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WHAT KIND OF SYSTEM IS LANGUAGE? – ON THE REVELANCE OF GENERAL SYSTEMS THEORY TO LANGUAGE STUDIES

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1. Introduction

If we were to point to one notion of utmost importance to physical, biological, economical, linguistic, or any other theory, it might be that of *system*. It is one of the most abstract and the most frequently used terms in modern science. 'System' is often used interchangeably with 'structure' or 'set of relations'; it may be viewed from the standpoint of the tight organization of its elements, or its resistance to change and influence from the outside. On numerous occasions we employ the term presuming that its denotation is rather obvious, whereas what we actually mean by it may vary considerably.

In the present article we would like to focus on what is meant by 'system' and 'language system', and point to some inadequacy resulting from the synchronic understanding of the notion, bequeathed to modern linguistics by Saussurean structuralism. As we shall see, a similar inadequacy is traceable also in the works of some more recent system theoreticians like Bunge[1] or Bocheński.[2] Our aim is to propose a slightly changed understanding of the term, in the direction of Bertalanffy's and Laszlo's theories of system, originally worked out for natural, biological and physical systems, which advanced a view of system as a spatial-temporal entity.[3]

Studies of system, as Bocheński noticed, belong to the domain of philosophy; although systemics deals with all kinds of systems: mathematical, physical, biochemical, social, etc., it deemphasizes the physics, biology or sociology of the system and focuses

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[1] Cf. Mario Bunge (1979) *Treatise on Basic Philosophy*, Volume 4: *A World of Systems*.
[2] Cf. Józef M. Bocheński (1994) 'O systemie'.
[3] Cf. Ludwig von Bertalanffy (1968) *General System Theory*, Ervin Laszlo (1972) *Introduction to Systems Philosophy*, see also Laszlo (1972) *The Systems View of the World.*

on the system itself, its structure and behaviour. This is our target: to view language system as an entity sharing the same systemic features which characterize any other entity called a 'system'. Language is just one more system, which may be explored for the same systemic properties like any other system, in accordance with Bertalanffy's postulate: 'there exist models, principles and laws that apply to generalized systems or their subclasses, irrespective of their particular kind, the nature of their component elements, and the relations or "forces" between them' (1968: 32).

2. On 'system'

What is 'system'? In the first place, we should distinguish between an *aggregate* and a *system*. An aggregate is a collection of items not held together; in a system (conceptual, concrete or mixed) the components are interrelated. Each system, irrespective of its nature, has a definite composition (elements), an environment and a structure (a synthetic principle, cf. Bocheński 1994). The order of the three is not accidental because enumerating a system's elements must precede any description of its environment and its structure, and before we describe a system's structure we ought to identify its environment.

The composition of a system is the set of its parts (at least two are required to form a system), but only those which enter independently into relations with others (see (3) below).

Bocheński (1994) provides the following properties of elements:

(1) there is no entity which is an element of itself
(2) if *x* is an element of *y*, then *y* is not an element of *x*
(3) if *x* is an element of *y*, and *y* is an element of *z*, then *x* is not an element of *z*[4]
(4) an element of a given system belongs to the same logical system as the system itself.

[4] As to (3), views on this matter differ. When we consider relations inside a hierarchy of systems, an important thing is delineating the boundaries of a given system, i.e. what constitutes a given system and what is not part of it. In most cases the answer is by no means obvious, because the boundary between the system and its environment is never distinct in open systems. This is also the problem how rigorously we take the concept of a hierarchy; whether the sets of relations which constitute the components of the system *A* into systems on their own level are to be excluded from *A* and treated as its (internal) environment, or they are to be treated as lower but parts of the system in question. Bocheński and also Bunge assume non-transitive relation, as in (3) above, whereas, for example, Laszlo's system does not extend exclusively to the sets of relations on its particular level. In his classification it is correct to say that social systems are composed of atoms, though obviously they are not systems of atoms: "the component modules of one level are modules belonging to some lower level" (1972a: 51). Thus, in Bocheński's approach we obtain a model of a regular tree branching out of a single point, without loops; which may be found intellectually more satisfying. However, the problem is that such a rigorous model of hierarchic order does not correspond to the really existing systems that it is supposed to represent; the systems we observe around us do not reveal strict consequence in their organization, so there is no point imposing such logically organized structure upon them.

An important thing is the concept of a link or connection holding among the components of a system. Bunge (1979: 6) distinguishes here between a mere relation, such as that, for example, of being older, and a connection making some difference to its *relata*. Two things are connected if at least one of them *acts upon* the other; thing *a* acts upon thing *b* if it modifies the latter's behaviour, or trajectory, or history. The action need not be eventuating something, but may depend on creating certain possibilities.

