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How the Physical World Impacts Different Objects

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Abstract
Main properties of the Universe are studied from some general positions of system theory. The world is described as the manifold of different objects. All of them have hierarchic stricture. The Objects constantly interact with each other. There are three basic types of interaction between the Objects. These interactions are implemented through flows of substance with different nature. Three main types of these substance flows are known. They are: the flow of matter, the flow of energy and the flow of information. Each of them can be divided in a standard paire – inflow and outflow. The affectation of all these pairs changes the each Object. If this affectation is weak one can say the properties of different parts of the environment are only reflected on the Object. The animation matter has active reflection of its environment. The non-animated matter has only passive reflection. One can select two stages of reflection. The first one is the interaction environment-interface. The second one is interaction between the interface and the internal parts of Object. The rates of these two interactions are different. Some practical examples of different rates of interaction are described. These examples are connected with the process of solidification in the case of non-animated matter. There are two additional examples for animated matter too. They are connected with the chains of transformation of information.

Key words: Interaction; Substance; Interface; Affectation of environment; Reflection; Information; Memory; Knowledge

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INTRODUCTION

Different Types of Substance Flows

Heterogeneity of the universe is one of its main properties. Its independent parts are usually denoted as Objects. Objects in their turn have complex structure as well. That is why one can say the universe is hierarchic. Different Objects constantly interact with each other. To study this complex system requires various simplifications. The set of simplifications creates different models. In many real situations, it is possible to treat only one independent part of the universe as an Object. At the same time the other parts one can be considered as Object environment. The Objects are divided from their environment with the help of transition region. These regions are called the border or the interface. For physical Objects the interface is the thin layer which gradually changes behavuours from Object to environment. In humanities all interfaces usually are symbolic.

A simplified understanding of the interaction between Object and environment involves the exchange of substance between them. The simplest way to describe this exchange is the flows from environment into the Object (inflow) and flow from Object into environment in the opposite direction (outflow). Substance has three alternative forms: matter, energy and information. These forms are interconnected. The matter and energy are connected with the help of the well-known Einstein formula $E=mc^2$. The connection between energy and information was studied in the set of previous publications (Ershov; Simbols, 1961) Descriptions of some similar

problems are outlined elsewhere (Bremermann, 1962). It means all three forms of substance are closely connected one to another. That is why in each flow at the interface through the border between the Object and its environment, one can detect all three alternative forms of substance. There are situation in flows where the only one of these forms is predominant. As a result one can study the models with three pairs of independent flows: namely matter, energy and information. One flow in each of these pairs is the inflow and the other one is the outflow (Figure 1). The interactions between the flows of different origins are also possible.

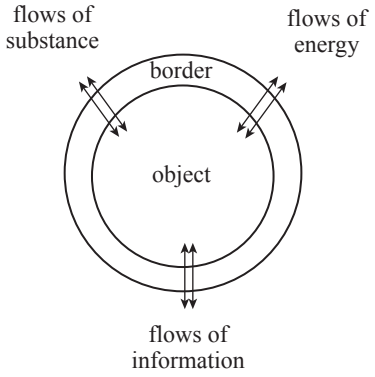

Figure 1
Interaction Between Object and Its Environment.
Note. They are dived by interface or border. Three types of matter flows cross this border (interface) zone. They are the flows of substance, the flows energy and the flows of information.Here as in many cases for simplicity the flows of matter are denoted as the flows of substance.

Each of flows affects on the properties of the Object. If these affectations are weak one can say the properties of different parts of the environment are only reflected on the Object. In that circumstance the basic properties of the Object would remain unchanged. If the flow influence is strong there can be full or partial transformation of the Object. In the case of transformation, the Object gets or loses some matter or energy or both and these processes create the significant changes in its own structure. It is no possible to determine exact conditions of reflection and transformation. However, it is possible to study the process of the influence of one Object on the set of others Objects or on the surrounding environment. The reflected properties of the Object have some time invariant regardless of what part of the environment they are reflected on. These invariant properties are denoted as *reflected information* (Viatkin, 2010).

