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COGNITIVE ARCHITECTURES BASED ON PHYSICAL OR SOCIAL REPRESENTATIONS

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Abstract

Cognitive or mental architectures are models made up of *input-output* type modules of the central nervous system activity, formed with the help of white, black or grey cybernetic 'boxes' and of the determined connection. Despite the great existing differences between the biochemical and electronic processing of information, the mental architectures help in comparing the human intelligence with the artificial one and even contribute to the creation of a common language between the human and the animal intelligence (taking into account static and dynamic representations). Based on this, cultural and social representations share a 'situational' semiotics, we use a common language with connection to referentiality or not, for physical or social representations.

Keywords: cognitive architecture, mental, social, cultural representations, stereotypes

1. Cognitive architectures and spatial - time representations

The *white* colour of the cybernetic box shows an entirely algorithmic issue and the *black* colour shows an issue whose structure is not known or does not make the subject of our interest. What is important is that the specified *inputs* produce an *output* corresponding to its name (or codification). The black boxes are also called 'demons' since they either mainly illustrate impossible cases or you don't know what outcome to expect after the processing is done, as in the case of 'Maxwell's demon', enunciated since 1871 by Max Clerk Maxwell for the study of heat proprieties, which was one of the first examples: an imaginary being made up from molecules would violate or not the second principle of Thermodynamics.

The cybernetic box is *grey* when the algorithm is partially known and can be divided into modules. Some specialists use the term of *perceptron* in order to designate the cybernetic box equipped with a series of possible inputs and a compulsory output – because through this representation we already witness a scheme of the perceptive process with the analysers, internal transformations and

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the emission of some externalized responses. The compulsoriness of the existence of output in such a scheme can be explained: the inputs can be absent in an issue with implicit data but due to the lack of outputs the algorithmic activity of the device loses its meaning: the entire construction must lead to a certain result.

In the pages below we will create the formal model as a representation more or less simplified of a 'material world'. We will, therefore, admit the presence of some *physical-mathematical*, *psychic* and *semiotic* models (depending on the language). The physical-mathematical models refer to the image of the world starting from the 4^{th} dimensional continuum perceived by our senses [1, 2]. The models are referential rather than imaginary because Physics inhibits the mathematical tendency of generating too many possible worlds. On the contrary, the psychological models can be also reported to imaginary luxurious worlds due to the outcome of our imagination which can be hardly quelled. Unlike the physical-mathematical or psychological models, the semiotic or symbolic models directly intercept the social processes within the communication and the information structuring since it refers to the language, thinking and, to some extent, even to the behaviour.

The *formal system* is more than a *model* due to its additional mandatory proprieties: 1) the possibility of self-representation; 2) the existence of some universal (holistic) proprieties.

A system as the psychic in a non-formal description has both *hereditary* proprieties (identical with the ones of the component elements) and *emergent* proprieties (specific only to the whole). The psychic manifests as a whole not only by hereditary proprieties but also by emergent proprieties. The memory represents a category of the psychic, therefore, from a hereditary point of view, the psychic is *memorative.* However, at the level of the psychic working as a whole, there are emergent proprieties truly exceptional such thinking (about something) or the state of awareness (towards something).

At this point, we are capable of describing the cognitive architectures as formal systems of the thinking process (in the extent to which the process of human thinking can be formalized); a more correct term would be 'semi-formalized systems'. The human information processing – from the stimuli acquiring, through the receptors, to their higher processing at the level of the brain cortex – is a complex process resulting in the adaptability of the human being to the environment. This is carried out at all levels of the nervous system including: the processing of external signals, representation of knowledge, obtaining the internal model of the external world, learning and, ultimately reasoning and problem solving.

The classical symbolic model of information processing was proposed by the papers of Alan Newell and Herbert Simon in 1972 and it is based on the classical point of view of artificial intelligence and on the sequential architectural structure of the Von Neumann machine [3]. The researchers consider that the human mind is a sequential machine of information processing using rules of production, such as formal grammar. They proposed the *IPS*

model (*Information Processing System*) based on the theory of problem solving, a serial system with input and output *patterns.*

The system above is composed of a long term memory (*LTM*), a short term memory (*STM*) and an external memory (*EM*). *LTM* has an unlimited capacity and an associative organization in which the information is stored in symbolic structures connected through different network and can be 'encapsulated' in other structures. *STM* has a limited capacity. In the process of problem solving, *STM* retains only two symbols for a task while another task is prepared to be solved. *EM* has an unlimited capacity and it is used to resolve and store information from the existing task. The sensorial and motor *patterns* are symbolized and kept identically in *LTM* and *STM.* In this structure the problem solving is carried out by searching in the problem space from a state of knowledge to another, until the desired solution is reached. This functioning of the system proposed by Newell and Simon determines its serial character which allows that at a certain time one piece of information to be processed. The Newell-Simon model allowed the elaboration and development of systems based on knowledge and expert-systems [4].

