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Norm as an area of the Optimum Functioning of Systems and their Complexes at the Co-Organization of Activity

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Biologists from past years generally were moving from general to specific: were starting with the whole organism, then were separating it into parts and were considering separate parts of the body and tissues; then they were studying particular cells under a microscope.

Molecular biology starts from the other end and is moving from the bottom towards up. It started with the simplest components of a living organism - began studying individual molecules and their interactions within cells, ignoring everything else.

Now it is the time to turn to that rest and to move up along the hierarchy of biological organization. Molecular biology - is the search for the molecular basis of the phenomena that classical biology studies at macroscopic level. Molecular biology - is the «three-dimensional» science par excellence and it assigns the central place to the structure. This does not mean that in its face we are dealing simply with a more sophisticated version of the morphology, because this science considers the structure in close connection with its origin and function.

In recent decades, the mechanisms of implementation of hormones action on biosynthesis of proteins has been intensively studied. Through the use of «tagged» hormones, it was possible to identify the fundamental mechanism of hormonal regulation at transcriptional level. Firstly, the hormone-receptor complex is formed in cytoplasm (CI), which, interacting with chromatin causes induction of catabolism enzymes in amino acids. The results of many authors research leave no doubt that, in addition to hormonal, there are several other factors of non-hormonal nature (starvation, protein meals, cold stress, thiamine deficit, introducing a mixture of amino acids) that cause increased protein catabolism with a subsequent increase of the level of its products in the blood of animals, resulting in the induction of many catabolic enzymes of the animals liver.

The effect of activating enzymes retains against the back-ground of adrenalectomy. This (so-called «protein») regulation of enzymes biosynthesis plays an important role in the complex mechanisms of the metabolism regulation in higher organisms. It was found that some onco-proteins are similar to growth factors, others - to receptors, the third - to the transmitters of information. But since their structure is similar, then, perhaps, they are acting in the same or a similar way? This issue is being carefully examined now.

In other words, we know what causes the transformation of normal cells into cancer ones, but we do not know how it happens; we do not know the molecular and biochemical pathway from oncogenic protein up to the cell systems that control its growth. To disclose that way, it will be apparently possible in the all-round, thorough study and understanding of the «adaptive norm» evolution of the human body.

Biology - is the study of the origin and development of life. In recent decades, it has reached impressive success and continues to grow at such a rapid pace that its new discoveries can be fairly placed on a par with the most important discoveries of modern physics, astronomy and cybernetics. In this regard, more classical biological disciplines - genetics, cell biology, cell physiology, biochemistry,

biophysics, gradually merge into a single system, so that it has lead to the appearance of a new branch of science, bordering between the molecular physics, organic chemistry and molecular biology (physical and chemical biology). The most amazing thing in the modern physical and chemical biology - is that it does not slow down the rapid pace of development, thanks to the appearance of fine and precise physical and chemical (and in the last decade - antropotehnical) methods of research. With their help, it became possible to penetrate into the deepest bowels of cells and to discover new facts in the study of such major life events as reproduction, growth, variation, development and heredity. Key positions in all of these events belong to two classes of molecules of very important biopolymers - nucleic acids and proteins. They are the main material basis of all living organisms and perform its main function in life processes. Nucleic acids (the material basis of heredity) have exclusively important ability to self-repeating.

It has been suggested that not all genes in chromosomes hold their «legitimate» sites and, along with genetic elements, there are other - unstable. For some strange reason, they can suddenly change the location and start a «journey» within chromosomes. As a result of these movements, they apparently intrude into stable genes of parental germ cells and cause mutations in the offspring - the same mutations that occur under the influence of X-ray radiation or chemicals. This is the special nature of mutagens - genetic. In 1976, the volatile elements were discovered at molecular level by the Academician of the Academy of Sciences of the USSR Georgiev G.P. and D. Hogness (USA). This class of mutations was called «transposition explosions» and it manifests itself in a one-stage and multiple transfers (to a certain extent - the directed) of unstable elements within the genetic system, with a high rate of movements' frequency. It is a matter of deep restructuring of «adaptive norm» of the human body, which can lead to significant structural and functional changes of the human body and its physiological characterristics.

