ABSTRACTS for 14 POSTERS on SYSTEMS PROCESSES AND PATHOLOGIES

…used as a supplementary display at the….

Saturday Workshop-Tutorial Session

INCOSE IS'13 Philadelphia, Pa June 22

POSTERS ON SYSTEMS PROCESSSES THEORY (SoSPT)
Product of the Institute for Advanced Systems Studies, California State Polytechnic University

Posters #3 to #12 were produced by Dr. Troncale and student co-authors and are collected from past Poster Sessions at the annual conferences of the ISSS (Int'l Society for the Systems Sciences) & ICCS (Int'l Conference on Complex Systems).

Poster # 1

Illustration of Fragmentation of Systems Theories & Sources I. Map of Contributors to General Systems Theories

Jeffrey Yi-Lin Forest, President, IIGSS after work by Schwarz
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This poster maps many (but not all) of the theories and domains of systems research showing some relations by clustering and others by linkages. Each square represents the lifework of a researcher or of a recognized discipline related to systems science. While much of the information is dated, it is effective in terms of portraying the sheer magnitude of attempts at explaining systems. The authors include in the outer ring of squares some of the philosophers and even physical scientists and mathematicians that may have developed foundations thought to influence the development of systems thinking.

Poster # 2

Illustration of Fragmentation of Systems Theories & Sources II. Map of Complexity Science

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This poster might be called an update of Poster #1 but representing mostly work in the new field of "complex systems" as investigated by natural scientists, mathematicians, and computer scientists. This new field seems to be a re-discovery of systems thinking using new tools and in new domains. It is conveniently arranged in chronological progression and the lines do show some relations among workers and sub-domains of inquiry. Again it demonstrates the development of systems thinking as a fragmenting tree of diversifications that are rarely integrated. In fact, much of the work in these areas is completely disconnected from the previous work of Poster #1.

Poster # 3

Introduction to a System of Systems Processes: The SoSPT Model as a Basis for Integration of Systems Sources: An INCOSE SSWG Project

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This poster introduces the main features of a candidate general theory of systems -- the System of Systems Processes Theory (SoSPT) – which serves as the basis for many of the following posters. It begins with a description of the need for consensus and integration of systems theories. It concludes from past history that there has been an inadequate focus on systems processes (SP) or mechanisms, an inclusion of far too few mechanisms, and a lack of explicit description of how one systems' process influences another. In contrast, the SoSP proposes individual Linkage Propositions (LP's) in the form of explicit dyad statements to describe the influences of one SP on other SP's. Recognition of numerous such LP's results in a meta-level of interacting isomorphies that satisfies some of the most important criteria for a general theory of systems. It also yields a much more detailed understanding of systems dynamics. The poster continues with a description of a number of Association Classes of Linkage Propositions, tools for using the complex network that results, and alternative ways to represent that network. The poster ends with several practical uses and applications of the SoSPT from systems education to systems design and problem solving.

Poster # 4

Integration of Sources on Systems Chaos and Origins for the SoSPT

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This poster will concisely report on a multi-year literature search for articles on the SoSPT systems process "chaos" and "origins" comparing the results obtained from physical science, biological science, and social science search engines. This is just one of the 50 or more systems processes that are used in SoSPT. The intention was to assess the extent of usage (penetration) of these ideas across disciplines and the feasibility of integration of widely separated sources of information to test their isomorphy. The poster presents a sample of "linkage propositions" of the SoSPT Model that describe the influences between "chaos" and other systems processes which is the key innovation of SoSPT studies. The poster will also show a sample of the working definitions, identifying features or functions, position of "chaos" in the SoSPT general systems lifecycle, sample information bits on "chaos" from the literature, types and taxonomies of "chaos", as well as a sample of institutions and workers involved in research on "chaos". (This abstract follows the "formula" prescribed in CSA group-study assignments, thus the text similarities. A dozen similar posters on different systems processes applied to different systems problems areas were produced by CSU graduate students, but not included in this demonstration series. Another set showing different systems processes could be applied to Sustainability problems were also produced by graduate students of the Center for Regenerative Studies at CSU but also not included here).

Poster # 5

Catalogue of Linkage Propositions of the SoSP (System of Systems Processes): A Candidate General Theory of Systems

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This poster presents the most critical element of Troncale's System of Systems Processes' Theory (SoSPT) as a candidate general theory of systems (GTS). It begins by describing the limits and assumptions constraining any GTS. It uses these to identify the central unsatisfied need of most GTS's – that they tend to focus on just a small number of processes, not the full set, and even then they do not explicitly describe the interactions among the processes. The concept of Linkage Propositions (LP's), first introduced by the SoSP in 1978, is defined using several characteristics. Some sample Linkage Propositions that describe the particular influence of one systems process on another are analyzed. These multiple interactions result in a meta-level, but still very detailed view of how systems work. A graphic of the network established by showing these Linkage Propositions connecting 70 systems processes is presented. A hierarchical outline listing 174 sample Linkage Propositions is also presented. How to find evidence for a new Linkage Propositions in the natural systems literature is suggested. The poster concludes that LP's are interdependent and ends with citation of several practical uses and applications of the LP network of the SoSP.

