INFORMATION AND DECISION-MAKING IN SYSTEM

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Summary
The aim of this article was to determine global rules referring to the reaction of objects / system in the conditions of environment with variables. A special methodology was applied and it included the mathematical model of combining three input parameters with six intensities of influence per one on the object and their simultaneous monitoring. The results showed that the object can act in congruence with three vital reactions and their combinatios: 1) On-line: acutely solving the problem (proportional regulation), 2) Common: including relations with other objects (derivation regulation). 3) Batch: long-time accumulating ideas and resources (integration regulation). There are no limits in this model and it is applicable in any kind of possible situations which can be applied in different disciplines. The practical value of this study is the possible application in the wide range of assignements (informatics, kinesiology, medicine, management,…). The results from this study are in a way peculiar and they require a kind of familiarity with global forms of reactions of any object of our interest in some field.

***Ključne riječi**: on-line, common, batch, regulation, decision making*

Introduction

The decision making within some, any kind of system or object, is always in connection with the three basic rules which directly determine each system: 1) aims of the existence of the system / object, no matter if we were familiar with the aim or not, 2) total integrated ideas and knowledge being imanent to the system / object which represent earlier accumulation of information and other resources, and 3) acute information coming from the environment of the system /object (Bonacin, 2004 a; Bonacin, & Blažević, 2006). In the unity consisted of these three sets of rules, each of the existing objects is defined as well as the each one which has ever existed or will exist. What is more, the possibility of existence and saving the object are sustainable only if the three mentioned sets of rules are well balanced and founded at the high level of function. This happens in the situation when the object which tries to save the unity of its internal structure and make progress, has to make decisions, especially in the situations when its environment is often and intensively changed (Duan, Tian, & Zhang, 2008). Such kind of decisions are made in a few different ways, and of course sometimes in some very unfavorable conditions (He, & Huang, 2008; Hua, Gong, & Xu, 2008; Ustun, & Demirtas, 2008). The probability of making right decisions is the direct function of the aims the object has imanently set for the purpose of existence and progress (Bonacin, & Blažević, 2006), but the possibilities of finding the optimal reactions for the optimal results are complex. And always in connection with influences which are not possible to control totally (Keil, Li, Mathiassen, & Zheng, 2008). Therefore, a subtle regulation within the possible answers and their precision is simply an imperativ, especially when in some tiny modalities some virtually very different solutions and consequences are possible Watkins, 2007; Bilbao, 2008; Wuppalapati, Belegundu, Aziz, & Agarwala, 2008). But, before we can understand or possibly get such subtle regulation modalities of management and decision making incorporated within the object, we have to determine the basic rules, or on contrary, without them they will be taken as guesses, wondering and infinite interventions with the results which will not be optimal at all further on (Bonacin, Rađo, & Blažević, 2005).

Problem and aim

Just because of insufficiently clear articualtion of basic rules, the aim of this study could be defined as defining those ideas which will resist local and temporary aspirations and ways of solving assignments which are set to different kinds of objects in real conditions. Namely, in the number of scientific disciplines it is witnessed that the acute assignements are tried to be solved mostly by mathematical models and tehnology-electronics systems for support to decision making. In most of solutions of that kind, among which lots of them could be prety good, there is absence of the first and the most important segment which refers to permanent laws (Bonacin, 2004 a), which could have their set of rules founded in a better quality way one day. In this way, a great number of research works is occupied by the consequencies provoked partially by the unknown facts in the models, instead in samples which should be set in the center of science, in order to get the consequencies common to the objects. The level of modern perceptions allows us to integrate different information from different fields in order to set up the rules which will be the basis for definition of subtle modulation in decision making. That kind of rules can be defined on the basis of different kinds of cognition and ensure true laws " of behaviour" of objects for then purpose of making some optimal decisions (Bonacin, 2004 a; Bonacin, Rađo, & Blažević, 2005; Bonacin, & Blažević, 2006; Bonacin 2007 b; Bonacin, & Bonacin Da., 2007). In that context, the aim of this study is foundation of the basis for the reaction of objects as a respond to different input values which should be recognized and identified by such a kind of an object and which should be absorbed and finally included in its own repertory.

