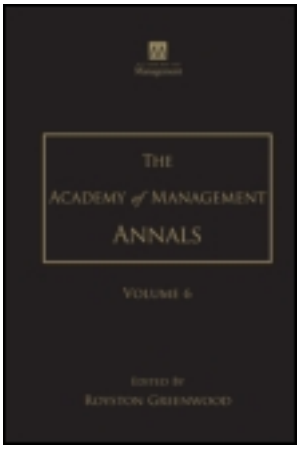

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Returning to the Frontier of Contingency Theory of Organizational and Institutional Designs

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Abstract

Much has been learned, and even more needs to be learned, about designing organizations and institutions. Since the 1960s this research has evolved from *contingency* to *configuration*, to *complementarity*, to *complexity* and *creative* theories of organizing. This chapter reviews these evolving theories (better called perspectives) and urges scholars to return to the frontier of organization studies by addressing an important new agenda in designing organizations with promising new research methods.

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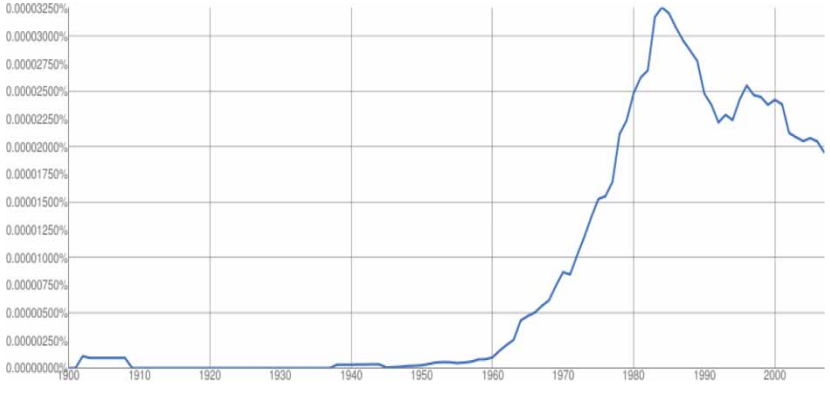

Figure 1 Google N-gram of the Term "Organization Design" from 1900 to 2007.
Source: Daved Barry, "Re-designing Organization Design", Presented at Design Business Conference, Barcelona, November 17–18, 2011.

Introduction

The purpose of this chapter is to encourage scholars to return to the frontier of organization science by reopening the study of contingency theory of organizational and institutional designs. In essence, a contingency theory proposes that performance outcomes of an organizational unit are a result of the fit between the unit's external context and internal arrangements.

After a burst of conceptual and empirical work in the 1960–1980s, the study of organizational contingency theory has declined. Barry (2011) shows evidence of this with the Google N-gram shown in Figure 1 on the terms "organization design" and its cousins (e.g. organizational design, organisational design). The figure shows a distinctive upward usage curve from the 1950s until the mid-1980s. Since then, there has been a relatively steady decline, apart from a small spike in the mid-1990s. Interestingly, Barry also ran an N-gram on the term "design", and he reports that its usage has been steadily increasing in popularity since 1900. So, it is not that "design" has been waning and taking "organization design" with it; quite the contrary.

But as the saying goes, "what goes around comes around." Recently, there has been a resurgence of interest in understanding the design of organizations and institutions. This resurgence is being fueled by (1) appreciating that design is a central and enduring problem of management scholarship and practice, (2) there is a growing demand for robust theorizing and empirical research on new forms for organizing ever-more-complex and dynamic situations, and (3) organization design goes beyond structure, and includes cognitive processes of sensemaking, creation and discovery, as well as social, economic, and political processes of developing and changing programs, policies, and routines. Key indicators of this resurgence is the new *Journal of Organization Design* (Obel &

Snow, 2012), annual research conferences being sponsored by a growing organization design community,[1] and a trend in business schools (especially in Europe) to be anchoring their graduate curricula in design science (van Aken, 2005; Friedman, 2012; Romme, 2003), artistic design (Barry & Meisiek, 2010), and strategic design (Helsinki Design Lab, 2012).

In terms of practice, perhaps, no other area of management scholarship has had such a profound impact; organization design has spawned and sustains a multi-billion dollar management consulting industry worldwide. The designs of organizations and institutions directly affect the behavior and performance of millions of workers and organizations each day, as well as the aggregate productivity and well-being of economies throughout the world. The world of organizations is changing, and so must our theories and research. It used to be that organizational life was relatively predictable and organizational arrangements could be designed with analytical engineering tools. Now, organizations and their environments are more unpredictable, rapidly changing, and require real-time creative designing. Barry (2011) notes that advances in information technologies, global market competition, and shortening product life cycles have created a huge demand for innovation and creative business solutions. For example, in an extensive McKinsey study of business performance, Keller and Price (2011) report that innovation and change have replaced scale and stability as determinants of organizational survival and success. Hence, instead of refining internal structural arrangements to fit a quasi-stable environment, today's organizational executives are designing for innovation, searching for distinctive and competitive ways to increase innovative capacity both within and outside of their organizations. Filling this need is the emergence of a new school of "creative organization design" that stresses "design thinking" (Brown, 2008), "innovation by design" (Barry, 2011), and more artistic, flexible, and generative approaches (Boland & Collopy, 2004) to design than the engineering and analytical approaches of the past.

Management scholars have also been rediscovering contingency theory in more profound ways. It is a foundational logic underlying many organization and strategic management theories and practices. The contingency theory has been influential in framing the practice of organization design by underpinning the McKinsey 7-S framework (Pascale & Athos, 1981), Galbraith's (1977) information processing model, Nadler and Tushman's congruence model (1999), and Hackman and Oldham's (1975) job diagnostic survey. It is also the basis of contemporary theories on institutional design and change (Greenwood, Oliver, Sahlin, & Suddaby, 2008a, 2008b; Hargrave & Van de Ven, 2006; Reay & Hinings, 2009; Thornton, Ocasio, & Lounsbury, 2012).

Common to these models is the proposition that performance is enhanced by an external fit between the demands of an organization's environment and the design of its internal structure, as well as an internal fit among key design components of strategy, structure, systems, and culture (Miller, 1992). In other

words, organizational environment moderates the relationship between organization design and performance. Stated this in a more general way, we see that any proposition that contains a moderating variable is a contingency theory. This approach is seen in the recent work by Battilana and Casciaro (2012), who, in examining structural closure in networks, produce "a contingency theory of organizational change" (p. 381). So also, Gulati, Wohlgezogen, and Zhelyazkov (2012) explore the contingencies of coordination (i.e. conditions when interorganizational relationships shift between cooperation and collaboration). For them, a contingent view is one that examines the conditions or boundaries in which particular structures and processes hold.

Like most areas of scientific inquiry, research on the organizational contingency theory has spurted and stuttered in both positive and negative directions over time. Much has been learned about designing work and organizations since the 1960′s as research evolved from *contingency* to *configuration*, to *complementarity*, and to *complexity* and *creative* theories of organizing. This chapter reviews these evolving theories (better called perspectives) and discusses five key ideas and challenges for returning to the frontier of organization design.

(1) While contingency theory provides a rich theoretical foundation, more caution should be taken in applying reductionist research methods than were taken in the past.
(2) Configuration and complementarity perspectives build upon the conceptual richness of contingency theory and adopt a holistic view of organization context and design that appears to avoid the pitfalls of early research.
(3) Complexity theory adopts a more dynamic view of organization design by shifting the analysis of fit to adaptation on static or changing organization and environment landscapes.
(4) Creative organization design adopts a more artistic, flexible, generative and engaging approach to design, and is emerging in reaction to the analytical and engineering orientation of the above perspectives.
(5) It is difficult to conceptually deduce or model a theoretical solution when organizations are complex; i.e. have multiple conflicting environmental demands, internal design configuration tradeoffs, and diverse performance expectations. Simulation modeling is emerging as an appropriate analytical tool for theory-building in such contexts. Empirical approaches including the frontier analysis, joint estimation of conditional mean and variance (Cameron & Trivedi, 1986; Harvey, 1976), quantile regression (Koenker & Bassett, 1978), and power law analysis (Dooley & Van de Ven, 1999) may be feasible methods that complement the traditional regression analysis. Creative approaches of artistic design are introducing new generative criteria that transcend efficient forms of organizing. An important direction for future research may be to find ways to integrate the analytical

empirical and modeling approaches to organizational complexity with creative and artistic design forms and functions as now found in some fields of architecture (Barry, 2011).

We optimistically think that the sky is the limit and the future looks rosy for organizational contingency theory because market and science demands will pull organizational researchers (perhaps grudgingly) to address these issues and create high-performance organization designs for dynamic landscapes.

Some Clarifications

Discussions of contingency theory of organization design often trigger a variety of interpretations and criticisms that we think need to be addressed and clarified at the outset. In particular, organization design is often viewed as a normative choice by powerful rational actors or a dominant coalition in structuring an organization to fit its environmental demands. Critics often question how contingency theory deals with the fact that organizational designs are both planned (as design implies) and emergent (often overlooked). How might contingency theory address rapidly changing and ambiguous environments facing organizations? This context appears to make obsolete the notions of fit and misfit for temporary, rapidly changing, self-organizing teams composed of flexible recombinations of people employed within and outside of the organization? How does contingency theory deal with the shift in agency from that of the organization's management to stakeholders, such as customers or regulators who impose their systems and structures into the organization and "call the shots" on how organizations should operate? How do you design and manage organizations effectively in these more ambiguous, temporary, and fuzzy-boundary settings?

While these questions reflect a more complex organizational context than existed when contingency theory emerged in the 1960s, we believe that they expand (rather than limit) the possibilities for organizational contingency theory by the variations they introduce in degrees of design choice (centrally chosen, negotiated among stakeholders, or self-organizing), control (planned or emergent), formality (informal ad hoc to formal rational arrangements), duration (short to long term), and unit of analysis (internal or external, micro or macro units) by active or passive agents or decision-makers. In other words, addressing these variations can significantly expand the boundary conditions in which contingency theory applies.

Expanding the boundary conditions of contingency theory is important for addressing the dramatic changes unfolding in organizing work and economic life over the past 20 years. Many of these changes are outpacing our theories and methods for representing and explaining them (Child, 2005). In an increasingly global and knowledge-intensive economy, the design of work

and economic life is no longer contained within a single organization or institution; it often transcends the boundaries of organizations, professions, and countries (Sinha & Van de Ven, 2005). Knowledge-intensive services have become the dominant form of work in the industrialized world (Quinn, Baruch, & Zien, 1997). This knowledge-based work often develops in several locations simultaneously and cuts across the boundaries of firms, industries, and nations. As a result, some knowledge-intensive work technologies have no nationality (Murtha, Lenway, & Hart, 2001). Such global distribution of work has been made possible by (1) technologies that enable division, distribution, and coordination of work across national boundaries, (2) the lowering of institutional trade barriers across countries adopting policies of economic liberalization, and (3) global diffusion of competencies to do the same work. Studying the designs of these new work arrangements requires expanding the organizational boundaries for applying contingency theory to include supply chains, interorganizational networks, occupational and professional associations, and multi-national institutional arrangements that are used to organize systems of work and economic exchange. To keep our language as simple as possible in this chapter, we will refer to these arrangements as "work" or "organization" systems that may include multiple organizations and institutions.

