SYSTEMS THINKING: COMMON GROUND OR UNTAPPED TERRITORY?

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ABSTRACT

At gatherings of the International Society for the Systems Sciences, the term "systems thinking" elicits understanding nods and smiles. Such thinking, it would appear, is a way this largely academic community works "all together now," thinking in a systemic way about our varied areas of inquiry. But how common is this understanding among us? And are its benefits commonly understood? Assessing the degree to which we work "all together now" requires recognizing the different assumptions we make about what systems thinking means. So powerful is systems thinking's capacity to holistically address 21st-century problems that much has been written about it for laypeople. This article presents a content analysis of 14 popular books on systems thinking, revealing that ISSS members' understanding nods and smiles belie a plurality of meanings assigned to systems thinking and claims about what it means to be a systems thinker.

What is held in common within the ISSS community is the conviction that the health of human systems can be supported by systems thinking. We argue that the benefits go further: that the psychological health of humanity itself depends upon helping people learn how to be systems-intelligent thinkers. At present, the community of systems thinkers has made only a start at this important endeavour.

THE CASE FOR "SYSTEMS THINKING"

The furtherance of knowledge has been a moral imperative for academic societies and universities since their roots in ancient Greece. Knowledge about systems has particular importance, given the systemic complexity of the gravest problems facing humanity in the 21st century. Likewise, knowledge about systems has particular importance, given the significance of systems to basic human health – both physiological and psychological.

Mental health includes interpersonal aspects. We see this in Freudian theory about the importance of parents (Breuer & Freud, 1893; Freud, 1905), in attachment theory advocating the crucial significance of relationships between child and a primary caregiver (Bowlby, 1940; 1958), in cognitive and behavioural work focusing on the necessity of accurately understanding the world of others so we can participate in that world (Beck 1963; 1964), and in current research on human wellbeing that disputes the assumption that mental health is merely the absence of pathology, but rather a psychological flourishing that few people manage to experience (Bornstein et al, 2003; Keyes & Haidt, 2003). Common to all of these views of human psychology is the understanding that a person must learn to relate to other people in order to be a healthy human being. We

encounter those other people in myriad systems – in families, peer groups, schools, and workplaces, and in broader political and cultural dimensions of human experience as well.

To be a healthy human being able to engage well with social systems requires the ability to understand them. From the earliest encounter with a family people develop a semiotic literacy in that family that helps them understand that system and how to react to it[1]. Yet the particular semiotic literacy that gets developed in our first human system does not guarantee the ability to understand and work competently within the many other social systems with which we must contend – a literacy that can affect the degree to which we are mentally ill or flourishing.

Exposure to diverse systems helps develop semiotic competency. But living in and around systems, ubiquitous as they are, doesn't guarantee that we really understand them well. So, how can a person develop the systems literacy so necessary to psychological health? The systems community comes in here – a community dedicated to the broadest possible understanding of how systems generally operate. The kind of systems literacy applicable to all systems is widely termed "systems thinking" by this community.

Knowledge about how to be a practising systems thinker is important for the lay public – the people who birth new families, purchase services and goods, run corporations, and participate in democracies. The application of systems science and research – thinking as a "systems person" – is seldom found in academic discourse, being more widely addressed in popular literature. There we find prolific instruction on systems thinking, how to understand human systems in a way to effectively participate in and engage with them. Here lies the promise of active, applicable knowledge of real significance to human wellbeing.

The promise is grand. The books we will consider here make many claims for what systems thinking offers. They describe it as fresh (Boardman and Sauser, 2008) and refreshing (Brynteson, 2006), "a new orientation to life" (Haines, 1999: 2). It is a way of thinking that increases "memorability by clever phrasing or a catchy name" ([Weinberg, 2001:41] – a case in point: systems thinkers become "paradigm pioneers" [Haines, 1999:203]!). Clearly then, the systems thinker is creative (Anderson and Johnson, 1997), insightful (Checkland, 1999; O'Connor, 1997), with "new and expansive patterns of thinking… [enabling] collective aspiration [that] is set free" (Senge, 1990:3). Systems thinking helps us change the systems we encounter (Senge, 1990), tame them (Sherwood, 2002), "go beyond our own borders and rules" (Haines, 1999:203). It is a thing of beauty (Haines, 1999), a "big idea" (Sherwood, 2002:1), something important and wonderful that will enable us to improve our quality of life (O'Connor, 1997). From one set of authors, it even warrants hearty "Congratulations [for] picking up this book!" (Anderson and Johnson, 1997:vii).

[1] Jerold Gold, personal communication, February 2, 2007.

STUDY METHOD

If a non-scholar wished to learn to be a systems thinker, what resources would be available to him and what would they teach him?

Amazon.com is among the world's largest online retailers, and a user-friendly way to find and purchase books on myriad topics. The search term "systems thinking" yielded some 942 books. For this study, we drew a purposive sample of Amazon's most relevant 14 books on systems thinking.[2] [3]

Table 1.

Title (listed by relevance to search term "systems thinking")	**Author, Year**	**Amazon US BestSellers Rank**[4]	**Amazon UK BestSellers Rank**
Thinking in Systems: A Primer	Donella Meadows, 2008	2,267	359,259
Systems Thinking: Managing Chaos & Complexity: A Platform for Designing Business Architecture	Jamshid Gharajedaghi, 2005	309,256	380,887
Systems Thinking: Coping with 21st Century Problems	John Boardman and Brian Sauser, 2008	536,976	688,967
Systems Thinking Basics: From Concepts to Causal Loops	Virginia Anderson and Lauren Johnson, 1997	87,404	1,182,221
The Logical Thinking Process: A Systems Approach to Complex Problem Solving	William Dettmer, 2007	126,888	497,405
An Introduction to Systems Thinking	Gerald Weinberg, 2001	326,241	483,571

[2] For this study, we used Amazon.com. In Table 1, we include comparative sales rankings for Amazon.co.uk.

[3] We chose to omit two of the relevant systems thinking books our search yielded for the purposes of this study: *The Systems Thinking Playbook* (an activity book by Linda Booth Sweeney and Dennis Meadows) and *When a Butterfly Sneezes: A Guide for Helping Kids Explore Interconnections in Our World Through Favorite Stories* (a children's book by Linda Booth Sweeney).

[4] "The Amazon Bestsellers calculation is based on Amazon.com sales and is updated hourly to reflect recent and historical sales of every item sold on Amazon.com" (amazon.com website). The figures listed here were reported on the site as of April 3, 2001, 3:15pm.

Systems Thinking: Creative Holism for Managers	Michael Jackson, 2003	873,112	230,642
The Manager's Pocket Guide to Systems Thinking and Learning	Stephen Haines, 1999	135,667	349,561
The Art of Systems Thinking: Essential Skills for Creativity and Problem Solving	Len O'Connor, 1997	288,070	152,468
Systems Thinking, Systems Practice	Peter Checkland, 1999	344,767	45,508
Business Dynamics: Systems Thinking and Modeling for a Complex World	John Sterman, 2000	122,939	223,572
Seeing the Forest for the Trees: A Manager's Guide to Applying Systems Thinking	Dennis Sherwood, 2002	259,559	151,733
The Fifth Discipline: The Art & Practice of the Learning Organization	Peter Senge, 2006	1,562	8,588
Once Upon a Complex Time: Using Stories to Understand Systems	Richard Brynteson, 2002	438,123	2,971,244

Each of these books purport to explain how one can become a systems thinker – how to know how and why a system[5] is operating as it is.

How one can *know* a system is an epistemological matter. How average people can be systems thinkers is a matter of lay epistemics. Kruglanski developed a "theory of lay epistemics" to account for the "process whereby people form their knowledge of various matters" (2004). In his formulation, lay epistemics require the knower to have a certain Knowledge Domain. To have semiotic literacy about the world of systems, for instance, one must know the definition, characteristics, and types of systems, along with techniques with which one can analyze and understand them. All of the books we consulted detailed such information. One might think that as long as systems scholars write books about systems, they will be propagating systems thinking, yet this is not so. One can know a great deal of facts about systems, yet not be a systems thinker. "One can see [something] without knowing that it is [that thing] that one is seeing" Audi, 1999:569). Kruglanski's theory of lay epistemics likewise recognizes that possessing a Knowledge Domain is insufficient to know a thing. A challenge of systems thinking is the very ubiquity of systems – how can we know when the actions and events we are seeing are produced by a system; how can we be systems thinkers without knowing this is so? The start of semiotic literacy is facts, but knowing about systems requires more.

Kruglanski posits another element of lay epistemics (1989): particular modes of thinking that are conducive to perceiving something accurately that he calls "Welcoming

[5] While it was not the explicit intent of this study, all of Amazon's "most relevant" books focus on systems thinking as it pertains to human or social systems, rather than, for example, mechanical, biological, or ecological systems.