Poster # 6

Tenets of the SoSPT: Prerequisites, Discinyms, Discriminations & Mutuality in the SoSP Model

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This poster begins with a concise description of the "tenets" of the System of Systems Processes Theory or Model and how those tenets distinguish it from other candidate general theories of systems. It continues with several specific examples of systems processes prerequisite for other systems processes resulting in a series of prerequisite "chains" or "flows." These chains result in the "mutuality" conjecture in SoSP that is then explained. The poster continues with a definition of "discinyms" and why their recognition is thought to be important to building general theories or to improve communication among those who study different disciplinary phenomena at different scales. The poster includes specific citations of six clusters of examples of discinyms. It also describes everal key discriminations that often interfere with communication between candidate systems theories and theorists. Finally, it describes some insights that come from recognizing prerequisite chains, discinyms, and discriminations.

Poster # 7

Comparative Systems Analysis of the SoSPT: Other Candidate General Theories and Tools

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This poster attempts to "compare" several extant systems theories in a detailed and compelling manner. It begins by explaining the pressing need for unification of candidate system theories. It relates these needs to the original purposes stated by the Founders of the International Society for the Systems Sciences (ISSS) in its constitution -- needs that are even more relevant today than when they were formulated in the 50's. The poster explains that the "comparative systems analysis" introduced here would continue in the great tradition of the contributions of comparative taxonomy, comparative anatomy, comparative physiology, and comparative genomics. The core of the poster is its At- A-Glance, process-based, 2-D comparison matrix. The matrix lists 100 systems processes on the Y-axis and six different candidates system theories on the X-axis (Troncale, Klir, Odum, Miller, Bertalanffy, and Prigogine). The intersects thus created are colored in various shades of white to grey to show whether each systems

process is “well covered,” “partially covered,” or “not covered at all” in each theory. One then can compare overall the breadth of coverage of each theory relative to the others. Several advantages and disadvantages of this processed-based comparison are described. The SoSP is described as a unique effort in “integrative eclecticism” that uses all systems processes equally. It continues by explaining why a candidate systems theory should focus on systems processes and further defines them. Finally the poster ends with the distinctions between structure and process and the “ structure is slow process, and process is fast structure" resulting in a concept of “structurprocess” as one indivisible entitation like matter:energy.

Poster # 8

Use of the Natural Sciences As A Source: Test of the SoSPT & Types of Isomorphies

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This poster describes the use of the conventional, reductionist natural sciences (specifically astronomy, physics, mathematics, chemistry, geology and biology, and computer science) as a “*sine qua non*” source of knowledge about the systems processes of the SoSP. Their empirical data presents the possibility of actually testing for isomorphy of systems process across the above named domains. The peer-reviewed literature of these disciplines could also be used to discover Linkage Propositions describing mutual influences between the different systems processes at different scalar levels. In this way, the entire cumulative experience and resources of the natural sciences becomes a database for system theories. The poster includes two tables that attempt to quantify this possibility. The first lists the number of case studies or phenomena our team has identified in each of the cited sciences that exemplify each of a dozen systems processes. The second table is an outline listing the names of the phenomena studied by each science organized not by the science that describes that phenomenon, but rather by the systems process exemplified by each phenomenon. The poster then suggests how the various scales of “manifest” system (material world objects) and the disciplines that study them emerge naturally from one another in an unbroken sequence of origins from the beginning of the universe. The main intent of the poster is to suggest a new way to empower systems theory to become more rigorous by testing general theories through "empirical refinement” made possible by the conventional sciences. A corollary of this approach is that the core of systems theory will be tied to the tools and the language of the sciences improving communications and mutual respect.

Poster # 9

The General Systems Life Cycle: Stages of Systems Development Using Systems Processes of the SoSP Model

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Users of the SoSP general theory of systems have requested simplifications of the length and complexity of the alphabetical listing of 100+ isomorphic systems processes. Previous papers used hierarchical clustering of similar or more intensely linked systems processes. This hierarchical clustering reduces the first-level entries to a dozen. This poster presents five additional ways to organize the long list of SP’s. First, the SP’s can be clustered by the higher level “functions” that the processes perform for systems in general. This strategy will be compared with the clustering of physiological networks by function in the new field of systems biology. Second, it describes how some systems processes are necessary or included within other SP’s. We call these “prerequisite relations.” The third organization of SP’s suggests that some are more elaborate versions of others as they are employed in higher scalar levels of manifest systems. The fourth organization of SP’s places them in order of “prerequisite” knowledge for learning

and understanding. Some must be know to be used to teach about others. Finally, the SP's are organized according to their participation in "stages" of a proposed general systems "lifecycle." This organization suggests that many manifest systems go through the same stages in a particular required order.