Model and Methods

Make it that there exist a few more equal sources of information y_i $\{i = 1..n\}$ which influence on some object x in which process the intensity of each particular source mentioned above is set on ordianal scale t_k $\{k = 0..p\}$ provided that $t_1=0$ *i* $t_p=p$, where x=0, which means that the particular source does not emit information towards the object x. Then it is completely sure that it is easy to calculate the maximal number of the possible events in the form of variations without repetition for each particular source $t_1=0$ *i* $t_p=p$. Using the combination without repetition of a few more sources together, we get a total set of possible combined events N, which is obviously $N = \Pi M_x+1$, in other words it is expressed in the form of product of the possible repetitions multiplication at each particular source $N = \Pi M_x+1$.

For the needs of this study, we supposed that there was only one object (x = 1) and 3 sources of information (y = 3) with 6 intensities ranging from 0 to 5. As the data were set on the ordinal scale k = {0, 1, 2, 3, 4 i 5}, it is sure that for the three sources we have in total $C = (M_1+1)*(M_2+1)*(M_3+1) = 6*6*6 = 216$ situations in the basic set A = {0, 0, 0},{1, 0, 0},{0, 1, 0},{0, 0, 1},{1, 1, 0},{1, 0, 1},{0, 1, 1},{1, 1, 1},…,{5, 5, 5} in which {5, 5, 5} means that all of the three sources emit towards the object x in the maximal manner. It is not obviously possible to neglect interactions from three different sources, because their achievement is surely nonorthogonal, so we can say that there exist some new functions $\psi_s = (y_1,y_2,y_3)$ which realize the interaction of individual events from y onto the object x, with the limitation that the cardinal number of that kind of events is equal to C.

If we suppose that one interaction is some function (for example ψ_1) equal to $y_{1,1}+y_{2,1}+y_{3,1}$, in other words it is a simple linear combination of summing, we will get that the set of possible events is equal to the range R = (0, M*y) in other words to R = {0, 1, 2, …, 15} with precisely determined appearance of each of the particular events from R. The distribution of this data into R, is of course normal, with the frequency of extreme values (0 and 15) towards the minimum, and with the frequency of modal values (7 and 8) towards the maximum, which in the end is nothing else but the development of an order (Bonacin, 2007 a) although the data is recorded as a fast response in the basic set.

Then, if some other interaction is supposed to be a function (for example ψ_2) which is equal to $y_{1,1*}y_{2,1*}y_{3,1}$, in other words in the form of a simple linear combination of the product of multiplication, we will get the set of possible events equal to the range S = (0, Π M_x), in other words S = {0, … , 125} with appearance of certain events acting according some certain and determined rule. The distribution of this data is, of course, in the form of logharitam. Finally, if it is supposed that some third function (for example ψ_3) is equal to $y_{1,1+}y_{2,1+}y_{3,1}$ za $y_{k,y} = \Sigma\, y_{k,y}$, in which $y_k = 1$ for each and every $y_k <> 0$, in other words, as a simple linear combination of zero and non-zero values resulted from the individual sources at the occassio when they indicated only dihotomy feature emit-not emit, we will get again the rule T.

The distribution of this data from T is of course the matter of a process (Bonacin, 2004 a i b). All of the three types of data are easy to understand and they were explained in literature repeatedly. The process of sorting data on the basis of the criterion of rise from the basic set , that is A = {0, 0, 0},…,{5, 5, 5}, and describing the data in the form of a polinom of the fifth degree (for the purpose of vizualization and easier recognition) will lead to formation of logical constructions founded on the take-off, logharitm and process trajectory, which in its origin reproduce the proportional, integrative and derivative regulator for the system operation, but in the logic of the social sciences it is nothing more but “On-line”, “Common” and “Batch” model of behaviour (Bonacin i Blažević, 2006; Bonacin 2007 b).

As it can be seen from the graphs 1., 2., and 3., all of the three basic models of behaviour are completely clear although it could be said that the system of reactions directly depend on the level of its local and internal development. So, it is then clear that the object will react, without any particular responses, on the input impulses which begin from the simpliest and finally realize entrances into the object by a set of information of the type {1, 0, 0},{0, 1, 0},{0, 0, 1},{1, 1, 0},{1, 0, 1},{0, 1, 1}, probably because it is dealt with local and not especially intensive inputs.