Cognitive Conditions".[6] Such conditions operate as mental stances and cognitive skills a person uses to focus their understanding. For our purposes, being a systems thinker requires knowing facts *and* utilizing particular ways of perceiving those facts.

In this study we utilized Kruglanski's notion of Knowledge Domains and welcoming cognitions as sensitizing concepts (Blumer, 1969) to guide our data analysis. Knowledge Domains were directly discussed in each of the books, requiring relatively straightforward descriptive coding. Welcoming Cognitive Conditions were less explicit, requiring more inferential, interpretive coding (Miles and Huberman, 1994). Our goal in identifying both was to determine what members of the public are being told they must know and how they are being told they must think in order to be systems thinkers.

SYSTEMS THINKING: DIVERSE VIEWS

Early on, it becomes clear that views about what systems thinkers must know are as varied as the parable of the blind men from Hindustan arguing about what an elephant is like based on whichever portion of the animal they had happened to grasp.

Dettmer (2007) is concerned with how people should think, and describes a distinctly unique systems approach he describes as "*the* logical thinking process" that a systems thinker should learn to use in organizational settings. By contrast, Senge (1990) frames systems thinking as only one of several thinking disciplines needed for contemporary workplaces. Boardman and Sauser (2008) position their version of systems thinking in terms of its value for organizational and military applications. Like these authors, Haines' concern is workplaces (1999); the systems thinking approach he teaches is a formulation that promises straightforward steps to more effective businesses and living a better personal life as well. Gharajedaghi's work (2007) is a university-level textbook aimed, no doubt, toward the students he has taught at the Wharton School of Business at the University of Pennsylvania. Yet Brynteson's (2006) book suggests that systems thinking is best taught through folksy stories. Checkland's 1999 work adapts ideas from systems engineering to human organizations, with the challenges of subjectivity found within them. Weinberg (2001) uses mathematical formulae to describe how to do systems thinking. Five of the 14 books focused exclusively on systems dynamics. Anderson and Johnson (1997), Meadows (2008), O'Conner (1997), Sherwood (2002), and Sterman (2000) all define systems thinking as the ability to model and label the dynamic structure of a system in order to understand it; as such, these books use descriptive examples (of workplaces, industries, political situations, etc.) and detailed instruction about how to diagram systems. Jackson's 2003 book comes closest to a view of the "entire elephant", presenting systems thinking as a plurality of different approaches, each with their own usefulness and shortcomings. Together, these books are indeed a motley collection of authoritative voices saying very different things.

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[6] Kruglanski's theory of lay epistemics involves 3 dimensions: here we examine *Knowledge Domains* and *Welcoming Cognitive Conditions*; his third domain, *logic*, falls beyond the scope of this paper.

Yet they are also a collection of voices saying many similar things.

COMMON GROUND(S): THE KNOWLEDGE DOMAINS OF A SYSTEMS THINKER – AND THE RELEVANCE OF DEFINING SYSTEM CHARACTERISTICS TO MENTAL HEALTH

We begin by identifying the foundational Knowledge Domain required by the systems thinker: an understanding of the key characteristics all systems possess. This domain is primarily definitional, yet it points to useful ideas and questions that bear on human mental health as well as systems thinking.

All writers about systems thinking invariably begin with basic descriptive characteristics of systems – their properties, types, and prevalence – as a way to set systems thinking apart from more common ways of thinking. The authors we consider here offer definitions of 'system' that are rarely more than a line long, belying the considerably complex idea of a group of people making up a singular entity. Yet, voiced in plain language, within the simple descriptions of 'what a system is' are rich ideas: intentions drive collective human behaviour, whether a system's members recognize this or not; human systems are comprised of both visible and invisible elements; patterns of profoundly interdependent relationships among members are a key system characteristic; and systems are paradoxical – containing singularity amidst multiplicity.

What a System Is, and Other Knowledge Domains

Systems thinking authors tell us that members of a system interact in a configuration unique to each system and held together by the interaction of its members (Boardman and Sauser, 2008; Jackson, 2003; Sherwood, 2002). The particular ways a system's members interact produce results not created by any single person, but rather by all of them operating together (Meadows, 2008); what happens in a human system is a product of its members' interactions, not of any individual member.[7] "[A] system itself can only be explained as a totality," Haines tells us (1999:191); "To understand the system it must be examined as a whole," Sherwood says (2002:18).

People are the primary tangible elements of the systems concerning these authors. But importantly, human systems are comprised of tangible *and* intangible[8] elements, or "entities" (Sherwood, 2002). The beliefs (O'Connor, 1997), information (Gharajedaghi, 2005), values (Checkland, 1999; Gharajedaghi, 2005), and ideas that individuals possess are intangible elements of a system; so too are the goals each person possesses. Some goals are officially endorsed by a system (Dettmer, 2007; Haines, 1999); some are not (Checkland, 1999). Some goals are known to those who possess them; some are not

[7] According to Boardman and Sauser, this astounding property of systems should "shatter the notion that specific components can delivery on specific functionalities [in a system]. Only the collection of them, the network of them, can do this" (2008:150).

[8] Haines describes them as "mental" aspects of a system.

(Brynteson, 2006). Some goals coexist harmoniously; some conflict (Checkland, 1999). Some of these intangibles – beliefs, information, values, ideas and goals – remain relatively unchanged over time; some change rapidly. And all are informed by the beliefs, information, values, ideas and goals of other people within the system. What we describe as the intangible dimension of systems, Gharajedaghi refers to as "an organization of meanings" (2005:83-84).

Building upon these foundational ideas about what a system is, our systems writers identify certain other key characteristics the systems thinker must understand.

Human systems are purposeful. Individuals hold myriad goals (Haines, 1999); some are unique to us, some are shared among other members of a system. Not all of these goals – individual and collective – are conscious. Even so, unrecognized goals have as potent an impact on groups' thoughts and behaviour as those goals their members consciously espouse. Human systems, then, are purposive (Checkland, 1999; Gharajedaghi, 2005). A system's behaviour is a clue to the purposes its members individually and collectively hold: systems "leave evidence of their presence like fingerprints or tire marks" (Anderson and Johnson, 1997:5).

Members of a system require one another to achieve their goals (Anderson and Johnson, 1997) – the recognized and unrecognized goals they share with other members of the system, and also their own personal goals, recognized and unrecognized. The interdependence of people upon people, ideas upon ideas, beliefs upon beliefs, etc. cause a system's results (Dettmer, 2007; Haines, 1999; Jackson, 2003). Indeed, Sherwood tells us that human systems exist because of people's "mutual willingness to align objectives" (2002:201). The depth of people's interdependence is evidenced in the resources people dedicate to one another: "Building connections between people requires a huge amount of time, effort, and energy" (Ibid.:187).

People exist in relationship. When a systems thinker wants to understand a system, understanding members' modes of relating is more important than understanding the characteristics of the members themselves (Haines, 1999). Rather than viewing a system's people as discrete pieces of a puzzle, where and how the pieces join is paramount. Several authors note that aspiring systems thinkers make the mistake of focusing on the number and characteristics *of system members* (i.e. the system's "detail complexity") (Sterman, 2000; O'Connor, 1997). More important, they point to the number and qualities *of relationships* a system contains. "Systems ideas are intrinsically concerned with relationships," Checkland emphatically states (1999:A24).

The way a system is organized arises from interactions among its members. Likewise, the way a system is arranged causes certain interactions to happen, certain relationships to be developed (Boardman and Sauser, 2008) which produce a system's results (Senge, 1990). There is a coherence between a system's structure and the results it produces (Meadows, 2008). How stable a system is depends on how its members are arranged and the degree of interactive connectivity among them (O'Connor, 1997).

Systems are rife with dichotomies and tensions. Several authors indicate that both parts and wholes (i.e. a system's members and also its collective identity) must be considered by the systems thinker. Every member of a system works to manage the system while working also to manage him- or herself – a fact Sherwood refers to as "the importance of managing the whole as well as the parts" (2002:38). Similarly, our authors note that systems are characterized by plurality (i.e. by multimindedness" [Gharajedaghi, 2005]), and also of unity (i.e. "wholeness" [Boardman and Sauser, 2008; Checkland, 1999; Gharajedaghi, 2005; Haines, 1999; Jackson, 2003; O'Connor, 1997; Weinberg, 2001]). Each writer illustrates in various ways how the properties of a system as a whole are different from the qualities of its constituent parts. Systems thinkers are urged to understand that the kinds of achievement possible for the system as a whole has a different order of magnitude – quantitatively and qualitatively – from that its individual members are capable of producing.

