

# **A Maturing of Systems Thinking? Evidence from Three Perspectives<sup>1</sup>**

**John Barton,<sup>2</sup> Merrelyn Emery,<sup>3</sup> Robert Louis Flood,<sup>4</sup>  
John W. Selsky,<sup>5,7</sup> and Eric Wolstenholme<sup>6</sup>**

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This paper reviews trends in systems theory/thinking from the 1970s to the early 2000s. It proposes a maturation of the field based on certain conceptual and methodological advances that have sought to liberate systems thinking from earlier strictures. An edited dialogue among three prominent systems thinkers from different systems “schools”—Merrelyn Emery, Bob Flood, and Eric Wolstenholme—provides evidence. Similarities and differences are identified, complementarities among the schools are derived and analyzed, and trajectories for future research are indicated.

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**KEY WORDS:** systems thinking; open systems theory; critical systems thinking; system dynamics; systems schools.

## **1. INTRODUCTION**

During the 1990s the field of systems thinking experienced a surge of interest among academics, practitioners, and consultants in several disciplines. This surge could be associated clearly with some trends and fashions in management practice. For instance, heightened competitive stakes in the corporate sector stimulated interest in learning and high-involvement human-resource policies, self-managing and cross-functional teams, total quality programs, and managing integrated processes.

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<sup>1</sup>Authors are listed alphabetically to reflect equal, although different, contributions to this project. An extended dialogue among Emery, Flood, and Wolstenholme provided the evidential base for this paper. Barton and Selsky edited and “bookended” this dialogue with help from the others.

<sup>2</sup>Marshall Place Associates Pty. Ltd., Melbourne, Australia.

<sup>3</sup>Fred Emery Institute, Melbourne, and Australian National University, Canberra, Australia.

<sup>4</sup>Maastricht School of Management, Maastricht, The Netherlands.

<sup>5</sup>Department of Management, University of Melbourne, Australia.

<sup>6</sup>Leeds Business School and OLM Group Consultants, United Kingdom.

<sup>7</sup>To whom correspondence should be addressed at Department of Management, University of Melbourne, Parkville, Victoria 3010, Australia. Fax: +61-3-9349-4293. email: jwselsky@unimelb.edu.au.

However, in academic social science, postmodernism, complexity theory, neoliberalism, and other trends continued the fundamental questioning of the nature, role, and method of the social sciences which began some decades earlier. In one sense, systems thinking and theory has been central to this questioning, because for over 50 years it has offered a major alternative to the reductionistic and disciplines-bound mainstream in social science. However, its recent attempts to shake off its near-capture by the structural-functionalism of the 1960s and 1970s have been both mixed and underappreciated. The result in the early 2000s is a disturbing lack of recognition of recent advances in systems thinking by researchers in organization studies and other social sciences.

The purposes of this paper are: (1) To examine where systems thinking is positioned at the current time and where it is heading in the next decade. Where is the common ground among the different systems schools, and where are the faultlines? Are the schools converging or diverging, or both? (2) To illustrate the strides that systems thinking has taken since the 1970s. Certain conceptual and methodological advances have sought to liberate systems thinking from earlier strictures. We assess these efforts and point to prospects for systems thinking in the social science paradigm wars.

These issues are important for both academic and pragmatic reasons. The number of systems schools has proliferated in the past 20 years. Without ongoing communication schisms may erupt, and systems researchers and the wider intellectual community of social scientists may lose touch with each other entirely. Moreover, the need to face up to the systemic problems besetting many societies, such as environmental degradation and the dysfunctions of economic globalization, is growing more urgent. The need to inform practice with systems solutions is all the more acute in the face of a torrent of *nonsystemic* advice and prescription.

The paper opens with a brief history of developments in systems thinking since the 1970s. This clearly shows movement away from structural-functionalism and social engineering toward appreciations of complexity, local emergence, and democratic values. Next, we recount a discussion among three prominent systems theorists-practitioners which illustrates several important themes in contemporary systems thinking. Eric Wolstenholme, Bob Flood, and Merrelyn Emery—each representing a different field of systems thinking—were invited to Monash University, Melbourne, Australia, to participate in a roundtable discussion of systems thinking moderated by John Barton and John Selsky from the university. The session was videotaped, and edited selections of the transcript comprise the middle part of the paper. The intention was not to achieve any convergence in the participants' views, let alone a grand, unified statement to guide future developments. Instead we hoped to initiate reflection on the state of systems thinking at the beginning of the 21st century through a dialogic exploration of similarities, differences, assumptions, methods, and trajectories. This would enable us to push systems thinking forward

by raising consciousness among the members of the systems schools and among those outside the systems community. In the last section we comment on the differences and similarities which emerged from the roundtable discussion, review our claim of a maturing of systems thinking, and reflect on the relevance of systems thinking vis-à-vis pressing social issues.

## 2. SYSTEMS THINKING: A MATURING?

A core premise of systems thinking around 1970 was that “[s]ystems are made up of sets of components that work together for the overall objective of the whole. The systems approach is simply a way of thinking about these total systems and their components” (Churchman, 1968, p. 11). Such a characterization reflected the structural-functional models prevailing in social science at the time, and was consistent with Parson’s (1949, in Martindale, 1960, p. 484) “functional prerequisites” for social systems, namely, order and motivation: “The system can only function if a sufficient proportion of its members perform the essential social roles with an adequate degree of effectiveness.” It also emphasized the “thing-ness,” or objective ontological nature, of systems. (See Shenhav [1995] for a lucid analysis of the engineering origins of systems theory in organization studies.)

A special-issue retrospective on general systems theory (GST) in the *Academy of Management Journal* in 1972 captured the broader meanings—both positive and critical—given to systems thinking around that time. von Bertalanffy’s (1972) brief sketch of the origins of systems theory noted holistic and teleological properties: “Aristotle’s statement that “the whole is more than the sum of its parts,” is a definition of the basic system problem which is still valid” (p. 407). von Bertalanffy argued that while the teleological strand in Aristotle’s philosophy was “replaced” in the scientific revolution in western science, “the problems contained in it, such as order and goal directedness of living systems, were negated and by-passed rather than shelved.” To reclaim that basic problem, von Bertalanffy said we must know both the “ensemble of the components and the relation between them”—a situation that “normal science, in the sense of Kuhn, was little adapted to deal with” (p. 407). Moreover, as a biologist he was “. . . interested in developing a theory of “open systems,” that is, systems exchanging matter with their environments” (p. 412). Even at this early point, the appropriation of an organic metaphor for systems thinking was problematic. Fred Emery had already challenged biological interpretations of open systems when applied to human systems, because the latter exhibit conscious choice and do not respond blindly to functional imperatives (F. Emery, 1969; see also Burrell and Morgan, 1979, p. 220). This challenge became an important advance by the 1990s, as discussed below.

The other authors in the 1972 *AMJ* special issue were more critical of the whole systems project. Peery (1972) lodged the most incisive criticisms by

attempting to show:

1. That many concepts comprising GST constitute nonrefutable hypotheses;
2. That GST has the same basic tenets as structural functionalism and is accordingly subject to the same criticisms as the functionalist school in sociology, including
3. An ideological bias toward order, stability and system maintenance.

These critiques had some validity at the time. Regarding the first critique, Lilienfeld (1978) attacked “. . . the claims made by the systems thinkers to have insights into humanity and society that are not granted to others,” suggesting that they were “without substance. . . . The constantly recurring refrain of systems thinkers is that of a great new era dawning to replace the present malaise” (p. 3). Regarding the second critique, Burrell and Morgan (1979) relegated systems theory to their conventional (and dominant) “functionalist sociology” quadrant of organization theory. Regarding the third critique, Lilienfeld (1978), by relating the rise of systems thinking to the rise of “new science” and technological elites, articulated a social engineering subtext in systems thinking. He criticized the systems scientist as a “scientific king”:

The man who offers an image of society as a closed system (i.e., able to be encompassed and manipulated by logically closed theoretical models) and who on the basis of technical work and discovery on such systems demonstrates expertise in these matters is clearly offering to assume benevolent control of society as a closed system, which he will manipulate from a position outside of and superior to that system. (p. 3)

More broadly, critical theorists have long alleged that systems thinkers are insensitive to issues of power and hold to unitarist and managerialist assumptions.

By the mid 1980s there was a sense that systems thinking had been passed by. For instance, in a review article in the *Academy of Management Review*, Ashmos and Huber (1987, p. 608) noted that “the systems paradigm has gone out of fashion among organization researchers,” in favor of trends such as population ecology and transaction-cost approaches to design and strategy.

