective construct that originates from a lower analysis level, a multilevel perspective urges researchers to consider the constituent parts of the collective and the theoretical structure with regards to how the parts interact; in doing so, they can enrich the meaning of the collective construct (Chan, 1998; Morgeson & Hofmann, 1999; Burton-Jones & Gallivan, 2007) based on the rationale that one can partly infer what some collective constructs mean from their constituent parts' attributes, perceptions, and behaviors. As Hofmann (2008, p. 250) notes:

> *Researchers often use what they know to help them understand things that are complex, unclear, equivocal, and less certain. For example, the use of different metaphors for understanding organizations can help to highlight certain types of organizational phenomenon…. Similarly, we use constructs with which we are familiar to help us understand collectives by, for example, referring to a team's "personality.*

According to Hofmann (2008), a collective usually does not act in the same way as an individual human being, which suggests that conceptualizing a collective construct might involve metaphorical features. "Group learning", for instance, describes some configuration of individual members in a group who learn through frequent and reciprocal interactions. It highlights some similarities between a group's learning outcomes and an individual's learning outcomes—both aim for knowledge gain. In such cases, if one conceptualizes a collective construct without articulating the collective's constituent parts and the collective's structure, one may lose the metaphorical content.

Moreover, by enriching the meaning of collective constructs from a multilevel perspective, researchers can better develop measurement models. Morgeson and Hofmann (1999, pp. 260-261) recommended that:

> *Scholars should not simply assume that the measurement of collective phenomena is the same as the measurement of analogous individual-level phenomena. There is a host of potentially important factors at the collective level, such as interaction, integration, coordination, and interdependence. In their theories and operationalizations, scholars must take these factors into account in order to fully understand the nature of such collective constructs.*

For example, Burton-Jones and Gallivan (2007) conceptualize groups' system usage from a multilevel perspective and considered how groups comprise individual users and how individual users interact in a group. These two elements likely differ across varying contexts, such as in situations that use a decision support system versus situations that use a collaborative writing platform. One enriches the meaning of groups' system usage via elaborating these two elements (Burton-Jones & Gallivan, 2007). Thus, researchers who use Burton-Jones and Gallivan's (2007) conceptualization of system usage can more accurately define definitions appropriate for the study context.

As another example, Roberts, Galluch, Dinger, and Grover (2012) suggest that information technologies play a critical role in developing a firm's absorptive capacity. They state: "In contrast to an individual's absorptive capacity, a collective entity's absorptive capacity is dependent upon several factors, such as the coordination between its individual members, the overlap in their cognitive schemas, and the diversity in their knowledge bases" (p. 638). Depending on these factors, one can conceptualize organizational absorptive capacity in various ways (Roberts et al., 2012). When researchers conceptualize organizational absorptive capacity, they need to elaborate on the factors that relate to individual members in an organizational context. By conceptualizing organizational absorptive capacity from a multilevel perspective, researchers may better develop measurement models appropriate for given settings.

2.3 Promoting Context-rich Theorizing

Social behavioral research is often sensitive to social or physical settings (e.g., workplaces that implement knowledge-management systems, small to medium-sized firms as opposed to large firms, and workplaces that implement an information technology (IT) governance structure) (Whetten, 2009; Whetten, Felin, & King, 2009). Thus, researchers must apply a theoretical model only in the "boundary conditions" that it focuses on explaining (Gregor, 2006; Weber, 2012). However, even though researchers strongly emphasize theory boundaries due to their importance (Dubin, 1978; Weber, 2012), they can easily ignore them as they immerse themselves in deep thinking and theorizing.

The multilevel perspective provides a tool for researchers to identify relevant contextual variables (e.g., an organization's size, a project's longevity, senior executives' tenure) and to incorporate the variables into their theoretical model (Zhang & Gable, 2017; Rousseau, 1985). A multilevel perspective primarily helps researchers to develop "context-rich" rather than "context-thin" theory. For example, consider

Bhattacherjee, Limayem, and Cheung's (2012) single-level theory of IT-switching behavior. Contexts that involve "fairly simple and easy to use" IT such as Web browsers rather than contexts that involve "more complex technologies such as ERP or HRM systems" bound this theory (Bhattacherjee et al., 2012, p. 332). To redevelop the theory from a multilevel perspective, researchers might conceptualize "IT complexity" as a potential contextual variable and incorporate it in the theory. As a result, they might produce a new multilevel model of IT-switching behavior: an increase in IT complexity may weaken the extent to which antecedents of IT switching predict IT-switching behavior. In comparison with the single-level theory, the enriched multilevel model would apply to both contexts that use both simple and complex IT. Thus, this added explanatory dimension makes the theory of IT-switching behavior context rich.

2.4 Explaining Hierarchical Data

The multilevel perspective can also help with challenges in analyzing hierarchical data (e.g., Rousseau, 1985; Hofmann & Gavin, 1998; Luke, 2004). When one collects inherently hierarchical data (e.g., department revenues aggregate into organizational income), one may face statistical challenges in analyzing it (Hofmann & Gavin, 1998). Specifically, hierarchical data would invalidate the independence assumption of individual observations; as most existing statistical procedures include the independence assumption, one would need advanced statistical models and analytic techniques (Luke, 2004); otherwise, statistical and validity issues might occur (Rousseau, 1985; Gallivan & Benbunan-Fich, 2005). When one uses advanced statistical models and analytic techniques to analyze hierarchical data, the fitted models often imply theoretical models spanning multiple levels of analysis. The multilevel perspective can help researchers develop theoretical models at multiple levels of analysis and, thereby, ensure consistency with the fitted models and the hierarchical data.

