Computational models in complex systems

2009

Lecture 1: Introduction, evolutionary systems, complexity

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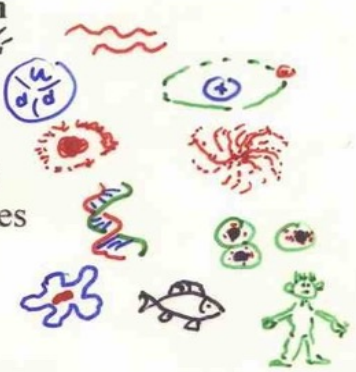
1. Order and disorder

Disorder

Chaos, utmost disorder, no laws, zero computability.
"Big bang" the only real known chaos.
Edge of chaos: complexity.

Formation of patterns and organisation

- strings, photons
- quarks, protons, electrons, atoms
- stars, galaxies
- exploding stars, heavy elements, planets
- amino acid molecules, early life processes
- cells, development of higher life



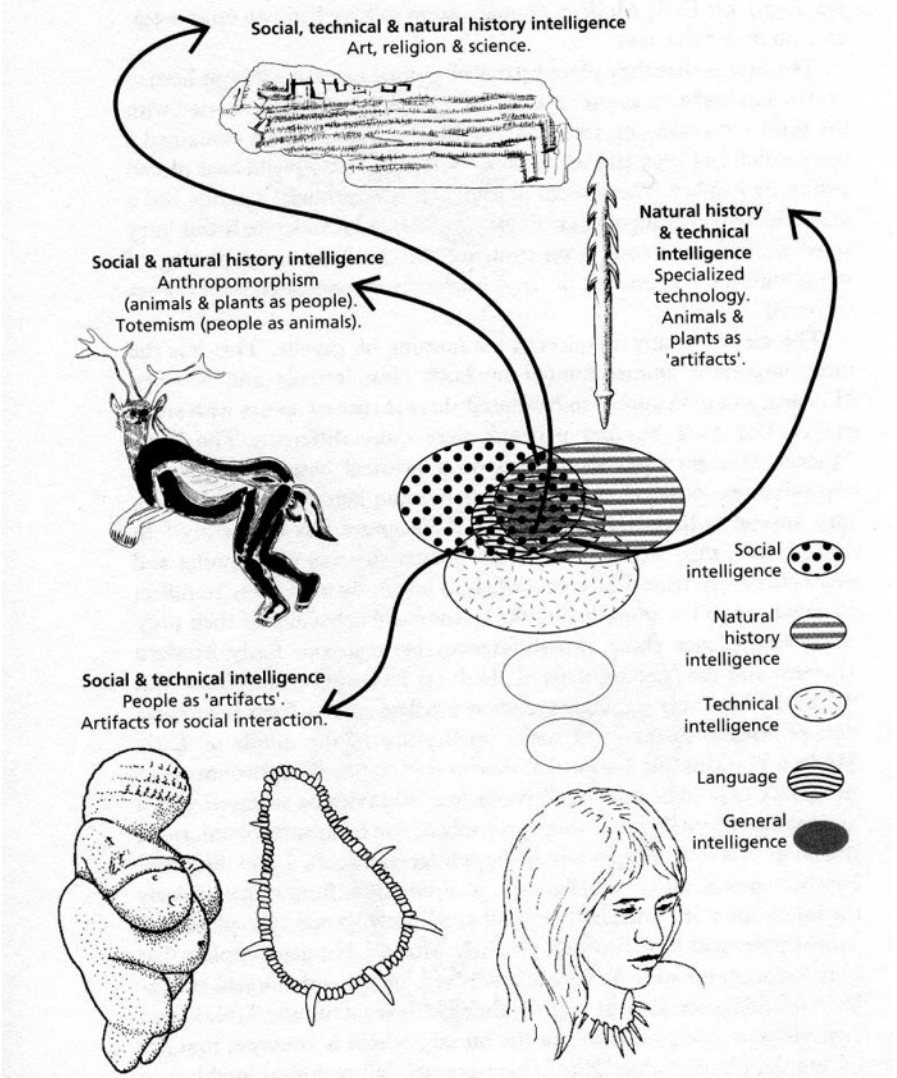
Order

- patterns, regularities
- Laws of Nature: Newton, Maxwell, etc.
- the Periodic System
- provides predictability
- order seems to be a static property

Organization

- dynamics of an ordered system
- a coordinated time process
- distributed activities against a commen goal (ants)