Ironically, many developments were occurring within systems thinking which would vitiate these critiques. First, a number of different approaches, or “schools,” were developing (see Lane and Jackson, 1995; Flood, 1996).<sup>8</sup> Thus it became increasingly inaccurate to critique systems thinking as a whole. Professionally, systems thinkers—often within their own schools rather than across them—were publishing their own journals, organizing their own societies and conferences, and

<sup>8</sup>In addition to the three schools represented in the roundtable discussion, other major systems schools include Soft Systems Methodology (SSM), Viable Systems Method (VSM), interactive planning, complex adaptive systems, and autopoietic systems. There is also a group of derivative “multiple” or “complementarist” systems approaches (e.g., Flood’s [1999a] “four windows”; Kaplan and Norton’s [1996] balanced scorecard might also be included).

operating in their own networks. Then, in 1990, Peter Senge's *The Fifth Discipline* broke out of the systems "ghetto" and into the mainstream by tapping into general concerns about learning and adaptation among organization theorists, social psychologists, managers, and consultants. Senge's book rekindled some interest in systems thinking among those groups, but some were inclined merely to dust off the object they had left on the shelf 10 or 20 years earlier.

By the 1990s the prevailing thinking within the systems community had shifted considerably from Churchman's notions and were more aligned with Senge's (1990, p. 7) definition: "Systems thinking is a conceptual framework, a body of knowledge and tools that has been developed over the past fifty years, to make the full patterns [of interconnections of elements associated with an event conceived as a whole] clearer, and to help us see how to change them effectively." In contrast to Churchman's earlier characterization, this definition emphasized the epistemological and emergent aspects of systems. The different systems schools produced many variations on these themes, and three of them are discussed in the roundtable forum below.

Because of this maturation in conceptualizing systems, the critiques of Peery and Lilienfeld could be at least partially refuted. This is not the occasion to do so in detail, but the contours of the arguments are as follows.

**Nonrefutable hypotheses.** The first criticism can surely be applied to the semiotic and cultural bases of *any* structure of thought. As the postmodernists argue, this makes all truth statements problematic. At various points in the roundtable discussion below, the participants are seen to be no more and no less guilty than other knowledge producers of asserting nonrefutable claims.

**Structural-functionalism.** The structural-functional criticism was driven by implications of the biological metaphors used during the 1960s–1970s, such as functional imperatives and survival (Burrell and Morgan, 1979, pp. 159–160). The criticism was fueled by the confusion created by Talcott Parsons' use of the term *social systems theory* when describing his functionalist position. Attempts to apply "hard" systems approaches such as engineering and operations research to "soft" social phenomena (see Ackoff, 1979; Checkland, 1981) compounded this confusion. Undoubtedly, much of systems thinking was captured by the structural-functional zeitgeist of the 1960s–1970s in the social sciences. One unfortunate result was the conflation of open systems notions with organic biological analogies (Burrell and Morgan, 1979, p. 220). However, many important developments in systems thinking since then have attempted to resituate the systems project, as seen in the roundtable discussion below.

**Bias toward order and system maintenance.** Recent developments in complexity theory and complex adaptive systems have directed the interest of social scientists toward nonlinear behavior, emergence, and system states that are far from equilibrium (Stacey, 2000). These concepts have been important in the development of several systems schools, such as Senge's (1990) introduction of

a learning dimension to System Dynamics, Checkland's (1981; Checkland and Scholes, 1990) method for understanding "soft systems," and Flood's (1999b) argument that complexity creates only very local "knowability." Nonlinear behavior and emergence also underpin the concepts of turbulence and coevolution in Emery's Open Systems Theory (see F. Emery, 1977/1998; M. Emery, 1999). In addition, the social engineering criticism can be partially refuted. First, most problem-solving strands of systems thinking now emphasize learning and see the process and its effect on participants as more important than specific outcomes (e.g., Vennix' [1996] approach to group model building in system dynamics). Second, many systems thinkers practice participative forms of research (e.g., action research) and engage with client systems in collaborative ways that strive for equal partnership (see Emery and Emery, 1997) or at least attempt to provide conditions for it (Chisholm and Elden, 1993). However, other forms of what gets called participative research and action learning may be subject to researcher manipulation.

Regrettably, there has been little recognition of these developments outside the systems community. Here are three examples. (1) In a retrospective account of organization theory in the *Handbook of Organization Studies*, Reed (1996) continues the tradition of associating systems theory with structural functionalism by identifying a "functionalist/systems orthodoxy" in organization studies (p. 38). (2) In his award-winning *Organizations Evolving* (1999), Howard Aldrich's only direct reference to systems approaches is a brief and misinterpreted reference to Emery and Trist's (1965) classic article on the causal textures of the environment. (3) In Peter Clark's (2000) intelligent discussion of organization theory, he asserts that "systems theories are the heartland of orthodox and much current organization theory" (p. 59). Many contemporary systems thinkers would blanch at this because much of that orthodox theory, such as transaction-cost and neo-Weberian control approaches, is patently nonsystemic (see also Ashmos and Huber, 1987, p. 610).

Fortunately there are exceptions. Luhmann (1995) asserts that "[s]ystems theory is a particularly impressive supertheory. Disputed though it may be, one cannot deny it a certain process of maturation" (p. 5). Looking back over 100 years, Luhmann identifies two fundamental changes in systems theory. The first was "to replace the traditional difference between *whole* and *part* with that between *system* and *environment*" (p. 6). The second was to embrace the notion of self-organization in terms of the "*theory of self-referential systems*" (p. 8; emphases in original). Luhmann sees the first development as addressing certain problems associated with the concept of wholeness when applied to social systems; an exploration of this argument is beyond the scope of this paper. The second development "maintains that systems can differentiate only by self-reference" (p. 9) and to do this they require reference to a system within environment. Essentially, "[o]ne can now distinguish the system/environment difference as seen from the perspective of an observer (e.g., that of a scientist) from the system/environment difference as it is

used within the system itself, the observer, in turn, being conceivable himself only as a self-referential system” (p. 9).<sup>9</sup>

Thus Luhmann (1995) sees a maturing in the way that systems theory interrogates the basic system problem posed by von Bertalanffy above, and the implications are profound. That maturation represents a shift from “an interest in design and control to an interest in autonomy and environmental sensitivity, from planning to evolution, from structural stability to dynamic stability” (p. 9). Moreover, Luhmann’s two major changes provide a tool for prying apart organic metaphors from notions of open systems. We return to these issues in Section 4.

Each of the participants in the roundtable forum has played a significant role in the evolution of systems thinking during the past twenty years. **Eric Wolstenholme** has been a leader in stressing the importance of incorporating learning structures in the application of system dynamics method. He has also championed the development of “soft systems dynamics” and the application of system dynamics to the management of value. **Bob Flood** has pioneered the application of critical and ethical thinking within the systems project, particularly in terms of using various systems approaches in a complementary fashion. His “four windows” approach—thinking about systems from the perspectives of process, structure, meaning, and knowledge/power, combined with an emphasis on applying the principles of action learning (Flood, 1999a)—claims to provide a coherent set of practical tools for planning and management. It also aligns with multiperspectival approaches which are now popular in organization studies (Morgan, 1997; Clark, 2000). **Merrelyn Emery** is a major contributor to the theory and application of OST. She sees developments in this field as part of an ongoing struggle to break out of the strictures of what Pepper (1942) describes as mechanistic and organicist world hypotheses, and to establish systems theory within a contextualist worldview. These contributions are indicated in the roundtable discussion in Section 3 and in the review section which follows it.

### 3. A SYSTEMS THINKING ROUNDTABLE<sup>10</sup>

We present the roundtable forum in six segments. First, the participants declare their basic positions, then explore the interplay of the social and the technical aspects of systems design. It is here that the capacity of people to cope with the systems and the environments that they are involved with begins to emerge as a major theme. This theme persists when Flood reflects on how do we know our

<sup>9</sup>Bausch (1997) summarizes Luhmann’s argument and his debate with Habermas over systems theory.

<sup>10</sup>The dialogue segments in this section were extracted from a verbatim transcript and then edited by the five authors. To improve conceptual value, accuracy, and readability, references and minor comments were added in the editing process.

local world in the face of appalling complexity and uncertainty. Differences between Emery's phenomenological stance (systems exist in the real world) and Flood's constructivist stance (we construct systems from the unordered stimuli of the world) lead the participants to meander in Plato's cave regarding their mental models of systems. Wolstenholme then points the discussion toward practical system tools and methodology, which draws out views about modes of reasoning in scientific method. The discussion concludes with speculations about the future of systems thinking, including the role of educational institutions in the early 21st century.

### 3.1. Basic Positions

*Eric Wolstenholme (EW):* The premise underlying my current thinking of what I do is concerned with accepting that the world is a self-organizing, adaptive system. However, we are a long way from people recognizing and understanding such a position, as demonstrated by some of the things that we still teach in management, such as equilibrium analysis and the way we teach things in very tightly defined and independent disciplines. It is important that we recognize that transition now is the norm, that equilibrium is *not* the norm, and that whatever we do in the world is connected to everything else and hence there will always be a reaction to any action. For instance, dominant strategies cannot remain dominant, they will quickly be overtaken by competitive responses.

