"COMPARISON BETWEEN NATURAL AND ARTIFICIAL COMPLEX ARCHITECTURES"

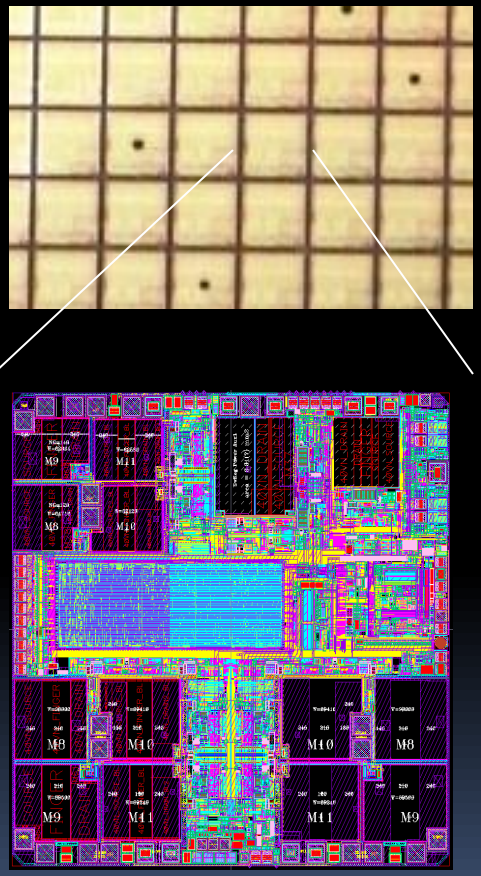
- *Ubaldo Mastromatteo*
  A.R.G.A.L. Via S. Stefano, 27/B – 20008
  Bareggio (MI), Italy,
  E-mail: ubaldo.mastromatteo@libero.it

SUMMARY

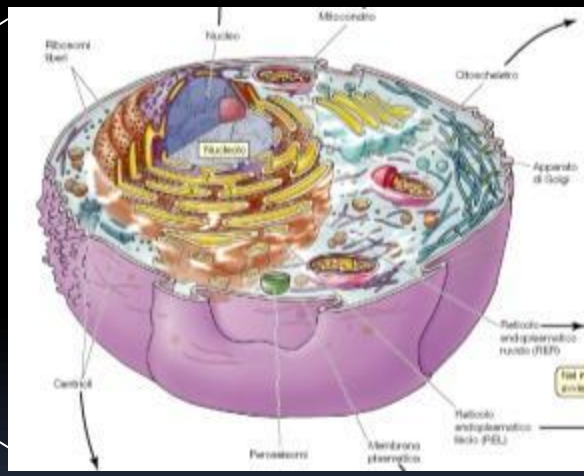
- Two complexities
- Artificial systems, instructions, environment, characteristics
- The lifeless environment
- Living systems
- Summary
- Final remarks

COMPARISON OF COMPLEX SYSTEMS

COMPLEX SYSTEM
ARTIFICIAL: MICROCHIP



LIVING SYSTEM:
CELL



COMPLEXITY: A FEATURE OF LIVING ORGANISMS, BUT ALSO A PRODUCT OF HUMAN ACTIVITY

- I have often asked myself the question: why human artifacts, even if much less complex than living systems of similar size, in comparison they require a great deal of work?

IT IS NOTED THAT:

- To build both a simple and a complex artificial system, you need instructions.
- The instructions must be transformed into a sequence of operations that give rise to what is called the "working process".
- The instructions contain "information" which refers to an appropriate "code" that gives "meaning" to the information.

EXAMPLE OF INSTRUCTIONS

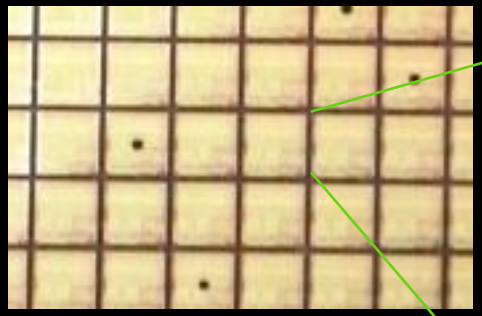
- *open the water tap.*
- *reach the 200 cc level in the glass.*
- *close the water tap.*

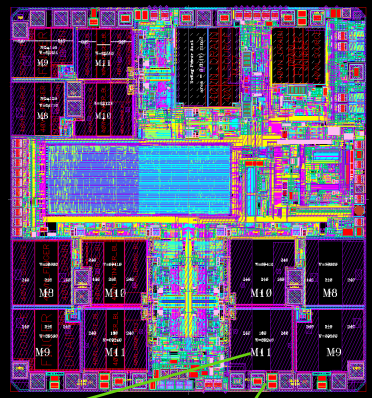
- The process is for filling a container.
- The sequence has three instructions.
- The code used is the proper language and grammar and the information in this case is intended for one person. If the process had been entrusted to a machine the code would have been different.

