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Organizational Buffering: Managing Boundaries and Cores

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Abstract

Organizations generally are more innovative, relevant, and responsive when they are exposed to market influences, yet they must regulate or limit the impact of outside influences to operate efficiently. This dynamic organization–environment tension has inspired the creation of several models of organizational buffering which delineate the systematic exposure and insulation of organizations from environmental uncertainty. We review three buffering paradigms — core, minimalist, and dispersed — and attempt to synthesize a model which weaves these perspectives together. The key to understanding functional and dysfunctional buffering lies with the organization's requisite variety and continuous or discontinuous environmental change.

Keywords: buffering, buffers, requisite variety, environmental uncertainty, organizational boundary

Thompson (1967) observed that organizations face a paradoxical mandate: To be efficient requires internal stability and order, but to be effective requires external adaptability and change.[1] One way organizations resolve this paradox, Thompson hypothesized, is through buffering, or insulating stability-sensitive parts of the organization from environmental flux, and exposing parts which assist the organization in adapting to change.[2] By buffering, firms can protect parts of the organization from a chaotic barrage of outside influences, while also tracking closely with environmental shifts and variation. That organizational buffers exist is not surprising. But the location of those buffers, their use, and their impact on organizational performance is less readily intuited.

In recent years, organizational buffers appear to have thinned, as have their advocates. Recent interest in lean manufacturing, market-orientation, cross-functional teams, and sense-and-respond strategy suggest that numerous benefits exist in minimizing buffers and maximizing the exposure of organizational units to the environment. But buffering is a subtle concept. Learning and innovation require *both* exposure *and* quiet reflection away from outside noise (Seibert and Daudelin 1999). Some leading companies which fail to stay at the top of their industries when sudden change occurs appear to do so because there is too tight a coupling between them and their

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customers, or not enough buffering to avoid unanticipated environmental flux (Bower and Christensen 1995; Meyer 1982). Thus, 'closing' off sectors of the organization from certain environmental influences is not always a denial of resource dependency (Pfeffer and Salancik 1978); sometimes it is the very action that enables a deeper understanding and readied preparation to deal with externally mandated change.

Buffering concepts have existed for decades in several organizational and social science perspectives.[3] But the recent controversy about buffering's merits, and the proliferation of buffering perspectives, invite an effort to collect the various strands of thought about buffering, and reconsider the role that buffering plays as a heuristic and approach for effective organizing. Thus, we aim to identify the theoretic contribution of buffering and identify changes in its amount, form, and locale. After further clarifying its definition, we review three buffering paradigms, and then attempt to weave the various perspectives together to produce a unified model of buffering.

Buffering Defined

One challenge of employing a metaphor such as 'buffering' is that its meaning is often assumed from common usage rather than from precise definition. In the minds and writings of some organizational scholars 'buffering' connotes security; to others, detachment; and to others, concealment. Since some scholars have called for a fresh and comprehensive definition of organizational buffering (Busch 1996; Meyer et al. 1992), and since definitional problems abound in untangling the strands of thought surrounding it, we offer a new, parsimonious definition of buffering based on a thorough review of the literature:

> Buffering is the regulation and/or insulation of organizational processes, functions, entities, or individuals from the effects of environmental uncertainty or scarcity.[4]

This definition suggests that: buffering can regulate or insulate; various processes, functions, or entities can buffer or be buffered; buffering can occur at various organizational levels and in varying degrees; buffering can be functional or dysfunctional, intentional or unintentional; and buffers may vary in locale, amount, and form. It is important to note, however, that while buffering includes efforts to mitigate uncertainty's effects, it does not encompass actions taken to alter the environment directly. Thus, a confectionery that holds chocolate butterfat in reserve to counteract the possibility of scarce supply is buffering; but a confectionery that buys cocoa bean futures in an attempt to insure a steady supply of butterfat is going beyond buffering and attempting to smooth inputs coming into the organization.

Four general forms of buffering may be refracted from this definitional lens, as presented in Table 1. 'Dynamic adaptation' and 'input and output smoothing' are functional because they maintain an appropriate level of buffering. 'Digressive insularity' and 'smoothing imbalance' are dysfunctional for they do not maintain adequate buffers. 'Dynamic adaptation' and 'digressive

Table 1.
Forms of Buffering

	Functional	Dysfunctional
Insulate	*Dynamic Adaptation* innovate in changing environments while protecting stability-sensitive areas from threat	*Digressive Insularity* maintain internal order but become desensitized to environmental shifts; or, fail to achieve internal order because of chaotic exposure or overexposure to the environment
Regulate	*Input and Output Smoothing* regulate fluctuations as needed to maintain internal order, yet remain in touch with environmental dynamics	*Smoothing Imbalance* maintain regulatory resources beyond or beneath what is needed for efficient and effective functioning

insularity' are protective, and thus generally deal with discontinuous, or radical and surprising marketplace shifts. 'Input and output smoothing' and 'smoothing imbalance' are regulatory and deal with continuous change, or variations around a norm. The functional and dysfunctional forms are somewhat tautological and they don't clarify exactly when buffering is excessive, ideal, or inadequate. Their purpose is merely to provide a typology for the sake of discussion.[5]

