

Learning at the edge – Part 1: Transdisciplinary conceptions of boundaries

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This paper focuses on one theme from complexity and new science literature: the theme of boundaries. It responds to requests from complexity theorists to bring organizational perspectives into dialogues about the use of complexity thinking by managers and leaders. The researcher has used phenomenographic analysis to explore published authors' qualitatively different ways of understanding boundaries. These have been grouped into two major categories, and several subcategories. These authors believed that boundaries deserve attention, and that they can be actively managed for a range of benefits. These ways of understanding are interpreted through a model based on theoretical work by Etienne Wenger. This is the first part of a two-part paper that attempts to strengthen a bridge between theoretical and practical worlds, and to create a space for further research and dialogue.

Introduction and purpose

In his chapter "Complexity and Management: Where do we stand?" (2002: 205) complexity theorist Steve Maguire writes: "we also make a plea, calling on researchers, in addition to exploring for new concepts and insights, to exploit the existing management and organizations literature. Draw on existing organization science; use what is out there today; relate and anchor complexity concepts to the existing literature; integrate; synthesize – all of this should be done as we move forward." Goldstein (2002: 262) wrote: "human organizations are a prime location for deepening the field of complexity, since they are accessible, exhibit self-organizing and emergence on many scales, and are equipped with many already existing metrics ... the directionality of influence of social science on complexity theory will grow in importance." This paper responds to these and other invitations by researching existing organizational literature about *boundaries*: an important concept for work with complex systems.

The journal *E:CO* blends ideas from academic inquiry and practical work in organizations

to help people iteratively improve their work as theoreticians and practitioners. Therefore, much of its work is action research, which is less a culture of inquiry than a statement of intent to influence a system (Bentz & Shapiro, 1998: 127). Bentz and Shapiro describe results and typical shortcomings of action research, saying that the outcomes are "(a) solutions to immediate problems and (b) a contribution to scientific knowledge and theory." They go on to say: "most of the work performed under the heading of action research during the past 10 years accomplishes only the former of these two goals..." (128–129). By contrast, this paper is intended to enable the refinement of theory through reference to practice, rather than to immediately solve practical problems through reference to theory.

This paper is not only *about* boundaries; it is a *boundary object*. By quoting practitioners from healthcare, education, community development, business, and other fields, I am bringing them to the edge of the organizational domain, where their work intersects with the academic inquiry of complexity theorists. I am hoping that some of those theorists (who may also be practitioners) will gather around this boundary object and, as Steve Maguire proposed, relate, anchor concepts, integrate, synthesize, *and stimulate dialogue and further research across the organizational science/complexity science boundary*.

Phenomenography as a research approach

As phenomenography is an unusual methodology for *E:CO*, I will describe its history and objectives in relation to action research and the purposes of this paper.

Phenomenography helps us to understand something more comprehensively. It explores qualitatively different ways in which people conceptualize an idea, and is often used to effect improvements (Agger-Gupta, pers. comm., 2001). It is therefore well suited for use under the umbrella of action research. Because complexity and the new economy are intertwined with knowledge and understanding, I set out to learn more about how practitioners

working in organizations understand boundaries, and chose phenomenography to do so.

Phenomenography emerged in the early 1970s in Sweden through the work of Marton, Säljö, Dahlgren, and Svensson. Although associated with education reform, researchers have used it to explore a range of topics and issues (Bowden & Walsh, 2000: Chapter 1). It is suited to empirical investigations, yet the researcher takes almost nothing for granted. Because phenomenography is a study of variations, it complements complexity theorists' interest in diversity. It also reflects general system theorist C. West Churchman's concept of sweeping in as much variation as possible, to enhance understanding of a phenomenon. In using this method, the researcher tries to maximize diversity by using data likely to contribute varied perspectives. The researcher (with or without participant involvement) watches for emerging patterns of understanding, and organizes them into named approaches. The names for these ways of understanding are often metaphorical. For example, Larsson *et al.* (2003) studied the ways in which anesthetists understand their work, and used *professional artist* to describe an approach in which the anesthetists' focus is on the medical practice and problem-solving elements of the work. Collectively, the variations discovered are referred to as the *outcome space*. The researcher does not necessarily use a pre-determined boundary of inclusion or a representative sample: at the end of the study, he or she can state that "there is *at least* this much diversity."

I hope that these empirical findings (perhaps derived iteratively over several studies) may help complexity scientists move forward with theory and/or make their work more accessible to practitioners. I also hope that practitioners will read ideas from their peers in other disciplines, and be inspired to understand and use boundaries in new ways as they work with complex systems.

I drew practitioner perspectives from two sources. The first is published writing; credibility therefore comes from the authors' backgrounds and/or the reputation of the publishers. The second source, used in the second phase of the research and Part II of this paper, is unpublished writing from a graduate course designed with complexity principles in mind. Credibility comes from the university's reputation and the positive participant reactions to the program and course.

I reviewed approximately 120 publicly available resources in this phase of the research (phase 1), including journal articles, books, and abstracts that explored boundaries and related concepts such as edges, peripheries and connections. My search began with key words including *boundary* AND *complexity* in academic databases, and expanded from there. Some resources were overtly complexity related; some were from related sciences; and others were from quite different disciplines. In phase 2, for Part II of this paper, perspectives from graduate learners were also analyzed through a phenomenographic lens.

I used ATLAS.ti for analysis of text segments related to the themes of this paper. The flexibility of this software allowed patterns and hierarchies to emerge from the data. I selected and coded quotations manually and did not use parsing software (as Michael Lissack has done with this methodology to assess word roles and placements). The findings I report are based on my interpretation of patterns from this analysis.

Preliminary analysis framework

Saying that *the researcher takes almost nothing for granted* reminds me of anthropologists' efforts to *be objective* in their observations of other cultures: I believe they are equally impossible. So I created the preliminary analysis framework (Figure 1) to think about the topics I was likely to encounter. I attempted to focus on content (e.g., authors might talk about a boundary) without jumping to the lenses through which that content was conceptualized (e.g., we should reduce boundaries, or boundaries are a fact of life). This framework provided the domain landscape within which I could study emergent patterns of conception.

