Linkage Propositions

DEFINITION & DESCRIPTION: *(this section is modified from Dr. Troncale's 1978 original article on Systems Processes Theory introducing linkage propositions. Citation: ????.)*

A Linkage Proposition (LP) is a semantic statement of an influence or relationship between two or more systems processes that has been observed across many diverse natural and social systems. The influence may be directional, bidirectional, or mutual among several systems processes simultaneously.

Systems processes are found active in and proven isomorphic to many systems. Their discovery, documentation, and proof as isomorphic across many systems results in a detailed general theory of how sustainable systems work. The addition of Linkage Propositions raises the net of connected systems processes to an even higher level of detail and generality. The net of many connections between systems processes is a detailed meta-theory of how systems work.

LP's are called "linkages" because they bind two systems processes together in a non-trivial way that enables integration or synthesis of processes into one, unified framework; a theory we call "a system of systems processes theory" or simply Systems Process Theory (SoSPT or SPT)." They are called "propositions" because although they are derived from experimental results for one or more "manifest" systems (phenomena) in the natural sciences or social sciences, they are presented as hypotheses for others until proven to exist or not to exist on a wider basis. It is the intention of Systems Process theorists (SPT) to find, organize, and maintain citation indices, workbooks, and tools that show exactly for which real systems any particular SP or LP has been proven to exist. As such, SPT research simultaneously

- unifies fragmented systems theories and approaches;
- tests general theories of systems, and so contributes to a "science of systems";
- yields practical tools for systems practitioners; and
- provides a detailed and rigorous 'framework' for the vast natural science data collection on how systems work and for future systems research carried out by large teams of systems collaborators.

L.P.'s possess the following characteristics:
(i) like the systems processes whose interaction they influence, they are themselves "isomorphic;" which literally means "iso" same and "morph" form. that is, they are domain-independent, discipline-independent, tool-independent, and scale-independent; the stated LP influence has the same form and function across all mature and advanced sustainable systems.
(ii) abstraction level: To achieve the generality we seek, it is necessary to abstract the statement of the influence or relationship
(iii) share common phrases
(iv) clues to a basic ontology of systems

The SPT and its L.P.'s also have the following possible uses:

(i) learning tool
(ii) modeling and simulation of real systems
(iii) mimicry engineering (as in bioengineering) "function abstraction"
(iv) artificial systems research
(v) provide a common framework and terminology for communication and cross-fertilization
(vi) significantly broaden the application field of systems engineering

The following are examples of linkage propositions relating cycles, cycling and oscillations to other systems concepts and processes:

An example of "tracking" or "tracing" one systems concept to the complete set of concepts to allow for fuller explanation and understanding of that one systems concept.

- Temporal Boundaries in a system result from selection by its environment for the most optimal Cycling time. This means that temporal Boundaries and Cycling time are types of externally-generated goals of the system.

Some L.P.'s describe conditions that must be realized either (i) for an appropriate and rigorous formulation of another P.S.C.[isomorphy] or (ii) as a condition for a systems feature.

- Metastability inhibits recycling of elements/components/entities

Some l.p.'s are useful for recognizing close correspondence between two P.S.C.'s often used by somewhat isolated groups of the 23 fields impinging on GST.

- Cycling of a system (Life Cycle type) is the same as temporal Boundaries of the system in question.

Some involve new ideas and/or linkages which would require much discussion and testing before acceptance.

- Recycling of systems components/entities after systems lifecycle decay contributes to Equilibrium of the next higher level of Hierarchy.

- Cycling reduces the energy Flow necessary to maintain a Negentropic deterministic succession of states or modes in a system. Cycling is a special case of Synergy.

Study of many LP's
Association Classes of L.P.'s (p. 41 of L.P.'s between systems processes)

Congruence/commonality relationship: "can substitute for;" "is analogous/homologous to;" "is isomorphic to;" "is the same as;" "is identical to."

Linear or conventional ordering relationship: "is in part, the cause of;" "is, in part the result of;" "contributes to;" "is a partial function of;" "acts among/or/within;" "is a condition necessary for;" "probabilistic influence on."

Inversion/or/reciprocality relationship: "negates;" "opposes;" "enhances;" "inhibits;" "increases;" "decreases."