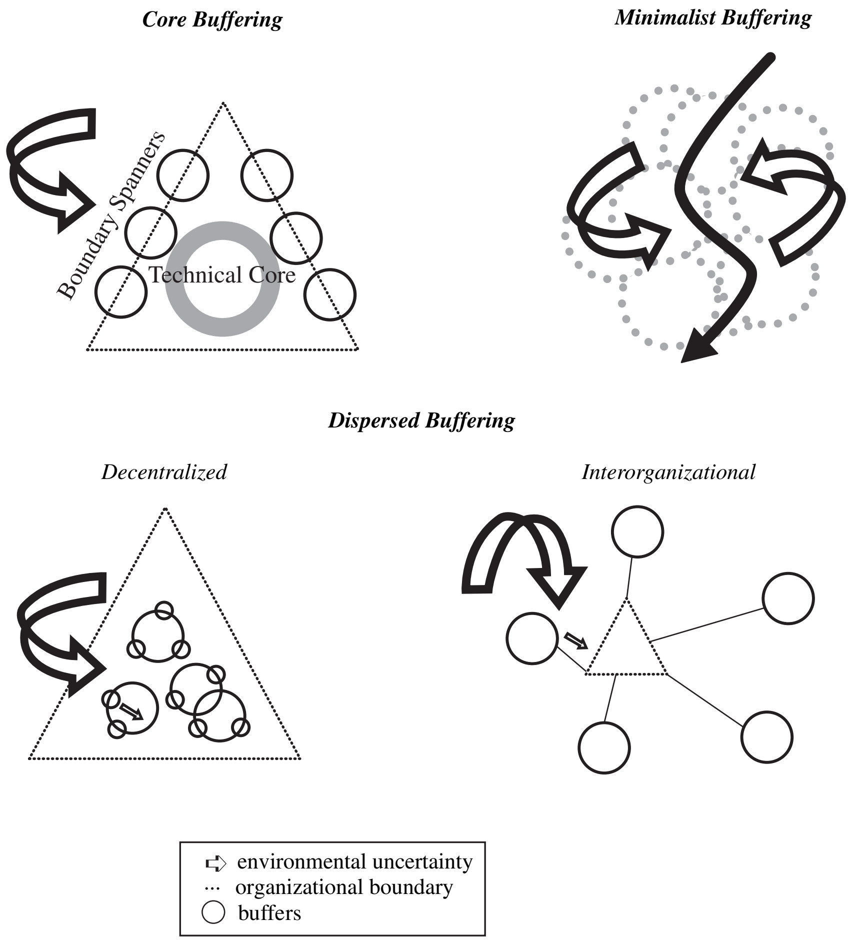
Core Buffering Paradigm

Technical Buffering

Thompson (1967) was the first modern scholar to formulate a model of organizational buffering.[6] He addressed a central organizing paradox by depicting organizations as having three distinct layers of environmental exposure based on the technology used by each layer and each layer's purpose. Boundary spanners were on the outermost layer, the technical core was at the center, and managers were in between. Thompson reasoned that specialists in fields such as law, purchasing, and marketing serve as boundary spanners. Their role is to anticipate, detect, and respond to environmental variability using tools such as coding inputs, stockpiling, and forecasting. Managers further adapt for environmental shifts by orchestrating the rate and direction of changes throughout the organization. By the time environmental shock waves reach the stability-sensitive technical core — predominantly for Thompson, a manufacturing assembly line — they are diffused into manageable adjustments and innovations.[7] A graphical illustration of the core buffering paradigm is shown in Figure 1. Arrows in the diagram represent environmental variability that influences the organization; dotted lines represent the organization's exterior boundaries; thin-line circles represent organizational buffers. In the core paradigm, the technical core is shown in grey.

Organizations may encounter two types of environmental flux: one is variation around a norm, such as fluctuations in demand for a product or in the supply of raw materials; the other more radical discontinuous change

Figure 1. Buffering and Exposure Models



suggests that the norm is changing, that significant shifts are occurring in technology, product design, governmental regulation, or other areas (Meyer et al. 1990). Although Thompson focused on variations in supply and demand, his model — and those of other perspectives — includes both types of environmental variability.

Although Thompson's scholarly influence has been pervasive (Bedeian and Wren 2001; Üsdiken and Pasadeos 1995), some of his ideas on buffering attracted only moderate research interest. Only five direct empirical examinations have been published on buffering's diminishing the effects of environmental turbulence, for example, and two of these studies diverge significantly from Thompson's work (Khandwalla 1974; Lev 1975). The three cleanest studies (Koberg 1988; Meznar and Nigh 1995; Sorenson 2003) found mixed evidence compared to Thompson's predictions. Koberg found that school systems were buffered more than oil producers, even though Thompson hypothesized the obverse — that it is more difficult for intensive technology firms to seal off the technical core, since customers generate organizational inputs and environmental turbulence, than it is for long-linked technology firms (Mills and Moberg 1982; Mills and Morris 1986). Consistent with Thompson's reasoning, however, Meznar and Nigh (1995) found that buffering was positively associated with environmental uncertainty and organizational size. Most recently, Sorenson (2003) found that vertically integrated firms outperformed their non-integrated rivals because buffering extended the period of time their knowledge was accurate.

Some studies suggest that organizational slack — a form of buffering which attempts to reduce the effects of resource scarcity — promotes innovation (Bourgeois 1981; Damanpour 1991; Singh 1986). These studies differentiate between two forms of buffering: unabsorbed slack, which is excess, uncommitted, generally liquid resources; and absorbed slack, which is excess costs committed to innovation-relevant areas, such as administrative expenses, sales expenses, and working capital. Research shows that absorbed slack is more strongly associated with innovation and risk taking than is unabsorbed, because it can be leveraged more quickly and directly to support innovation (Damanpour 1991; Rosner 1968; Singh 1986). Nohria and Gulati (1997) found that both too much and too little slack is detrimental for innovation, however. While slack represents only one form of buffering, these studies illumine earlier research on core buffering because they refine the notion that to catalyze environmental adaptation, organizational buffers must be able to be readily leveraged.