The framework is based on Etienne Wenger's exploration of the nature of learning. Wenger developed the concept of *communities of practice* – self-governing groups of individuals who come together because they share a common practice and want to learn from each other. People can participate in the cores or peripheries of communities, or travel between the two. Boundary objects are among several tools used to enable community intersections. In organizations, executive members do not dictate community of practice outputs; their processes of operation, leadership, and learning are largely emergent. A true community of practice

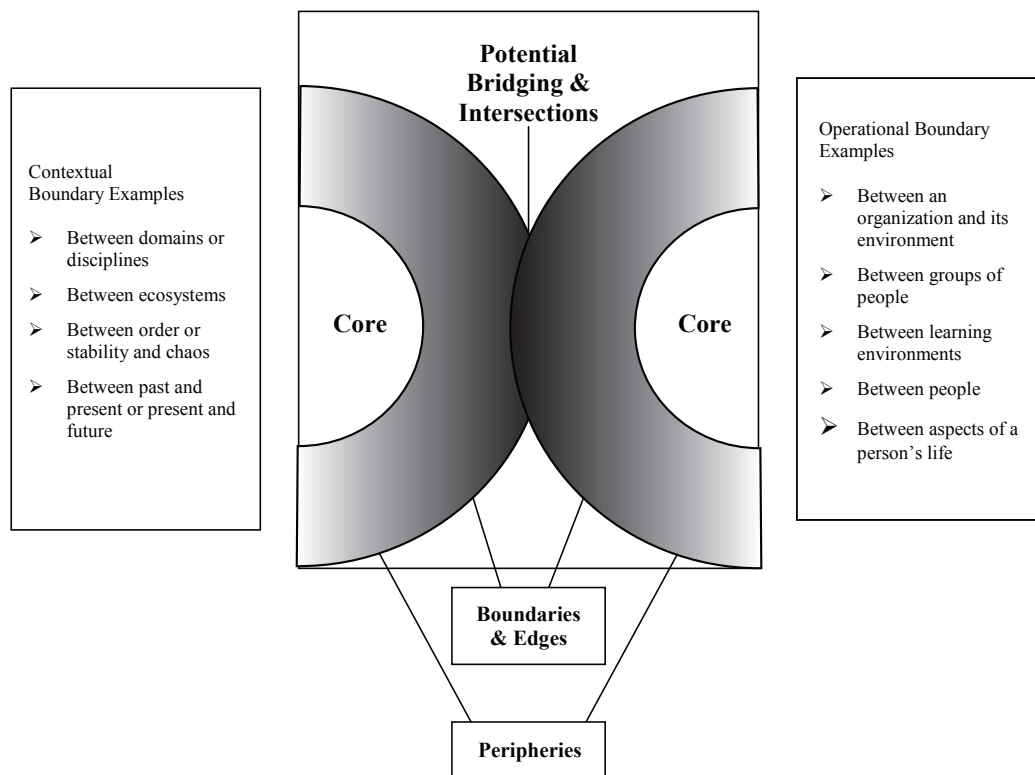


Figure 1 Preliminary framework for research of complexity and boundaries

(as opposed to a project team dressed up in community of practice language) is a complex adaptive system. On one level, we can interpret this graphic as representing the intersections of a community with expertise in applied organizational work and a community with expertise in complexity theory.

According to Wenger, *boundaries* and *peripheries* both refer to the “edges” of communities, but emphasize different aspects. “*Boundaries* – no matter how negotiable or unspoken – refer to discontinuities, to lines of distinction between inside and outside, membership and nonmembership, inclusion and exclusion. *Peripheries* – no matter how narrow – refer to continuities, to areas of overlap and connections, to windows and meeting places, and to organized and casual possibilities for participation offered to outsiders or newcomers” (Wenger, 1998: 119–120).

In the third and final research phase (included in Part II of this paper), I compared conceptions of boundaries in published literature with those from the graduate course, again with the intent of showing diversity.

Boundaries: Lines or metaphors?

Published authors explored several boundary types, from the literal to the metaphorical. Some explorations were conceptual: assumptions that we have made in our society. For example, Newtonian physics, Cartesian thinking, and scientific management have all encouraged the creation of boundaries to break things into parts, a practice that may be less relevant in new sciences or the new economy. Some boundaries were between disciplines, communities, or organizational roles. Some were physical, such as the boundaries of ecosystems.

Authors working with complexity have written extensively about the pros and cons of metaphor: Maguire (2002: 205); Lichtenstein (Fitzgerald *et al.*, 1999: 85); Tom Petzinger (2002: 245); Maguire & McKelvey (1999: 23); Lissack, (2002: 4–5). This writing reflects tensions among the natural science brand of rigor, the implicit inaccuracies of metaphor, and practitioners’ desires to communicate provocatively. Beyerchen (1997) explained that: “A metaphor is ... literally false according to the rules of abstract rationality (i.e., logic, truth tables), but is true according to the rules of imaginative rationality (i.e., art).” Given the perceived value of metaphors for *non-prescriptive* applications, I did not