Such a worldview is intuitively sound to many people, but others have a problem embracing the ideas. Some of the problem lies in the way we were brought up and the way the education "system" works, both school and higher education. We are brought up to think sequentially rather than in parallel, and in organizations to think "uni-directionally." For example, school and work reward us for being goal seeking. We are encouraged to pass exams, increase profits or achieve excellence. Rather than just going in one direction, it is important to try to be multi-directional in our thinking or, at least, to be bi-directional.

One simple way of looking two ways is to look to an obvious or recommended goal, but also to look 180 degrees around in the opposite direction toward an "anti-goal." Goals and anti-goals are attractors at opposite ends of a spectrum; understanding the anti-goal and why we are not as strongly attracted to it as we are to the goal can be quite enlightening. We may realize perhaps that we do not want ever to get too close to the attractor that appears to be our goal and that we have a "comfort zone" on the spectrum between the attractors. In practice the "life table" is of course multi-dimensional. Our comfort zone is dynamic both in time and space, and we constantly shift our position to achieve balance on many spectra.

In general, and particularly in business where my work is centered, I feel that we are far from understanding these concepts and how they relate to our actions. My challenge is to improve the quality of thinking, to try to get an understanding of

the dynamic world around us and how we contextualize, integrate and inter-connect things and ideas.

My approach is to use the subject of system dynamics. System dynamics gives people a visual way of mapping and modeling the world—actually creating pictures, but in a language that can be shared. Using maps and models is a big challenge, because it means moving people towards visualization and quantification which might be outside their existing comfort zones. However, my challenge and mission is to move people incrementally towards the “harder” end of the thinking spectrum because I believe it improves the rigor and appropriateness of action.

In business, the five main interconnections are among resources (both tangible and intangible), boundaries of organizational responsibility/power (which create barriers to processes), information feedback (which makes processes work), policy and time factors (which create complex behaviors in organizations). Such generic constructs mirror the underlying premise about the world as an adaptive, self-organizing system.

So mine is primarily a very practical approach. It is specifically embedded in what I (and my business partner at Cognitus, Richard Stevenson) have recently referred to as *value chain dynamics* (VCD) (see Wolstenholme, 1999). One of the problems is where to find a home for systems thinking in everyday business and VCD helps with this. It organizes thinking at the value chain level of organizations, which is where operations and strategy come together and where value is created and destroyed in an organization. I try to get people to understand the value chain, to think about mapping and modeling it, and to learn from the experience. The key word here is “learn.” It is the *process* of doing that is more important than the outcome.

Finally, I believe there are encouraging signs that many businesses are moving into a more systemic way of thinking. For example, many businesses are embracing performance measurement across the organization. There is a move away from just measuring finance, and into measuring elements like intellectual capital, customers, and internal processes. Another area I tie into is the idea of *value-based management*. This moves people to think about the future and to examine the value they’re creating over some future time horizon. I believe that the way forward is to tie systems ideas into activities that businesses do which are semisystemic, and to encourage them to move further in the systems direction.

*Bob Flood (BF)*: As Eric said, there are many ideas that we certainly will share, if not sharing totally the same view. We are likely to locate commonalities and express similar interests. So, rather than rehearsing the systems idea as Eric has done well and to which I broadly agree, I would prefer to trace my interest in systems thinking and possible sources of difference back to my youth, because that is an extremely important foundation for me. I am a product of that lovely era ’65 to ’75, which was one of great creativity and much transformation in the West, especially in the arts, music, architecture and poetry. My teenage mind, my

mindset, was formed in that era and that era taught me to think critically. It is the critical idea that draws out the deeper value of the systems idea for me.

Originally my thinking was radical and angry in the mould of John Lennon, rather than critical, but over the years I have learnt that radical is just another dogma. Dogma actually was what we were arguing against. So my approach has mellowed to more of a critical approach.

I became interested in exploring the critical idea intellectually, and made up my mind to go off to university in my mid-20s. I sought a course that would allow me to develop such a process of thinking, and I was interested in organizations and management as well. Unfortunately, universities seemed to be churning out the sort of economic-rationality type Masters course which has become the traditional MBA today. That not surprisingly posed no challenge and no interest to me whatsoever. However, I happened to stumble across a course that focused on systems thinking, which reflected some of my interests. But I found very soon as a student on the course that the course as a whole was dissatisfying too. I had joined a department mainly of systems engineers—some tremendous colleagues, tremendous friends—and they did teach me some of the ideas and concepts of systems thinking, but these didn't somehow transfer to the world in which I found myself. The course contents didn't resonate with my life experiences. In systems engineering I was told that we would look for systems in the world, we would identify them, then we could optimize them, and from that everything would be “hunky dory.” Economic rationality à la systems thinking. To be controversial, this mode of thinking is something I feel can still be found in system dynamics, Eric's field of interest, and open systems theory, Merrelyn's field of interest.

Fortunately, in the UK at that time, the 1970s, a new movement of thinking was coming through which became known as soft systems thinking. This was Peter Checkland's work and I was strongly influenced by him. Through his writings he helped me to understand that central concepts such as inter-relatedness and emergence—points that Eric referred to—are powerful *not* in helping us to identify systems *in* the world, but powerful in helping us appreciate our experiences *with* the world (Checkland, 1981). This is what systems thinking started to mean to me—powerful concepts that allow us to construct a more meaningful understanding of the world. They empower us by explaining the relationship we have with the world. One can go on from that and revisit things like design, decision-making processes, etc. And further still, systems concepts put an inquiring framework of thought around them, which can be developed as C. West Churchman (1968, 1979) has done. This is where things go full circle for me. With the helping hand of Churchman I get back to critical thinking and what mattered to me in my youth.

I find critical thinking extremely relevant, in the sense that it helps us probably more than anything else to raise relevant questions with systems concepts. One of my favorite expressions found in the literature comes from Churchman; he says, “There are no answers, just more questions.” To me that is what *critical*

*systemic thinking* is: It's using the systems concept to construct understanding and appreciation, but never to think that we know ultimately what is out there, or indeed to be clear in our mind that we never have comprehensive and clear absolute theories. No, we must remain critical. A result of critical systemic thinking is that one begins to appreciate the limits to any person's thinking, or indeed, our thinking in groups and in organizations. In fact, our perspectives are partial and indeed transient, temporary. So critical systemic thinking encourages a partial and temporary view, capturing a perspective of the world in which we live. But by so doing we are spotlighting one perspective and putting into the shadow another perspective or perspectives of that reality.

By generating a partial and temporary point of view, or an "action area" in management terms, we are in effect identifying clients, the beneficiaries, as those who are in the spotlight. Clearly, not everyone is spotlighted and a beneficiary. Right from the outset then, we see that if this argument that I have been working through holds, then we must recognize that the fundamental issue raised by critical systemic thinking is one of an ethical nature. This is a main distinction between soft systems thinking and critical systemic thinking. That is, critical systemic thinking recognizes that we are choosing who is inside our boundaries of thinking and who will benefit, and who is outside and thus will not.

*Merrelyn Emery (ME): Open systems thinking or theory (OST)* is a very broad conceptual framework which encompasses many different elements and concepts. In terms of its intellectual heritage, it is clearly within Pepper's (1942) world hypothesis of contextualism, insofar as it states that all systems are open and all boundaries are permeable.<sup>11</sup> If you look at the work that OST has developed, boundaries are not static, they are themselves dynamic. A system is defined by having a system principle (Angyal, 1941) which identifies the unique relation between that system and its environment. OST has also developed concepts of social environments, or "extended social fields of directive correlations," which you can identify and measure, and examine the way in which they impact the various systems within them (F. Emery and Trist, 1965; F. Emery, 1977/1998; M. Emery, 1999). The concept of the directive correlation comes from Sommerhoff (1950, 1981).

Basically OST says that there are systems and there are social environments or fields, and there are relationships between them. In Fig. 1 the "L" stands for lawful. Each of these entities and their transactions are governed by laws which you can learn about and come to know. Much of the work in OST has implicitly and explicitly looked at those lawful transformations. OST acknowledges, and uses the fact that living systems are very dynamic and flexible—as Bob and Eric have noted as well—so we distinguish levels of environment. The relations between

<sup>11</sup>The premise of contextualism is that "there is a whole changing over time and that we know it through a series of historic events within the changing context of the whole" (M. Emery, 1997, p. 11).