Newell – who is among the founders of the traditional computational models, suggested a plausible solving [5]: the cognitive processes at the lower level such recognition of objects can be well modelled by connectionist models but the cognitive processes at higher levels such as reasoning and language can require a traditional symbolic modelling [6].

According to the *brain metaphor*, the human cognition is best understood in terms of brain properties. The brain metaphor and, more specifically, the so-called connectionist neuro-mimetic networks as computational implementations of the module in which the brain could function, become more and more popular during the last years and challenged the leadership status of the computer metaphor when we are talking about theorizations regarding the nature of the human cognition [7]. The connectionist networks, the neural networks or the parallel distributed processing models, as they are variedly called, differ from the theories based on the computer metaphor due to multiple aspects. For example, in theories adhering to the computer metaphor, all the processes assumed to be underlying to the human behaviour must be explicitly described. The connectionist networks, on the other hand, can to a certain extent 'program' themselves in the way in which they can learn to produce specific outputs when certain inputs are given to them. Moreover, the connectionist theoreticians often reject the use of explicit rules and symbols and use distributed representations in which the concepts are characterized as activation patterns in a network.

The current connectionist networks typically present the following characteristics: a) the network consists from elementary or *neuro n-like* units or nodes that are interconnected so that a single unit has many links with other units; b) the units affect other units by excitation or inhibition; c) a unit usually takes the weighted average of all the *input* connections and produces a single *output* towards another unit of the weighted amount exceeds a threshold value; d) the network as a whole is characterized by the proprieties of its units, by the

manner in which the units are interconnected and by the algorithms or the rules used in order to modify the strength of the connections between the units; e) the networks can have various structures of layers; they can have a layer of input units, intermediary layers (the so-called 'hidden units') and a layer of output units; f) a representation of a concept is stored in a manner distributed by an activation *pattern* in the network; g) the same network can store many different patterns without interfering necessarily between them; h) an algorithm or a rule that is used in the neuronal networks in order to allow the occurrence of learning is known as 'reverse propagation' (or 'retro-propagation') of the errors.

David Marr states that an information processing system can be understood at any of the three description levels. These are: 1) the level of computation where we ask ourselves what does a device do and why; 2) the level of representation and algorithm where we ask ourselves how the computations described at level 1 are implemented; specifically, we are interested what are the representations corresponding with the input and output of the device and what is the algorithm for transforming those representations; 3) the level of hardware implementation – in Psychology this is the level where we would describe in the brain the physical accomplishment of the representations and algorithms described at level 2.

Marr observed important relationships between these levels. In particular, he specified that "some types of algorithms will match better with certain physical sub-layers than others" [8].

A model of cortical information processing should be in consonance with the following suppositions: 1) the sensorial stimuli transmitted to the brain for processing are chaotic; 2) the processing system can convert the input information as continuous stimuli in distinct data units; 3) the degraded or ambiguous stimuli can be processed – even though only partially; 4) a large volume of information can be easily processed, stored, recovered and used in a corresponding way.

Within the brain information processing three stages can be distinguished, each of them associated with a certain storage system: 1) reception, filtration, storage and initial processing of the information with the help of the sensorial system (generalized by *geographical* system); 2) final analysis, short term storage and a second filtration of data via the *short term memory*; 3) accessing of the long term system and integration of some information in the database of the *long term memory.*

The human being works with two knowledge bases: propositional (declarative) and ambient (geographical); the second base has a distinctly non-linguistic character and is also present at the sufficiently intelligent animals, helping to orientation in the environment [9]. We shall consider that a propositional knowledge basis – which can be present both in the human mind and on certain electronic support – contains *FLC* (*fundamental logical categories*) and *DLC* (*derived logical categories*)*:*

$$FLC = \{n, p\} \quad (1)$$

$$DLC = \{\textit{sensu stricto operators, connectors, subnectors, predicators}\} \quad (2)$$