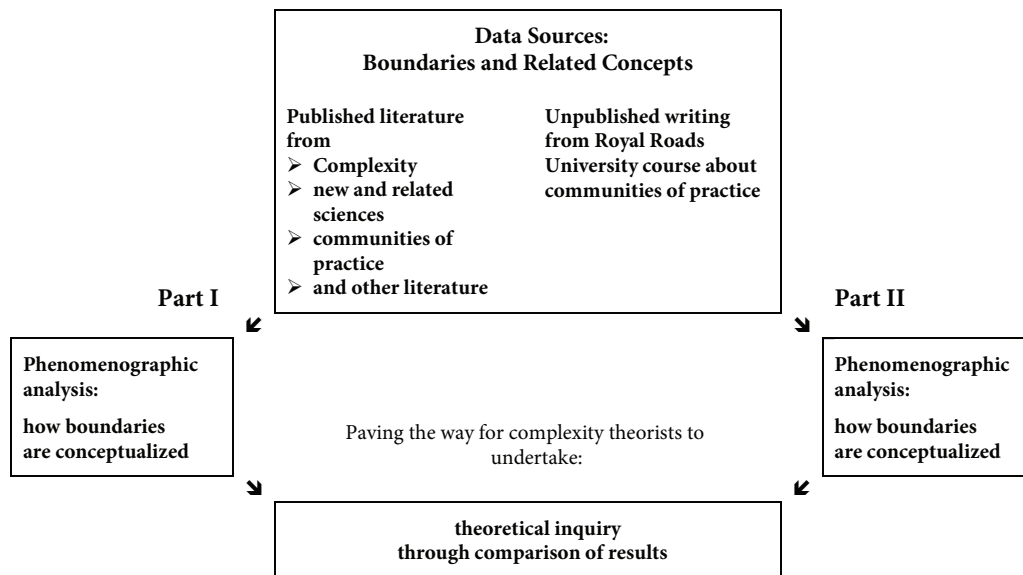


Figure 2

exclude conceptions of boundaries because they might be criticized as misrepresentative of scientific or mathematical concepts. Nor did I attempt to segregate complexity from systems theory, chaos theory, or new sciences that have sprung up in over a dozen fields (Fitzgerald *et al.*, 1999: 83, quoting Ogilvy).

Conceptualization of boundaries

Because phenomenography was used to understand *others'* conceptions of boundaries, the analysis framework (Figure 1) was a touchstone, rather than a blueprint. My predefined constructs of “contextual” (e.g., between disciplines) and “operational” (e.g., between groups of people) were not helpful, because the scopes and scales of the works varied so greatly. I therefore adapted the framework as shown below.

Revised framework for research of boundary-related concepts

I retained the ideas of cores, peripheries, boundaries, and potentially intersecting systems, and replaced the contextual vs. operational separation with two spectra. The macro to micro spectrum recognizes relative variations in scope or scale. The reflection–action spectrum draws on learning style frameworks developed by Kolb, McCarthy, and others. This spectrum contextualizes several questions. Is a boundary something to be aware of? Is it pre-existing but consciously blurred, spanned, or strengthened? Is the boundary constructed by the

author? The Janus figure in the center represents the adaptive tensions between macro and micro, and reflective and active elements of understanding.

Emergent patterns in ways of understanding boundaries

Authors whose work I analyzed conceptualized boundaries in several ways, which often spanned disciplines or fields. In this section of the paper I describe what is meant by each of the approaches named below in Table 1: the outcome space. I also include quotes to convey additional diversity as a catalyst for dialogue.

These findings are grouped under two headings: *Why care about boundaries* and *Managing boundaries*.

Resident		
Traveller	Filmmaker	Documentary
		Science fiction
	Healer	
	Competitor	

Table 1 The outcome space, or collective understanding, of boundaries by published authors in sample

These categories are about different ways of understanding, not necessarily about different people. Some authors focused primarily on one approach, some on several. Collectively, they form the “outcome space” for this portion of the

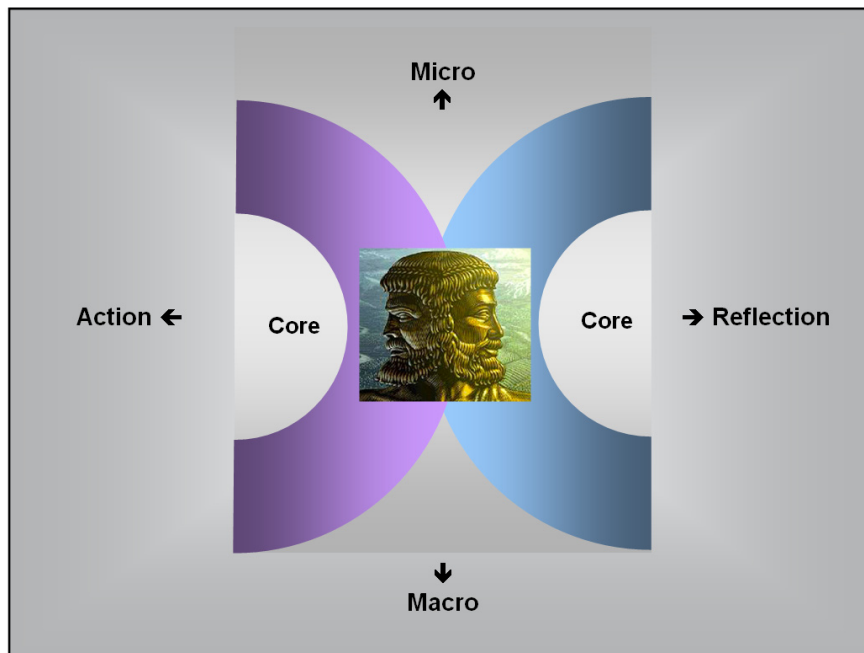


Figure 3

research, as I described in the section about the research methodology.

Why care about boundaries?

The authors wrote about boundaries (explicitly or implicitly) in two different ways, which I have termed the *resident* and the *traveler*. In this section of the paper I describe these two approaches, including the sub-categories of the *traveler*, providing illustrative quotes for each category.

The *resident* cluster was characterized by expert perspectives from the cores of groups (see Figures 1 and 3) and was reasonably homogeneous. The *traveler* cluster, characterized by mobility of various sorts, had more variation, so I named several sub-clusters, as shown in Table 1. Each of these clusters and sub-clusters is described below, with quotes from different disciplines.