The environment of thing *a* is defined as the set of all things, other than these belonging to composition, that act on *a*, or are acted upon by *a*. The above mentioned requirement of connection makes it clear that by the environment of a system is meant the immediate environment, not the total one, i.e. the set of all things that are not parts of the system. Bunge makes the following assumptions concerning the transactions of a system with its environment. First, all systems receive inputs and are selective, that is they accept only a small subset of the total number of environmental actions on them. Second, systems always react on their environment, their output is never nil. Thus the environment must be included in the description of a system, since the system's behaviour depends heavily on its milieu. However, that point is not unquestionable, for example, Bocheński claims that there are many so called 'closed systems' in which any influence from the outside is excluded, such as, for example, axiomatic systems. As regards the linguistic system, the question whether the environment of language should be taken into consideration in a linguistic theory, and if so, to what extent, has proved by no means easy to answer. The Saussurean postulate to treat language as an entity *en soi et pour soi*, whether formulated by Saussure himself or not[5], has found many followers in the twentieth-century linguistics.[6]

The structure of a system is defined as the set of all relations among the system's components, as well as among these and things from the environment. 'Structure' and 'system' are not to be confused; a system is not itself a structure, it has a structure. In Bunge's theory of systems, a difference in a system's composition induces a structural difference, although not conversely, two systems may have different structures but the same composition. This formulation, as we shall see, is the source of the major problem with Bunge's notion of system as it does not allow systems to exist *in time*. Also Bocheński's interpretation of synthetic principle (the system's structure) is not free of the problem. According to Bocheński, in actual systems the order of elements relies on their causal dependence. Thus,

Definition 1: An actual system is an object whose elements are causally related with one another. (1994: 243)

[5] Saussure's lectures were first published posthumously and the very sentence might have been an insertion by the editors to underline the general postulate of the autonomy of linguistics. This view was first advanced by R. Godel in *Les sources manuscrites du 'Cours de linguistique générale' de Ferdinand de Saussure*, Geneve, Paris 1957: 119, 181 (see the Polish edition of *Cours* 1991: 258).
[6] Kuryłowicz, for example, also underlined the necessity to confine interpretations of language phenomena to purely internal, linguistic factors and rejected extra-linguistic explanations pertaining to dialect geography, psychology, cultural anthropology, sociology, etc. For opposite views, see Jakobson (1989).

However, there is no causal dependence among non-actual elements, such as to be found in an axiomatic system or in a poem. For such cases, Bocheński adopts the notion of dependence as it is used in phenomenology[7]:

> Object Q_1 is dependent with respect to object Q_2 if for the existence of or occurrence of Q_1 the occurrence of some state of affairs in which Q_2 is the subject is necessary. (Ginsberg 1982: 278)

Then, Bocheński provides the following definition of a system:

Definition 2: A system is an object which has at least two elements and whose all elements depend on one another. (1994: 243)

The definition of system adopted by Bocheński is the source of at least two problems. First, if in every system all elements depend on one another (see definition 2 above), then we cannot distinguish between centralized and non-centralized systems; there are no centralized systems and all elements in a system are equally significant – most of us would probably be reluctant to agree on this since we are surrounded by a multitude of systems whose main parts are easily distinguishable, e.g. the central nervous system in a living organism, or the commander-in-chief in an army. Second, if all elements of a system depend on one another, then change in a system is theoretically intractable; every element constitutes the whole and the individual identity of an element is important. The stronger the dependencies among the system's elements, the less probable that any element can be replaced without changing the system itself. Therefore, with every change of the system's elements, the system changes too. Let us recall that also in Bunge's theory a difference in a system's composition induces a structural difference, and, in consequence, a new system emerges. This however, makes the system an ephemeral entity and, hence, not a very useful concept. If language is considered to be a system thus understood, each time the pronunciation of a word changes or a morpheme is deleted, the language system changes, though slightly perhaps. In fact, this is the only way Saussure admitted of the notion of 'system' with regard to language change: with every change in a language system a new system arises (see below).

We might ask what is wrong with such a synchronically understood conception of system. There are two problems: first, in a multiplicity of systems that would thus emerge, there is a methodological problem how to discover the bonds which connect system S_1 at time T_1 with system S_2 at time T_2; in consequence, we would be unable to abstract any system model which would be more general than an individual ephemeral system. Second, if 'system' means a cognitive model limited to synchrony, then there is the question on what basis it is advanced. We assume here that a system model, if it is to be applicable to events and relationships in the field of empirical phenomena, must be essentially isomorphic with the phenomena for which it is advanced. If one of the chief

[7] Cf. Edmund Husserl's *Logical Investigations*, chapter III, vol. 2.

characteristics of the human language is its variation and changeability in time, then the system model must be able to account for that feature. And *vice versa*, if a system model is assumed to have some properties, then it must mean that the network of relations in a language for which the model is interpreted exhibits these properties. Thus, our choice of a particular theoretical system as a model enabling us to grasp and present certain phenomena is valid on two conditions: (1) it is determined by a really existing system for which the model is advanced, i.e. both systems exist, and (2) the two systems, the theoretical and the real one are isomorphic, i.e. they reveal the same properties. Therefore, we believe that 'language system' cannot be a concept limited to synchrony, although this approach is well established in post-Saussurean linguistics.

