

**THE SIMILARITY BETWEEN CARTOGRAPHIC AND THE NATURAL  
LANGUAGE, RESULTING FROM THE TWO-LEVEL NATURE OF  
CARTOGRAPHIC CODE**

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**Summary:** *The author views a map from the point of view of the general theory of signs and questions connected the psychophysical form of the image of map in the mind of both creator and receiver, against the background of the general process of communication between people. He states that the map took shape primarily from the need to act as a communiqué. Its main task is to transmit information concerning the spatial location of objects, phenomena or relations, together with their qualitative-quantitative characteristics, of interest to man. The tool of man's mind, with the aid of which this communiqué has been created, should be called the cartographic language. It is perceived as a two-level code (such as is the natural language). Its two-level nature arises from the syntactic dependences which reflect spatial relations and the formal differentiation of objects in reality. The model character of a map is the result of adopting the constituent rules of the cartographic language. The summing up of the paper is the statement that cartography can be considered in linguistic categories, and a map - in the categories of a textual work in cartographic language.*

The need to transmit information concerning the situation of objects, phenomena or relations of interest to man, and occurring in the surroundings, resulted in the devising of maps. Initially they were similar to pictures in which iconic signs representing the objects mentioned were situated in approximate positions. Simultaneous with the development of mathematical sciences and measuring methods, these signs began to be located on the surface of maps more and more accurately. The signs themselves also changes with time. They began to be unified, the legend of the maps defining what they concerned. A certain specialistic "writing" emerged, this containing a specific number of unified stipulated graphic signs, together with a certain number of mathematical-logical regulations defining the manner in which the signs should be inserted on the plane of the map.

It should be brought to mind that every object or phenomenon noted by the senses, which communicates not only itself, but thanks to the meaning given to it, substitutes some other element of reality, is called a sign. The term meaning (semantic essence) used here, should be understood in psychological categories [12], as a unit of memory occurring in the human mind, the mental content of which determines a concrete notion, which in turn, consists of memory traces

and system of connections occurring between them. Memory traces are defined as hypothetical units of retaining in the memory of experiences of human senses, arising as the result of direct reactions to concrete stimuli from the environment. In turn, a mental image created in the mind of man appears, in turn, as a certain structure of connections of memory units, reflecting the true or created (by intellectual processes) state of the surrounding reality, appears. Reasoning in these categories, each sign is received in two ways. First, as an object (or phenomenon) observed, the shape and form of which give rise to specified direct experiences of human senses. Secondly, as an object, phenomenon or relation, resulting from the semantic essence secondarily activated on the basis of previously declared connections. These are defined as mental processes taking into account concrete dependency rules. Each sign is thus a physical conveyor of additional mental contents, comprising a different meaning, generally accepted by the given group of society.

Worthy of particular note is the fact that all the objects, phenomena or relations taking place in the surrounding reality are always presented on maps by means of graphic signs. They contain quantitative-qualitative information referring to objects, phenomena or relations, as well as informations as to the spatial location of the same objects, phenomena or relations (resulting from the placing of the corresponding signs on the surface of the map) [1].

The shape of the sign may show similarity to that of the object it represents. This is the so-called isomorphism of figures. As a rule, the isomorphism of figures, together with the isomorphism of position (illustrating the relation of the position on the map depending upon the position of the object represented in the terrain) and isomorphism of contents (expressed in the relationship of facts) suggests synonymity in the examining of the map as a model.

Having in mind the general theory of models, it could be said that "a map is a model of the structure of spatial information on reality" [32]. Cartographic models should have features proper to all scientific models: a) models are systems; b) models are always related to some original (reality); c) every model has practical advantages as compared with the original (ease of manipulation).

Apart from this, assuming the assumptions of cognitive realism and referring to semiotics, one can also treat the map as "a specific model of reality" [17], functioning as a means of its recognition. In view of the relation to the recipient, a map is "a pictural-notional model", as during the process of using the model, a sensory image of reality appears in the mind of the recipient. Its visual method and mensurability is related to the illustrative character of the cartographic model, where as its notional character is illustrated in the relations between elements of the model and the ideas they represent.

