Gnomon of Solar Hours Calendars—The Ancient Instrument of Orientation in Space-Time, a Key of a Labyrinth and a Basis of Modeling of the World

Alina PARANINA¹ and Roman PARANIN²,*

¹,²Herzen State Pedagogical University of Russia, St. Petersburg, Russia

*Corresponding author

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Abstract. The article presents the author's concepts of labyrinth-gnomon and information modeling of the world, based on the leading role of solar navigation (orientation in space-time by the sun). The concept was developed in the course of comprehensive research on the main patterns of use of information resources (semiotics) during the exploration of nature of geographical space by humans. The objects of study were the monuments of ancient material culture of European Russia and Southern Siberia. The applied field research methods (survey, description, observation, work with maps) and Earth remote sensing, as well as methods of mathematical, conceptual modeling and mapping. Theoretical analysis is based on the theory of reflection and systemic and chorological approach, methodological statements of historical geography by V.I. Paranin [1,2].

Introduction

It is well known that the energy of the sun maintains more than 90 % of all the processes on the surface of the Earth. Sunlight at different latitudes of the globe at different angles creates geographical zoning of the Earth, which is evident in every aspect of living and inanimate nature, determining the quantity, quality and dynamics of material and energy resources. However, the mode of surface illumination provides all life forms with another important resource - information about the space-time development, whose adequate reflection guarantees survival and development.

Observation of sunrise/sunset and fixing of astronomically significant points on the horizon line by establishing visual communication with elements of the observation site, its near and distant surroundings, has been called direct sighting in horizontal astronomical observatory. Depth of tradition, development and application of this technology are reflected by a diversity of monuments of megalithic culture. But these marine navigation methods initially had a limited use (only on shore), so a more developed technology was back sight movement of the sun shade on a vertical or inclined Polaris subject—gnomon that were used before the advent of modern navigation tools [3-7].

Analysis of the descriptions and images of sundial calendars in literature, spoken folk tradition, studies on the history of optics showed that the gnomon could be a staff, spear, rod, scepter, mast, anchor, as well as the human’s height in correlation with the measured length of foot and even shade of the palm in relation to the length of one of the fingers. Calculations of the annual amount of shadow of the gnomon at different latitudes showed that encoding of motion of the Sun through the shadow of the gnomon geometry paves the way for the formation of character, genetically related to the diversity of incarnations of space-time [8-13].

Versatile determining of the quality of the object referred to by its position in space-time contributed to development of this form of information encoding. In contemporary research on semiotics a method of comparative analysis of different quality characters as elements—within the established system—is used.
Objects and Methods

The objects of study were the monuments of ancient material culture of European Russia (siedis, menhirs, stone labyrinths). From 2009 to 2016 the objects located on coast of the White Sea are investigated: in the archipelago of Kuzova, in the archipelago Solovki, in the gulf Keretsky, in the gulf Kandalaksha, in the mouth of the river Umba (Fig. 1-5).

Figure 1. Labyrinth with a stele in the archipelago of Kuzova.

Figure 2. Labyrinth No. 1 Big Zayatsky Island of Solovetsky archipelago.

Figure 3. Keretsky labyrinth, island Red Luda.
The applied field research methods (survey, description, observation, work with maps) and Earth remote sensing, as well as methods of mathematical, conceptual modeling and mapping.

Theoretical analysis is based on the theory of reflection and systemic and chorological approach, methodological statements of historical geography by V.I. Paranin.

Results and Discussion

Gnomon as a Key to Labyrinth

The proposed concept of a labyrinth-gnomon—an orientation tool in space and time—conveys possible usage of a bispiral labyrinth as a sundial, compass and calendar. The shadow of the vertically adjusted object in the centre—a gnomon (from Greek—*indicator*) reflects the daily and annual movement of the Sun. Aggregate daily shadow has the shape of the fork and reminds horns or wings.

Calendar changes in the geometry of shadows conform to the structure of the figure of the labyrinth and can be used to refer to the seasons: the first from the center of the arc corresponds to the short shadows of the summer solstice (next to it are the shadows all the summer months, which is consistent with the title this season in many European languages)

The second arc corresponds to the equinoxes (separating the two main seasons, the first of which—the summer, and the second—winter), the last, eleventh arc corresponds to a time, close to the winter solstice. Twelfth of the arc at a latitude close to the Arctic Circle was not used, because noon shadow in the days of the winter solstice was far removed from the center of the labyrinth, for its observation is more suitable vertical screen of the stones - the northern addition (Fig. 6, B).

In more southern regions where winter sun does not descend so low, and shadow is shorter, the extreme edge corresponds to the winter solstice, and the total number of arcs 12 and 7—in the classical forms of rational five arcs can be used twice.
Gnomon as a Key to Information Modeling of the World

The development of this level of technology required to use backsight by shadows—all double-substituted lighting objects and, in fact, - the very light. The diagram of shadow of the gnomon for the year represents a Labrys—Bilateral horned ax of gods - creators of the world (Fig. 7, C).

According to one definition, a labyrinth is the house of Labrys. However, on the same basis you can draw graphics and other sacred images of Time: Lotus - the day of gods and equivalent of year, the many-armed Shiva, whose six hands correspond to azimuths division of year to the astronomical seasons (sunrise/sunset at the equinoxes and solstices). Marks of the position of heights of gnomon’s shadows per day contain a fork and consistent forms of drawing creates a graph, comparable to widely distributed in the ancient art of various attributes of the gods according to structure and contour: the wings of birds (individual lines represent feathers), caudal fin of fish (lines represent fin rays), bulls horns (lines represent annual growth).

Thus, the encoding algorithm can be represented as a series of «natural process - sign – image». If you give a new definition of these concepts: sign is a graphical record of the natural process, image is an artistic interpretation of the sign, myth can be defined as the image-recording scene of a natural process.

A sign is concrete in terms of content and abstract in terms of form. Image is available for mass knowledge, easily replicated and transmitted, but not for representatives of urban culture, divorced from nature, it is abstract in terms of content, as the astronomical instrument. Of course, the myth bears not only a description of the real nature of the process, but also an admixture of mysticism - as any attet to describe the fullness of integrated but not fully understood process.

Figure 7. Gnomon (A) and geometry of its shadows: per day (B) and per year (C).
Conclusion

Gnomon, being an ancient astronomical tool for orientation in space-time, allows to: 1. distinguish the natural basis for all existing sign systems; 2. solve the problem of the humanities (archeology, ethnography, philology, semiotics) on a rational basis; 3. see the solar sources of culture.

References