Dual opposite relationship: "is a counterparitor to;" "is a symmetrical counter to;" (note the duality aspect of several entries in the other relationship categories; for example, increase/vs/decrease, or cause/effect).

General/ specific/ grouping relationship: "is a type of;" "sub/super;" "micro/macro;"

1. **Boundary Conditions**.

1.1. **Boundary Conditions** are defined by the full range of Inputs/Outputs acting on the subject system.

1.2. **Boundaries** of a system are partially defined by identifying the included systems as **components, entities, elements or subsystems**.

1.3. Boundary Conditions must be known to properly define internal versus externally generated goals/purposes for the system.

1.4. Restructuring can only be defined if Boundary Conditions are clearly recognized.

1.5. Boundary Conditions must be known to define whether a system is open or closed.

1.6. Intrasystem coupling contributes to the establishment of Boundary Conditions.

1.7. Life Cycles are a type of Boundary Condition that specifically defines temporal Boundaries.

1.8. Transitions/Phases/Modes are transformations in the predominant types of subsystem interrelationships which in turn change some but not all of the parameters used to define the system's Boundary Conditions.

1.9. Identifiable Boundary Conditions are in part the result of achievement of Steady State, whether this be achieved by static or dynamic Equilibrium.

1.10. **Boundary Conditions** are a partial cause of the **Exclusion Principle**.

1.11. Hierarchical relativity is in part the result of applying different Boundary Condition parameters and getting different Bounded systems.

1.12. and/or

1.13. Hierarchical relativity is in part the result of applying different Boundary Condition parameters to a set of systems resulting further in differently Coupled subsystems.

1.14. Patterns in Incremental Trends are the partial result of comparing the magnitudes of parameters of Boundary Conditions (and forces acting across the Boundaries) across the levels of modular Hierarchies.

1.15. Temporal Boundaries of a system results from selection by its environment for the most optimal Cycling times. This means that temporal Boundaries and Cycling time are types of externally-generated goals of a system.

1.16. Recognition that a system has components/entities/elements which are sometimes called subsystems is the same as recognizing the system as Decomposable.

1.17. For a component/entity/element to be properly defined it must be placed in the appropriate Hierarchical level.

1.18. For a component/entity/element to be properly defined all of its linkages/interrelationships must be documented.

1.19. Systems organization allows a greater variety and higher level of behavior than can be achieved by any of the systems elements alone (paraphrased from Ackoff, 1971). This “variety increasing” function of systemness actually contributes to transgressive attribution.

1.20. Boundary Conditions of a system are in part the result of the strength and duration of the linkages between its subsystems.

1.21. The participation of entities/components/elements as subsystems in a supersystem is in part the cause of their transtemporal stability.

1.22. In cases of synergy, boundaries are expanded from tightly drawn around the bounded entity to a much wider boundary including the other participants in the synergy.

1.23. Intra-system coupling contributes to the establishment of Boundary Conditions.

1.24. The mechanics of Unity/Wholeness is in part the result of Boundary Conditions.

1.25. Boundary Conditions are involved in the distinction between between Insulated and Non-Insulated linkages.

1.26. Temporal capture of energy flux must occur within the boundary of a system.

1.27. Concrescence ratio can lead to the establishment of new stable Boundary Conditions by causing, in part, new levels of transgressive Equilibrium/Attribution.

And/or

1.28. Concrescence ratio can lead to the establishment of new Boundary Conditions as well as the associated features of transgressive equilibrium and transgressive attribution/emergence.

2. Linkage and Interrelations

2.1. Transitions/phases/modes are in part the result of alterations in the linkages among subsystems among subsystems of a system.

2.2. Inputs/outputs are classifications of the broader category of linkages. These classifications are based on the function they perform in the self-reference space of the system.

2.3. Linkages across levels in different hierarchies cause three-dimesnional, topological hierarchies.

2.4. Linkages are the medium by which subsystems become systems, and systems become supersystems.

2.5. Periodic cycles are the result of special types of linkages,which are deterministic in the sense that the same sequence of states always obtains and the same specific state is always found in the specific time zone of the periodicity

2.6. Temporal capture of energy flux is a function of linkages which results in transtemporal stability

2.7. Similar linkage strengths, times, and distances (incremental parameter trends) characterize the entitities within a level of the hierarchy and help to define the levels empirically and non-humanocentrically.