The boundary-spanning portion of Thompson's model has attracted considerable research attention. The findings are complex, but not inconsistent with Thompson's predictions — boundary spanning occurs most often in firms utilizing mediating technology and organic work structures, and in organizations operating in highly uncertain environments (Aldrich and Herker 1977; At-Twaijri and Montanari 1987; Friedman and Podolny 1992; Hirsch 1972; Kopp and Litschert 1980; Leifer and Huber 1977; Lysonski et al. 1988). Factors such as the degree of perceived environmental uncertainty and market orientation of the firm may regulate the degree of boundary-spanning activity, which may be performed by individuals or groups (Ancona and Caldwell 1988). Recent work on the processes and heuristics by which organizations gather and interpret knowledge from beyond the firm underscores the continual role of boundary-spanning activity in post-bureaucratic organizations (Leonard-Barton 1995; Zahra and George 2002).

Institutional Buffering

While Thompson's theory focused on manufacturing organizations and technical environments, institutional theorists saw applications of core buffering to less tangible environmental influences, such as social norms and myths applied intensely to schools, labor unions, religious organizations, and hospitals. Buffering with an institutional face has the same goal — to maintain efficiency — but it does so by decoupling managers from the technical core (e.g. Meyer and Rowan 1977; Oliver 1991; Powell and DiMaggio 1991). As

Meyer et al. (1992) put it: '[T]he technical organization faces in toward its technical core and turns its back on the environment, while the institutional organization turns its back on its technical core in order to concentrate on conforming to its institutional environment.' Institutional buffering, in other words, focuses on adapting the managerial level to external normative influences, but protects the technical core from the impact of many of these issues.

Institutional buffering is viewed as concealment by many (Meyer et al. 1992), although some forms of buffering — such as financial endowments — can help prevent goal displacement in institutionalized environments. Empirical research generally has supported the idea of institutional buffering. Board members buffer the full-time staff from the public in state wildlife organizations (Price 1963), for example, and administrators buffer healthcare providers from normative environmental threats (Begun et al. 1992; D'Aunno et al. 1991; Mohr 1992). In sum, technical and institutional writers operate within a similar buffering paradigm, the main differences between the two being the corporeality of the influence, the entity being buffered, and whether buffering is primarily insulating or regulatory (Table 1).

Minimalist Buffering Paradigm

Since 1980, criticisms of organizational buffering have been levied on several fronts, including that: buffering undermines competitiveness; customers and technologies permeate organizational cores; and buffering is incompatible with several emerging scholarly assumptions. Although diverse in motive and method, these writers generally recommend minimal buffering and maximum exposure (see Figure 1). They assume increasingly complex and uncertain environments, and reflect the development of enhanced organizational tools to absorb such uncertainty. At least three camps advocate a minimalist perspective.

Buffering Undermines Competitiveness

The largest group of minimalists has observed that buffering makes firms uncompetitive because of heightened production costs, less managerial and employee vigilance for innovation, quality, and efficiency, elongated cycle time in new product development, and a diminished appreciation of customer service (Borys and Jemison 1989; Bourgeois 1981; Child 1972; Cole et al. 1993; Ettlie and Reza 1992; Harmon and Peterson 1990: 100; Macduffie 1995; March 1981; Piore 1994; Porter 1990; Smith et al. 1991; Snow et al. 1992). Minimalists argue that buffering consists of excess financial, human, and operational resources, which constitute excess cost. Not only is inventory costly, but exposing the organization's technical core to outside influences helps employees stay current with the needs and wants of customers and suppliers (Borys and Jemison 1989). Linking technical core employees to customers enhances manufacturing flexibility; exposing employees to suppliers improves productivity and capacity (Ettlie and Reza 1992).

Perhaps most fundamentally — and at first glance, opposing Thompson's thought — minimalists claim that buffering weakens organizational change.

Scholars (McClelland and Wagner 1988; Harmon and Peterson 1990) caution that full inventories may give a false sense of security to employees about an organization's stability and engender a lack of corporate vigilance in the marketplace. Porter (1990) found support for this argument at an industry level when he found that countries with competitive resource disadvantages often became world leaders — too many resources undermined innovation. Bahrami and Evans (1995) found that 'recycling' knowledgeable employees across boundaries from one firm to another contributed to the innovation produced in a network of firms in Silicon Valley. As Child and McGrath summarize:

> 'the achievement of flexibility thorough a dynamic recombination of resources can take place both within the formal boundaries of a firm and across those boundaries, within a sectoral domain or regional ecosystem. The search for flexibility is seen to open up, even decompose, organizational boundaries. Taken to its full conclusion, the firm or business system becomes disassociated from any one organization, though it remains "organized" and in this respect, distinct from a marketplace.' (2001: 1128–1129)

The benefits of being lean and exposed appear to hold true in numerous circumstances: small businesses and entrepreneurs who find scarcity the mother of invention (Shane and Kolvereid 1995; Westhead and Cowling 1995); psychologists who find that social buffering may encourage dependency and ultimately powerlessness (Conger and Kanungo 1988); accountants who argue that profit centers and responsibility accounting promote better performance than do buffered cost centers and historical budgeting approaches; and economists who argue in favor of competition over protectionism. In short, minimalists claim that buffering increases costs and anesthetizes the organization to environmental change because of excess resources and an insular orientation.

Customers and Technologies Permeate Organizations

A second camp of minimalists simply have difficulty buffering service organizations where customers regularly penetrate the technical core and where empowered employees have the authority to make decisions benefiting customers (Mills and Morris 1986; Schmenner 1986). Where customer interactions are common, a market orientation for every employee seems more appropriate than does isolating employees from environmental forces.

Relatedly, technology pundits observe that information and computing technology today directly link the technical core with suppliers and information, thus nullifying buffering's raison d'etre. Enterprise resource planning systems and the Internet offer rich, immediate, and direct communication media linking stakeholders to core employees and functions (Colombo 1998; Ettlie 1993; Hayes et al. 1988). Links such as these allow employees to circumvent slower, traditional information channels through management and boundary spanners, and respond to market changes more quickly. Thus, this camp suggests that buffering should be minimized wherever possible.