However, as already mentioned, the map arose primarily from the need to transmit chorological information, i.e. the need to fulfil the rôle of a communiqué. This is its main aim and task. The insignificant use of the natural language to create this type of communiqués resulted in the

inventing of a special code, or mathematical-logical rules and graphic-relief signs enabling the creating of special graphic signs and the setting up of these at suitable points on the graphic „notation“, i.e. map created by means of this code. The model character of the map is the outcome of the adopting of the code. It facilitates the easy recording of chorological information and its speedy reading. This code is often called the cartographic language, and the graphic signs - cartographic signs. Is a code so designed rightly called a language?

The term „code“ is used for all systems of signs serving for purposes of communicating. This is a primary term in relation to that of „language system“.

Codes can be natural and artificial. The natural are the biological provisions of various species of animals and serve communication between and inter-species. So far, the artificial are only those created by man and serve communication between people and man with inanimate systems of data processing.

Another division of codes is the division into single- and two-level codes. The single-level code is a group of signs as material objects and meanings corresponding to these. The single-level code includes two components of each code: the material structure (material surround, form) of signs and their meanings (semantics). If to these two components of code is added a third - syntax, then such a code will prove to be able to produce new signs in infinite numbers. It becomes a two-level code. This double articulation is treated by linguists as a specific feature of natural human languages. Thus, if it is established that apart from syntax, the components include also material structure and meaning, the code can then be classed as two-level. Its name can also include the term „language“, thus emphasizing the similarity of the code to natural languages.

To understand the task fulfilled by syntactical dependencies, one should observe the overall-mechanism of exchange of information between people by means of language.

In the process of communication between people, a mental image is created in the mind of one person and is then transmitted to others. The natural language, fulfilling the role of a tool of human mind, enables the creating of the description of a mental image, where the whole mental contents are „divided“ into numerous parts corresponding to the particular meanings of elementary ideas. This is followed by perceptible language units containing these mental contents. Language units are arranged in a linear series known as the language text. In other words, the language text is the conveyor of the mental contents of a mental image created by person producing the text. The text may be preserved and stored. The person perceiving the text by means of reverse mechanisms of the natural language, extracts and assimilates the mental contents, building in his mind a mental image conforming with the original.

In written texts it is easy to observe the two-level character of natural languages. On the first level of articulation from letters - graphic forms of elementary sounds of speech, as yet without meaning, we obtain words - language signs of elementary meaning. At the second level of articulation, thanks to the rules of syntax, sentences are formed. The meaning of a sentence is not

the simple sum of the meanings of the expressions contained, but also the rules of syntax adopted. The meaning of words arising from social conventions. They cannot be created freely. On the other hand, the meaning of sentences is formed during the realisation of the text. The list of words in a given ethnic language constitutes a complete series in a specifically defined time, where as the number of sentences possible in the language is, for all practical purposes endless [12].

The problems of the syntax of map language was variously formulated. J. L. Morrison still turned attention to the syntactic structure of symbolism, which was defined as "formal relations taking place between various kinds of graphic expressions, corresponding to the classification of data elements according to a scale of measurement" [28]. A. F. Aslanikashvili [1] treated the syntactical structure of the cartographic language as a reflection of structure of a concrete area, i.e. the relationship of the mutual distribution of a system of lines, points and surfaces corresponding to the spatial location of objects in the field studied.

Two years later, L. Ratajski [28], taking into account "the conscious formulating of a communiqué by a cartographer and the understanding of the information by the user of the map", defined the range of syntax of the map more extensively. He turned attention to the "specific language of the map, which results in each cartographic expression containing both existing and potential information. The former is contained in the signs inserted on the map and is restricted to the number of such signs. The potential information, however, is not revealed by the signs, but results from their distribution and meaning (...). The range of this information is unlimited and depends upon the interpretative abilities of the map reader".

According to Ratajski "in cartography syntactical dependencies define the formal composition of a map, leading to simplicity and cohesion of the configuration of its contents. These also concern such relations between cartographic signs as resulting, inconsistency, relations between elements of a complex expression, etc." If the syntax is understood to be "a series of rules of forming expressions and their conversion" then these rules on the map define how to join single expressions-signs into a more complex whole. Rules of deduction, e.g. those of separation and substitution are also adopted.

Ratajski emphasized that "several conformities result from the syntactical dependencies, e.g.:

- conformity of mutual distribution of signs on the map, with the same distribution of corresponding facts in reality;
- conformity of the system of cartographic coordinates with that of geographical coordinates;
- conformity of distortion of the size of objects with the scale of the map;
- conformity of distortion of the surface, angles and distances with the projection accepted;
- conformity of the method of cartographic presentation and the shape of signs, with the degree of generalisation of contents adopted;
- conformity, with reference to the given map, of potential and existing information."