Today it is very difficult to answer the question of how the «protein» regulation is related to the hormonal system. One thing is clear - in respect of certain hormones, the «protein» regulation can operate quite independently on hormonal systems. In this case, corticosteroids may have a dual mechanism of action: direct and through the strengthening of the protein catabolism.

This confirms the view of the USSR Academician Skulachev V.P. about the presence in higher organisms of a generalized form of induction, which is caused by a common product for the protein catabolism and all amino acids. The nature of the product is to be studied.

Presently, the biology has developed ideas about the concepts of «normal reaction» and «adaptive norm», and molecular biology proved the fact of the genetic apparatus involvement in adaptation changes of the body of animals. This makes it possible, with the development of new highly sensitive method of research, to trace regularities of changes at level of genetic apparatus of the human body transition to a new level of normal functioning - adaptive norm. Perhaps it is near the day when molecular-biological characteristics of the genetic apparatus in a complex of well-known biochemical and psycho physiological indicators will make it possible to reliably determine the state of stress limits of mental and physical forces, will increase the diagnosis reliability of this state in people whose conditions differ by raised-strenuous activities. This will allow getting a reliable and objective indicator of tension to prevent in people different kind of psycho-physiologic and neuro-dynamic disorders.

At present, the issue of global research project on the issue of human adaptive norm has come to a head. As the Bible says, there time to scatter stones and a time to gather them. Today, it is the time: the science is des-tined to be demanded. The age of nano is all over the world - is objectively true. Humankind has an alternative of «zero waste» production - we see the atoms, we can manipulate them and create one design using them - new materials with desired properties. This is a difficult and long way; nobody knows all the features of this design. In addition, nanotechnology will change the economic structure of the world. Those countries that understand these challenges and have the appropriate potential will get into the circle of the leading powers of the XXI century.

Today, we have come to a new stage: we have understood the structure of proteins, determined their complex three-dimensional spatial structure, have studied the mechanism of functioning of these biological molecules. In humans, there exists the ribosome protein, which has been producing our genetic code for billions of years.

Studying at nanobiological level these processes, we will find a better way of complex information processing and its management at the level of adaptive norm of the human body's functioning (nanolevel). Of course, we study humans and try to copy some of their properties, already trying to create detectors based on a biological self-organization. But this is just a way to adapt our civilization to the living world, as it was originally conceived. Today it is clear that the opportunities for economic growth based on the existing model of the industrial world is completely exhausted because the resource is finite. It is quite clear: the world cannot go further like that. Humankind has no enough resources of «adaptive norm» of the normal functioning for confrontation, especially to the global depletion of energy resources.

That is why the nano-projects inherently must have originally a social orientation, focused on us, providing modeling and express-diagnosis of «adaptive norm» of the human body functioning in conditions of high-intense activity.

The contemporary state of the Russian society is preconditioned by the political and economic processes of the transition to market relations, the development of business, the modernization of the army and defense industry etc which introduce essential correctives into the functioning of a sphere of reorganization of public consciousness (high and middle school, retraining and professional development). The Russian system of reorganization of public consciousness (in particular, of University education) is directed towards: ● Elimination of the state monopoly on education; ● Extension of the autonomy of universities; ● Creation of the new educational institutions; ● Transition to a multi-level system of education (bachelors, masters, specialists); ● Integration into the global educational system.

University or institutes graduates often face very high requirements, conditioned by tough competition on the labor market as well as by expansion of scientific and business international contacts. The whole diversity of educational institutions of higher professional education should be orientated towards training and retraining of the intellectual, cultural and scientific elite of humanities and technological orientation for the Russian Federation and other states.

