

Theoretical cartography structure, connections, functions

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Abstract:

Modern cartography is presented in several aspects a) academic science, b) production and system of technological means, c) methodological system, d) branch of art, and e) military branch.

Cartography as an academic science has its general theory - the doctrine of the subject, method, and language. Theoretical cartography is a complex logical and methodological system. The research object of cartography is the spatial relationship between the spatial reference system (Ssys) and various objects and phenomena of reality (O₁, O₂, O₃, . . .) at a certain moment or period of time (Rst).

The study object of cartography can be represented as the following set:

$$Rst [Ssys, Sp, Sl, Sa] \quad (1)$$

It is a logical and mathematical model of the subject of knowledge of cartography and is very important for a further theoretical understanding of the specifics of cartographic science and identifying its unity with geography.

The formula for adequate display of the object of knowledge of cartography can be represented as the following set:

$$R'st [S'sys, Sp, Sl, Sa] \quad (2)$$

This is a set of spatial relationships between the following mappings: a spatial reference system (Ssys), signs localized in points (Sp), lines (Sl), and areas (Sa).

This formula is a fundamental logical and mathematical model of a cartographic model. It, as a linguistic image of reality, includes all the semiotic aspects of the map language: syntactic, semantic, sigmatic, and pragmatic, Aslanikashvili (1967). The syntactic aspect expresses the spatial relationship between the display of the spatial reference system, points (p), lines (l), and areas (a). In this way, it shows purely spatial relations without the content of the objects, on a strictly defined scale of space. This scale simultaneously acts as a degree of abstracting (simplification, bringing the imagery from more specific to less specific). The logical-mathematical model of syntactic relations is expressed as a set:

$$Rsynt [S'sys, p, l, a] \quad (3)$$

Traditionally understandable cartography in its theoretical comprehension (but not in practice) was silent about these relations, and thus the main epistemological meaning of the map and cartography in general eluded it.

The relationship of signs with the meaningful side of the objects that they denote, i.e. with the content meaning, is called a semantic relationship (Rsem). Symbolically, it can be expressed in two versions, the direct and inverse relationships:

$$Rsem (s, n) \text{ and } R'sem (n, s) \quad (4)$$

s - a cartographic sign in these mathematical expressions is meant in its general form, localized in point, line, and area.

The sigmatic aspect of the linguistic sign differs from the semantic one, by the fact that it conveys the relationship of the sign not to the thought, not to the content value (n), that expresses the content of the object, but to the object itself (o), which it (the sign - s) denotes.

Symbolically, sigmatic relations can be written as follows:

$$R_{\text{sigm}}(s, o) \text{ and } R'_{\text{sigm}}(o, s) \quad (5)$$

These symbolic expressions reflect the relationship between the linguistic signs (s) and the objects (o) they represent.

The relationships between the cognizing subject and signs are called pragmatic relationships. The pragmatic relationship during the functioning of the map language represents bilateral relations between the people (M) who produce, transmit and receive cartographic signs (s) and these signs:

$$R_{\text{pragm}}(s, M) \text{ and } R'_{\text{pragm}}(M, s) \quad (6)$$

In these relations, everything that is connected with the function and target direction of the created map is apparent. Here it is important to consider for whom the map is being created and what thoughts, ideas, and even behavior it should evoke in those who will use it.

The scale function is actively depicted in the semiotic aspects of the map language: 1) In the process of depicting a specific space, the degree of abstraction (scale of the space) of the reflected object (the specific space) is actively functioning, which is directly related to the change of the map scale. 2) In the process of depicting the mapped content (theme), the degree of generalization (scale of content) is actively functioning, which is also directly related to changing the scale of the map. 3) In the process of depicting the dynamics of events, the degree of generalization of the development essence of the cartographic event (time scale) actively functions, during which the scale of the map can remain unchanged, Gordeziani (2012).

So, the traditionally understood cartography, willy-nilly or not, was losing the principally necessary feature of a cartographic, model image. What was lost was that the subject of scientific modeling in this image is a completely real, concrete space of objects and phenomena of objective reality.

After identifying the essence and cognitive role of map language, it becomes possible to theoretically understand the cartographic method of scientific research as a unified system of cartographic forms and logical methods of cognition.

Cartography is the methodological basis for all sciences that study the subjects of their research in relation to a certain territory. The cartographic method of research connects cartography with these sciences, and they, together with cartography, explore their subjects of knowledge, Aslanikashvili (1981). In this sense, the branches of thematic cartography somehow "seat" in the essence of these sciences and are the logical and methodological foundations of their systemic unity.

A striking example of this is geographic cartography, which is not an integral part of geography as a system, but the logical and methodological basis of its systemic unity. The cartographic method of cognition consists of the following cartographic forms: comparison, analysis, synthesis, abstraction, generalization, and modeling, Aslanikashvili (1968), Aslanikashvili (1974). These cartographic forms as a whole serve a complex process of displaying a specific space and the content of reality.

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