But, when intensity is increased {4, 4, 5},{5, 5, 4},{5, 4, 5},{4, 5, 5},{5, 5, 5}, the reactions will then be very intensive and energetic, with the tendency to solve such a kind ot tasks, independent of the fact if the solution is the possible withdrawal from such kind of situations or the possible destruction of the sources of such a strong intensity. Articulation of these functions leads us to on-line, common and batch model which describe the acquired status in any of the phases in an excellent way.

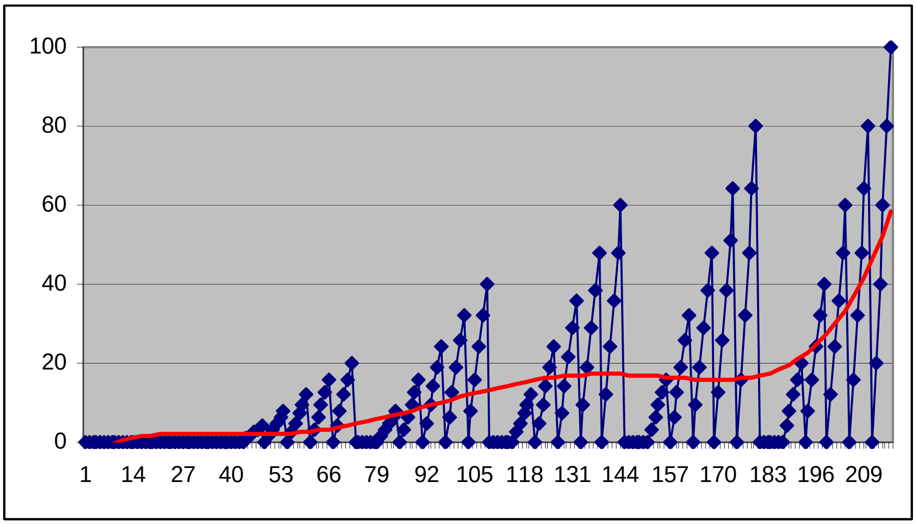
Results

The proportional response is visible from the graph 1., that is the reaction which should be used by the object to realize the maximally fast response, and as we all know, that reaction is moving away from the source of danger because it is surely more efficient to move away from the acute situation than to start acting without some developed efficient strategy. Therefore, if the strategy is not developed, the reaction is in a form of a fast response, in other words and in the form of general terms it is On-line dynamics, and this cannot refer to anything else but to its removal. If the proportional regulator or On-line regime is the only permanent possible choice from the possible repertoire of some system, it will not be able, for sure, to optimize its reactions because it is constantly forced to try to move away from the source of danger, that is, from high inputs intensities, which means nothing else but to try to restore the actual "error" in differences between the expected and desired status in the constant maximal speed.

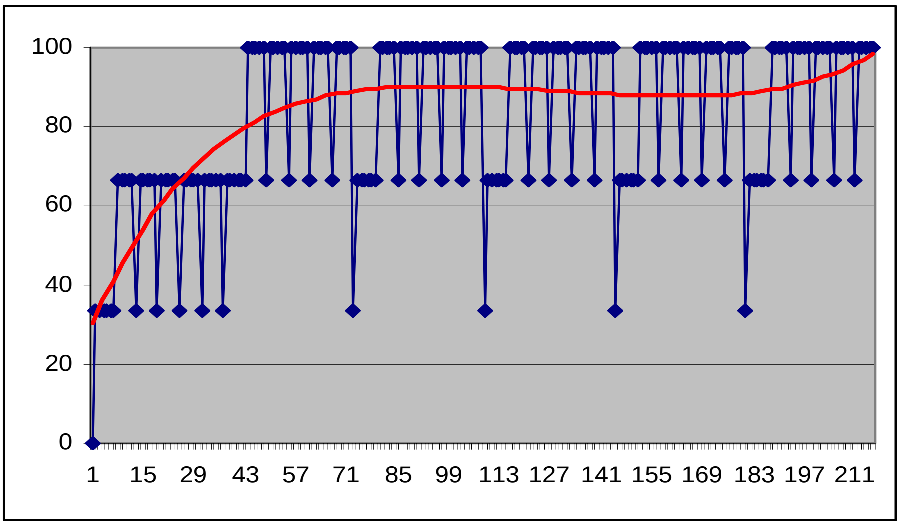
Obviously, it is not possible to restore some of the inputs by fast responses, and thus the On-line regime threatens to slowly destroy the system which does not have quality reponses to such kind of new states that appear. This type of reactions belongs to individual, nonintegrated objects which independently try to stay alive in the field of numerous interactions around them. In the graph 2., however, we can recognize the other aspect of the system behaviour, which is described in the simpliest way as an integrative regulator, whereas in the process periods it refers to Batch operation which is used by the object to acquire a higher level of accumulation, in other words we can say that it learns from the previous situations.

