



**Workshop Complex System Science  
Action ONCE-CS, Vilnius 2006**

**ORGANIZED COMPLEX SYSTEM**

**as**

**Informational Closed-Loop Coding-Decoding  
Control System**

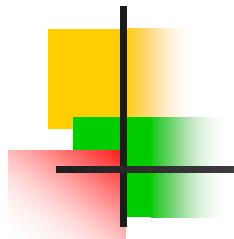
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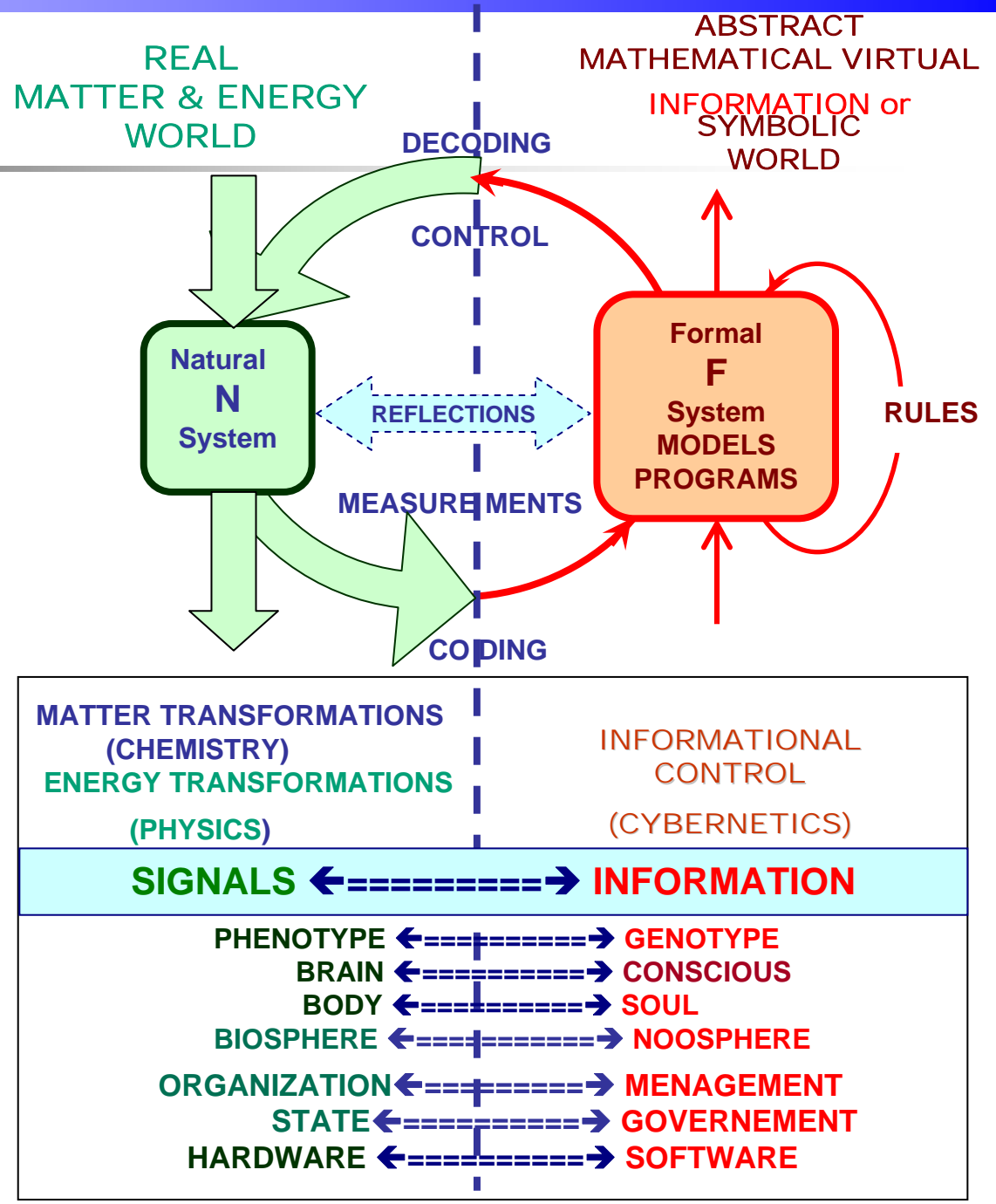


