ADAPTING BANATHY'S SYSTEMS VIEW OF EDUCATION TO A SYSTEMS VIEW OF HUMAN SYSTEMS

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ABSTRACT

While Troncale's System of System Processes (SSP) lists over eighty processes found in complex systems throughout nature, most systems workers are familiar with and apply a fraction of that number. Although knowledge of all eighty processes is not be necessary for a systems view, familiarity with most of the processes and their interactions should be a prerequisite for claiming expertise. In *A Systems View of Education*, Banathy described concepts and processes of human activity systems generally, and educational systems more specifically. He then asked readers to apply the concepts and processes to their particular systems. He took readers through three models of a system: the system-environment model, the function/structure model, and the process model. A comparison of *A Systems View of Education* with the SSP led to six suggestions for adapting and updating the rubric to general and specific natural and human systems: (1) Rename the "process model" to the "development model" or "change model." (2) Add and/or emphasize development, hierarchy, networks, and chaos/attractors. (3) Reframe abstract, philosophical concepts like beauty, good, plenty, and truth into systems functions and processes. (4) Add the primary drives and physiological functions of human systems.(5) Articulate consciousness, cognition, and emotion as functions and series of processes. To more fully develop this rubric, a comparison to more recent systems texts is in order. Findings from fields as diverse as neuroscience, social and evolutionary psychology, and business management can provide further insight and examples. Finally, determining what is important for developing a beginning systems view and what should be included in later courses may be best discovered by offering the course and then determining with participants what is helpful and what needs revision.

Keywords: systems processes, isomorphies, systems education, human systems, consciousness, systems development, system of systems processes

INTRODUCTION

While Troncale's (2007) System of System Processes (SSP) includes over eighty processes found in complex systems throughout nature, most systems workers are familiar with and apply a fraction of that number. Most researchers are concerned with modeling specific processes for application in their particular fields. Networks and power

laws; evolution and adaptation; cycles, oscillations and symmetry; and chaos and attractors are a few of the groupings.

Although knowledge of all eighty processes is not be necessary for a systems view, familiarity with most of the processes and their interactions will probably be a prerequisite for claiming systems expertise in the future. With the increasing use of systems terms and processes in science and business literature, a basic, nonmathematical overview course for undergraduates and for those unfamiliar with systems concepts and theory is in order.

In *A Systems View of Education*, Banathy (1992), an educator, developed a three-model approach to developing a systems view of human activity systems generally and then educational systems more specifically. He first contrasted the industrial worldview with the systems worldview and then described his three models or "lenses." The system-environment model shows a "bird's eye" view of the system interacting with its environment. The structure/function model shows a still picture of the system at a particular moment. The process model shows a moving picture of the system adapting and evolving through time. In fifty exercises scattered throughout the book, readers are asked to apply the concepts and processes to their particular educational systems. Banathy used the text as the basic curriculum for his introductory systems classes at Saybrook Graduate School, and continued to write about human systems design and societal evolution.

I have applied the three-model approach to develop a systems view of the self, or subjective experience, and found it to be a useful framework (Rasmussen, 2000, 2004, 2006). However, Banathy's later work, Troncale's system of systems processes (SSP), and new work in hierarchies, networks, chaos theory, critical systems and more demands a considerable revamping of the content of the models.

INITIAL SUGGESTIONS FOR ADAPTATION

Comparing Troncale's list of systems processes to those covered in Banathy's three-models reveals those processes not included. Although all are not necessary for a beginning overview, many processes have become more generally recognized over the last fifteen years.

Adapting Banathy's View

Table 1. A comparison of Troncale's list of systems processes with processes found in Banathy's three models and suggested addition

SYSTEM PROCESSES	Banathy	Rasmussen Additions
Adaptation Processes		
Allometry Patterns		
Allopoiesis		
Anergy Mechanisms		
Ashby's Conjecture (Requisite)		
Attractors		
Autopoiesis & Autocatalysis		
Bifurcations		
Binding Processes		
Boundary Conditions as a Proc		
Boundary Limits & Constants		
Catastrophe Processes		
Causality Processes (linear vs net)		
Chaotic Processes		
Circuits & Network Motifs		
Closed Systems		
Competitive Processes		
Constraint Fields & Analysis		
Cooperative Processes		
Counterparity Diagrams & Proc's		
Criticality, Self-, Tipping Pts		
Cycles and Cycling, General		
Cycles, Rechargeable Loops Limit		
Decay, Autolytic & Senescent Proc		
Deterministic/Directive Process		
Deutsch's & Dollo's Conjecture		
Development Patterns & Laws		
Dissipative Processes		
Diversity & Variation Processes		
Duality-Complementarity Mech's		
Embodiment & Subsumption Proc		
Emergence Processes		
Energy Processes		
Entropy, General		
Entropy-Dissipation Processes		
Equifinality as a Process		
Equilibrium & Steady State Proc's		
Ergodic Processes		
Evolutionary Processes		
Exclusion Principle		
Feedback, Coupled		