Poster # 10

Institutional Strategies for Further Research on the SoSPT & Human SoS Problems: ISIS & fPARCSI

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The Institute for Advanced Systems Studies is scheduled to terminate at its current university home with the retirement of its founder and present director. Before that time, and in coordinated manner, two new organizations are being proposed. One would continue the concept of convocations and research projects conducted by Faculty Fellows, Associate Fellows, and Student Fellows who have joined together to form an Institute for System-Integrated Sciences (I.S.I.S.). ISIS would be a system-wide unit with its Fellows drawn from all 23 campuses of the California State University System. Its function would be to bring together the small numbers of scientists and engineers who are faculty of the Colleges of Science and of Engineering who are active in complex systems research. ISIS would have its own curriculum with courses ranging from Comparative Systems Analysis to Systems Theory to Systems Biology and Earth Systems Science. ISIS would then form the basis for a Federation for Pacific Rim Complex Systems Institutes (fPARCSI). The Pacific Rim nations are linked by their rapidly-growing economies. fPARCSI would provide a base for cooperation in external grant proposals, conferences, publications, education, and research.

Poster # 11

SoS (System of Systems) Engineering Problems: SOS as Fundable Science: A Report to the U.S. National Science Foundation

SoS-NSF Commission

This poster summarizes the final report to the National Science Foundation of a Colloquium given the task of deciding whether or not the new field of system of systems engineering (SoS) is mature enough for funding. It first defines the meaning, characteristics, and importance of System of Systems (SoS) problems. It lists examples of SOS problems such as those involving healthcare systems, warfare systems, homeland security, resource management, global warming, complex diseases, pandemics, species extinction, and many more. The poster uses these case studies to suggest the importance of SoS research and funding. Panel discussions tried to identify central problems of the new field and how our underlying natural science knowledge could be used to help solve these crisis societal problems. Significant questions were formulated such as, "Is there currently a science of SOS or can one emerge?" The panelists agreed that the most vital current deficiency was the difficulty that different systems modeling tools (e.g. dynamic modeling using mathematics vs. new tools like agent-based modeling) have in "talking" to each other as they must to examine any SOS problem. Several agencies were identified as potential funders of SOS. Although the conclusion of the panelists was that the field was still too immature for funding, minority reports countered that until significant funding occurred, the field would remain immature.

THE NEW Top-Down FIELD OF SYSTEMS PATHOLOGY
Product of the Institute for Advanced Systems Studies, California State Polytechnic University

Poster # 12

Systems Pathology as Systems Biology & the SoSPT Model

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This poster summarizes the arguments for a new complex systems' specialty as presented in two past paper sessions of the ISSS. It relates the practice of modern medicine as it derives from intensive study of the human body and its pathologies as a complex system to the anticipated fruitful practice of studying ANY system and their observed pathologies. It argues that a quantum leap in the development of systems pathology is possible through emulation of the lessons learned by medicine over its very long and tortuous history. It also suggests that systems' practitioners and interventionists should devise their own version of the Hippocratic Oath (First, do no harm). It suggests that interested parties contact the author and join together in establishing an American Society for Systems Pathologists (ASP) as soon as possible to stimulate work in this area. A Special Integration Group (SIG) of the International Society for the Systems Sciences has already been established as a precursor and sponsor of this intellectual and application innovation.

Poster # 13

Naming Clusters of Systems-Level Diseases for a General Systems Pathology

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This poster continues to fill out the outline of the proposed new field of Systems Pathology by describing how the established traditions of associating symptoms with specific diseases in medicine could be used to identify the sources of systems' diseases. It posits that the same techniques and rewards used in medicine relative to discovering and subsequently "naming" new diseases could be used for this new field. Systems Pathology could then establish the etiology, diagnosis, prognosis, and treatment standards typical of medicine for other systems in society and systems in nature. This would speed work on regenerative and sustainable systems, and communication among those interested or responsible for a wide range of real systems. The poster defines such "clusters" of systems' diseases as cyclopathologies, heteropathologies, cyberpathologies, and others in order to link symptoms with causes of pathology in systems stability and dynamics.

Poster # 14

ISGE: The Integrated Science General Education Experience: "Stealth" Systems Science at Every Four-year and Community College

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This poster describes the product of a decade of effort funded by the U.S. National Science Foundation, private foundations, and the California State University system at a level of $1.5M to create an innovative curriculum that satisfies all of the usual 12 units of science general education (GE) requirement for non-majors at most universities. The ISGE year of study uses intensive computer-based modules for independent or online, distanced study combined with face-to-face, social methodologies to teach the

basic facts & theories of seven conventional sciences organized NOT by the disciplines but by a dozen major systems process themes. The poster states that ISGE solves 20 common obstacles to effective GE. It describes how the vast range of subject matter is synthesized and integrated using systems processes as Integrative Themes. It describes how the ISGE methodology for the first time uses transdisciplinary labs, current results of brain and learning science, twenty special multimedia features, and electronic games. The poster also includes a summary of the assessment data collected to date to evaluate ISGE effectiveness.