**Organizationally closed**

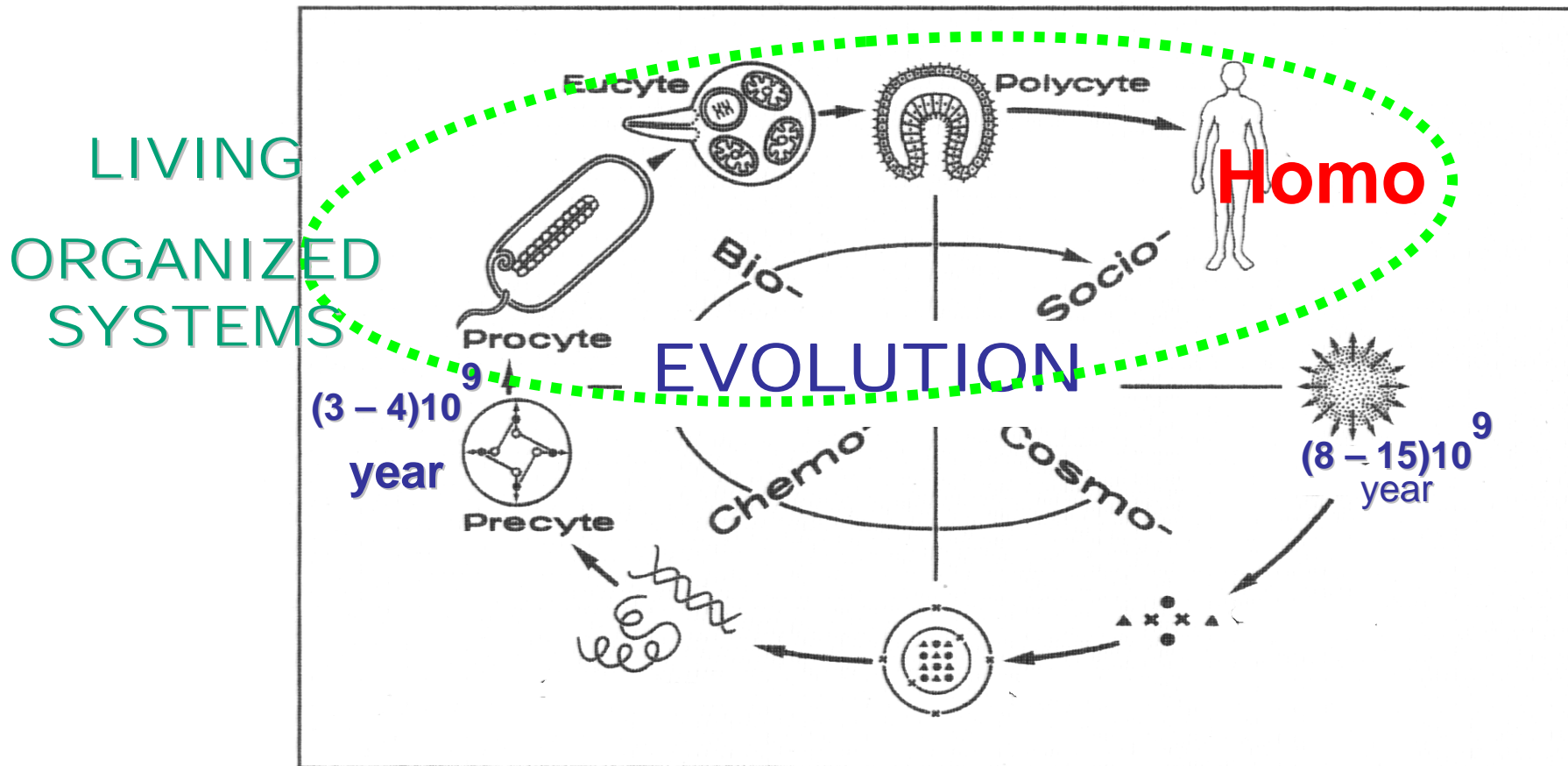
**Matter-energy-information open**

**Closed-loop coding-decoding control**

**Paradigmatic schematization**



# World evolution (After W. Schwemmler)



Phenomenon of informational control and closed-loop coding-decoding appeared on the Earth 3-4 billion years ago, when the life or organized complex systems originated.



“... **“If the matter is organized and alive, a special force should be operating that connects, controls the matter and makes it alive. We shall name this force **organic** or **organizing force**.”**

A. Sniadecki, **“The theory of organic beings”**, Vilnius, 1804..”

JĘDRZEIA  
SNIADOCKIEGO,  
MEDYCYNY DOKTORA,  
Teorya Jestestw Organicznych.

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*Służmy poczciwej sławie, a iako kto może  
Niech ku pożytku dobra spólnego pomoże.*

JAN KOCHANOWSKI.

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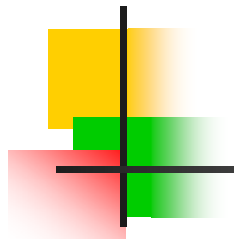
TOM I.

*Należy do Szkoły Polowej w Warszawie*

w WARSZAWIE,

w Drukarni N° 646. przy Nowolipiu.

1804.

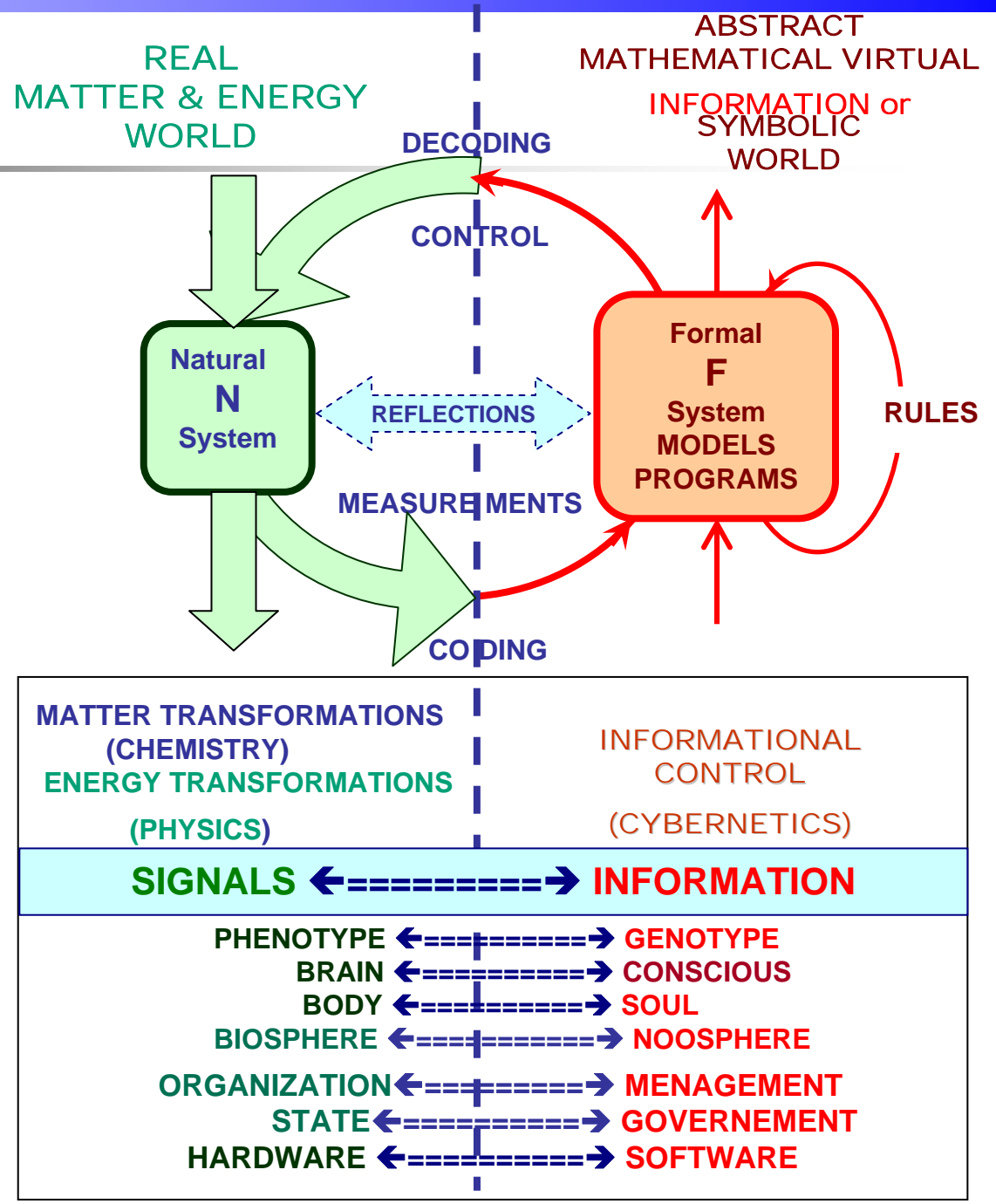


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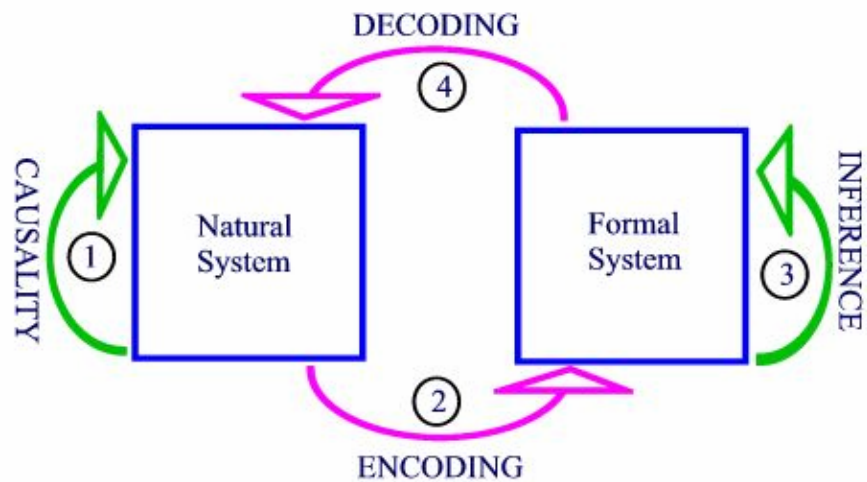
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# MODELING RELATIONS after R. Rosen and J. Casti