These characteristics are all found in all human systems. And we argue that they all are relevant to human mental health, raising a variety of questions useful to examining the impact of a system on the wellbeing of its members and those who interact with it:

> *Human systems are purposeful.* Mental illness and health involve human agency – particularly, the degree to which people's various agencies operate in conflict or harmoniously. Interpersonal behaviour is a clue to recognized and unrecognized objectives. The things a group of people do or don't do, the words they say or leave unspoken, the interests and activities they share or avoid all function together in service of these agencies. The purposive nature of every human system – and the plurality of purposes each system pursues – raises several questions bearing on the mental health of both individuals and a group of people: *What are the system's official, stated objectives? What actions are members taking in service of those objectives? What actual outcomes is the system producing? (– which may differ significantly from its stated objectives) What unrecognized objectives would produce/underlie such outcomes? Are the stated and unstated objectives of the system complementary? Is the energy the system must expend to achieve its stated and unstated objectives diffused by conflicting goals? Are members of the system willing to surface and articulate their personal and shared unrecognized objectives? Can and should the system's stated goals be modified to incorporate previously unrecognized objectives? Can members of the system reframe their objectives to synthesize previously stated and unstated goals?* The interplay of recognized and unrecognized agencies – their consonance or dissonance – is well understood to be important for understanding individuals; it is likewise important for understanding how groups of individuals work together.
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> *Members of a system require others to achieve their goals*. This characteristic of systems highlights ways in which people are necessary to one another. The view suggests that how a person is presently functioning is, to some degree, a product of the others on which s/he has been relying: one's states of mental illness are created with the assistance of others; and one's states of mental flourishing are a

product of the others on which s/he depends. Likewise, the wellbeing of others is similarly related to our own wellbeing. *In what way is a person relating to others in a way that is integral to the achievement of the goals of both? In order to achieve a group's goals, how must members interact? In what ways are members dependent on one another in order to achieve each of their personal goals? In what way is a person's participation in a system necessary to achieve his/her goals, recognized and unrecognized? How can a system's members be made aware of the ways in which they rely upon one another for the achievement of both their collective and personal goals? How can a system of people set goals for itself that requires interdependence among the system's various members? In individualistic cultures, how can mutual dependence be made palatable to a system's members, especially mutual dependence with members of the system performing tasks others don't understand?* Insofar as people must rely on others to achieve goals they consider important, how people manifest their need of others influences their state of mental wellbeing.

People exist in relationship. Mental health involves relatedness – the styles of connection and qualities of relationship one shares with others affect a person's wellbeing. Some of a person's important relationships are based on commonalities – shared interests, for example. Other important relationships are based on complementary differences – paired roles such as parent-child, manager-employee, or producer-consumer, for example. Similar or different, people's mental health is impacted by ways in which they belong – the ways in which they are relevant to other people. Systemic relatedness raises a variety of questions. In a group of people, *What are the relationships each member has with other members of that system? What are the qualities of those relationships? Do such modes of relating effectively serve the purposes of the individuals involved and the system of which they are part? To make groups of people more reflexive about their relatedness, how can members be trained to examine the ways they relate to one another, rather than the ways in which they differ as individuals? Can people be trained to understand their states of mental health as an outcome of the ways they relate? How can relationships be altered to better serve both systems' members and the systems overall?* The characteristic of systemic relatedness highlights the importance of people fitting together rather than co-existing in disconnected ways.

The way a system is organized arises from interactions among them. Any state of mental health is, to some degree, a byproduct of a person's interactions with other people. We can conceive of states of mental health as structures (specific patterns of thought, affect, and behaviour) arising from the systems in which we are a part; therefore, all mental health outcomes are structures produced by the systems in which we are engaged. And conversely, the systems in which we are engaged create the mental health states we attain. The relationship between structures that manifest in people/groups and the interactions that gave rise to those structures raises interesting questions. *What formal structures have been established in this system (or in a particular person's life)? What patterns of connectivity do such*

structures facilitate and what results do they produce for this system (or person)? What informal relationships exist in the system, indicating unofficial/tacit structures? What patterns of connectivity result from such informal structures and what results do they produce for the system (for people)? Is the system deemed stable/able to generate desired results reliably – or are its structures unstable, indicating little consistency in the patterns of interaction operating within that system? What behavioural structures – regular/repeated patterns of interaction – need to be introduced in order to build relationships – stable structures that will improve the results (mental wellbeing) the system is able to produce? Which existing structures that inhibit interactions within the system need to become more inclusive? As we will see, issues of system structure are of great interest to many systems writers.

Finally*, systems create dichotomies and tensions.* Working through seemingly intractable tensions plays a part in many human systems, as it does in psychologies, from Freud's oedipal drama to the enantiodromia described by Jung. In systems, each person plays the dual role of (1) individual and (2) part of a greater whole. Numerous developmental psychologists (e.g. Erickson, Kegan, Kohlberg, Levinson) point to the challenge of reconciling one's individuality with belongingness to groups of people – "the prize and prize of togetherness" in the words of Boardman and Sauser (2008:151). Taking too firm a stance for either oneself or for others compromises mental health; the general consensus among developmentalists is that finding effective ways to incorporate both in one's identity and actions promotes wellbeing. *What tensions exist between members' loyalties to themselves and their loyalties to the system overall? In what ways is membership in the system a benefit to members? An impediment to them? Do system members wish to engage in dialogue about the valuable ways their views coincide and differ? How do people learn to equally value what can be achieved by both individuality and belonging?* In every human system, then, we will observe the interplay of self and other. How well the claims of individuality and group membership are mediated has considerable impact on how well and individual or system will function (Germain, 1978).

The basic characteristics of systems can inspire intriguing questions for those interested in a systems understanding of mental health. Agency and need, human relationship, the results produced by people's interactions, the push-pull to belong to oneself alone and also to a community of others – these speak to the challenges inherent in the human experience. They shift focus away from the search for singular factors that can impact mental wellbeing toward a systemic view instead. And each of these characteristics appears repeatedly in the popular books on systems thinking that we examined. But, existentially important though these characteristics may be, they do not comprise the entire domain of knowledge required by a systems thinker, just as they would fail to provide a person with the systems literacy and semiotic competence one requires to function effectively in a systemic world. Other Knowledge Domains come into play.

Our writers appears to agree that the Knowledge Domains a systems thinker must possess go beyond definitional matters. In order for systems to be comprehensible, these writers think one must know:

- Particular laws or lists
- Two basic system types: open and closed
- System dynamics and archetypal patterns
- Multiple "methodologies" developed by systems scholars
- How to draw visual models of a system

While each of the 14 authors indicates that their book presents *the* authoritative guide to systems thinking, emphases on the Knowledge Domains they describe varies.

Laws and Lists

Several systems thinking books present "laws" or lists the systems thinker must memorize. For example, Anderson and Johnson (1997) provide numerous lists to guide the systems thinker, such as general principles of systems thinking, guidelines for identifying problems in systems, and detailed "Do's and Don'ts" for the systems thinker. Boardman and Sauser (2008) frame systems thinking around a more concise formulation: 3 Principles for Togetherness. Dettmer, (2007) positions his book as a "systems approach to complex problem solving" but more importantly, as an authoritative instruction manual on the logical thinking process itself as he understands it. To him, the logical way to understand a system is to understand its constraint (he assures us that each system has one). He presents 5 Focusing Steps to rectify a system's constraint, and among other lists he presents to investigate and model a constraint. Gharajedaghi (2005) likewise states that there are 5 crucial Systems Principles, but his are: openness, purposefulness, multidimensionality, emergence, and counter-intuitiveness. Further, he believes the systems thinker must know his 5 Dimensions of a Social System: power, knowledge, wealth, beauty, and value. Each of these dimensions can malfunction; thus he points out that his list doubles as the five dimensions of "obstruction analysis" for systems thinkers to be able to do. Haines (1999) sees systems thinking as focused on the 4-point "ABCD model" (each letter corresponding to input, output, feedback, throughput and environment). To Senge (1990), systems thinking itself is best framed as belonging in a list of 5 disciplines: the others being personal mastery, mental models, building shared vision, and team learning. Weinberg's (2001) guide to systems thinking proceeds methodically through 10 principles and laws, and he presents mathematical proofs, graphs, and practical examples to explain them.

The aspiring systems thinker is presented with many authoritative statements about what systems thinking means. While having the challenge of systems thinking simplified by manageable lists may encourager learners, the wide divergence among the lists, principles, and laws these authors present as the fundamental requirements for systems literacy is daunting. Common ground does exist among the lists and laws presented in these books: emphases on connected people and processes, multiple dimensions to consider, and appeals to both scientific and anecdotal support for their views of systems thinking abound. Just as striking are the idiosyncratic declarations of what systems thinking means: including counsel to focus solely on finding and eliminating whatever one constraint is obstructing a system (Dettmer, 2007); and presentation of systems

thinking as the application of scientific data versus the consideration of human values (Checkland, 1999; Gharajedaghi, 2005; Haines 1999). While memorable heuristic guides are used in most disciplines to guide a student's thinking, the popular systems literature suggests that being a systems thinker demands one master a very wide array of such guides.

