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Computational-Communicative Actions of Informational Processing

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Abstract

This study is circumscribed to the Information Science. The zetetic aim of research is double:

a) to define the concept of action of informational processing and

b) to design a taxonomy of actions of informational processing.

First, the investigation trays to demonstrate that the computational actions of informational processing or the informational actions are computational-investigative configurations for structuring information: clusters of highly-aggregated operations which are carried out in a unitary manner operate convergently and behave like a unique computational device. From a methodological point of view, they are comprised within the category of analytical instruments for the informational processing of raw material, of data, of vague, confused, unstructured informational elements. As internal articulation, the actions are patterns for the integrated carrying out of operations of informational investigation.

Secondly, we propose an inventory and a description of five basic informational actions: exploring, grouping, anticipation, schematization, inferential structuring.

We would like to continue with further and future investigation of the relationship between operations, actions, strategies and mechanisms of informational processing.

Keywords: information, communication, actions ,computational actions, informational processing

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1. Introduction: Actions of informational processing

We think that information is computation. Processing constitutes computation. Computation involves operations, actions, mechanisms and strategies. The composition of mechanisms and strategies supposes a series of operations which are developed together, are stabilized as procedure, are unitarily structured in producing some coherent effects. These performed unitary operations to achieve a unique effect are called "the action". "The actions consist of operations of different genres" (Golu, 1975, p. 189), they may be perceptual or mental actions (judgment, reasoning); they may involve circulations and transformations of objects, images, concepts with defined informational content, on the signs and formal-abstract structures. The choice and the performing of actions depend on the form of presentation of the communication situation (objectual, imagistic or symbolic-abstract). G. Wersig and G. Windel speak about "a theory of information actions" (Wersig and Windel, 1985). K. L. Smith and S. Fernie focus on "action research" (Smith and Fernie, 2010).

Any action benefits by an anticipatory informational model, which is part of the knowledge base. "The actions or behaviors that are performed by subject are either automatic or controlled" (Miclea, 1999, p. 322). The automatic actions or behaviors are determined by knowledge of working memory. The controlled actions and behaviors are the results of knowledge processing and of structuring of goals from the most active part of working memory (Taylor, 2013). We can talk about five types of actions: exploration, grouping, schematic, anticipation and inferential structure of meanings (Zins, 2007); (Henno, 2013); (Hjorland, 2013); (Hjorland, 2014).

Between actions, Jean Piaget reveals several dependencies: anticipatory schema is only grouping schema itself, or ordered sequence consciousness of possible operations. Filling of this schema is simple deployment of these operations. The organization of prior notions complex belongs to the laws of grouping. The question as guiding anticipatory scheme comes from the prior group and the anticipatory scheme is nothing else but the direction impressed searching, by the structure of this group. Each issue does not consist only of a particular operating system, so concerning anticipatory assumption of a solution, as well a detailed examination of it prove necessary. Any new acquisition modifies earlier notions or risks to lead to a contradiction (Piaget, 1965, p. 90). Improving the perceptual actions, shows Jean Piaget (Apud Golu, 1975, p. 122), entails increasing the fidelity degree of information.

Informational processing, we repeat, is a cognition device consisting of an automated mechanism and voluntary strategies. The idea that, partly, processing would be a mechanism, an important gain in information history, would remain a dead letter if beside this mechanism (compound of movements, actions and operations) that gives inter subjectivity and objectivity, substance of information, there would be would not be seen the reality of some individual strategies (made also of the actions and operations) that ensure the originality of the act and expose, as an assumed risk, hazard information so as to become illusion, to lose and to build an informational object essentially unreal (Vakkari, 1999);(Capurro and Hjorland, 2003);(Castells, 2011).

Informational consumption is mechanism and strategy.

Scientific gain "mechanism" was imposed in epistemological conceptual device by J. Piaget (Piaget, 1961) and in Romanian science especially by Mielu Zlate.

J. Piaget links "mechanism", without a clear hierarchy, to concepts such as "mental operation", "perceptual activity", "schematization". On the same theoretical trajectory, there are also registered concepts like "schema" and "inference", representing a significant contribution of Uriel Neisser to conceptual tools of epistemology.

Among these mechanisms there are listed: exploring and grouping, and as "intellectual mechanisms": anticipation, schematization and internal organization of the field (Zlate, 1999, pp. 132-142) .