A. Provide mathematical and scientific expertise to those applying theory – the *resident*. Boundaries are worthy of attention. The term *resident* is drawn metaphorically from two types of killer whales or orcas off North America's west coast. Resident pods travel fairly predictably in established territories, whereas transient pods travel near shorelines (habitat peripheries and boundaries as shown in Figures 1 and 3). The *resident* concept describes understanding from the expert cores of disciplines. Although some statements were from practitioners

as well as theoreticians, *resident* writing focused on provision of factual information in order to further theory and/or support application. Their focus was on what they saw to be truth, optimal practices, or definitive questions or insights.

Sample resident quotes from a range of disciplines

"Two factors of the Information Age – the inability of most enterprises to offer lifetime employment and the necessity of many to hire 'temporary' outside specialists – converge for new thinking about boundaries." (Kelly & Allison, 1999: 92)

"The Systems Idea... As it is impossible for any analysis to be totally comprehensive, this leads on to a consideration of boundary judgements ... the boundary concept is fundamental: it is the core idea of systems thinking." (Midgley, 2000: 33)

"Images of boundary crossing and cross-fertilization are superseding images of disciplinary depth and compartmentalization." (Klein, 2005: 4)

"Where do services begin and end? What is the doctor's work and responsibility? The nurse's? The patient's or patient's family's? Boundaries are often uncertain, and the cracks between them can be large..." (Harte, 2002: 185)

“On a global scale, national boundaries are over-spread by multinational corporations, transnational criminal organizations, non-governmental organizations and religious authorities and sects... And a third is the set of analytical blinders we unavoidably wear in real life, blinders that make us slice up the universe in manageable pieces and then perceive as chance the intersections of some of those slices.” (Beyerchen, 1997)

“All riparian zones [river edges]...are generally more productive in terms of biomass – plant and animal – than the remainder of the area; and they are a critical source of diversity within the forest ecosystem. Riparian zones frequently have a high number of edges and strata in a comparatively small area. These produce habitat for a greater number of species, reflecting the diversity of plant species and community structure.” (Thomas et al., 1979: 41–42)

“Plants that live at ecological edges are unusual in that their meristems (growth points) are undetermined, possibly making them more resilient. They are capable of responding to changing ecological conditions with different growth types, and sometimes even different growth positions by the use of floating meristems, which may move about.” (Vivienne Wilson, pers. comm., Oct. 2005)

“Exploring the arguments made against and in favour of *lex mercatoria*, Cutler can be read as arguing for the paradoxical re-entry of the dividing lines between state and civil society, public and private, even if and because the two opposing poles cannot be married in a single unifying concept but only together constitute the poles of our orientation.” (Sharma, 1999: 73)

“The parable of the blind men and the elephant is endlessly repeated to illustrate the problem of different and partial points of view.” (Bateson, 1994: 132–133)

“Here, however, is our application of the [edge effect]. Quite often community psychological projects involve working across boundaries. Examples from our work include initiatives spanning the one or more of the following boundaries: ...Health and social welfare services...” (Burton & Kagan, 2000)

The above quotes show how some experts in fields from law to community psychology understand boundaries. These *resident* authors assembled a landscape of rationale in which they or other authors can envision interventions to effect change.

B. Scanning, spanning, interpreting and implementing – the traveler. Boundaries can play a role in change. Like transient orcas, these individuals traveled in the peripheries of their territories (see Figures 1 and 3). They looked outward to see contexts of broader or adjacent systems in ways that could help them to catalyze or effect change. They wrote about potential, often integrating understanding of several fields.

The *traveler* sub-categories are labeled *documentary filmmaker* (which overlapped with *resident*), *science fiction filmmaker*, *healer*, and *competitor*. It is important to note that *healer* perspectives were found in work normally thought of as competitive and vice versa. Descriptions of each of these four ways of understanding follow.

B1. Bridging and interpreting by presenting new lenses on boundaries – the filmmaker. Boundaries were things to be explained, reflected on, and used to rethink previous assumptions. “Filmmakers” worked primarily on the reflection/awareness side of the framework. By definition, they were boundary-spanners in that they interpreted information about boundaries in ways that could inform, provoke, or enable others to effect change. There were two dominant filmmaker “genres.” One was the *documentary filmmaker*, which overlapped with the *resident* category. These authors interpreted factual information that had a past-research and current-findings focus. The other genre was *speculative fiction*, (reminiscent of Asimov or Roddenberry), which had a future focus designed to encourage rethinking of assumptions.

Sample filmmaker quotes from a range of disciplines

“Emphasis on management for diversity in forest ecosystems will help insure the continued existence of the living components of the system – plants as well as animals.” (Thomas et al., 1979: 41–42) – documentary

“An ongoing debate is whether to conserve species or communities. In classifying land units, for example, where do planners draw the line in grouping sites as belonging to the same community?” (Klomp & Green, 1996) – documentary

“Evidence from the treaty negotiations and the failed implementation of the treaty suggest some very significant boundary conditions for the application of rational choice models in the business, politics, and international relations contexts.” (Bottom, 2003: 367) – documentary

“An explicit study of the process and effectiveness of inter-organizational knowledge transfer activities through boundary spanners (such as the appointment, training and support of knowledge workers) might provide generalizable lessons for organizations seeking to develop their capacity in this area.” (Greenhalgh et al., 2004: 29–30) – speculative fiction re healthcare

“We do not know enough about the new sciences to apply them very well yet, but every attempt helps us learn and adapt to the changes with which we must cope.” (Beyerchen, 1997) – speculative fiction

“The contention of this paper is that we are entering a third age in the management of knowledge. Further, that the conceptual changes required for both academics and management are substantial, effectively bounding or restricting over a hundred years of management science in a similar way to the bounding of Newtonian science by the discoveries and conceptual insights of quantum mechanics et al in the middle of the last century.” (Snowden, 2002b: 100) – speculative fiction

B2. ... *protection and repair through boundary management – the healer.* Boundaries can protect or heal. Healers spoke in concrete terms about the action side of the framework. They combined contextual information with examples or they proposed actions that could lead to protection or repair of something they believed to be important and neglected. Sometimes their work had an altruistic tone, or a context of social or environmental justice. The first quote illustrates how ways of understanding can cross the conceptual boundaries that I have drawn, as it illustrates both *healer* and *docu-*

mentary filmmaker perspectives in its description of a legal issue.