The fundamental goal of the higher professional education is a development of skills and an ability to solve problems of securing of their effective professional activity in the future. In no less extent, a student needs to gain the scientific, organizational and pedagogic skills, a wide range of his outlook and scientific erudition. The universities and institutes should guarantee the synthesis of the special technological and wide humanitarian educations, should give an opportunity for the intellectual development of a person, his creative self-realization.

One of the ways of solving this problem is the introduction of modern high-tech (first of all, computers) to the learning process. Meanwhile, technology is understood as a means, a tool of performing of a purposeful activity, based on the scientific ground, and striving for graduates' ability to successfully solve professional problems.

The computer technologies in teaching are the most effective, because the computer means are more and more widely introduced in all spheres of human activity. The new stage in the development of the world culture and the scientific-technological progress is in progress: a transition from the age of book publishing to the age of global computer technologies. It makes possible: ● Presentation in the unified digital form of textual, audio and video information (creation of audio-visual works; ● Complete or partial computerization of all operations in information processing (from routine to creative); ● Its more compact storage and quick delivery.

Under these conditions, the essential part of the teaching process is formed by computers, as well as by up-to-date audio and video devices. A great number of secondary and higher schools are equipped with computer classes. It lets students work with educational programs at the individual or group lessons, use the telecommunication networks.

The number of reference and educational programs, electronic books and lectures on various subjects grows very rapidly. They widely use the graphics, animation, sounds, video fragments and multi-media technologies. All those innovations essentially intensify the teaching processes. But, at the same time, and to the same extent, they increase mental and physiological burden on a student.

In the process of training with the use of audio, video and computer means of multi-media technologies the situations occur when the well-known and distinguished methodologies that proved themselves in the course of many years in the traditional modes of communication between teacher and student are in need of essential correction (or a replacement by other methodologies, specifically oriented towards new conditions). These things happen when the seeming simplicity of the use of new means and methods of training (develop a media course and translate it to students) run into the following facts:

- The principle change in the process of work with information;
- The change (often substantial) of norms in the field of technology, which is not coordinated by anyone, and the influence of these changed norms on the physiology and psyche of a student is not studied and extensively debated by anyone;
- The invariability of the adaptive norm of a student, established in the course of his life.

The well-known theorist of informational society, American sociologist D. Bell assumes that man is simultaneously both homo faber (a creature producing tools of labor) and homo pictor (a creature producing images, se-mantic pictures of the world). Under conditions of the modern technological society in the dual unity of the rational and the visual-graphic the clear advantage is on the side of the first. Accounting, calculating and practical benefit prevail. This does not encourage originality of judgments, moral independence and comprehension of the essence of events.

There exists a gap (cultural lag) between the technological maturity of the modern society and the underdevelopment of the world outlook, reaching the level of moral and ethic ignorance. This threatens to destroy the fundamental principles of the modern society.

It is well known that «a principle» is a regulator of activity. It is constant and differs from «the rule» because it cannot be violated under any conditions. It reflects the fundamental foundations of the universe, pointing at the essence of certain processes.

Visualization is a principle, derived from certain fundamental relations, connecting on the basis of epistemology man to the world, he lives in, and to the people, he communicates with. Semantics of the term «visualization» is simultaneously simple and complicated. To look, to glance - this is the first layer of modality of perception of visualization (visible). The second, more profound semantic layer of «visualization» is «obvious», «evident», «appeared» (in the end, not necessarily visual).

Visualization may be of different types: «saw the solution», «a thought flashed», «idea sprang up», «a truth epiphany» and so on. The long succession of logic constructions may be built in order to approach the truth eventually.

It also might be done instantly, «having seen the solution». It is common to divide people into smart ones (those who easily and quickly create the space images) and not so smart.

Many outstanding scholars and writers thought that it was possible to teach people to fins analogies, construct images and operate them. Charles Dickens wrote: «I do not invent the book's contents, but see them and write them down». Louis de Broglie assumed that «images lie at the basis of all true achievements of science». Antoine de Saint-Exupery thought «…one should learn not to write, but to «see», writing is a consequence». D.I.Mendeleev saw his periodic table of elements in his sleep. James Watt discovered the principle of the steam engine's work while watching a lid of a boiling kettle and so on.