**Modeling Relations  
after R. Rosen, 1985**

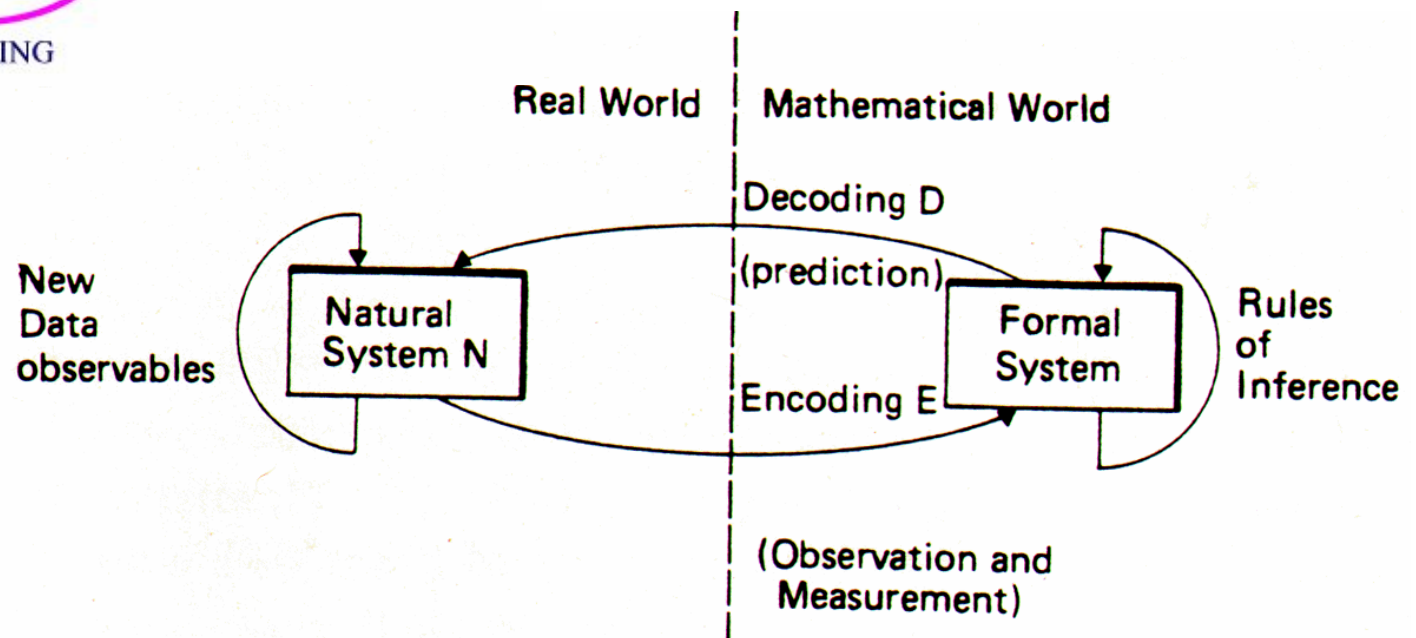
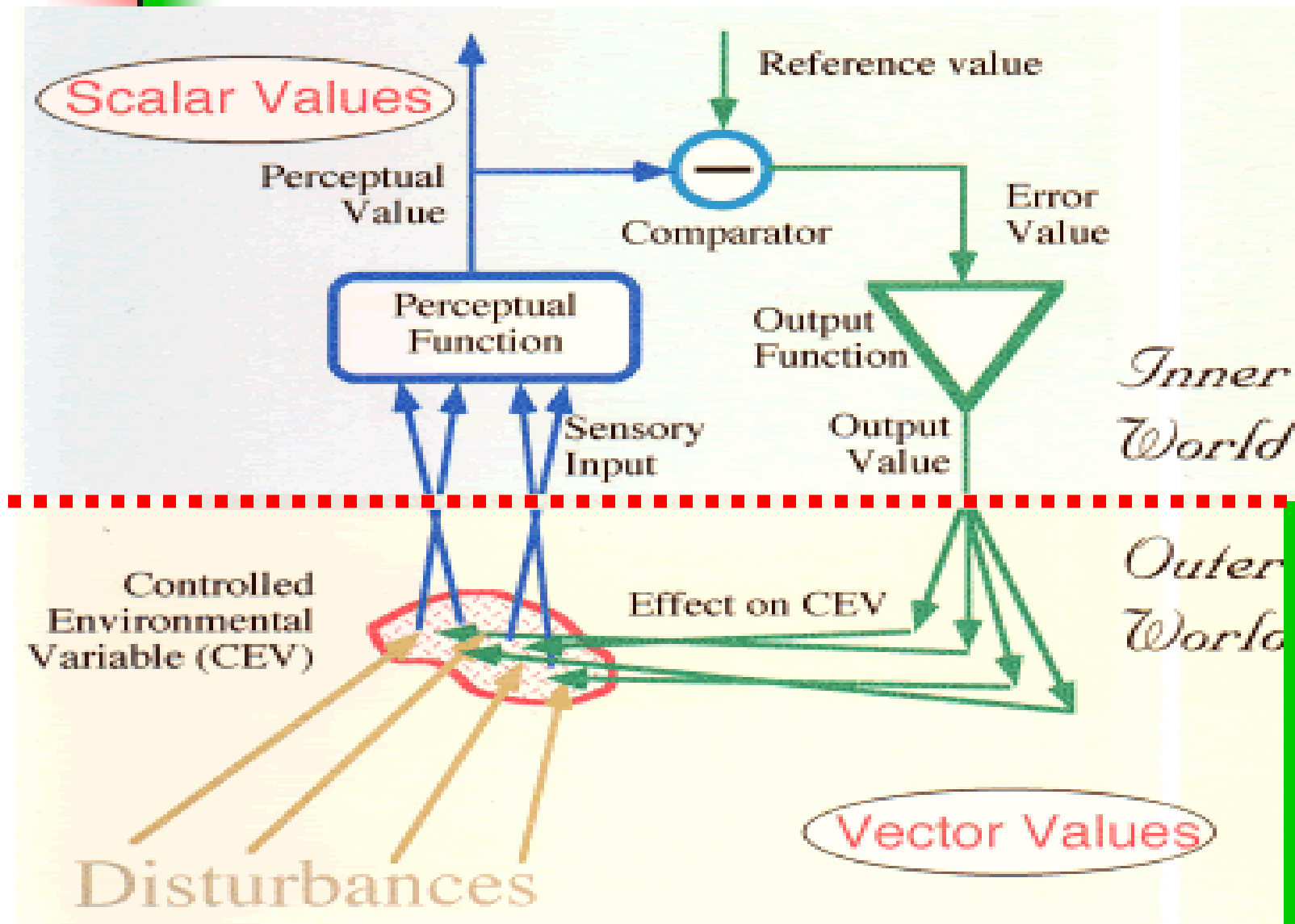
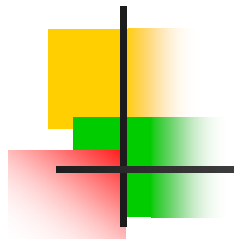