It is also important to clarify at the outset that organization design entails a normative strategy, although a positive approach is often needed to assess the effectiveness of this strategy. In "The sciences of the artificial", Simon (1999) stated the following:

> The world we live in today is much more of a man-made—or artificial world than it is a natural world (p. 2). The contingency of artificial phenomena has always created doubts as to whether they fall properly within the compass of science. This seems to me not to be a real difficulty. The genuine problem is to show how empirical propositions can be made at all about systems that, given their circumstances, might be quite other than they are. Engineering, medicine, business, architecture and painting are concerned not with the necessary but with the contingent—not with how things are but with how they might be—in short, with design. Artificiality is interesting principally when it concerns complex systems that live in complex environments. (p. xiii)

We hope to show in this chapter that the normative choices involved in designing artificial organizations and institutions are amazingly complex and far exceed our limited human capabilities of arm-chair theorizing. Positive scientific methods can make significant contributions of providing evidence-based knowledge for designing complex organizations.

Early Work on the Contingency Theory

A historical review of scholarship on contingency theory of organization design over the past 40 years is useful in learning from the past and for identifying dead ends and promising directions for future scholarship. In particular, we discuss below the roots of contingency theory, the limitations of past research on contingency theory, and the potential of configuration, complementarity, complexity, and creative perspectives for addressing the changing nature of designing organizations and institutions.

There were two approaches to the study of organizations that led to a more formal approach to the study of organization design and contingency theory. One was the rise of classical management theory, the other was the concern with bureaucratization and its underpinning of rational–legal authority.

Through the 1930–1950s, classical management theory was developed which covered what had become known as "scientific management" (Taylor, 1947), but went beyond it. A generation of scholar practitioners attempted to outline the principles of management and administration (cf. Barnard, 1938; Sloan, 1964; Urwick, 1943). Their aim was to understand the management of organizations through a set of generic principles, always looking for the ingredients of better management. They were concerned with a wide range of organizational design elements such as functional specialization, spans of control, centralization–decentralization, job design, integration, and in all cases, they were on a journey to find the best way to design and manage an organization. This classical management approach became tagged with the notion that they were searching for "the one best way".

In the 1950s and 1960s, there was a strong reaction by academics to this idea of the one best way by academics as organization theory began to be developed. In the U.S.A., this was initially triggered by March and Simon's (1958) analysis of performance programs in organizations, Lawrence and Lorsch's (1967) study of organizational differentiation and integration, Thompson's (1967) seminal analysis of organization design strategies under conditions of environmental uncertainty and heterogeneity, Perrow's (1967) analysis of tasks and structure, Galbraith's (1977) information processing view of organization design, and Hackman and Oldham's (1975) model of job design.

Particularly influential was the work of Lawrence and Lorsch (1967) which directly challenged the notion of "one best way". They emphasized two basic design elements: differentiation and integration. Organizations develop differentiated (segmented) structures of organizational units to deal with the variety of tasks performed by organizations, both operational and support. This differentiation produces the need for integration to coordinate the organization as a system. Organizations require both an appropriate level of differentiation and of integration. Having shown that organizations followed different organizational designs, they then asked the question, why is this the case. The

answer was in the extent of environmental uncertainty. Their finding was that the greater the environmental uncertainty in markets and technologies, the greater the extent of internal differentiation; this greater differentiation required more integration. Thus, organizations facing high levels of environmental uncertainty need high levels of both differentiation and integration if they are to function effectively.

This study is important for three reasons. First, it directly challenges and shows that there is no one best way of organizing. Second, it provides a much more precise set of concepts for describing organizational management (and in their work, Lawrence and Lorsch break down their two main concepts into sub-concepts). And third, they suggested that there were environmental determinants for different ways of organizing. Thus, we have the critical components of contingency theory: an analytical description of organizations, the external circumstances that produce particular organizational designs, and the idea that there is an appropriate linkage between the external, the internal, and performance.

In a similar vein were two influential studies in the UK that challenged classical management theory. Burns and Stalker (1961) and Woodward (1965) were both directly concerned with analyzing variety in organizational designs and establishing the conditions for such variation. Burns and Stalker, in their study of an industrial policy attempt to change organizations producing traditional products into organizations producing new, rapidly changing products, came up with a distinction between two ideal types, mechanistic and organic organizations as the opposite ends of a continuum. Mechanistic organizations (machines) had high levels of differentiation, clear (and rigid) role definitions, strong hierarchies, and vertical communication and control. This organizational design corresponds closely to a bureaucracy. The organic design continually adjusts and redefines tasks with as much horizontal as vertical communication and the avoidance of formally laid down rules, procedures and role definitions. The contingency argument was, once again, environmental and task uncertainty. The mechanistic organization performs well under conditions of certainty; the organic when faced by high levels of uncertainty. For Burns and Stalker, administrative wisdom comes from understanding that there is no one optimum type of organization and management.

Woodward (1965) has a similar view of classical management suggesting that the so-called principles of management were nothing more than expedients based on personal experience that have never been subject to systematic testing. She initially examined 100 British firms investigating specific features such as spans of control, levels in the hierarchy, division of functions, the use of written communication and role definition. First, as with Lawrence and Lorsch and Burns and Stalker, she found considerable variation in organizational structures. Second, she showed that the technology used was the primary factor producing differences on these various dimensions. Her

sample consisted of manufacturing organizations and she divided them into three broad technological categories (each with sub-categories) which were unit and small batch production, large batch and mass production, and process production which, for Woodward, was a scale of technological complexity. Now, alongside uncertainty, we have technological complexity as an explanatory factor.

The second concern that led to contingency theory was the analysis of bureaucracy and bureaucratization with its underpinning of rational–legal authority, derived from the work of Weber (1947) and a central theme in the sociology of organizations. Weber argued that the authority base for organizing had changed significantly during the industrialization of society. Traditional authority had collapsed and charismatic authority was inherently unstable. In their place came rational–legal authority where means are clearly related to ends (rational) and tasks are designed and allocated on the basis of expertise (not kinship) and supported by policies, rules, and procedures (legal). Such authority is expressed in the organizational design of a bureaucracy. Weber also argued that bureaucracy was a technically efficient form of organization.

One way of exploring the idea of bureaucratization was in the work of Selznick (1949), Gouldner (1954), and Blau (1955). These studies dealt with the negative consequences of bureaucracy and thus criticized Weber's idea of technical efficiency. Gouldner, for example, identified three different kinds of bureaucracy within the same organization, namely, representative, punishment-centered, and mock. "The focus on variation in actors' interests and their relation to the larger social structure was a common feature of these comparative studies" (King, Felin, & Whetten, 2009, p. 7). While these studies did not contribute directly to contingency theory, they opened up the description of organizational differences *within* a specific organizational design.

This was taken up in a much more formal way in the investigation of the design components of the bureaucratic ideal type. These approaches developed measures of each aspect of bureaucracy, such as specialization, standardization, formalization, centralization (Blau & Schoenherr, 1971; Child, 1972; Hage & Aiken, 1967; Hall, 1963; Pugh, Hickson, Hinings, & Turner, 1968) and related them to aspects of organizational context and environment (cf. Pugh, Hickson, & Hinings, 1969b and the summaries in Donaldson, 2001). These studies showed the importance of organizational size in predicting a bureaucratic design, but also affirmed the impact of technology and environmental certainty. Particularly important in this work was a multivariate approach to both organizational form and organizational context with the underlying idea that the appropriate fit between form and context impacted performance positively.

Another aspect of the opening up of the concept of bureaucracy was the construction of typologies and taxonomies. Theoretically derived typologies

of organizations were developed by Etzioni (1961), Blau and Scott (1962), and Perrow (1967). Typologies emphasize ideal types based on a priori distinctions (Meyer, Tsui, & Hinings, 1993). Blau and Scott distinguished organizations in answer to the question "who benefits", Etzioni emphasized different methods of compliance, while Perrow (1967) used tasks as the basis for distinctions. Empirically derived taxonomies have the same aim of establishing organizational differences in a coherent way to produce types, but the approach is through multivariate empirical classification (McKelvey, 1982). Pugh, Hickson, and Hinings's (1969a) analysis produced four classifications, the full bureaucracy, the workflow bureaucracy, the personnel bureaucracy, and implicitly structured organizations. Thus, variation was shown within the bureaucratic form and non-bureaucratic organizations were distinguished from them. The underlying idea for both typologies and taxonomies is that organizations strive for internal consistency and coherence (Miller & Friesen, 1984) which produce configurations, and the configuration to which an organization belongs has an impact on many aspects of organizational activity. In addition, these different configurations are systematically related to variations in organizational characteristics such as size and technology, and to environmental variations such as uncertainty and complexity.

So, these pioneers argued against the prevailing view that it was possible to articulate universal design principles that would yield optimal outcomes across organizations, work groups, and jobs. They proposed instead, a contingency theory—the notion that organizations are more effective when the design of their structures and processes are internally coherent and fit, or match, their environmental demands.

The contingency theory views organization design as a constrained optimization problem. At the organization level, this entails maximizing performance outcomes by minimizing the misfit between diverse environmental demands and internal organizational arrangements, which in turn requires maximizing the benefits of organizational differentiation and minimizing the costs of integration (Lawrence & Lorsch, 1967). At the job level, Hackman and Oldham (1975) framed the problem as maximizing individual motivation and performance by designing jobs that satisfy both the demands of the task and the growth needs of individual workers. This proposition echoes preceding research by Trist (1981) at the Tavistock Institute in London on designing socio-technical systems in ways that balance technological requirements with human needs for a "whole" job.

Unfortunately, much of the conceptual richness of contingency theory was stripped away as researchers adopted simplified models of the theory in their empirical studies. Research during the 1970s and 1980s focused on a single level of organizational analysis, viewed fit as a static equilibrium, and adopted reductionist and incremental methods of analyzing the external fit between individual context and design variables one-at-a-time. As King et al.

(2009) put it, "comparative analysis by the late 1960s was primarily interested in explaining static differences between organizations as a function of environmental, technological, and task-related variation". As we now understand in hindsight, these early organizational structural contingency studies had some major limitations.

First, the studies produced mixed empirical evidence. While support for the contingency proposition was found in jobs and organizations that are relatively *simple* and *stable* (Donaldson, 2001; Gresov, Drazin, & Van de Ven, 1989), limited support was found in more complex and changing jobs and organizations (Pennings, 1975; Schoonhoven, 1981). Second, the concept of fit in contingency theory was operationalized as a static equilibrium (Becker & Gerhart, 1996; Drazin & Van de Ven, 1985) that could not reflect more dynamic views of adaptive fitness with evolving organizational landscapes (cf. Levinthal, 1997). Third, the traditional division of scholarship—where psychologists focus on individual behavior and sociologists examine organizational and institutional structures—did not reflect the multilevel nature of work design choices (Rousseau, 1985). Finally, studies of organization design emphasized characteristics of organization structure, strategy, and systems and tended to overlook how work was done. Barley and Kunda (2001) called for bringing work back into the study of organizations. However, studies to date have shed little insight on how work contexts, practices, and performance are interrelated across hierarchical levels within and between organizations.