3 A Consistent Terminology for Multilevel Researchers

The terminology for the multilevel perspective lacks consistency in several ways (Burton-Jones & Gallivan, 2007; Bélanger et al., 2014). Table 2 presents some examples. Recognizing the inconsistency, previous authors have attempted to clarify the terminology (e.g., Gallivan & Benbunan-Fich, 2005; Burton-Jones & Gallivan, 2007; Bélanger et al., 2014). Kozlowski and Klein (2000) conducted one of the earliest and most comprehensive studies on unifying terminology about the multilevel perspective. Bélanger et al.'s (2014) study represents a more recent endeavor.

Table 1. Issues with Multilevel Perspective Terminology in the Literature

Issue	Example
Using different labels for a similar term	• Klein, Dansereau, and Hall (1994) use "level of statistical analysis" and Rousseau (1985) uses "level of analysis" to mean the same thing • Chan (1998) uses "composition models" and Kozlowski and Klein (2000) use "data-aggregation models" to mean the same thing
Conflating terms under the same label	• Rousseau (1985) uses the term "multilevel models" in a different way to how Kozlowski and Klein (2000) and Burton-Jones and Gallivan (2007) use it • Kozlowski and Klein (2000) use the term "single-level models" in a different way to how Burton-Jones and Gallivan (2007) and Klein et al. (1994) use it

Building on the literature, we synthesize the terminology for the multilevel perspective. We begin with "levels" as the term in the multilevel perspective usually connotes an ontological view: "things" or "objects" in the real world tend to be hierarchically embedded such that smaller or modular things constitute parts of larger or grander things (Mathieu & Chen, 2011). For example, individual persons constitute a part of a group or a department, and project teams constitute a part of a firm. This ontological view manifests an entire research lifecycle to the extent that researchers often make choices that center on alternative levels. The terminology for the multilevel perspective should explicate those choices. Table 3 summarizes the terms that relate to levels.

Table 3. Summary of Terms Related to Levels

Term	Definition	References
Level	• A level refers to either a system or a system element; here, a system refers to “a set of interrelated elements” (Ackoff, 1971, p. 662). • Levels are “nested”: a level is either higher or lower relative to all other levels in a hierarchy (e.g., a group of individuals).	Ackoff (1971), Staw et al. (1981), Rousseau (1985), Mathieu & Chen (2011)
Level of construct or level of theory	• Level of construct refers to “the level at which it [a construct] is hypothesized to be manifest in a given theoretical model” (Kozlowski & Klein, 2000, p. 27) or the focal unit “to which generalizations are made” (Rousseau, 1985, p. 4) (e.g., individual users, project teams, etc.). • Level(s) of theory refers to a combination of the levels of all constructs in a theory.	Rousseau (1985), Klein et al. (1994), Kozlowski & Klein (2000)
Level of measurement	• Level of measurement refers to the level of the data source.	Kozlowski & Klein (2000)
Level of statistical analysis	• Level of statistical analysis refers to “the unit to which the data are assigned for hypothesis testing and statistical analysis” (Rousseau, 1985, p. 4).	Rousseau (1985), Klein et al. (1994)
Unit of analysis and level of analysis	• Studies in the literature sometime treats unit of analysis and level of analysis interchangeably and use them loosely to refer to any of level of construct, level of theory, level of measurement, and level of statistical analysis. • We restrict the meanings of “unit of analysis” and “level of analysis” to “level of construct”.	See “note” below;
Note: surprisingly, the multilevel perspective literature rarely defines “unit of analysis” or “level of analysis”, which tend to be the most common terms in the IS literature. Thus, we interpreted the meanings of these two terms 1) based on how IS literature has used them and 2) relative to those more precise terms that we define in the above rows.		

3.1 Level

Researchers often call the entities they focus on levels (e.g., a firm, a work group, or a family unit). In this sense, they use a system metaphor to think about levels (Staw et al., 1981; Rousseau, 1985). Drawing from Miller (1978), Rousseau (1985) posit that levels exhibit a hierarchy in a system: a higher level comprises lower levels.

To illustrate levels’ nature, consider the way in which Ackoff’s (1971, p. 662) defines “a system”:

> *A system is a set of interrelated elements. Thus, a system is an entity which is composed of at least two elements and a relation that holds between each of its elements and at least one other element in the set. Each of a system’s elements is connected to every other element, directly or indirectly. Furthermore, no subset of elements is unrelated to any other subset.*

In light of Ackoff’s (1971) definition, we may view a level as a system or an element of a system. With this definition, we can define “hierarchy” more precisely. If multiple levels exist, any level must be either higher or lower relative to every other level. More precisely, we say level A is higher relative to level B if and only if level B is an element of level A or at least one other in-between level (e.g., level C) that is lower relative to level A and higher relative to level B exists. In other words, multiple levels should exhibit a hierarchical relationship or (at least partially) be “nested” (Mathieu & Chen, 2011).

When defining “levels” in a particular setting, researchers assumedly observe and approach phenomena according to the levels they define. Thus, Mathieu and Chen (2011) call for attention to criteria that define a level’s membership in a specific setting since differences in such criteria may influence research outcomes. For example, one might group users as a work group based on 1) physical access to IT, 2) their frequency with which they interact with a virtual community, or 3) their online browsing trails or shopping behaviors when visiting a website. Such differences in the way researchers define a user group’s membership can lead to quite different conclusions about a phenomenon.