Where the abbreviations mean [*n*]*otions* and [*p*]*ropositions* and *DLC* are designated as functions (not necessarily logic) abbreviated by the first two letters and having the proprieties [M. Drăgănescu, *The Spirituality*, www.racai.ro/media/Spiritualitatea.pdf, accessed on 15.01.2015]:

$$op = f(n/n),\ co = f(p/p),\ su = f(n/p),\ pr\ (p/n) \qquad (3)$$

The formula *f* (*x/y*) with the significance: 'a function that transforms *x* in *y*'. In case of operators and connectors, the simple notions or propositions are transformed in composed notions/propositions. This model functions based on the successes of *artificial intelligence*, the field by which the intelligent human or animal thinking and behaviour are compared (occasionally forcibly but sometimes in an inspired way) with the operation system of a computer and with the external actions issued by it [10].

We will state that the operators and the connectors are *homogenous derived categories* and the subnectors and the predicators, *heterogeneous derived categories*. Even in the language of some intelligent animals we will be able to describe activities based on acquiring some notions or even actions described by verbs (the latter, in fact, leading us to the 'nucleus' of a proposition). Although in case of animals the representations of these notions or 'proposition nuclei' are not linguistic, however, they often represent the basis of a similar logic to the one present in certain human conducts.

The proposition offers *clear information* if we can label it as either *true* or *false*. If not, we say that is *indecisive.* The one who extracts the information from the environment is usually called an *agent.* The latter can also be a 'physical character', for example the *wind*. In Semiotics, the agents are specialized in *emitters* and *receivers*. Not all agents are intelligent! The current PC has both a routine, non-intelligent part (the majority of processed algorithms) and an intelligent part (procedures of artificial intelligence with which various programs are equipped).

Regarding the aspects of the message (in its broader sense) the Aristotelian coupling (*matter, form*) is replaced, from the middle of the 20th century, with a triadic model, *SEI* (*substance, energy, information*) [11]. All the components of the model are concepts, in other words, notions difficult to define but, in general: 1) the substance is a support, a passive, a memory etc.; 2) the energy is a non-intelligent element-like active; and 3) the information, an intelligent active. What distinguishes the information from the energy is the possibility of the former to be revealed by successive attempts to which only *yes* or *no* answers are given (*true* or *false*). Therefore, the information can be defined as negentropy (the opposite of disorder) taking the form of a logarithm to base 2 with the minus sign.

Usually, the information is digital (numerically 'discretized') or analogue (continuous) but the energy generally does not admit discretized models and the continuous models of the energy are usually complicated (in the way in which that they can be expressed in analogical way but the numerical representations can be built with great difficult).

A cybernetic scheme of the computer as processor of program - codes (with optional inputs within which there is also a γ(P) program-code and a mandatory output) can be applied also to the human psyche. The psyche behaves as a perceptron with *feed-back* and its systemic aspect is assured by the *state of consciousness* – by which the brain exercise a process of monitoring/control on the entire body. Therefore we can represent the psyche as a cybernetic box with *feed-back*, the model being obviously inspired by the representation of the computer through a universal cybernetic box. Such box not only has simple inputs (INP_1, ..., INP_n), but also receives program - codes (*figured by γ(P)*), which means that we also admit algorithms, data and program on entry. Moreover, the idea of 'universality' of the psyche (but also of the computer) is related to the possibility of enumerating all the possible programs written in a programming language. At the level of the human psyche, the intelligence fulfils the role of that 'universal program' determinant, the thinking being manifested as a type of hierarchy of universal programs.

There is a *tautological* ration between thinking and intelligence based on the psyche. Thinking is a defining category of the psyche through which the latter becomes controllable in a certain measure. It comprises aspects such as reason and logic, produces the change of attitude and influences the behaviour, cooperating with other availabilities of the human psychic system not only on a cognitive line but also on an affective-motivational and volitive - regulating line.

Next to consciousness and personality, thinking determines the stability of the psyche (follow the main determinations in the following figure). Together with consciousness, thinking concurs in forming the behaviour of *cybernetic system with self - representation* of the psychic. Therefore we can describe the psyche as a cybernetic box (with eventual input variable, at least one output variable and a number of intermediary computational variables) with *feed-back*.