3. On the origin of the synchronic language system

Language is a system of signs – this would probably be the most frequent and ready-made answer to the question what is language. It shows to what extent Ferdinand de Saussure's legacy shaped our thinking on language. He himself defined language as follows: 'language is a system of interdependent terms in which the value of each term results solely from the simultaneous presence of the others' (Saussure 1959: 114).

Several of Saussure's assertions have been questioned and regarded as problematical or untenable, for instance his views on the homogeneity of language system, linguistic relativism and the uniqueness of each language, or lack of structure in human thought.[8] However, the claim that each language should be regarded as a system of combinatorial and contrastive relations whose elements – sounds, words, etc. – cannot be described and have no validity independently of each other has had such a heavy and long lasting impact that structuralism in this broad sense has been the most characteristic feature of several different schools in modern linguistics.[9]

Apart from being structured, another widely recognized fact about language is that it undergoes constant change. These two facts, however, have not coexisted well in modern linguistics. First, if the elements of language are interconnected and determine each other, then it is difficult to explain the fact how and why language change takes place. Second, in a structure where, to use Meillet's phrase, *tout se tient*, theoretically speaking, any change should impair to a greater or lesser degree the functioning of the system, which is not observed in practice, despite the fact that language is in a state of continuous change. That elements of a linguistic system form an interrelated structure and language constantly changes without collapsing has always been from the structural point of view a kind of theoretical puzzle. Structuralism, important as it undoubtedly was, provided linguistics with a couple of theses difficult to apply in diachronic studies of language. As Weinreich *et al.* put it:

[8] Cf. Saussure (1959: 111)
[9] Cf. Lyons (1975: 50).

> For the more linguists became impressed with the existence of structure in language, and the more they bolstered this observation with deductive arguments about the functional advantages of structure, the more mysterious became the transition of a language from state to state. After all, if a language has to be structured in order to function efficiently, how do people continue to talk while the language changes, that is while it passes through periods of lessened systematicity? Alternatively, if overriding pressures do force language to change, and if communication is less efficient in the interim (as would deductively follow from the theory), why have such inefficiencies not been observed in practice? (1968: 100-1)

The dichotomy between language structure and language change was a result of the predominance in modern linguistics, at least in the mainstream of it, of a homogeneous model of language based on the language system of the individual speaker; the approach which may be traced back to Paul's ideas expressed in his *Prinzipien der Sprachgeschichte*.[10] Much as *Course* was innovatory in relation to the Neogrammarian approach, Saussure's views on homogeneity of the object of linguistic study were not basically different from what Paul had advocated. For Saussure, speech [*parole*] is heterogeneous, whereas language [*langue*] is homogeneous; it is a system of signs in which both parts of the sign (meaning and sound-image) are psychological entities and the study of language is also exclusively psychological in nature. The grounds for that are ontological (as in Paul's theory): if language really exists and is systematic, the elements of language and relations holding between them (structure) must be located in the mind of the individual speaker.

> Language [*langue*] is concrete, no less so than speaking [*parole*]; and this is a help in our study of it. Linguistic signs, though basically psychological, are not abstractions; associations which bear the stamp of collective approval – and which added together constitute language – are realities that have their seat in the brain. (Saussure 1959: 15)
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> Synchrony has only one perspective, the speaker's, and its whole method consists in gathering evidence from speakers: to know to just what extent a thing is a reality, it is necessary and sufficient to determine to what extent it exists in the minds of speakers. […] The term synchronic is really not precise enough; it should be replaced by another – rather long to be sure – idiosynchronic. (1959: 90) [emphasis added]

The ontological obligation present in the above quotations is the reason why synchronic and diachronic phenomena have nothing in common. The synchronic phenomenon is of primary importance since it is the true and only reality to the community of speakers, whereas

> The first thing that strikes us when we study the facts of language is that *their succession in time does not exist in so far as the speaker is concerned.* He is confronted with a state. That is why the linguist who wishes to understand a state must discard all knowledge of everything that produced it and ignore diachrony. (1959: 81-2) [emphasis added]

For Saussure, a synchronic fact always requires two simultaneous terms; for example, in German it is not *Gäste* alone but the opposition *Gast: Gäste* that expresses

[10] Cf. Weinreich *et al.* (1968).

the plural. This relation *Gast: Gäste* is present in the consciousness of the speaker. In the case of diachronic facts such as the substitution of the old form *Gasti* by *Gäste* there is no opposition between the two terms present in the consciousness of the speaker. Language [*langue*] is homogeneous and 'for the new term to appear (*Gäste*) the old one (*Gasti*) must first give way to it' (1959: 85). The psychological unreality of diachronic facts places them outside the language system. In consequence, diachronic facts are isolated, independent events, and 'form no system among themselves' (1959: 94):