Buffering is Inconsistent with Emerging Scholarly Assumptions

A third camp of minimalists, marshaling resource dependency theory, suggests that the assumptions which undergird buffering are incompatible with numerous emerging organizational perspectives (see Child and McGrath 2001). For instance, enactment and deconstructionist scholars eschew Thompson's reified environment and organizational boundaries (Smircich and Stubbart 1985). Self-managing work team advocates and those of knowledge-based firms advocate exposure, learning, and delayering (Cherry 1989; Nonaka and Konno 1998). Perhaps those scholars most strongly arguing for exposure are complexity and chaos theorists who reject the isolationism of buffered organizations. Some of these scholars argue that being off balance and out of control is a sign that organizational units are taking steps toward getting back in line with environmental change. Organizations will never 'catch up', they argue, because much environmental change is emergent, enacted, and interwoven with the firm's action itself. Thus it is important that employees conceptualize of a dynamic world by interacting with it directly and constantly, and that buffers be removed.

Disequilibrium advocates appeal that order is found in exposure, not protection (Peters 1988, 1992; Senge 1977; Sherman and Schultz 1998; Zimmerman 1993a, b; Zimmerman and Hurst 1992). Sherman and Schultz suggest that chaos occurs because of buffering, not because of exposure to a chaotic world:

> 'Mistakenly, organizations think they can stave off chaos by closing their systems. Unfortunately, building stronger walls in a vain attempt to solidify a position invites chaotic dissolution. The problems that invariably force a company into chaos are often brought about when the flow of information becomes dammed by the impediment of too much infrastructure ... In the name of maintaining security, organizations lose the ability to adapt cognitively ... *Innovation and institution, at their core, are at odds with each other.*' (1998: 10, 26, 24)

Many minimalist writers are reacting against an over-insulated, unresponsive organization, both of which are manifestations of dysfunctional buffering (Table 1). It is the combination of environmental vigilance and appropriate internal structure, however, that produces effective organizational learning and response (Brown and Eisenhardt 1997). It may be that, rather than eliminating buffers, as just-in-time inventory systems and outplacement advocates suggest has happened, organizations are jettisoning buffers higher and lower than the macro-organization level — they remain in place, just out of sight.

Dispersed Buffering Paradigm

Decentralized Buffering

Some industry commentators (e.g. Louis and Yan 1996) suggest that buffers have not been minimized but rather moved — broken into small bits, and decentralized, making buffers less detectable but still functional (Figure 1). For example, Cole et al. (1993) asserted that boundary-spanning roles are dispersed to most or all employees in some organizations. As organizations bulldoze functional chimneys, trim inventory, and adopt communication technologies which connect organizational units with outside influences, buffering is decentralized in the organization to individuals and teams.[8] In these cases, boundaries serve as clues to the location of buffers, although the two should not be equated. Hirschhorn and Gilmore, as early as 1992, argued that:

> 'Managers are right to break down the boundaries that make organizations more rigid and unresponsive. But they are wrong if they think that doing so eliminates the need for boundaries altogether. Indeed, once traditional boundaries of hierarchy, function, and geography disappear, a new set of boundaries become important.' (1992: 104–105)

These are namely boundaries around teams which each have their own buffering function.

This team-level buffering observation is consistent with Friedman and Podolny's (1992) discovery of dispersed boundary-spanning behavior across organizational members at multiple levels. And it squares with research on flexible work assignments in lean organizations where buffering is provided 'on the fly' with few visible resources (Zavadlav et al. 1996). Spender and Kessler (1995: 52) argue 'against the nostrum that teaming and removing organizational barriers is a comprehensive answer [to replace organizational buffering]'. Their hunch that organizational buffering retains a place even in team-based organizations was supported empirically by Cooper and Smith's (1992) finding that buffering exists between disparate product divisions within a company. Thompson also suspected that buffering would be dispersed in complex environments:

> '[B]oundary-spanning components facing heterogeneous and dynamic environments have serious adaptive problems; if they are, in addition, reciprocally interdependent with a technical core which itself is complex, the resulting set of constraints and contingencies exceeds the organization's capacity to adapt and coordinate. By identifying several separable domains and organizing its technical-core and boundary-spanning components in clusters around each domain, the organization attains a realistic bounded rationality.' (1967: 76–77)

In sum, decentralized buffering simply moves resources and responsibilities deeper into the organization, much like divisional structures divided and dispersed critical functions to geographic or product divisions (Chandler 1962).

Interorganizational Buffering

Some scholars suggest that buffers also are being moved but in another direction — out to specialists, alliances, networks, and other modular components 'beyond' the organization (Figure 1).[9] These extra-organizational resources 'permit the organization to mobilize resources quickly for new, unanticipated activities or self-defense' (Wholey and Huonker 1993: 692) — or again, in other words, buffer. The interorganizational perspective suggests that if an organization outsources its public relations function, it may appear to have eliminated buffers, but in actuality, it has merely loosely coupled them beyond sight (see Gulati et al. 2000). One-half of US manufacturing managers and one-third of such managers in Japan agreed in one study that a just-in-time inventory system 'only transfers inventory responsibility from customers to supplier' (Ettlie and Reza 1992: 81). Networked firms buffer each other (see Andersson et al. 1999) and assist in organizational transformation during periods of environmental change (Miner et al. 1990). Thus, getting back to the dual purpose of buffering, it appears possible for interorganizational buffers to produce both adaptation and order (Table 1).

Reconciling Buffering Paradigms

Is it possible, across three decades of scholarly thought, and a great deal of environmental change and industry practice, to pull together this plurality of buffering perspectives? What does each contribute to our understanding of buffering today? Before attempting to construct a general model, we must address four issues which dissolve some of the apparent incongruity among perspectives.