A. A. Lutyj [14] presented a concept of map language, into which he introduced two additional concepts "sublanguage I" and "sublanguage II". With the aid of these he takes into account the spatial structure of the map, thus illustrating the similarity between the natural language and that of the map. The syntax is understood by him as a series of dependencies between cartographic signs (connected with the reality described), which should exist in order that given record on the map be acknowledged as correct.

The works of another cartographer - J. Pravda [19,20,21,22,23,24,25,26,27] - also indicate the great similarity existing between the cartographic and natural languages. Simultaneously, the existing differences which he observes, induce him [26] to state that the "language" concept should be differed from that of "linguistic" in the cartographic code. The difference in terminology is to consist in the fact that applying "linguistic" the concept of the cartographic language is brought closer to the natural language, which, however, according to Pravda, does not take place. The rules of grammar on various levels of articulation in the system of the natural language, do not correspond to similar rules in the system of cartographic language. This difference is to have resulted from the fact that the structure of transmitting information in the natural language is of a linear character, and in cartographic language - spatial. Thus, as this embraces the idea of the cartographic language to a greater extent, he proposes that the concept "language" be used.

Indeed, the syntax of a map is more complex question and differs considerably from that of the natural language. The manner of joining words in a sentence differs from that of cartographic composition, having the meaning of an opinion. In the natural language words are set out linearly (one after the other) in suitable sequence also being given various morphological and derivational forms, simultaneously being given certain syntagmatic relations. On the map, marks are arranged (and perceived) spatially over the whole surface, their position depending upon that of the objects or phenomena represented, in reality, which the map reflects. The syntactic dependence can be noted in the position of the signs on the map, their density, distribution in relation to neighbouring signs, complexity and graphic features of the signs (treated differentiating elements). They are the reflection of spatial relations and formal differentiation of objects in reality. Thus the model character of the map is the result of the syntax of the cartographic language.

The use of any language takes place in a particular social situation and constitutes a certain organized whole, having a beginning and an end, as well as an internal structure. The whole is defined by the term discourse [12]. The discourse may be a dialogue or monologue with its different types: the issuing of instructions, describing of occurrences, conducting lessons in school, transmitting of concrete information, etc. The different types of discourse are subject to different socio-linguistic and stylistic rules (those of conversation, discussion, construction of narratives, writing of letters, etc.) composed of the greater or lesser knowledge of the persons

participating. They are also the subject of social awareness and may assume highly codified forms (textbooks for rhetoric or stylistics, behaviour in court, etc.).

As the language text produced constitutes the realization of a discourse, it is subject to the grammatical rules of the particular language, as well as the socio-linguistic and stylistic rules obligatory when adopting the given type of discourse. The text of the discourse may be called a textual work. This constitutes, as it were, a certain whole as regards form and contents. As from a short while ago, some linguists state that „it is a unit of language which is larger than a sentence” [3], as it is created on a higher level of articulation. Textual works include: treatises, theses, literary works, publicistic articles, lectures, communiqués, letters, etc. The outcome of this opinion is the development of the discipline names "linguistic genology" [7,8].

When using a map, one has to deal primarily with the process of exchange of information between the person who made it and those using it. In this process, a mental image of the true picture of spatial described reality is first formed in the mind of the author, then in relation to this, objects, phenomena or relations which awaken interest are defined. In order to create a description of the mental image, the author of the map should have at his disposal such collections of signs and rules as to enable a fairly detailed definition of the spatial situating of the objects, phenomena and relations mentioned, as well as their quality-quantity characteristics. By means of cartographic signs and rules contained in the cartographic language, separate elements of the mental image which transmit only part of the information, are presented. As compared with a communiqué conducted by means of the natural language, it can be said that one has to deal with separate means of communication. It is only when all the information joined into one whole in accordance with specified rules, that we have a corresponding communiqué. Thus, the map as a finite collection of individual statements, completed with the aid of the cartographic language can be called a "cartographic communiqué" in the form of a "written" text. In order to be able to extract and absorb the information contained in the cartographic communiqué, the user should employ the same tool of the human mind, i.e. the cartographic language.

Summing up, it can be stated that cartography can be considered in linguistic categories, and the map - in the category of a textual work in cartographic language.

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