Module 3 Lesson 1 – Systems Theory

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- Cartesian Thinking
  - foundation of dominating engineering way of thinking
  - "reductionist" or traditional
  - assumes that problems of the larger system will be addressed if all problems of system's constituent parts are solved.
  - not always the case!

  - We need to think about our larger, more indirect, long-term impacts on systems that support life & the modern world.

- The Systems Approach
  - provides a frame for interpreting the web of variables & relationships in both a city and the supply-chain
  - enables analysis of a sub-system while keeping an eye on the context the sub-system is in

  - Instead of breaking large problems into small parts, this approach ask us to consider self-organizing behaviour and system interdependencies.

3.1.2 Simple or Complex?

- Is it a system? Ask:
  1) Are there discrete elements (components/parts)? If yes, ✓
  2) Do the elements affect each other? If so, ✓
  3) Do the elements, together, generate a different effect than when they are individual elements?

- Simple Systems
  - the whole is equal to the sum of the parts
  - can usually be modelled by Newtonian physics, calculus, other "normal" science techniques

- Complex Systems
  - the whole is greater than the sum of the parts
  - ex. the body, brain, family, education system, etc.
  - Complexity science
    - study of complex systems, sometimes modelled using post-normal science techniques

URBAN INFRASTRUCTURE
SUPPLY CHAINS
} made up of different simple & complex systems that overlap & interact with other systems

3.1.3 Mental Models

- System is a type of mental model
- Systems thinking
  - a way of viewing the world around us as the interplay between multiple overlapping/layered systems (both complex & simple)

3.1.4 Systems Thinking

▶ Systems Thinking
- a perspective that focuses on observing relationships between things, the context of the relationship, and finding recurring patterns within and between these relationships
- means being aware of the interplay between a variety of different systems at different scales & with different themes
- aware of:
  - > physical structure & scale
  - > context
  - > relationships
  - > processes
  - > patterns of behaviour