Systems Approach and Modelling for Managing Complex Systems

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Russell Ackoff
(1919 – 2009)

Analysis has been the dominant mode of thought in the Western world for 400 years.

Outline

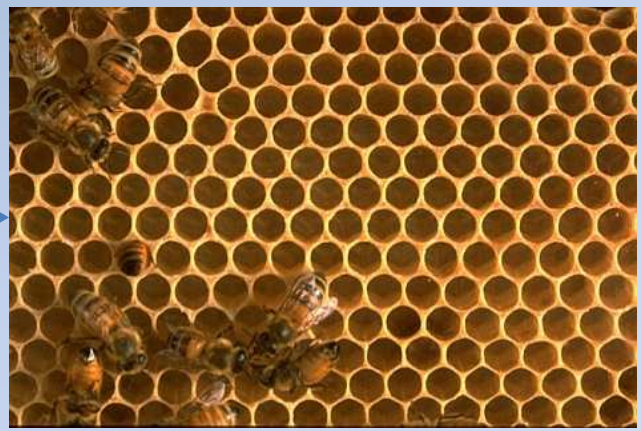
- Systems approach
- Systems, Complex Systems
- Medical System as a Complex System
- Triad S-O-M in medical system
- Analytical vs. Systems Approach
- Modelling and Simulation
- Systems Approach Future
- Conclusions

Systems Approach

- Systems approach: way of thinking and forming problem solutions, holistic point of view of processes and problem phases with external and internal influences consideration and influences – systems, systems thinking, system theory.
- Aims: understanding, appropriate solutions finding
- Tools: modelling, simulation

Systems vs. set of elements

- All systems have common patterns, behaviors, and properties that can be understood and used to develop greater insight into the behavior of complex phenomena and to move closer toward a unity of science.



- Set of elements

Three Categories of Systems

- Hard systems—involving simulations, often using computers and the techniques of operation research.

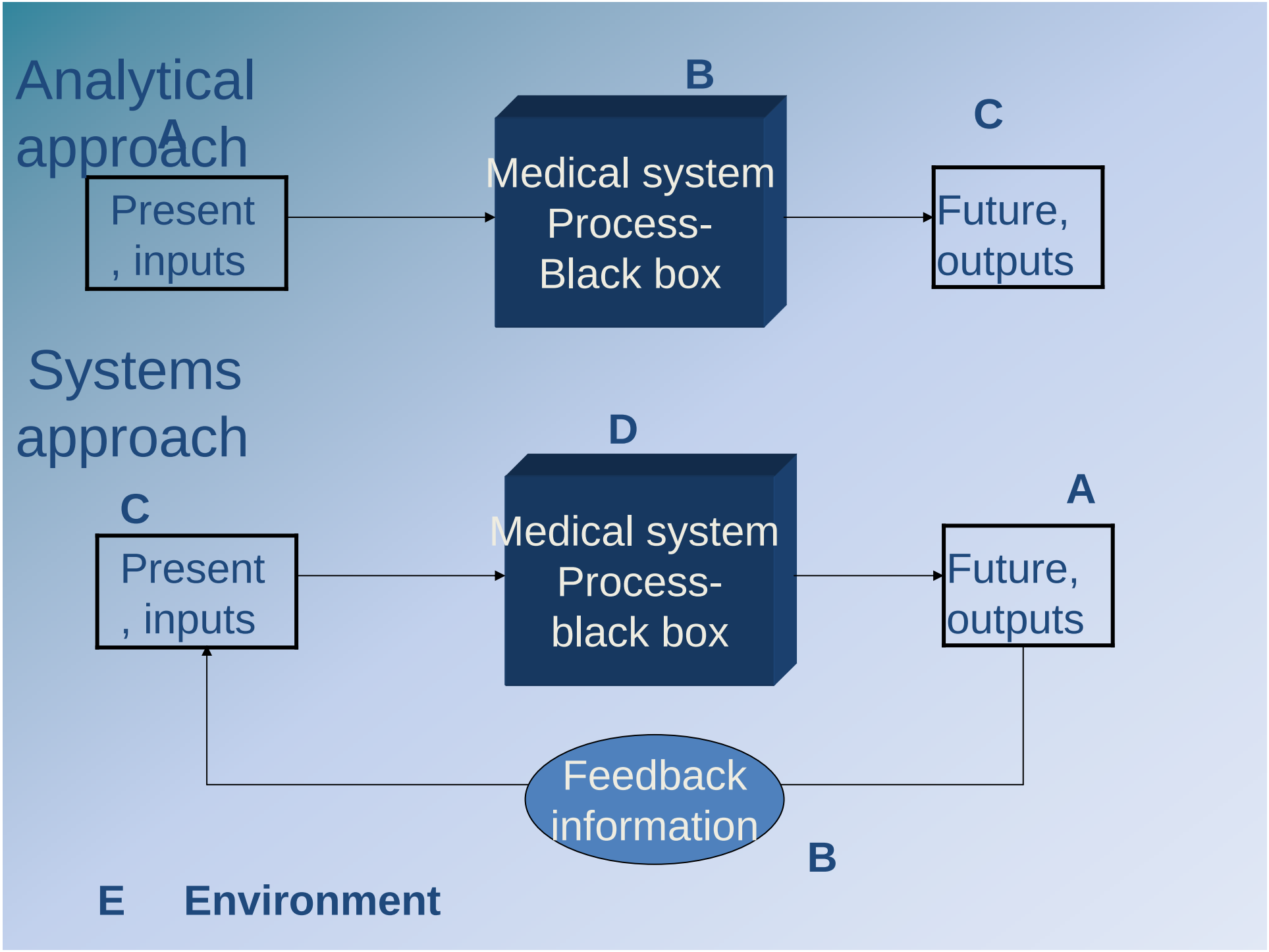
- Soft systems - understanding motivations, viewpoints, and interactions and addressing qualitative as well as quantitative dimensions of problem situations.