Table 2

Author	**Sample Laws and Lists Required to do Systems Thinking**
Anderson and Johnson, 1997	*5 Principles of Systems Thinking:* Thinking of the "big picture"; Balancing short- and long-term perspectives; Recognizing dynamic/complex/interdependent aspects; Considering measurable and nonmeasurable factors; "Remembering that we are all part of the systems in which we function, and that we each influence those systems even as we are being influenced by them" (p. 18) *5 Guidelines for Identifying Systemic Problems…* *8 Do's and Don'ts of Systems Thinking…*
Boardman and Sauser, 2008	*3 Principles for Togetherness:* coexistence, cooperation, coeducation
Dettmer, 2007	*Theory of Constraints:* "Each system has a 'weakest link' (constraint) that ultimate limits the success of the entire system" (p.13) *5 Focusing Steps of the Theory of Constraints:* 1 identify the system constraint; 2 decide how to exploit the constraint; 3 subordinate everything else; 4 elevate the constraint; 5 go back to step 1 but be aware of inertia
Gharajedaghi, 2005	*5 Systems Principles:* openness, purposefulness, multidimensionality, emergence, counter-intuitiveness *The Five Comprehensive Dimensions of a Social System (and Obstruction Analysis):* power, knowledge, wealth, beauty, value *The Core Concept of The Systems View of the World:* development
Haines, 1999	*ABCD Model*: input, output, feedback, throughput, environment *Systems Thinking Begins With the End in Mind*
Senge, 1990	*5 Disciplines:* Personal Mastery, Mental Models, Building Shared Vision, Team Learning, Systems Thinking
Weinberg, 2001	*The Square Law of Computation, The Law of Large Numbers; Generalized Thermodynamic Law, Generalized Law of Complementarity, Principle of Invariance, Principle of Indifference, Principle of Indeterminability, The Strong Connection Law*

As have the systems thinkers here, memorable lists are used by some mental health clinicians to educate patient populations. For example, the "core mindfulness skills" that are taught to patients with borderline personality disorder who are undergoing dialectical behavior therapy learn '3 what skills' (patients are trained in *observing – describing – participating*) and '3 how skills' (patients are to focus on behaving *nonjudgmentally – one-mindfully – effectively*) in order to achieve '*wise mind'* (a synthesis of '*emotion mind'* and '*reasonable mind'*) (Linehan, 1993). An example from Adlerian therapy is the acronym BURP, which guides therapists in handling patients by Behavioural re-description of the problems the patient perceives in him/herself, discovering the patient's Underlying rules, Reorientation to new ways of thinking, and Prescribing new behavioural rituals (Corey, 2009).

Open and Closed System Types

Another area of knowledge about systems that some authors stress is the notion of closed and open systems. The merits of maintaining an open system focus on sustainability ("Open systems have a better chance of staying alive and vibrant in the world" [Brynteson, 2006:22]). The challenges of openness are also described: open systems

> require a continuous flow of energy in order to maintain order and cohesiveness… [leading a system] is all about the active, continuous, pumping of energy into and through the team, especially when the going gets tough. No wonder being a leader isn't easy… It requires that oh-so-draining giving of energy. (Sherwood, 2002:188)

To cope with the challenges of openness, "the first rule for getting a handle on open systems [is] the imperative of predict and prepare. Predicting the environment and preparing the system for it," according to Gharajedaghi (2005:30). Despite this challenge posed by an open system, systems thinkers are warned against the greater peril of closedness in human systems, citing the mass suicides undertaken by religious cults in the United States and Guyana, and the Soviet Union's "implosion" upon itself as cautionary tales (Brynteson, 2006). While readers are told that "most systems fall on a continuum between totally open and totally closed" (Ibid.:22), the authors' preference for openness is clear.

Systems writers typically discuss open and closed systems focusing that concern on the health of the system itself. We can consider these two system types (or the single spectrum from open to closed) with a focus on individual health as well. For example, the inflexibility characterizing mental pathologies such as personality disorders suggests a psychology closed to information from the surrounding environment that creates ineffective and "enduring patterns of perceiving, relating to, and thinking about the environment and oneself that are exhibited in a wide arrange of social and personal contexts" (American Psychiatric Association, 2000:686) – a descriptor indicating that mental health relies upon a relatively open (adaptive) flow of information between people and their surroundings.

Some systems writers list knowledge of closed and open systems among the key domains of understanding a systems thinker must have; these two system types are useful frameworks for understanding mental pathology and health as well.

System Dynamics

For much of the population, systems thinking is synonymous with systems dynamics, for good reason. In the 14 popular books on how to be a systems thinker that we examined, 7 authors (Anderson and Johnson, 1997; Brynteson, 2006; Meadows, 2008; O'Connor, 1997; Senge, 1990; Sherwood, 2002; Sterman, 2000) focus exclusively on systems dynamics as *the* definitive way to think like a systems thinker. Another three (Boardman and Sauser, 2008; Haines, 1999; Jackson, 2003) also refer to systems dynamics, directly by name or otherwise. To Anderson and Johnson, (1997), systems dynamics represent at once "*the* principles of systems and systems thinking" and the "systems thinking tools" a systems thinker requires (p. vii – our emphasis).

Many systems theorists suggest that systems dynamics represent both start and end to systems thinking – the only form of systems literacy of any import. Other theorists object, but systems dynamics are an accessible way for a person to begin to learn how human systems operate. A focus on the dynamics of a system begins with a basic premise: within every social system, information gets transmitted, influences how people act, and such actions are interpreted as further information with further effects on people's behaviour (Checkland, 1999). Systems dynamicists refer to the information transmission mechanism within systems as feedback. Handily, and no doubt a central aspect of systems dynamics' appeal for aspiring systems thinkers, there are only two ("indeed the only two" [Sherwood, 2002:125]) types of feedback: reinforcing and balancing. Any individual who has lived or worked with others can recognize the authors' various descriptions of how the way people's thinking, words, and actions tend to sustain or amplify the status quo (reinforcing feedback) or prevent the status quo from changing much (balancing feedback). To systems dynamics proponents, such flows of information are vitally important for learners to understand: "*everything* you experience is feedback" (O'Connor, 1997:221 – our emphasis). For them, systems thinking is a matter of understanding how information creates circular cause and effect relationships, making every system function, in effect, as a looped "chain" (Dettmer, 2007).

For a great many authors, systems thinking is a matter of focusing one's attention on the system-wide structure that results from the causal connections that have developed among sometimes considerably disparate groups of people (Jackson, 2003; Sterman, 2000). Haines points out that such focus requires the ability to discover connections that may not be readily evident: "Feedback requires receptivity; it calls for us to be flexible and adaptable," he says (1999:46). Because of the ways information often causes unexpected and unintended behaviour, a system's dynamics are often misperceived: "Dysfunction in complex systems can arise from the misperception of the feedback structure of the environment. … Dysfunction in complex systems can arise from faulty mental simulation – the misperception of feedback dynamics" (Sterman, 2000:29) – hence the need for skilled systems thinkers. Most importantly, a focus on the dynamics that give rise to a system's behavioural structure shifts one's understanding from the assumption that what happens among people can be erroneously attributed to the motivations or dispositions of individuals (Sterman, 2000), when such behaviour is more accurately understood as the result of "interrelations among your variables that you may

not have considered before," according to Anderson and Johnson (1997:51). The elegant proposition – every system's behaviour has a structure that emerges from the ways information flows within it – is bolstered by a second helpful point: systems dynamicists have determined that there are only about 10 likely structures (Senge, 1990). All have pithy names (e.g. "fixes that fail" "limits to growth" "tragedy of the commons"), and all are "responsible for some of the most intransigent and potentially dangerous problems" that human systems face (Meadows, 2008:5-6).

While the systems dynamics school of thought offers an accessible way to explain the often mystifying behaviour found in groups of people, authors that subscribe to it stress its practical utility to the systems thinker: understanding systems dynamics gives one powers of prediction (Jackson, 2003), and the ability to locate a system's particularly important feedback processes (Brynteson, 2006) – leverage points where it is possible to make structural changes that can create substantive change for minimal effort (O'Connor, 1997; Sterman, 2000).