2.8. Similar linkage strengths, time, and distance determine what is inside and what is outside a system in applications of the exclusion principle

2.9. Linkage influences what is considered inside and outside a system and so results in recognition of its Boundary Conditions

2.10. Linkages must be known to define whether or not a system is open or closed.

2.11. The uncertainty principle is caused by the number of linkages being never entirely knowable

2.12. All linkage propositions are generic cases of real systems linkages indicating how the attributes of systems are produced in nature.

2.13. Temporal capture of energy flux can only be found in open systems.

2.14. Positive and negative feedback mechanisms are often found coupled together.

3. Feedback

3.1. Goal-seeking feedback is in part the cause of teleological/purposive systems.

3.2. Goal-seeking Feedback is in part the cause of Oscillatory Cycling.

3.3. Goal-changing feedback is a characteristic feature of evolving systems of the biological/sociolgocial type.

3.4. Feedback paths may be within levels of a Hierarchy or between levels.

3.4.1. Feedback is one of the few types of linkages which operates across widely separated levels of the Hierarchy.

3.5. Feedback from the environment of the system is in part the cause of shifts in phases and modes.

3.6. Feedback is a special type of coupling between subsystems of a system.

3.7. Positive feedback contributes to growth.

3.8. Negative feedback contributes to equilibrium.

3.9. Coupled positive and negative feedback generates the sigmoid curve characterstic of all systems growth and decay cycles.

3.10. Coupled positive and negative feedback contributes to transtemporal stability.

3.11. Coupled positive and negative Feedback mechanisms are in part the cause of the Oscillations around the ideal median typical of Cycles.

3.12. There is no feedback in static regulation

3.13. Either positive or negative feedback can be found in dynamic regulation.

3.14. Positive and Negative Feedback mechanisms are often found linked together as a partial cause of dynamic Equilibrium.

3.15. Positive Feedback is a partial cause of amplification of rates of growth and development or decline and decay.

4. Equilibrium

4.1. Dynamic equilibrium is the same as cyclic oscillations around an ideal median of system behaviors, where the limits of behavior which the environment of this system will allow leads to a version of the limit cycle for the system.

4.2. Transgressive Equilibrium is in part the cause of levels in hierarchy

4.3. Transgressive equilibrium is, in part, the result of the probabilistic, random nature of subsystem interactions to form systems

4.4. Instability in the form of unsatisfied counterparity leads, in part, to systemic evolution.

4.5. Equilibrium is a mechanism for achieving transtemporal stability.

4.6. Static equilibrium is found in open or closed systems, while dynamic equilibrium is found only in open systems.

4.7. Restructuring is a mechanism for achieving equilibrium.

4.8. Temporal capture of energy flux contributes to achievement of equilibrium

4.9. Equilibrium is, in part, the result of dynamic regulation.

4.10. Metastability is destructive of equilibrium and transtemporal stability.

4.11. Recycling of systems components/entities after systems lifecycle death contributes to equilibrium of the next higher level of the hierarchy.

4.12. Instabilities in small amounts built upon larger magnitudes of stability are the most conducive to systems level evolution which, in turn, yields new transgressive equilibria and transgressive attributes (new qualities).

4.13. Instability is the opposite of stability, and their pairing in nature makes them one of the most fundamental of counterparities.

4.14. Non-Equilibrium Thermodynamics is a necessary condition for Diffusion-Limited Aggregation.

5. Cycles and Oscillations

5.1. Consonant Cycling is a special case of Synergy.

5.2. Cycling reduces the Energy Flow necessary to maintain a Negentropic, deterministic succession of States in a system.

5.3. Instability to stability back to instability is a flow typical of life cycles and recycling of components/entities/elements.

5.4. Goal-seeking feedback is in part the cause of oscillatory cycling.

5.5. Metastability is a partial inhibitor of Recycling of components/entities/elements.

5.6. As cycling requires continuous energy input for its maintenance, it is found most often in open systems and is negentropic in nature.

5.7. Cycling (of the life Cycle variety) is the same as the temporal Boundaries of the system in question.

5.7.1. Life Cycles are a type of Boundary Condition, specifically defining temporal Boundaries.

5.8. Recycling of components of a system is a special type of linkage between the system and other systems in its environment.