Sample healer quotes from a range of disciplines

“A large number of aquifers exist that are intersected by a political boundary and, hence, are transboundary and international in nature. Others are located entirely within the territory of one state but are hydraulically linked to a transboundary river. They could be regarded as “international aquifers” because they are part of an international system. Such a “system approach” would be similar to the Watercourses Convention.” (Ulfstein & Werksman, 2003: 52)

“A child died right outside a Chicago area hospital because his young friends were unable to drag him through the door and the health care providers refused to go out to help him.” (Harte, 2002: 185)

“Now, this dissatisfies the more-ambitious young men. They want to achieve a science which both gives the same exactness of prediction... as you achieve in the physical sciences... If they really created a society, which was guided by the collective will of the group, that would just stop the process of intellectual progress. Because it would stop this utilization of widely dispersed opinion upon which our society rests and which can only exist in this very complex process which you cannot intellectually master.” (Prusak, 2002: 192)

“Perhaps the problem is psychology itself – the rejection of much of the apparatus of individual psychology leaves community psychology rather bereft of theoretical content. Elsewhere we have argued for the use of concepts from non-psychological spheres...” (Burton & Kagan, 2000)

“Churchman (1970) is interested in the concept of improvement, and if a change is to be justifiably called an improvement then reflecting on the boundary of analysis is crucial. What is to be included or excluded is a vital consideration: something that appears to be an improvement given a narrowly defined boundary may not be seen as an improvement at all if the boundaries are pushed out. Essentially, defining the boundaries of improvement is an ethical issue, requiring the exercise of value judgements. For this reason, Churchman argues that as much

information as possible should be 'swept in' to definitions of improvement, allowing the most inclusive, and therefore most ethical, position on improvement to emerge." (Midgley, 2000: 137)

"The planet may be the final test of whether we prefer competition or cooperation, for the earth is a home we share with many species, not an asset to be divided up among the human players alone." (Bateson, 1994: 193)

B3. ...using boundaries to get ahead – the competitor. Boundaries are used to gain advantage over other companies, countries, and so on. Competitors also spoke in concrete terms about the action side of the framework. They combined contextual information with examples or proposed recommendations that could help one entity become more successful than its counterparts. There was overlap with the *healer*, in that some competitors believed there were major flaws in current management approaches.

"That is when I turn to complexity theory for an idea. Think of the organizational context. We have a firm facing an energy differential. It is out of date, it is obsolete, it is not keeping up with the rapidly changing world. It is under a great deal of adaptive tension. You see this with much M&A activity. We buy a small firm in New England. We send in the M.B.A. terrorists, we get rid of the management, we change the culture, we change the accounting system, we change the information systems. And right away, we create a lot of chaos. If we don't do all of that, if we merely passively buy the firm and hope for the best, this little firm stays the way it is and not much good happens." (McKelvey, 2002: 86)

"An understanding of the porousness of the boundaries between politics and war can be a real weapon against those who envision those boundaries to be impermeable." (Beyerchen, 1997)

Managing boundaries

In the section above on the importance of boundaries, *residents* assembled a landscape, and *travelers* provided some compass bearings. This section focuses on concrete, active boundary-related leadership and management. The quotes below are from the three outcome space *traveler* categories described above: *filmmaker*, *healer*, and *competitor*.

The authors brought expertise from complexity theory, the military, business, informal adult education, healthcare, and several other fields.

Filmmaker quotes maintain an observer stance and interpretive style. The first refers to the Cynefin sensemaking framework developed by David Snowden, which helps practitioners think about the nature of their work (e.g., predictable vs. complex).

"Some groups consider only the five [Cynefin] domains and what sorts of situations or problems can be found there... some talk about boundary transitions, boundary sensing, and boundary management; some talk about dynamics ranging over the whole framework space." (Kurtz & Snowden, 2003: 471)

"This study also suggests that where possible educators should create online maps with features located near an edge or border to enhance the recall of feature-related facts." (Crooks et al., 2001)

"Individual brains may work in relative isolation, or they may be appropriately networked to create social capital..." (McKelvey, 2002: 87)

"Crossing boundaries between practices exposes our experience to different forms of engagement, different enterprises with different definitions of what matters, and different repertoires – where even elements that have the same form (e.g., the same words or artifacts) belong to different histories. By creating a tension between experience and competence, crossing boundaries is a process by which learning is potentially enhanced, and potentially impaired." (Wenger, 1998: 140)

"Every war involves inherent nonlinearities that pose problems for prediction, and Clausewitz talks about three broad categories of nonlinear factors that make for unpredictability in war... His attention is always drawn to where boundaries are complex rather than simple." (Beyerchen, 1997)

"Tushman (1977) documented and explored the nature of special boundary roles... he offered some practical suggestions..."

- *Managers should be sensitive to the impact of task characteristics on boundary roles; different*

task areas may require boundary roles with particular backgrounds and characteristics. The notion of boundary spanning is of course linked to that of knowledge management and knowledge manipulation..." (Greenhalgh et al., 2004: 189)

"Mr. Huckman says the results suggest that the surgeon's interactions with anesthesiologists, nurses and technicians are crucial to the outcome of the surgery." (Thurm, 2005)

"Community development involves creating and managing opportunities for connection and communication across sectoral, identity and geographical boundaries. This is termed meta-networking and is a core function of the professional role." (Gilchrist, 2000: 264).

