The full slide show has been moved to the top of this page https://bit.ly/2yXGlmr

A systemic view of systems thinking

https://lnkd.in/gqkj6tc

All that remains here is the section on Clemson's principles

Inc. Clemson's management cybernetic principles

Last updated Saturday, November 9th, 2019

For our next System Theory tutorial in London: email grahamberrisford@gmail.com

The full slide show

- Takes a systemic look at system concepts
- Disambiguates several terms that appear in systems thinking
- Holistically joins up concepts in
  - cybernetics
  - complexity science and
  - enterprise architecture.

- Favors a scientific viewpoint
- Doesn’t cover every branch of "systems thinking"
  - some of which is mystical or metaphysical
  - or misinterprets or misapplies scientific terms

The full slide show contents

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All that remains here is the section on Clemson's principles

Clemson's 22 principles of "management cybernetics"

What is Management Cybernetics? (1984)

Barry Clemson (with Allenna Leonard)

Clemson on “management science”

- “In my 1984 introductory book on management cybernetics I said that most books with the words “science” and “management” in the title are neither scientific nor good management.”…
- Clemson

- Not in dispute here☺

Clemson on “management cybernetics”

- … “I claimed that management cybernetics, on the other hand, is good science and teaches us how to co-operate with the natural order of things rather than continuously bloodying our heads on stone walls.
- In that 1984 book, Allenna Leonard and I listed 22 laws, principles, and theorems of management cybernetics.
- Ern Reynolds then suggested a very useful exercise: paste the name of your organization in place of the word “system” in the 22 laws, principles and theorems.
- You will then have a useful cybernetic description of your organization.”
- Clemson

- This slide show lists the 22 “laws” with commentary

- Your “Organization” = System?

Clemson's principles for management cybernetics

1. System Holism
2. Darkness
3. Eighty-Twenty
4. Complementarity Law
5. Hierarchy
6. Godel's Incompleteness Theorem
7. Entropy – the Second Law of Thermodynamics [of questionable generality]

8, 9, 10. Redundancy of Information, Resources and Potential Command

11. Relaxation time [of questionable generality]

12, 13. Circular Causality

14. Feedback dominance theorem
15. Homeostasis [of questionable generality]
16. Steady State [of questionable generality]
17. Requisite Variety Law
18. Conant-Ashby theorem
19. Self-Organizing Systems [ambiguous in this context]
20. Basins of Stability
21. Viability
22. Recursive System Theorem

Clemson Principle 1. System Holism

- A) A system has holistic properties possessed by none of its parts.

- B) Each of the system parts has properties not possessed by the system as a whole.

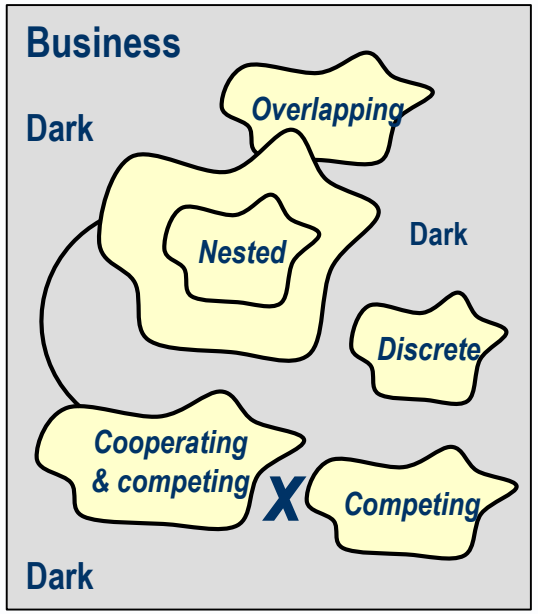
- Clemson

- A) OK - normally
- What if the system is homogeneous?
- E.g. A school of fish
  - Divide it into two parts
  - Each part behaves the same.

- B) OK – but to be picky
- What if an external entity can directly observe a part, or interact with a system actor? Can the external entity distinguish the actor's properties from the system's properties?

Clemson Principle 2. Darkness

- No system can be known completely.
- Clemson



- No *entity* can be known completely.
- A human "organization" is infinitely complex and not completely knowable.
- It is a concrete system only where and in so far as it realises a system description
- An abstract system illuminates or directs some behavior relevant to "some main interest that is already given."
- That system can be known completely by the observer(s) who create and use it.