In the area of interactive computer graphics (ICG) the compositional sub-structure of the figurative human thinking is identified with the organizational-technological sub-structure. The ICG influence on the intuitive, the figurative human thinking led to the emergence of a new field that is cognitive (promoting cognition) with regard to computer graphics. There are two functions discriminated in the ICG: illustrative and cognitive.

The illustrative function allows to embody in the more or less adequate visual formation (fig.1) only that which is already known, that is which already exists either in the surrounding us world or (as an idea) in the mind of a researcher in form of graphic, animation, audio or video illustrations.

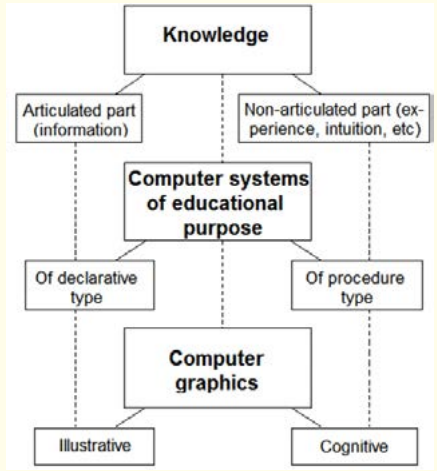


Figure 1: Conceptual difference between the cognitive and illustrative functions of computer graphics.

The cognitive function is intended to receive new knowledge with a help of certain image. This new knowledge does not exist even in the mind of a specialist. This function should at least promote the intellectual process of gaining this knowledge.

Every man forms the methods of the subconscious mental activity in his own way. The modern science does not possess yet strictly-grounded methods of forming human creative potential.

The famous specialist in the field of artificial intelligence D.A.Pospelov has formulated three essential problems of cognitive computer graphics:

- Creation of a model of presenting knowledge, possessing a possibility to present both as objects characteristic of logical thinking and as images-pictures with which the imaginative thinking operates by one-dimensional means;
- Visualization of knowledge, for which it is yet impossible to find textual descriptions;
- Search for the ways of transition from the images-pictures being observed to formulation of a certain hypothesis of the mechanisms and processes hidden behind the dynamics of pictures being observed.

The interaction of people in the functional areas (fig.2) is reached by the means of: infographic modeling (formation and coordination of images), making decisions and implementation of controlling influences, their fixation in the form documents, systematic and complex processing of documentation.

The informational impact contains a certain sense (carries inside itself a certain information). It is perceived (recognized) and deciphered (classified) as a subject as well as an object of impact.

Under the energetic impact on an object the latter may not receive that impact, may not feel and/or not conceive it (the energy influences, but the information about it is lacking). This way, the energetic impact is a particular case of informational impact.

The minimal energetic equivalent between an informational unit (byte) and an energy unit (Joule) was introduced by Felker: one byte equals $0{,}114 \times 10^{-19}$ Joules (I.G.Wilson, M.E.Wilson Information, Computers and System Design.- John Wiley & Sons, N.Y., 1965). It lets a model render the informative impact and energetic impact by a single function of informational-energetic process (IEP) of forming decisions (figure 2).

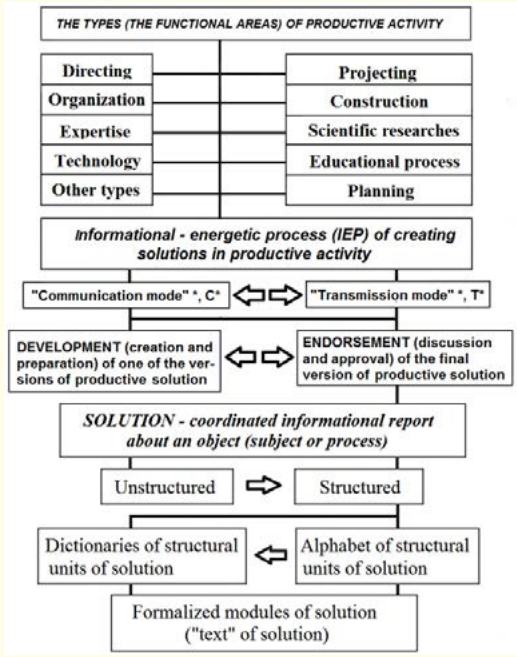


Figure 2: Forming of solutions in the productive activity.