Somehow, the delimitation is correct, but for clarity of concept we have to say that in fact these "mechanisms" involving conducts of work and operations always coupled in the same way, represent informational actions. The role of informational actions is one of efficiency and not of existence, such as the role of fundamental operations is: notification of presence, connection, detection, discrimination, identification, interpretation, feedback, feed-forward.

Without operations exercise, the processing does not occur. Without the actions, processing has no efficiency when it occurs. The actions effect is multiple: providing deep cognition of the field of meaning, favoring constancy of processing, facilitating causality detection and reducing primary errors and the establishment, by installing new ex-informative relationships, a series of deformation. All actions are rationally guided practices.

2. Action of exploring

Uriel Neisser (1967) conceives cognitive processing as a cycle involving an "object" (available information), "exploratory action" which explores the object and "schemata action" that gnosis material is structured and has the role to guide exploration. So, processing technology is examined not at the operations levels, but at the actions levels, which if it occurs without losing sight of the implicit purpose of the informational act, development, processing, collection, retrieval, information creation, is not wrong (Brillouin, 2013). The difference is only in organization and productivity. Anyway, exploring as assembly of operations of "gradual contact" access with the informational object can be of different types, according to used tools.

The Exploring action involves operations "exploration, search, analysis, comparison" (Zlate, 1999, p. 132). It depends on the particularities of the situation in which this is achieved, on the nature and type of task which is carried out. It is approached much more of the reality of the object, when exercised by much more methods. There are, as J. Piaget shows (Apud Zlate, 1999, p.133), two modes of exploring, which are distinguished by their nature and different effects. Simple exploring consists of space-temporal transpositions of remote elements, ensuring a balancing game between centering effects.

Polarized exploring occurs by primary interconnection of some elements until than not related, by accumulation of centers on certain significant part of informational object (Maior, 2009); (Beynon-Davies, 2013); (Gnoli and Ridi, 2013); (Iacono, 2013).

Simple exploring has also an effect of diminution of primary errors of comprehension, while polarized exploring sometimes produces errors of understanding, biases, and distortions.

Exploring is focused on routes that cross occur exploratory operations centring (exploratory, search, analysis, comparison). Describing it as "link" to an informational act, Professor Mihai Golu considers that exploring involves "a sequence of operations" (Golu, 1975, p. 131) of getting over the assembly of meanings.

From our point of view, this serial processing schema constitutes an action that engages simple operations such as presence notification, volume adjusting of processed meanings and connection to a controlled purposes structure of the cognitive system of the informational subject. Exploring expresses the active character, constructive of the contact with the object and it is per-

formed as a clutch of cognitive schemata of inspection and control fixed by previous experience in the knowledge base of the subject to noetic material (Floridi, 2010); (Allo, 2007); (Floridi, 2011).

As regards the structuring degree of schemata and their deployment measure in processing, exploring can be "spontaneous-random" or "selective-directional".

Spontaneous exploring is always performed outside of a specific project developed, its trajectories are random, investigative spirit journey is directed at random. Meeting with an indedited object, entirely new is specific to it (Lingard, 2013); (Furner, 2014). Directional exploring is based on a previous interior project. It is part of an algorithmic or heuristic strategy and occurs selectively, as fixing duration of the points of interest of the object and as the frequency of inspection of these points. It is sometimes based on a computational analysis, which is established by the relationship between duration and frequency of meanings that block inspection.

Action of exploring is based on some principles, whereof there can be mentioned:

- the extension principle (an exploring more extended assures a clearer and more accurate vision);

- the involvement in exploring of more models will convey to get a trans-information closer to information;

- the diversity principle (quantitative and qualitative diversity of informational objects submitted to exploring are the key to the performance of this cognitive action).

The action of exploring is not essential, in itself, to constitute information; it is neither "constrained" by the characteristics of informational objects nor by subject features. As such, it appears as a working tool, available to the cognitive subject. It is also a component of strategies (as processing programs adapted to the task).

Inside of strategies based on exploring, the simultaneous or separately functioning of more rules is clear:

-the rule of the economy (a consequence of Zipf's law) consists of processing centering on the nearest meaning from semantic point of view, which is in relation to the one previously integrated in the structure of information establishment;

-the rule of informative areas, representing the orientation toward centers containing the greatest amount of meanings;

- the rule of dissymmetry up-down, that supposes exploring from high to

low, from general meanings to a particular meaning.