Although the need to study design at multiple vertical organization levels and different horizontal units in supply chains within and between organizations is now well recognized in the organizational literature (e.g. Donaldson, 2001), its conceptual and methodological implications are daunting. For example, Herriot and Anderson (1997, p. 27) point out that given three organizational levels of analysis (individual, team, and organization) in combination with three kinds of interactions among the levels (complementary, neutral, and contradictory) that could be applied to multiple dimensions, the number of possibilities are analytically immense and conceptually intractable. More fundamental is the problem of reductionism which treats the anatomy of an organization as decomposable into independent elements that can be examined separately, and assumes that knowledge gained on each element can be aggregated to understand the whole organizational system. As discussed below, new conceptual frameworks and methods are needed that avoid such a reductionist quagmire and begin to address organization systems from a more holistic perspective.

Donaldson (2001) touched on many of the themes that we revisit here. His aim was "to pay homage to a rich tradition and pass it on, to advance a coherent interpretation of the array of theories and research within it, and to set signposts to what may be fruitful avenues for future research" (p. xvii). In many ways, Donaldson has been the guardian of contingency theory. For him, the heart of contingency theory is SARFIT, structural adaptation to

regain fit. Donaldson (1996, 1999, 2001, 2010) has been concerned with demonstrating both the rich contribution that contingency theory has already made and the promise that it holds for the future. Underlying this is the notion that progress in organizational theorizing is made through persisting with existing frameworks rather than looking for new ones.

Recently, Qiu, Donaldson, and Luo (2012) have taken a Kuhnian perspective, arguing for persisting with existing paradigms in organizational theory. They utilize the structural contingency theory to discuss the persistence of paradigms in organizational theory through paradigm continuity, elaboration, and extension which are distributed along the degree of change taking place in the theory. Paradigm continuity is about attempting to deal with anomalies in the existing theory. Paradigm elaboration develops theory, adding to its complexity. Paradigm extension moves into new theory and thus involves the greatest level of change. We agree with Qiu et al. (2012) in their general position of persisting with established theory rather than seeking new theories *for their own sake*. Our approach deals with all three aspects of paradigm persistence, from further testing of established ideas in different settings, to new frameworks and methods as part of paradigm elaboration and extension.

More recent perspectives that build upon the conceptual richness of contingency theory, but avoid the pitfalls of early research are *configuration, complementarity,* and *complexity* perspectives. These perspectives are complementary. Whereas, the configuration and complementarity perspectives characterize the holistic patterns of design interdependencies among organizational units and levels of a work system, the complexity perspective is useful for viewing the emergence and change of these holistic patterns on fitness landscapes upon which organizations function and adapt over time. We now review these perspectives and discuss how they provide a useful conceptual foundation for advancing new theories and research on work and organization design.

Configuration Perspective

The configuration perspective conceives of organizations as holistic entities, both comprised of a set of subsystems, and yet still distinguished from components alone (Meyer et al., 1993). Subcomponents are related to each other in ways that yield a coherent ensemble (i.e. an overall pattern called a work system). These ensembles are often referred to as ideal types, archetypes, modes, or programs. For example, March and Simon (1958) and Thompson (1967) proposed three types of programs (or routines) for organizing and coordinating routine, discretionary, and developmental work. As Table 1 outlines, a contingency theory underlies these three organizing modes: systematized programs for routine work, discretionary programs for work requiring diagnosis and selection of responses from an existing repertoire, and developmental programs for creating novel strategies for dealing with unprecedented cases (Van

Table 1 Comparative Properties of Performance Programs

Systemized program for non-varying repetitive tasks or issues that can be programmed in advance	**Discretionary program for varying, periodically unique tasks or issues, with unique strategies available for each task type**	**Developmental program for novel tasks or issues for which no solution strategy exists**
• Capital-intensive programs	• Labor-intensive services	• Team-intensive efforts
• The program specifies: (1) Sequence of task steps (2) Timing and pacing rules (3) Monitoring and control devices (4) Personnel roles and available discretion	• The program specifies: (1) Tasks ends or goals (2) Repertoire of means (3) Guidelines for diagnosis	• The program specifies: (1) Goals and deadlines (2) Means unspecified, no repertoire exists (3) Interpersonal norms (4) Decisions made by judgmental or bargaining strategies
• Personnel are either machine-appendages or systems designers	• Personnel exercise discretion	• Personnel are interdependent actors
• Promotes efficient, high quality, predictable output	(1) In analysis of task (2) Selection of strategy from repertoire (3) Performance evaluation	• Promotes novel, single-unit designs
	• Once trained, personnel are independent actors • Promotes effective, low quantity, flexible output	

Sources: March and Simon (1958), Thompson (1967), Van de Ven and Delbecq (1974).

de Ven & Delbecq, 1974). Analogous contingency typologies were developed by Burns and Stalker (1961) of organic and mechanistic types of organizations by Perrow's (1967) distinctions between routine, nonroutine, craft, and engineering organizations, and Powell's (1990) critique of markets, hierarchies, and network types of organizing. As Meyer et al. (1993, p. 1175) state, "Configurations may be represented in typologies developed conceptually or captured in taxonomies derived empirically. They can be situated at multiple levels of analysis, depicting patterns common across individuals, groups, departments, organizations, or networks of organizations".

The configuration perspective examines in a simultaneous manner, the many contingencies, design alternatives, and performance criteria inherent

in organizations or institutions. Drazin and Van de Ven (1985, p. 515) refer to configuration theory as a "systems'" approach where fit is the internal consistency of multiple contingencies and multiple structural characteristics. They found no support for interaction effects among pairs of organization context and structure dimensions on performance, but significant support for the systems (or configuration) approach to fit. Analytically, a configuration implies a multidimensional combination of work contingencies, design and performance elements that commonly occur together. But rather than trying to explain how an organization is designed from its constituent elements, one-element-at-a-time, a configuration perspective tends to focus on how a work system is designed from the interaction of its constituent elements taken together as a whole. From this standpoint, configurations are seen as internally congruent patterns of organizational elements that are held together in a mutual dependence that is at once hard and risky to disturb (Whittington & Pettigrew, 2003).

In addition to internal fit or congruence, the configuration perspective argues that a high-performing design pattern must also achieve an external fit with its environment or context (Ketchen, Combs, Russel, & Shook, 1997; Siggelkow, 2001). Achieving both internal and external organizational fit is an elusive goal and often forces decision-makers to make tradeoffs on the relative degrees to which a work system can achieve an internal and external match (Miller, 1993). It is widely acknowledged that work units located both within and between organizations operate in contexts of multiple and often conflicting contingencies.

What happens when a configuration of different environmental contingencies is encountered, each having different implications for organization design? Child (1977) first raised this design dilemma confronting a large organization facing a variable environment. "Should it set a limit on its internal formalization in order to remain adaptable, or should it allow this to rise as a means of coping administratively with the internal complexity that tends to accompany large scale?" (Child, 2005, p. 175). In his studies of manufacturing firms (1975) and airlines (1977), Child determined that those firms that performed well sacrificed external fit to maintain an internally consistent structure, while the lower performing firms showed a good deal of internal inconsistency by adopting structural arrangements that attempted to respond to diverse environmental contingencies. Khandwalla (1973) and Miller (1992) obtained similar results in their studies.

This introduces an element of choice and equifinality in organization design (Drazin & Van de Ven, 1985). In acknowledging that both environmental contexts and organizational designs are composed of multiple, partly conflicting dimensions, and that organizations pursue multiple, partly conflicting goals (March & Simon, 1958), we must correspondingly recognize that seldom, if ever, can a single organization design be matched perfectly to a specific

environmental context. Managers typically encounter conflicting demands among context, design, and outcomes in their work systems. Realistic design choices, of course, are always limited by the feasible alternatives available to decision-makers. The greater the number of effective options for a given situation, the greater the opportunities for managerial choice in work design. The search for equifinality, or the existence of several feasible, equally effective design options for given environmental situations, is an important objective of the configuration perspective (Gresov & Drazin, 1997; Meyer et al., 1993).

Research and theorizing on equifinality, however, is still at an embryonic stage. One pioneering study by Doty, Glick, and Huber (1993) empirically tested the hypothesis of equifinality among alternative design configurations in the Mintzberg (1983) and the Miles and Snow (1978) typologies which have been very influential in organization theory and strategy. Mintzberg's (1979, 1983) typology has five organizational designs, namely, simple structure, machine bureaucracy, professional bureaucracy, divisionalized form, and adhocracy. Mintzberg's classification was based on a combination of design and contextual factors. The three primary design factors are coordinating mechanisms such as supervision and standardization, which organizational group is dominant, and the type and degree of centralization. Mintzberg also included organization's age and size and attributes of its environment and technology, including complexity and stability. His hypothesis is that the closer an organization is to an ideal type, the more effective it will be, a contingency argument.

Miles and Snow (1978) identified four ideal types of organization design, the prospector, the analyzer, the defender, and the reactor. Their classification is somewhat "looser" than that of Mintzberg. The prospector type is the most dynamic of the organizational forms being of an organic type, with low levels of formalization and specialization, high levels of decentralization and few hierarchical levels. It operates in an uncertain environment and so uses high levels of environmental scanning and flexible, nonroutine technologies. The defender is less dynamic facing a more stable and predictable environment. As a result, they have relatively more mechanistic structures utilizing formalization, centralization, specialization, and vertical differentiation as coordination mechanisms. The analyzer is a "unique combination of the Prospector and Defender types" (Miles & Snow, 1978, p. 68), and as a result has characteristics of both. The fourth ideal type, the reactor, is different in character from the other three as Miles and Snow see it as unstable, lacking a consistent context-structure-strategy alignment. Thus, each configuration is made up of contextual, structural, and strategic factors and they argue that these organizational types are effective.

Doty et al. (1993) modeled the logical structure of design configurations in these two typologies, and then examined deviations in profiles of observed organizations from these ideal types in different environmental contexts.

They found no evidence for the Mintzberg (1983) models, and some evidence for the models in the Miles and Snow (1978) typology.