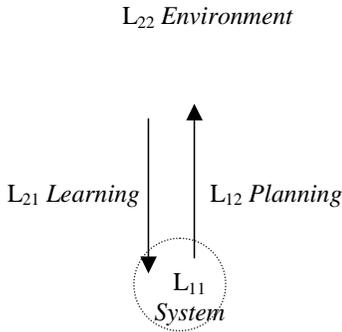


Fig. 1. The OST model of an open system.

systems and environment have been identified as learning and planning. Of course at the heart of OST you have purposeful people as defined by Ackoff and Emery (1972). People create social fields and co-evolve with them. A field of directive correlations can be modeled graphically, and doing so shows the coevolution of system and environment over time, rather than Fig. 1, which gives a picture at a moment in time. While the open systems diagram (Fig. 1) contains the possibility of both adaptations and maladaptations, the directive correlation model can tell you precisely whether system and environment are adapted or not. When you have maladaptations, you can measure the distance from adaptation, then begin to plan interventions which will help you to lower the distance to adaptation, then map over time how your interventions are going, whether they're moving toward adaptation or away from it. The directive correlation model is most useful for planning and monitoring change. I lay out some of this in a recent paper (M. Emery, 1997; see also Gloster, 2000).

The details of OST's intellectual traditions vary depending on which part of the open system you are talking about, but it is heir to a long and consistent development of reality based social science embodying transactionalism. The heritage includes von Bertalanffy (1950) whose work on open systems, while profound, was incomplete. He did not conceptualize the  $L_{22}$ , the extended social field. Without this, a concept of adaptation makes no sense.<sup>12</sup> Conceptualizing and identifying the changing nature of that environment was Emery and Trist's (1965) breakthrough. The traditions go back beyond Lewin (M. Emery, 2000). Many of the impacts of organizations on people have been identified from the work of people like Solomon Asch (1952) and Wilfred Bion (1953, 1961) and tested in action research. So you can see that OST has been eclectic in its disciplinary sources, but it is all based on open rather than closed systems. It is continuously in the process of developing

<sup>12</sup>The  $L_{22}$  is the environment of a system. OST practitioners believe that it can be directly apprehended and known. Emery here is calling attention to the core belief in OST that without a specific conceptualization of the environment, it is unclear what a system is adapting to.

those many sorts of relationships across those boundaries, and then putting them into practice to see if they work. Theory and practice advance together.

**Interim summary.** *The basic positions of the three participants are summarized in Fig. 2 and illustrate the contrasts and similarities. All participants bow to the holism and connectivity that are the hallmarks of all systems schools, but each is also at pains to highlight distinctive features and roots of his/her approach. Issues concerning realist versus representational understandings of the world and the need for systems based engagements with the world begin to emerge. These issues are taken up in Section 4.*

### 3.2. The Social and the Technical

*... In which Flood and Emery struggle to find common ground to understand each other's perspective on organizational and system design, given their different mental models and professional experiences.*

**BF:** Merrelyn, don't you think that there is a danger that if we went too far toward the human/people side, that we would miss some of the contributions that systems thinking could make through technological developments now occurring; as Eric pointed out, for example, in management information systems?

**Merrelyn Emery (ME):** No, I don't, because when you get people to sit down and explore their open systems in the reality of their organizations and their communities, they don't leave those things out. They try to integrate what is best for the people, for their technological systems, and also for their environments.

**BF:** But my experience of things has been that because of the functional silos in which people work, if you start emphasizing people too strongly, you suddenly lose the technically minded people—they go off and do their own thing. I remember this being an issue in a consultancy job I worked on with an IT group from Old Mutual in South Africa. Then you're left with the human resources people who fall in love with you. You can easily lose technically minded people from what you are doing.

I dislike very much a term Eric used earlier, which is "hard and soft," because I think it creates boundaries in our thinking between the technical and the social. I would prefer to rub that out. Merrelyn, I would prefer not to approach the issue in the way that you have. I would simply say that systemic thinking exhibits importance in a variety of different issue areas, such as efficiency of processes, effectiveness of structure, and meaningfulness in terms of processes of dialogue. Indeed, it can even cast light into things like fairness in terms of those factors that break down the processes of dialogue, such as what I would call knowledge/power. In other words, what is considered to be valid knowledge is held by the powerful (see Flood, 1999b). I feel that if we can approach things from a critical perspective, if we can engage those issues critically all at the same time, then maybe we can

***Wolstenholme***

- Sees world as “self-organizing adaptive system”; believes this is neither recognized nor implications understood.
- Emphasizes continuity and connectedness of resources, stakeholder perspectives, processes and information flows.
- Finds that System Dynamics provides methodology for applying above perspectives, a means of making tacit knowledge explicit and known to a community, and a framework for interpreting reality.
- Adopts accommodating approach to other modes of systemic thinking; inclusive.

***Flood***

- Accepts tenets of complexity theory, questions whether long-term intended action is possible. Expresses implications of complexity theory in terms of 3 fundamental dilemmas: managing within the unmanageable, organizing within the unorganizable, knowing of the unknowable.
- Following Churchman, sees critical systemic thinking as means to construct understanding, appreciation, but never to settle on “absolute and clearly absolute theories”. Hence, sees action learning/research as fundamental.
- Uses four “windows” to help people “appreciate our experiences within the world”: systems of processes, of structure, of meaning, of knowledge-power.
- Views both system dynamics and open systems theory as objectivist, or realist.

***Emery***

- Starts with Pepper’s 4 world hypotheses as device for distinguishing scholars’ ontologies, epistemologies; advances hypothesis of *contextualism* as most appropriate for describing purposeful human behavior; thus, rejects complexity theory as being aligned with *organicism*.
- Defines an open system by reference to a system principle which defines the relationship between system and environment; recognizes that people create social fields and co-evolve with them.
- Identifies 4 sets of “lawful relations” that exist within and between system and environment; “you can learn about and come to know” these relations in concrete local situations.
- Uses search conference process to establish a community capable of taking responsibility for its own future, followed by Participative Design Workshop to implement/diffuse design; based on “design principle 2” (redundancy of functions).
- Interprets other systems approaches as based on *closed* systems thinking, i.e., based in non-contextualist world hypotheses (e.g., organicism).

All participants agreed there was growing need for systems thinking in line with world’s increasing complexity and rate of change. All called for fundamental changes in education systems.

**Fig. 2.** Basic positions of roundtable participants.

avoid some of the experiences I've had, that is, the dangers of slipping from one silo to another. Maybe you haven't had those experiences?

*ME:* I think there is a bit of a misunderstanding here, because the design work that we do in organizations involves breaking down those silos. It involves legally changing the design principle on which those structures are built. When you've actually legally changed the design principle, those silos do not exist. So all the dimensions of the open system are being changed at the same time.

*BF:* In a sense we agree. As I understand it, in the open systems work you *do* want to appreciate the whole. I'm just reflecting on experiences that I have in the workplace, and the dangers and difficulties that we face in skating from one silo condition to another. But I am respectful of what you have achieved.

*ME:* No, I don't think we agree. We do not work within the existing silos. The redesign is done within a binding agreement for systemic change and it encompasses the change of design principle and, therefore, the total legal structure of the organization.

*BF:* But that's your process, and I feel sure that you are operating only on the mental models of people.

*ME:* I know there is a lot of misunderstanding about this. We are not talking about human relations and human resources at all; it's much more concerned with industrial relations than human relations. I'll give you the jargon. In structures built on the first design principle (DP1), the legal responsibility for coordination and control is vested in the supervision; it is not vested with the people actually doing the work. DP1 is called "redundancy of parts" because there are more parts, i.e. people, than the organization can use at any given time. People, jobs and goals are individualized and the structure encourages competition. The structure itself is called a "dominant hierarchy" as those above have rights of personal dominance over those below.

The agreement, usually union-management, includes a shift of design principle from DP1 to DP2 as without this, the organization will still be legally structured on DP1 as it is encoded in formal documents such as duty statements, job specifications and the pay and classification systems, amongst others. People are well aware of this and ignore phoney or nonbinding change. In the Participative Design Workshop which is the method [we use] for this redesign work, those who work in the organization redesign their own sections on the second design principle (DP2). They locate responsibility for coordination and control with the people doing the work, learning, or planning. DP2 is called "redundancy of functions" because more skills and functions are built into each individual than the individual can use at any particular time. With DP2 at the total system level, you end up with a flat hierarchy of functions, not a hierarchy of personal dominance. It is a totally different structure in which the relationships between *all* self managing groups are negotiations between peers. Most importantly, groups decide and then negotiate

the comprehensive set of measurable goals which controls their work. You find that these design principles and the structures that flow from them are extraordinarily powerful, and people's behavior literally changes from the one set of conditions to the next (M. Emery, 1999).