Note that, for social and behavioral IS research, levels often concern groupings of people, or certain ways to group people at least implies certain levels. For example, Cenfetelli and Schwarz (2011) distinguish between two levels: the “individual user level” and the “system (website) level” (pp. 817-818). Although the website level is ostensibly a non-human grouping, Cenfetelli and Schwarz (2011) identified websites based on users who regularly visited them. In other words, Cenfetelli and Schwarz (2011) analyzed the website level since they wanted to analyze the behavior of users who visited the same website.

Making a study's "levels" clear represents only the first step. Researchers also need to consider other terms when conceptualizing, operationalizing, and testing theoretical models.

3.2 Level of Construct (or Level of Theory)

In the conceptualization phase, "the level of construct" helps to make clear "the level at which it [a construct] is hypothesized to be manifest in a given theoretical model" (Kozlowski & Klein, 2000, p. 27) or the focal unit "to which generalizations are made" (e.g., individual users, project teams) (Rousseau, 1985, p. 4). When multiple levels pertain to a study, researchers should make the level to that each construct refers to clear. For instance, the construct "perceived ease of use of technology" might refer to individual perceptions or group perceptions, which implies different construct levels.

Researchers may also use the term "the level of theory" to specify the level at which the proposed theory manifests (Klein et al., 1994). If a theory includes multiple constructs and the constructs pertain to different levels, the theory manifests at multiple levels.

3.3 Level of Measurement

In the operationalization phase, the term "the level of measurement" can help researchers to clarify alternative ways to operationalize a construct (Kozlowski & Klein, 2000; Chen, Mathieu, & Bliese, 2003). Rousseau (1985) refers to the level of measurement as "the unit to which the data are directly attached" (p. 4), whereas Kozlowski and Klein (2000) refer to it as "the level at which data are collected to assess a given construct" (p. 32). Despite the ostensible similarity, the two definitions capture two different things.

According to Rousseau's (1985) definition, the level of measurement refers to what data describe. For example, suppose that a researcher assesses a group's performance by asking each individual group member to report their own performance and then uses the aggregated score to represent the group's performance. Because the researcher has collected ratings that characterize individuals' performance, the researcher would consider the individual as the level of measurement. However, if the researcher asked each group member to rate the group performance (rather than their individual performance) before averaging the data, the researcher would regard the group as the level of measurement.

In contrast, according to Kozlowski and Klein's (2000) definition, the level of measurement refers to the level of the data's source. For example, suppose a researcher studies a group's norm in terms of encouraging innovation or abiding policies with group as the level of construct. Then, suppose the researcher asks every individual group member to rate the group's norm in terms of some measurable scale, such as the extent to which it encourages innovative behaviors. Based on the way in which Kozlowski and Klein (2000) define level of measurement, the level of measurement would refer to the individual group member even though the data describe a group. Note that "what the data describe" (i.e., the first definition) would be the group; the second definition, "the source of data", conflicts with the first definition.

One cannot accommodate both definitions in a simple way; the literature seems to more commonly accept the second definition (e.g., Chan, 1998; Morgeson & Hofmann, 1999; Chen et al., 2003; Hitt, Beamish, Jackson, & Mathieu, 2007). Thus, to be consistent with the extant literature, we use Kozlowski and Klein's (2000) definition when referring to the level of measurement.

The term "the level of measurement" primarily helps researchers to identify potential discrepancies between a construct and its measures. Thus, they have used the term to differentiate alternative approaches to operationalization and to suggest appropriate procedures to deal with alterative operationalization approaches (e.g., Chan, 1998; Chen et al., 2003). (We return to this issue in Section 4.2.)

3.4 Level of Statistical Analysis

The term "the level of statistical analysis" clarifies alternative choices in data analysis and theory testing. Klein et al. (1994, p. 198, emphasis added) posits:

> *The level of statistical analysis describes the treatment of the data* during statistical procedures. *For example, if the level of measurement is the individual, but* individual scores are aggregated *by using the group means* in data analysis*, the level of statistical analysis is the group.*

Rousseau (1985) uses a different label—"the level of analysis"—to define the level of statistical analysis. Specifically, she defines it as "the unit to which the data are assigned for hypothesis testing and statistical analysis" (p. 4). To avoid confusion, we consistently employ the label "the level of statistical analysis" that Klein et al. (1994) and Kozlowski and Klein (2000) use and adopt Rousseau's (1985) definition.

The level of statistical analysis may differ from the level of measurement (see the example in Klein et al.'s (1994) quote above). When the level of measurement differs from the level of construct, researchers need to transform the level of measurement to the level of statistical analysis so that the level of statistical analysis is the same as the level of construct (Kozlowski & Klein, 2000). Consider the prior example of individuals' rating their own work performance in which case the individuals constitute the data's source (hence, the level of measurement is the individual). If the theory explains group behavior and performance (hence, the level of construct is the group), the level of statistical analysis must be the group so that it is the same as the level of construct. To ensure that researchers achieve consistency between the level of statistical analysis and the level of construct, they might sum individuals' performance scores for each group and make the level of statistical analysis the group.

3.5 Unit of Analysis and Level of Analysis

The IS literature also tends to widely (and sometimes interchangeably) use two other terms, "the unit of analysis" and "the level of analysis", to loosely refer to any of "the level of construct", the level of theory", "the level of measurement", and "the level of statistical analysis". As such, using the terms in research from a multilevel perspective lacks precision, and we restrict "the unit of analysis" and "the level of analysis" to mean "the level of construct".

4 Guidelines for Multilevel Researchers

When conducting research from a multilevel perspective, researchers need to reconsider how they formulate, operationalize, and test theoretical models (Kozlowski & Klein, 2000). In this section, we illustrate the main procedures by contrasting the multilevel perspective with the single-level perspective (see summary in Table 4). The bolded text in Table 4 highlights extra considerations compared with the single-level perspective.