Irrespective if they have a born or gained support, the mental schemes help us in coping with a continuous flow of stimuli, to order to received information and, therefore, to be able to communicate and take action in an efficient way. In the specialty literature, the concept with the highest degree of generality and also the most used concept is the one of 'mental scheme'. It subordinates the terms of 'category', 'prototype' or 'stereotype'.

2. Geographical, social or semiotic knowledge of the human knowing agent

The mental schemes refer to the own person, to others, to social roles and institutions, to social groups and nations, to social events. These have the function to simplify and to speed up the filtration and organization of the information, storage in the memory and remembering, thus to take decisions and to act as promptly and efficiently as possible.

An important aspect of the schemes is that many of them have a hierarchical organization, at the top of it there are the general and abstract elements which, as long as we go down towards the base, are specified in distinct categories, acquire concreteness until specific cases. The association

between the schemes of the components often takes the form of a 'tangled ball of yarn' of significant interferences rather than of a clear hierarchy.

Some authors [12] assess that in social judgments, the most explicative concept is the one of 'category' (and categorization) or that it is prior in the explanation of cognition to the 'scheme' one. In simple words, the category represents a class of objects with common features and high degree of similarity. Here are some features of categories:

1) Categories, especially the social ones, do not refer to a feature of the individuals from a class but to many attribute that are distributed as a *cluster*, e.g. related to others from a polymorphic point of view.
2) The categories are structured vertically in the way that there are various levels of abstraction which they offer. E. Rosch shows that there are three such levels: the supra-ordinate, intermediary level and the sub-ordinate level [13-15]. The intermediate level is also called the basic level because it is optimal in cognition. The supra-ordinate one incorporates more individuals with multiple features, and the sub-ordinate one, including many details, requests a great cognitive effort. For example, the notion of 'priest' is much easier to be defined than the supra-ordinate notion of 'intellectual' or the sub-ordinate one of 'Catholic priest', 'Orthodox priest'.
3) There is also a horizontal structure of categories, in the way of constellations of attributes but also in the way that they are detectable, categories with well-defined borders, while others are *fuzzy* assemblies or sets.

The prototype is an intimate concept related to the one of category, expressing the model of typical features, the characteristics of group members, of a category. The prototypes are compressed descriptions which exist in our mind, operating as *decisive marks* in the classification and interpretation of the surrounding reality [16].

The respective marks are either ideal models or types or a model representing the average of the features in a category or the most frequent feature or combination of features or a concrete representative of the respective class considered typical.

Here a firm dissociation must be operated between the use of prototypes at the level of scientific knowledge and the way in which they function in the daily practice: for example, the researchers are called upon to discover the large share of error and illusion in the content of many prototypes and stereotypes at the level of common consciousness materialized in expressions such as 'that's how the Romanians are'.

Among other mental schemes, *the stereotypes* were heavily exploited in social psychology. An approximate definition of the stereotype would be: a mental representation of a social group and its members, a mental structure regarding different groups (ethnic, age, class, sexual, professional, etc.). A wider definition would be the following: the stereotypes are an assembly of socially communicated beliefs regarding the specific features of a group of persons (from the point of view of personality, attitudes, values, conduct, etc.). Therefore the

stereotypes are mental representations referring to social groups and not to objects from the natural or social space.

A similar notion is the one of *cliché* which has a wider sphere of comprehension. We are talking about clichés, for example, regarding certain treatments and diseases, art, economic reform etc. The clichés and stereotypes revolve in the social environment of the individual picking them up as such without a critical analysis. Further on we will state the fundamental issues occurred in their study.

1) As mental schemes, the stereotypes help us in organizing the information, to rapidly classify the concrete individuals in the category they belong to and therefore to also deduct their personality features. They help us to make behavioural predictions, e.g. to be aware of what we should expect from the persons belonging to a group or another and thus to know what attitude to adopt, how to behave with them.
2) Relatively recent studies show that the stereotypes are no longer regarded as exaggerated and false beliefs but their use maintains self-esteem, justifies the decisions and actions of the humans depending on the situation. Oakes argues that the features considered being our own (auto-stereotypes and auto-categorizations) and hetero-stereotypes (how others from other groups are characterized) depend on the context of interaction [17]. We are talking about the activation of situational stereotypes.
3) A disputed topic is in what extent the stereotypes are true or false. For their carriers, they have of course a truth value. It seems that if they are useful to the group they belong to, they are also true and correspond with the reality.
4) It is very likely that most of stereotypes are false perceptions and interpretations and are dysfunctional in the relationships between humans and groups.