Obviously, this type of accumulation and reactions belongs to the most developed objects having a high level of autonomy in the choice of reactions, as well as in objects with a very high persistency which cannot be influenced by some inputs in a disastrous and fatal way. It can also be seen that it is obvious the Batch regime and is acquired very fast because as early as after ca. 50th (of 216) step being in the form of operation combinations continually positioned in an upward line on to the object was realized, the level of accumulation of over 90% of the maximum was realized, which means that the initial learning has passed and the object keeps, but selectively, the information or the resources which are found to be necessary.

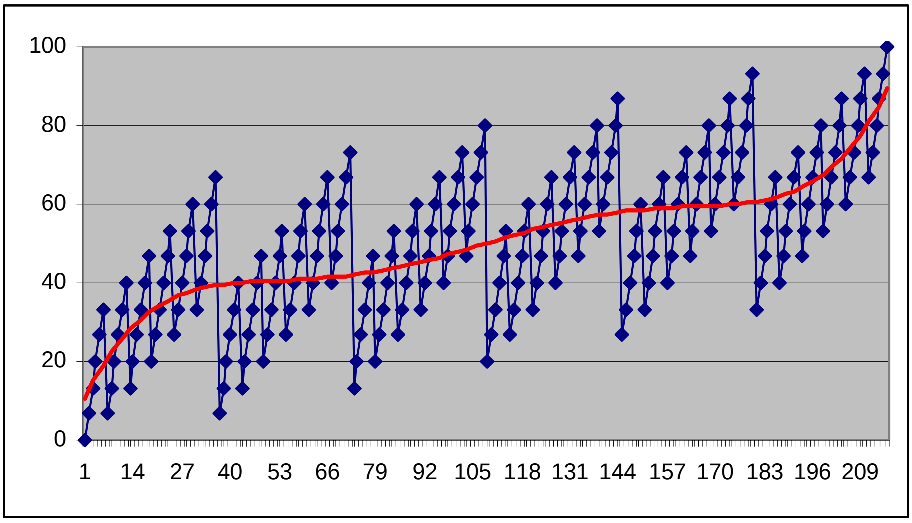
Graph 1. The product of multiplication of the three input information expressed as the per cent of maximum (the marked function set up as a polynomial of 5th degree)



Graph 2. Integration of existence of the three input informations
expressed in the form of the percent of maximum (the marked function set up as a polynomial of 5th degree)



Graph 3. The sums of the three input information expressed in the form of percent of the
(the marked function set up as a polynomial of 5th degree)



Finally, in the graph 3., we can recognize the remaining aspect of the object behaviour and the issue is about the derivation regulator, or to be more precise about the Common type of action, when it becomes, on the one hand, necessary for the purpose of existence and development to cooperate with other objects, and on the other hand it turns to be impossible to survive independently in a real situation. This always happens when an object tries to restore the actual acute state, but in the situation of existing interaction possibility with some other object, when both of them acquire a new quality in the restored interaction. In that way, the object itself is improved and using the help of other objects it ensures the synergy necessary for accumulation which will later be particulary expressed in the form of the Batch process.