Figure 1.5 The Modeling Relation

# Basics Perceptual Control Theory (PCT)

after W.T. Powers





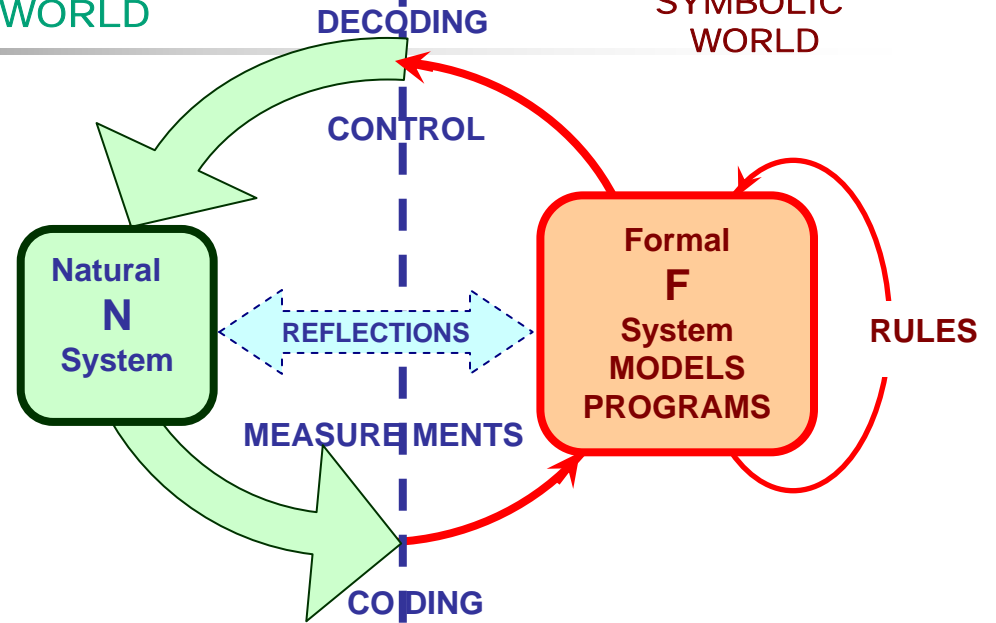
**Organizationally closed**

**Closed-loop coding-decoding control**

**Paradigmatic schematization**

REAL  
MATTER & ENERGY  
WORLD

ABSTRACT  
MATHEMATICAL VIRTUAL  
INFORMATION or  
SYMBOLIC  
WORLD



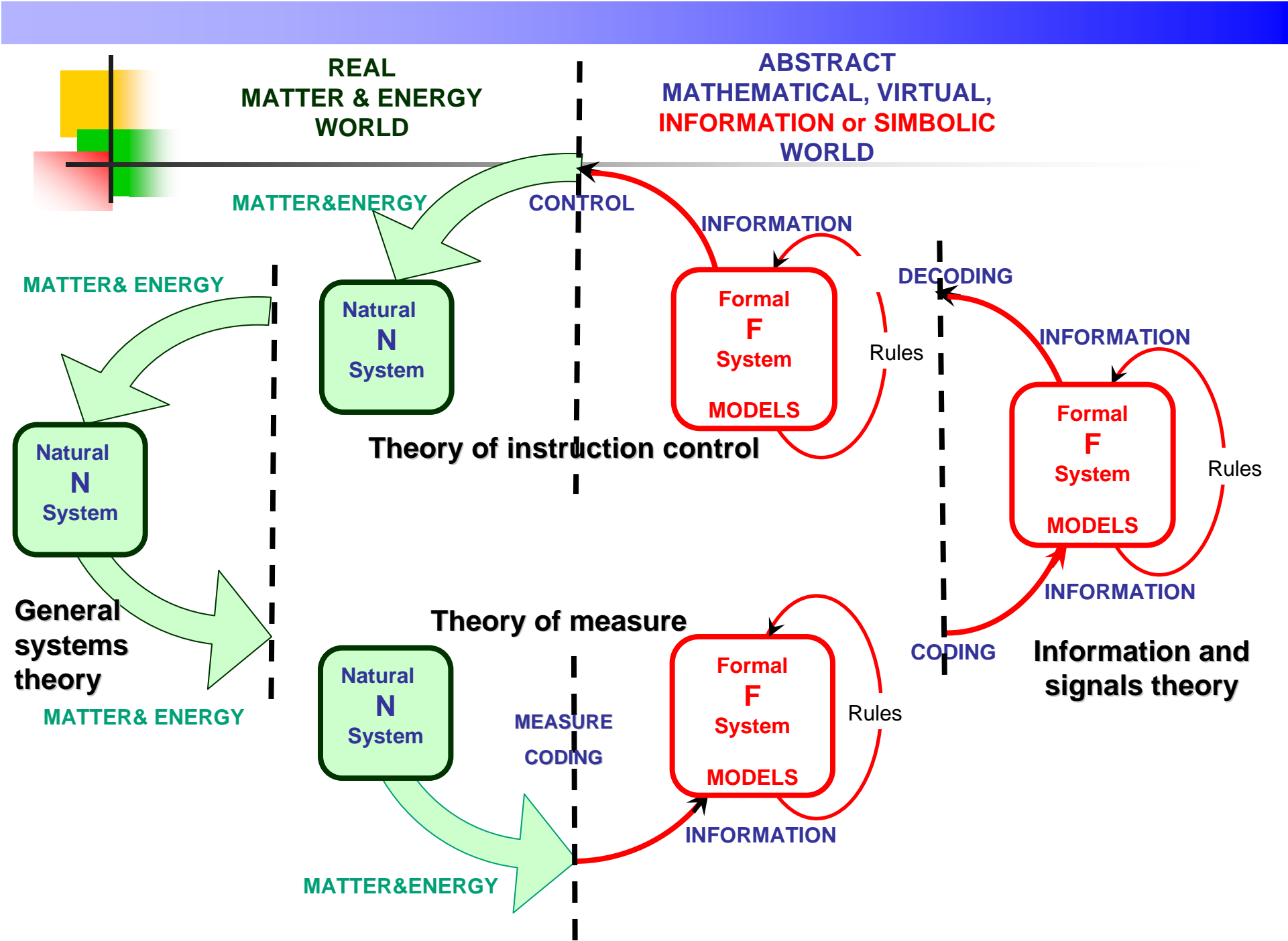
MATTER TRANSFORMATIONS  
(CHEMISTRY)  
ENERGY TRANSFORMATIONS  
(PHYSICS)