Source: J-T Eriksson



Source: Steven Mithen, The Prehistory of the Mind

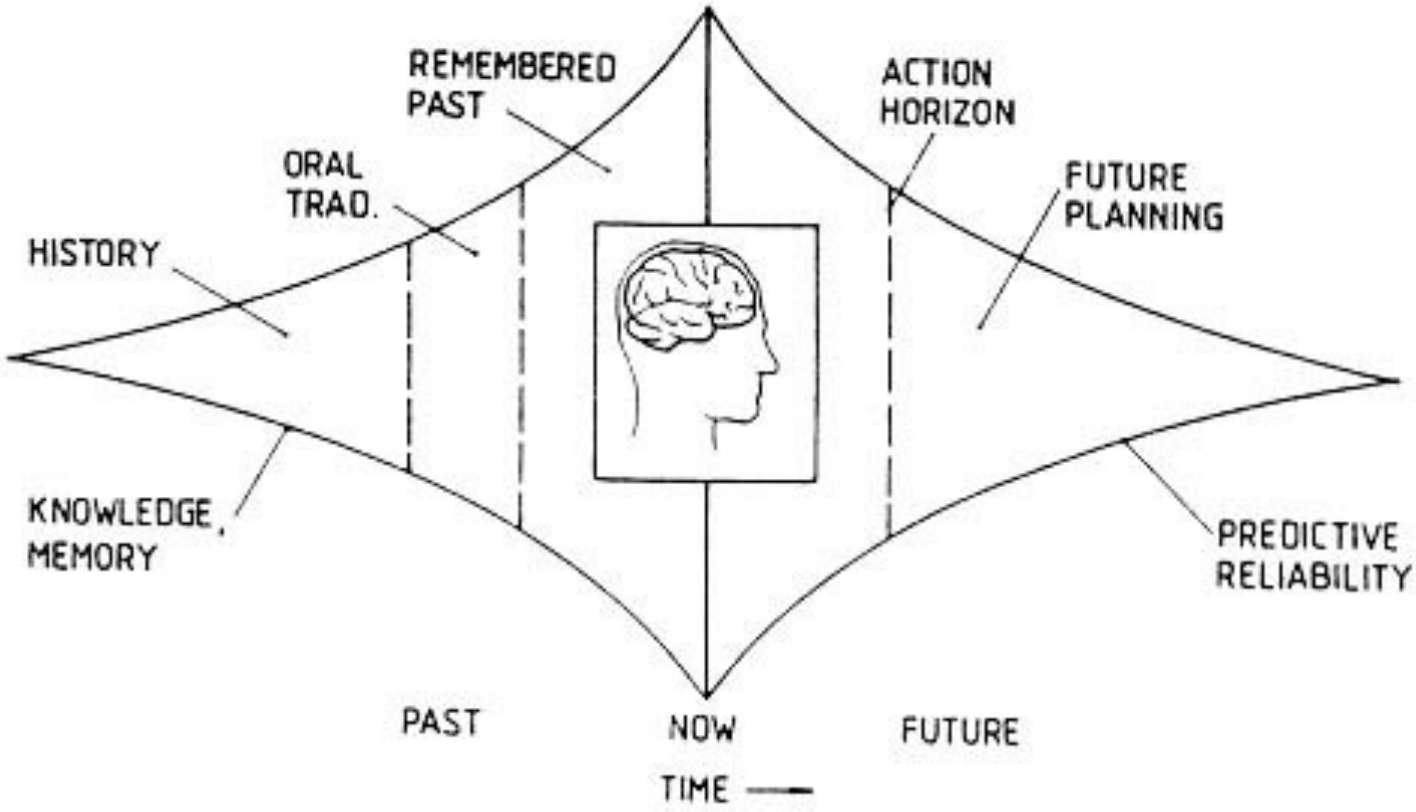
25 The cultural explosion as a consequence of cognitive fluidity.

Intellectual skills were distributed into different brain areas in the primitive human being. Areas did not communicate.

The development of language facilitated cognitive thinking.