5.9. Cyclic behavior is planned instability.

5.10. Synergy between systems which are a large number of levels distant from each other in the natural hierarchy provide for greater stability on the lower levels. For example, animal life cycles in alignment with the geological/seasonal cycles.

5.11. Deterministic sequences of subsystem transformations lead to periodic cycling.

5.12. Reductions in required Energy Flow for Cycling are partially dependent on contributions of Recycling of components to Autopoiesis of systems in succeeding Hierarchical levels.

6. Evolution

6.1. Neutrality quest causes systems structures to form.

6.2. Neutrality quest causes a small number of pocket of negentropy to form, and drives their evolution.

6.3. Neutrality quest is caused by the fundamental dualisms (counterparities) on each level of the metahierarchy.

6.4. Dichotomies such as open/closed, internal/external, and input/output are not counterparitites because though opposite, they are not necessarily always equal or acting in opposition to each other.

6.5. The ability of feedback to act as a coupling between widely separated levels of the hierarchy contributes to hierarchical relativity.

6.6. Counterparity (dualism) is in part cause of the neutrality quest.

6.7. Counterparity acted upon by neutrality quest can sometimes cause transgressive equilibrium, or the origin of a new level of entities and a new portion of the hierarchy.

6.8. A small amount of unsatisfied counterparities in a population of entities with mostly satisfied counterparities will result in concrescence.

6.9. Concrescence leads to transtemporal stability.

6.10. Coupled positive and negative feedback mechanisms are a generic example of counterparity.

6.11. Hierarchical organization contributes to the mechanics of unity or wholeness.

6.12. Neutrality quest is the result of the universal trend toward entropy death.

6.13. Instability in the form of unsatisfied counterparity leads, in part, to Systemic Evolution.

7. Hierarchy

7.1. Hierarchically organized systems, especially of the modular type, are decomposable.

7.2. Hierarchical organization is highly negentropic.

7.3. Flatness in a Hierarchy is Stable in static systems, but Unstable in dynamic systems.

7.4. Hierarchical organization increases the probability of transtemporal stability of ever larger complexes through systemic evolution and thus causes higher levels of negentropy.

7.5. Hierarchical organization contributes to systemic Growth and Development and allowable complexity limits.

7.6. The deterministic aspect of hierarchical organization (once probabilistically evolved) enhances the deterministic aspect of cycling.

7.7. Counterparity and neutrality quest acting together cause transgressive equilibrium, which is synonmymous with genesis of a new level of the hierarchy. (systemic evolution)

7.8. Gaps in Hierarchical levels are the result of the appearance of new magnitudes of Bonding strength, distance, time, and energy due to the appearance of new unsatisfied Counterparities.

7.9. Subsystems are the same as components/entities/elements of a system while the system so formed is a component/entity/element of the next level in the hierarchy.

7.10. Hierarchical levels determined in part by incremental parameter trends are in part the cause of the exclusion principle.

7.11. The transtemporal stability of hierarchical organization is enhanced by cross-level feedback.

7.12. Each new hierarchical level achieves a new transgressive equilibrium.

7.13. Each new hierarchical level is in part the result of a new counterparity.

7.14. Each new hierarchical level contributes to the sudden emergence of a new quality of systems over and above that of the levels below. (transgressive equilibrium)

7.15. Transgressive Equilibrium is in part the cause of levels in Hierarchy.

7.16. Symmetry Breaks are a partial cause Hierarchical Structure (Clustering).

7.17. Diffusion Limited Aggregation is a partial cause of Hierarchical Structure.

7.18. Recycling of systems components/entities after systems lifecycle decay contributes to Equilibrium of the next higher level of Hierarchy

8. Fractal Structure

8.1. Non-Equilibrium Thermodynamics is a necessary condition for Fractal Structure.

8.2. Diffusion Limited Aggregation is a partial cause of Fractal Structure.

9. Energy Flow

9.1. The systems which get the most energy and use it the most effectively are the systems which are the most likely to survive.

9.2. Neutrality quest is a special case of energy flows and provides them with direction.

9.3. Energy flows derive from counterparities seeking their complement to achieve a neutrality balance.

10. Duality

10.1. Uncoupling of Dualities is a partial cause of Symmetry Breaks.

10.2. Spontaneous breakage of Duality-based Coupling Forces results in Symmetry Breaks and is a partial cause of Phase Transitions.

