The Boundaries of Complexity
The Limits of Systems

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WHAT IS COMPLEXITY

Complex vs. Complicated

Emergence!

Complexity is an attribute of a *system*

The idea of the “Network”

Networks have structure

CHARACTERISTICS OF COMPLEX SYSTEMS

They consist of a large number of (often simple) components.

These components interact dynamically.

The interaction is usually quite rich.

The interaction is non-linear.

No direct link necessary for distant elements to interact – other elements mediate.

- There is an abundance of (non-linear) feedback routes.
- Complex systems are open systems.
- They operate under conditions far from equilibrium.
- The history of a system is vitally important.
- Subcomponents of the system cannot have access to all the information in the system, they can only react to local information. The behaviour of the system as a whole is a relational (emergent) property. (Denying the homunculus).

SOME CONSEQUENCES

- Complexity is not reducible. Since the structure of a complex system is organised non-linearly, it cannot be compressed. (Causality is upheld, but effects cannot be tracked deterministically.)

- If the system is complex (in the incompressible sense) it cannot be described accurately by a limited set of abstract rules.

- The structure of complex systems are not arbitrary, nor “chaotic”. (Even the concept “on the edge of chaos” could be misleading.)

Boundaries

Systems do have boundaries, even open systems

Systems are operationally closed (Luhmann),

But …

The “nature” of boundaries

Constraints are necessary (cf. the eardrum)

Structure is enabling (cf. music)

The “place” of the boundary: the boundary is everywhere

Hierarchies

If complex systems have structure, hierarchies are inevitable

Hierarchies/levels/structure need not be neatly nested (c.f. the cortex)

In a vital systems, hierarchies are provisional and have to be transformed (deconstructed)

Boundaries, Limits and Frames

Systems have boundaries, knowledge has limits

Limits (frames) are a condition for knowledge of complex systems, thus

Knowledge is provisional, contextual and contingent (but not arbitrary)

Descriptions (models, theories) involve choice. There is always a normative element involved when dealing with complexity

MODELS OF COMPLEX SYSTEMS

- Reducing complexity and fixing boundaries are what models do
- We cannot have perfect models of complexity (complex models will be as difficult to understand as the systems they model)
- We *have* to make models in order to *understand* complexity
- Models have to be revised and transformed (deconstructed) continuously. Long term prediction will remain problematic.

CONCLUSIONS

- Asymmetry is an inevitable characteristic of complex systems
- We cannot have a *perfect* understanding of complex systems. This is no reason for despair, it is a continuous challenge.
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- Our judgements should always be provisional (An imperfect understanding that is willing to revise itself is better than one who claims to be correct, but is not.)
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- We cannot blame our models if things go wrong. We are always responsible.