**Interim summary.** *A crucial difference surfaces here. Flood voices two common problems in consulting engagements and some forms of action research, namely, the segmentation of employees in functional "silos" and dependency on the consultant. Emery articulates OST's solution: authentic collective participation of a system's members in exploring the current and future states of that system and changing its fundamental authority and governance structure, or design (from "DP1" to "DP2"). This involves using search conference or similar methods, as compared to consultant–client methods for effecting system change. Flood searches to understand the radical nature of the OST approach. The methodological differences here derive from the participants' basic positions noted in Fig. 2; the implications for power are discussed in Section 4.*

### 3.3. How Do We Know?

*... In which the participants surface differences in their ontologies of systems.*

*John Selsky (JS):* Bob, a major theme in your recent work (cf. Flood, 1999b) is what you see as an emerging consensus among systems thinkers that "things are inherently unknowable to the human mind." You say this conclusion implies three paradoxes related to managing, organizing and knowing: "We will not struggle to manage over things, we will manage within the unmanageable. We will not battle to organize the totality, we will organize within the unorganizable. We will not simply know things, but we will know of the unknowable." Given these three paradoxes, can you describe your perspective on uncertainty, how people deal with it, and how and where it arises?

*BF:* Actually the three paradoxes sound frightening initially, and I had my own traumas in even coming to terms with them. As it turns out, what results from those paradoxes can be a highly practical way of thinking.

First of all, let's be clear that the idea of the unknowable has been around for many years in the philosophical tradition: Socrates, Kant, in more recent times Churchman (1968, 1979). There has been an intuitive appreciation of that idea, but what is extremely exciting in recent times is the emergence of complexity theory as a strand of systems thinking. It's not the details of complexity theory that excite me, it's the further explanation that it begins to give to the concepts of inter-relatedness and emergence. For years we have been operating with models that show relatively small numbers of variables. Even the models that take up half a wall have relatively few variables and a relatively small number of inter-relationships compared to what might be out there. System dynamics modeling and influence diagrams, for

example, were built on that way of thinking (see Wolstenhome, 1990). To some extent researchers thought that we can know enough through those models about what's going on, in order that there could be some form of simulation and decision making based on the results. In earlier days this meant indulging in prediction and control. Eric has explained clearly that a significant number of people don't use system dynamics models in quite that way nowadays.

Yet I think there is a need to step a bit further. As complexity theory suggests (see, for example, Cilliers, 1998; Coveney and Highfield, 1995; Waldrop, 1992), inter-relatedness doesn't just stop at the end of the models as system dynamics might suggest. There is almost endless inter-relatedness; for all intents and purposes this is infinite for any individual. What I am saying, then, is that in terms of the individual's mind and group understanding, we have extremely limited knowledge. Knowledge is local to us: local in terms of the issues we are involved in, and local even in terms of periods of time. So we don't have very much knowledge about what's going to happen in the future, and we even have a restricted memory of what has happened in the past. Through a sort of reminiscing we tend, like a cartoonist, to pick out key points and represent things in that way. Yet, inter-relatedness means that there is a vastness that we cannot access—past, present and future. Things are inherently unknowable to the human mind.

I must add one further thing to this. Complexity theorists introduce a special form of emergence, which they call spontaneous self-organization. This means that things just spontaneously occur, they are not predictable, it's not knowable what will happen even in the near future. So we're not just thinking in terms of flows through tubes of inter-relationships; the whole picture, the whole world, is characterized by spontaneous change. I would argue that this concept puts some detail behind, for example, Churchman's idea that every view is temporary and partial. Now we have a systemic model that helps us to understand such an idea. I find in practice that the new complexity model resonates with people's experiences of the world in which they find themselves.

*JS:* Rather than predicting and controlling and optimizing reality?

*BF:* Quite so. We can't know the future. We can only proceed into the future from here, now, which is why the sub-title of my recent book is "Learning Within the Unknowable" (Flood, 1999a). That's probably what we are doing with systems ideas, at best.

*ME:* I think this has elements of Pepper's contextualism, but from the way that Bob has explained it, it almost sounds as if it's delving back into organicism. While I think everybody would agree with you that there are some things which may be unknowable, I also think we, as human beings, actually know a lot more than we are conscious of knowing. We have huge amounts of tacit knowledge, and if you can find ways of bringing some of that tacit knowledge to consciousness, then people can recognize huge slabs of "knowings"—a better term than knowledge—which

they have extracted from their various environments, and which they have in common.

*BF:* I do not want to say that we have no knowledge in regard to this great complexity, but instead to ask how we can bring our existing knowledge and new knowledges to the fore, in order that we can learn our way into the future. I don't think this falls into organicism.

*ME:* As Pepper defines it, the root metaphor of organicism is integration, and your position does have elements of that in it. Whereas from the contextualist point of view there is a world out there, there are environments out there, and human beings do have the adaptive capacity to know a lot about that immediately. This knowledge is that which we directly *extract* from our perceptions and experience. It is not the knowledge found in textbooks which has been *abstracted* from its base in concrete reality (F. Emery 1980/1993). The distinction between organicism and contextualism lies mainly in the acknowledgement of the reality of the context and its power.

*EW:* One of my objectives in using system dynamics is to expand cognitive limits of people by helping them to externalize and share tacit knowledge. [*agreement from group*] I do believe that we all have an immense knowledge in our heads and releasing it can be a frightening experience. We get a glimpse of how complex our world is when we do that.

*John Barton (JB):* This means that the model is not an end in itself, but just a means to facilitate the process of understanding the world.

*EW:* It *is* a process. This is the key to modeling for learning, rather than modeling for prediction. This is where modeling links with knowledge management. Current trends in knowledge management tend to be dominated by technology, by explicit data, by ways of accessing and sharing it. The subject doesn't really address too deeply how we actually share tacit knowledge. We have a wonderful repository in our heads, and bringing it into consciousness is actually what we are doing now. I can't sit down now and tell you all I do, I can respond to prompts—and that was one. How we share knowledge is important. You know I have talked about a value chain, but I also talk about a *knowledge* chain. This could be a really important concept in management. The knowledge chain is a process of activities by which we translate raw data to useable action through the stages of gathering, sharing, filtering, embedding and using. The knowledge chain can be thought of as the missing link in organizational learning, which connects individual experience to collective action. So organizations don't have to start from square one every time. Knowledge is an elusive thing, but can be captured. People don't store knowledge nearly as well as they might. I try to encourage people to think of having a tapestry in their head onto which they can weave patterns. One of the fundamentals of system dynamics is this idea of getting away from just seeing events, and of seeing events as part of a pattern. I believe that I have a mental shelf of patterns in my head and I try to explain that to people and to encourage them to

have similar patterns. It is a matter of organizing internal databases, so that ideas can be brought into consciousness much more effectively.

### 3.4. Meandering in Plato's Cave

*... In which the participants, having begun to appreciate how deep-seated their differences are, explore further the underlying differences in their worldviews, probe for similarities, and toy with how the similarities and differences affect their mental models of systems.*

*BF:* Some of the differences that have separated us in the dialogue today may superficially appear to join us. I think Eric's explanation of generative learning and Merrelyn's contribution on the same score show that in some ways we are thinking about similar things. But I do believe that there may still be fundamental principles that are very deep, the *Weltanschauung* if you will, which lead each of us to different interpretations of interests we have in common. For example, my view of boundary setting is very strongly influenced by C. West Churchman rather than by system dynamics or open system theory. I would hark back to what I was saying earlier that we need to be humble and to accept the very limited and partial views that we have that bound our thought. This is despite the fact that we can think immensely creatively within and between those views, and expand them in generative fashion.

What Churchman says to me—and Peter Checkland to some extent in his soft systems thinking—is that we need to be very careful with our language, our terminology and our concepts of systems thinking. For example, we need to step back from thinking about systems in the world. Now I am not suggesting systems in the world is exactly what you were presenting through your illustrations, Merrelyn, but the language you used could easily be construed to intimate that. We all know that systems thinking has historically been talking about systems in the world, and perhaps the three of us in our various ways have been trying to get away from that. I myself prefer to use the term “systemic thinking.” We use systems models in the mind as ways of thinking about a systemic world. That, for me, is where we begin. So concepts like system identification, which is an old systems way of thinking, can be re-conceptualized into thinking in terms of getting to grips with an action area. The action area is specified in terms of issues and dilemmas that people face, rather than the idea of system, environment, wider system, and the relationships between those various things. I don't even use the idea of system and environment in the work that we do. We begin just by looking for an action area, which is defined by who is “client,” if you will. Of course there are multiple realities on that, so one needs to explore the multiple realities as to who are the clients, or who is to be chosen as client. That is an ethical choice that we'd be making. It is a critical process, a dialogical process, with which we get to grips

with this, always appreciating that there are different views that we could operate with. But at some time, hopefully, we will indeed capture a picture of things that is good enough for the people working together to use.