Note that we need to clarify what we mean by a single-level perspective. Despite various definitions, we regard a study as being from a single-level perspective if its level of construct, level of measurement, and level of statistical analysis belong to the same level and the researcher collects data only at this level; in other words, the study involves only one level. We mainly intend this working definition of a single-level perspective to illustrate the subtleties of a multilevel perspective. As an example of single-level study at the individual level, a researcher might theorize that a users' age negatively affects their intention to use a system, measure "age" and "intention to use" at the individual level, and then statistically test the hypothesis also at the individual level. As an example of a single-level study at the group level, a researcher might theorize that group size increases the time needed for the group to reach a consensual decision toward adopting an information technology, measure "group size" and "elapsed time" based on group leaders' estimation (and, thus, at the group level), and then test the hypothesis using collected data.

Throughout this section, we use Kang et al.'s (2012) study on collaborative technologies (CT) (or groupware) use as an example.

Table 4. Summary of Guidelines for Conducting Multilevel Research

Research phase	Activity	Main procedures
Specify the theoretical model	Develop constructs	• Specify the meanings, boundary conditions, and dimensionality of constructs • **Clarify the relevant hierarchy of levels and justify the existence of the levels about collectives (e.g., dyads, groups, firms)** • **Elaborate the conceptual similarities between multilevel constructs at different levels by 1) specifying the similarity in definitions of the constructs (e.g., individual and group task performance are both defined as the consequence of performing tasks) and 2) elucidating the similarity in the cognitive or behavioral processes to which the constructs refer (e.g., individual satisfaction and group morale both refer to affective or emotional processes)**
	Theorize relationships	• Specify 1) single-level causal relationships among constructs • **Specify 2) cross-level causal relationships, 3) structural relationships, or (4) functional equivalence among constructs**
Operationalize the theoretical model	Develop measures	• Consider measures at the same level as the level of construct (e.g., group-level ratings to measure a group-level construct); • **Consider measures at levels that differ from the levels of constructs (e.g., individual-level ratings to measure a group-level construct)** • **Justify the measurement models with the structural relationships theorized**
	Validate constructs	• Evaluate construct validity • **Evaluate structural relationships**
Test the theoretical model	Choose data collection strategies	• Collect data at the same level as the level of construct • **Collect data at levels that differ from the levels of constructs** • **Collect data that are sufficient to test the theoretical model (e.g., data that show adequate between-group variance)**
	Select data analysis techniques	• Consider traditional statistical analysis techniques • **If traditional statistical analysis techniques are inadequate, consider multilevel data-analysis techniques, such as hierarchical linear modeling**
	Interpret data analysis results	• Evaluate the presence (or absence) of single-level causal relationships • **Evaluate the presence (or absence) of cross-level causal relationships**

4.1 Specify the Theoretical Model

A theoretical model comprises constructs and relationships among constructs (Weber, 2012). When one develops constructs and theorizes relationships, the multilevel perspective and the single-level perspective entail different considerations.

4.1.1 Develop Constructs

When developing constructs, one needs to specify their meaning, boundary conditions (i.e., what phenomena a construct includes and excludes), and dimensionality (i.e., unidimensional or multidimensional) (MacKenzie, Podsakoff, & Podsakoff, 2011). One needs to do so for both for studies from a single-level perspective and from a multilevel perspective. Consider the way in which Kang et al. (2012) define six constructs (see Table 5). The boundary conditions of the constructs include CT users. Here, CT refers to "computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment" (Ellis, Gibbs, & Rein, 1991, p. 40). Kang et al. conceptualize all the constructs as unidimensional.

Construct development from a multilevel perspective requires several additional considerations. When a construct points to collective—namely, groupings of individuals such as dyads, groups, organizations—researchers need to clarify the relevant hierarchy of levels and then justify the existence of the levels (Mathieu & Chen, 2011; Burton-Jones & Gallivan, 2007). Mathieu and Chen (2011) caution two common scenarios that need attention: when a higher level partially includes a lower one (e.g., when an organization "partially" employs part-time workers) and when multiple higher levels simultaneously include a level (e.g., when a worker belongs to both a special-task team and an organizational department). The CT use example includes two levels that relate to each other: the individual level and the group level (see Table 5); a cohort of individual users who use a common CT constitutes a work group. Further, researchers need to consider whether "a particular collective is a salient grouping entity" and to make rules for including and excluding members clear (Mathieu & Chen, 2011, p. 615). Burton-Jones and Gallivan (2007) further suggest that researchers use both empirical evidence and theoretical justification in determining whether assumptions about the existence of a level hold true. Burton-Jones and Gallivan (2007) recommended two criteria for justifying whether a cohort of individual users constitute a team: a shared goal and interdependency among members (Burton-Jones & Gallivan, 2007). CT's nature, which requires users to use it for a common task-related goal and to collaborate at a high level of interdependency (e.g., via exchanging information via the CT), mainly justifies the existence of the group level in the CT example.