The strategies based on exploring are developed according to a task and are oriented definitely on informational process efficiency.

3. Action of grouping

The concept of "grouping" is one of the greatest contributions of the gestaltism to conceptual dowry of epistemology. The action of grouping consists of coordinating some operations of delimitation and association according to criteria that lead to the structuring rules discovery of informational object.

By W. Kohler, K. Koffka and M. Wertheimer, "the gestalt" (form, figure, and configuration) is obtained after the grouping of elements (organization of field elements) based on the following principles:

- the principle of proximity: close elements are perceived as forming a unity, a configuration;

- the principle of similarity: analogous elements are perceived as constituting a form;

- the principle of continuity: oriented elements in the same direction tend to be structured perceptively in the same form;

- the principle of symmetry: symmetric figures beside one or two axes constitute "good forms" and are easier to process;

- the principle of good continuation: at the intersection of two contours their continuation will be perceived after the continuation of the simpler one;

- the principle of closure: processing tends towards well delimited forms, closed and stable.

"The essential law" of gestalt, shows J. Piaget, is the law of pithiness: among all possible forms, the form which is imposed is always the best (Piaget, 1965, pp. 106-107). M. Zlate (such as J. Piaget) defines laws to these essential relations, repeatable and constant. Others, for example Claude Bonnet, define the principles and in an extended research find a number of 114 gestalts principles (Bonnet, 1989). Mircea Miclea speaks about the existence of four principles (of proximity, of similarity, of good continuation and of closure); therewith, he mentions the possibility of restraint of all gestalts principles in the Pragranz's law: stimuli are grouped in such manner, so as the simplest configuration results (Miclea, 1999, p. 82).

To the above mentioned principles and laws, theoreticians add, usually, another two:

-the law of generalization: perceiving of an informational form attracts for this grant of a meaning;

- the law of constancy (approached by Leonardo Da Vinci and defined by (C. von Ehrenfels, 1988)): good forms tend to conserve characteristics in spite of the presentation mode; a song remains recognizable even if it is interpreted in other register, an information is structured also from fragments.

As harsh critic of gestalt, Jean Piaget did not hesitate, to value it so as to adopt the concept launched by them: "From a psychological perspective, says he, the grouping consists of a certain form of balance of operations" (Piaget, 1965, p. 88). It has as effect the internalization of object and its organization in assembly structures.

As a whole, in processing there can be ascertained the functioning of an action of grouping.

Actions of grouping occur both on automatic section (mechanism) and on the intentional-teleological (strategic) section of this. "Grouping performs for the first time the balance between things, the assimilation in subject action and the subjective schemata accommodation to changes of things" (Piaget, 1971, pp. 68-69) . Although rarer than strategies based on exploring, the strategies based on grouping have a more pronounced impact of informational efficiency than the strategies based on exploring. In audio-perception, for example, in the sound fields there are grouped ambiguous words spoken in the same language, words linked syntactically correct, the words of a same articulated voice, sounds produced by the same TV or radio, the same instrument etc. They are as many strategies for defining the sound field. In informational synthesis development there occur actions of exploring, grouping and anticipation. Delimitation and association, which represent the main operations of the grouping action, are achieved in informational strategies either simultaneously or alternately, each benefiting of the gain of previous.

Exploring and grouping are grafted on the relation in-informational subject-object, unlike anticipation, schematic and field organization that perform ant-act, at least partially, and are grafted on *ex*-informational relations.