30.000 years ago a giant developmental leap in brain function:

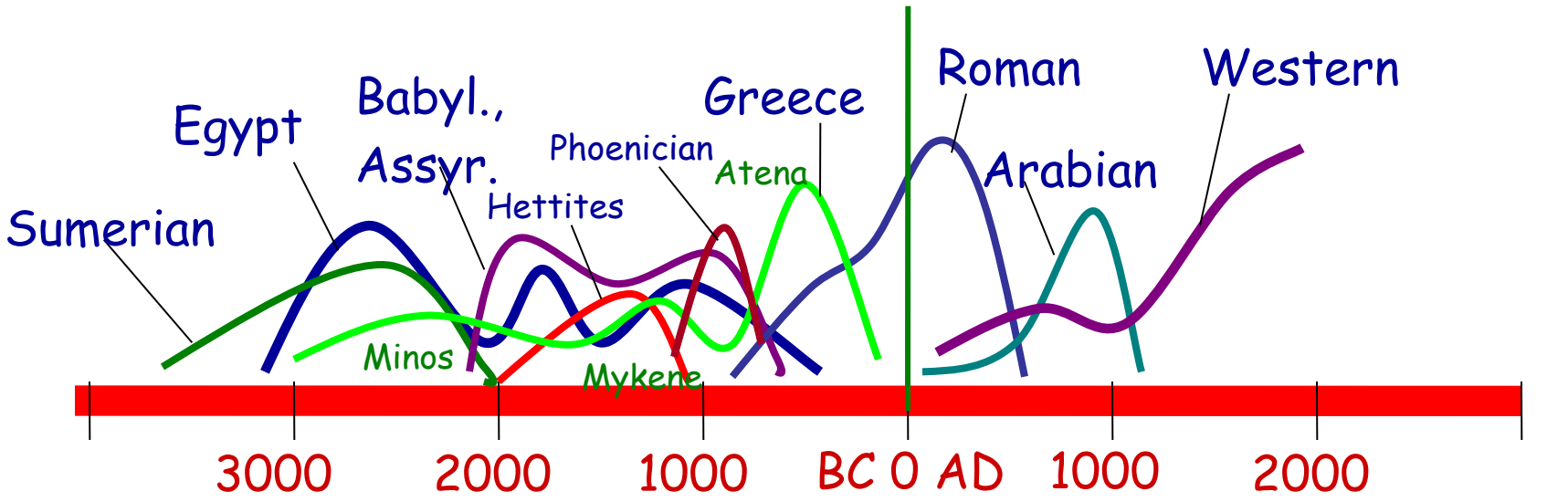
Fantasy removed the human being from a stiff anchoring to the instant of reality.



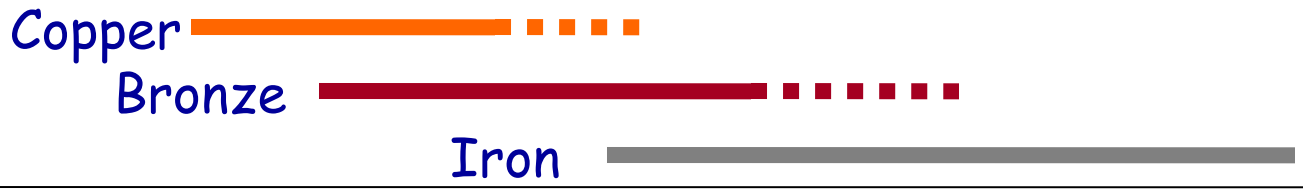
Only humans are able to make time travels in their fantasy.

Source: J-T Eriksson

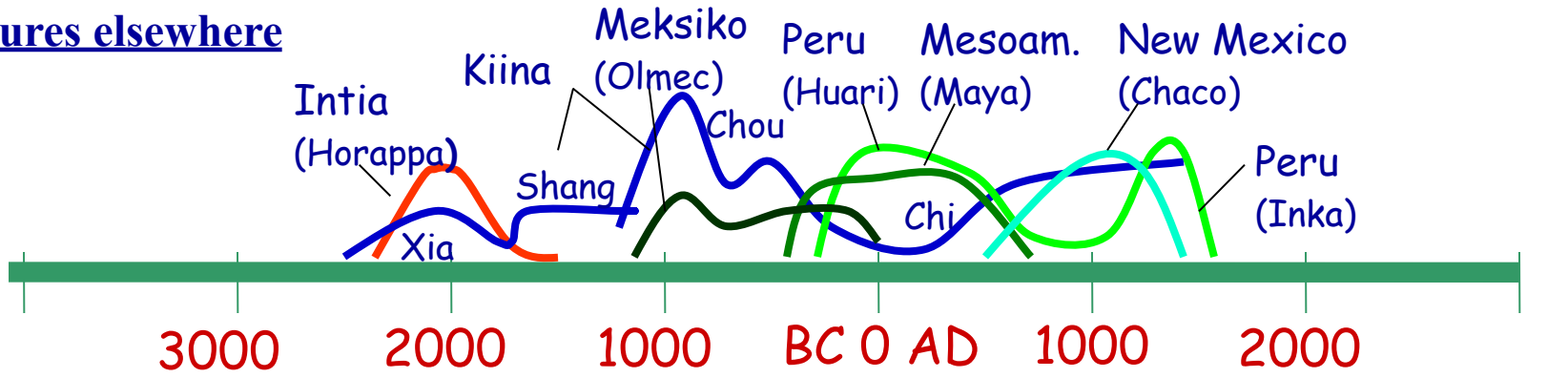
"Roots of the Western Culture"