Table 5. Example Definitions of Constructs (from Kang et al., 2012, p. 222)

Construct	Definition	Level of construct
Perceived usefulness (PU)	"The level at which individuals believe the target IS improves the task performances in organizations" (p. 222).	Individual level
Perceived ease of use (PE)	"The degree to which using the target IS is effortless and easy" (p. 222).	Individual level
Consensus on appropriation (COA)	"The level of agreement among users on how a target system ought to be used" (p. 222).	Group level
Faithfulness of appropriation (FOA)	"The degree to which the current usage of the IS is consistent with the designer's plans" (p. 222).	Group level
Collaborative techniques use (CT Use)	"The user's perception of his or her dependency on the target IS in performing tasks in terms of intensity of use, frequency of use, and general dependency on the system" (p. 222).	Individual level
Task Performance	"The individual user's perception of easy execution of tasks, reduction of task loads, and improvement in task execution capabilities as a result of using a particular system" (p. 222).	Individual level

Furthermore, researchers should clearly state the conceptual similarities in multilevel constructs (Rousseau, 1985). Multilevel constructs refer to two or more constructs that share conceptual meaning but at different levels (Chen et al., 2003; Burton-Jones & Gallivan, 2007). The CT use example does not involve multilevel constructs. Suppose we define a new construct "group task performance" to capture the total task performance of users who use a common CT. The individual-level task performance in the CT use example and the group task performance are multilevel constructs because they similarly refer to the consequences from performing tasks (Burton-Jones & Gallivan, 2007). Rousseau (1985, p. 11) calls a model that one employs to represent the conceptual similarities in multilevel constructs a "composition model"[1]. According to Rousseau (1985), one can use two criteria to judge whether two constructs have conceptual similarities. First, the two constructs must have a similar definition (e.g., one defines both individual and group task performance as "the consequences from performing tasks"). Second, the two constructs must originate from identical cognitive or behavioral processes. As an example, Rousseau (1985, p. 12) argues that "individual satisfaction" and "group morale" conceptually resemble each other given they both originate from affective or emotional processes. In the CT use example, individual-level task performance and group task performance both result from performing tasks.

4.1.2 Theorize Relationships among Constructs

One cannot easily specify the relationships among constructs from the multilevel perspective due to the fact that four types of relationships (two casual and two non-causal relationships) rather than one may exist (see Table 6).

A causal relationship is a single-level causal relationship if the origin and the target of a causal relationship belong to the same level and a cross-level causal relationship if the origin and the target belong to different levels (Kozlowski & Klein, 2000). For example (see Figure 1), the relationship between

[1] Note that other researchers (e.g., Chan, 1998; Chen et al., 2003) use the term "composition models" in a different sense, which we explain in Section 4.2.1.

PU and CT use is a single-level causal relationship because both constructs belong to the individual level. In contrast, the relationship between COA and CT use is a cross-level causal relationship because COA belongs to the group level.

Table 6. Types of Relationships in the Multilevel Perspective

Nature	Type	Definition	Example
Causal	Single-level causal relationship	A causal relationship in which the origin and the target belong to the same level.	PU (at the individual level) may positively affect CT use (at the individual level).
	Cross-level causal relationship	A causal relationship in which the origin and the target belong to a different level.	COA (at the group level) may positively affect CT use (at the individual level).
Non-causal	Structural relationship	A mathematical (non-causal) relationship between multilevel constructs; one infers this relationship from the structure of a collective construct.	Individual task performance (at the individual level) and group task performance (at the group level) may structurally relate to each other. Thus, the group task performance for a group of two might equal the sum of the individual task performance multiplied by two.
	Functional equivalence	Two or more constructs at separate levels are functionally equivalent if and only if they respectively lead to the same outcomes or effects at the same level.	Individual CT use (at the individual level) and group CT use (at the group level) are functionally equivalent because they respectively lead to the similar constructs individual task performance and group task performance.

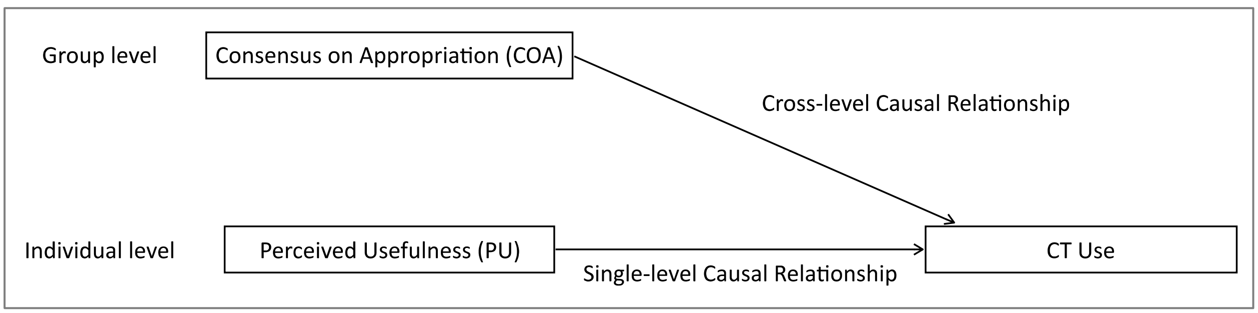

Figure 1. Single-level vs. Cross-level Causal Relationships

A structural relationship refers to a mathematical relationship between multilevel constructs. This relationship does not imply causation. For example, if a structural relationship between individual-level task performance and group-level task performance exists, the values of individual-level task performance and group-level task performance mathematically relate to each other. However, a structural relationship between the two constructs does not suggest that individual-level task performance causes group-level task performance or vice versa. One infers or assumes a structural relationship based on "the structure of a collective construct" (Burton-Jones & Gallivan, 2007; Morgeson & Hofmann, 1999). Morgeson and Hofmann (1999, p. 252) coined the term "the structure of a collective construct" to refer to "a series of ongoings, events, and event cycles between the component parts (e.g., individuals)" of a construct about collectives. Burton-Jones and Gallivan (2007, p. 661) state that: "An individual is a person, a collective is an interdependent and goal-directed group of individuals or collectives (e.g., a team or firm), and a construct is a concept that researchers use to describe an individual or collective phenomenon". Thus, "the structure of a collective construct refers to the actions and interactions among individuals that generate the collective phenomenon that a collective construct is used to reflect" (Burton-Jones & Gallivan, 2007, p. 661). Hofmann (2008, p. 250) notes: "the structure of constructs…focuses on the processes through which these [collective constructs'] outputs and effects come about". In the CT use example, the structure of group task performance characterizes the actions and interactions of individual users who employ CT to complete tasks and to generate task performance; for instance, specific actions include participating in regular online meetings and co-editing documents via CT. The structure also includes how the individual actions give rise to group task performance. Based on the structure of group task performance, researchers might infer a structural relationship between group task performance and individual task performance (e.g., the group task performance for a group of two might equal the sum of the individual task performance multiplied by two) (see Figure 2).