"Through a process of theoretical coding, five themes affecting cross-boundary cooperation were identified: land tenure, power, ideology, uncertainty, and trust. These themes illuminate the complexity involved in cross-boundary cooperation." (Bergmann & Bliss, 2004: 377)

"It is cultural knowledge, acquired, exchanged, and passed on across cultural edges and temporally down through generations, that has provided people with an understanding of the importance of ecological edges and has allowed them not only to take full advantage of ecological edges but also to create and extend ecological edges for their own benefit." (Turner et al., 2003: 457)

"Halfway through the talk, there was an absolute, living bond between myself and the audience, as if there were no speaker and no listener and the words were simply being created at the unknown frontier between listening and speaking. I looked out and knew this was the edge at which I wanted to live." (Whyte, 2002: 149)

Healers focused on repair, often in systems built with mechanistic or reductionist principles. The *healer* approach to boundary management links with views on the importance of boundaries. The short quotes below do not always illustrate the concrete, applied nature of the writing. For example, the first quote by Kelly and Allison draws on findings from their work with Citibank.

"Each boundary will, by necessity, be binding, yet elastic, simultaneously a buffer and a conduit, requiring a far different supporting infrastructure than we've had in the past." (Kelly & Allison, 1999: 92)

"The fourth message is that to address organizational learning there is a need for boundary-crossing and interdisciplinary partnerships between the vocational education and training and human resource development communities." (Nyhan et al., 2004: 67)

"We need to associate complexity with simplicity and complicated approaches with simplistic. In dealing with a complex system, we need to draw boundaries and construct simple interventions that result in complex activity." (Snowden, 2002a: 171)

"The tensions between process and practice, if left unbalanced, can slowly kill a company, whether at the hands of process or of practice... experimental 'sandboxes' implicitly recognize the way process can stifle creativity, and they attempt to provide a safe environment for knowledge creation." (Seely Brown, 2002: 150)

"By overlooking issues of boundary, schemes for classifying knowledge into types often place too much emphasis on individual cognition and thus on solution to problems that do not take advantage of the landscape of practices." (Wenger, 1998: 139)

"The emerging sciences suggest that war is a radically different type of phenomenon – with a different operating dynamic – than typically understood in the American military. While radically different than commonly understood, war may have much in common with other types of nonlinear dynamical systems such as, as Clausewitz suggested, commerce. If war is a dramatically different type of phenomenon than commonly understood, then the implications for the way we perform command and control may be – should be – nothing short of profound. As we learn more about the behavior of complex systems, we will likely come to view command and control in fundamentally different terms." (Schmitt, 1997)

"Managers should actively encourage the development of boundary roles (by recognizing and rewarding boundary-spanning activity; by easing access to external information and professional literature; and

by facilitating extensive communication networks through job assignments)." (Greenhalgh et al., 2004: 189)

"The characteristic way that new solutions to social problems emerge, Mann maintains, is neither through revolution nor reform. Rather, new solutions develop in what he calls interstitial locations – nooks and crannies in and around the dominant institutions." (Brecher, et al., 2000: 24)

"Where covering materials are used, a patchy application can be very beneficial with respect to native plant colonization... the deliberate use of this edge effect is more likely to set in motion the developmental trajectory that is a core principle of ecological restoration...than the homogeneous cover often employed." (Winterhalder, 2003: 1)

"Further, since much of the original Gitga'at knowledge was embedded within the Sm'algayax language, the traditional understandings and practices have been eroded as this language was replaced by English." (Turner et al., in press)

"Community development involves human horticulture rather than social engineering...Links which cross system boundaries permit the import of new ideas and comparisons between different perspectives." (Gilchrist, 2000: 269)

"We started from an analysis of the actors' usual issue frames, pointing out their differences in selecting aspects, connecting them and drawing boundaries around the issues." (Dewulf et al., 2004: 177)

"As migration and travel increase, we are going to have to become more self-conscious and articulate about differences, and to find acceptable ways of talking about the insights gained through such friction-producing situations, gathering up the harvest of learning along the way." (Bateson, 1994: 23)

"The analysis...from the process of extending work's conceptual boundaries, has highlighted the central role that marginalized forms of labour can play in people's work histories and shown how unpaid labour outside the family can be central to, or even constitute, a career." (Taylor, 2004: 45)

"Uprootedness is an occupational hazard of brokering. Because communities of practice focus on their own enterprise, boundaries can lack the kind of negotiated understanding found at the core of practices about what constitutes competence. That makes it difficult to recognize or assess the value of brokering." (Wenger, 1998: 110)

Competitor quotes focus on improvement in the sense of fitness, prosperity and/or competitive advantage:

"...build commitment across stakeholder boundaries; institute open learning for everyone; and do business on the basis of synergy and collaboration to maximize customer satisfaction." (Fortune & Petzinger, 1999: 66)

"But to create growth you will want to pull this community apart, allowing people to develop particular facets of the community's insights... As soon as this happens, coordination, which is almost implicit within such groups, becomes an explicit headache. Boundaries, almost invisible within communities, become a major source of concern between them." (Seely Brown, 2002: 149)

"...hybrid vigor is a valuable metaphor for exploring the organizational collaborations that online learning enables. Just as the genetic diversity of two blended populations can increase the vigor of a species, we propose that diversity and synergies resulting from collaborations such as ours can enrich learning environments and increase the adaptability of our educational offerings." (MacGillivray & Smith, 2004)

"These changes call for a greater interdisciplinary approach and integration in teaching and research to mirror the practice of competitive strategy, which recognizes the importance of both an external focus rooted in market orientation and an internal focus on unique firm resources and capabilities." (Sharma, 1999: 73)

"Not only are flexibility and imagination required for attaining one's ends in a complex system. The ends themselves will often be shifting and/or unclear. In some cases it may be desirable to fragment competing parties ("divide and conquer" – e.g., the British

role in India); in other cases to consolidate them (create alliances or nations – e.g., the creation of Yugoslavia).” (Saperstein, 1997)

