

Module 3 Lesson 2 - Complexity Science & Resiliency

Friday, September 23, 2022 3:44 PM

* C.Ss = complex science

3.2.2 Synopsiis

- Complex systems have three common properties:

1) Complex collective behaviour

- All CSs consist of large networks of individual components, each typically following its own simple rules with no central control
- The collective action of these components (in vast #s) give rise to the complex, hard-to-predict, changing patterns of behaviour

2) Signalling & Information Processing

- All CSs produce & use information & signals from both their external & internal environments

3) Adaptation

- All CSs adapt to improve chances of survival or success
- Done through learning or evolutionary processes

• Self-organizing Systems

- organized behaviour arise without an internal or external controller/leader
- Emergent
 - the macroscopic behaviour of simple rules (which produce complex behaviour in hard-to-predict ways)

How does the behaviour at one scale give rise to behaviour at the larger scale?

3.2.3 Resilience

From Thomas-Dixon:

- We've created systems that are very vulnerable to collapse
- Resilience needs to be built into the systems

From Brian Walker

- To create resilience in the system, allow the system to probe its boundaries to see what the system can & cannot handle

- In a CS, resilience protects its nested group of interacting sub-systems from devastating disturbances

3.2.4 The Adaptive Cycle

- ▶ The Adaptive Cycle has 4 phases:

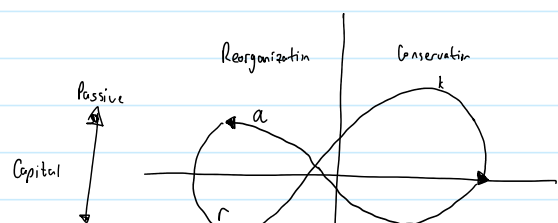
1) Rapid Growth (r)

- Social, economic, environmental resources are abundantly available and facilitate rapid growth
- Tends to be fast

2) Conservation (K)

- Resources are no longer plentiful, slowing growth
- Usually slow with little capacity to change
- System is less flexible & vulnerable to collapse

3) Release/Disturbance (L)

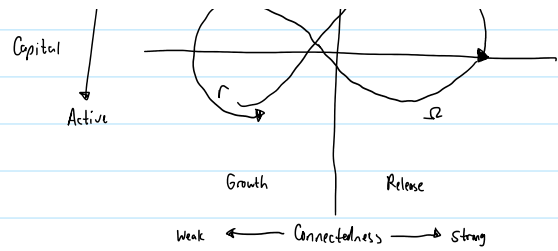


- System is less flexible & vulnerable to collapse
- 3) Release/Disturbance (Ω)

- Causes system to collapse
- quick & chaotic phase

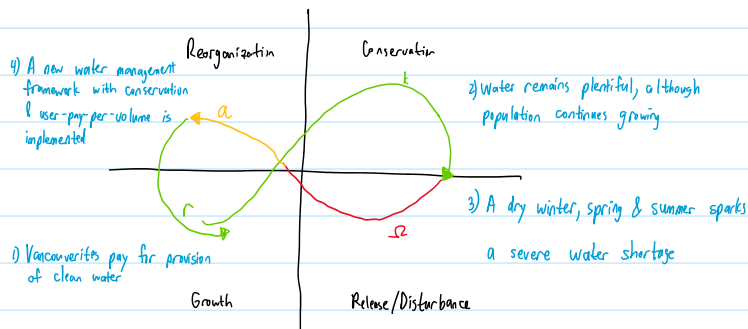
- 4) Reorganization (α)

- quick phase
- system may reorganize into a different structure after collapse
- new entities may be formed & innovation achieved



3.2.5 Examples of Adaptive Cycles

> Example 1 — Vancouver's Water Supply



> Example 2 — Steel Bridge Design