Developmet of the use of Metals



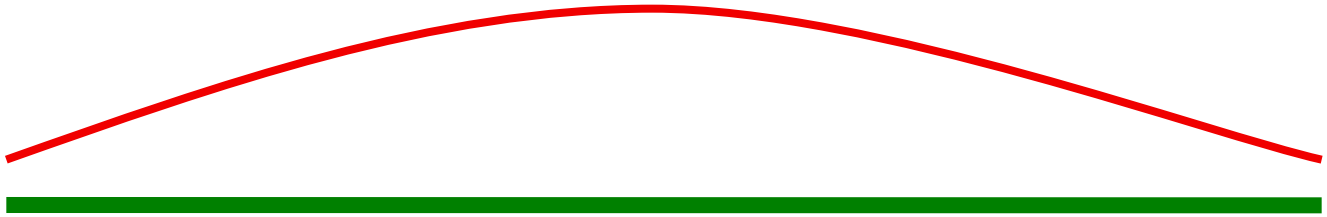
Cultures elsewhere



Source: J-T Eriksson

The 4 seasons of cultural development

(Oswald Spengler)



	Spring	Summer	Fall	Winter
Mentality	Joy of life, naiveness	Growing self-confidence	Maturation, consideration	Stiffness, civilization
Culture	Idealistic, hero stories	Religion dominated	Enlightment philosophy	Mass culture,
Classic	Odysseia, Illia	Thales, Pythagoras	Aristoteles	Zenon
Western	Knight tales, sagas	Galilei, Luther	Voltaire, Kant	Marx, Nietsche
Art	Naive religious	Artist central romantic	Realistic, naturalistic	”modern” non-figurative
Politics	King, nobility priests	growing bourguise	power of the bourg. class	metropolitan gowernance

Complexity and culture

1. Humans are problem-solving survivers
2. A society aims at strengthening the surviving force
3. A society is mainteined by the continuous flow of resources and information
4. Distribution of resources is conditioned by a socio-political system
5. Stability requires harmonic envolvement of sociopolitical institutions