Cautioning Against Objectivist Theorizing

In language closely akin to buffering minimalists, Luhmann (1973) depicted reified social system theorizing as whirlpools of meaning, with socially created objectifications of organizational phenomena endlessly swirling and treated as if they were real.[10] In so doing, he cautions against taking an objectivist approach to organizations. Any approach which speaks of organizational 'boundaries', 'buffers', and 'environments' begs the question of objectification. We do not mean to deny the social construction of such ideas nor ignore the theoretician's tainted observations. Although some of the researchers cited begin with objectivist assumptions, the three buffering perspectives transcend the objectivist-constructivist debate because the general nature of each is largely unchanged when viewed from constructivist or objectivist angles. While warning against theoretical reification, the constructivist view fits with the depiction of organizational life characterized by (circular) second-order cybernetics and autopoiesis, two systems approaches which undergird much of the discussion of buffering.[11]

Avoiding Revisionist History

It is inaccurate to assume that modern firms have followed a linear progression toward less buffering. Just-in-time inventories, for example, were used in automobile production before and after World War I (Schwartz and Fish 1998). Even earlier, at the turn of the 20th century, many American firms were characterized as having 'close interactions with clients, suppliers, and rivals ... They built interfirm alliances to manage markets and fashioned specialized institutions — trade schools, industrial banks, labor bureaus, and sales consortia.' (Scranton 1997). In concept, technical buffering isn't new, nor is minimalist buffering, nor interorganizational buffering. It is equally important to recognize that radical, discontinuous change has occurred in some industries during the recent past and significant shifts have occurred in modern markets, law, politics, technology, and other areas. Thus, the practice of buffering may be much more like a precarious strange attractor, with economic cycles orbiting organizations through periods of increasing and decreasing buffering.

Recognizing Functional and Dysfunctional Buffering

Across all three paradigms, buffering ideally is a mechanism to assist organizations in adapting to change, not to avoid change by being insular. If the minimalist critique of buffering is merited, it may fit insular organizations best — those which have lost the capacity to innovate and respond to organizational change (Table 1). Sherman and Schultz's (1998: 24), claim that 'Innovation and institution, at their core, are at odds with each other' is exactly the paradox that Thompson raised originally and attempted to address in his technical core buffering paradigm. The real issue of dialogue between buffering and all but the most purist of complexity theorists (minimalists) is about the rate at which organizational innovation and adaptation is phased, and the extent to which all employees are exposed to chaotic environmental dynamics.

Clarifying Buffering's Object

As has been mentioned, employee empowerment, cross-functional teams, outsourcing, and organizational networks may give the appearance that corporate cores are being penetrated and buffers are thinning. But besides looking deeper into the organization, or out to alliances, it is important to note whether the object being buffered has changed as well. In Thompson's original notion, production lines, for example, were buffered, not the employees working on the line. But through the 1980s and 1990s, quality, customer service, ecologically friendly processes, and other outcomes were added to efficiency. When the object of buffering changes, so likely do the buffers. Thus, a change in the exposure of employees to external dynamics, even in the technical core, is not sufficient evidence that the level of buffering has increased or decreased. The entire production system needs to be understood if buffering is to be properly assessed (Schilling and Steensma 2001).

A Unified Buffering Model

The First Missing Key — Requisite Variety

Although he does not refer to it, Thompson's original buffering notion incorporates Ashby's (1954, 1968) systems theory concept of requisite variety, which suggests that when organizations mirror the complexity of their environments, organizational members are better able to understand, predict, and respond to environmental forces. Requisite variety occurs then, when the organization is designed to be as complex as its environment so it may better monitor, interpret, and react to environmental change. The process by which requisite variety occurs is further specified by recent work on dynamic capabilities and absorptive capacity (see Teece et al. 1997; Zahra and George 2002).[12]

In Thompson's words: '[A]s the pace of technological change increases and as host environments become more complicated and more dynamic, organizations are having to learn to be more flexible and adaptive' (Thompson 1967: 80). Weick says it this way: 'It is the unwillingness to disrupt order, ironically, that makes it impossible for the organization to create order' (Weick 1979: 189). Thompson incorporates requisite variety in the boundary spanners' knowledge and techniques to monitor and comprehend their environment. Requisite variety is built into the technical core as well since the form of technology determines the need for routine and rationalization.

Ashby prepared a path for Thompson by suggesting in his law of requisite variety that buffering can fill the gap when an organization's requisite variety falls short (as it inevitably does in uncertainty) of the level of perceived environmental complexity.[13] All buffering paradigms argue for adequate, not excessive, buffering; enough to help the organization function efficiently and remain connected to the marketplace. When buffering takes the place of or duplicates requisite variety, an organization becomes insular. It is only when buffering fills a gap which requisite variety cannot that it remains functional.

Requisite variety, however, does not necessarily manifest itself linearly through one structural form, such as by adding additional centralized boundary spanners. As the minimalist buffer scholars argue, organizational complexity at some point becomes too cumbersome for centralized systems to respond to rapid environmental change. Organizations may better match environmental complexity by decentralizing and dispersing boundary-spanning roles and buffering resources (Schilling and Steensma 2001). In other words, requisite variety has both informational and structural expressions — informational in that organizations track and interpret environmental dynamics; structural in that organizations may organize in ways which better facilitate environmental comprehension and response. In Boisot and Child's words, organizations can develop 'behavioral plasticity': '[Organizations] can hold multiple and sometimes conflicting representations of environmental variety, retaining in their behavioural repertoire a range of responses, each of which operates at a lower level of specialization' (1999: 238). Thus, the firm appears to revert from complexity (e.g. centralized, unabsorbed slack) to simplicity (decentralized absorbed slack), but it actually is better equipped to respond to environmental uncertainties by doing so (see Malnight 2001; Rommel et al. 1995).