4. Action of anticipation (feed-forward)

"The real is proposed to us on condition to anticipate it somewhat," says Mikel Dufrenne (Dufrenne, 1976, p. 31) . Informational act is rooted in an act of thinking. Done, it enters in a personal informational history and it is linked willy-nilly to past experience that here so precedes it, involves it and somehow anticipates it. Informational act, of any kind, oriented (executed in a task achieving), latitude (executed by pleasure or ludic), analytical, audio-perceptive, video-perceptive etc. does not represent the absolute beginning of the informational experience. Accordingly, it follows another act whose achievement was already engraved. Repeating generally the same type of act mobilizes an old act that, extracted from memory, becomes anticipation of that which is gradually formed. If the two acts are performed shortly after each other, then anticipation is consolidated and becomes waiting, expectation. Action of anticipation requires at least two operations: memory accesses times long or short and projected into the new act of the principal act model data from storage. The essence of the action is represented by a projection-active subject and constructive work. This is source of efficiency, but also of deficiency: in most cases it helps, but, in the position of "thoughtlessness", it is deformed. The concept of anticipation was introduced by J. Piaget. Cognitive processing, as activity, operates by means called by J. Piaget "infra-logic operations", while intelligence works with logical operations (Piaget, 1965, p. 96 and p. 132). Informational activity is one of incubation media which required, in their genesis, intelligence operations. As operations are comparisons, transpositions (temporal and spatial) and anticipations, these operations would be themselves "acts of informational rank". M. Zlate defines anticipation as "a kind of pre-inference, an aspect of a perceptive schema, entraining other through an immediate involvement which modifies the perception" (Zlate, 1999, p. 140) (also Thellefsen, Thellefsen and Sorensen, 2013)). The assembly of operations or pre-inference, concerning anticipating takes into consideration this fact: it modifies the development of informational act and implicit trans-information which is constituted. Any cognitive activity requires some anticipation. Information without anticipation is nonsense. The informational strategy of feed-forward is based on anticipation action.

5. Action of schematization

In the cognitive history of each topic, shows Jean Piaget, there are formed some structures, "some schemata (...) that must be accommodated constantly by explorations and corrections, situations, even at the same time when they assimilate" (Piaget, 1965, p. 114). Action of schematization is composed of exploratory operations, corrections and modeling. It is the consequence of a previous conceptualization and represents a current act direction.

The scheme is interposed between the informational object, target of consumption, and the conceptual category/class which it belongs to. Schemata are actions susceptible to be repeated actively (Piaget, 1965, p. 61). They mediate the relationship between abstract class and concrete object which tends through cognitive operations to be subsumed to it, making "conceptual equivalent of thing" (Ceausu, 1981, p. 61). Scheme, shows J. Piaget, "results exclusively from the centered action on objects whose choice is naturally guided by a conceptual circumstance" (Piaget, 1961, p. 244).

The concept imposed by Jean Piaget proved the force of explanatory-interpretative and prescriptive-descriptive by the takeover of epistemology. So, he who dedicated the term of cognitive psychology, Uriel Neisser, uses the concept to mean "relatively stable psychological structure which performs organization and ordering of data coming from the outside" (U. Neisser, 1967, pp. 36-37). The scheme absorbs meanings, within certain limits, changes and processes them, so as to produce a greater volume of information. The same as anticipation, schematization is based on a repetition. Moreover, "schemata, says J. Piaget, have a history; there is a mutual reaction between past experience and present act and not a one-way action" (Piaget, 1965, p. 115), because, being by definition a structure, this "informational structure is a system of interdependent relations." Schematization through mentioned operations links the current informational act to a complex of concepts relating to which there is created - by comparison abstract-concrete - a gap, a failure (Craia, 2008); (Cover and Thomas, 2012).

On the other hand, schematization covers the gap by correction, by means of meanings concrete. In this action, the schema gives categorical personality to cognitive act, and act fills with new elements the operational schema. Schematization can be seen, as does Professor Mielu Zlate, also as a "generalization as a common structure or schema of a certain activity" (Zlate, 1999, p. 141) as a result of its repeating. As generalization, operation of thinking

is typically intelligent, thus it results the dual nature of the system: perceptive and rational. There are two types of cognitive schemata: empirical and geometric. There are to be delimited two types of processing: geometricizing (those approaching the object of something known) and empirical (those locating the object in the proximity of the informational objects familiar to the cognitive subject). Both schemata have therefore deforming effects, leading to the appearance of errors and compensatory effects, corrective (one of action specific operations of schematization is correction). Schematization intervention in informational act, is not, as it is seen, a neutral event.

Actions of schematization appear both in cognitive mechanism (automatic), and efficiency strategies, that compound the informational process. There are strategies that are based on schematization, they are used especially in ambiguous discourses and extensive contents (as in object messages or the summarizing of materials of hundreds of pages). For example, on the sound field composed of fuzzy voices, cognitive subject will project (through exploratory operations, correction and modeling) models of known voices beside which those that compound the "cocktail" will be placed on the levels as "bring with..." , "looks like ...", "is close to ...", "is similar to ..."