This idea of design configurations is, in fact, important in theoretical approaches other than the structural contingency theory. An important example is institutional theory which also utilizes forms of contingent arguments. Hinings and Greenwood (1988) and Greenwood and Hinings (1993, 1996) introduced the idea of "archetypes". The configurational argument is that "organizational structures and management systems are best understood by analysis of overall patterns" (Greenwood & Hinings, 1993, p. 1052). The contingency argument is that these patterns are derived from ideas, beliefs, values, and interpretive schema (Ranson, Hinings, & Greenwood, 1980). Greenwood and Hinings (1996) make this argument more strongly as they examine the impact of the institutional context on templates (archetypes) of organizing. The important contingency argument here, is that an organization's institutional environment (not its technical market environment) determines its configuration; "to survive, organizations must accommodate institutional expectations" (Greenwood & Hinings, 1996, p. 1025). However, just as in contingency theory, Greenwood and Hinings have market and economic conditions as external conditions that impact the nature of institutionalized archetypes.

In particular, they argued in the context of professional service firms that market contingencies produce pressures that lead to the development of new organizational configurations (archetypes) that then become legitimated and thus, taken-for-granted as an appropriate organizational design (Cooper, Hinings, Greenwood, & Brown, 1996; Greenwood, Hinings, & Brown, 1991; Greenwood, Suddaby, & Hinings, 2002). Two interesting developments take place here. First, the nature of organizational environments is extended to legitimacy. Second, an interaction is proposed between the institutional and the economic elements of organizational environments.

Another important way in which institutional theorists have used contingency theory is in exploring the contingencies of institutional designs. Thornton et al., (2012) summarize studies indicating the historically contingent nature of institutional logics. They cite studies showing that meanings of common institutional terms are historically contingent. For example, they show that the meanings of the terms "profit" and "debt" change with shifts in accounting procedures, tax laws, and larger societal changes. They also point out that some institutional arrangements are particular and others appear universal across time and place.

As these studies suggest, institutional theory is making two important additions to contingency theory. One, is to view ideas, values, and beliefs as important contextual constraints on organizations. As Scott (2001, p. 186) suggests, a distinction between "ideas (scripts, schemas, logics) and ordered activities (organizational routines, systems forms)" is important to institutional

theory and particularly to understanding institutional change. The second important addition, which initially derives from Meyer and Rowan (1977), is to revise the relationship between context, organizational form, and performance as usually defined. The suggestion is that institutional pressures for organizational conformity override market, technological, and scale pressures. To again quote Greenwood and Hinings (1996, p. 1025),

> Institutional theory, in other words, shows how organizational behaviors are responses not solely to market pressures, but also to institutional pressures (e.g. pressures from regulatory agencies, such as the state and the professions, and pressures from general social expectations and the actions of leading organizations.

These insights of institutional theory are important for examining the impact of institutional factors *alongside* "traditional" contingency concepts of organization design. They also expand the criteria used to assess organizational performance beyond efficiency or financial returns, and to include legitimacy. One important implication of this is the challenge posed by Child (1977) of conflicting contingencies and performance criteria. A central theoretical and empirical issue for institutional theory has been the diffusion of practices (organizational elements and organizational forms), but with little interest on the wider issue of organizational performance and institutional design. Greenwood et al. (2008a, 2008b) point out that while, initially, institutional theory contrasted itself with contingency theory issues of design and efficiency, there have been attempts to examine the complementarities between the two theories. For instance, Volberda, van der Weerdt, Verwaal, Stienstra, and Verdu (2012) explicitly examine such complementarities. They find that contingency and institutional fit are not only mutually reinforcing and interdependent but also that the deviations from institutional fit are less detrimental to firm performance than the deviations from the contingency fit.

An important reason for the disjunction is the centrality of the concept of legitimacy to institutional theory. For Haveman and David (2008), legitimacy is the central concept. In contingency theory, legitimacy links context to form. Organizational forms are adopted from an institutional context precisely because of their legitimacy. Deephouse and Suchman (2008) point out that there have been many attempts to classify different aspects of legitimacy. Scott (2001, p. 59) suggests that legitimacy is "a reflection of perceived consonance with relevant rules and laws, normative support, or alignment with cultural-cognitive frameworks". The point for us is that legitimacy adds further dimensions, and thus, richness, to a contingency approach. The contingency theory would ask questions such as, what types of legitimacy impact what aspects of organizational structure? What types of organizational designs are legitimate and illegitimate in different institutional environments? What kinds of institutional designs are efficient and legitimate? In what

situations do particular kinds of legitimacy impact efficiency negatively or positively?

In doing this, we are suggesting a somewhat different direction or emphasis for institutional theory. There has been considerable concern with the diffusion of institutional forms, archetypes, and templates (Greenwood et al., 2008a, 2008b). There has been much less interest in institutional design per se, yet it can be found in the various approaches that we have mentioned. A more systematic contingency approach within institutional theory would ask questions about what produces one institutional design rather than another in different situations.

Complementarily Perspective

An emerging literature on organizational complementarities is useful for identifying what components of organization configurations are important when adapting and changing the configurations. It suggests that the core elements of a design configuration are those that are highly interdependent, and as a set, produce positive interactions with performance. Miligrom and Roberts (1995, p. 181) describe the basic notion of complementarity as "doing *more* of one thing *increases* the returns to doing *more* of another". For example, Siggelkow (2001) examines the work design system of the fashion apparel manufacturer, Liz Claiborne. During the 1980s, Liz Claiborne designed an interconnected set of choices that allowed it to be very profitable. One choice was not to allow retailers to reorder items, which allowed Liz Claiborne to have no production-to-order, to have low spending on information systems and distribution, to deal with a large number of small suppliers based in the Far East which yielded long lead times, and to design six collections per year (rather than the typical four). These choices were complementary to each other in that each choice increased the marginal benefit of other choices. In the 1990s, the company management changed one element of this system (it allowed customers to reorder individual items and promised to deliver within two weeks), but ignored the interactions with other choices. This led to a large inventory buildup and consequent write-offs that had a negative effect on Liz Claiborne's profitability (Siggelkow, 2002, pp. 902–903). As this example suggests, "changing only a few of the system elements at a time to their optimal values may not come at all close to achieving all the benefits that are available through a fully coordinated move, and may even have negative payoffs" (Miligrom & Roberts, 1995, p. 191).

As Whittington, Pettigrew, Peck, Fenton, and Conyon (1999, p. 585) argue, by examining the complementary activities of a work system "the focus shifts from comparison between whole types, to the gap in between, where the transition from one type to another is incomplete". It explains the often-observed *J*-curve relationship between change and performance, with partial implementation potentially worse than the status quo. This highlights that a key

challenge in managing a change process is to untangle one complementary work configuration and introducing a new one. Reconfiguration requires both lateral and horizontal structural changes, simultaneously. What matters in comprehending the relationship between structure and performance in modern organization, is the adeptness of management at fostering system-wide changes in parallel.

A related challenge is to examine organizational complementarities across levels of analysis. Burton, Lauridsen, and Obel (2004) and Hakonsson, Burton, Obel, and Lauridsen (2008, 2012) examined fits between individual leadership style and organization strategy and climate on performance of Danish medium-sized enterprises. Vaccaro, Jansen, Van den Bosch, and Volberda (2012) report a similar study of top management leadership and organizational innovation, moderated by organization size. They find that leadership significantly influences organizational innovation, especially in small, less complex organizations. Fang, Lee, and Schilling (2010) also conduct a cross-level study of sub-group design and organizational learning. They use network structure (variations on Watt's connected caveman model) as a lever for improving the balance between exploration and exploitation. Using simulation models, they find that moderate levels of cross-group linking lead to the highest equilibrium performance by enabling superior ideas to diffuse across groups without reducing organizational diversity too quickly.

Complexity Perspective

The past 20 years has witnessed the emergence of organizational complexity for examining nonlinear dynamics in changing organization design configurations (Anderson, 1999). Organizational complexity theory can be seen as a generalization of the complementarity perspective. In addition to focusing only on complementary relationships, organizational complexity theory examines both positive and negative interdependencies. Two distinct but complementary approaches are being taken to study organization complexity: an empirical approach (e.g. Cheng & Van de Ven, 1996; Dooley & Van de Ven, 1999; Koput, 1997) and a modeling approach (e.g. Levinthal & Warglien, 1999; Nickerson & Zenger, 2004; Siggelkow & Rivkin, 2005). The diagnoses of nonlinear dynamic patterns in observed time series data on organizational change processes provide strong grounding for determining what kind of model to use to explain the process, and for knowing what kinds of explanatory models to reject. However, the detailed formulation of the model often remains unspecified. Mathematical models of complex adaptive systems (CAS) tend to begin with Kaufmann's class of *NK*(*C*) models. They tend to be very general and abstract, resulting in criticisms that the models are not grounded adequately in specific organizational settings or managerial interventions. Nevertheless, complexity theory may lead to

important advances in contingency theory. Building on the tradition of using simulation models in contingency theory (e.g. Burton & Obel, 1980a, 1980b), techniques developed within the context of complexity theory allow teasing apart the effects of various situational factors and organizational design configurations as well as their interactions (Siggelkow & Rivkin, 2005). Even though such interactions are central to contingency theory (e.g. Burton, Lauridsen, & Obel, 2002), developing and testing theory relying on traditional methods has proven challenging. We believe that complexity theory will play a critical role in advancing contingency theory—in particular when future research is able to integrate findings from empirical and modeling approaches. Recognizing this importance, we review complexity theory and discuss its relevance for contingency theory in more detail.

Empirical Approaches

Dooley and Van de Ven (1999) point out that when one examines the sequence of events that unfold over time in a changing organizational configuration, the observed event time series may reflect one of four different dynamic patterns: periodic (or stable equilibria), chaotic (strange attractors), colored noise (that can be plotted as a negative power law characteristic of a punctuated equilibrium process), and truly random (white noise).

These different patterns require different explanatory models that vary in the number of causal factors (dimensionality) and the nature of interaction between these causal factors. Low-dimensional causal systems yield periodic and chaotic dynamics, while high-dimensional causal systems are reflected in pink and white noise random dynamics. Periodic and white noise dynamics stem from systems where causal factors act independently or in a linear fashion, while chaotic and pink noise systems reflect configurations where causal factors act interdependently in a nonlinear fashion. Thus, given a diagnosis of an observed time series of change events in a work system, we can determine what kind of process model is appropriate for explaining the change dynamics. While it is generally known that linear deterministic models (such as regression analysis) are appropriate for explaining periodic cycles or stable equilibria, and stochastic or probability models should be used to explain white noise random processes, relatively few organizational scholars have explored nonlinear dynamic models that are needed to explain chaotic and colored noise patterns. In particular, these models may be relevant for studying the interplay between organizational configurations (Siggelkow & Rivkin, 2005).