IEP is completely determined by the function of logical variables $f = (S_i, C_n, S_s, R_i, I_r)$, where: S_i is a source of impact; C_n is a channel with noise; S_s is a sign system (semiotics); R_i is a receiver of impact; I_r is an interpretation of a receiver of impact (its predilection for impact).

Presence of a man-interpreter («meta-observer» in fig.3) adds situational cases to infographic model of IEP and removes processes under consideration beyond the limits of possibilities of the automatic-regulation theory.

Meta-observer defines a type of IEP, giving the f function:

$f = 1$, if $S_i \& C_n \& S_s \& R_i \& I_r = 1$;
$f = 0$, if $S_i \vee S_s \vee R_i \vee I_r = 0$, $C_n = 1$;
f is not defined, if $C_n = 0$.

Under f = 1, the process is informational, under f = 0, the process is energetic.

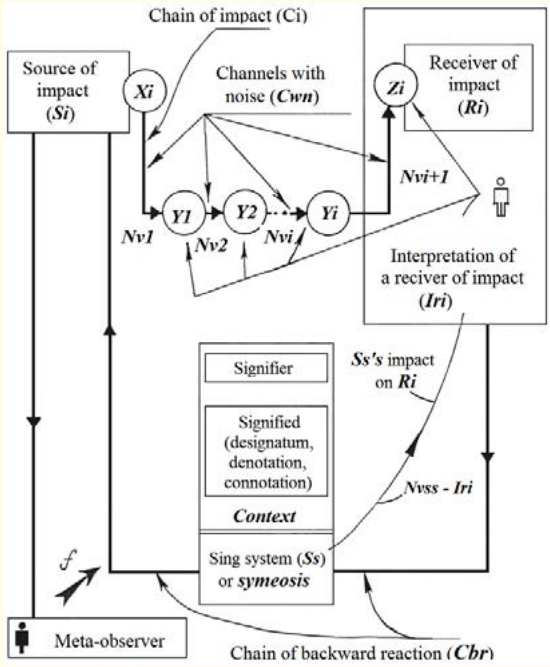
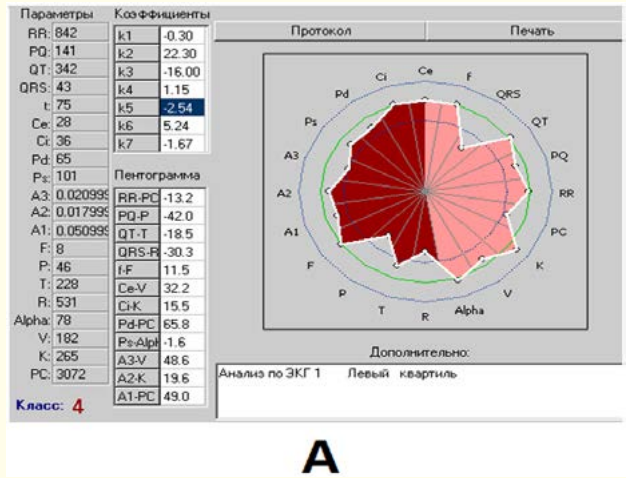


Figure 3: Infographic model of IEP.

The chain of documentation management C_m consists of a chain of impact C_i and a chain of back-ward connection (C_{bc}), (figure 3).

In case of the replacement of situation interpreter's position at the block of receiver of impact to automatic device carrying inside itself one or several fixed conditions of receiver with relevant interpretations, to model (figure 3A,B) may be applied the statements of the theory of automatic regulations. This situational backward connection, the contents of which are completely dependent on situational interpretation, it turns into backward connection of regulation.