Clemson Principle 3. Eighty-Twenty

- In any large, complex system, eighty percent of the output will be produced by only twenty percent of the system
- Clemson

- This is a variation on the Pareto principle (or 80/20 rule), which may be applied to many other system features

Clemson Principle 4. Complementarity Law

- Any two different perspectives (or models) about a system will reveal truths about that system that are
- neither entirely independent
- nor entirely compatible.

- Clemson

- Again, many systems can be abstracted from one real world entity

- Two systems may be independent in the sense they maintain unelated variables (say, temperature and blood sugar level).
- But in operation, both depend on the existence of the same real world entity

- Two systems can be compatible or incompatible to a greater or lesser degree.

Clemson Principle 5. Hierarchy

- Complex natural phenomena are organized in hierarchies with each level made up of several integral systems.
- Clemson

- Complex natural phenomena include
  - Waterfalls, Hurricanes
  - Oysters, Sponges
  - Maize plants. Fungi.
- Arguably, there is no higher or lower in nature – e.g. a body serves to maintain its cells which serve to maintain their DNA.
- Hierarchies appear in the descriptions we impose on nature, to make sense of it.

Hierarchical decomposition

- Human body, organs, cells, organelles
- Human business, divisions, departments, employees

- Most decomposition is not fractal, meaning, the structures are different at each level of decomposition

- Aside: remember

Cells in a body are	Employees of a business are
mechanical	actors with free will (“choice” to Ackoff)
not viable outside their body	able to work for (possibly competing) businesses
dedicated to their role	not entirely committed to any role
unable to invent responses to stimuli	able to invent responses to stimuli
physically contained inside one body	logically grouped by type or design
in contact with each other	connected remotely by communication

Clemson Principle 6. Godel's Incompleteness Theorem

- All consistent axiomatic foundations of number theory include undecidable propositions.
- Clemson

- Gödel's Theorem suggests a computer can never model human thinking,
- because the extent of a computer's knowledge is limited by a fixed set of axioms
- whereas people can discover unexpected truths.

- The ability of human actors in a business to recognise, interpret and respond to unexpected events or conditions is beyond the scope of a cybernetic control system.

Clemson Principle 7. Entropy – Second Law of Thermodynamics

- In any closed system the differences in energy can only stay the same or decrease over time;
- or, in any closed system the amount of order (or organization) can never increase and must eventually decrease.

- Clemson

- Of questionable generality

- Our main interest is in open systems where a supply of energy, sufficient to maintain the order of the system, is available

- Ashby diminished the role of thermodynamics in cybernetics

Clemson's Redundancy principles

8. Redundancy of Information Theorem

- Errors in information transmission can be protected against (to any level of confidence required) by increasing the redundancy in the messages.

9. Redundancy of Resources

- Maintenance of stability under conditions of disturbance requires redundancy of critical resources.

10. Redundancy of Potential Command

- In any complex decision network, the potential to act effectively is conferred by an adequate concatenation of information.

- Duplication and redundancy are how system designers improve
  - Throughput
  - Reliability
  - Recoverability
  - Integrity of data
  - Scalability

- See "The importance of information"

Clemson Principle 11. Relaxation time

- System stability is possible only if the system's relaxation time is shorter than the mean time between disturbances.
- Clemson

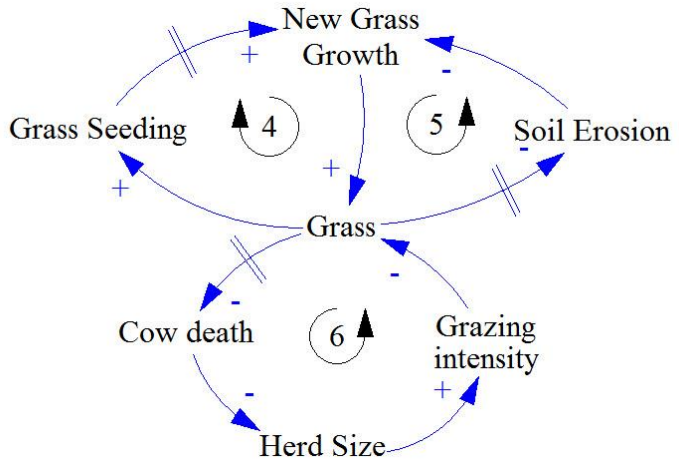
- Of questionable generality
- "Relaxation time is the time an isolated many-particle system takes to reach equilibrium, irrespective of its initial state."
- After Richard Fitzpatrick

- Businesses often
- advance state progressively rather than homeostatically
- advance discrete subsystem states in parallel operations

Clemson Principle 12 and 13. Circular Causality

- 12. Given positive feedback (i.e., a two-part system in which each stimulates any initial change in the other), radically different end states are possible from the same initial conditions.
- 13. Given negative feedback (i.e., a two-part system in which each part tends to offset any change in the other), the equilibrial state is invariant over a wide range of initial conditions.
- Clemson

- Mutually-reinforcing feedback will move two coupled systems forwards to new states



- Mutually-constraining feedback will tend to keep two coupled systems in a stable state.