Now let us focus the power of the environmental influence on the Object. One can highlight two different states of the Object-environment interaction. The first situation is stability which is usually denotes as stationary. One can call it dynamic equilibrium. Then for each of the three pairs of substance forms the power of inflows and outflows are equal (Tiller, 1991). The second or non-stationary is the more frequent situation. The power of inflow and outflow are not equal for at least one of the form of substance. This non equality is simultaneously produced both in the Object and in its environment. In order to describe these processes, it is necessary to study the changes of the states in the following sequence.

(a) The General Sequence of The Changes of the States in the Process of Interaction:

Object↔Interface↔Environment

The achievement of equilibrium between Object and interface or environment and interface are very high in comparison with the rate of equilibrium processes both in the Object and environment. That is why one frequently presumes the processing rates which describe the equilibrium between *Object* ↔ *Interface* and between *Interface* ↔ *Environment* are infinitely high. It is possible as a result to restrict the study of the whole transformation study the processing rates in the Object and its environment only. Strictly speaking, the process of changing the systems state may be caused by change in environment or change in the Object. One can describe these opposite situations with the help of a standard set of equations which differ only by the signs of some coefficients.

1. REFLECTION

In the case of reflection, all changes in the Object's behaviours do not need to be very active. That means the main Object's properties remain unchanged upon the reflection. The properties of the environment are reflected on the Objects in both of their main states namely animated and non-animated ones. Any tree, for instance, can be reflected on the photo plate and on the human brain. Yet these cases are different in nature. During the reflection, the photo plate changes some on its behaviours only. These changes are fixed and the process is ended after that. One can conclude: T*he reflection on the non-animated matter is passive.* Contrary to this, the reflection on the animated matter is *active*. It creates the set of further changes of the Object: The transformations and processing are the most serious acts in this set. *The disparity between passive and active types reflection is one of the fundamental differences between of animate and inanimate forms of matter.*

2. PRACTICAL EXAMPLES

The best way to study the general laws of nature is to examine concrete example. The case of solidification of a multi-component liquid is a convenient example which was investigated previously in details. We have a two component system. Let the concentration in the liquid and solid phases be denoted as C_l and C_s respectively. At the fixed temperature of the surrounding system T, the different values of C_l and C_s are in equilibrium. The

factor that caused alteration of equilibrium is the change of T or C_l As a result, the value of C_s changes too. If one knows the new value of T or C_l he or she will know the new value of C_s as well. All these can be found with the help of phase diagram. Using well known methods (Tiller, 1991; Romanenko, Schilz, Nikitina, & Ivanov, 1994) one can find the new values of C_s with the help of those phase diagrams. The process velocity is not taken into account in this study. This is so called quasi static approximation. This approximation provides excellent results in many situations. It is justified in two cases. The first one is related to infinitely small rates of changing T or C_l. The second one is the opposite. In this situation the process rates in all parts of the system are infinitely large. In other words all diffusion and other mass and energy transfer processes are frozen. Both of these cases are the very strong simplifications of reality. In spite of this, there are known a set of phenomena which are excellently described on the basis of such models. Segregation is the most famous of them. The origin of segregation may be explained as a result of the difference between velocity of homogenization in the solid and liquid states (Tiller, 1991; Romanenko, Schilz, Nikitina, & Ivanov, 1994). These velocities are dependent on diffusion and mixing processes in both the solid and in the liquid phases (Munson, Young, & Okiinshi, 2006). Let us return to figure1. Here the liquid phase is the environment and the solid phase is an Object. The velocities of all three parts of figure 1 are different. Yet the velocity which describes equilibrium in the interface layer is infinitely large. This infinite value of velocity is usually the principal point of analysis. It means that only the velocity in the interface layer is very high in comparison to other velocities of system homogenization. In general, the homogenization velocities are different in all three parts of the system. Many experimental and technological works confirm this conclusion.