> […] never is the system modified directly. In itself it is unchangeable; only certain elements are altered without regard for the solidarity that binds them to the whole. It is as if one of the planets that revolve round the sun changed its dimensions and weight: this isolated event would entail general consequences and would throw the whole system out of equilibrium. The opposition of the two terms is needed to express plurality: either *fōt: fōti* or *fōt: fēt*; both procedures are possible, but speakers passed from one to the other, so to speak, without having a hand in it. Neither was the whole replaced nor did one system engender another; *one element in the first system was changed, and this was enough to give rise to another system.* (1959: 84-5) [emphasis added]

Thus, in Saussure's theory, from a diachronic perspective language as a system does not exist. This is analogical to (much later) Bunge's and Bocheński's theories of systems in which strict interdependence of elements results in the theoretical intractability of change and, in consequence, it leads to the purely synchronic existence of systems.

4. General Systems Theory

Laszlo's conception of system, by contrast to Bocheński's, does not require the system's elements to be strictly interdependent, nor is it limited to synchrony; the evidence that we are dealing with a system (of whatever kind), and not a random aggregate, lies elsewhere. Namely, there are some properties concerning systems' behaviour that any entity called a 'system' is expected to reveal.

In his preface to *The Systems View of the World* Laszlo writes: 'There is no theory without an underlying world view which directs the attention of the scientist. There is no experiment without a hypothesis and no science without some expectations as to the nature of its subject matter' (1972b: VI). The view of the world we have is basically systemic. Whenever we try to understand phenomena or objects, and try to grasp their complex nature, we tend to take them in integrated chunks, even at the cost of a simplification of the real states of affairs. Thus, we tend to talk of business companies rather than individual workers and administrators, or of football teams rather than individual interacting performers. This epistemic approach is not just a matter of convenience, but it is based on the ontological foundation that such wholes *exist*. The world is composed of systems and subsystems; they are enormously variegated: their components may be grouped into a number of levels: physical, chemical, biological, social or cognitive, but these systems and subsystems are not merely theoretical constructs imposed on the reality by scientists; they are really existing entities, and, necessarily, they exist in time. Any system model, if it is to be applicable to the dynamic aspect of the reality for which it is interpreted, must be essentially isomorphic with that reality. So it is also with the language system; it exists in reality, and hence, it exists *in time*. If there is variation in that real language and it undergoes change, then we cannot limit our understanding of 'language system' to a homogeneous synchronic model with strictly interdependent elements, in which change is virtually intractable.

According to Laszlo's theory of systems, there are four systemic invariances characterizing the behaviour of any system (1972a: 36):

1. Coactive relation of parts results in *ordered wholeness* in the state of the system.
2. The function of adaptation to environmental disturbances results in the *re-establishment of a previous steady-state* in the system.
3. The function of adaptation to environmental disturbances results in the *reorganization* of the system's state, involving, with a high probability, an overall gain in the system's complexity and information content.
4. There is *dual* functional-structural adaptation: with respect to subsystems (adaptation as systemic *whole*) and suprasystems (adaptation as co-acting *part*)

The first invariance is the fundamental feature of any system: systems are wholes with irreducible properties, i.e. wholes which are not the simple sum of their parts as aggregates are. Systemic approach puts limits on analytical procedures in science, which assume that objects or phenomena investigated can be (materially or conceptually) resolved into ever smaller units with isolable causal trains, and hence can be constituted or reconstituted from their parts put together. In a system an element cannot be understood by itself since the interrelations among elements do qualify their joint behaviour. As Laszlo put it:

> The properties of the group are irreducible to the properties of its individual members although not, of course, to the properties of its individual members plus their relations with each other. But again computing the character of the group by computing the individual properties and relationships of each member is both hopelessly complex and entirely futile. The group manifests characteristics in virtue of being a group of a certain sort, and may maintain these properties even if all its individual members are replaced. (1972b: 29)

It is clear that Laszlo's approach is different from that of Bocheński, where every element of the system being dependent on other elements constitutes the whole and cannot be replaced without changing the system itself. Also in Bunge's theory, a difference in a system's composition induces a structural difference. Laszlo's approach is more flexible; it allows of changes within the complex entity without changing its properties and identity as a whole as long as the internal structure and relations are upheld. We feel that we can disregard the unique individuality of the members of such units as long as there are certain types of members in certain proportions. Even if individual members change, the unit remains with much the same features it had before. This approach is basically not different from Bloomfield's views on language change, which might be summed up as follows: if the pattern of relations among elements remains the same, we cannot speak of any language change, even though all the elements may have changed their values - the change is insignificant so far as it does not affect the structure of the language.[11]