Three Categories of Systems

- Evolutionary systems — cultural anthropology, evolutionary theory and evolution of consciousness.

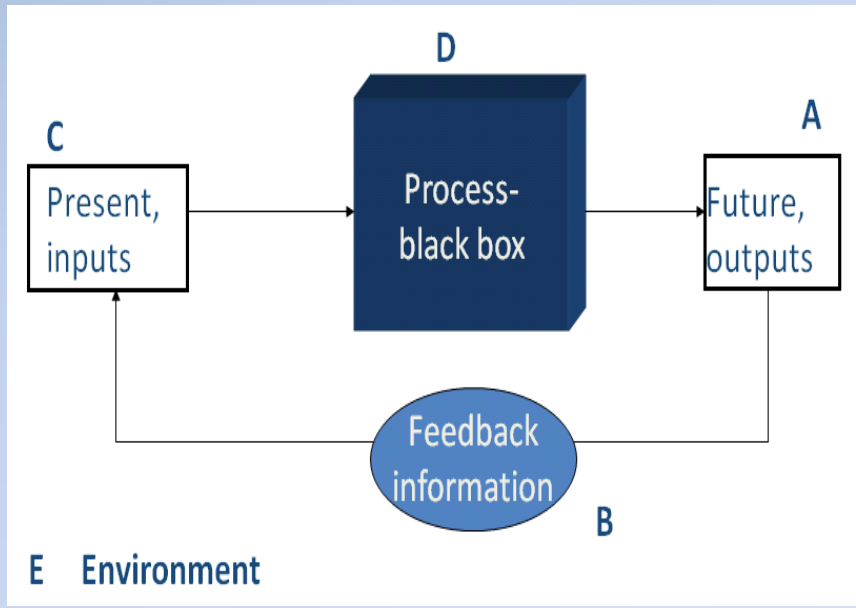
Complex systems

- Large number of different interacting elements
  - interacting with environment (open system)
- Collective behavior ≠ sum of individual behaviors
- Interaction & evolution rules not linear
  - small perturbations can create big cascading effects
  - high sensitivity to initial conditions
- Main characteristics:
  - robust
  - self-organizing
  - adaptive
  - etc.


Analytical approach
A
Present , inputs
B
Medical system Process- Black box
C
Future, outputs
Systems approach
C
Present , inputs
D
Medical system Process- black box
A
Future, outputs
Feedback information
B
E Environment

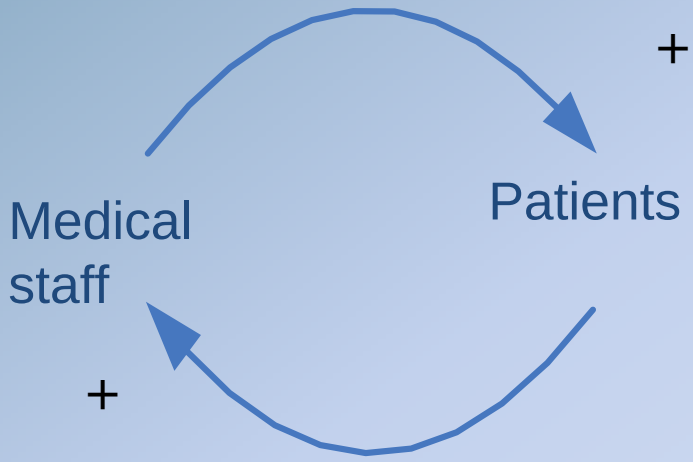
Models - Causal Loop Diagram (CLD)