Modeling Approaches

If one concludes that the event time series of an observed change process in an organizational system exhibits a nonlinear dynamic pattern (e.g. either chaotic

or pink noise patterns), then one must decide how to model the underlying process. Currently, the most influential model for explaining nonlinear dynamic systems in organization studies is Kauffman's (1993) theory of CAS. CAS emphasizes the importance of self-organization and local action in producing aggregate system outcomes in contrast to traditional theories of central design and control. The interaction of elements in a system can produce surprising, emergent behavior that can be modeled in terms of fitness landscapes. The fitness landscape, a concept originally developed in evolutionary biology by Wright (1932), has been formalized by Kauffman (1993), and applied to studies of organizational adaptation by Levinthal (1997), Siggelkow (2001), and Rivkin (2001), among others. The fitness landscape is an abstract representation connecting organizational fitness with various organizational configurations. The main objective is to provide a model of organizational adaptation. The key property of the fitness landscape is its "ruggedness", which is given by the ratio between the density of interdependencies and the number of organizational attributes (e.g. Levinthal, 1997). Since organizations searching a fitness landscape are limited in their ability to examine many organizational configurations at the same time—i.e. they search locally—searching a more rugged landscape leads to a problem called "lock-in". Lock-in occurs if organizations are unable to improve upon a suboptimal organizational configuration because it constitutes a local peak. To improve fitness, the organization would have to simultaneously change multiple organizational attributes at the same time—i.e. cross a "valley" in the fitness landscape. The existing work has predominantly focused on how various organizational designs interact with environmental characteristics in the

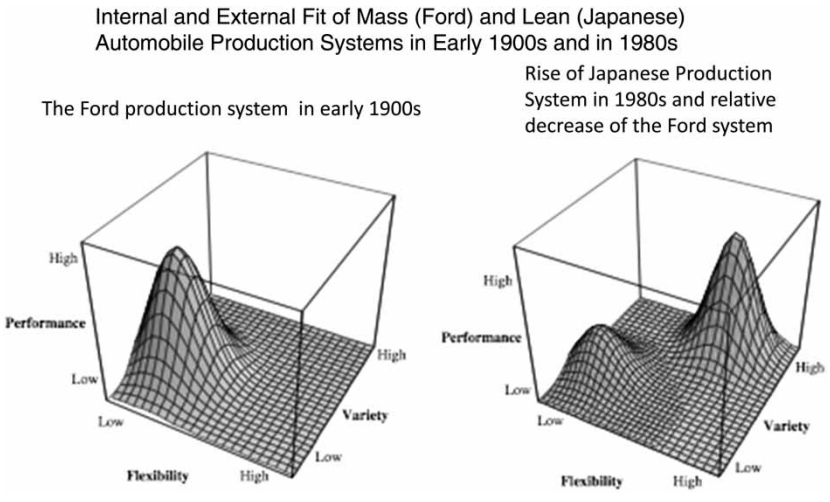

Figure 2 Work Design Performance Landscapes.

context of organizational adaptation given by the fitness landscape. As a result, it closely relates to central features of contingency theory.

For instance, Siggelkow (2001) illustrates how notions of internal and external fit in contingency theory can be translated to fitness landscapes. He graphs the performance landscape of the Ford Motor Company's low-variety/low-flexibility mass production system in the early 1900s (the left side of Figure 2), and illustrates how its performance decreased in comparison with the Japanese (Toyota) high-variety/high-flexibility lean production system in the 1980s (on the right side of Figure 2). External fit—the performance of a particular work design given environmental conditions—can be represented by the height of a peak on the fitness landscape. External fit encompasses all factors that affect the relative profitability of a particular work configuration, including competitors' actions, customer preferences, and available technologies. Internal fit—the internal coherence or interdependence among components of a particular design configuration—can be represented by the shape or steepness of a peak. "Internal fit corresponds to the shape of a peak because changing any single element (and not changing any other element) within a consistent set of choices leads to a decline in performance" (Siggelkow, 2001, p. 840). Environmental changes during the 1900s are represented by changes in the height, shape, and location of existing peaks, and the emergence of new peaks on the fitness landscapes in Figure 2. For instance, given the production technologies available in the early 1900s, low-variety/low-flexibility production systems were very efficient. However, the performance of this work system configuration declined relative to the high-variety/high-flexibility production configuration that became technologically feasible by the 1980s.

From the perspective of contingency theory, Siggelkow's (2001) study is important because it shows how researchers can use complexity theory to delineate explicit mechanisms that underlie internal and external organizational fit.

Further, Kauffman (1993) modeled the concept of fitness landscapes with his $NK(C)$ model, where N is the number of elements or modules in the system, K is the degree of interdependence among these elements within the system, and C reflects the system's coupling with other co-evolving systems in the landscape.[2] Levinthal and Warglien (1999, pp. 344–345) examine alternative kinds of fitness landscapes that emerge with variations in K and N. When K is low compared with N (i.e. the ruggedness is low), the landscape will tend to have a very large smooth basin of attraction leading to a single peak (as illustrated in the left of Figure 3). Low interdependence among system components in the fitness landscape implies a situation where one can pursue universal best-practices for each organizational attribute. Each component actor improves the fitness of the overall system by improving his or her own contribution to fitness. Single-peak landscapes with smooth adaptation surfaces are robust designs. Here, the behavior of autonomous actors is highly predictable

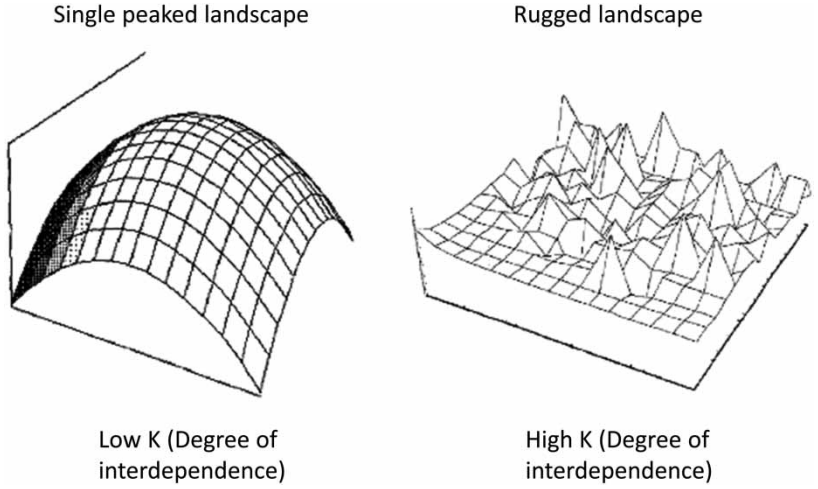

Figure 3 Single vs. Rugged Landscape.
Source: Levinthal and Warglein (1999).

without having to know their specific choices and their starting points on the landscape. Levinthal and Warglien (1999, p. 347) point out that a single-peak fitness landscape "solves the problem of coordination, but it does so at the cost of diversity".

A rugged landscape as illustrated in the right of Figure 3, in contrast, encourages divergent exploration of alternative and equifinal configurations but at the cost of unpredictability in collective behavior. A fitness landscape becomes more rugged with multiple peaks when interdependence (K) increases among system components or actors. When K is high, a change by any component influences other components in the system, often in dysfunctional ways (i.e. diminishing performance or fitness) despite the fact that a simultaneous change in a large set of components may enhance performance. This is a dynamic representation of the configuration perspective whereby changing a single component of a complementary system may diminish effectiveness if there are not also concurrent changes in other core interdependent components of the system. As Levinthal and Warglien (1999, p. 348) state, "search in rugged landscapes is basically the search for new sets of complementarities". Complementary configurations are represented as different hills on the fitness landscape. Moving from one design configuration to another typically entails some random exploration, long jumps between hills, and the risks of forgoing the benefits of known, attractive sets of behavior. Making incremental changes in a design configuration may represent suboptimal movements up or down a local hill, as opposed to shifting from local peaks to a global peak. Shifting between hills is necessary when "breakthrough"

and "platform" innovations are desired. Even the basic *NK* model thus allows explicitly examining and formalizing how the organizational adaptability depends on organizational and environmental complexity. The contingency theory maintains that complexity is one of the key environmental and organizational attributes affecting fit (e.g. Burton et al., 2002).

Siggelkow and Rivkin (2005) extend the basic *NK* model and study the role of organizational design as a factor mediating the relationship between the environment (in terms of complexity and stability) and organizational fit. In the tradition of contingency theory, the authors analyze how various organizational attributes such as organizational archetypes (Greenwood & Hinings, 1993), departmental processing power, firm-wide incentives, coordinative processing power, and richness of information flow affect organizational fit (without distinguishing between internal and external fit). Like other contingency theorists, Siggelkow and Rivkin find that organization design matters in different environments. Simple but turbulent environments call for a decentralized design with supportive leadership and active management-by-exception. The objective of organization design in this context is pursuit of speedy improvements. Stable and complex environments in turn require designs that foster diverse search such as a hierarchical firm with rich information flows and firm-level incentives. Turbulent and complex environments are the most challenging requiring designs that balance speedy improvements and search diversity. Siggelkow and Rivkin's study is a prime illustration of how the *NK* model can be used to advance contingency theory. The authors use the model to carefully tease apart how various attributes of organization design affect fit in response to environmental conditions.

Levinthal and Warlingen (1999) and Ganco and Agarwal (2009) also explore dynamics produced by coupled landscapes where the fitness landscape of an actor shifts and deforms as the result of *C*, the adaptive efforts of other interdependent actors at other levels, and over time. Coupled landscapes illustrate how movements by co-evolving actors shift the landscape topography for each other. Actors are engaged in hill-climbing, but this climbing is of a continually shifting landscape. A macro or system-wide policy decision may shift the relative positions of actors on a hill, just as it may increase or decrease the height of the peak on the landscape. The positions of actors relative to others on a hill are not static; they continually change with time. Cooperation, conflict, and competition among interdependent actors in work systems are inevitable and ongoing. The image of actors "dancing" across a fitness landscape over time is apropos, as actors adapt to each other's steps as well as to moving frontiers. Through this process, some improve and others fall behind. Still other situations reflect a "Red Queen" effect (Barnett & Pontikes, 2008; Barnett & Sorenson, 2002), where competing actors invest great effort in fine-tuning their fitness landscapes, but then find their relative positions have not changed over time. The aggregate topography of co-evolving landscapes

tends to resemble a punctuated equilibrium process (Tushman & Romanelli, 1985). As Kauffman (1995) states, "Early on [and for a relatively short period] the diversity of forms is more radical; later [and over a much longer period of time], it shrinks to a fine-tuning of details" (p. 120).