The other feature of the system included in the first invariance is that of orderliness. Order should be understood as (1) spatial order expressed as the 'structure' or 'morphology' of a system, and (2) temporal order grasped as its 'function', or 'physiology'. Order in structure and order in process are not in conflict but different manifestations of what Laszlo calls 'the basic orderliness of the spatial-temporal pattern of the organism' (1972a: 71). The apparent dichotomy between structure and functioning, or morphology and physiology is, in fact, a result of a static, or mechanical, conception of system; like in a machine, there is a fixed pre-established arrangement of parts that can be set in motion, or can also stay at rest. In reality, this possibility of separating between pre-arranged static structure of an organism and its functioning does not exist. A living organism, or any other open system, is a demonstration of a continual orderly process, but, on the other hand, this orderliness in functioning is maintained by its orderly structure. Yet, structure on its own is merely an ephemeral cross-section through what is a spatial-temporal entity.

The second and third of Laszlo's invariances refer to the problem how systems face the challenges of the environment. In any system there are two kinds of forces: first, fixed forces imposing some constant constraints upon the system which keep it in a so-called steady-state, and, second, unrestrained forces which may give rise to perturbations (1972a: 39-41). The fixed forces, which maintain the system in or around a steady-state are always present in a system, we might say that they keep the system running just to enable it to stay in the same place. They are successful if the perturbations introduced by the unrestrained forces do not exceed the threshold of self-stabilization. If they do, the system evolves in new directions, which corresponds to the third invariance. If both the fixed and the unrestrained forces were removed, the system would reach a state of thermodynamic equilibrium, which means death and decay. As Bertalanffy put it, for any living system life does not mean the maintenance or restoration of equilibrium but, on the contrary, life depends on the maintenance of disequilibria.[12] The particular configuration of parts and relations which is found in a self-maintaining and repairing system is called a 'steady-state'. It is a state in which energies drawn from the environment are continually used to maintain the relationship of the parts and keep them from collapsing in decay.

Implicit in the second and third invariances is the concept of the system being open to its environment. In a closed system all processes are controlled by the intrinsic set of constraints, an open system is involved in and depends on a vast range of import

[11] Cf. Bloomfield (1935: 369).
[12] Cf. Bertalanffy (1968: 39).

and export processes with the environing systems.[13] And the environment is never constant. Thus, a system finds itself in a sea of change, constantly facing environmental disturbances, with two possibilities: remain the same or undergo alterations. Normally systems tend to choose the first option. They have the capacity of self-regulation and up to a certain point , the system's control resources, i.e. its capacity for dealing with change, can maintain the parameters of the existing structure, beyond that point the system is launched on a process of change carrying it away from the hitherto steady-state.

The openness of systems involving interchange with the environment is their fundamental characteristics. There is basically no difference in this respect between physical and biological, social or cognitive systems; yet, the upper levels of the hierarchy of systems, i.e. biological systems and higher, are characterized by more unstable steady-states, which rely to a higher extent on the constant openness of the system's boundaries and the import of energy from the environment. Thus, in Laszlo's world-view all kinds of natural and cognitive systems might be described as open systems in a dynamic steady-state, which keep themselves in running condition and perform repairs should their coherence be endangered. Language constitutes a good example how a system maintains itself in a changing environment. Although most of diachronic writing is concerned with language change, the mechanisms which maintain certain structures in language are no less important and fascinating.[14]

As said above, if systems buffer out or eliminate the perturbations we observe adaptation of the system consisting in re-establishment of a previous steady-state (2nd invariance). Yet, the system may be exposed to perturbations exceeding the threshold of self-stability or to newly emerging constant influence in the environment, and then the system reorganizes its fixed forces and acquires new parameters giving rise to a new steady-state. This adaptive function of the system consists in self-organization (3rd invariance). The reorganized system need not, however, be a more stable one; it is better adapted to resist the kind of influence which triggered off the process of reorganization but not to resist *any* challenges in its environment.[15] Therefore, adaptive self-organization is not tantamount to reaching structural stability. Actually, what happens is rather the opposite. It is so because systems increase their complexity when striving to meet challenges from the environment; in systems with higher organizational structure there is more freedom which affords higher functional capacity and, hence, greater adaptive potential to cope with the changes and challenges of the environment. Thus, adaptive self-organization leads to greater complexity of the structure; this, in turn, results in the system's being more unstable[16] and liable to disorganization. We might

[13] According to the second law of thermodynamics, the state of ultimate disorganization is inevitable in any isolated system, because energy stored to keep up the organization of the components gets used up and no energies are given in limitless supply.

[14] See Labov (2001: 74-92) on the existence of stable long-term variation which does not mark a transitional station between two stages of the language but is transmitted in essentially the same form over many centuries, and is a phenomenon no less common than completed changes.

[15] Cf. Lightfoot's claim that 'grammars practice therapy not prophylaxis' (1979: 123).