10.3. Symmetry Breaks are a partial cause of Gap Discontinuities (Hierarchical Clustering).

10.4. Instability and its opposite stability are paired in nature as partial cause of one of the most fundamental of counterparities (dualism).

10.5. A small amount of unsatisfied Counterparities in a population of entities with mostly satisfied Counterparities will result in Concrescence and Emergence of Hierarchical Structure.

10.6. Coupled Positive and Negative Feedback mechanisms are a generic example in Counterparity.

11. Fields

11.1. Field Dynamics neutralizes the consequences of Complexity (Computational Explosion).

12. Entropy

12.1. For certain types of open systems, the rate of entropy production tends to a minimum. (from Rapoport, in Klir, 1971)

12.2. Closed systems are characterized as proceeding irreversibly to entropy and disorder

12.3. Entropy is an expression of the more universal neutrality quest.

12.4. Components avoid entropy death by restructuring.

12.5. If entropy death results in a structure, then that structure is metastable?

12.6. Types of systems such as astronomical, physical, and chemical tend toward entropy.

12.7. As there is entropic loss to all flows (energy, informational, etc.) and linkages, the linkages that survive the longest are those which are based on transformations from a state of great available energy to lesser. This relationship is partly the source of incremental trends across hierarchical levels such as decreasing numbers and increasing size. It also explains the probabilistic nature of transtemporal stability.

12.8. Open systems can locally increase their order or negentropy if energy is constantly supplied for throughput.

12.9. Open systems can reverse the universal tendency toward entropy in their local space/time continuum only if energy is constantly supplied.

12.10. Negentropy requires permeable Boundary Conditions.

12.11. Systems with internally derived goals actually design negentropy in the environment. Systems with externally derived goals cannot although cluster of such systems increase the probability of negentropy in the local area.

12.12. Restructuring leads to negentropy.

12.13. Transtemporal stability is a case of negenetropy.

12.14. Types of systems such as biological, sociological, and man-made tend toward negentropy in the short-term, but succumb to entropy in the long-term.

12.15. Temporal capture of energy flux, when coupled with restructuring, increases negentropy.

12.16. Coupled feedback favors negentropy.

12.17. Both dynamic and transgressive equilibrium increase negentropy in a system.

12.18. Energy required for maintainence is proportional to the negentropy of a system. (Odum and Odum, 1976)

12.19. As negentropy increases in systems the effectiveness of these systems in utilizing energy increases as well as their ability to exploit a variety of energy sources.

12.20. Entropy Measures are a Dual Opposite Counterparitor to complexity of a system.

12.21. Uncoupling of Dualities is a partial cause of Entropy.

12.22. Symmetry Breaks are a partial cause of Entropy.

12.23. Neutrality Quest is in part the result of the universal trend toward Entropy death.

12.24. Hierarchical organization is highly Negentropic.

13. Synergy

13.1. Synergy is a special type of positive feedback characteristic of purposive systems.

13.2. Synergy contributes to Negentropy.

13.3. Synergy sometimes results (cooperates?) in achieving a transgressive equilibrium.

13.4. Synergy increases the ability of the cooperating entities to achieve to achieve restructuring.

13.5. Synergy is a special relationship of input/output processes such that the components sharing the relationship have achieved an unusual focusing of their outputs on each other as stimulatory input. (aspects of inbreeding)

13.6. Synergy is the result of an intensified set of linkages between a group of entities.

13.7. Does synergy enhance transtemporal stability?

13.8. Synergy is a type of coupling.

13.9. Synergy maximizes temporal capture of energy flux.

13.10. Synergy in purposive systems disfavors both instability? And metastability?

13.11. Synergy may result from consonance in cycles.

13.12. Synergy contributes to transitions/phase shifts/accelerated modes.

13.13. Synergy may act within or between levels of the natural metahiearchy.

13.14. Synergy implies directionality of systems energy flows when in purposive systems, and also in non-purposive?

13.15. Synergy is favored by neutrality quest selection of some ranges of concrescence ratio over others.

13.16. Synergy intensifies purposiveness of teleological systems while having no such effect on non-teleological systems.