- Represent the feedback structure of systems
- Capture
  - The hypotheses about the causes of dynamics
  - The important feedbacks



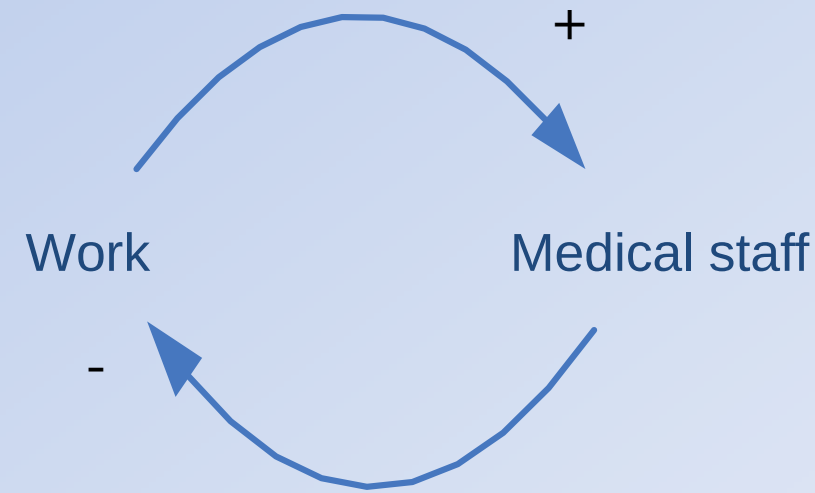
Creating Model (Building) CLD

The kinder the medical staff,
More satisfied the patients.



More satisfied the patients, the
kinder the medical staff.

The more work, more work has to do the medical staff.



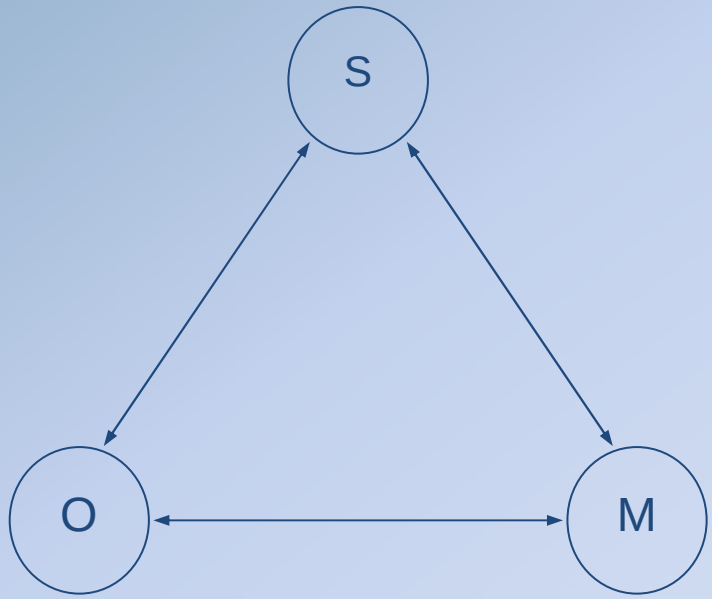
More work has to do the medical staff, the less work has been done

Subject, Object, Model

S = medical staff (Observer or subject)

O= patient (Object or point of observation)

M= medical system (Model)



Connections:

O ⇔ S = patients experience with medical staff

S ⇔ M = mental models of reality

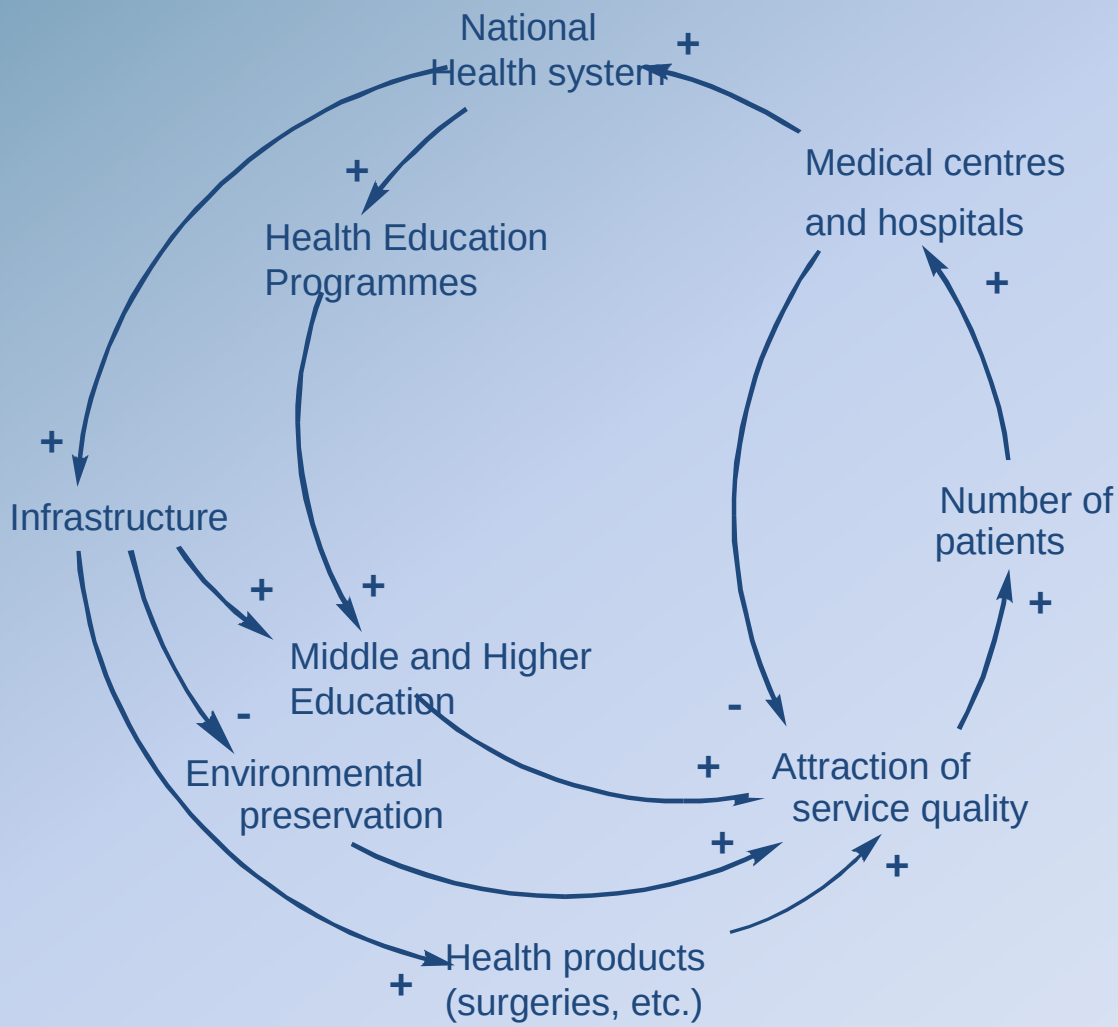
O ⇔ M = evaluation of a model,theory and praxis