Where uncertainties exceed requisite variety, buffers are still required to insulate rational systems (Chu and Hayya 1988; Paraskevopoulos et al. 1991; Vollmann et al. 1993). Material requirements planning, for example, has been found to work well only when demand can be forecasted accurately, when there is adequate time to acquire materials, and when there are few technological uncertainties in the manufacturing process (Berry and Whybark 1977; Etienne 1987). Where buffers don't exist, problems are exacerbated, as occurs with managerial problems:

> 'When there's some slack — when the traffic intensity is below about 80% — the system works well. But when the traffic intensity nears 100%, problems start sitting in the queue for a while. When traffic intensity is greater than 100% — that is, when there are more problems than can be solved, even if everyone works flat out — organizations get into real trouble ... [Managers and engineers] find themselves spending more time responding to irate inquiries than working productively ... [W]ork becomes far less efficient precisely when the most work needs to get done.' (Bohn 2000: 85)

Thus, we reason that, as requisite variety increases, the need for insulation and regulation decreases. But where requisite variety is exceeded by uncertainty, buffers are beneficial.

Basic Relationships

Based on the foregoing discussion of buffering paradigms and requisite variety, we propose the following basic relationships. An organization's combined requisite variety and buffering (RV + B) are theoretically optimal when they match the level of environmental uncertainty (U) surrounding the organization (Figure 2). The organization develops knowledge and processes, and where appropriate, buffers beyond its knowledge, to match the level of uncertainty in its environment. In low to moderately uncertain environments (*a*), requisite variety and buffering can be centralized in organizational units such as departments or warehouses. Centralization satisfies the organization's need for efficiency and allows a reaction of sufficient speed to match the relatively stable and simple environment. As uncertainty increases (*b*), requisite variety and buffering tend to be decentralized to smaller units and/or jettisoned to interorganizational structures which afford greater organizational flexibility and response time to environmental shifts. Thus, the centralization (C) of requisite variety and buffering varies inversely with perceived environmental uncertainty.

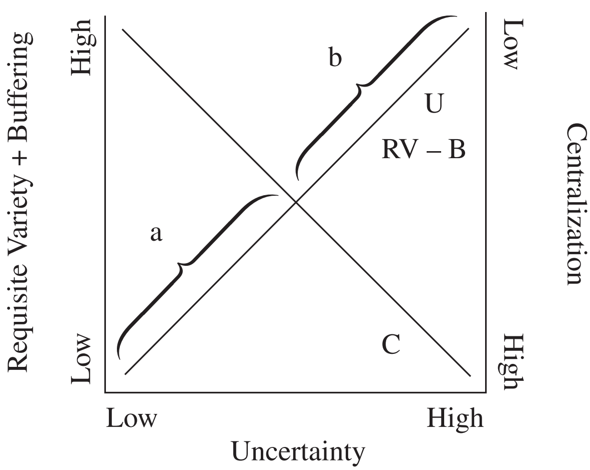


Figure 2.
Buffering and Exposure Models

Figure 3.
Ideal Relation of Uncertainty, Buffering, Requisite Variety and Centralization

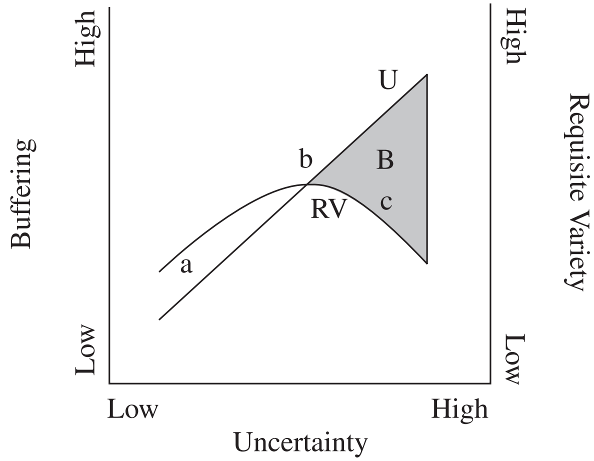
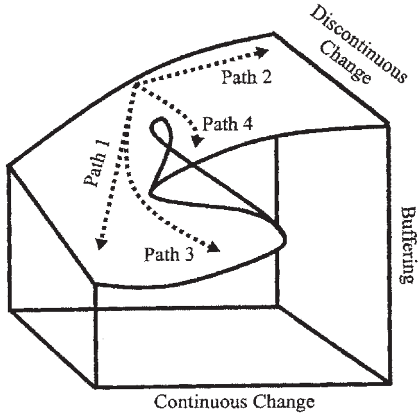


Figure 3 breaks out a proposed relationship of requisite variety (RV) and buffering (B) to environmental uncertainty (U). When uncertainty is relatively low (*a*), organizations are able to develop knowledge and structures (requisite variety) which exceed their external challenges (represented by the RV line above the U line). No buffering is required. At some point (*b*), an organization reaches the limit of its ability to predict and absorb change through requisite variety alone. As uncertainty increases (*c*), the organization's requisite variety proves inadequate to deal with uncertainty and may decline because of overloading the administrative systems. At this point, buffering (indicated by the shaded area) is needed to absorb the impact of environmental uncertainty which exceeds the organization's structural or knowledge-based requisite variety. Effectively functioning organizations utilize the minimum amount of buffering needed and reduce buffers when the organization's learning, technology, and structure (requisite variety) catch up with challenges from the environment. This theoretically ideal level of buffering fills the gap between uncertainty and requisite variety until organizational learning and innovation narrow the organization-environment fissure.

This unified buffering model balances the outside-inside paradox of change versus stability and efficiency versus innovation (see Poole and Van de Ven 1989). It addresses the issue of why buffering is at times centralized and at other times decentralized or jettisoned — whether marketing, for example, resides in a single organizational department, in an outsourced contract, in interorganizational networks, or in cross-functional teams. It also addresses the desirability of minimizing or eliminating buffers where requisite variety has advanced, such as was provided by innovations in flexible and lean manufacturing, and incorporated in the minimalist buffering perspective. Finally, it advocates the use of buffers where necessary to avoid anarchical and reactive management and organizational systems, as suggested by Thompson in his original theory.