3. TWO STAGES OF REFLECTION

The study of processes given in the previous paragraphs confirms that the change of the system state requires several stages. Some experimental works describe experimental data confirming two stages in interaction processes between Objects of different nature and their environment (Tiller, 1991; Romanenko, Schilz, & Nikitina, Ivanov, 1994; Munson, Young, & Okiinshi, 2006). All of them are connected with material transformation. There are also two well-known stages of transformation in the energy transfer between Object and environment. As a result, there is serious interest to study stages of information exchange in the analogous systems. Information exchange between Objects and their environments is widely spread. Objects involved in these processes can be both of animate and inanimate nature (Turchin, 1997). The time intervals in this set of interaction can vary from billions of years to fractions of a second. It depends only on the system nature. In living nature such interactions include biological and social systems (Frigg, Hartman; Palmer, & Palmer, 2002). These last two groups of systems have the most practical interest. Let us discuss situations in which the information connected with the Object is changed. Information changes can be result from affectation of flows with different nature. Artificial immunity is an example of information changes in creating the new behaviour program under environment affectation (Palmer & Palmer, 2002). The nature of the agent produced by these changes is not informational. Genetic code saved in the cells explains and confirms the biological information. The cell has a set of hierarchic levels. Information behaviours at each of these levels are different. Despite this, there are several common laws which are valid on all these levels. We suppose that as discussed above, two stages of information interaction between Object and its environment is one of the universal laws in the area of information exchange.

4. INFORMATION REFLECTION AND MEMORY

Analysis of informational exchange does not permit one to define rigid borders of the Object. These borders frequently are symbolic only. Nevertheless this situation does not affect our methods of discussion. Yet in the information area, the terms which are usually used are different from the ones in other areas of knowledge. The traditional description is introduced in the study of such a chain (Youngson & Wtitelaw, 2008).

(b)The Chain of Traditional Description of Signal Transformation:

Signal →Receptor→ Filter →Memory

The information processed in the memory stored in the brain affects special structures named effectors. In this chain, the border functions as the receptor and, at times the filter as well. The total chain is known as behaviour or reaction. The behaviour has two functions. The first one is changing the Object after affecting the environment. The second one is the opposite. This conservative function has to save the main information structure of the Object. The correct reaction of the Object under external affectation is based on the balance of these two functions. The higher fidelity of a receptor produces a great effective reaction. The filter in the chain mentioned above restricts its fidelity. To catch all changes in environment, the reaction rate must be very high. Nonetheless the instantaneous reaction is impossible. The restrictions on reaction rate are necessary to avoid the accidental effects. In summary, an effective border should respect quickly on all external affects. Yet

extraction of new content should be slow enough. In this case only the existence of two different rates in a reaction chain is not accidental. It is the principal moment indeed. The study of epigenetic memory in biology (Rumbaugh & Miller, 2011) confirms the preposition about the existence of two types of interaction rate in the informational exchanges of Object-environment. This situation explains the fact that some personal behaviour can be stored in the memory after repeating the external affectation many times at the period of several generations.

One can find some examples of this type in educational processes too. The guided transformation of different Objects does not restrict on the industrial processes only. Teaching is guided transformation of students' knowledge, skills and abilities. Advertising is also a process. Advertising is also a process which changes customers' information about different goods in the predicted way. That is why we can engage our understanding of transformations of Object behaviours. One can say the whole zone of active transformation one can divide on the three different parts. The division of these tree parts is associated with relation between the humans and the studied Object. If the humans are out of Object and can only observe it or can manage it we have the industrial process or technical technology. If the active actions are affects on humans it is the case of humanities technologies. The advertising, the firm's management are the few among them. If the humane is simultaneously the actor and the object of external action we can say this process is combined. The psychological, medical and learning processes are excellent examples of the combined technological processes. The investigation of the real border between these types of technologies and the study of their principal differences is the problem of higher interest.

The information inflow in economy as additional transformation in our brain. According with (Ackoff, 1989) in the situation of decision making after external action the chain of information transfers one can write as a chain at Figure 4:

(c) The Chain of Stages of Information Transfer Ih the DIKW Theory:

Data→Information →Knowledge→Wisdom

It is so called *Theory of DIKW.* This theory describes more complex situation in comparison with previous ones. We have here two interfaces. The first one is traditional external border Environment→Objet. The second one is internal. It is located in human brain. That is why one can detect here more than traditional two rates if information transfer.

CONCLUSION

Nobody can say much about any case in which one can confirm the absence of the two values or two stages in the interaction chain. Our point is to say the two stages of interaction are the result of equilibrium between the two opposite tendencies – the tendency of adaptation to the change of environment behaviours and the tendency of stabilization in the behaviours of the Object. So the philosophic sense of border (interface) is its action as a filter between Object and its environment. This conclusion, we suppose, has general interest.

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