[16] In Laszlo's terms: 'thermodynamically more improbable' see (1972a: 43).

describe the relation between the system's adaptive potential on the one hand, and its structural stability on the other, as that of inverse proportion: the higher the complexity of the system's organization and the wider the range of adaptive functions of modules, the lower the overall structural stability. Thus, atoms which are structurally pretty stable have rather low potential of adaptive self-organization, by contrast to highly complex and highly unstable socio- and ecosystems, whose adaptive capacity is the biggest.

We could draw interesting analogies between Laszlo's second and third invariances and Lightfoot's conception of catastrophe points in syntactic change.[17] In Lightfoot's conception of grammar (understood as a biological entity embedded in the brain/ mind of the speaker), minor changes in the input do not result in similar changes in the output. It is so because language acquisition is cue-based and parameters continue to be set in basically the same way as long as the adequate number of relevant cues is secured. Grammars do not change in spite of the multitude of minor changes that may pile up and introduce some inconveniences into the functioning of the system; these minor changes are as if ignored. Only when they add up and exceed a threshold level, or the so-called 'catastrophe point', is the system forced to react and reorganizes its structure; that is, in Lightfoot's terms, some parameters responsible for language acquisition encoded in the brain/ mind of a child are set differently, which, in turn, is manifested in various parallel changes in surface structure. And similarly to Laszlo's theory, the parameters are reset to cope with a particular local problem which is healed, without regard that this may cause opacity in other areas of grammar.[18]

Self-stabilization maintains the system in its pre-existing state of organization, whereas self-organization changes the existing structure of the system, and, in consequence, a new system emerges. This leads to the question of the system's continuing identity. The problem is difficult, but only so when the system is considered in isolation. As Laszlo put it:

> It becomes necessary to choose a more suitable strategic level in the examination of the processes and mechanisms of self-organizing systems, and this level is that of the next higher suprasystem, i.e., the system formed by the given species of systems in a shared environment. Such a system can be seen to evolve notwithstanding the change of identity of all its constituent subsystems, and it can exhibit causal factors in the system-environmental relations – leading to reorganization as a response to environmental constants – which are obscured in the individual system view. […] This is not to deny that self-organization takes place in a given system in relation to its environment, […] it is only to suggest that self-organization is better amenable to conceptualization from the viewpoint of a population of systems than it is from that of the self organizing single system itself. (Laszlo 1972a: 47)

Thus, the process of self-stabilization maintaining the system's structure is observable in an isolated system considered solely in the relation to its environment, but the processes of self-organization, which change the system's structure, can only be

[17] Cf. Lightfoot (1991, 1999).

[18] See the re-categorization of the English modals, which put an end to their morphological exceptionality but triggered off a number of further syntactic changes, in Lightfoot (1991: 141-54), (1999: 180-97).

grasped from the perspective of the next higher suprasystem. In language studies, we can observe the evident advantages of this strategy when we compare the intractability of linguistic change in the idiolect and compare it to the sociolinguistic approach to language, in which the actuation, implementation and embedding of changes, though these do take place in individual language systems, can be grasped and explained solely from the overall perspective of a speech community. As Weinreich *et al.* expressed it, 'the key to a rational conception of language change – indeed, of language itself – is the possibility of describing orderly differentiation in a language serving a community' (1968: 101).

Laszlo's fourth invariance asserts that systems form intra- and inter-systemic hierarchies. Systems are organized like a multilevel pyramid with many simple systems at the bottom and fewer but complex systems, with a wider repertoire of functional capacities at the top. The systems occupying the intermediate position constitute wholes in regard to the component subsystems and parts in relation to higher suprasystems, and thus they link the levels below and above them.

There are two basic advantages of hierarchical organization. First, as Simon showed on the basis of mathematical models, given the same number of elements complex systems evolve from simple systems more rapidly if there are stable intermediate forms, i.e. if they are hierarchically organized.[19] Thus, hierarchical systems are more efficient.[20] The second advantage, connected with the first, is that any failures that may occur in the organization of the hierarchical system do not destroy it as a whole, but it is decomposed to the next lower level of subsystems and in this way the system may rebuild in a relatively short time, whereas non-hierarchical systems disintegrate completely.

What results from the conception of the hierarchically organized system is that these hierarchies must to some extent be independent of each other. Only on such a condition can a system continue to function as a whole instead of collapsing when one part is damaged. This may appear to be inconsistent with the first invariance. However, this inconsistency is considerably reduced when we remember that Laszlo rejects the concept of a system where all elements, or subsystems, are strictly interdependent (cf. Bocheński's definition of 'system').