1. Complexity offers a solution to perceived problems

2. Complexity is the responce to social needs

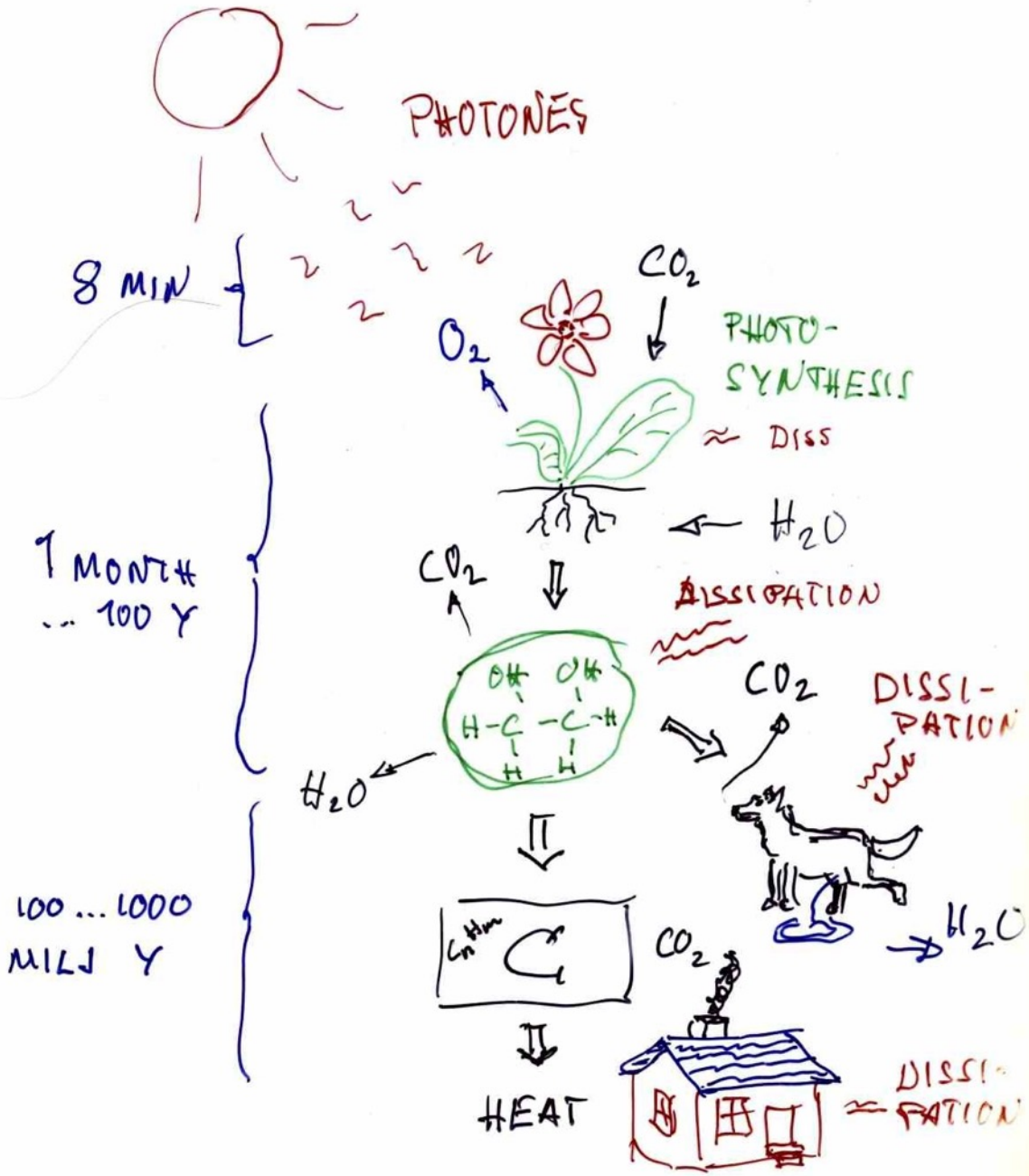
3. Investment in complexity results in benefits for the society – up to a certain point

Complexity and culture

Why cultures collapse? (Joseph Tainter)

1. **Less over-all coordination.**
2. **Less flow of information.**
3. **Less trading and redestribution of resources.**
4. **Less investment in cultural attributes.**
5. **Less economical and occupational specialization.**