Clemson Principle 14. Feedback dominance theorem

- For high gain amplifiers, the feedback dominates the output over wide variations in input.
- Clemson

- No comment

Clemson Principle 15. Homeostasis

- A system survives only so long as all essential variables are maintained within their physiological limits (e.g. blood sugar).
- Clemson

- Of questionable generality
- Clearly true of organisms
- Business “organizations” may be more progressive than homeostatic
- Some business systems continually *advance* system state
- Some terminate in a result.
  - A **rocket** may consume its fuel and crash
  - A **project** continues until something or change has been delivered, or the time or money run out

Clemson Principle 16. Steady State

- If a system is in a state of equilibrium (a steady state),
- then all sub-systems must be in equilibrium.

- If all sub-systems are in a state of equilibrium,
- then the system must be in equilibrium.

- Clemson

- Of questionable generality

- The world's biosphere might be seen as a stable system in terms of (say) the total biomass
- Despite (or because of) volatility in species and organisms, which come and go.

- A nation's economy may be stable in terms of (say) interest rates and inflation
- Despite (or because) there are many business failures and start ups

Clemson Principle 17. Requisite Variety Law

- The control achievable by a given regulatory sub-system over a given system is limited by
- 1) the variety of the regulator, and
- 2) the channel capacity between the regulator and the system.

- Clemson

- There other limits to how far a target system can be controlled by a regulator

- You can’t control a system that is already or more strongly controlled by other forces outside your control – such as market forces

Clemson Principle 18. Conant-Ashby theorem

- Every good regulator of a system must be a model of that system.
- International Journal of System Science, Conant and Ashby (1970)
- Clemson

- A regulator models those variables of the target system it seeks to control, not necessarily all the variables that the target system maintains.
- (A *stateless* regulator can import its model before it processes an event, then put the model away again.)
- See “The importance of information”

Clemson Principle 19. Self-Organizing Systems

- Complex systems organize themselves;
- the characteristic structural and behavioral patterns in a complex system are primarily a result of the interactions among the system parts.
- Clemson

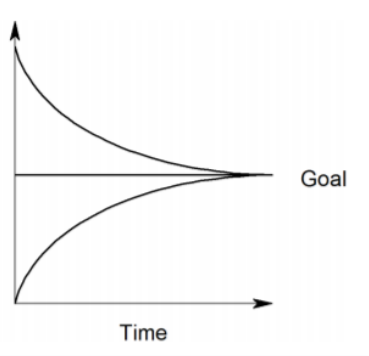
- Ambiguous in this context
- For discussion, see the section on “Complexity Science.”

- Some patterns structures and behaviors may evolve naturally from interactions of *rule-using* actors.
- Others patterns may be designed.by *rule-setting* actors.

Clemson Principle 20. Basins of Stability

- Complex systems have basins of stability separated by thresholds of instability.
- A system “parked” on a ridge will “roll downhill”.
- Clemson

- A variable, whatever its initial value, may led by events to settle on a particular value, which appears to be its goal



- Or be attracted to the nearest of several possible stable values
- Various other behavior patterns are possible

Clemson Principle 21. Viability

- Viability is a function of the balance maintained along two dimensions:
- 1) autonomy of sub-systems versus integration of the system as a whole, and
- 2) stability versus adaptation.
- Clemson

- Viability depends on many factors
  - Resources
  - Competition
  - Legality.
  - Etc.
- 1) Centralization v distribution of subsystems appears in several pairs of contrasting design patterns.
- 2) Does adapt mean system state change or system modification?

How the viability principle applies to EA

- Centralization v distribution of systems appears in several pairs of contrasting design patterns.
- Each pattern can be viable, but each has different pros and cons.

See later presentation on centralizing v distributing design patterns

Clemson Principle 22. Recursive System Theorem

- If a viable system contains a viable system, then the organizational structure must be recursive;
- or, in a recursive organizational structure, any viable system contains, and is contained in, a viable system.
- Clemson

- Not sure what this means
- *Recursion* implies more than hierarchical decomposition.