All of the writers who advocate for mastering systems dynamics argue its importance with examples of systems that have gone awry. The reason for understanding the dynamics of systems is to find ways to fix them when the system is not working. This logic mirrors the vast majority of the field of psychology, which focuses on promoting mental health by diagnosing and treating lacking mental health (i.e. mental pathology).[9]

Models and Graphics

For almost all of our authors, systems thinking involves drawing: the creation of graphics of various names: e.g. models (Sterman, 2000), purposeful activity models (Checkland, 1999), schematic representations (Gharajedaghi, 2005), systemigrams (Boardman and Sauser, 2008), objectives maps (Dettmer, 2007), or rich picture building (Checkland, 1999). Most popular authors use visual representations to illustrate the behaviour of systems, and most advocate that systems thinkers do the same. Various reasons for this are offered: visuals act as "intellectual devices whose role is to structure an exploration of the problem situation being addressed" (Ibid., 1999:A21). "They play a very helpful role in listening," Sherwood explains, "since in examining someone else's causal loop diagram you are in fact listening to their thinking; and anyone examining one of your diagrams is listening to you" (2002:183). In short, learning about systems "is not a spectator sport. Developing your systems thinking and modeling skills requires the active participation of you" (Sterman, 2000:viii).

Checkland emphasizes a shortfall of viewing systems thinking as inseparable from modeling skills. "The normal connotation of the world 'model' in a culture drenched in scientific and technological thinking, is that it refers to some representation of some part of the world outside ourselves" (1999:A21). Underacknowledged by most promoters of diagramming systems as a way to understand them is the caveat that diagrams are, at best, social constructions that Checkland cautions us are never final. Postmodern

[9] The recent advent of research on positive psychology and apithology point to shifts in focus from health via its absence toward studying mental health itself.

perspectives on psychoanalysis likewise emphasize the socially-constructed nature of reality, and its lacking finality. Among many such perspectives, for example, we see challenges to the 'givenness' of gender coming from feminist theorists who encourage people's internal models of masculinity and femininity to be revisited and redrawn when those models unhealthily constrict a person's gender identity (e.g. Benjamin, 1992; Chodorow, 1980).

Multiple Methodologies

To this point, our review of systems thinking best sellers suggests that mastery of various laws and lists, recognition of two main systems types, or simply systems dynamics alone qualifies one as a competent systems thinker. Less represented in popular literature is the perspective that systems thinking itself is a transdisciplinary proposition, requiring a wider array of knowledges and techniques. All systems authors agree that non-systems approaches to understanding human behaviour are ineffective; Jackson makes the further point that oversimplified approaches to systems thinking are mere panaceas: "fundamentally, simple solutions fail because they are not holistic enough" (Jackson, 2003: xiv). As systems are best understood as holistic entities, so Jackson aims to present a more holistic set of ways systems thinking can be understood.

As other bestselling authors, Jackson presents systems thinking options in an accessible way via a classification system:

- Systems approached for improving goal seeing and viability
- Systems approached for exploring purposes
- Systems approached for ensuring fairness
- Systems approached for promoting diversity (p. xx).

Within these categories, numerous versions of systems thinking are outlined, less as a how-to guide to using any of the methods, but rather arguing that systems thinking is not one single way of thinking.

Bestselling systems books each claim to present definitive, comprehensive way to think about systems. By contrast, Jackson reframes systems thinking as plural – rather than the ability to apply any one recipe or technique, to him a skilled systems thinker is one who understands multiple thinking approaches and which to use when: "increasingly, being a systems thinker is coming to mean being able to look at problem situations and knowing how to resolve them from a variety of points of view and using different systems approaches in combination. *Critical* systems thinking specifically encourages this kind of creativity" (p. xv – our emphasis). Akin to psychologists who advocate approaches such as clinical eclecticism (Javaratne, 1978) or psychotherapy integration (Stricker and Gold, 1993), Jackson's critical systems thinking recommends that systems thinkers forgo single-minded mastery of any single form of systems thinking in favour of developing the discernment to apply a variety of techniques when the thinker deems them useful.

Knowledge Domains a systems thinker must possess vary according to the book on systems thinking one consults. But each author is eager to persuade readers of the importance of systems knowledge. Each writer tells us that these domains don't merely represent information that is useful – knowledge about systems is *wisdom,* for several

reasons. First, they argue that it pertains to everything around us, and as such, is practical: "Every person we encounter, every organization, every animal, garden, tree, and forest is a complex system," Meadows points out (2008:3). Second, it is to be believed – Haines instructs the neophyte that

> Systems thinking comes from a rigorous scientific discipline called General Systems Theory… its major premise was that [the common laws governing systems], once known, could serve as a conceptual framework for understanding the relationships within any system, and for handling any problems or changes encompassed by that system (1999: v).

Third, framing systems thinking as wisdom available exclusively to scientists is a misconception these authors wish to correct. Systems thinking, as they explain it, is accessible – everyone can (and should) become a systems thinker. Indeed, according to Meadows, people unwittingly possess fragments of the systems thinker's Knowledge Domain:

> We have built up intuitively, without analysis, often without words, a practical understanding of how these systems work, and how to work with them. Modern systems theory, bound up with computers and equations, hides the fact that it traffics in truths known at some level by everyone. It is often possible, therefore, to make a direct translation from systems jargon to traditional wisdom (2008: 3)

For example,

> Because of feedback delays within complex systems, but the time a problem becomes apparent it may be unnecessarily difficult to solve – a stitch in time saves nine"

and,

> A diverse system with multiple pathways and redundancies is more stable and less vulnerable to external shock than a uniform system with little diversity – Don't put all your eggs in one basket. (Ibid.:3-4)

It may not be that all people are wise – indeed, since not all people possess the systems thinker's Knowledge Domain, perhaps few people are: "Wisdom, as an innate characteristic, is rare," according to Sherwood. He is quick to add, "But everyone can learn how to draw causal loop diagrams… We can indeed all become wiser" (2002:332).

The message of most writers on systems thinking is that knowing the characteristics and types of systems, or knowing laws, methods and techniques for modeling them will create a person who is able to engage effectively with and within human systems. Certainly the start of systems literacy is knowledge about systems and how they work. But knowing definitions or facts or steps does not enable someone to actively apply knowledge about systems in the way the term "systems thinker" implies. Such knowledge does not necessarily guarantee thinking processes that allow one to understand the often-perplexing behaviour and results produced in human systems – no more than memorizing Japanese words would enable one to operate effectively in Japan.

Following Kruglanski's model of lay epistemics, we suggest that particular Welcoming Cognitive Conditions are also needed in order to be a systems thinker.

WELCOMING COGNITIVE CONDITIONS FOR SYSTEMS THINKING

Checkland remarks that "Teaching a way of thinking is harder than teaching substantive factual material" (1999:A42). Certainly many of us find the factual material of systems thinking – its various Knowledge Domains – fascinating in their own right. But if creating systems thinkers merely required teaching those facts to others, the world would have as many systems thinkers as it has people who have read a book about systems or taken a course about them. It seems to us that something more is required, that in order to be a systems thinker – "a practitioner of that art" (Haines, 1999:6) – one must think in a particular systems-thinking-kind-of-way.

Writers on systems thinking refer to "the systems thinking mindset" (Haines, 1999:1), "a type of thinking" (Boardman and Sauser, 2008: xvii), a "point of view" (Weinberg, 2001:35, 52, 227-228) one requires to be able to discern the systemic nature of the world in which we operate. In Kruglanski's words, certain "Welcoming Cognitive Conditions" should make thinking like a systems thinker possible. First among them is a faith in the systemic nature of human society. Faith is required that a great variety of situations contain a discernable order (Weinberg, 2001), that they relate somehow (O'Conner, 1997), that they can be usefully understood as possessing a wholeness (Checkland, 1999). Possessing such conviction makes the systems thinker unusual: citing Kenneth Boulding, Weinberg claims that

> The general systems man… is constantly taking leaps in the dark, constantly jumping to conclusions on insufficient evidence, constantly, in fact, making a fool of himself. Indeed, the willingness to make a fool of oneself should almost be a requirement for admission to the Society for General Systems Research… we must be as little children… first forming a general impression of the whole and only then passing down to more particular discriminations. (2001:36)

The belief that a system exists amidst disparate people, behaviour, and events spread over time and space is indeed a mental leap, one regularly taken once one becomes a systems thinker. Yet if Kruglanski's theory of lay epistemics is right, people who are systems thinkers must have the capacity to take a particular mental stance toward human dynamics that enable them to discern the system-ness binding together those dynamics. With the notable exception of Boardman and Sauser's *Systems Thinking: Coping with 21st Century Problems*, our best selling authors offer little explicit guidance on *how one can know* that a system is present. However, taken together, we find that these authors imply that a person does, or should, take particular mental stances, or orientations, in order to be a systems thinker:

- Orientation toward logic
- Orientation toward particular data sources
- Orientation toward explicit and explicit structures
- Orientation toward static elements and dynamic processes
- Orientation toward causality

- Orientation toward subjectivity
- Orientation toward self-reflection

Orientation Toward Logic

Anderson and Johnson (1997) explain that thinking like a systems thinker requires one to assume the presence of logic in a situation or setting, whether or not that logic is readily apparent. We refer here to logic in the sense of a "set of principles underlying the arrangement of elements" (Oxford Dictionary) that are present. The task for a systems thinker is to see past initial impressions about what is occurring, O'Connor counsels (1997) to "find sense" where sense may not be readily apparent (Boardman and Sauser, 2008). A set of principles underlying disparate people and processes point to connectedness the systems thinker searches for (Brynteson, 2002; O'Connor, 1997); connectedness that gives that disparateness a particular coherence and integrity in Checkland's words (1999), a particular "shape," according to Anderson and Johnson (1997).