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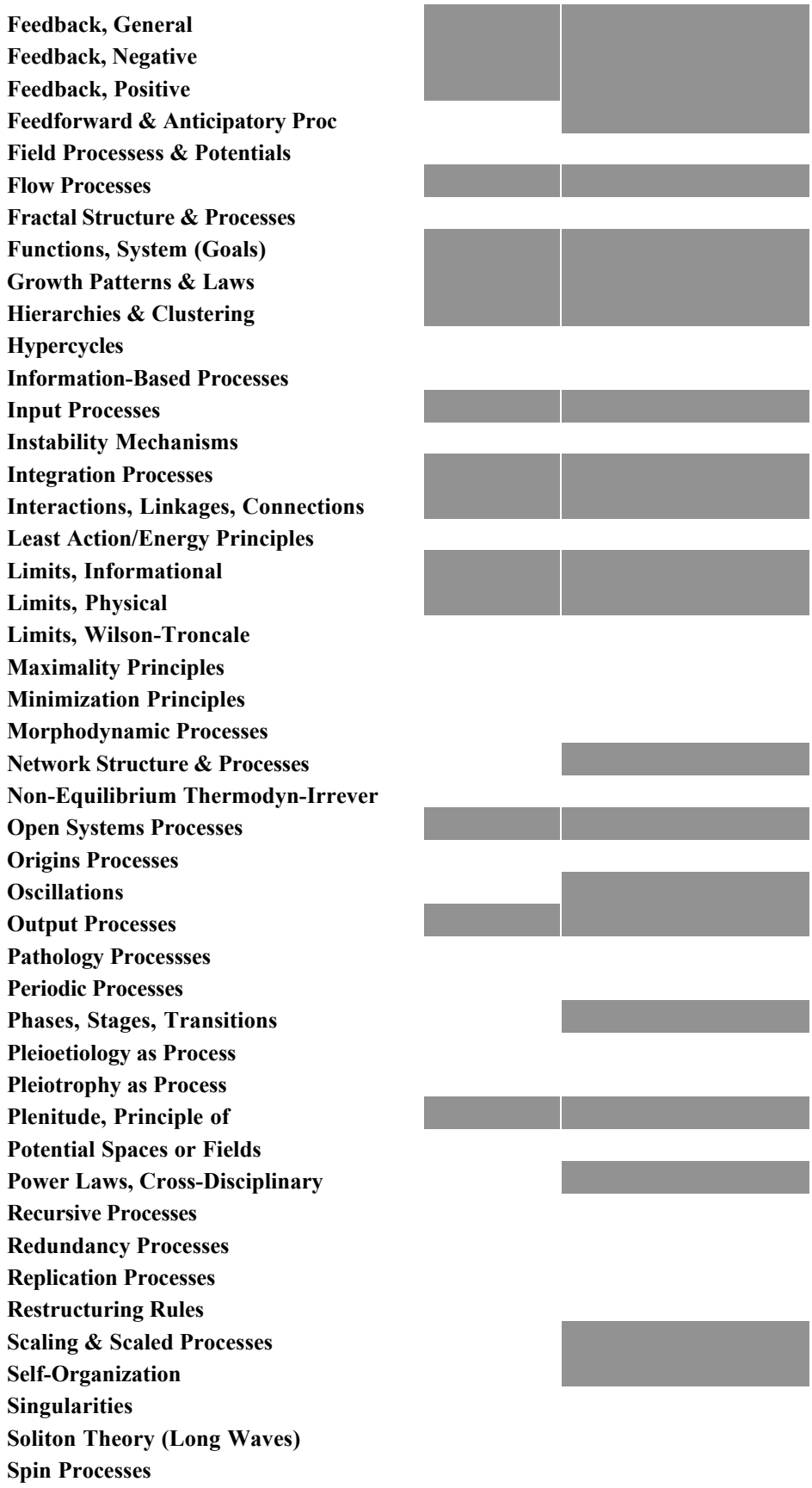