Creative Design Perspective

Inspired by Simon's (1999) *The sciences of the artificial*, there has been a recent growth of scholarship in advancing a more creative and human construction view of organization design than has been discussed thus far (van Aken, 2005; Boland & Collopy, 2004; Romme, 2003). Instead of adopting a natural science approach of describing and explaining organizations as they are, "design scientists ask what could be, seeking betterment of the human condition" (Jelinek, Romme, & Boland, 2008, p. 317). Instead of using the word "design" to denote structuralist recipes, design scientists are turning to the

> more tangible, experimental, creational design fields, e.g. fashion, auto, software, graphics, social, and strategic design. With this comes a shift in organizational design thinking towards a warmer, livelier, and more engaging field that incorporates the sensory, aesthetic, artful, and creative sides of design. (Barry, 2011)

A good example of this new design school is Avital and Te'eni (2009), who explore the generative capacity and fit of an organizational design. *Generative capacity* refers to a person's ability to reframe reality and subsequently to produce something ingenious or new in a particular context. *Generative fit* refers to the extent to which a particular artifact or design is conducive to evoking and enhancing that generative capacity in people. In other words, some organizational designs provide a greater generative capacity of empowerment, flexibility, and affordance (Gibson, 2002) than others. "Generative capacity comprises the ability to rejuvenate, to produce new configurations and possibilities, to reframe the way we see and understand the world and to challenge the normative status quo in a particular task-driven context" (Avital & Te'eni, 2009, p. 349). Avital and Te'eni (2009) advance three broad design directives for creating generative designs: they should be *evocative*, *adaptive*, and *open-ended*. For each of the three design directives, they propose several operational features that contribute to generative fit. Evocative designs provide opportunities to visualize, simulate, communicate, and integrate design features. Adaptive design features allow for customization, revision, and re-invention. Open-ended designs enable peer and open-source production and rejuvenation. Avital and Te'eni (2009, p. 363) point out that generative designing requires a dynamic view of fit because a single time-point measurement fails to provide an adequate picture of the role of fit in relationships between users, tasks, and designs. Generative fit has a temporal

dimension and long-term effect on users' behavior through learning and its impact on work practices.

Yoo, Henfridsson, and Lyytinen (2010) discuss layered modular architecture as an approach to creative and generative designs of complex systems. Modularity is a general characteristic of a complex system, referring to the degree to which a product can be decomposed into components that can be re-combined (Schilling, 2000). A modular architecture offers an effective way to reduce complexity and to increase flexibility in design by decomposing a product into loosely coupled components interconnected through pre-specified interfaces. In layered modular architecture, components in different layers do not necessarily belong within, and constricted to, the same design hierarchy (Arthur, 1999; Clark, 1985). Components can co-evolve through recombination, which makes the design process open and distributed (Yong Um, Yoo, Berente, & Lyytinen, 2012), and they can be combined at the time of consumption, rather than production, which further makes the process inherently generative and dynamic (Yong Um et al., 2012).

Garud, Jain, and Tuertscher (2008) point out that Simon's *The sciences of the artificial* requires system boundaries (or interfaces) and decomposability of components or modular sub-assemblies. This is unlikely in environments characterized by continual change, open boundaries, and multiple designers. In this context, incomplete designs act as a trigger for generative engagements by co-designers.

Future Research Directions

Building on prior studies mentioned above, we believe that an important direction for future research on organizational and institutional designs is to find ways to deepen the connections between contingency, complexity, and creative design perspectives. Specifically, we now discuss a variety of ways for advancing contingency theory using theoretical complexity approaches, empirical analysis, and creative design. Such integration may reinvigorate the relevance of and interest in contingency theory, and organization design in firm performance.

Advancing the Contingency Theory using Theoretical Complexity Approaches

The contingency theory distinguishes between the notions of external and internal fit and strategies for changing the organization and/or its environment. Thompson (1967) and Pfeffer and Salancik (1978) proposed the proactive and reactive strategies for coping with environmental dependencies that are outlined in Table 2. Through its reactive strategies, an organization chooses to change its internal design to fit the constraints of its environment. Through its proactive strategies, the organization can change its industry and institutional environment to better fit its goals and operations. Recently,

Table 2 Organizational Strategies for Coping with Environmental Dependencies

Reactive strategies that change organizations	**Proactive strategies that change markets**
Cost of strategies	
High	**Low**
(A) Seal off core technology	(A) Inter-organizational structures
(1) Buffering	(1) Trade associations
(2) Leveling	(2) Joint-ventures
(3) Forecasting	(3) Cartels
(4) Rationing	
(B) Environmental surveillance	(B) Mergers
(1) Boundary spanning and intelligence	(1) Vertical integration
(2) Overlapping board membership	(2) Horizontal integration
(3) Personnel transfers	(3) Diversification
(C) Create new products/enter new markets	(C) Change market rules and norms
(1) Product diversification	(1) Enhance benefits of regulation
(2) Imitation and licenses	(2) Use antitrust to self-advantage
(3) Innovation and patents	(3) Political action to change regulation

Source: Ouchi and Van de Ven (1980, p. 304).

strategic management researchers have been studying various ways that firms change the external environment in their own favor by, for example, creating industry technological standards (Garud, Jain, & Kumaraswamy, 2002), by acquiring firms with complementary resources and divesting of noncore businesses (Kaul, 2012), and by advancing new technologies or products that change industry competitiveness (Toh & Kim, 2012; Wang, 2012).

So also, McKinley (2011) argues that contingency theory applies equally well to designing the external environment to fit an organization's capabilities and strategies. He reviews three theories where organizational managers construct the environmental states that constrain them: Weick's (1979) enactment-selection-retention theory, Berger and Luckmann's (1967) social construction of reality, and Giddens' (1976, 1979, 1984) structuration theory. McKinley (2011) proposes a model of organizational adaptation and environmental construction that is contingent on organizational youth, diversification, environmental orientation, and organizational crisis. In general, constructing an organization's environment objectifies, simplifies, and recreates managers' environmental strategies. McKinley (2011, p. 819) argues that his proposals also apply to neo-institutional attempts to explain institutionalization of various practices through the behaviors of agents.

The distinction between internal and external fitness is important and intuitive from the perspective of organization design. As Table 2 suggests, when the

external environment is given as a constraint for a focal firm, the reactive strategies may be employed to increase efficiency and consistency of internal activities. In this case, managerial decisions may lead to endogenously determined interdependencies that emerge within the firm. When opportunities arise for the firm to change its market environment, its proactive strategies represent changing the external interdependencies and fit of the environment with the organization. Providing an important building block, prior research has conceptually mapped the notions of internal and external fit to the shape of the landscape (Siggelkow, 2001, 2002). The modeling approaches, however, do not distinguish between the two constructs. Both types of fit are subsumed in the exogenous interdependencies that determine the *NK* landscape—even though distinguishing them may provide a natural extension of existing studies (Siggelkow & Rivkin, 2005).

Consequently, we see a significant potential in creating more explicit connections between contingency theory and complexity modeling. By the virtue of designing an organization, managers create interdependencies with consequences for both internal fit and external fit. By partially endogenizing the interdependencies in an *NK* model and allowing agents to create and eliminate interdependencies in response to contingency factors (Burton et al., 2002), researchers may be able to advance the contingency theory. Modeling some interdependencies as choice variables may allow gaining deeper understanding of how fundamental organization design processes affect performance. For instance, by modeling both the changes in the interdependencies between organizational units (e.g. reflecting organizational design choices (Siggelkow & Rivkin, 2005)) and between the focal organization and other organizations (e.g. reflecting Thompson's (1967) proactive strategies), it may be possible to explicitly disentangle the determinants of internal fit and external fit. However, the existing structure of the *NK* model does not accommodate such questions—the interdependencies are fixed and set at the beginning of each simulation run. To address this problem, we propose two general approaches: (a) rely on verbal theorizing when combining contingency theory with the insights of the complexity models, and (b) develop modifications of the *NK* model that would allow endogenizing interdependencies. We illustrate both possibilities with existing studies.

Nickerson and Zenger (2004) provide an illustrative example of extending the predictions of complexity models using verbal arguments. Their study highlights that modeling is not always necessary when advancing contingency theory using complexity-based thinking. Building on the insights of the *NK* model, Nickerson and Zenger (2004) develop a knowledge-based theory of the firm. Even though they do not frame their study in the context of contingency theory, their approach is highly relevant. Consistent with contingency scholars (Burton et al., 2002), Nickerson and Zenger connect fundamental organization design choices with complexity of the environment. They see problem-solving as the primary role of both firms and markets and assume

that the knowledge creation process is a search through a problem landscape—the ruggedness of which depends on problem complexity. The authors argue that, due to the differences in costs that need to be expended to find a valuable solution of a problem, the appropriate organization design choice depends on the problem complexity. The market-based hierarchy is best suited for problems with low complexity; the authority-based hierarchy is the best choice for problems with moderate complexity, while the consensus-based hierarchy needs to be chosen when solving the most complex problems. The authors assume that internal processes including incentive intensity, type of communication channels, and dispute resolution regime drive organization costs. These processes need to be consistently designed to match the external nature of the problem that the firm solves. Viewing the arguments from the perspective of contingency theory, the internal fit is achieved by creating complementarities between the internal processes. The external fit is achieved when there is a match between the set of processes and the problem structure. Nickerson and Zenger's study thus shows how researchers may develop contingency theory by incorporating insights grounded in complexity theorizing.

The interest in contingency theory could be also reignited by developing simulation or formal models that are specifically designed to address questions that are at the heart of the contingency theory. Such developments may follow naturally since simulation modeling has been an integral part of contingency theory (Burton & Obel, 1980a, 1980b). Extending the *NK* model by allowing agents to adapt interdependencies may provide such an impetus. The traditional specification of an *NK* model implies that agents solve problems that are exogenous and the parameters *N*, *K,* as well as the interdependencies remain fixed over each simulation run. Such specification makes the model computationally tractable, parsimonious, and transparent, but it prevents researchers from examining how agents may redesign interdependencies contingent on environmental challenges.

The main issue is how one incorporates the changes in *N* and *K* into the existing structure of the model. Altenberg (1994) proposed a solution to this problem. He assumed that after "rewiring" (i.e. changes in the interdependencies) or after changing the number of elements (*N*), the algorithm redraws the payoff contribution of all the elements that are linked to the focal element. Furthermore, Altenberg (1994) developed a computational algorithm that can be used to simulate such a model and applied the model to the study of selective genome growth. In essence, selective genome growth expands the size of the system as new elements are linked to the existing elements. The model predicts that, as genome expands, it is optimal to add elements with decreasing number of linkages. As the system grows, the performance can be enhanced if the landscape becomes less rugged. Altenberg's (1994) selective genome growth model found some application within the management literature. Frenken (2000) applied the model to the study of dominant design. He argued that the selective

growth explains why highly interdependent elements of technological innovations are settled first and then innovation typically proceeds with less coupled elements surrounding the core innovation. This is consistent with Thompson's (1967) design principle of grouping together the most interdependent units first, and the least interdependent units last.

Even though the structure and the predictions of Altenberg's (1994) selective genome growth model may not necessarily apply to organizational design mechanisms, similar models may prove helpful in explaining organization design choices. For instance, increasing demand or opportunities in related markets may drive organizations to add new units to achieve external fit. At the same time, the operations of the new units need to be consistent with the existing organizational processes to achieve internal fit. Models similar to the selective genome growth model may thus prove helpful in disentangling the exogenous effects of the environment from the endogenous managerial choices about the interdependencies—driving both internal and external fit of an organization.