Figure 4. Buffering in Continuous and Discontinuous Change



The Second Missing Key — Uncertainty — Yields a Dynamic Model

Now that some basic relationships are established among buffering, requisite variety, uncertainty, and centralization, it is possible to consider a more dynamic view of buffering and its efficacy by incorporating two types of environmental uncertainty — continuous and discontinuous change. This second missing key helps explain the locale and extent of buffers as presented across the three perspectives. Buffering, requisite variety, and environmental uncertainty can be portrayed in a cusp diagram with buffering representing the dependent variable — and the counterpart to requisite variety — and continuous and discontinuous change representing the two independent variables (see Figure 4).

As continuous change (variation around a norm) increases in occurrence (that is, as you move forward in the figure, illustrated by Path 1), organizations have an incentive to decrease buffers. This is because variation around a norm may be anticipated or matched through advances in knowledge, structures, or technology (requisite variety). As requisite variety increases, the use of buffers is decreased. Where they duplicate requisite variety, buffers weaken an organization's initiative and continued learning in tracking continuous change carefully, and they add overhead cost. An organization operating with few buffers and sufficient requisite variety — such as in lean manufacturing — will tend to move an organization and, if sizable enough, its industry, toward cost savings and efficiency as competitive weapons. Close and constant exposure to environmental flux is necessary. This relationship is consistent with minimalist buffering paradigm and with core buffering as well, both of which advocate advances in requisite variety reduce the need for buffering.

When discontinuous or unpredictable change increases (i.e. as you move to the right in Figure 4, illustrated by Path 2), buffers increase because they offer dual benefits: they offer resources to insulate organizational units from threat, and they allow focus on innovation which is partially isolated from the pressures and patterns of the current environment (see Bower and Christensen 1995). In sum, continuous change is best dealt with by requisite variety which reflects the current environment, and discontinuous change is best accommodated with buffers which allows experimentation — and eventual requisite variety — in radically different circumstances.

When environments are high in both continuous and discontinuous change (i.e. in the cusp region in Figure 4), it is difficult to predict an optimal buffering solution. Only a slight difference in the balance of types of continuous and discontinuous change will require radically different degrees of buffering — low buffering would be functional for Path 3, for instance, and high buffering for Path 4. This indeterminancy is consistent with population ecology descriptions of the impossibility of predicting survival or death on the basis of lean or buffered operations (e.g. Kaufman 1985) and it fits Meyer's (1982) description of inefficient hospitals flourishing over efficient ones when discontinuous change occurs. Dispersed buffering through inter-organizational alliances and outsourcing may have increased in recent years because it moves the risk of indeterminancy of highly uncertain environments, outside the firm to other organizations. Likewise, decentralizing buffers allows for greater organizational flexibility through project improvisation and low-cost probes into the future which characterize successful firms engaged in continuous change (Brown and Eisenhardt 1997).

Conclusion and Future Research

Following a review of recent scholarship on evolving organizational forms, Child and McGrath conclude that 'Paradox is likely to be a core theme of postmodern organizational design' (2001: 1144). The need for concepts which function similarly to buffering continue to be needed. More specifically, based on the present review, theoretic and some empirical evidence suggests that buffering continues to be a useful heuristic for understanding and managing organizations, as long as it complements an organization's requisite variety and matches its perceived environmental uncertainty. Buffering appears to contribute to functional organizing wherever uncertainty exists — especially protecting stability-sensitive areas and enabling internal order. When organizations decentralize or network, buffers are often relocated. They may be more difficult to locate and move beyond the traditional boundaries of the organizational system, but their contribution and purpose remain the same.

In terms of future research, it should be noted that the majority of the foundation for this work — including the conclusions drawn above — is theoretical rather than empirical. There are several buffering dynamics which could be investigated empirically; additional theoretical strides could be taken as well. Questions in both camps include the following: What specific environmental fluctuations are buffered, and in what organizational locales? What is the effect of market competitiveness and resource munificence on buffering and requisite variety? What specific resources contribute to informational, technological, and structural requisite variety? Does excessive buffering reduce requisite variety, and if so, how quickly and by what process? Under what conditions of uncertainty does requisite variety decline and in what types of environments does buffering tend to get delegated to teams or alliances? (Malnight (2001) has begun addressing this question.)

Which buffering functions are retained at the organization level and which are transferred to teams or organizational networks? When buffers thin, to what degree is this shift technologically driven — such as by increasingly sophisticated computer networks and knowledge — or, economically driven — such as by a shift in competitive bases (e.g. from efficiency to quality) and declining munificence — or institutionally driven by myths and the actions of peer institutions? How do buffered functions respond to radical market shifts? Additionally, little is known of how managers utilize buffers or to what degree obtaining buffers is political, technical, or strategic (see Meyer 1985).

Notes

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1 Research since Thompson (e.g. Ostroff and Schmitt 1993) suggests that different factors contribute to efficiency and effectiveness, but structure plays a role in both.

2 Thompson's techniques for reducing uncertainty directly included forecasting, leveling demand, and rationing. In the same year that Thompson published his notions on buffering, Miller and Rice (1967) published similar ideas with less detail. Rice's thinking is substantial, however, with his theories fermenting from as early as 1963. His definition (Rice 1963: 17) of an ideal organization was: '[S]ufficiently flexible to allow the enterprise to respond to short-term environmental change within the existing framework, and to adapt, without major disturbance, to long-term change'. Beer was contemplating the organization-environment paradox as early as the 1950s but didn't articulate his thoughts fully until 1972 when he published his Viable Systems Model (VSM) (Beer 1972). In Beer's model, each organizational component has an internal order ('management') function and an organizational adaption ('environmental') function.