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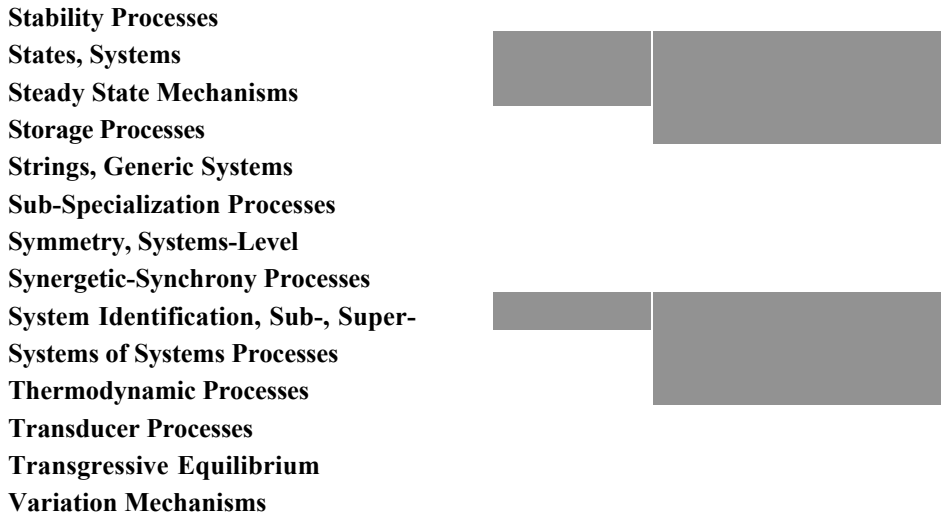

The following are initial and broad suggestions for adapting and updating Banathy's rubric for application to both general and specific human systems:

1. Rename the "process model" to the "development model" or "change model."

Because the term "process" is used to describe isomorphies found in all three models, the label "process model" is awkward. In his process model, Banathy focuses on input, transformation, and output processes, and then guidance and management of each. With his focus on education in the 1980s, he was concerned about entrenched bureaucracies. Although the bureaucracies still exist, the Internet and online communities offer people different experiences and a "feel" for systems that wasn't as prevalent twenty years ago. Processes of development and networks lend a richer view of systems moving through time that are applicable and useful now.

2. Add and/or emphasize development, hierarchy, networks, and chaos/attractors.

Development: In his first chapter on general introductory concepts, Banathy compares five "systems types" that range from relatively closed, unchanging, and controlled to relatively open and continually evolving. The same systems types can be shown to exist in various human systems as developmental levels, each level demonstrating an increasing capacity to integrate and deal with complexity and co-evolve with environments (Rasmussen, 2006).

Hierarchy: Although Banathy explains embeddedness and the relationship among systems, subsystems, and suprasystems, hierarchy is referred to only once. A basic 1996 systems skill is to place the observed system within its systemic context and then understand the general dynamics and relationships among the surrounding levels. The system of investigation, N, interacts with its subsystems, N-1, N-2,. . . and with the systems in which exists, N+1, N+2, . . . N-1 is the level of explanation for N, while N+1 is the level of significance of behavior of N (Au & Allen, 1996). In human systems

generally, for example, a marriage, N-1 will be the individuals and N+1 could be the community in which a marriage exists. Hierarchy as a process is also demonstrated in hierarchical levels of human development.

Networks: A basic understanding of networks, whether neural, cognitive, or social, is required for even an introductory systems view. How they form, how they are maintained and grow, and their interrelationship with development and hierarchy lends to the understanding of whole systems (Barabasi, 2003; Troncale, 2004-2007).

Chaos/attractors: In brains and cultures, extremely complex networks form attractors, and attractors disintegrate into chaos and form up again (Perkovsky, 2007). From a mechanical view, chaos is breakdown. From a systems view, chaos may represent the temporary reorganization to a more complex and integrated level of systemic development. In human systems, from individuals to the global, this process is experienced but poorly understood.

3. Reframe abstract, philosophical concepts into systems functions and processes.

Banathy describes fundamental "purposes" of human activity systems from the Greeks: beauty, truth, plenty, and good. These can be reframed in terms of function and process.