cooperation

S → O → M = subject union in a phase of object confirmation

M O S = learning and generalising process

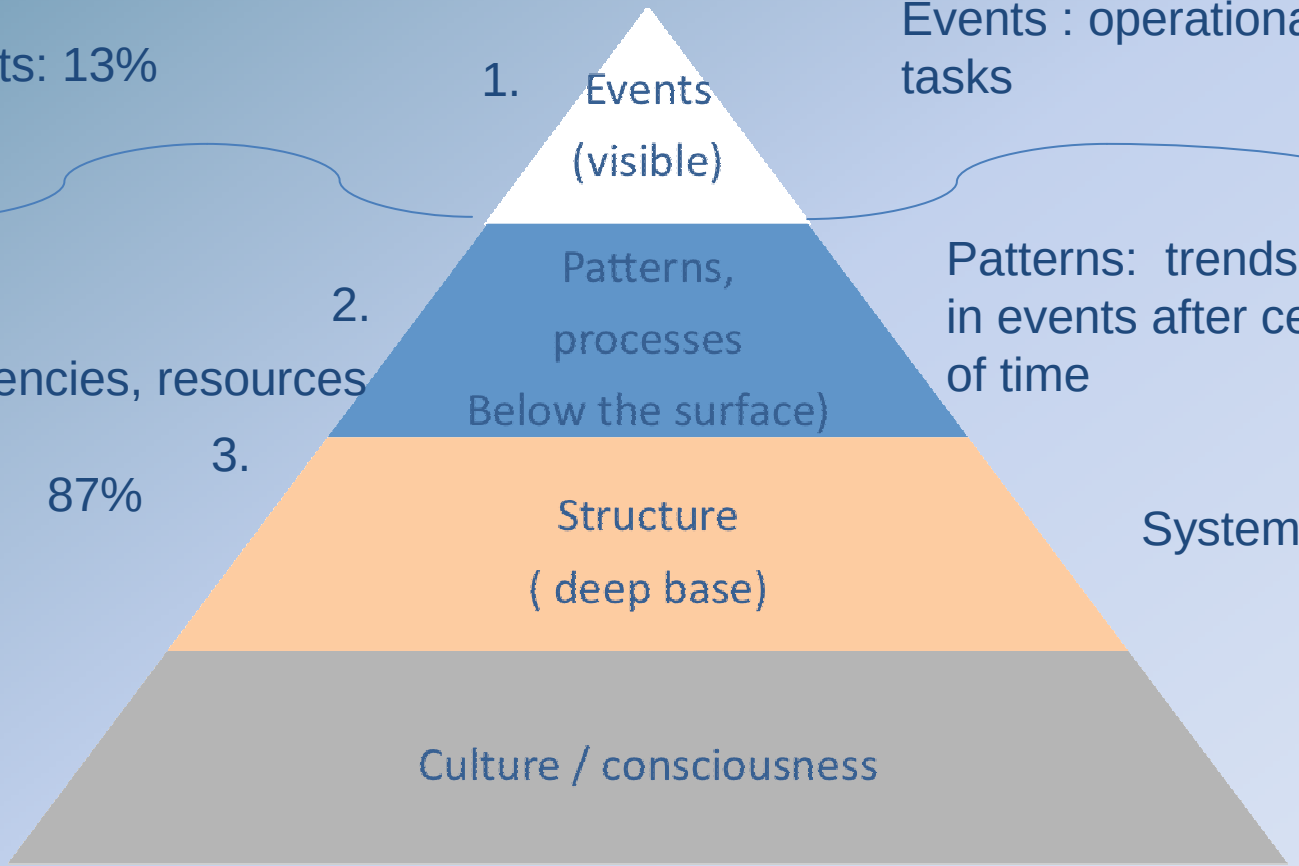
Model of Medical System



Simplified causal loop diagram of medical system

Source: Haines, S. (2005) Pearls of Wisdom. Haines Centre International. San Diego