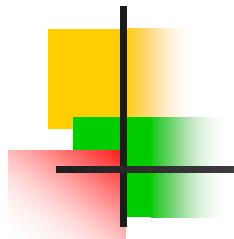
INFORMATIONAL  
CONTROL  
(CYBERNETICS)

**SIGNALS** ↔ **INFORMATION**

PHENOTYPE	↔	GENOTYPE
BRAIN	↔	CONSCIOUS
BODY	↔	SOUL
BIOSPHERE	↔	NOOSPHERE
ORGANIZATION	↔	MANAGEMENT
STATE	↔	GOVERNEMENT
HARDWARE	↔	SOFTWARE





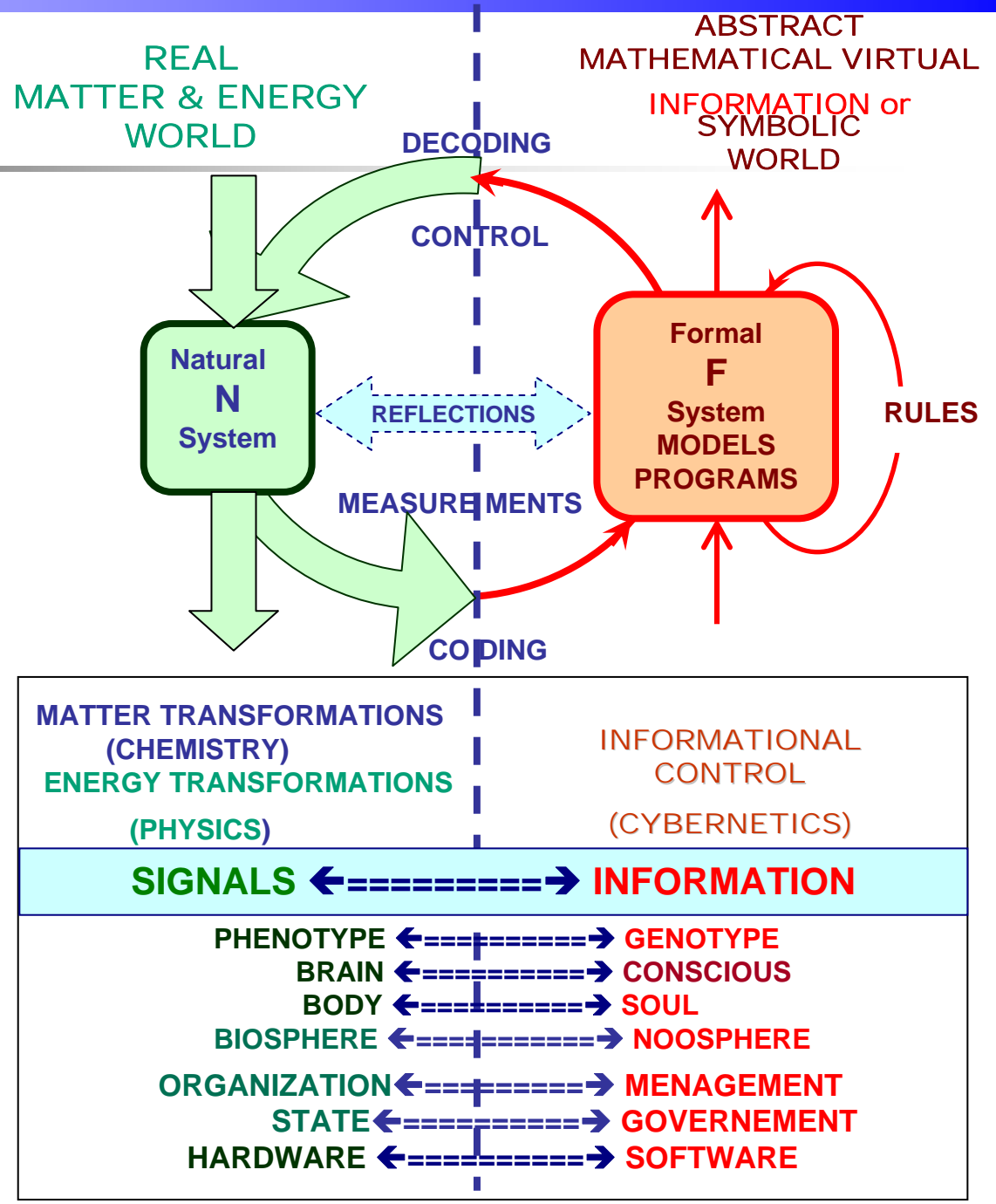


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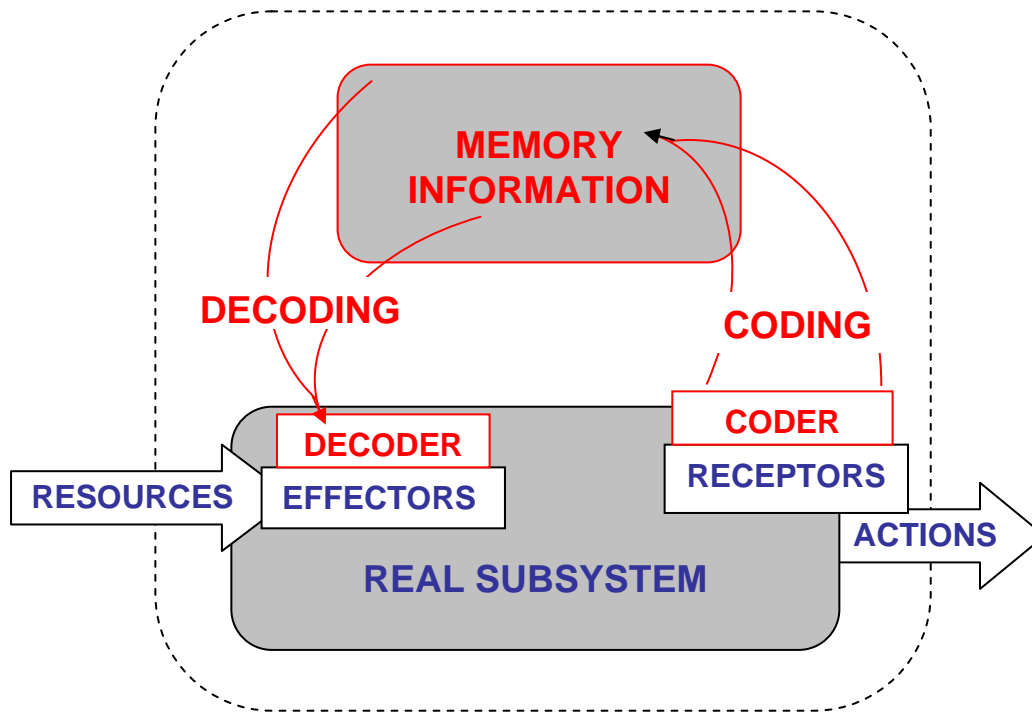
**Matter-energy-information open**