A system's particular shape may become apparent by virtue of its longevity. Several authors point to this. O'Connor explains that the logic underlying a system is a way of operating by which that system is being maintained (1997). As such, it is robust (Sherwood, 2002), an equilibrium (Anderson and Johnson, 1997) which becomes that system's particular signature. To the human observer, a system's logic underlies the sense that "things are staying the same" according to Weinberg (2001), that events are "chronic and reoccurring" according to Anderson and Johnson (1997), that people are operating by habit, according to O'Connor (1997).

Perceiving the logic that is governing a system can be difficult, particularly when that logic differs from – or outright contradicts – the espoused logic declared by the system's designers or participants. A system's logic may look like purposeful activities toward "a well-defined objective" (Checkland, 1999: A7). A system's logic may just as readily be operating at cross-purposes to stated objectives, say Boardman and Sauser (2008). All of the popular system's thinking books investigated here presumed that problems were the motivating rationale for becoming a systems thinker. As such, the thinker may often be seeking to discern logic in situations that O'Connor describes as those "when life seems at its most unfair and a situation most intractable" (1997:220). The logic underlying a system can be "vicious or virtuous," in Sherwood's words (2002:126).

It is worth noting that not all of our authors advocated an orientation toward logic. O'Connor states outright that "logic… is inadequate to deal with a world of complex systems" (1997:96). He does, however, indicate that a systems thinker's "challenge is to see the connections, to have a system of knowledge and not a heap of facts" (p. 229). To us, seeing those connections is seeing the presence of a logic as Oxford defines it – a set of underlying principles indicating that, intentionally or not, elements are arranged in some way that should make sense. "Nearly all of what we see in our systems that we don't like are not problems, but indicators. They are the resultant effects of underlying causes" (Dettmer, 2007:13). Systems thinkers orient themselves toward such sense,

presuming that underlying logic is somewhere present and that searching for it is a meaningful endeavour.

The assumption that logic is present in a system is an orientation akin to the assumption that the circumstances of a person's life have a 'logic' that is meaningful, an assumption known by psychologists to have positive impact on a person's mental wellbeing. Both serious traumas and lesser adversities of daily life are more bearable when seen as meaningful (Cohler, 1991; Emmons, 1999; Frankl, 2006). Coming to grasp meaning can be a curative factor in many mental illnesses. Researchers on the psychological state of flow believe that the discovery of meaning enables one to "establish and sustain an intense relationship" to a flow activity (Nakamura and Csikszentmihalyi, 2003:95), allowing one to engage with challenging circumstances instead of (or as well as) being merely controlled by those circumstances. Grasping meaning is not only useful in mitigating difficult circumstances; it may also be conducive to psychological thriving: "A sense that life has meaning is associated with wellbeing and is seen as necessary for long-term happiness" (Ibid.:95). The assumption that logic or meaning is present is useful to people seeking mental health, as it is for systems thinkers.

Orientation toward particular data sources

Anderson and Johnson (1997) offer direction regarding where a systems thinker can focus the search for logic. They call these "levels of understanding". First among them are "events" – incidents and/or problems that occur are the building blocks of systems understanding. For these authors, "patterns" are the second level of focus. A systems thinker should assume that events are related somehow, connected in a way that is particular in space and time, evidencing a stability (Weinberg, 2001) that is a clue to understanding the way events and patterns are unfolding systematically. Patterned behaviour indicates the presence of "structure", the third source of data in Anderson and Johnson's counsel to systems thinkers. In a system, occurrences unfold according to "a precise set of rules" (p. 21) that, once discerned, clarify the ambiguity a person might initially experience in trying to make sense of what is happening. If approached in sequence, events-patterns-and structures can reveal the presence of a system.

The processes by which many mental health practitioners assist people's suffering builds on the same data sources. Painful events occur in every person's life. But Haines points to a common pitfall where events are concerned: "Rather than identify a problem as one isolated occurrence, we must learn to identify and solve patterns of problems" (1999:6). The impact of painful events spreads to other facets of one's life experience in a particular pattern. Over time, that impact creates a stable personality structure – healthy or otherwise – which drives a person's behaviour. Anderson and Johnson's focus on event-pattern-structure is fruitful in understanding both human systems and human psychology as well.

Orientation toward explicit and implicit structures

The thinker seeking a systems view of life experiences will note that certain obvious structures exist in the world – hierarchically-structured workplaces and governments, developmentally structured growth in plants, animals, and children, cyclical structures in

business and nature, etc. Any of these structures operates with readily discernable sets of rules (Anderson and Johnson, 1997; Haines, 1999; O'Connor, 1997), rules that Weinberg likens to a "program being executed" (2001:227-228). Structures are explicit arrangements of people, information, energy, and matter that set limits on the range of behaviour that is possible in those organizations, organisms, etc. Structures keep situations in place (O'Connor, 1997), provide stability (Weinberg, 2001), provide "something to count on" (O'Connor, 1997:63). As Checkland puts it, system's structure provides the "means and mechanisms" by which that particular system gets things done (1999:102). Several of our authors stress a fundamental principle for the would-be systems thinker: you must see the logic driving a system as behaviour arising from the system's structure: "Once we can see the relationship between structure and behaviour we can begin to understand how systems work," says Meadows (2008:1). "The structure of the system gives rise to its behaviour," in Sterman's words (2000:28). He continues with a cautionary note for the aspiring systems thinker: a system's results, good and bad, are produced by its overall structure *to a far greater extent than any individuals within it*. Although people commonly blame problems on the actions, motivations, or disposition of particular players, the systems thinker must know that "different people placed in the same structure tend to behaviour in similar ways" (2000:28). Events and behaviours arise from a confluence of factors to do with the explicit structures set up within the system. Other authors (e.g. Meadows, 2008; O'Connor, 1997) make this same point.

The arrangement of people, information, energy, and matter also give rise to unintentional behaviour and events – events that may seem insignificant to system participants, but that a systems thinker will note as indicators of system-wide importance. Patterns in the unendorsed and often unrecognized behaviours that emerge within a system are generally more difficult to detect. But such implicit system structures are no less potent an influence on people's behaviour than the explicit structures in which people operate (Brynteson, 2002). One way a systems thinker should become alert to a system's implicit structures is the language used by those within it: 'ought', 'should', 'have to' and 'must'" are indicators of tacitly shared ideas that govern the actions of those within the system, according to O'Connor, 1997 – whether such injunctions are officially sanctioned or merely assumed. In Haines' words, within a system, "How you think is how you act is how you are: The way you think creates the results you get" (1999:33).

Most mental health practitioners are trained extensively in the detection of the implicit structures working in people's lives. Normative language is an important clue to the assumptions and expectations that create the life a person is living – healthy or otherwise. Particularly when a person feels victimized by things that are "happening *to*" him or her, a skilled clinician's ear will orient to the implicit attitudinal structures that may be contributing to such happenings. Cognitive-behavioural psychologists would agree with Haines' counsel to systems thinkers that "How you think is how you act is how you are" for its relevance to both cause and treatment of mental suffering. Conversely, Haines' counsel applies just as readily to mental wellness. The study of what mental structures facilitate psychological health is relatively young, such as research on happiness

beginning in the 1930s, optimism beginning in the 1960s, and thriving (past infancy) beginning in the 1980s.