Iceberg as a trap of analytical approach



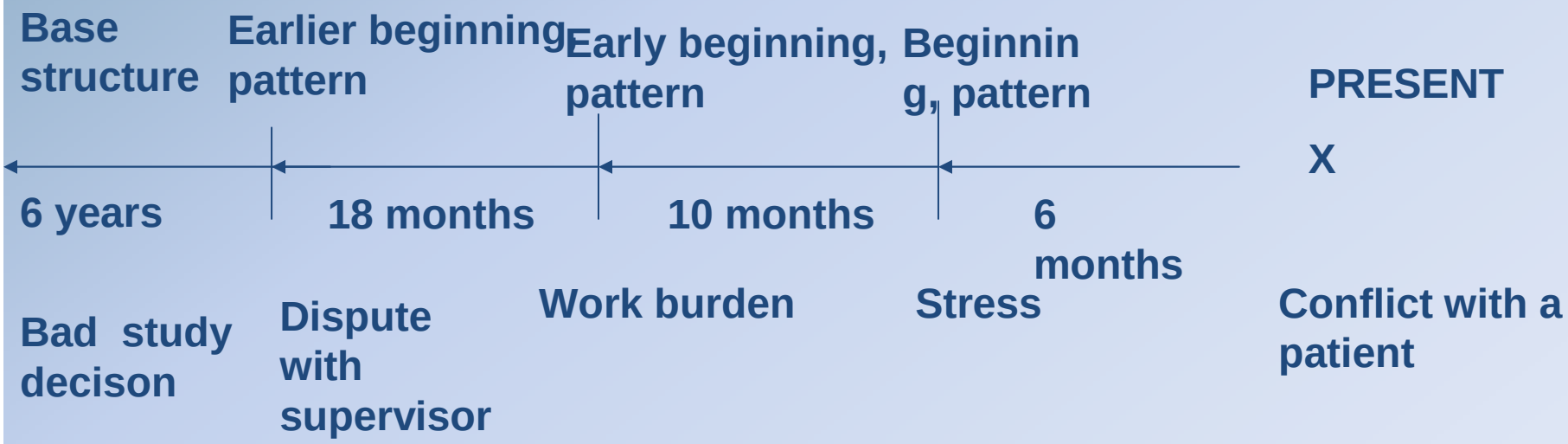
CONTENT MYOPIA

It is our failure to focus on Process and Structure **Yet**

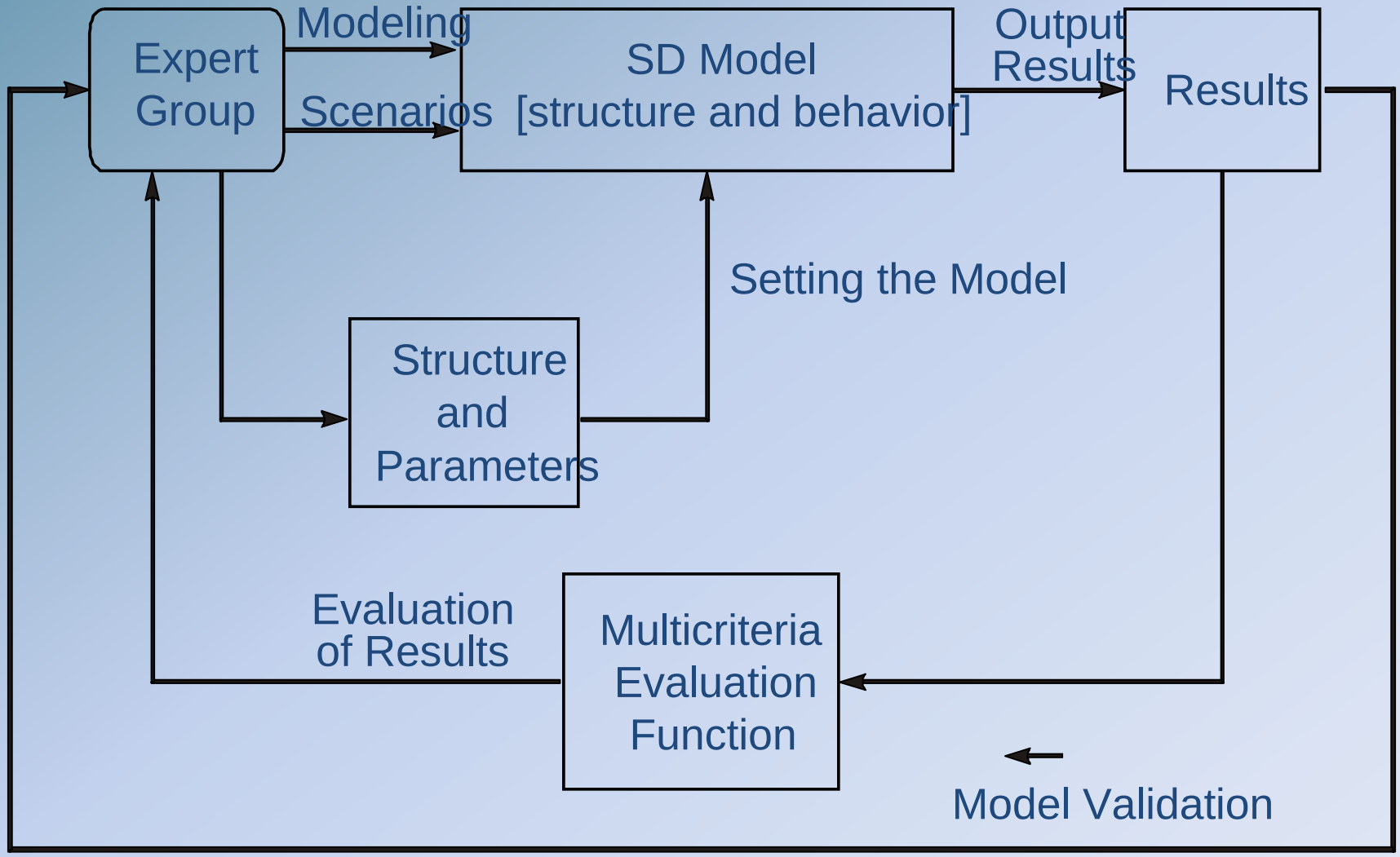
Solutions, Changes are dependent on good Processes and Structures in order to achieve the Content of the desired solutions.

Recognising events, patterns and structure of a problem

"It is only with the heart that one can see rightly. What is essential is invisible to the eye". (A. de Saint Exupery)