While extending contingency theory, a specific application of the model that incorporates interdependencies as a choice variable may be to explore how the drivers of internal and external fit vary with the level of analysis. Different levels of analysis may represent various time frames or environmental conditions. In the short run or in environments with low degree of environmental change, the firm may compete by pursuing mostly reactive strategies of undertaking *internal* organization changes. As contingency theorists suggest (Thompson, 1967), such reactive strategies may include "sealing off core technology"—designing the organization so that internal processes can be performed at a stable pace. The internal processes are thus isolated from the fluctuations in the environment or from the product and technological changes that are initiated in response to outside stimuli. In the context of the *NK* model, the reactive strategies may be conceptualized by allowing the agents to adapt only few interdependencies within the organization. At a higher level of analysis, organizations may behave proactively by shaping their outside environment (Table 2). They may influence the structural characteristics of the markets by collaborating or merging with competitors, pursuing regulatory and institutional changes, or pursuing radical (Tushman & Anderson, 1986) or architectural innovations (Henderson & Clark, 1990). Such mechanisms can be modeled by allowing the agents to alter the interdependencies across organizations. Further, the standard industrial organization economics analysis suggests that, while many costs are fixed in the short run, over the long run, they become variable (Carlton & Perloff, 1999). Analogously, in the *NK* model, many interdependencies may be modeled as fixed in the short run—because changing them requires time and resources—and adaptable over the long run.

Explicitly incorporating the *NK* model into the contingency theory may thus lead to novel insights about when organizations should employ reactive vs. proactive strategies and how these strategies influence organizations'

internal and external fit. Through the example above, we hope to stimulate thinking about how contingency theory may evolve and continue to provide a valuable contribution to the current discussion in the field.

Advancing the Contingency Theory through Empirical Analysis

An integral part of any theoretical pursuit is the ability to empirically support or refute the hypothesized theoretical mechanisms. We believe that the empirical contingency analysis of complex organizational phenomena may require researchers to go beyond the traditional regression analysis. Aside from the questions related to identification of causal mechanisms, which are salient in any model or hypotheses testing and are addressed elsewhere (e.g. Angrist & Krueger, 2001), we briefly discuss the methods that complement the traditional regression analysis. These methods are specific to our objective of extending contingency theory using modern complexity perspectives. Interdependent organizational processes frequently change not only the mean tendencies, but also the distribution of outcomes. Shifting the focus from central tendencies toward the understanding of distributions of outcomes is reflected not only in complexity models, but is also evident from a wide variety of empirical studies (e.g. Fleming & Sorenson, 2001; Lenox, Rockart, & Lewin, 2010; Mantegna & Stanley, 1995; Poole, Van de Ven, Dooley, & Holmes, 2000; Viswanathana, Fulcoa, Lyraa, & Servaa, 2003). In the next section, we discuss a number of methods that researchers can use when developing and testing contingency-based theories grounded in complex organizational phenomena. These methods are particularly useful when studying outliers, variance, and shape of the conditional distributions and not only the mean tendencies.

Frontier Analysis

Most organizations face multiple and often conflicting environmental demands, structural arrangements, and performance criteria at macro and micro organizational levels (Lewin & Minton, 1986; Thompson, 1967). Achieving fitness with local environmental demands and with corporate strategies often result in conflict (Child, 1975; Khandwalla, 1973). These complexities require making tradeoffs between purposeful and emergent goals at micro and macro organizational levels (Miller, 1993; Sinha & Van de Ven, 2005). Further, the complexities make it difficult to specify in concrete terms the relationships among abstract notions of organization environment, configuration, and performance in contingency theory.

To move beyond the limits of arm-chair theorizing, Sinha and Van de Ven (2005) and Van de Ven, Leung, Bechara, and Sun (2011) take an empirical approach using methods of the frontier analysis to advance our

understanding of micro and macro organization designs. We believe that the frontier analysis is a promising direction for future research because it provides a systematic way to assess the relative overall performance of organizational subunits facing comparable resource and environmental constraints, and for unpacking the tradeoffs between micro and macro organizational factors that may have different impacts on sub-unit performance.

Introduced to organization design researchers by Lewin and Minton (1986), the frontier analysis is a method that begins with the outliers in a sample. It empirically identifies the most adapted or best-performing units on the outlying frontier in the sample and then provides a way to examine the relative distance of other units in the sample from their comparable cohorts on the frontier. The frontier analysis directly addresses the constrained optimization problem in contingency theory that is central to configuration and complexity perspectives (Sinha & Van de Ven, 2005). The best-performance frontier consists of organizational units that maximize desired output criteria subject to input resource and environmental constraints in comparison with others examined in the sample.

Figure 4 provides a geometric intuition on how Data Envelopment Analysis (DEA) works. DEA searches for the weights that optimize outcome performance measures (the *Y*-axis) subject to a set of input factors (on the *X*-axis) for organizational units being investigated. Once scores are calculated, a best-performance frontier can be identified from which other units can be compared. A best-performance frontier refers to the maximum output that can be attained given a set of input conditions for a sample of units that use

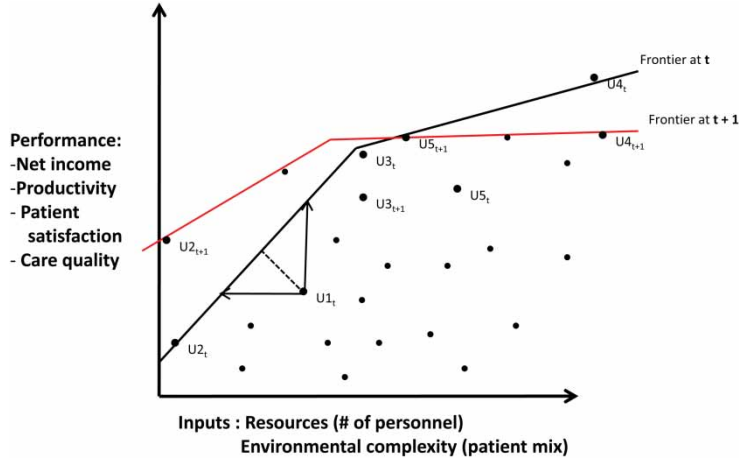

Figure 4 Changing Relative Performance of Units and Frontiers over Time.

a similar transformation process to convert inputs into outputs (Jayanthi, Kocha, & Sinha, 1996). Instead of trying to fit a regression plane through the center of the data, DEA floats a piecewise linear surface to rest on top of the most extreme observations in a sample of organizational units (i.e. DEA envelops the observations and, hence, the name *Data Envelopment Analysis*).

Van de Ven et al. (2011) conducted a frontier analysis to examine headquarters–subsidiary relationships in a longitudinal study of a large medical group practice of 32 local community clinics. They used DEA to compute the relative distance of clinics from a best-performance frontier, determined what proportions of changes in clinic performance are due to factors that are endogenous or exogenous to the clinics, and examined the organizational factors that may explain these performance changes. They found that uniform headquarters policies had different unintended effects on the performance of subsidiary units, benefiting some and hindering others through no fault of their own. They also found significant differences in performance volatility of different types of unit designs, which suggests a need to examine the risks of changing organization designs.

Joint Estimation of Conditional Mean and Variance

While the frontier analysis allows estimating the effects of independent variables as they affect the maxima (i.e. the "data envelope"), the method does not provide information about the shape of the conditional distribution. Important information that may improve understanding of the underlying complex process is the conditional variance. For instance, parameters of the *NK* models typically affect both the conditional mean and variance of performance outcomes (Fleming & Sorenson, 2001; Ganco & Agarwal, 2009). The methods to estimate the conditional mean and variance have been developed for both count and non-count data (Cameron & Trivedi, 1986; Harvey, 1976) and applied to validate the complexity models. For instance, Fleming and Sorenson (2001) test the predictions of the canonical *NK* model by examining the relationship between complexity of innovations and their usefulness. Among other results, they find that usefulness becomes more varied as the number of interdependencies among innovation components increases. Similarly, Lenox et al. (2010) test their extension of the *NK* model of a technological search on a cross-industry data. They find that the industry-level mean firm performance exhibits an inverted U-shaped relationship with increasing product and process complexity. Further, they report that within-industry variance of firm performance increases with product and process complexity. To the extent that innovation, product and process complexity are associated with contingencies within organizational design (e.g. Sanchez & Mahoney, 1996), such results may be seen as analogous to the insight from Van de Ven et al. (2011), who show how volatility and risk increase with the ruggedness of organizational landscape. The studies by Fleming and Sorenson (2001) and

Lenox et al. (2010) indicate how researchers can empirically examine the relationship between interdependencies in organizational design and performance with potential implications for contingency theory.

Quantile Regression

Quantile regression (Koenker, 2005; Koenker & Bassett, 1978) is a method that allows estimating the effect of independent variables on the dependent variable separately for different quantiles, as opposed to estimating the effect at the mean. It, thus, complements a simple estimation of conditional variance—the researchers can estimate the shape of the conditional distribution of the dependent variable as a function of covariates.

Even though the existing research has not applied quantile regressions to the study of complex organizational phenomena and the method has been used only sparingly in the management field (Godfrey, Merrill, & Hansen, 2009; Henderson, Raynor, & Ahmed, 2012), we believe that quantile regression has a substantial potential. For instance, Van de Ven et al. (2011) find that certain organizational characteristics increase both performance peaks and troughs leading to a higher risk for a given organizational form. It is conceivable that through the creation of internally consistent interdependent practices (Siggelkow, 2001; Siggelkow & Rivkin, 2005), organizations can increase the upside potential of their activities while not increasing the probability of failure. Such drivers could be modeled using an *NK* model and then tested using quantile regression. In the context of contingency theory, these drivers may include factors that affect contingency fit such as climate, technology, management style, ownership and strategy (Burton et al., 2002).

Tail Analysis of the Distribution

Interest in the tail behavior of distributions of empirical data is mostly driven by a hypothesis that complex interdependent processes give rise to non-Gaussian, heavy-tail distributions with the power-law property in the tail of the distribution (Mandelbrot, 2008).[3] The stronger version of this hypothesis (which has been criticized by Stumpf & Porter, 2012) maintains that the complex processes that drive the power laws are universal across a wide variety of empirical settings. These theoretical predictions are closely related to the modeling efforts—many agent-based models such as the models of network formation (Barabasi & Albert, 1999) give rise to power law distributions of outcomes.

A well-known distribution that exhibits a tail behavior consistent with a power law is Pareto distribution (Zipf, 1949). Pareto distribution has been studied in the context of income distributions or firm sizes (cf. Hill, 1974, 1975). Another frequently used class of heavy-tailed distributions is called the Lévy-alpha stable distribution (Clauset, Shalizi, & Newman, 2009; Nolan,

1999, 2009). These distributions may have an undefined mean, infinite variance, and undefined higher moments depending on various parameters. For instance, Wagner and Leydesdorff (2005) study the organization pattern of international scientific collaborations. They find that portions of the distribution of the number of international collaborations of a given researcher indeed exhibit power law properties indicative of a self-organizing process such as preferential attachment (Barabasi & Albert, 1999). Even though the authors find some support for the preferential attachment model, they observe deviations from the power law. They proceed with discussing possible theoretical mechanisms that may explain such deviations such as different pattern for junior and senior scholars due to institutional constraints. The study by Wagner and Leydesdorff (2005) is an excellent example of how one can utilize the tail analysis to generate insights about organizational phenomena. Dooley and Van de Ven (1999) estimate the number of causal factors that drive changes in organizational configurations and the density of interdependencies among these factors. Tail analysis may extend this approach to help uncover the mechanism that drives the changes in organizational configurations.