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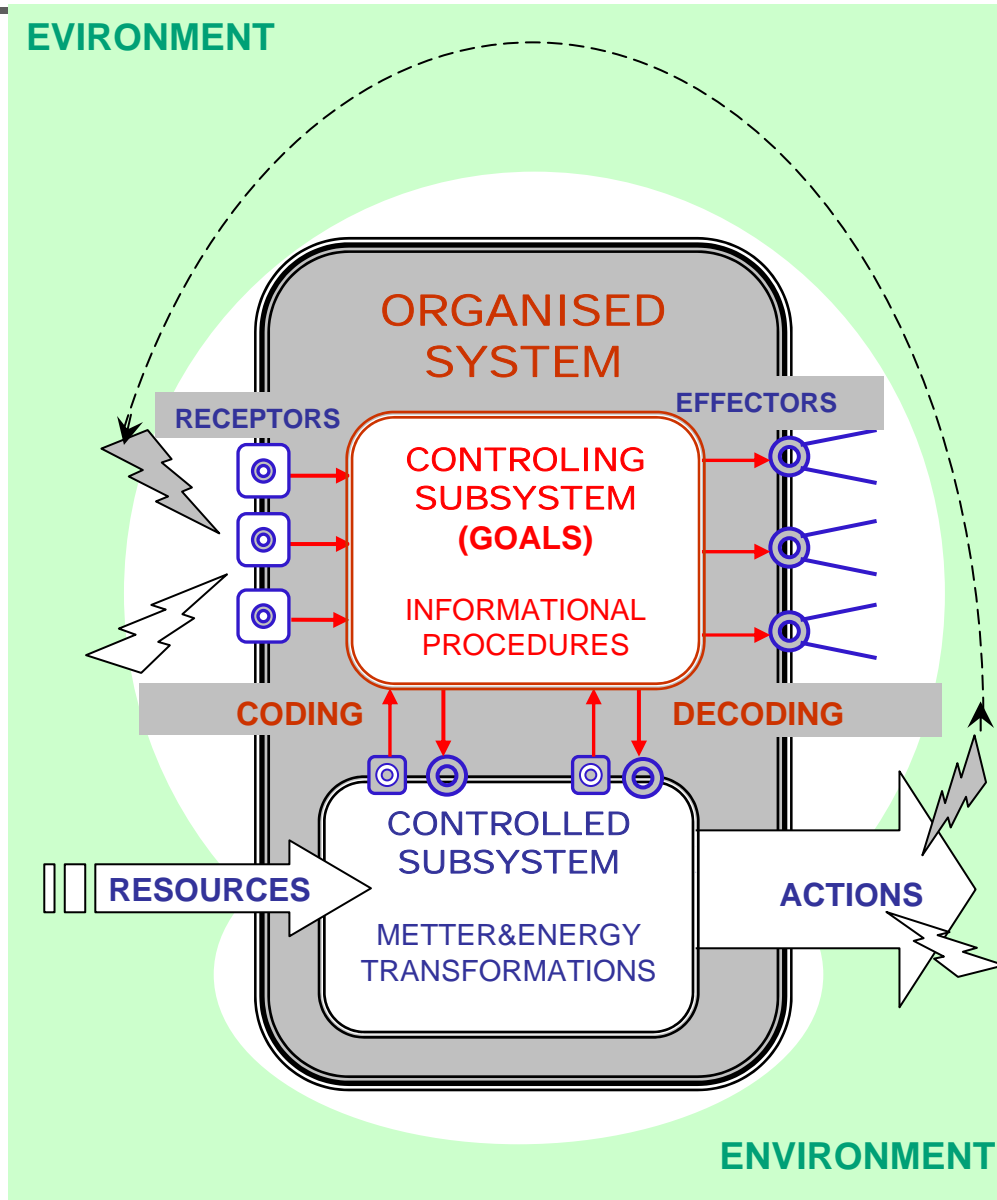


# CLOSED-LOOP CODING-DECODING SYSTEM STRUCTURE



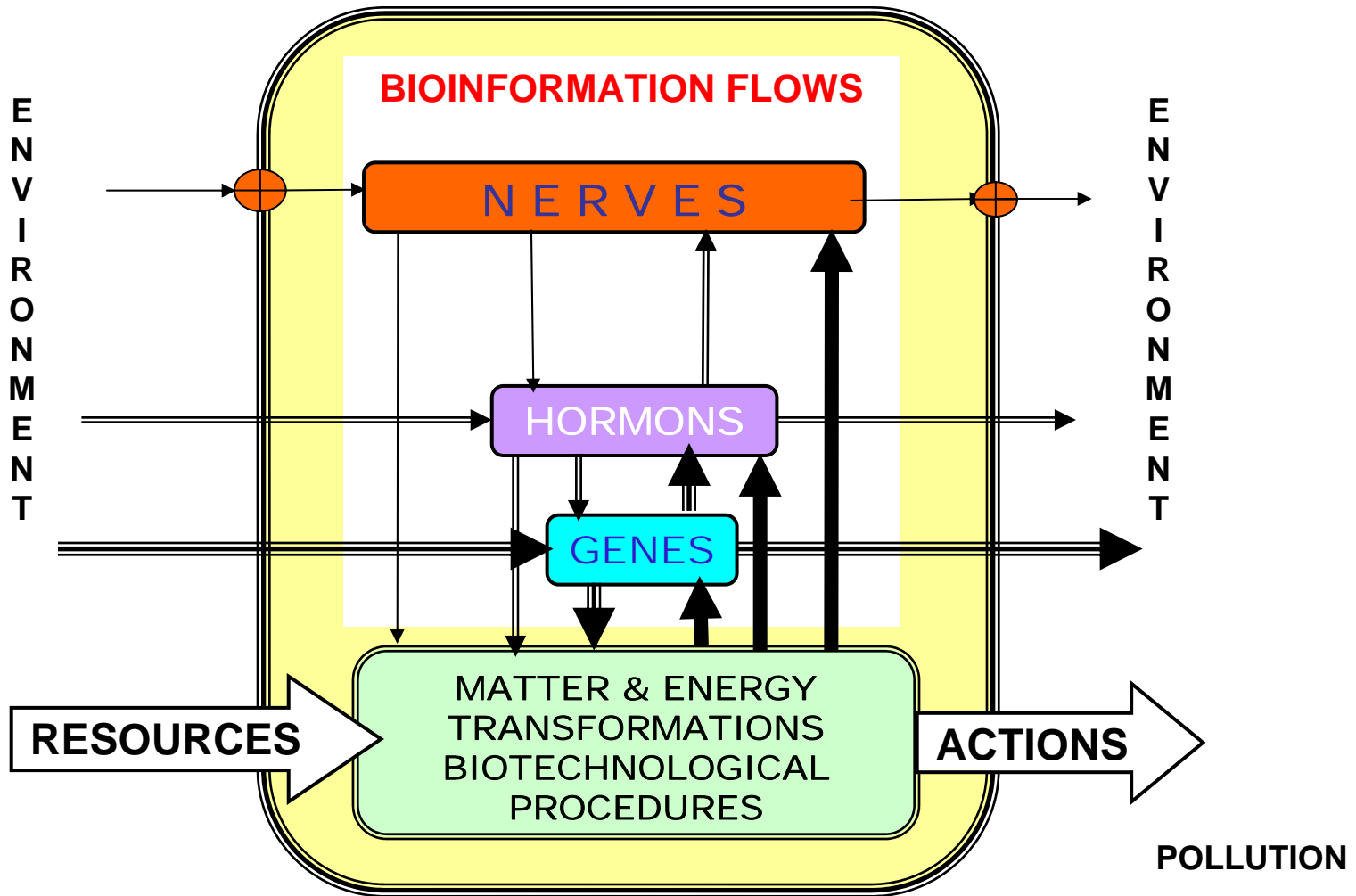
# GENERAL FUNCTIONAL STRUCTURE of the ORGANIZED SYSTEMS