There is something else. I don't think the dialogical processes that Merrelyn is talking about are straightforward at all. I do believe, in systemic thinking, that if we are going to talk about open and meaningful dialogue, we need to also problematize the forces at work against achieving that open and meaningful dialogue. I am referring again to Churchman and his concern that we remain ethically alert.

*ME:* I think we definitely do have a divergence, because we in OST are talking about real people, real organizations, some of which are systems and some of which are not, in a real world. We are not talking mental models, we are talking about making change out there on the ground and which real people make, and recognize, and use, and which has ripple effects. It is easily demonstrated that the quality of communication or dialogical processes is dependent on the structures within which it is occurring (Emery and Emery, 1976).

*BF:* I know words are very limited and they don't really express well what we are trying to say. Let me try and make things clearer. I do believe that we are not dealing with a concrete real world. With critical systems thinking we are *being realistic* about the world in which we find ourselves by recognizing it as socially constructed, and therefrom trying to help people to seek out improvements that will be meaningful and lasting to them.

*EW:* I don't think there's too much of a divergence here at all. Clearly there's a problem about using the word "system." I personally do not have a problem with the fact that it is in such common use in the "real" world—we all know what a car repair system or health system means. We can be in the "real" world talking to people in such a language and looking at the various relationships between groups of people. What we can then do, in Peter Checkland's terms, is cross a systems boundary, where we operate to redesign a real world issue. To me this is nothing more than moving from the doing to the reflection, where you do the design and thinking about the situation "off-site." We then come back into the "real world" and compare the new reality we have put together with the reality previously observed. I believe all three of us do this. Is that not true?

*ME:* Yes, I think a lot of that is true. I want to comment on something that you said earlier, Bob, about real systems. It's all intensely real, certainly for the people that you're working with. One of the first things that you need to do, and it's built into our search conference method, is to understand exactly where the problems and the barriers are. Then you need to build strategies and actions to get around them, which means bringing people together in ways that neutralize those barriers. We're trying to capture the *actual* relationship and realities that exist out there.

*BF:* I would say that the difference is that you are much more positive in your view about what you do, what you discover, what your knowledge is, and the basis

of your actions than I feel. My view is that the mental models are just *pictures of reality*, “the real issues,” “the real dilemmas” people face, their thoughts and emotions, which can seem very real. And we help them to seek ways to improve their experience in their lifetimes, their working lifetimes, their family’s lifetimes, etc. So we *do* try to enhance people’s experience when consulting, for which I prefer to use the term “action research” (Flood, 2001). But I would never be as positive as you suggest about our picture of reality or the knowledge that we have on which we base our reality. That is why we have this idea of learning a way into the future. It’s a different notion of learning than perhaps your way. I believe we are both concerned with learning, but I would encourage a less positive view of the knowledge that is generated, so I think your observation on our differences is fair.

### 3.5. System Tools and Methodology

*... In which the participants discuss the need to remain specific enough to be meaningful whilst abstract enough to be relevant. This allows systems tools and techniques to be positioned within this spectrum.*

*JS:* Eric, what do you see as the main role or roles of systems approaches in the “real world” of business or public sector organizations, and what tools are required (cf. Wolstenholme, 1999)?

*EW:* I tend to go back to my comments about the systems boundary. I *can* actually think of working in the real world. I do think that understanding current reality and actually modeling “what is,” is quite an important contribution. If I map this onto the soft systems methodology, then that’s doing nothing more than saying that system dynamics has a role in understanding the “rich picture” and the “mess” that we think about in the current reality. I can also think about crossing the systems boundary, and then starting to use system dynamics to help to develop and re-design the elements that we have been talking about—the whole thing, the actual processes, structures and the people’s roles within them. My discussions with Peter Checkland have been around his observation that there are a lot of tools and techniques within the systems world, such as system dynamics, that could be used for re-design, and I find that comforting. Tools and techniques are really important. Many analyses in management systems tend to diverge in all sorts of ways from a clear understanding of physical reality.

In addition, there is some misunderstanding between the “open” and “closed” systems. I have no problem rationalizing the fact that I deal with open systems like Merrelyn, which relate to the environment. But one of the paradoxes here is that system dynamics has always emphasized the concept of internal blame. This thinking promotes the idea that we often create our own problems and have a tendency to shoot ourselves in the foot, but blame the environment for the result.

I would like to make it clear that these two stances can co-exist. I can get people away from blaming the environment for everything and to see that they do often shoot themselves in the foot. But I also want them to realize that the environment is changing rapidly and is a great influence on what they do.

*ME:* I couldn't agree more. We find that one of the most powerful things you can do is to get people to look at that environment—what it is doing, where it's going, and what it actually consists of. Then instead of blaming the environment they can start to see the whole range of forces within that environmental "matrix." That makes it a lot easier for them to analyze what the environment has been doing to them both positively and negatively over a period of time, why things have worked and not worked. So doing that environmental analysis and then re-synthesizing it can be extremely powerful for any organization or group of people.

*EW:* One of the biggest problems is changing traditional theory and theorists in their use of methodology. Originally management borrowed the scientific methodology and created some of the things we're trying to get away from in the systems approach. But the classic, and still very much used, social systems research methodology is the semi-systemic one of collecting and analyzing data and using this to derive conclusions. I think systems people have a lot to say about how research methodology should really change. Some of the things we have discussed today are methodological points and the systems ideas support the case for new methodologies. The nearest we have come to a radically different methodological approach is action research. Action research is a valid way of carrying out critical research. I occasionally get torn between working right at the practical end of the spectrum—where we're trying to help people understand the real world problems that they have—and at the other end thinking that it would help a lot if we extended the systems ideas further back into education. Right now, in general, our education systems don't embrace these things. I can count on one hand the courses that I think are valuable in terms of innovation in a systemic sense.

*BF:* I think there is a need to change the practice of what is currently the dominant scientific methodology in universities, which currently is largely responsible for where resources are to be allocated. Unless you do your traditional piece of scientific work and then publish thirty papers on it, it's not seen to be valid research. Action research says we need to go out into the workplace and develop knowledge with the people. It's a process of co-creation, co-operation, co-authoring. But if you take that back into the world of academia, you find it's very difficult to get published because there are many editors of journals who don't see this as valid research. It's then very difficult to get resources from the university to support us. We have a self-perpetuating dynamic, a dominant culture, which hopefully can and will be broken in due course. It obstructs the learning and development that we all clearly value.

### 3.6. The Future of Systems Thinking

*EW:* I think that the current trend that we see toward systems thinking will become stronger and stronger. I have already commented from my own point of view on the two main forces at work. The need for systems thinking grows with the complexity of the world around us, and with our need to extend our cognitive ability. Whether this can be achieved through technology or computers or whatever, I don't know, but I think there are going to be ways of doing it. I think pushing the boundaries of the systems world forward is not so important as helping the world to catch up. Some of the things that have been said today are really powerful thoughts and examples, but I see the Machine Age is still alive and well. In companies that I go to, I can see frontline staff treated more and more as machines, appallingly so. We're still treating people badly, we are still downsizing, we're still not recognizing intellectual capability and capacity. I think we've got an enormous amount of consolidation to do here in broadening the impact of systems ideas. There just aren't enough people who are helping. There is a significant time delay, or lag, in the education system catching up with some of this. I think some of the more traditional establishments are the most difficult to change in this regard. In terms of bureaucracies, I think universities are one of the worst examples. [*general agreement*]

In my experience (mostly management) the risk free route to a doctorate is to use the social science methodology. To use action research or modeling can be risky and needs the right external examiner. But modeling is an interesting counterpoint to the social science method. For example, in studying projects and trying to ask what are the most effective policies for reducing time and cost overruns, you could collect mountains of data over many projects, or you could "play" with policies in one project in a microworld. The world of methodologies and their relationships is largely unexplored.

*ME:* I agree with Eric that if we are to build momentum on the trends that are out there, then we definitely have to make a major effort with the education system. I'm not just talking about universities; I'm talking about the way in which our schools are structured. We start teaching kids that they're getting the wrong answer at a very early age, when in fact they're speaking from their own experience and their own perceptions. I think there's a lot of groundwork that needs to be done in getting some open systems principles built into the education system right from the start and to get away from this "top-down" teaching which has been dominating our concept of education. That is something that we seriously need to address.

Education systems are socio-psychological, not socio-technical systems. They require much more of an action researcher by way of planning and action. Although a school may look like an organization, it belongs to its community of parents, citizens, students and staff, all of whom need to be involved in setting direction.

Then both the staff and the students must be involved in organizing themselves into effective participative democratic structures. In addition, the learning that students do needs to blend direct perceptual learning with the requirements for abstract knowledge.

*BF:* I totally agree. I would also focus on the systems community itself. I would like to see a little bit more tolerance there.