Synthetizing the above, categories and prototypes are schemes focusing on content and the way of processing the information, while the stereotypes focus on groups.

The mental schemes help the cognitive agent in a fast operation and with less effort at the level of all main processes of information assimilation and processing: in perception, attention, memory, interpretations and evaluations. We insert below a systematization of the issue of scheme functioning.

1) It is clear that we do not perceive and do not pay the same attention to all the elements in the surrounding environment. A selection of stimuli takes place as they are numerous and complex, direct or indirect, especially by mass-media. The prior existence in our mind of schemes guides the attention mainly on the elements 'coming out' from the scheme, which do not confirm it.
2) However, it was found out that the information consonant with the mental scheme is better and faster embedded in the memory and we find them much easier in the process of recollection, reproduction.

3) The mental schemes increase the information processing speed but there are also cases in which the evocation of some scheme comprising many elements, that are not entirely consonant, slows forming an opinion or taking a decision.
4) The schemes also have the function that through an automated inference to complete the informational picture.
5) In confronting the schemes with the reality, almost always the comparison between 'what I expected' with 'what I have found' occurs in the foreground. The extent in which the two planes are identical is a strong source of satisfaction or dissatisfaction.
6) The confrontation between our mental structures and the data of the concrete reality does not lead automatically to disagreements. Most of the times the two places are harmonized because: 6.1) we choose the situations that confirm the schemes; 6.2) because we perceive, judge, rationalize (justify) the structures; 6.3) they radically modify our schemes; 6.4) the schemes are imposed to the reality, transforming it in accordance with our wishes and expectations.

If you expect something and you think that this will be fulfilled, this also comes true – a phenomenon called *self - fulfilling prophecy* [18]. Robert Merton interpreted the inter-ethnic relations in the USA: the Caucasians perceive the African-Americans as untrained, lazy, forgetting that they as such due to some stereotypes or practices of the Caucasians (anticipations).

The human system of information processing can be made up of three memory-related deposits, five fundamental cognitive processes and two channels of representing knowledge. The three memory-related deposits are the sensorial memory where the sensorial input is stored for a short time in its initial form; the working memory, where a limited number of elements of the presented material are stored and handled in the alert consciousness [*conscious awareness*]; and the long term memory where large quantities of knowledge are stored for long periods of time.

The five cognitive processes are: selection of images, selection of words, organization of images, organization of words and the integration of all of them. The two channels are the auditory-verbal channel (in which the material enters in the cognitive system through the auditory analyser and is in the end represented by verbal codes) and the visual-pictographic channel – in which the material enters in the cognitive system through the visual analyser and in the end, is represented by a pictographic code.

The final cognitive process – and namely integration – connects the pictographic model with the working visual memory, the verbal model with the verbal working memory and the knowledge prior to the long term memory. The outcome is an integrated representation based on visual and verbal representations of the present material the same as the relevant previous knowledge. As a whole, building of knowledge requires that the subject to select relevant images and sounds from the presented materials, to organize them in coherent pictographic and verbal representations and to integrate the

pictographic and verbal representations between them and with the previous knowledge.

In synthesis, the presented model of information processing is based on three assumptions from the cognition science: assumption of the dual channel, the assumption of limited capacity and the assumption of active learning.

2.1. The assumption of the dual channel

The assumption of the dual channel is stated as follows: people have separate channels of information processing for the visual - pictographic material and the auditory - verbal one [19]. For example, the printed words and parts of the exemplifying material (such as graphic illustrations, animations and video) are processed as visual images (at least initially) in the visual-pictographic channel, while the spoken words are processed as sounds (at least initially) in the auditory-verbal channel. However, the way in which the verbal and pictographic material is represented in the working memory is different, so that there is a *verbal code* and a *pictographic* one.

2.2. The assumption of limited capacity

The theory of the 'Naïve Scientist' begins with the assumption that, in the everyday life, people do not act in the same way as authentic scientists, developing logical reasoning, but resort to information to confirm their opinions which treats them by using different 'heuristics'. Hence errors in thinking at the level of common sense result, including errors regarding the sequences of happiness. Laurean J. Chapman and J.P. Chapman were the first to study this phenomenon [5].