5. On the coherence and interdependence of elements in a linguistic system – towards biological systems

If language is regarded as a system in which each element is defined by its relations with every other element of the system, then its description would require relating all segments of language to one another. To be true, if one took this postulate literally, it would have an intimidating effect on any research and theories put forward, because even well grounded analyses would have to be treated very tentatively. However, the

[19] Cf. Herbert A. Simon, "The Architecture of Complexity", *Proceedings of the American Philosophical Society*, 106 (1962)
[20] On the advantages of hierarchic organization in the speech production process, see Puppel (1988).

claims about expanded interconnections within the language system (rooted in Saussurean structuralism) left its unmistakable impress also on the understanding of language change. Although Saussure himself most probably would not have approved of such expansion of structural principles (see above), many linguists found thoroughly acceptable and accurate what Jakobson wrote, namely, that 'every modification must be treated as a function of the system in which it is a part. A phonological change can be understood only by elucidating its role within the system of the language.' (1978 [1931]: 103)[21]

Those who aim to emphasize the systemic and structured nature of language see nothing wrong in such rationalistic deductions. The more structure is postulated in language, the more elegant and coherent the linguistic theory appears to be. However, the assertions about expanded interconnections within the language system and their relevance to language change are based on deductive principles which may prove wanting in the face of evidence. To believe that language is a system where everything is closely interrelated is a matter of conviction, whereas the history of some real languages points to a different view of language system. Linguistic phenomena such as relexification of languages, 'mixed' languages or syntactic convergence prove that even major shifts in one of subsystems are possible and the overall system continues to function with the other sub-components relatively intact.[22]

The problem of mutual interdependence of language subsystems has been at the core of the so-called 'regularity controversy': whether sound change, which is the major force of language change, operates on sounds or on words. The crucial question here is whether sound change is solely phonetically conditioned and affects all phonetically relevant lexical items uniformly, as the Neogrammarians claimed, or, as in the lexical diffusion model, the implementation of sound change is not lexically uniform and is also conditioned by such factors as the frequency of words comprising the relevant sound and their role in the grammatical system, the tendencies to avoid homonymic clashes or to maintain useful grammatical distinctions. According to Labov (1994), the regular sound change of the Neogrammarian type dominates; sound changes which diffuse from word to word are in minority. Moreover, as it appears from Labov's account, even these diffusing changes are also exclusively phonetically conditioned because what decides about their irregular spreading across the lexicon is their phonetic complexity, i.e. the fact that they involve simultaneous changes in a couple of phonetic features; it is not their meaning or role in the grammar system that are at play. Thus, the major 'doer' of language change is determined solely and autonomously within the sound subsystem of language, without any regard to the consequences in other subsystems. Such a system, in which changes most essential to its development occur autonomously within one of the subsystems can hardly be viewed as closely interrelated.

Perhaps the most fundamental question to answer is why such a system as language, which is supposed to be a functional device enabling humans to communicate,

[21] Cf. also Hockett (1958: 448): 'a change in *any part* of a phonemic system alters the structural position of *every* form in the language'.
[22] Cf. Hymes (ed.) (1971), Gumperz, Wilson (1971), Thomason, Kaufman (1988).

tolerates variation and change; it would certainly be more functional and purposeful if languages did not change and did not split into unintelligible dialects. The problem is that all systems which are not durably fixed in a physical matter must reproduce in order to survive – this refers to biological organisms and also to symbolic systems like language. Such systems never reproduce with a perfect success; if they did, we would observe no change in the world.[23] Perfect reproduction is not possible since languages evolve in history, and, however dysfunctional this fact might seem, their historicity implies change. The characteristic feature of each historical process is that it does not repeat itself. Any system evolving in time depends on initial conditions, and in the case of open systems interacting with their environment it is inevitable that these conditions are never the same. This is essential in Bertalanffy's and Laszlo's views of the system: the system is not characterized by a static equilibrium, but by a continual struggle of various forces which keeps the system in a dynamic steady-state. Therefore, two systems which develop in similar but not the same environments are sooner or later bound to diverge.

The imperfect reproduction forms the history of a system and is a source of massive variation. Some of these reproducing errors may be picked up by a speech community and further transmitted as a linguistic change. The rest forms linguistic junk, which is insignificant for the operating of the human language, but is always there; languages tolerate such redundant and purposeless elements. In fact, redundancy is nothing exceptional in the world; to take a biological analogy: genomes of various organisms consist of genes which are crucial to the development of the organism, and also of genes which mutate, but do nothing in the organism; they do not encode any information nor does their mutation threaten the identity of the organism. Yet, the sheer fact that such a store of useless material exists gives the organism wider evolutionary opportunities. It is not the 'aim' of such useless material to provide these opportunities, but it does provide them because it is there and may eventually come in useful.