RECEPTORS  
SENSORS

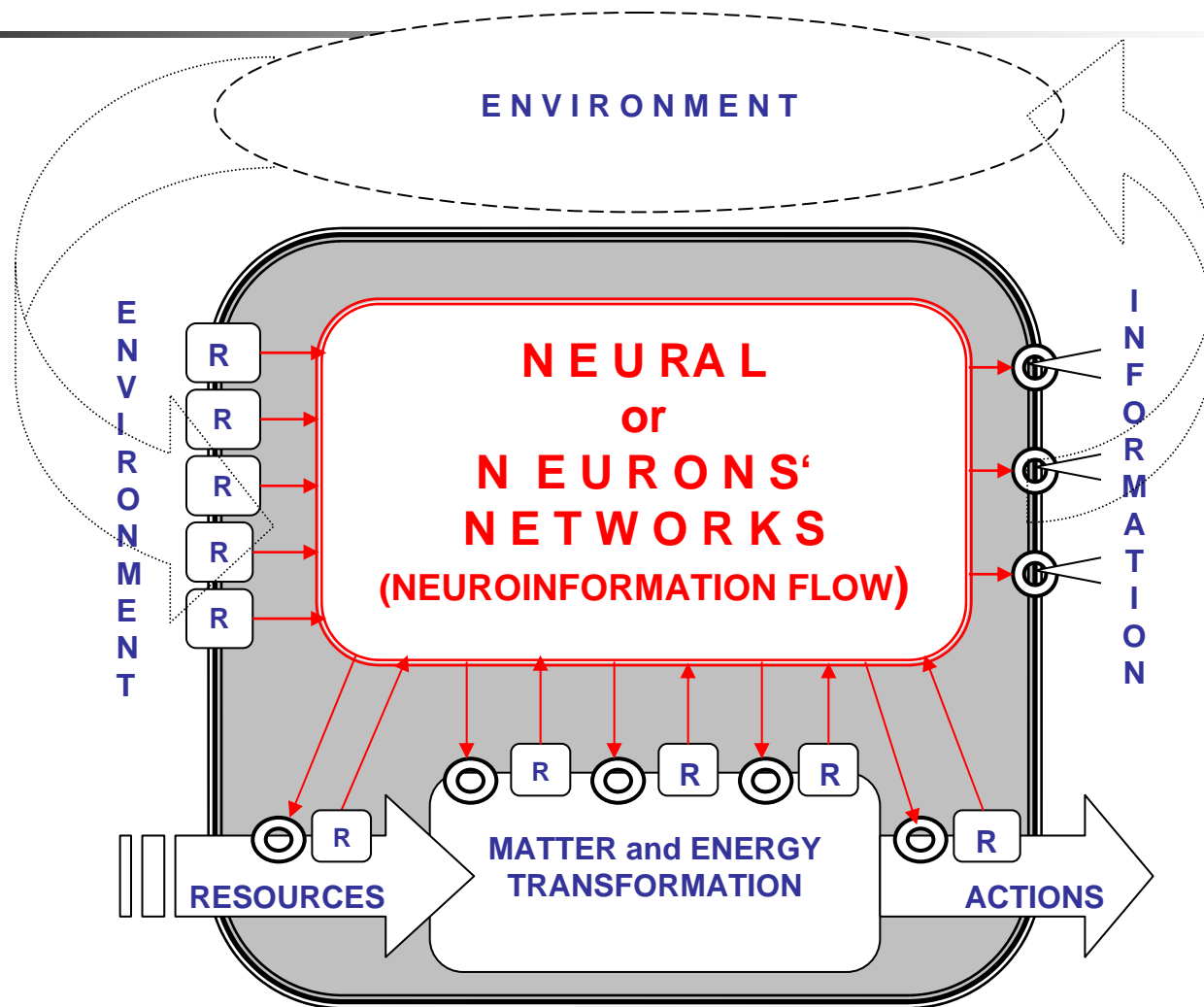


EFFECTORS

# Hierarchical Closed-Loop Coding-Decoding procedures in human and animals



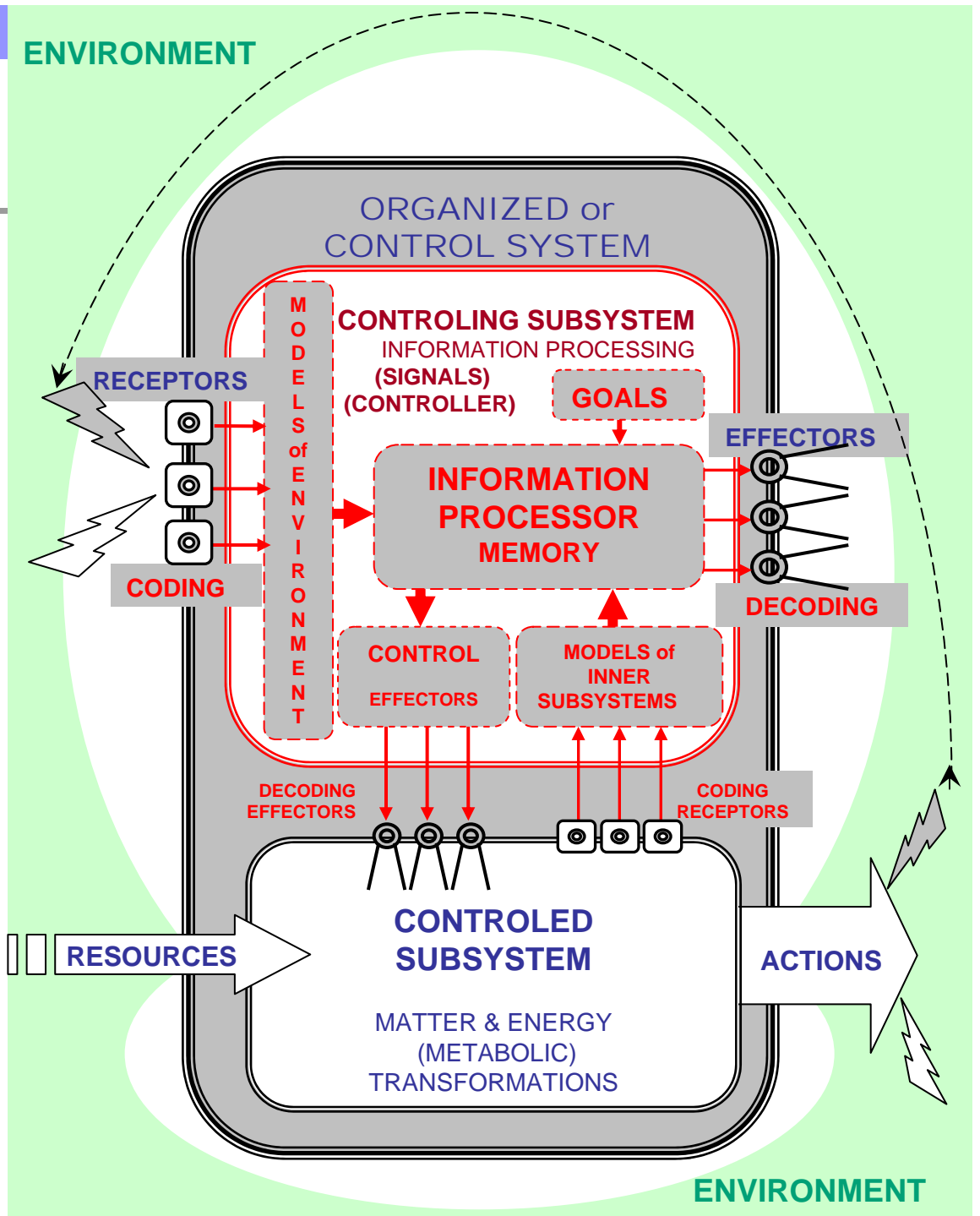
# NEURAL SUBSYSTEM in the ORGANIZED SYSTEM

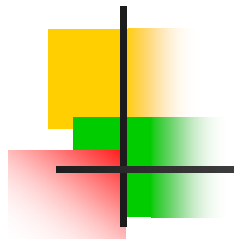


Neural networks in the organized system (organism)

**R** - receptors or elementary coders,      **⊙** - effectors or elementary decoders

**COMPLEX ORGANIZED SYSTEM with CONTROL STRUCTURES**



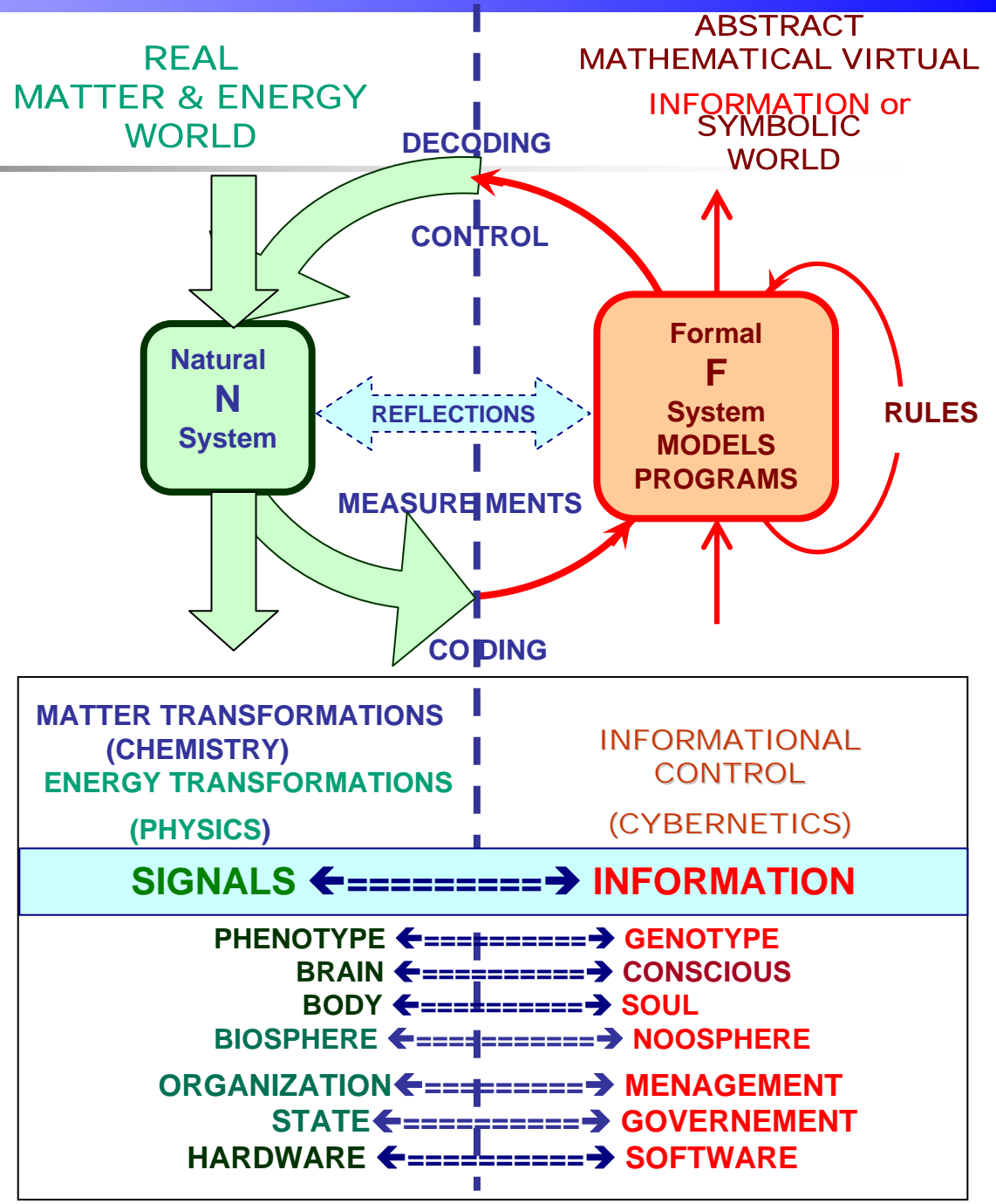


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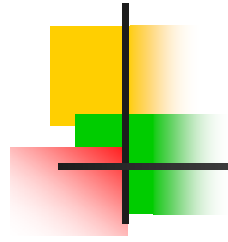




# CONCLUSIONS

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- 1. The complex organized systems – living, linguistic, social and some engineering ones – could be regarded as the systems with Informational Closed-Loop Coding-Decoding Control (CL-CDC).***
- 2. In a organizationally closed system, Coding-Decoding adds the functional (semantic) meaning to the system.***
- 3. Informational openness gives the system the ability to receive the additional information about the environment.***
- 4. The matter-energy-information openness enables the system to synthesize more complex organized systems from CL-CDC elements.***



***Thank you  
for your attention***