In such a schematized strategy enters, of course as secondary, also segmentation operations of audio field, of repeating and variable centering of perception. Generally, shows J. Piaget, "semantic space is not homogeneous, but is centered in each moment" (Piaget, 1965, p. 120). In processing, cognitive subject always has a grid that centers its approach (Cojocaru, 2009).

Center makes the area of attention focusing to be stronger than the periphery of the field and not confusing; repeated centering on different areas will make semantic space clearer, more accessible, understandable, information more easily structured.

6. Action of inferential structuring of informational field

Computation is fundamental human process (Nielsen and Chuang, 2010); (Piccinini and Scarantino, 2011); (Tishby and Polani, 2011); (Burgin, 2011); (Tetlow, 2012); (Fresco, 2014). The basic of the computation is the inference (MacKay, 2003). Memory capacity is not large enough to store in a single act of informational centering the entire semantic content that is extracted to constitute trans-information. When it is especially talking about in homogeneous fields, ambiguous or higher dimensions of centering capacity within a single informational act, things are worse. "Being is computation" shows Rafael Capurro (Apud Hofkirchner, 1999, p. 10).

Any text is a carpet. Let's think of the example of a visual field consisting of a carpet, having a complicated pattern and multicolored. The informational object cannot be clearly included in a single view in a satisfactory perception. A single centering is not enough, there are necessary more, related to each other so as to be drawn a geometric shape, geometric model or painting, the used colors, the material of which it is made. Throughout this informational event occur meaning connections partially resulted of perceptual acts, in a large structure, integrated by field.

Organizing partial perceptions in an integral one occurs through operations of exploration, comparison, correction, modeling and control. All of this constitutes the action of inferential structure. Inference is, according to U. Neisser, the assembly of operational steps and elementary transformations applied to information in its internal processing (Neisser, 1967); (Case, 2012); (Chapman and Ramager, 2013).

Structuring "successive centering", involving operations of "correction and adjustment" (Piaget, 1965, p. 160) leads also to the internal organization of thinking schemata through pre-inferences. However, pre-inferences that structure informational fields and whose effect can be seen more easily in case of the complex fields, are similar to basic axioms, basic rules, the golden rules: pathways orientation determines the reference systems, the main access roads and fundamental ways for phenomena understanding (Doucette, Bichler, Hofkirchner and Raffl, 2007); (Floridi, 2011).

Pre-inferences can be of four types: inductive, deductive, abductive and analogical. J. Piaget defined three of them in relation to inferences: the inductive produces switching from part to whole, from the detail of the figure to overall schema of the figure-background field; the deductive directs switching from whole to part; for the passage of almost to almost, from part

to another part, J. Piaget did not have a name, for this, U. Eco (Eco, 1982, p. 46) called it, abduction; the fourth type of inference is by analogy, that also from the part to part, but without a strict respect of first part rules.

Action of inferential structure is used as a main pillar in various informational strategies. For example, in an audio perception task of determining the number of people discussing in a space for which we do not have images, except for the audio perception mechanisms of operational and actionable technology it will be applied a strategy based on the effect of radiography that allows action of inferential structure of the field (Hofkirchner, 2010); (Eisenberg, 2010); (Hofkirchner, 2013). It will plot the field, the perception will focus on each area, it will compare portions of auditory space concerning the voices coincidence of each plot, it will shape the entire audio space to infer the number of voices, finally, it will proceed to adjustments of connections performed between perceptive centered areas and it will operate the necessary corrections. In case of summarizing some written documents there occurs a structuring on principal ideas, by using different pre-inferences.

7. Conclusion

After thousands of years of evolution, the informational subject has integrated computational procedures for processing the informational environment as automatisms. Nowadays, the human being can process any kind of information. The difference between the nave, unaware, unprepared and automatic informational subject and the specialized informational subject is reflected by the possession of computational instruments for strategic, non-automatic informational processing. The unprepared informational subject gathers pieces of information depending on criteria profoundly impregnated by subjective automatic bias and without an appropriate preliminary preparation. The specialized informational subject produces, studies and uses computational instruments for processing the cognitive material; the specialized informational subject draws and gathers pieces of information strategically, non-automatically: depending on objective criteria, inter-subjectively tested and acquired in the process of specialized learning. The concept of informational action is a specialized instrument of informational processing.

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