“How should boundaries change? Many patients were found to need fewer post-operative visits than had been customary in the practice. This allowed patients to leave the clinic’s boundary sooner, freeing up appointment times. Physicians stayed within the clinic service boundaries on days that were blocked for surgery, but no surgeries were scheduled, thus being able to see patients the same day as requested. Both of these boundary changes increased capacity.” (Harte, 2002: 186–187)

“Recognise ‘edge species’ and encourage them (e.g. a community activist develops skills and credibility in mediating between her ethnic minority community and the police).” (Burton & Kagan, 2000)

“We would like to propose that social groups living on ecological edges, or those who are able to significantly expand and elaborate such edges through anthropogenic processes and cultural edges, are more likely to be flexible and resilient than those situated within more homogeneous environments, or those with access to more limited environments.” (Turner *et al.*, 2003: 456)

“Becoming a community of practice in its own right is a risk of boundary practices that may thwart their roles in creating connections - but this risk is also their potential. Many long-lived communities of practice have their origin in an attempt to bring two practices together. New scientific disciplines, for instance, are often born of the interaction of established ones... sociolinguistics, biochemistry...” (Wenger, 1998: 115)

The quotes above show ways in which published authors understood boundaries as having value for management and leadership. Their approaches were situated in many different parts of the model. For example, Wenger’s quote about the occupational hazards of brokering relates to coping with pre-existing boundaries, whereas Winterhalder’s quote about planting disturbed natural areas with a “patchy application” is a deliberate creation of boundaries.

Conclusions: Part I

For decades, boundaries have been an important topic in disciplines such as ecology, and the emergence of new sciences and economies is catalyzing awareness of their importance. Midgley states that he considers the concept of *boundary* to be central to systems thinking. This study distilled findings from different disciplines into a schema to show several transdisciplinary ways of conceptualizing boundaries. These are grouped in two main categories termed *resident* and *traveler*; the latter has several sub-categories. I used phenomenographic inquiry, under the umbrella of action research, to present these variations. The purpose of this work was to help organizational practice inform complexity theory, just as complexity theory informs practice. I also hope that readers will be inspired to think about the importance of work with boundaries in their practices.

The authors I studied were often motivated to work with boundaries because of resource issues: to increase the diversity of available resources, for example. Because this was an interdisciplinary study, these resources ranged from tangible business assets through personal learning to biodiversity. These authors usually saw boundaries as problematic if there were [perceived] restrictions to working near or across them. The scale of focus ranged from micro: “In psychology, for example... [f]ragmentation is considered a direct threat to the ‘self’, to our sense of who we are” (Lissack, 2002: 4), to macro: “The argument of this book is that people can indeed exercise power over globalization, but only by means of a solidarity that crosses the boundaries of nations, identities, and narrow interests” (Brecher *et al.*, 2000: x). This work suggests that boundaries and related concepts are very important in systems thinking, complexity theory, and for practical application. It also suggests that further collaborative exploration of theory and practice could yield valuable results.

References

- Bateson, M. C. (1994). *Peripheral Visions: Learning Along the Way* New York, NY: HarperCollins, ISBN 0060168595.
- Bentz, V. M. and Shapiro, J. J. (1998). *Mindful Inquiry in Social Research*, Thousand Oaks: Sage, ISBN 0761904093.
- Bergmann, S. and Bliss, J. (2004). “Foundations of cross-boundary cooperation: Resource management at the

- public-private interface," *Society & Natural Resources*, ISSN 0894-1920, 17: 377-393.
- Beyerchen, A. D. (1997). "Clausewitz, nonlinearity, and the importance of imagery," in D. S. Alberts and T. J. Czerwinski (eds.), *Complexity, Global Politics, and National Security*, Washington DC: National Defense University, ISBN 1579060463, pp. 153-170.
- Bottom, W. P. (2003). "Keynes' attack on the Versailles treaty: An early investigation of the consequences of bounded rationality, framing, and cognitive illusions," *International Negotiation*, ISSN 1382-340X, 8: 367-402.
- Bowden, J. A. and Walsh, E. (2000). "Phenomenography," in J. A. Bowden (ed.), *Qualitative Research Methods* Melbourne: RMIT University Press, ISBN 0864590199, pp. 154.
- Brecher, J., Costello, T. and Smith, B. (2000). *Globalization from Below: The Power of Solidarity*, Cambridge, MA: South End Press, ISBN 0896086232.
- Burton, M. and Kagan, C. (2000). "Edge effects, resource utilisation and community psychology," *European Community Psychology Conference*, Bergen, Norway, pp. 7.
- Crooks, S. M., Verdi, M. P. and White, D. (2001). "Effects of fact and feature location on learning from online maps," *AERA Seattle*, Washington.
- Dewulf, A., Craps, M. and Dercon, G. (2004). "How issues get framed and reframed when different communities meet: A multi-level analysis of a collaborative soil conservation initiative in the Ecuadorian Andes," *Journal of Community & Applied Social Psychology*, ISSN 1099-1298, 14 (May 7, 2004): 177-192
- Fitzgerald, D., Lichtenstein, B. M. B. and Black, J. A. (1999). "Leadership and the new science/A simpler way (book review)," *Emergence*, ISSN 1521-3250, 1(2): 78-89.
- Fortune, P. and Petzinger, T. J. (1999). "The complexity advantage (book review)," *Emergence*, ISSN 1521-3250, 1(2): 62-70.
- Gilchrist, A. (2000). "The well-connected community: networking to the edge of chaos," *Community Development Journal*, ISSN 0010-3802, 35: 264-275.
- Goldstein, J. A. (2002). "Complexity and management: An expanding traveling wave" in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 253-265.
- Greenhalgh, T., Robert, G., Bate, P., Kyriakidou, O., Macfarlane, F. and Peacock, R. (2004). "How to spread good ideas: A systematic review of the literature on diffusion, dissemination and sustainability of innovations in health service delivery and organization," London: National Co-ordinating Centre for NHS Service Delivery and Organization R & D (NCCSDO), pp. 424.
- Harte, H. (2002). "Improving health care quality from the view of adaptive systems," in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 183-187.
- Kelly, S. and Allison, M. A. (1999). *The Complexity Advantage: How the Science of Complexity Can Help Your Business Achieve Peak Performance*, New York, NY: McGraw-Hill Companies, ISBN 0070014000.
- Klein, J. T. (2005). "Interdisciplinarity and complexity: an evolving relationship," in K. A. Richardson, J. A. Goldstein, P. M. Allen and D. Snowden (eds.), *Emergence, Complexity and Organization: E:CO Annual Volume 6*, Mansfield, MA: ISCE Publishing, ISBN 0976681404, pp. 3-11.
- Klomp, N. I. and Green, D. G. (1996). "Complexity and connectivity in ecosystems," *Complexity International*, ISSN 1320-0682, 3(April).
- Kurtz, C. F. and Snowden, D. (2003). "The new dynamics of strategy: Sense-making in a complex and complicated world," *IBM Systems Journal*, ISSN 0018-8670, 42: 462-483.
- Larsson, J., Holmström, I. and Rosenqvist, U. (2003). "Professional artist, good Samaritan, servant and coordinator: Four ways of understanding the anaesthetist's work," *Acta Anaesthesiologica Scandinavica*, ISSN 0001-5172, 47: 1-7.
- Lissack, M. (2002). "Complexity, management, coherence, and understanding," in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 4-12.
- MacGillivray, A. and Smith, J. D. (2004). "Genetic diversity as inspiration for instructional design," *AACE E-Learn*, Washington DC, pp. 6.
- Maguire, S. (2002). "Complexity and management: Where do we stand?" in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 203-240.
- Maguire, S. and McKelvey, B. (1999). "Complexity and management: Moving from fad to firm foundations," *Emergence*, ISSN 1521-3250, 1: 19-61.
- McKelvey, B. (2002). "Complexity and leadership," in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 85-90.
- Midgley, G. (2000). *Systemic Intervention: Philosophy, Methodology and Practice*, New York, NY: Kluwer Academic/Plenum Publishers, ISBN 030646488.
- Nyhan, B., Cressey, P., Tomassini, M., Kelleher, M. and Poell, R. (2004). "European perspectives on the learning organisation," *Journal of European Industrial Training*, ISSN 0309-0590, 28: 67-92.
- Petzinger, T. J. (2002). "Reality and complexity," in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 241-246.
- Prusak, L. (2002). "An action theory of complexity," in