2.3. The assumption of active learning

Also, we resort to the assumption of active learning: learning with a meaning [authentic] (or understanding) is made when the subjects undertake in adequate cognitive processing during learning – including the selection of relevant information, organization of the material by a coherent representation and integration of input visual and verbal information with the previous knowledge. The balanced and coordinated activation of these types of processes leads to the achievement of a significant outcome of learning that can be stored in the long term memory for a subsequent use. Briefly, significant learning is a generative process in which the subject must actively engage in a cognitive processing rather than to passively receive the information for storage.

3. Conclusion

Starting from the logical and linguistic universals of discourse, one can lay the foundations for linguistic serving sociological study of notions and

propositions – fundamental logical categories. We can include these concepts into a semiotic theory of categories that we presented in the second section.

Turning then from text properties (or ‚semiotic texture' for non-symbolic representations such as the visual type) to the discourse, we can describe properties such as consistency (contradiction), completeness, minimality of system axioms, their independence, etc. Thus, mental representations draw to a large extent, from the social point of view both signified form and content-oriented sense, justifying the description of man as a social animal.

References

[1] J.L. Casti, *Reality Rules, II: Picturing the World in the Mathematics. The Frontier*, John Wiley and Sons, New York, 1992, 101.

[2] J.R. Searle, *The Construction of Social Reality* (*Realitatea ca proiect social*), Romanian translation, Polirom, Iaşi, 2000, 80-83.

[3] A. Newell and H.A. Simon, *Human problem solving*, Prentice-Hall, Englewood Cliffs, 1972, 17.

[4] F. Ceaușu, *Clarificări conceptuale ale relației corp - psihic din perspectiva filosofiei mentalului*, Princeps Edit, Iaşi, 2008, 57-64.

[5] L.J. Chapman and J.P. Chapman, J. Abnorm. Psychol., **72** (1967) 193-204.

[6] A. Newell, *Unified Theories of Cognition*, Harvard University Press, Cambridge, (MA), 1990, 45.

[7] R.T. Bell, *The Theory and the Applications of Interpretation (Teoria şi practica interpretării)*, Romanian translation, Polirom, Iaşi, 2000, 17-30.

[8] J. Delacour, *Introductions aux neurosciences cognitives (Introducere în neuroştiinţele cognitive)*, Romanian translation, Polirom, Iaşi, 2001, 57.

[9] D. Marr, *Vision: A Computational Investigation*, in *Human Representation and Processing of Visual Information*, Freeman, New York, 2003, 113.

[10] P. Ioan, *'Integral' Logic in Distinctions, Operalizations, Definitions, and Exemplifications (Logica 'integrală' în distincții, operaționalizări, definiții și exemplificări)*, Ștefan Lupașcu Publishing House, Iași, 1999, 180.

[11] T.A. Sebeok, *The Play of Musement (Jocul cu fantasme)*, Romanian translation, All, Bucureşti, 2002, 78-90.

[12] G. Ceaușu, *The Analysis and Synthesis of Information Systems by means Semiotic Categories (Analiza și sinteza sistemelor informaționale pe baza categoriilor semiotice)*, Al.I. Cuza University Press, Iași, 2012, 201.

[13] P. Iluţ, *Illusion of localism and localization of illusion; Current topics of psycho - sociology*, Polirom, Iaşi, 2000, 64-65.

[14] O. Corneille and J. Leyens, *Categories, social categorization and psychological essentialism*, in *Stereotypes, discrimination and inter - group relationships*, R. Bourhis & J. Leyens (eds.), Polirom, Iaşi, 1997, 87.

[15] I. Radu, *Interpersonal attraction, affiliation relationships and sociometric enquiry*, in *Social Psychology*, I. Radu (ed.), EXE, Cluj-Napoca, 1994, 18-31.

[16] E. Rosch, *Principles of categorization*, in *Cognition and Categorization*, E. Rosch, & B. Lloyd (eds.), Erlbaum, Hillsdale (MJ), 1978, 349.

[17] P. Oakes, S. Haslam and J. Turner, *Stereotyping and Social Reality*, Blackwell, Oxford, 1994, 233.

[18] R. Merton, *The Self - Fulfilling Prophecy*, in *Social Structure and Social Theory*, Free Press, New York, 1957.

[19] R.E. Mayer, J. Educ. Psychol., **88(1)** (1996) 64-73.