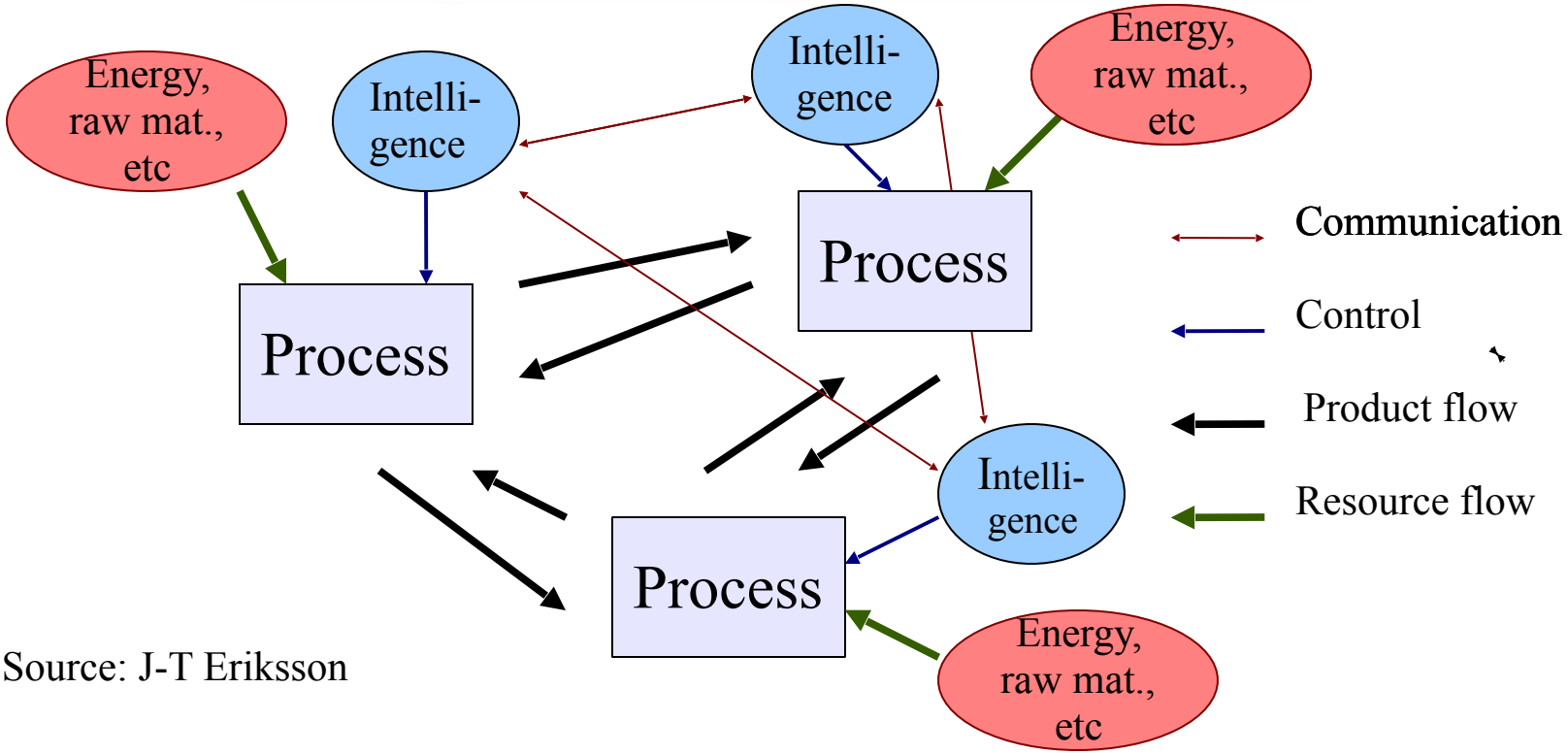
Spatial and temporal interconnection in the biological cycle.



Source: J-T Eriksson

Characteristics of a Complex system

- the system consists of a network or is continuously distributed in space
- centers for consumption or production of resources, energy etc.
- flow of energy and resources
- flow of information
- coherence between the two types of flows
- energy through flow, dissipation
- delays and different time scales for separate processes



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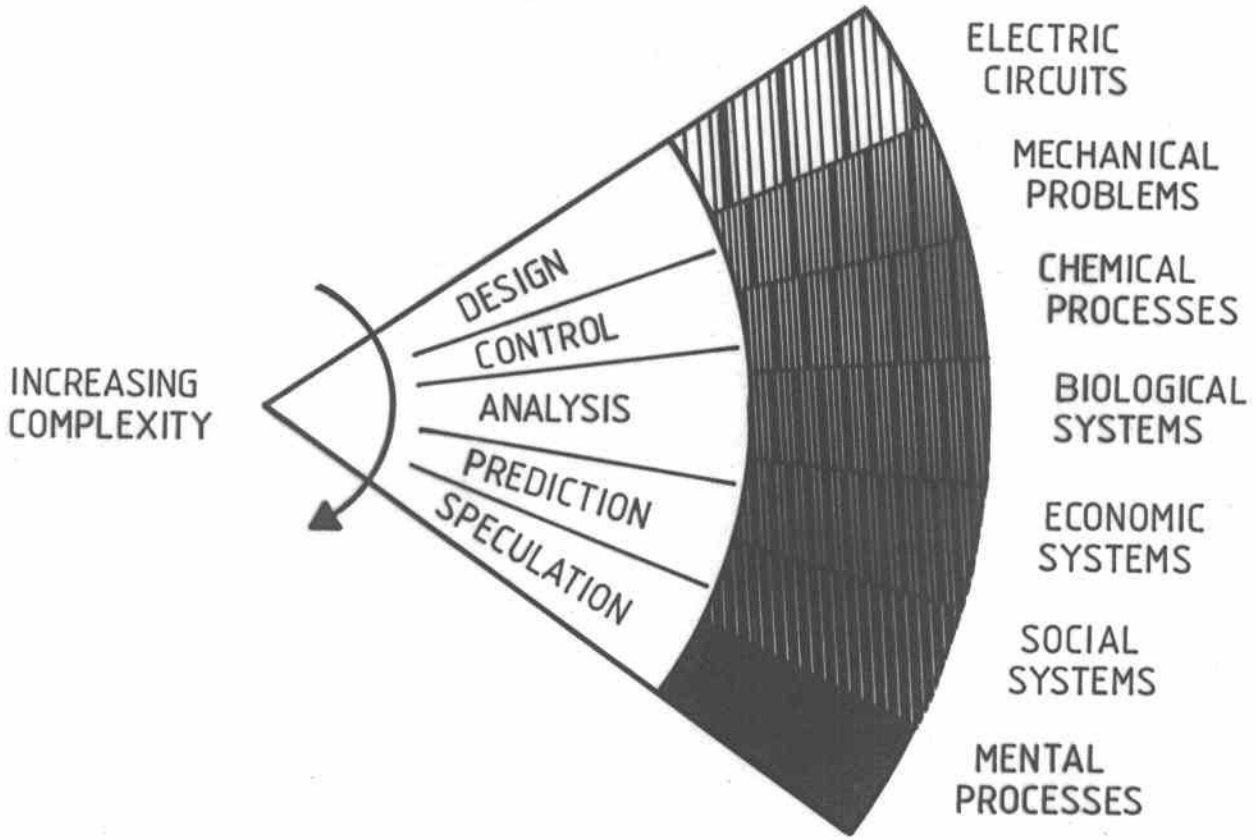