Orientation toward static elements and dynamic processes
The most visible structures in any system are static arrangements of material objects. Our authors advise that a systems thinker seeks to understand the implications of those static elements, and also to the structured dynamic processes occurring within the system. Each system possesses stability even in its movement. In this regard, a systems thinker understands structure differently than most. To see how processes occurring within a system are governing the system's behaviour, a systems thinker must see how such processes possess a regularity, (i.e. a structure). For this systems thinking orientation, Weinberg counsels "we must begin by stripping from the word 'stable' some of its everyday connotations that would only serve to mislead our general systems thinking. We often confuse the word 'stable' with the word 'immobile'" (2001:229). Likewise, mental health is impacted by relatively 'static' elements: physical location, material possessions, family members, socioeconomic status, etc. (as Bronfenbrenner proposed in his 1979 'ecological systems theory'); it is also impacted by dynamic processes: aging, physical activity, sickness, and recovery. A person's state of psychological equilibrium is strengthened or weakened by the combination of both static and dynamic factors.

Orientation toward causality
As popular systems theory writers describe it, causal explanations are a central goal when trying to understand a system under observation or one in which a systems thinker is embedded. "We make up causal theories all the time: more police means less crime, more money means a happier life, seat belts save lives…" O'Connor point out (1997:83). For most of the authors (who are schooled in systems dynamics methodology) a system is comprised of a multitude of causally linked variables that make up the system's structure, and this structure causes the system's behaviour. Anderson and Johnson put the relationship between structure and cause this way: "Whenever we ask questions like 'why is this pattern happening?' we are probing at structure. Thinking at the structural level means thinking in terms of causal connections" (1997:8).

All of our systems writers consistently warn that the difference between one who is a systems thinker and one who is not is the understanding that human behaviour has multiple causes. By definition, "the central concept 'system' embodies the idea of a set of elements connected together which form a whole, this showing properties which are properties of the whole, rather than properties of its component parts" (Checkland, 1999:3). The point is made repeatedly. To Haines, the outdated "machine age" "seeks to explain virtually every phenomenon by resorting to a single relationships: cause and effect" (1999:9). In Brynteson: "I am uneasy when clients blame their problems in single individuals or pairs of people. Usually, these 'culprits' are acting out other visible and invisible forces in the system" (2002:35) and "The next time you are involved in a complex situation where finger pointing is the norm, stop and reflect. Map out all of the contributors to the situation. Who has contributed to this problematic situation. … In systems thinking, there is no blame, only levels of responsibility" (p. 27). In Anderson and Johnson's list of "Do's and Don'ts of Systems Thinking": "Don't use systems

thinking to blame individuals" (p. 88). For O'Connor, "When you start to think in systems, there is no blame" (1997:220); "It makes more sense to think about influencing factors" (p. 83); "Habitual thinking is insufficient to deal with systems because it tends to see simple sequences of cause and effect that are committed in time and space, rather than as a combination of factors that mutually influence each other" (p. xvii). Simple cause and effect sequences are uniformly seen as inferior thinking, not the particular way of thinking about the world known as systems thinking according to Checkland (1999). Even a writer who argues that causes for most organizational issues are few (i.e. O'Connor, 1997), and one who argues that one focus attention on a system's "weakest link" (i.e. Dettmer, 2007) both agree that a system's behaviour has multiple, and usually complex, causes.

Just as the state of any human system has many causal factors, so too does any person's state of mental health. Certainly some theorists (and laypeople) believe that a single traumatic childhood vent or stroke of good fortune accounts for a person's state of psychological suffering or wellness. Such a perspective is not a systemic one. A systemic view of psychological health would not discount the importance of seminal life events; but it would examine factors such as ethics, spirituality, mind and body as co-causal influences to be considered (Wilber, 2000; Wilber et al. 2008).

Orientation toward subjectivity

A crucial orientation for the systems thinker is toward the subjectivities that are a particularly potent feature in human systems (Jackson, 2003). The commonest catch-phrase our authors used in this regard is the "mental model", referring to implicit structures within individuals and groups comprised of "taken as given" assumptions and meanings (Checkland, 1999:A35), preconceived ideas, values, beliefs (Anderson and Johnson, 1997), and personal philosophies (Jackson, 2003) that act as inner rules (Anderson and Johnson, 1997). As other implicit structures, mental models act as personalized logics that provide people with a sense of purpose on which they act (Jackson, 2003). In Checkland's words, they arise and operate this way:

> We all do the following: selectively perceive our world, make judgments about it, judgments of both fact (what is the case?) and value (is this good or bad, acceptable or unacceptable?); envisage acceptable forms of the many relationships we have to maintain over time; and act to balance those relationships in line with our judgments (1999:A41).

The judgments people make about facts and value predispose them to particular behaviour, Haines says (1999). Thereby, a human system's mental models of reality create and sustain that system's status quo (O'Connor, 1997).

Mental models can become problematic, O'Connor indicates, because these models become structures that both generate *and limit* the behaviours a system will exhibit. Such structures can rigidify when members fail to view them as subjective. Mental models are ways people assume that they understand how reality really is; paradoxically, the models narrow the range of possibilities that people believe they should consider, yet tacitly people assume the models they carry are universal and are, or should be, unquestionable.

Mental models thus work to eliminate uncomfortable ambiguities within and surrounding human systems – ambiguities which often feel intolerable. These implicit structures limit people's curiosity, and a system's capacity to learn and change. Their intangibility notwithstanding, mental models are potent structures within every human system, and potent causal forces that govern how members of a system think, feel, and operate.

A systems thinker's job, then, is clear. Mental models must be detected and examined. One must translate people's tacit perceptions into explicit language, Anderson and Johnson say (1997). This is a deceptively difficult skill to master, requiring close attention to system members' use of the modal operators we referenced earlier (i.e. "must, mustn't, should, shouldn't, cannot" – O'Connor, 1997:111), and also behaviour implying the presence of musts, shouldn'ts, and cannots. The detection of mental models is a central aspect of the mental health professional's skill set.

A problem posed by mental models is that their actual utility for a system's (or individual's) explicit aims are usually left unexamined. Another is that, while all members of a system hold many of the same "deep-rooted guiding ideas" (O'Connor, 1997) (in fact, membership in a system requires such commonality), the difficulties a human system encounters is often created by differences in the subjectivities of system members. As Sherwood says it:

> Much of the dysfunction arising between people results from a failure to understand one another's fundamental beliefs, one another's deeply held mental models. Rather than listening to and respecting the other person's mental models, we seek to ram our mental models down the other person's throat and we get very frustrated when the other fool doesn't get it. Two [opposing views], perfectly synchronized, escalate the conflict exponentially until the whole thing breaks down. The wisest policy? Stop forcing and start listening. (2002:183)

The plurality of subjectivities operating within human systems is a major source of difficulty in coping with and within them (Jackson, 2003).

To fully grasp the subjectivity of a human system, one must deliberately suspend one's own mental model (Haines, 1999) in order to understand the model held by members of that system – from *their* perspective (O'Connor, 1997). Most authors indicate that the systems thinker will find this a challenge. Invariably, "Systems thinking is a deliberate attempt to think when thinking itself is put at risk by… confusion, and confrontation, when the thinking process is being assailed and overwhelmed by debate, opinion, doctrine" (Boardman and Sauser, 2008:2). The attempt to bracket one's own mental models can only ever be partly successful, and examining the deeply-held mental structures of others will invariably bring them into conflict with one's own. A "rigorous approach to the subjective" (to borrow Checkland's phrase [1999:A43]) is required here. Systems thinkers must learn to appreciate the mental models of the systems they operate with and within, seeking to avoid imposing their own judgments on those models (Gharajedaghi, 2005). Regardless how illogical the mental models of a system with which one must engage, the systems thinker must find how members' views of reality make sense (Boardman and Sauser, 2008). Recognizing the difficulty in this crucial

undertaking, O'Connor (1997) frames the cognitive stance a systems thinker must engage: "You do not have to agree with them, but unless you understand them, you will not understand the system" (p. 147). A crucial point here is this: for a systems thinker to understand a human system, the veracity of its members' tacitly-held views is irrelevant. Perhaps especially when a human system's realities appear dubious, the skilled systems thinker appreciates them for what they are – social realities which must be reckoned with. An important Welcoming Cognitive Condition in systems thinking is orientation toward the subjectivities within a system. Likewise, a skilled mental health practitioner learns to see clients as those clients see themselves, from within their subjective experience of themselves and their world. Various frameworks for therapists to grasp a patient's subjective understanding have been proposed; for example, "acts of self, expectations of others, perceived acts of others, and self-image/self-treatment" from the psychodynamic literature (Butler and Strupp, 1991; Messer and Warren, 1998).

Orientation toward self-reflection

According to several of our authors, the object of systems thinking is not only the system, but also the one observing the system – the systems thinker. Subjectivity is a property of human systems and also of those seeking to understand them; hence, systems thinkers must orient their inquiry outwardly toward the system and also inwardly toward themselves.