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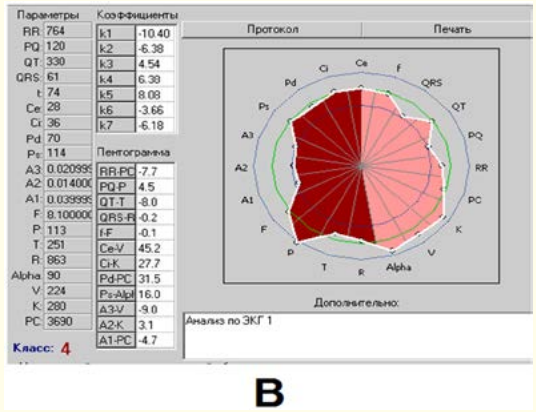

Figure 3(A). (B): Dynamics of the functional state of a group of students (statistical pattern) before (A) and after (B) exam - psychological stress modeling.

Function f shows that an absence of at least one parameter IEP allows to define it as energetic (energy impacts, information is absent). The absence of channel of connection completely removes the question of transition of information. The presence or absence of meta-observer, a context or situational interpreter allows us to speak of various modes of IEP.

For the IEP analysis in infography the discrimination of the terms «regulation» and «management» is extremely essential. Other scientific fields (for example, cybernetics) consider such discrimination as not essential.

The regulation inquires comparison between a current value of a real object's parameters and a standard (pattern, norm). If we fix a deviation of the current value of a real object's parameter from the norm, then along the whole chain of impact (channel of connection) in every elemental branch regulation mechanisms switch themselves on.

These mechanisms ensure an impact on a parameter according to certain program and turn deviations to zero.

The management implies two types of activity: the managed and the managing. The managed should have the naturally established direction of development and to possess a possibility to change such a direction. The managing activity is built upon the managed. The management denies a presence of the pattern (norm).

The «optimum» constructs every time a managing subject in accordance with its purposes. Every act of formation of such a purpose we need to relate to as a state of an object (messages or documents at a given moment of time). Only after that the choice of regulating impact is being done in accordance with a certain purpose of the managing subject. In such way, the regulating in infography is attached to the management.

In cybernetics the documentary turnover is considered as a channel of connection, transmitting a message from a source to a receiver with a certain «noise» (impediment or unavoidable interferences during translation).

Unlike cybernetics, infography allows Ri to set its relation to that message of Ci which it receives or wants to receive from Si (fig.3) before the beginning of its own process of activity. These boundaries oscillate from a complete refusal of receiving to a strict demand: what, in what form and at what time it is necessary to receive by Ri. In the computerized processes of studying this problem for the formalized audio-visual products is solved through a dialogue with computer.

The infographic model of IEP shows that through a connection channel a person may communicate with another person, his hypothetical model or a programmed realization of this model. Let us consider a few typical situations of such communication (fig.4).

The mental activity of one person in the absence of other people or their hypothetical models serves as an initial situation. Being a source of information in the technology of mental activity, a man establishes a connection channel with himself as a receiver of this information.

In figure 1 such situation is equivalent to «personality duplication».

When the volume of information, formed in a connection channel, exceeds the capacities of human operative memory, a person by criteria, known only to himself (sometimes unconsciously, he does not articulate that criteria for himself), begins to divide the processed information into two groups.

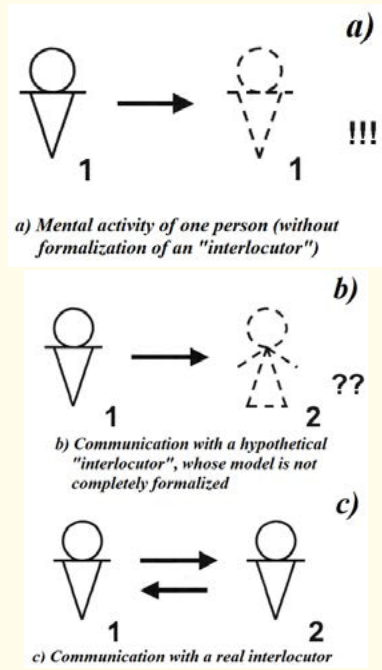

Figure 4: Typical situations of communication in the IEP.