- M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 189-199.
- Saperstein, A. M. (1997). "Complexity, chaos, and national security policy: Metaphors or tools?" in D. S. Alberts and T. J. Czerwinski (eds.), *Complexity, Global Politics, and National Security*, Washington DC: National Defense University, ISBN 1579060463, pp. 101-133.
- Schmitt, J. F. (1997). "Command and (out of) control: The military implications of complexity theory," in D. S. Alberts and T. J. Czerwinski (eds.), *Complexity, Global Politics, and National Security*, Washington DC: National Defense University, ISBN 1579060463, pp. 219-246.
- Seely Brown, J. (2002). "Complexity and innovation," in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 145-154.
- Sharma, S. (1999). "Trespass or symbiosis? Dissolving the boundaries between strategic marketing and strategic management," *Journal of Strategic Marketing*, ISSN 1466-4488, 7(June): 73-88.
- Snowden, D. (2002a). "From organic to complex knowledge management through the use of story," in M. Lissack (ed.), *The Interaction of Complexity and Management*, Westport, CT: Quorum Books, ISBN 1567204279, pp. 159-172.
- Snowden, D. (2002b). "Complex acts of knowing: Paradox and descriptive self-awareness," *Journal of Knowledge Management*, ISSN 1367-3270, 6(May): 100-111
- Taylor, R. F. (2004). "Extending conceptual boundaries: work, voluntary work and employment," *Work, Employment & Society*, ISSN 0950-0170, 18(March): 29-49.
- Thomas, J. W., Maser, C. and Rodiek, J. E. (1979). "Riparian zones," in J. W. Thomas (ed.), *Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington*, Washington, DC: US Government Printing Office, pp. 40-47.
- Thurm, S. (2005). "Teambuilding has more benefits than promoting solo 'stars,'" *The Wall Street Journal Online* New York, ISSN 1815-8463.
- Turner, N. J., Davidson-Hunt, I. J. and O'Flaherty, M. (2003). "Living on the edge: Ecological and cultural edges as sources of diversity for social-ecological resilience," *Human Ecology*, ISSN 0300-7839, 31(September): 439-461.
- Turner, N. J., Marshall, A., Thompson (Edosdi), J. C., Hood, R. J., Hill, C. and Hill, E.-A. (in press). "Ebb and flow: Transmitting environmental knowledge in a contemporary Aboriginal community," in B. Neis and J. Lutz (eds.), *How Knowledge Moves*: Queens University Press.
- Ulfstein, G. and Werksman, J. (eds.) (2003). *Yearbook of International Environmental Law*, Oxford, England: Oxford University Press, ISBN 0199264154 (2004), pp. 45-80.
- Wenger, E. (1998). *Communities of Practice: Learning, meaning, and Identity*, Cambridge, England: Cambridge University Press, ISBN 0521430178.
- Whyte, D. (2002). *Crossing the Unknown Sea: Work as a Pilgrimage of Identity*, New York, NY: Riverhead Books, ISBN 1573221783.
- Winterhalder, K. (2003). "From reclamation to restoration: Using the edge effect to enhance native woody colonization on mining-impacted land in Northern Ontario," *SER Ontario News: Society for Ecological Restoration*, pp. 1-2.

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- MacGillivray, A. (2002). "Educating for competence," *Financial Management Institute Journal*, 14(1): 7-10.
- MacGillivray, A. (2000). "Using business intelligence tools to facilitate front line priority-setting in a public sector organization," Victoria: Royal Roads University thesis.

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