*ME:* I don't think that there *is* a systems community. There may be several, and they don't seem to have a lot of understanding of each other, as this dialogue may have demonstrated.

*BF:* For me today has been refreshing, very rewarding, sitting here in open discussion with colleagues representing different schools of thought. I think we've enjoyed an extremely useful dialogue. I have definitely learnt from this process. But ironically I think in the wider span of the systems movement there is a lack of tolerance between different schools of thought and I think that's very destructive. Perhaps we could undertake more processes like [this forum], discover the similarities and enjoy that. The similarities mean that there's integrity, there's coherence, there's something happening. But we also need to discover the differences, why those differences actually occur, and celebrate those differences, not fight over them. It seems to me that the differences offer us the possibility for future growth, future learning and future contributions.

#### 4. REVIEW

In this section we review the roundtable dialogue as an exercise in what some systems thinkers call complementarism (Flood and Romm, 1996a). That is, we summarize differences and similarities among the participants' positions and highlight major issues. In doing so we harken back to the historical origins of the schools and draw out implications for practical engagement in the world. We conclude by identifying trajectories for the future of systems thinking and re-visiting our earlier claim of a maturing of systems thinking.<sup>13</sup>

##### 4.1. Similarities and Differences

The main positions distilled from the roundtable dialogue are summarized in Fig. 2. Like the participants themselves in the dialogue, readers are likely to

<sup>13</sup>We resist the temptation to apply objective criteria, an external classification scheme (e.g., Churchman's (1971) inquiring systems), or any current concepts (e.g., complexity theory or autopoiesis) for comparing the three approaches. (See Jackson and Keys [1984] and Flood and Jackson [1991] for attempts to compare various systems approaches.) Any criteria proposed for evaluating the positions would attract unresolvable controversy and any classification scheme would be immediately endogenized, thereby recapitulating the types of dilemmas that each position is attempting to address. We thank Rafael Ramirez for raising this issue.

be drawn to the differences. Wolstenholme's System Dynamics, Flood's Critical Systems Thinking, and Emery's Open Systems Thinking tussle with each other in expressing the nature of systems thinking and its implications for engaging with the world.

The participants agreed unequivocally on two points (see bottom of Fig. 2): the need for systems thinking to cope with the world's growing complexity and rate of change, and the need for fundamental changes in education systems in favor of systems thinking. A layer of subtler similarities lies beneath these agreements. Wolstenholme observed:

I believe we all have the same objectives, similar base constructs but different processes. The common objective is to create sustainable holistic change. The common constructs are interconnectivity, contextualisation and the need to change people's mental models. Beyond that you know our individual processes. . . . My anchor point is always that most of the world would not see any difference at all between us! (email to Roundtable group after the event)

This observation emphasizes the importance to systems thinkers of the core assumption of *continuity of the whole*. This assumption was captured in Lilienfeld's (1978, p. 9) description of the fundamental worldview of the systems thinker:

The world is seen as an unlimited complex of change and disorder. Out of this total flux we select certain contexts as organizing Gestalts or patterns that give meaning and scope to a vast array of details that, without the organizing patterns, would be meaningless or invisible.

This worldview leads to a system defined as an organizing gestalt associated with an organizing principle. It emphasizes a "synthetic" (rather than simply analytic) view of a phenomenon which is decomposable yet retains its integrity (Ackoff and Emery, 1972, Chap. 1). There is a rejection of worldviews that ignore continuities, particularly between a system and its environment (Churchman's [1979] "environmental fallacy"), and consequently, a rejection of reductionist methods used extensively in organizational and other social research today (e.g., much conventional survey research; controlled laboratory experiments on one variable at a time). Below we show that different systems schools may emphasize different aspects of the organizing gestalt. This "unity in diversity" drives the evolution of systems thinking over time.

The different perspectives on systems presented at the roundtable—for Wolstenholme as a complex adaptive system, for Flood as a chaotic system made sensible by local knowledge, for Emery as coevolving purposeful systems and environments—can be described as different "takes" on the worldview described by Lilienfeld. That is, each of the roundtable participants appears to place emphasis on one particular aspect of the organizing gestalt more than on others. For instance, Emery's OST position emphasizes the relationship of the system to its environment, system dynamics focuses on the structure of the system, and critical systems

thinking uses multiple perspectives to surface moments of power-knowledge. This is not to say that these approaches ignore other aspects, but that their distinctive contribution lies in the aspect mentioned; they are complementary. Essentially it is the commonality of reference back to the organizing gestalt that challenges reductionistic thinking and provides the common thread to the roundtable dialogue.

Given this fundamental similarity, why are the differences among the systems schools voiced so vigorously? Why are there different “takes” on the organizing gestalt? We suggest it is for two reasons: first, because the takes are embedded in the different *historical origins* of the approaches and, second, because the takes lead to different ways by which systems thinking informs *practical engagement* with the world. These reasons are discussed in turn.

#### 4.2. Historical Origins

Organic versus machine metaphors of human collective behavior provide one of the most common differentiators of the paradigms held in the social sciences. General systems theory and cybernetics both originate from the organic position, as do contemporary theories of chaos and complexity. Flood, coming out of the soft-systems tradition, uses complexity as his starting point, and this leads to his three management dilemmas (see “How Do We Know?” in Section 2). Wolstenholme’s position comes out of the system dynamics tradition, the origins of which lie in mechanically based servo-mechanism theory (see Richardson, 1991; Dupuy, 2000). As Wolstenholme points out, although system dynamics now also sees the world as a self-organizing adaptive system, it continues to decode complexity in a deterministic way by creating simulation models of complex systems that exhibit extreme sensitivity to changes in parameters (see Sterman, 2000).

For systems thinkers today, the metaphor of the complex adaptive system is the most widely accepted representation of the world in which we live and is the basis of both Flood’s and Wolstenholme’s positions. This metaphor can be traced back to Pepper’s (1942) world hypothesis of organicism. It is in Flood’s and Wolstenholme’s positions that we can see the shift in systems thinking from images of mechanism to images of organicism, and this is clearly a move forward in representing complex social phenomena. These positions embrace the continuity assumption of systems thinking “spatially,” that is, in terms of part–part and part–whole relations. However, another step can be taken.

In distinct contrast to system dynamics and critical systems thinking, Emery’s open systems theory derives from the assumption that environments are essentially the product of the behaviors (adaptive or maladaptive) of members of social systems (F. Emery and Trist, 1965), and *not* a product of Darwinian evolution or chaotic processes. As Merrelyn Emery explains in the roundtable, “maladaptive” behavior over a long period of time has led to the decline of the long-standing “Type 2,” placid-clustered environment to which human beings were well adapted,

and eventually to the emergence of the contemporary “Type 4,” turbulent environment, to which humans are poorly adapted. OST originated among researchers at the Tavistock Institute in a reaction to the conception of the environment as random and formless which prevailed in the 1960s. Fred Emery (1997, p. 38) recalls that von Bertalanffy introduced the now well known input-output model of a system and its environment during that period. However, Emery points out, in doing so,

Von Bertalanffy effectively wrote off the environment at large as random—and therefore unknowable. Being unknowable, it could be written out of our scientific theories, or treated as a valueless constant. . . . Prigogine. . . added the sophisticated touch that within this randomness there could occur “large random fluctuations.” A system exposed to a large random fluctuation could evolve in unpredictable ways. This postulate of a second order of randomness is no basis for a social ecology.

This statement shows that at its beginnings OST believed other systems approaches were based on a “closed,” *noncontinuity* assumption about the relation between a system and its environment over time. Continuity, OST asserts, must extend to the relations between human/social systems and their environments *over time*; synchronic spatial adaptation is necessary but insufficient for authentic open systems. That is, OST emphasizes the “temporal” aspect of the systems continuity assumption. As products of human endeavor, the relations between the whole and its environment are “lawful” and purposeful, and expressible in terms of planning and learning (see the notation  $L_{12}$  and  $L_{21}$  in Fig. 1). Thus, from the OST position system dynamics models essentially treat the system plus task environment as a closed system. The system dynamics response is that system models are practical devices for codifying knowledge and facilitating dialogue. As Wolstenholme emphasizes, they are a means to an end in the processes of planning and learning. Moreover, from the OST position complexity models essentially treat the system as closed against a random environment. For Flood, critical systems thinking and its emphasis on “learning into the future” through action learning defines a process for exploring the planning-learning relationships between a system and its environment. However, there is no “lawfulness” as to how these relationships are conducted, as OST claims. Flood’s adoption of a complexity worldview is a practical device which enables him to push his main objective, namely, articulating to a wide audience the liberation of systems thinking by rejecting “hard” systems approaches and extending Checkland “soft” systems method to issues of power and diversity (Flood, 1990a, b).