Simulation Methodology for Problem Solving and Decision-making



Systems Approach Future

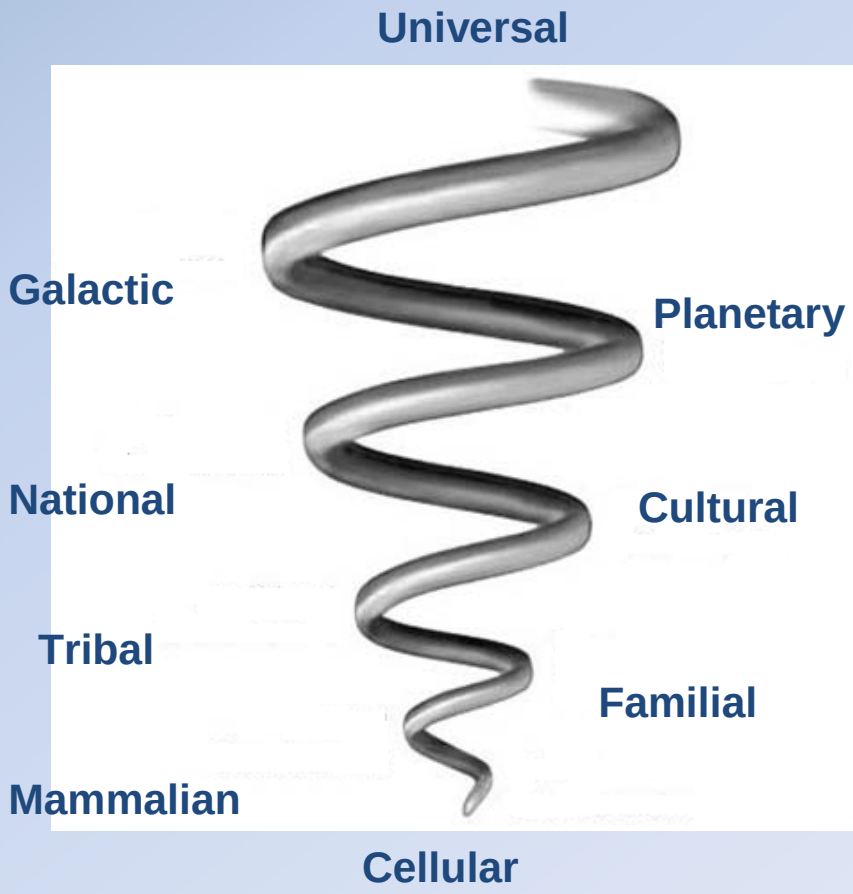
A man, a woman:

- Sees **“the big picture”**
- Creates **partnerships** and **alliances**
- Uses **systems approach**; recognises a balance of **cooperation, leadership, following - co-creation**