Discussion and conclusion

On the basis of the stated results, it is almost impossible in total to close a reliable composition consisting of the objects reactions. Namely, with appropriate knowledge of a number of distinct sources, a range of information coming from the mentioned sources and their intensities, and the realtions within the sources, on condition that they are seen as inputs in the object, we come to the level of predictability of the object reactions we are interested in. And vice versa, of course. In other words, if we know an object reaction, we can, with some variations, recognize the type and intensity of the input stimuli as well as the interaction within the sources. Namely, in some ideal situation, highly skillful and persistant system will react very fast in the On-line system, at the same time having some high but foggy reactions in the Batch sub-model, whereas the area of Common will be relatively intact. This can be realised only in the way that the object locate the source of information emission in a very fast manner but at the same time some visible reactions are small, and without some surplus in energy and other resources consumption, and with a minimal engagement of other objects. This position in the world of animals can be used to characterize a wolf who is, due to large accumulation, very resistant to other animals' reactions but at the same time it will locate and remember the sources the inforamtion come frome very well and to be true it will mostly act generally individually with rare and planned cooperation. That group can also include for example: elephants, crocodiles, whales, boas, etc. On the other hand, the object which is positioned low in the Batch and the On-line model, will constatly require maximization of other similar objects in order to learn on the one hand and on the other hand to be protected with the sole fact that there are a lot of them and it turns to be a sufficient protection and the base for development and improvement. The maximization of this component represents for sure the maximization of the Common model or the derivation regulator but due to the insufficient accumulation, we still do not have an adequate response on the input information but we try to find the mentioned responses dominantly in the mass.

This is possible only if an object optimizes its operation constantly in the direction of integration with other objects and if it completely relies on them in the process of solving input information being recognized and identified.

In the animal world, bees and birds which live in flocks (for example at some ocean islands) and also the herds of sheep, goats and other similar animals are the closest to this extreme type of this model. Naturally, the objects which can be described as proportional regualtors, in other words, those being constantly exposed to the On-line model behave in the simpliest manner but they also restore the tasks with the greatest number of difficulties because they are the very ones that neither have sufficient accumulation nor sufficient interaction with the similar ones, and for that reason they are constantly forced to react in the time area. When it is about the maximization of this type, we can say that it is for sure about the simpliest models of behaviour with mostly previously expected reactions and without some specific variations. An efficient function is possible then and only then when the object is exposed to a very small number of known input information which can have an appropriate response and if it is constantly in the regime of expecting the input to start some appropriate, common reactions. It is even not important to say that the largest number of electronics systems have been constituted in this way. In the world of animals, this kind of behaviour would mostly describe for example some types of fish that mostly live as individual entities until they are not forced to do a certain reaction by some "triggers" (genetic, food, escape,…). Only after an On-line situation is overcome, an object can enter the Common relations, in order to obtain the Batch level by a longer accumulation.Those processes, from the progress point of view, can last for a long time but they always happen and they are partially present at all of the existing objects.

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INFORMACIJE I ODLUČIVANJE U SUSTAVU

Sažetak

Cilj članka je bio utvrđivanje globalnih pravila reakcija objekta / sustava u varijabilnim uvjetima okruženja. Primjenjena je posebna metodologija koja je uključivala matematički model kombinacije tri ulazna parametra sa po šest intenziteta djelovanja na objekt i njihovo simultano praćenje. Rezultati su pokazali da se objekt može ponašati u skladu s tri vitalne reakcije i njihove kombinacije: 1) On-line akutno rješavajući problem (proporcionalna regulacija, 2) Common uključujući relacije s drugim objektima (derivacijska regulacija), i 3) Batch dugotrajno akumulirajući spoznaje i resurse (integracijska regulacija). Ovaj model nema ograničenja i primjenjiv je u bilo kojoj situaciji koja se može u raznim disciplinama aplicirati. Praktična vrijednost rada je moguća primjena u širokom dijapazonu zadaća (informatika, kineziologija, medicina, menadžement,...). Rezultati rada na svojevrsni način su presedan i utemeljuju poznavanje globalnih oblika reakcija bilo kojeg objekta koji nas u nekom arealu zanima.

Ključne riječi*: on-line, common, batch, regulacija, odlučivanje*

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