One approach comes from the explanatory level of whole brain activity. As described above, ensory information is continually entering the brain and forming into masses of networks at different brain areas and levels, and then emerging in the whole brain as "attractors." These attractors organize, break down into chaos, and reform four to five times per second in what Freeman (2000) describes as being like "cinematic frames." When the attractors are highly orderly, they reflect familiar patterns that evoke positive emotions. This same dynamic operates not only in brains and individuals but also in whole cultures (Petrovsky, 2007).

Beauty can be framed as orderly patterns that result in good feelings and openness. **Truth** is the clear flow of information that reflects the world as it is. The pattern is "in sync" with experience in the world. **Good** can be framed as the clear flow of information and matter/energy toward the increased order, integration, and development of systems and their systemic environments. **Plenty** is the flow of resources toward the further integration and development of a system.

Banathy lists seven "dimensions of purpose" required for a human system to operate as a functional whole. He describes them as interrelated and as a system of purposes. Take Banathy's reasoning a step or two farther and these dimensions of purpose can be framed as flows of information and matter/energy that support the increasing integrity and development of the system, its subsystems, and its systemic environment:

Social action is flows of information and matter/energy—behavior--from the system that strengthens the systemic environment. N → N+2, N+3

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Economics quantifies the flows of resources (information and matter/resources) through the system and its systemic environment N ←→ N+1 ←→ N+2 . . .

Morals and ethics represent actions and behaviors directed toward the increased well-being of the system and its systemic environment. N → N+1 N→N+2 N→N+3

Health is clear flow of information and energy/matter through the system that results in growth, development, functioning of the system. N ←→ N-1←→ N-2←→ N-3

Education and learning is the flow of information that assures the growth and development of the system and its capacity to adapt to or co-evolve with its environment.

N + 1, N+2, N+3 → N ←→ N-1

Esthetics—great design, beauty, art--are openness and order that allow for and increase flows of information and matter/energy through and among systems.

Governance and guidance refer to control of the direction of flows and the openness/closure of flows. Governance involves feedback systems that regulate system.

Science and technology are extensions of system's capacity to function. They increase human capacity to attain all of the above purposes.

4. Add the primary drives and physiological functions of human systems.

A function of human activity and meeting basic needs, and can be described within Banathy's dimensions of purpose. Maybe because his focus was on educational and business systems, Banathy didn't focus on the basic needs for air, water, shelter, etc. and the basic instincts that underlie and drive human behavior. Interesting to note, Perlovsky (2007), a neuroscientist and engineer, describes what he has coined as the "knowledge instinct:" "To satisfy any instinctual need—for food, survival, and procreation—first and foremost we need to understand what's going on around us. The knowledge instinct is an inborn mechanism in our minds, an instinctual drive for cognition which compels us to constantly improve our knowledge of the world (p. 73)." He extrapolates that drive to whole cultures.

5. Articulate consciousness, cognition, and emotion as functions and series of processes.

Banathy doesn't deal directly with the concepts of consciousness, cognition, and emotion in the three models. Recent research from neuroscience offers explanations and models that can be reframed as interactions of processes.

Human systems, whether individuals or nations, operate at different levels of consciousness that are associated with boundary conditions of openness and closure, the capacity to integrate and adapt knowledge and information, the capacity to direct flows of information and matter/energy in constructive directions, and the capacity to understand and deal with increasing complexity. These are the same processes described in Banathy's

systems types and can be framed as developmental levels within the change and development model.

Consciousness is also associated with our "second nature," our capacity to not only exist within but also to imagine and create systems together (Edelman, 2007). Design is a uniquely human activity. Although it was a primary theme in his later books, Banathy briefly touched on it in his final chapter on activation of the models. Design can be included as a function in the structure/function model and further described in the process or change model.

Emotion operates as a part of a regulatory function in individuals and can be extended to all human systems. Love and peace can be framed as the feelings (internal signals) and expressions (external signals) triggered by the open flow of information and matter/energy between and among people that results in the bonds that from social groups. Fear and anger are associated with closure in response to threat (Davidson, 1993). A function of consciousness is to open in the face of threat in order to see more clearly and respond.

FURTHER RESEARCH

While Banathy's three-model approach offers a valuable framework, the focus on human systems generally, rather than on educational systems specifically, demands significant additions and revisions. To more fully develop this rubric, a comparison to other, more recent systems texts is needed. Findings from fields as diverse as neuroscience, social and evolutionary psychology, and business management can provide further insight and examples. Finally, determining what is important for developing a beginning systems view and what should be included in more advanced courses will be an interesting challenge that may be best determined through action research, by offering the course and then determining with participants what is helpful and what will need to be revised.

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