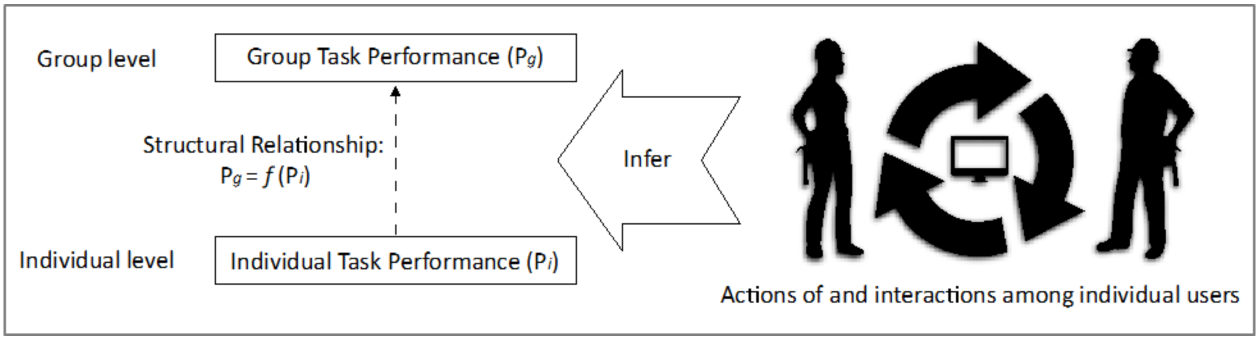

Figure 2. Structural Relationship vs. Structure of Collective Construct

As another kind of non-causal relationship, functional equivalence characterizes the relationship between two or more nomological networks. A nomological network links a set of constructs together only by causal relationships (Cronbach & Meehl, 1955). Nomological networks need to simultaneously satisfy two criteria to establish functional equivalence. First, each nomological network should include only constructs at the same level (and, thus, connect to one another only by single-level causal relationships); constructs from different nomological networks belong to different levels. Second, each nomological network must include a focal antecedent construct, and the focal antecedent constructs from different nomological networks must lead to "the same outcome or effects" (Morgeson & Hofmann, 1999; Burton-Jones & Gallivan, 2007). Figure 3a shows an example that we have adapted from Burton-Jones and Gallivan (2007, p. 662). Two nomological networks pertain to CT use and task performance. Both Nomological Network 1 and Nomological Network 2 include only one single-level causal relationship: from group CT use to group task performance and from individual CT use to individual task performance, respectively. Thus, the two networks satisfy the first criterion. Further, Nomological Network 1 has individual CT use as its focal antecedent and Nomological Network 2 has group CT use as its focal antecedent. The two focal antecedents have "the same effects" (i.e., task performance) at different levels according to Morgeson and Hofmann's (1999) definition. As such, the two networks the second criterion. Hence, Nomological Network 1 and Nomological Network 2 are functionally equivalent.