The methods that help recognize power laws in empirical data may prove to be important in the toolbox of an organizational researcher. Not only are the methods complementary in the pursuit of a holistic understanding of data, but they may also be particularly salient when examining multiplicity of factors and contingencies such as those affecting organizational fit.

Advancing the Contingency Theory by Incorporating Creative Design

The creative design perspective presents the challenge of incorporating a generative, artistic dimension into the analytical approaches of complexity modeling and empirical methods discussed above for advancing contingency theory. This may be easier said than done. To paraphrase Barry (2011), the kind of data that creative designers generate may be viewed as noise to analytical designers (and perhaps vice versa). And the interests and skill sets for each approach go in very different directions. Analytical design requires a penchant for convergent, law-directed, and causal formulations and testing, while creative design asks for divergent, law-breaking, exploratory ideas. "Hence becoming good at one orientation or the other requires thinking and working in almost opposite ways" (Barry, 2011, p. 6).

Interests notwithstanding, organization designers are being dragged into combining these analytical and creative skills as managers and policy-makers are increasingly demanding innovative, generative, and on-going ways of designing organizations and institutions in response to more uncertain, competitive, global, and fast-changing markets. Companies, such as Apple, Google, GoreTex, 3M, Disney, Proctor and Gamble, and many others are experimenting with a variety of design tools and programs, such as OrgCon (Burton, Obel,

& DeSanctis, 2011), IDEO-driven design thinking (Brown, 2008), Business Model Canvas (Osterwalder & Pigneur, 2010) as well as group processes for participative design and tangible modeling that are being developed in design labs at universities in the Denmark, Finland, Norway, UK and U.S.A. With all of this experimentation going on, we agree with Barry (2011, p. 8–9) that "it's only a matter of time before analytical designers incorporate creative design, and vice versa. Maybe creative designers will come up with the innovative designs and analytical designers will test their effectiveness". In such future assessments, generative capacity will be an equally important criterion as efficiency in evaluating the effectiveness of a design. Through such assessments

> perhaps a more unified organization design school will emerge, where "delight, deliver, and deepen" all come together using bits and pieces from both orientations. To be successful thought, this new OD [organization design] will require a lot more than asking executives to brainstorm, prototype, and otherwise "get creative". Coming up with effective organization designs that deliver, delight, and deepen will require training along the lines that designers get—years of learning how to reframe organizational problems into evocative questions, finding inspirational networks alongside solutional ones, creative and aesthetically sophisticated experimentation, and working with multiple mediums and representational forms. It will also require systematic testing over time, to see where and how these innovative designs work, and don't work. Clearly OD is heading towards a new chapter, perhaps its most interesting and inventive one yet. (Barry, 2011, p. 9)

The field of architecture provides a good example of design where analytical engineering sciences and creative arts and humanities appear to go well together. Well-trained architects have a deep understanding of the analytical properties of material sciences, regulatory mandates, and building codes. These materials and institutions provide the context and constraints for creating designs that transform constraints into enabling conditions and that may enhance the generative capacity in people (Avital, Boland, & Cooperrider, 2008). Because people are affordant (Gibson, 2002), any design can be interpreted and used in many ways; it is what you make of it. Designing is a dynamic process leading to temporary outcomes. Ongoing design engagements lead to new enactments and affordances of organizing (Jelineck et al., 2008; Weick, 1979; Yoo et al., 2010). But as noted before, some designs provide greater capacity of empowerment, flexibility, and affordance than others. A significant direction for future research is to learn the difference.

Concluding Discussion

This review of the contingency, configuration, complementarity, complexity, and creative design perspectives has identified a number of key ideas and challenges for a research agenda on organization and institution design. This agenda includes the following five items.

First, while contingency theory continues to be useful and influential in framing research and practice on work design, the reductionist research methods that were used to analyze the external fit between context and design variables one-at-at time should be abandoned. The configuration and complexity perspectives build upon the conceptual richness of contingency theory and appear to avoid the pitfalls of this early research. Both perspectives take a holistic view of work designs as consisting of configurations of subsystems (modules) nested in systems located within and between organizations.

Second, the configuration and complexity perspectives offer complementary paradigm extensions of contingency theory. In the configuration perspective, work design is viewed as a dual optimization problem: work systems are most effective when they maximize an external fit between environmental demands and design configuration, and an internal fit among its design components and levels of strategy, structure, systems, style, and culture. We have argued that institutional theory, (currently the dominant perspective for examining organizations (Greenwood et al., 2008a, 2008b)) contributes to notions of fit through institutional demands and legitimacy, but also needs to be more concerned with institutional design. In addition, institutional theory has lost sight of the organization, per se, with its emphasis on fields (Greenwood, Hinings, & Whetten, 2013; Wooten & Hoffman, 2008) and it would revitalize both contingency theory and institutional theory by more systematic examination of the ways in which organization designs are both influenced by, and influence, institutional contexts. The complexity perspective takes a more dynamic view by locating the relative height (external fit) and shape of the peak (internal fit) of work configurations as they evolve on a fitness landscape over time. Hill climbing reflects incremental changes in a configuration, while hill jumping represents radical changes from one design configuration to another on a rugged landscape.

Third, achieving both internal and external fit for an organization remains an elusive goal, particularly in situations with multiple conflicting environmental demands, internal design configuration tradeoffs, and diverse performance expectations. In these situations, it becomes difficult, if not impossible, to conceptually deduce or model a theoretical solution. The empirical approach of discovering an inductive solution by observing samples of organizations or institutions appears more feasible.

Typologies and archetypes are useful and appropriate for testing theoretical configurations of work designs, but not for discovering new design

configurations. In many cases, both researchers and practitioners do not know what alternative design configurations exist in a sample of work systems being examined, nor can they determine the relative performance of various configurations existing in diverse contexts. The number of factors that must be taken into account simultaneously exceeds the bounds of our rationality. Empirical approaches appear promising for identifying and comparing taxonomies of work design.

Fourth, scholars studying organizational complexity are pursuing two distinct but complementary approaches: an empirical approach and a modeling approach. The diagnoses of nonlinear dynamic patterns in observed data provide strong grounding for determining what kind of model to use to explain the process, and for knowing what kinds of explanatory models to reject. CAS models (often based on Kaufmann's class of *NK*(*C*) models) tend to be very general and abstract, resulting in criticisms that the models are inadequately grounded in specific organizational problems or work settings. Empirically observing a sample of work systems and then mapping and analyzing their moves on a fitness landscape provides a plausible next step for integrating the insights that both models and data can provide to advance our understanding of organizations.

Fifth, searching for distinctive and competitive ways to increase innovative capacity both within and outside of their organizations is also central to advancing organization design. Filling this need is the emergence of a new school of "creative organization design" that stresses "design thinking" (Brown, 2008), "innovation by design" (Barry, 2011), and more artistic, flexible, and generative approaches (Boland & Collopy, 2004) to design than the engineering and analytical approaches of the past. Creative approaches of artistic design are introducing new generative criteria that transcend efficient forms of organizing. An important direction for future research may be to find ways to integrate the analytical empirical and modeling approaches to organizational complexity with creative and artistic design forms and functions as now found in some fields of architecture (Barry, 2011).

With regard to complexity theory, Anderson (1999) cautions that the next steps may be very difficult to accomplish. He states:

> Agents at any level of analysis face far more complicated adaptive landscapes than CAS models have envisioned to date. Hill-climbing towards higher fitness on one measure may cause performance to deteriorate on others. The image of a rugged adaptive landscape presumes that conflicting selection pressures can somehow be aggregated into a single measure of performance. In reality, organizations and the individuals in them juggle a host of conflicting expectations and assessments that create a payoff function too difficult to assess and optimize (March & Simon, 1958) ... Additionally, many organizations fall considerably short of

> the frontier defining the highest fitness attainable, and the actions of firms move this frontier, leading to a cascade of changes within and among actors. (p. 224)

Given these difficulties, Anderson (1999, p. 225) cautions that the adaptive landscape metaphor must not be pushed too far.

We agree, but we also see some untapped potential of using findings from empirical studies to guide modeling and simulation efforts. Most organizations are too complex for arm-chair theorizing because they have multiple conflicting environmental demands, internal design configuration tradeoffs, and diverse performance expectations. In these situations, it becomes difficult, if not impossible, to conceptually derive a model reflecting these complexities. We propose instead a research agenda that emphasizes grounded empirical evidence for guiding the development of organization design models. Indeed, this is the approach that Donaldson (2010) takes. The findings from running these simulation models, in turn, can inform the design and conduct of subsequent empirical studies.

In summary, our review highlights that contingency theory is highly relevant in the study of organizational and institutional designs. We propose specific ways that contingency theory can advance the frontier of organization science. The relevance of contingency theory goes beyond challenging universality of organizational and institutional designs. We suggest that many constructs developed in the tradition of contingency theory may be extended using modeling efforts while yielding relevant insights. The connections are particularly promising in the context of organizational complexity theory. For instance, we suggest that the notions of internal and external fit (Drazin & Van de Ven, 1985; Miller, 1992; Siggelkow, 2001), conflicting organizational objectives (Child, 1972), or proactive vs. reactive strategies (Thompson, 1967) can be further developed using the models and methods of complexity theory. In addition, we underscore the importance of expanding the methodological toolbox for empirical research. Advancing contingency theory while relying on methods developed to analyze complex interdependent data can lead to powerful insights when holistic approaches to empirical analysis such as the frontier analysis are utilized (Van de Ven et al., 2011).

In turn, we believe that simulation modeling and holistic empirical approaches may reinvigorate interest in contingency theory. They allow advancing the theory through methods that were not available when the contingency theory was first introduced. Complexity theory brings in a set of structured approaches that permit studying the fundamental questions of organizational and institutional designs while examining the effect of contingencies such as internal and external fit. One of the benefits of complexity models is to provide a well-controlled setting in which researchers can disentangle the effect of

various organizational characteristics. A more diverse empirical approach then allows empirically validating the predictions of complexity models.

Overall, it is our belief that reopening the study of contingency theory in connection with more recent approaches, such as complexity theory, will shed new light on the fundamental questions of organizational and institutional designs. We hope that our review will open pathways for renewed interest in this area.

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Endnotes

1. See organizational design community at http://orgdesigncomm.com/
2. In reference to Dooley and Van de Ven's (1999) model, *N* corresponds to the dimensionality of a system, and *K* refers to interdependence among these dimensions.
3. Heavy- and fat-tail distributions are distributions with tails that are not exponentially bounded and exhibit large skewness and kurtosis relative to normal distribution (Clauset et al., 2009).

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