The information of the first group, as a rule known to this man, he recognizes and remembers in context of occurring situation (fixates it in his own brain). This information cannot be separated from a man who has recognized it. The model of «companion» in this case does not need formalization and is not obviously expressed (fig.4 a). The information of the second group, as a rule new for this man, he fixates (archives it) on a certain external carrier (writes down on paper, draws on sand and so on). He designates such information for the continuation of his mental activity in the future or is oriented towards an external receiver of information.

The source and the receiver of information in this situation is a same person (fig.4a). At the continuation of mental activity man unites information, fixated only in his brain, with that information, which is fixed on external carrier, reconstructing the unified conception of previous process of activity.

The presence of only one kind of fixated information (either just remembered by man, or just fixated by him on external carrier) makes the result of reconstruction of a previous situation not trustworthy. Precisely because of that we do not recommend the students to use the other people's conspectus.

At the single person's mental activity it is not necessary:

- To teach a receiver of information the linguistic means, of its source in the IEP chain;
- To clarify predisposition of a receiver for perception of information;
- To determine the level of interferences in the channel with noise.

The second typical situation is a dialogue with a supposed «companion», in which the capacity acts as a set of assumptions (model of information receiver, the extent of formalization of which and its adequacy to the real IEP is determined by a source of information).

Usually the meta-observer determines results and quality of such situation. The level of meta-observer's awareness is higher than the awareness of a source of information.

To ensure the guaranteed perception by a receiver of transmitted information, it is necessary to tolerate the redundancy of information, the redundant volume of documentation, the complexity and natural character of a signed system «a companion» is (fig.4b) a not completely known hypothetical model.

It is impossible to teach a hypothetical receiver of information the linguistic means, to clarify his predilection for perception of information and a level of interferences in a connection channel. The model of a «companion» is formalized and clearly expressed, although its adequacy is not proved.

The third, the least exotic and more frequent, situation is the following: a source and a receiver of information are different really existing people, simultaneously participating in informational technology (fig.4c). A source of information has a possibility to form a precise model of a receiver and to test its adequacy.

On the basis of the typical situations of communicating mentioned above, two basic modes of IEP impact on activity are discriminated. These are communication* (fig.5) and translation* (fig.6) modes.

The names of the modes are conventional. The starsigns after them imply that those terms got the contents, different from the commonly used.

The «communication*, C*» mode, corresponds with organization of interactions under conditions of linguistic differences and partial formalization. The compensation for these deficiencies is carried out by way of personal (visual or oral) communication between a developer and a user for decision making.

The «translation*, T*» mode corresponds with organization of message (or impact) recognition. A user Ri gets them from a developed Sa in the absence of their interaction.

The T* mode may be considered as a connection of several C* modes, each of which carries certain functional load: C_1* provides making engineering solutions, corresponding to existing norms and restrictions of developers; C_2* provides recognition (hermeneutics) of this engineering solution by its user without communication with its developer; C_3* provides control and assessment of correctness of interpretation (recognition) of engineering solution by a user. Therefore: $T^* = C_1^* \cup C_2^* \cup C_3^*$.

The indicators of discrimination (relevance) of T* mode:

- The breach in communication media by resource;
- The interrupted communication channel (absence of direct access);

- The accurate separation of a developer's and a user's positions;
- Absence of backward connection and interconnection;
- A developer's orientation on a user's model, a probable character of possible demands of potential user's account;
- Natural character of a sign system of a document, redundancy of information for ensuring comprehension.

It can be said that «communication*» is a synchronized process of communication, while «translation*» is a diachronic process of communication (with a breach by resource: by time, space, information, energy, etc).