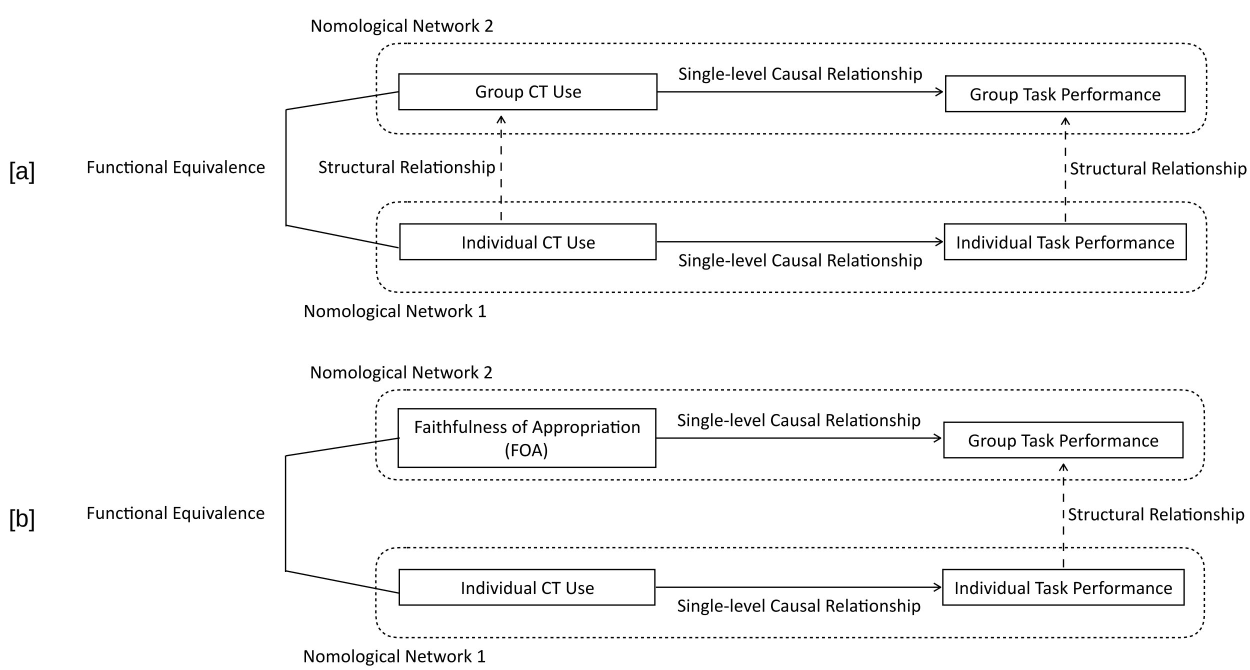

Figure 3. Illustrative Scenarios of Functional Equivalence

Functional equivalence depends on “the function of a construct” (Morgeson & Hofmann, 1999). Morgeson and Hofmann (1999) refer to a construct’s function as its “causal outputs or effects” (p. 254). Functional equivalence exists when two constructs have similar outcomes or effects. Further, researchers may employ reasonable standards to decide whether two constructs have similar outcomes (Morgeson & Hofmann, 1999, pp. 255-256):

> *In attempting to identify similar functions, one may question whether the outcomes are truly similar. There is a host of evidentiary standards one might apply to demonstrate similarity, and the choice of standards would appear to depend upon the level of measurement precision one desires and the minimum amount of evidence deemed necessary to establish similarity. Perhaps the most rigorous standard would be an examination of the network of relationships these outcomes at different levels have with other variables. Other possible standards include simple agreement percentages among trained raters or judges, a more involved Delphi consensus process, or pairwise comparisons.*

According to Morgeson and Hofmann (1999), multilevel constructs (e.g., individual task performance and group task performance) represent an instance of “similar outcomes” at different levels. Hence, if two multilevel constructs (e.g., individual CT use and group CT use) each lead to another outcome construct and the two outcome constructs are also multilevel constructs (e.g., see Figure 3a), the two nomological networks are functionally equivalent (Burton-Jones & Gallivan, 2007). However, the two antecedents being multilevel constructs is not a necessary condition for establishing functional equivalence. As Figure 3b shows, individual CT use and FOA are functionally equivalent but not structurally related; as such, one cannot consider them to be multilevel constructs.

4.2 Operationalize the Theoretical Model

Operationalizing a theoretical model from the multilevel perspective involves two steps: developing measures for constructs and validating the constructs.

4.2.1 Develop Measures

The level of measurement and the level of construct mean the same thing from a single-level perspective but do not necessarily mean the same thing from a multilevel perspective (Chen et al., 2003; Chan, 1998). One can measure a construct in various ways with “composition[al] models” (Chan, 1998, pp. 235-242; Chen et al., 2003, pp. 280-285), which, according to Chan (1998), essentially refer to measurement models. (Recall that Rousseau (1985) uses the term “composition models” to refer to “conceptual similarities between constructs”.) In the CT use example, Kang et al. (2012) measured all the constructs at the individual level. However, one could measure, for instance, COA at the group level by asking an independent expert to rate the agreement among a group of users. Note that, when researchers use lower-level measures to operationalize a higher-level construct, Kozlowski and Klein (2000) also call such a measurement model a “data-aggregation model”. For example, Kang et al. (2012) measured COA, a group-level construct, at the individual level.

Researchers must theoretically justify their measurement models (Burton-Jones & Gallivan, 2007; Chen et al., 2003; Kozlowski & Klein, 2000; Chan, 1998) since “the nature of the construct under examination is intimately tied up with the way in which a researcher operationalizes that construct through the measurement process” (Hofmann, 2008, p. 257). Researchers should use the structural relationship that we discuss in Section 4.1.2 as the main rationale to justify a measurement model (Kozlowski & Klein, 2000; Morgeson & Hofmann, 1999; Chan, 1998; Chen et al., 2003). With regard to this issue, Kozlowski and Klein (2000, p. 30) argue that:

> *When researchers describe and study shared unit properties [i.e., constructs that are linked to lower-level constructs through a type of structural relationship], 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?*

For example, researchers need to justify the data-aggregation model for the construct COA using the structural relationship between individual-level COA (i.e., individual members’ perceived consensus on appropriation) and group-level COA (i.e., group consensus on appropriation). Kang et al. (2012) do not theoretically justify the data-aggregation model (i.e., why group-level COA is the mean of the individual-level COA for a group). The data-aggregation model implies a theoretical process in which members have a reasonable amount of peer influence on each other and some degree of interdependence exists (Sarker & Valacich, 2010). Otherwise, members' perceptions in a group might vary significantly and the mean value might not reflect the group consensus; for instance, given their domain knowledge and expertise, a small number of influential persons or opinion leaders could primarily drive a group's consensus on appropriation (Sarker & Valacich, 2010).

4.2.2 Validate Constructs

To validate constructs empirically, the multilevel perspective also involves additional procedures (e.g., James, Demaree, & Wolf, 1984; Kozlowski & Hattrup, 1992; Chen et al., 2003; Bliese & Hanges, 2004; Beal & Dawson, 2007) beyond existing statistical procedures for the single-level perspective (e.g., see MacKenzie et al., 2011). These procedures primarily focus on validating the structural relationships (Hofmann, 2008; Burton-Jones & Gallivan, 2007; Gallivan & Benbunan-Fich, 2005; Chen et al., 2003; Kozlowski & Klein, 2000) (see Hofmann (2008) for a detailed overview of the various procedures) and, thereby, on empirically justifying the measurement models that researchers use. For example, Kang et al. (2012) performed several statistical tests to empirically justify the data-aggregation model for COA and concluded that they found empirical justification for the data-aggregation model. As such, they further enhanced the COA construct's validity (Kang et al., 2012).