### 4.3. Practical Engagement

The different takes on the organizing gestalt may be understood in terms of how systems theory informs practice. The particular emphases in the systems approaches lead to different methods of intervention and different preferred modes

of engagement with social systems. Basic differences here lie in the participants' judgments as to what extent people can coevolve with their environments and hence determine their futures. These differences play out specifically in how the different schools deal with learning and knowledge. Central here is how tacit knowledge may be made explicit and how it may inform practice in organizations, communities and other systemic settings. In system dynamics, the development of causal hypotheses to explain the emergent behavior of systems relies on the surfacing of "mental models" grounded in tacit knowledge. In turn, causal hypotheses can be validated using simulation models and used as a tool to explore policy scenarios.

Emery goes further in asserting the primacy of "ecological learning": "[L]iving systems learn and hence adapt because of their ability to react to general and less variable properties of the environment, rather than because of the sensitivity to the concrete events and objects which yield a constant flux of stimulation" (M. Emery, 1999, p. 26). Emery is suggesting that the "constant flux of stimulation" in our high-velocity world may have drawn us to the popular metaphors of chaos and complexity and blinded us to enduring underlying continuities.

Like Checkland, Flood assumes that the process of critical inquiry will help inquirers to explicate their tacit knowledge and, thereby, lead to changes in their behavior. In Emery's search process, the assumption of a diffusion of learning among the participants is quite similar (1999, Chap. 4).

Thus, all three participants believe that their concepts translate into action through one form or another of action learning. While this is an integral part of OST's contextualist root metaphor, many other systems approaches are forced to imbed their organicism-based perspective within a learning process in order to make progress. Thus the difference between organicism and contextualism offers a significant challenge to all systems scholars to rethink their implicit assumptions.

More generally, many in the systems community harbor the fundamental belief that the tendency in deductive scientific method to achieve rigor by disregarding important features of complex social gestalts must be resisted. Systems thinkers do not deny the difficulties of deploying their "holistic" methodologies. Some have responded with laudable attempts to develop "a new rationality for planning and management that balances the demands of rigor and relevance and that is sensitive to context" (Verma, 1998, p. xi). We would include here the burgeoning interest in action research and action learning methods. This is evident in the last segment of the roundtable discussion where the participants reflect on useful directions for future systems research.

Other systems thinkers have responded with attention to issues of power. For instance, many are deeply concerned about the ethics of exclusion, especially when exclusion is used as a convenient means to an end of reductive explanation or expedient intervention. As the field progresses many systems thinkers have come to recognize that power issues need to be part of any holistic examination of and intervention into social systems, because these issues clearly shape their

organizing gestalts (see Checkland, 1981; Flood, 1990, 1999; Barton and Selsky, 2000). For example, in the roundtable discussion we see that OST deals with power in terms of participative organizational designs and legally binding agreements for the relocation of authority. For Flood, the critical systems approach deals with power in terms of boundary judgments which uncover interests and allow them to be contested. For Wolstenholme, system dynamics deals with power in terms of learning and its relation to knowledge-power. These efforts reflect the heritage of systems practice in facilitating the creation of effective workplaces (Burrell and Morgan, 1979). Such pragmatic efforts to deal with the realities of power in social systems may not satisfy those critical theorists who have associated systems approaches with the controlling structures of capitalism and who have accused systems thinkers of downplaying power implications. From a critical theory perspective, once power and values are problematized, then any engagement of social scientists with client systems becomes suspect (see Cullen [1998] and Chisholm and Elden [1993] for recent discussions of this issue in action research). However, as long as organizational and social problems continue, then systems thinkers and practitioners in social systems must continue to tangle with each other.

How they should engage with each other around issues of learning and power is the vexing question. Calls for action research or action learning are in the right direction but not a panacea. Too many varieties of these methods have been propounded (Chisholm and Elden, 1993; Reason and Bradbury, 2001), and they vary too greatly in the nature of the relationship between researchers and client (including the balance of power between them) to be universally useful. Setting up and sustaining truly collaborative relationships in organizations and communities appear to hold the most promise for “liberatory” engagement, but as the roundtable participants acknowledge, the difficulties are great.

#### 4.4. Conclusion: A Maturing of Systems Thinking?

The roundtable dialogue displayed a representative sampling of systems thinking. The dialogue was used to illustrate our claim that in the 1990s the field was maturing by liberating itself from some earlier strictures. We have interpreted that maturation partly in terms of a shift from (Pepper’s) mechanistic to organic metaphors but noted that systems thinking may still require a further movement to contextualist metaphors. We have shown that the maturation involves both conceptualizations *about* systems and practical engagements *with* systems (or, alternatively, with fields construed in systemic terms).

To summarize, Flood (1990a, b) helped to liberate Soft Systems Methodology from a managerialist focus by introducing an explicit critical dimension to systems thinking which located latent power issues. His agenda has been to

liberate systems thinking from the confines of thought with which it had traditionally been identified. Previously action-oriented systems studies had two main themes: first,

design: finding out how systems are best coordinated and controlled...and second, debate: finding out how sets of purposeful activity and people's differing viewpoints can be systemically reconciled or accommodated for. (Flood and Romm, 1996b, p. 1)

In the dialogue Flood is keenly aware of the difficulties of actively working out our own futures, given the inherent complexity and unknowability of the world. Flood's is a *critical or political* expression of liberation.

Following Forrester's (1961) initial directions, several researchers helped to liberate System Dynamics from mechanical conceptions by articulating its qualitative and group learning dimensions much more explicitly (see, for example, Senge, 1990; Wolstenholme, 1990; Vennix, 1996). In the dialogue Wolstenholme amplifies that theme by ascribing to the "endogenous" argument (Richardson, 1996) that systems can and do change their own dominant structures as they evolve, so that they are robust in the face of exogenous shocks. Wolstenholme's is a *learning* expression of liberation.

Baburoglu (1992) located a latent liberatory theme in Open Systems Theory, and Merrelyn Emery recaps this theme in her advocacy of the participative/democratic Design Principle 2. Emery is more optimistic than the others about our abilities to improve our situation; she views complexity and uncertainty primarily as the result of our own maladaptive behavior and believes we have considerable collective capacities to redress such behaviors. She believes in a contextualism grounded in purposeful human behavior in a knowable context. Emery's is a *democratic* expression of liberation.

Interpreting the roundtable dialogue as a complementarist exercise has enabled us to begin, but certainly not complete, the important work of exploring the implications of the concepts and techniques of each systems approach for the others. We have shown that the concept of the organizing gestalt is able to unite the phenomenological/realist and constructivist/representational positions that appeared to divide the roundtable participants. This unity-in-diversity device yields several trajectories for future exploration for the three systems schools:

- How useful would it be for system dynamicists and critical system thinkers to revisit Pepper's four world hypotheses? Are their current worldviews, based in the popular complexity metaphors (e.g., complex adaptive systems), adequate for their purposes?
- While Emery open systems theory has a strong emancipatory theme evident in its emphasis on people taking responsibility for their own communities, organizations, and futures, can emancipation of the powerless be enhanced through the application of Flood's multiple perspectives approach? Can system dynamics modeling and simulation techniques be used to further refine the exploration of system-environment relations?

- Can system dynamics improve its application by adopting the search conference techniques from open system theory? Can Flood's multiple perspectives approach be used to enhance an already strong emphasis in system dynamics on multiple stakeholder perspectives?
- How might the critical systems approach embrace Emery's open systems theory as *complementary* to other approaches?

More generally, important trajectories for future research in systems thinking include learning and knowledge management and working out appropriate methods for dealing with power in practice. Of particular significance is the issue of whether Pepper's contextualism might provide a richer framework than the current organicism for developing systems thinking further. In a sense the differences among the three schools recapitulate unresolved issues first highlighted by Checkland, Churchman, and Fred Emery 30 years ago. How might theories of complexity and self-organization inform each of the three schools and the relations between and among them?<sup>14</sup>

In conclusion, our view is that two principles are key to understanding systems thinking today and in the near future: first, the concept of a "system" as associated with the continuity assumption, and second, the perduring spirit of practical inquiry that moves away from the imagery of a mechanical world and toward the imagery of organizing gestalts in context. We believe these key principles have not changed over the past twenty—or fifty—years, but in recent years the message has been lost outside the systems community. In this paper we have shown solid evidence of a maturing of systems thinking since the 1970s, but also that a mature systems thinking is far from reality. The basic meaning of being systemic today lies in actively embracing the holistic principles of systemic inquiry and actively opposing the reductive tendencies of analytic inquiry, as revealed in practical engagements with social systems. Thinking more in these ways could greatly assist the attempts to move toward better managed, more humane organizations, more open and democratic societies, and more sustainable practice in economic and social development and in the use of natural resources. However, we are all too aware that the entire systems enterprise struggles against the reductionist realpolitik in the worlds of academia, consulting, and management practice.

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