Languages are redundant in a similar way: they produce enormous amount of redundant variation, but these variants are not there to enable the language to change, nobody introduces new variants *in order to* create an opportunity for language change. Yet, change is possible because there is variation; linguistic change does not produce novelty out of nothing, it is a process of reworking and transforming what is already in language and combining old parts into new shapes.[24] However, as said above, most of variation does not lead to language change; particular variants arise locally and disappear, conditioned by various minute and unimportant factors; only some of that linguistic junk may stay for longer in the language system when a novelty is picked up by some speakers.[25] But still, its fate is not settled yet, it may develop or disappear, and its development or disappearance are not important for the system because the role of such a novelty is too peripheral to be noticed, or, we would say, its role is close to none at all. It is as in Laszlo's second invariance: systems return to ordered steady-states

[23] Cf. Hockett (1965: 203-4), also Lass (1997: ch. 6, 7)
[24] Cf. the theories of exaptation in biological evolution.
[25] On the mechanism of the implementation of sound change, see Labov (1972, 1994, 2001)

following perturbations introduced by the environment. Here we reject the concept of 'orderly heterogeneity' (cf. Weinreich *et al.* 1968) in its strong version, which says that all variation is structured, i.e. each linguistic variant is conditioned by specifiable social or linguistic factors and has a relevant placement within the system that is not dictated by chance. This view on variation is not quite correct. Even less compelling is the view of a Saussurean system where 'everything holds together'.

In any open dynamic system, and we consider language as such a system, we do not find full coherency based on the significance of each particular element. As said above, in Laszlo's conception, the identity of particular elements in a system is not important for the maintenance of the system, or, we should rather say, not all elements in a language system are equally important, some are not important at all, and there is no need for every element to count. A neat and purposeful organization of elements is characteristic of man-designed systems such as a car or a computer, where every element is *for* some purpose and all elements co-work. Language is not such a rationally designed system.

There are countless examples of, for example, biological systems which are not perfectly orderly and purposeful in their organization; they have ill-fitting parts, but, nevertheless, their systemic character as wholes is never put in question. Humans, to take an example, have wisdom teeth, partly hair-covered skin, appendix, which are all purposeless parts of our organism, and yet, the human body is (rightly) regarded as a system, which works and reproduces itself transmitting these poorly adapted parts to future generations. Redundancy in language systems is crucial because if it did not exist, and languages were perfectly orderly and rational systems with mutually dependent elements, there would be no possibility for such elements to mutate freely, to produce variation and to change without impairing communicative capacity of the language.

6. Conclusions

Our two chief assumptions in the article are that systems exist in reality and, second, that system models advanced for describing that reality must be isomorphic with the really existing systems. Since real systems exist in time, are open to environmental influences and heterogeneous in nature, theoretical models must also reveal these properties. Hence, we reject such understanding of the notion of 'system' which focuses on the interdependence of elements in the system and makes variation and change in a system theoretically intractable.

Language is a non-physical, reproducing system which is means for communication for people, and, therefore, it must be 'shared' by its users. If it were not shared, the uniqueness of each idiolect would impair communication – this is not observed. Therefore, we must agree that the language of a speech community is to a considerable extent stable and resistant to change (2^{nd} invariance). On the other hand, we know that in language there is massive variation dependent on various more or less important factors – an inevitable result of imperfect reproduction of an open system. These are two undeniable facts about language. Therefore, if we understand 'language system' as a really existing entity, which maintains a considerable degree of 'sameness', and, at the same time, we take into account its variation and change, then it is only reasonable that not all elements of that system are perfectly coherent and equally count. Also, it is obvious that we cannot uphold the idea that in a system all elements depend on one another (cf. Bochenski's definition of system or the structuralist view of language where everything holds together). However, variation in a language system is not incongruent with Laszlo's systems theory. In his view, let us recall, systems are 'ordered wholes', ordered in structure and ordered in function; but, at the same time, systems produce random mutations and variation and their elements are replaceable.

What makes 'language system' a system is the property that it keeps that random and purposeless changeability under control, so that it reveals two-kind adaptability: self-regulation and self-reorganization, and thus it does not collapse in its communicative functions. Inventions and mutations on the level of an individual language system are indeed random and plentiful, and chance alone determines which system produces what invention at which time, but still on the whole, they are produced fairly regularly, and some inventions prove more compatible than others with the behaviour of the environing systems. As a result, on a higher level out of that chaos there emerge certain coordinated patterns. The crucial factors in the evolution of any system, including language, are adaptation to environmental challenges and coordination with the behaviour of other systems in a shared environment. As Laszlo expressed his views on the direction of systems evolution:

> Adaptation becomes the key function of evolution, without assuming the randomness of the process as a whole. Rather evolution is the outcome of the interaction of populations of systems and their environments controlled by the adaptive capacity of the former. The basic concepts of random mutations and subsequent natural selection are not discarded, but integrated within the holistic context of evolving systems populations. (1972a: 92)

It is important to assume such ontology of language which would allow us to consider these phenomena from a perspective higher than the individual language system; by this we mean the heterogeneous language system of the speech community. Only on that suprasystemic 'social' level can the language system maintain its identity in spite of the fact that reorganizing changes (3rd invariance) give rise to new individual language systems. This, in turn, allows the language system to exist *in time*.

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