4.3 Test the Theoretical Model

To test a theoretical model from the multilevel perspective, researchers need to consider how they collect, analyze, and interpret data.

4.3.1 Choose Data-collection Strategies

As a multilevel perspective involves testing theory at multiple levels, one often needs a larger sample than when one tests a single-level theory (Kozlowski & Klein, 2000). On the one hand, data should contain sufficient variance in a group, between different groups, or over different periods (Kozlowski & Klein, 2000; Klein et al., 1994); for example, a variety of users who have improved and have not improved task performance in using CT (Kang et al., 2012). On the other hand, the sample must have a sufficiently large size at all construct levels (Maas & Hox, 2005). For example, Kang et al. (2012) used a sample of 279 individual users in 40 different workgroups. Researchers require many more individual users to test multilevel models compared to the minimal sample size they need to test a typical single-level model (e.g., testing technology acceptance model at the individual level) because both the number of groups (e.g., 40 in the CT use example) and the number of individual users in a group (e.g., seven users on average in the ICT use example; ranged from five to 16) must be sufficiently large for researchers to reach a desirable degree of confidence in model testing (Maas & Hox, 2005).

4.3.2 Select Data-analysis Techniques

Testing models from the multilevel perspective needs multilevel analysis techniques, which differ from statistical techniques for the single-level perspective. Hierarchical linear modeling (HLM) represents one commonly used multilevel analysis technique based on multiple regression (Hofmann & Gavin, 1998; Bliese, Chan, & Ployhart, 2007). Because various families of multilevel analysis techniques differ in their underlying assumptions and the kinds of questions they can answer, researchers should select multilevel analysis techniques according to the nature of their theoretical model (Kozlowski & Klein, 2000). For example, Kang et al. (2012) employed HLM to test their CT use model.

4.3.3 Interpret Data-analysis Results

Interpreting data-analysis results from the multilevel perspective centers on assessing both single-level and cross-level causal relationships (as opposed to only single-level causal relationships) (Hofmann & Gavin, 1998; Luke, 2004). For example, in their data analysis, Kang et al. (2012) found both single-level and cross-level causal relationships: individual CT use (at the individual level) positively affected individual task performance (at the individual level), while the group's FOA (at the group level) positively affected individual task performance (at the individual level).

In addition, researchers also need to assess whether their data satisfy statistical assumptions related to the chosen multilevel analysis. Researchers can conduct additional analyses to assess the magnitude of cross-level causal effects and, thereby, determine whether the multilevel theoretical model explains the sampled data better than single-level models. For instance, Kang et al. (2012) do so via comparing results from fitting data with multilevel and single-level models.

5 Conclusions

Researchers who plan to carry out multilevel research may face several challenges. In this paper, we clarify the various ways in which the multilevel perspective contributes value and allude to its potential for theory building and data interpretation. By highlighting the subtle differences between the terms related to levels, we provide a consistent terminology for conducting multilevel research. On the one hand, such consistency can help researchers to accurately understand existing methodological guidelines in the literature. On the other hand, it can help ensure that knowledge advances consistently. Further, we contrast the multilevel perspective with the single-level perspective in terms of conceptualizing, operationalizing, and testing theoretical models. This more holistic understanding will help researchers to more effectively and more flexibly employ the multilevel perspective across the many complex situations, problems, and phenomena that typify IS research.

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About the Authors

Meng Zhang is Research Fellow, School of Information Systems, Queensland University of Technology (QUT), Australia. He studies the use, design, innovation, and impact of information systems, with a focus on digital innovation and digital platform. He is interested in social behavioral research methods for conceptualizing and theorizing, including multilevel theorizing, conceptualization approach, and simulation theorizing. He received his PhD degree from QUT in 2016. This paper derives from his PhD dissertation titled, *Systems Thinking in the Construction of Information Systems Theory: A Set of Methodological Inquiries*. His work has been published in several journals, including *Information Systems Research,* and *Communications of the Association for Information Systems*, *Australasian Journal of Information Systems* and conference proceedings, including the proceedings of the International Conference on Information Systems.

Guy Gable (PhD Bradford, MBA Ivey, BCom University of Alberta) is Professor and Director of Research, School of Information Systems, Queensland University of Technology, where he heads their "Methods Foundations" research program. Editor-in-Chief (2019) for the *Journal of Strategic Information Systems*, he has served on boards of *MISQ, JAIS, EJIS* and others. A Charter Member, he's held a range of AIS roles and in 2016 was made a Fellow of the Association for Information System (AIS) and Member AIS College of Senior Scholars. He has been strongly involved in ICIS, PACIS and ACIS. Research interests include: Research Methods, IT Professional Services, IT Evaluation, and Design Science. With over 100 refereed publications (e.g. ISR, *MS*, *JAIS*, *JSIS*, *I&M*, *EJIS*) he has led a series of successful Australian Research Council (ARC) grants totalling several million AUD.

Mary Tate is an Associate Professor of Information Systems at Victoria University of Wellington, and a Research Fellow at Queensland University of Technology. Mary has published over 90 peer-reviewed articles in leading Information Systems journals including the *European Journal of Information Systems*, the *Journal for the Association of Information Systems*, and *Information and Management*; and in leading Information Systems conferences. Her research focusses on Information Systems foundations and research methods, and digital channels and services.