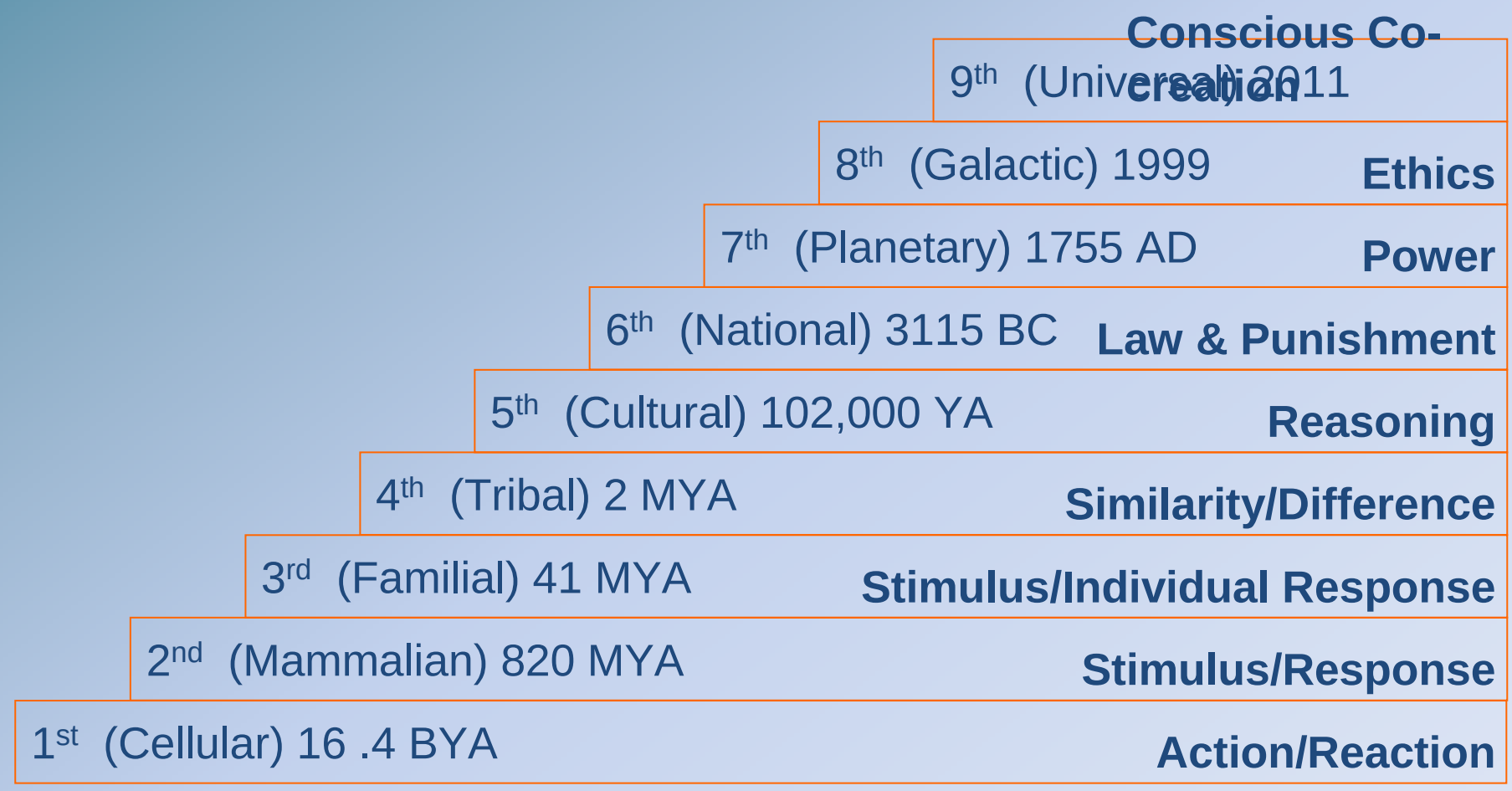
Shift of Consciousness

- What we pay attention to we become aware of.
- Consciousness happens in living systems. A life sign is autopoietic loop. (Maturana & Varela)

Cycles of Consciousness



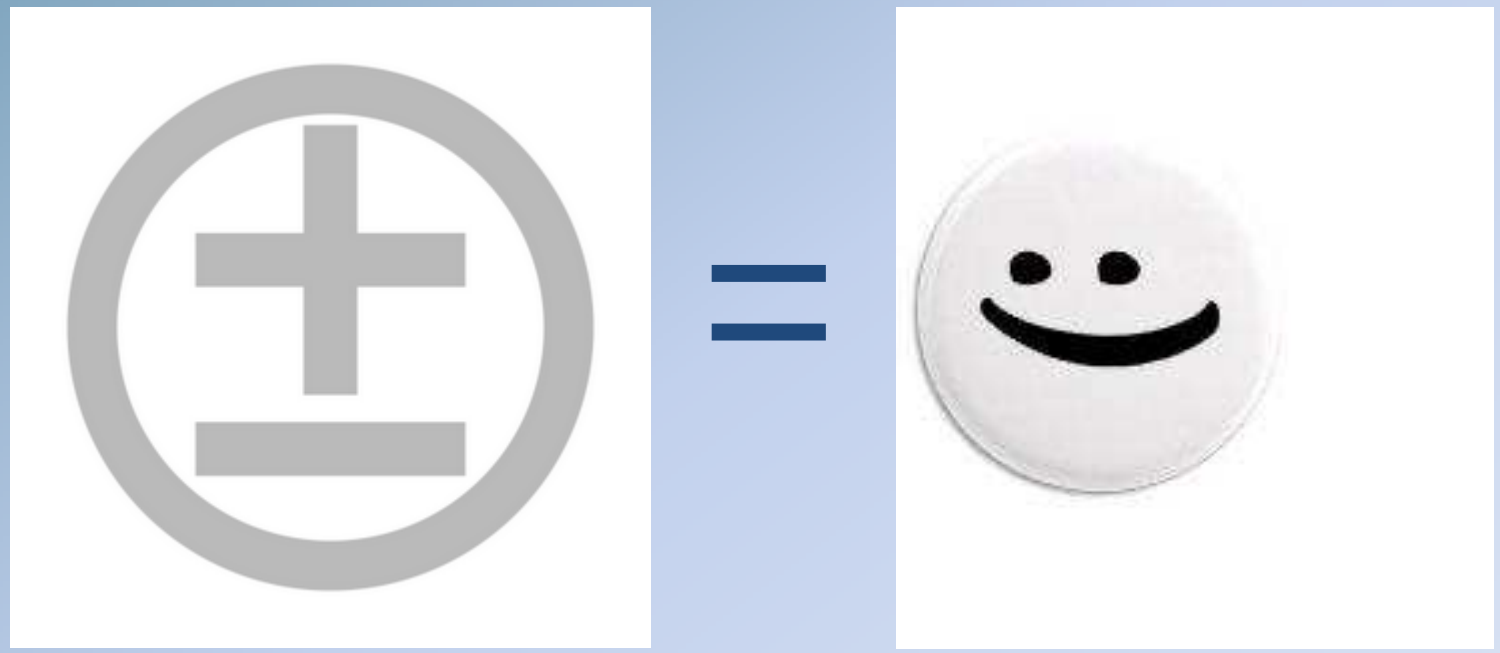
Conscious Evolution of Each Cycle



Source: Calleman, C.J. (2004). *The Mayan Calendar and the Transformation of Consciousness*: Bear & Co. Rochester

Conclusions

- Systems approach and modelling are thinking in terms of cause-and-effect relationships
- Focusing on the feedback linkages among components of a system
- Determining the appropriate boundaries for defining what is to be included within a system
- Systems approach seems to be appropriate methodology for the future of synthesis and universal consciousness, where + and – will be juts two parts of a whole.



See you in the future…