Cues to a systems thinker's unrecognized mental models arise in the systems thinking process itself. One's own assumptions about oneself and others can be inferred by the disbelief or disagreement – oppositional emotions – that emerge in the systems thinker when working to understand a system (O'Connor, 1997; Weinberg, 2001). While such discomfort signals that one's own subjectivity is being challenged, more importantly it signals the surfacing of one's worldview, which Checkland asserts should be consciously reflected upon (1999).

Systems thinking demands one orient attention both inwardly and outwardly because, our systems writers point out, it is a productive way for dealing with the outside and inside world, and for discovering the relationships between them. Several authors state emphatically that systems thinking is not an enterprise for someone who wishes to remain dispassionately outside an object of inquiry. While systems thinking is framed as a superior way of thinking intelligently, it is also personal. The authors put this different ways: for Anderson and Johnson, "Systems thinking is characterized by the principle… that we are all part of the systems in which we function, and that we each influence those systems even as we are being influenced by them" (1997:18). Brynteson wants his readers to consider their own personal connection with the systems they want to fix in the outside world, asking them to reflect "Try this: There is no 'away'. How does this work in your life? What do you want to go away that will not go away? Does that problem help you dig deeper into your repertoire and stretch yourself and, thus, help you grow? Think about it" (2002:59). Haines, too, urges people to use systems thinking skills outwardly and inwardly: "In personal terms, systems thinking is about finding patterns and relationships in your work and your life, and learning to reinforce or change these patterns to achieve personal fulfillment" (1999:51).

Psychoanalytic therapists employ self reflection when working with patients, because awareness of oneself is understood to help them work effectively with patients. As early as 1910, Freud was writing about what he termed "countertransference" – the psychological process by which a psychoanalyst becomes unconsciously entangled in the dynamics of a client, thereby becoming less able to effectively understand and treat that client. This form of unreflectiveness can damage the working relationship between analyst and patient, creating "chaotic situations" instead of increased understanding and healing (Berne, 1975).

TOWARD COGNITIVE SKILLS OF SYSTEMS THINKING

The authors explored here offer clues to particular orientations – toward logic, particular data sources, a system's explicit and implicit structures, its static elements and dynamic processes, issues of causality, subjectivity, and self-reflection – that inform our understanding of a systems thinking epistemology for the layperson. Orienting oneself in these ways, one creates Welcoming Cognitive Conditions that are conducive to understanding the behaviour of a human system. We consider each of these to be mental stances one needs to take in order to do what is called "systems thinking."

We argue that if the community of systems scientists and theorists are to propagate systems thinking, more is required than communicating system definitions and facts. Likewise, if we are to create systems thinkers, more is needed than an understanding of orientations/mental stances conducive to systems thinking. Beneath the orientations we have gleaned from popular systems thinking books, specific cognitive skills necessary for one to apprehend the workings of a system must exist. We believe that many cognitive skills are involved in the systems thinking process. Few of these have been directly discussed in the popular systems literature or elsewhere. Yet they seem, nonetheless, to be crucial aspects of systems thinking. For the systems community to disseminate systems thinking to a broader public, and to increase the world's capacities to create healthier human systems, greater clarity about the mental capacities required to be a systems thinker must be understood. We offer some possible candidates below.

A systems thinker must be able to think *concretely*. Notwithstanding systems writers' critiques of analytical reasoning (described by nearly all of our authors), systems are comprised of parts, of individual people with distinct identities and agendas. The systems thinker must view these visibly disparate human entities, the tensions that exist between each, and between each and the system as a whole. Boardman and Sauser speak to this issue:

> There are two imminent challenges for systems people… First the tension established on behalf of a part (of a whole) to essentially belong to a whole… the tension is between belonging and being autonomous, of being independent and yet interdependent… it is a real and not imagined tension, for diversity is what gives the whole its strength and its function, and yet harmony is what the whole needs for its form. (2008:25)

Despite the primacy of the whole promoted among systems writers, a systems thinker must also possess the skill to identify and understand a system's parts as well.

To a systems thinker, more important that the individuals who visibly comprise a system are the interactions among them. It takes skills of *abstraction* to discern the 'space' between members of a system where exist the relationships they co-create. At the level of abstraction, less important than the individuals themselves are the qualities of their engagement with one another, the roles they have assumed in relation to one another. To Gharajedaghi, in fact, "the significance of membership in sociocultural systems… lies in the fact that the units of these systems are not so much the individuals but the roles imparted to them" (2005:66). In every human system, individuals act together to create a cohesive, singular storyline. Apprehending the roles people play within the patterns of behaviour a system displays is a crucial skill if one is to understand the logic in those behavioural patterns.

Systems thinkers require flexible *mental switching* processes (Bishop et. al, 2004) to shift between a system's parts and seeing those parts in aggregate.

Social systems are peopled by humans, each with their own unique views. A systems thinker must have skills of *integration* – the ability to see how a plurality of people, ideas, information, opinions, functions, resources coexist, how the many dimensions of a system interact (Gharajedaghi, 2005). Trying to take multiple aspects into account is sound systems thinking. Checkland describes it also as an exercise in empathy:

> We should remember that many people find their way unconsciously to world-views which enable them to be comfortable in their perceived world. Coming along with a [systems thinking] process which challenges world-views and shifts previously taken-as-given assumptions, we should remember that this can hurt. (1999:A44)

As well as the switching movement between a system's micro and macro levels and the ability to integrate them is a capacity to synthesize, to create a unified view of system members' diverse perspectives. If one orients attention only toward a system's individuals – the parts of the system whose activities often appear to contradict – onlookers generally see "unfeasible parts… the zero-sum game… a win/lose struggle" (Gharajedaghi, 2005:38). In contrast, "systems approaches are holistic and use 'joined up' thinking, and therefore tackle problems in a more profound way" (Jackson, 2003:31). Systems thinkers take a metaview (O'Connor, 1997), seeking superordinate descriptions of system participants' overall purpose or functioning. Boardman and Sauser approach their synthesizing approach thus: in this "theme of commonality when faced with variety and the apparent lack of anything common… our line of questioning goes something like this: what is the similarity or sameness?" (2008:21). O'Connor tells himself to "Move up a level and ask what larger goals would include both party's goals" (O'Connor, 1997:206). This ability to integrate, to take a metaview of individual actions and events is a way a systems thinker can "synthesize into a single objective reality or need that singularly makes sense of the variety of viewpoints available" (Boardman and Sauser, 2008:6-7). This skill is highly prized by systems writers: "Contrary to a widely held

belief, the popular notion of a multidisciplinary approach is not a systems approach. The ability to synthesize separate findings into a coherent whole seems far more critical than the ability to generate information from different perspectives" (Gharajedaghi, 2005:xv). Particular cognitive skills must enable systems thinkers to be able to understand the unified function of a system's behaviour. Such skills remain to be identified and examined by the community of systems scientists.

DISCUSSION AND CONCLUDING THOUGHTS

Throughout this paper, we have proposed connections between systems thinking and mental health. Mental health involves understanding and working with the forces that affect one's life. This requires relating with systems and understanding their effects sufficiently to operate effectively within them.

Given how much time people spend as members of human systems, and how much of the world's activity is conducted by human systems (Frederickson and Dutton, 2008), people develop varying degrees of semiotic competency that can be strengthened by skills of systems thinking that are based on sound science. We consider systems thinking a basic life skill our world's population sorely needs. In this view, we are not alone. "Every leader and organization should think this way," Haines declares (1997:138). We think there is merit in his sweeping statement. But what "this way" exactly is, is not clear. To a great extent, the community of systems scholars has left this conversation to popular writers.

And so as an application of systems science, systems thinking remains largely untapped territory. Beyond agreeing that systems are important, agreeing that everyone is embedded in them, and agreeing that systems scholars should spread knowledge about them, much is yet to be done *to think about this intriguing way of thinking*, as we are encouraged to do by this conference's call for papers. Systems scientists themselves need to look closely at what systems thinking means. While its potential value for ecological and social problems of global scale is largely understood, its potential value for the very psychological health of those who populate the world has yet to be discussed. One can argue convincingly that people who can solve urgent world problems must have skills of systems thinking. One can argue likewise that they also require basic mental health – particularly the kind that provides a literacy and capacity to recognize, understand, change, and work skillfully with systems, human and otherwise.

Pointing out the interplay between notions of systems thinking and notions of mental health, we have sought here to initiate conversation about how to do systems thinking. Amidst the words of popular writers trying to create systems thinkers of the general public we discern hints of a Knowledge Domain and Welcoming Cognitive Conditions required to make systems thinking possible. Likewise, we see hints of distinct cognitive skills which have yet to be identified that comprise the "way of looking at the world" (Weinberg, 2001:52) known as systems thinking. An opportunity exists for the systems community to take up this task. We think that members of this community interested in mental health are particularly suited for the role.

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