3 Although organizational buffering is the focus here, buffering's functional equivalents exist in many related fields, such as: *finance* — working capital, budgetary slack, and various sources of short-term credit; *economics* — peripheral industries and secondary labor markets, protectionism and monetary buffer stock; *business law* — incorporation which protects employees from litigation; and *organizational behavior* — coping, such as with stress reduction, ego protection, and group performance.

4 This definition is consistent with buffering's more general cybernetic definition: 'Buffering is the passive, absorption or dampening of perturbations' (Heylighen and Joslyn 2001: 13), and with Nohria and Gulati's more narrow concept of slack, which they define as: 'The pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output' (1997: 604).

5 An organization is not simply 'open' or 'closed' to its surroundings, nor are its boundaries easily demarcated. Rather, an interpretative schema filters (dare we say, buffers) environmental influences and organizational actions. Two executives may view an event as inside or outside the borders of an organization (Grønhaug and Lines 1995), and two organizational actors facing similar economic pressures may respond quite differently (Laughlin 1991), due to their interpretive schema. These schemas can leave an individual impervious to some external influences even though he or she has multiple interactions with stakeholders (Hawley 1995). Thus, while 'exposure' to forces outside an organization may increase the likelihood of organizational adaptation, it does so only to the extent that the interpretative schema of individuals labels these forces as 'influences', and the interpreted events are translated into organizational learning (Greenwood and Hinings 1988; Purvis et al. 2001). There is an extensive literature on cognitive schema and organizational learning. The issue is raised here as a reminder to avoid over-rarefying environmental 'openness'.

6 While buffering in the classical school did not exist per se due to little environmental attention, the two basic ingredients for technological buffering were in place: (1) the concept of environmental uncertainty and the need for organizations to buffer environmental flux (see Weitz and Shenhav 1996), and (2) a division of labor and a scalar chain which separated the location of policy, allocative, and coordination decisions (Parsons

1956). Weitz and Shenhav (1996) show that the notion of uncertainty and the need for its regulation infiltrated management theory via American mechanical engineers in the period 1879–1917. It was 'institutionalized, and thus neutralized from its ideological underpinnings' in the period 1918–32. Adam Smith and Charles Babbage widely discussed divisions of labor, but it was Parsons who placed the top management policy-making group at the center of the organization with middle management ('coordination') and the technical core ('allocative') on the periphery. This arrangement was logical as was the absence of clearly differentiated boundary-spanning and buffering functions, since in the post-war period, there was relatively little theoretic accommodation for external elements such as competitors or scarce resources. By the early 1960s, open systems theorists were depicting organizational models in a way that foreshadowed Thompson's.

7 With increasing recognition of organizational stakeholders, scholars added environmental sectors and accompanying boundary-spanning functions to Thompson's model (Aldrich 1979; Daft 1995). Some of these influences — such as socio-cultural and ecological — were less discrete and tangible compared to Thompson's original focus on resource inflows. Thompson, however, only included resource supplies in his theoretical propositions dealing with environmental uncertainty.

8 Earlier scholars (Friedlander 1987; McCollom 1990) applied buffering and boundary protection to work groups and assigned the buffering roles of 'sentries' and 'guards' to team members (Ancona and Caldwell 1988).

9 Acquisition, alliances, and interfirm networks typically are given as examples of bridging strategies rather than buffering because they tend to reduce uncertainty directly rather than mediate its organizational effects. Interorganizational alliances can buffer the organization by absorbing environmental threats, regulating inputs and outputs, and providing economic flexibility by transforming the fixed costs of organizational services and resources into variable costs (Welch and Nayak 1992). Interorganizational alliances can also increase uncertainty and threat. Bettis et al. (1992), for example, argue that outsourcing can increase competition if a supplier acquires proprietary technological or market knowledge near the organization's core competencies.

10 Clam summarizes Luhmann's thought: 'When boundaries are de-spatialized to become the expression of the self-difference of the system (as system-environment) in the system (as building a self-identity), the system enshrines in itself its own negation. It becomes a circular dynamic whose potentialities flow from the internalization of its environment (non-self) in itself. That is how order is built from noise: that is why the main resources for stability and adaptation are inherently instability and variety and why fixed optimality is suboptimal and diverse suboptimality a major asset for evolution' (Clam 2000: 67).

11 Because self-reference is inevitable in theorizing about social systems, the notion of buffering is itself the map rather than the territory. It is an approximation of reality embedded in reality itself. In a way, the concept of buffering is paradoxically a buffer in itself.

12 Two concepts are of interest here — dynamic capabilities and absorptive capacity. Dynamic capabilities are the firm's ability to 'integrate, build and reconfigure internal and external competencies to address rapidly changing environments' (Teece et al. 1997). Relatedly, Zahra and George (2002: 186) define absorptive capacity (ACAP) as 'a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability'. The first two dimensions of ACAP — acquisition and assimilation — deal with how an organization identifies and acquires externally generated knowledge. Thus, they address the process by which requisite variety occurs. Although dynamic capabilities and absorptive capacity are emerging theoretical topics, requisite variety is the best-fitting construct here since its focus is on the *presence* or the noun of organizational/environmental complexity equilibrium, rather than the *process* or verb represented by dynamic capabilities and absorptive capacity.

13 Ashby (1968; see Heylighen and Joslyn 2001) stated his law of requisite variety as:

$$V(E) \geq V(D) - V(R) - K$$

where
V(E) is the variety of outcomes of essential variables
V(D) is the variety of disturbances
V(R) is the variety of counteractions from the regulator (e.g. feedforward and feedback)
K is buffering
Ross Ashby's law dictates that (environmental) disturbances (E) must be equaled or surpassed by the combination of requisite variety (R) and buffering (K).

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