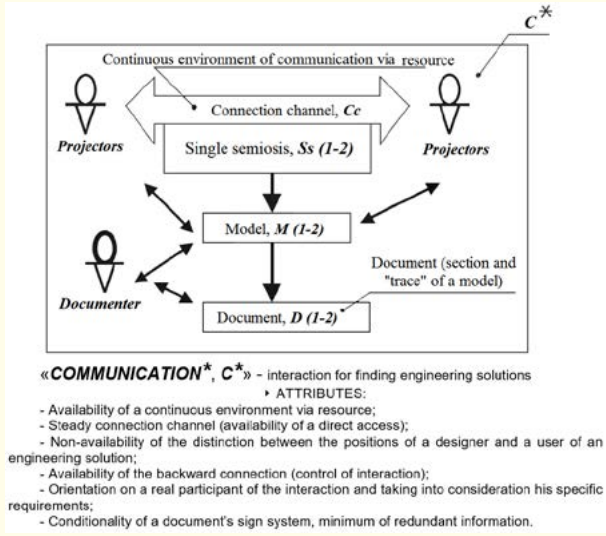

Figure 5: Infographic model of the C* mode.

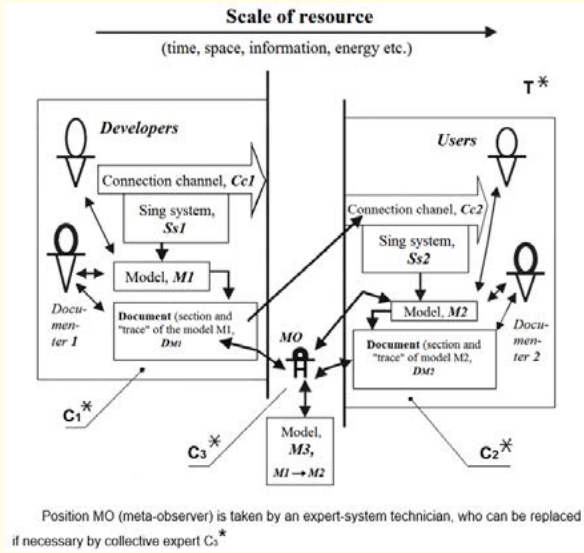

Figure 6: Infographic model of the T* mode.

The C* and T* models lay out the specifics of model of management chain, C_m (fig.3). They are essentially different from the known scheme of informational process (Piotrovsky R.G.,1972) by the following: ● Interpretation of a receiver of impact; ● Influence (impact) of a sign system on this interpretation; ● Backward connection; ● Multitude of channels with noise and inter-communicators in the chain of impact.

Si carries out the desired changes in Ri by means of the chain of impact Ci which possesses a number of specific characteristics.

We have to ascertain that under new conditions of the use of video computer and multimedia technologies in the teaching process the previously existed kind of IEP communication between a teacher and a student "face to face" in the unbroken physical space of an auditorium (communication) is replaced by another kind of IEP (translation) broken along the media of communication. Meanwhile, it is necessary to correct the norms in accordance with each of indicators of the C* and T* modes' discrimination (at the extreme point, to replace the previously existed norms of traditional process of studying by the new ones).

As was mentioned above, the principal changes in the process of working with information and changes (quite often essential), the norms in the field of science (on the basis of their open correspondence, the resources on the influence if those changed norms on physiology and psyche of a taught person with a wide discussion of the results of such research) are the constant, first grade components of the innovative modernization in the conditions of applying the video and computer multi-media technologies in the teaching process of the higher education institution.

Nevertheless, these two essential constants are not the most complicated ones for realization. They concern the field of technology, where the procedures of formalization of algorithm of activity and their realization with an application of computer technologies are actively functioning.

The more complicated is a realization of the third component. This is a need for a change of an adaptive norm of a taught person. This adaptive norm has been established in the course of his life, under the influence of principally different for each taught person processes and circumstances of vital activity. The success of a solution of this problem during limited terms of teaching is essentially rising if they use scientifically grounded system of a visual-graphic infographic modeling.

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