

BUILT ENVIRONMENTS OF DIGITALLY-BASED ECOSYSTEMS: SYSTEMIC VARIETY-BASED DESIGN

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OVERVIEW

- ✘ Built environments are increasingly becoming digital eco-systems
- ✘ Understanding management, power and control in the built environment is more complex and difficult
- ✘ Five tools for understanding and designing complex built environments in the digital eco-system arena
- ✘ Airport example: use of authors' five extensions to Ashby's Law.

CONVENTIONAL ACTIVIST STRATEGY-MAKING

- ✘ Typical approaches
 - + Environmental scanning
 - + Advice of 'experts'
 - + Simulation and modelling
 - + Critical analysis
 - + Scenario-building
- ✘ Can be supported by VSM, System Dynamics, Critical Systems Heuristics and 2nd order Cybernetics.

SCOPE OF RESEARCH AND FINDINGS

- ✘ Application of Ashby's Law of Variety to dynamics of power relations in ***complex socio-technical systems***:
 - + Multiple constituencies – changing over time
 - + Multiple overlapping sub-systems
 - + Multiple overlapping processes across subsystems
 - + Mixed ownership of sub-systems
 - + Varying purposes and roles of system and sub-systems
 - + Complex and dynamic distribution of formal and informal power and control
- ✘ Examples: mass media, transport systems, retail, manufacturing, construction, religion, political systems, education, computerised information systems, design activities, and legal systems.

CONCEPTUAL LEVEL

1. Level at which things happen
2. People ordinarily plan what happens
3. People analyse how people ordinarily plan what happens
4. Basic systems models and systems thinking
5. Thinking about variety in systems and balance between control variety, system variety and environment variety
6. Thinking about distribution of control, system and environment variety across sub-systems and their conceptual representations
7. Thinking about the time and location of distributions of control, system and environment varieties
8. **Thinking about the dynamic shifts in power and control that result from dynamics of change in time and location of control, system and environment varieties.**

EXTENSION 1

For complex, layered and hierarchical systems involving multiple constituencies in which the distribution of variety generation and control is uneven across the system

THEN

the differing distributions of generated and controlling variety result in a structural basis for differing amounts of power and hegemonic control over the structure, evolution and distribution of benefits and costs of the system by particular constituencies.

EXTENSION 2

For complex, layered and hierarchical systems that have a variety of typical stable states of system structure,

THEN

the structural system state that the system will evolve into will depend on the relative locations of subsystems generating variety and the control subsystems able to use variety to control overall system variety.

EXTENSION 3

Where differing sub-systems of control are involved in the management of a system and some sources of control are able to increase their variety to accommodate a shortfall of requisite variety in other control systems

THEN

the overall distribution of control between sub-systems and constituencies will be shaped by the amount and distribution of transfer of control to the accommodating control system and its owners.

EXTENSION 4

In complex systems in which multiple sources of variety generation and variety control interact

THEN

the relative effect of different forms of system variety and control variety on system behaviour and system control are typically dependent on their relative [Coasian] transaction costs.

EXTENSION 5

In complex systems in which multiple variable sources of variety generation and variety control interact and in which control varieties are generated dynamically to respond to changes in system varieties

THEN

relative control of the feedback loops driving control varieties shapes the future distribution of power and hegemonic control between sub-systems and constituencies over the structure, evolution and distribution of benefits and costs of the system.

AIRPORTS: SOCIO-TECHNICAL SYSTEM



- ✘ Involve dynamic combination of intelligent, active and passive electronic, physical, human and animal systems.
- ✘ Multiple subsystems and processes crossing system and subsystem boundaries and capable of fulfilling similar roles
- ✘ Multiple constituencies with differing amounts of power distributed over a large number of interdependent subsystems.
- ✘ Sub-systems can be outsourced so their control lies outside the system in focus.
- ✘ Distributions of power and constituencies change over time.
- ✘ System characteristics, functions and loci of control are changing and emergent.

EXTENSION 1

Distribution of variety and controlling variety across constituencies shapes power relationships and distribution of benefits.



Retail variety
increases



Retail constituency
power increases



Planning power
decreases unless increases
control variety



EXTENSION 3

Where shortfall in controlling variety by one constituency group or sub-system is accommodated by increase in controlling variety by another constituency/sub-system then power and control tends to be redistributed to the constituency(ies)/sub-systems(s) providing the necessary additional controlling variety.



+



System variety
increases



Increased control
variety by others
to take up variety slack



Shift of power to
others

EXTENSION 4

Relative effects of elements of controlling variety are dependent in a Coasian sense on their relative transaction cost.

Example: Recent environmentalist activities in US by securing differing standards for vehicle emissions at State level resulted in requests by vehicle manufacturers to the Federal government to set national standards.

1. Should FBI and other nationally screen people be allowed to avoid airport security checks?
2. Should it be possible to pay to have an external company screen you to avoid airport queues?

EXTENSION 5

Control of the feedback loops driving control varieties shapes the future distribution of power and hegemonic control.

- ✘ Membership of management committees
- ✘ Influence processes by which feedback loops are constituted
- ✘ Lobbying via media or other systems to amplify feedback

SUMMARY

- ✘ Five extensions to Ashby's Law of Requisite Variety to redirect power and control in complex socio-technical systems.
- ✘ The fifth extension is described for the first time in this paper.
- ✘ Airports used to illustrate the application of the five extensions to Ashby's Law.