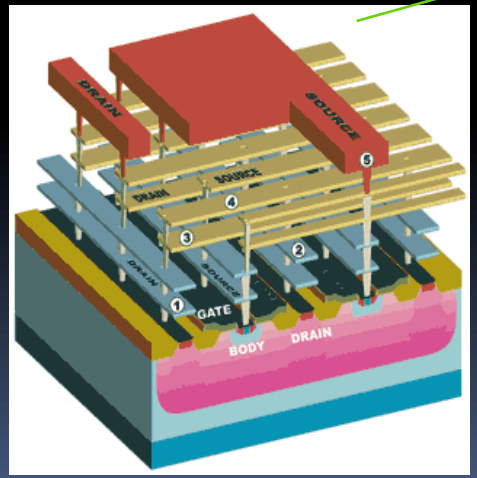
ENVIRONMENT OF THE PROCESS

- Any process requires a particular environment suitable for executing the instructions as appropriate:
- The kitchen for preparing food;
- The construction site for building a house;
- The workshop to repair cars;
- .....etc

WHERE MICROCHIP IS MADE







CHARACTERISTICS OF ARTIFICIAL PROCESSES

- The processes for the realization of complex artificial systems are not spontaneous;
- The process has the purpose of giving shape to the "system" by putting together the parts that compose it, doing work using energy and directly or indirectly producing waste material;
- At the end of the process, the system contains a quantity of "information" generally proportional to its "complexity";
- The environment that houses the factory increases its disorder because it receives the waste of the process in energy and materials;

ABIOTIC WORLD

- in an abiotic world all transformations are a sequence of spontaneous processes leading to an increase in entropy.
- In a lifeless world, all phenomena that occur and that involve matter and energy are subject to physical laws without information being involved.

Surface of Mars

ABIOTIC ENVIRONMENT AND INFORMATION

- In the "abiotic" world the laws of physics apply: for example the law of energy conservation
- In the "abiotic" world there are no codes and there is no transmission of information, there is only exchange of energy and matter: total disorder increases and therefore entropy
- Information is foreign to the laws of physics
- It may happen that order is created in a part of the abiotic system, like formation of ice, but that does not derive from information exchange, as for the formation of a crystal, the decrease in entropy derives from the transfer of heat to the environment and the entropic balance is always positive

LIVING SYSTEMS

- As for transformations in a lifeless environment, the growth process of a living organism is spontaneous
- As with artificial systems, the process is based on information
- The information is contained in the DNA inside the organism cells, while in artificial systems the information is present and acts from the outside
- During the growth process, order prevails over disorder and the overall entropy decreases; moreover the system increases its internal energy.

GROWTH OF A LIVING SYSTEM

EMPTY FACTORY
messy environment
(substances scattered in the ground and in the environment)

High entropy

FACTORY AT WORK
Transformed and ordered matter

Low entropy

SUMMARY

- Both the manufacture of complex artificial systems and the development of living systems are dependent on information;
- For the former the process is not spontaneous, for living systems it is spontaneous;
- In the abiotic world, phenomena are regulated by physical laws and there is no information present;
- The information as a product of the human mind allows to create order and lower the entropy of a system, but increases the entropy of the environment;
- The growth of living organisms creates order and decreases the entropy of the system without increasing it in the environment.

Final remarks

It has been seen that for the fabrication of complex systems it is necessary to use information in the form of a sequence of instructions expressed by means of an appropriate code.

The same is true for living "systems" whose encoded information is contained in the DNA inside the cells nucleus of every organism.

Since the abiotic world does not contain codified information nor is it able to generate it through processes that are subject to the laws of physics, it follows that in this type of world the formation of complex structures having functions deriving from codes and, even more so, living organisms, is impossible.

THANK YOU FOR THE ATTENTION