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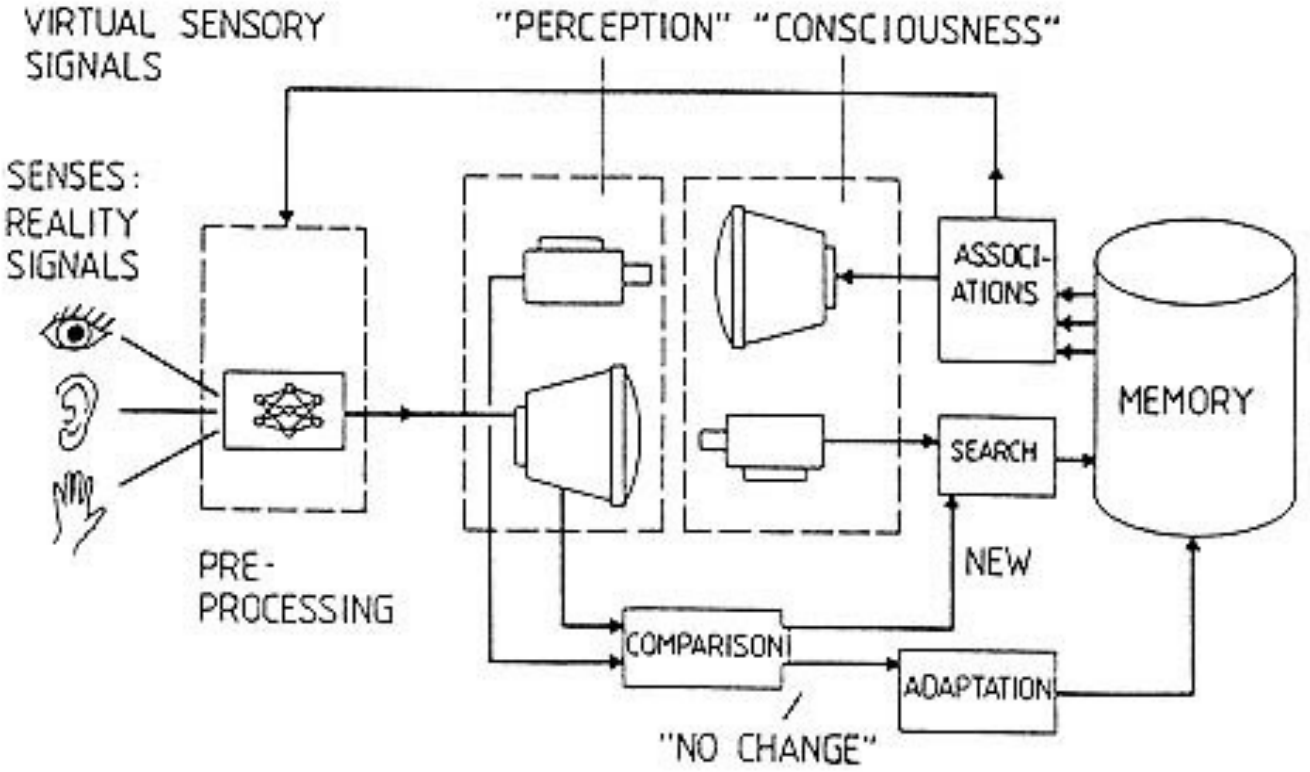
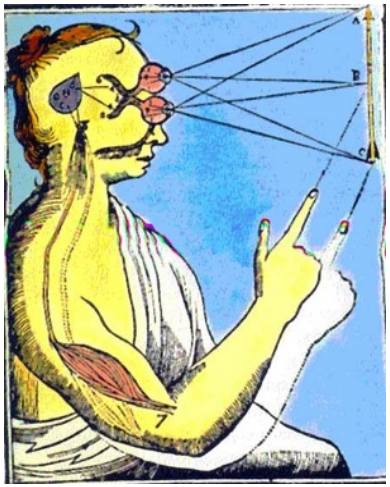
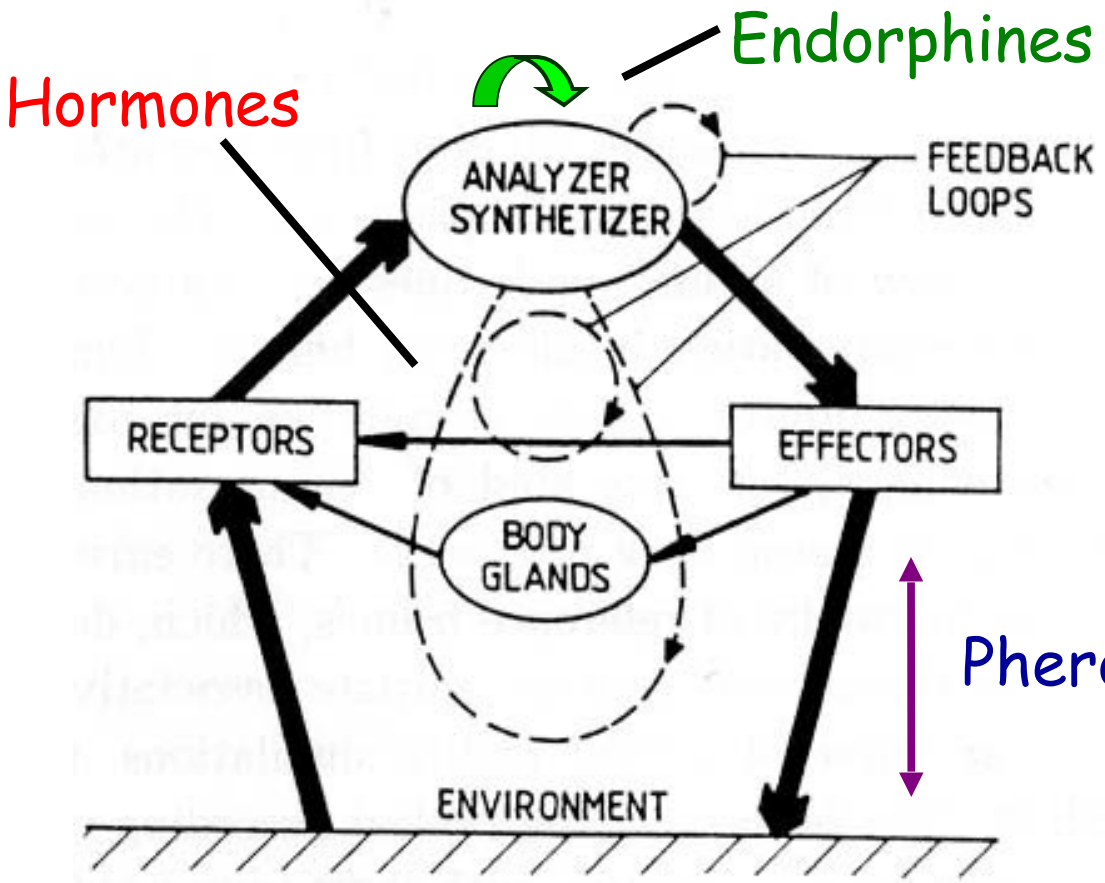




What humans see or sense is not projected on an "inner film screen", but has to be recognized by the memory. The conscious mind builds a representation of the experienced real world.

Source: J-T Eriksson



Living creature - Survivor through interaction with real world.

Source: J-T Eriksson

Developing the understanding of complex systems

- Cross-disciplinary education.
- Awareness of methodological diversity.
- Individual focus on specific methods.
- Cooperative networking acting like the brain of the individual.