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GNOMONIC TERMS IN THE SERBIAN LANGUAGE

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Abstract: In Serbia, as in many other European countries, there has been a widespread revival of interest in gnomonics in recent decades. An increasing number of sundials and a growing number of publications on gnomonics demonstrate the popularity of sundialling. Accordingly, it is interesting to find out which gnomonic terms are used, when they appeared and how they developed. In Serbia (and the countries formed after the disintegration of the former Yugoslavia), societies of gnomonics enthusiasts do not exist and therefore it is not reasonable to expect any concern intended to preserve gnomonic heritage or the existence of the gnomonic terminological system. This assumption has been confirmed by the analysis of publications in the field of gnomonics published in the Serbian language. Due to unfavorable historical circumstances in the Balkans, Serbian scientific terminology began to form rather late (19th century) and the first gnomonic terms appeared at the beginning of the 20th century. They were introduced in the articles of the Serbian astronomers, professors Milan Nedeljković (1902) and Vojislav V. Mišković (1930/1932). However, most of these terms have not been preserved. Contemporary gnomonic terminology is multidisciplinary, and when the terms belonging to neighboring sciences are removed, a small number of gnomonic terms remains. Among them, the following four are the key ones: *gnomon, gnomonic projection, sundial* and *gnomonics*. In this paper, a modified definition of the most important term — gnomon has been proposed as well as the definitions of all other key gnomonic terms related to it.

Keywords: gnomon, gnomonics, gnomonic projection, sundial, mathematical geography

Introduction

In recent decades, interest in gnomonics has increased in a new form through the activities of sundial societies in Europe, thus acquiring a systematic approach. Such societies exist in eleven European countries (Nosek, 2009) as independent associations, such as The British Sundial Society (UK) and the Asociación de Amigos de los Relojes de Sol (Spain), or within national astronomical societies, for example, the Commission des cadrans solaires — Société Astronomique de France and Gnomonicae Societas Austriaca — Arbeitsgruppe Sonnenuhren im Österr. Astronomischen Verein (Austria). The oldest society of gnomonics enthusiasts was founded in 1969 by the Unione Astrofili Italiani, which has ten

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branches throughout Italy today (Nosek, 2009). In the neighboring countries, a sundial society exists only in Hungary.

These societies study and restore old sundials, design and mount new ones, hold symposiums that include thematic excursions, issue journals and other publications from the field of gnomonics. In Serbia, a sundial society does not exist, a fact that can be described by the same comment that professor Vojislav V. Mišković made between the two world wars, comparing the activities of astronomical societies abroad and in Serbia: “We do not have it yet, but not because people are not interested and refuse to be engaged, but because nothing has been done in this direction so far” (1930, p. 6).

The growth of popularity of sundialling is evident in the number of sundials mounted in public places throughout Europe (Pantaneli, Bressan & Comini, 1998). At the beginning of this century, thirty stationary sundials were registered in Serbia, while in 2017 this number exceeded one hundred (Tadić & Prnjat, 2016; Tadić, 2018). This is still more than thirty times lower than, for example, in Austria (Schwarzinger, 2006), but the relative increase in the number of sundials in Serbia is much higher. The popularity of gnomonics is not reflected only in the number of new sundials, but also in the number of publications in the field of gomonics. Taking into consideration bibliographies (Aked, 1997; Aked & Severino, 1997), the number of such publications has been constantly increasing since the second half of the 20th century. In the latter of these bibliographies (a total of 9500 entries), for example in 1950, 24 titles were registered, in 1960, 42, in 1970, 53 in 1980, 105, and in 1990, 247 titles. In addition to articles published in journals, which are the most numerous, there are monographs dedicated to theory and practice of gnomonics, bibliography lists, catalogs and dictionaries, in printed or digital form (some in both forms). Among recent monographs, the following two should be noted: on ancient sundials (Schaldach, 2006) and on medieval sundials (Arnaldi, 2011).

With the increase of membership of the societies of sundial enthusiasts, the need to edit and explain gnomonic terminology has intensified. Dictionaries of gnomonics began to be published in journals in sequences, added at the end of monographs or posted on personal websites (Severino, 2004) and websites of sundial societies (The BSS Sundial Glossary, 2018). The aim was to standardize gnomonic terms and avoid confusion in their use. In Barcelona, for example, a multilingual dictionary of gnomonics (Vallhonrat, 2000) in eight languages with 378 terms was published. The entries are in the following languages: Catalan, Dutch, English, French, German, Italian, Portuguese and Spanish. The dictionary has an appendix in which the author, in colaboration with gnomonists around

Europe, provides basic gnomonic terms in several other European languages (among them Serbian/Serbo-Croatian terms).

In Serbia (and as far as we know, in all other countries of the former Yugoslavia) there is no a sundial society that would deal with and care about the appropriate terminology (Prnjat & Tadić, 2017). Therefore, it is interesting and useful to find out which gnomonic terms are in use in the Serbian language today, how they are defined, which language they originate from and how they evolved, whether they were conceived methodically or spontaneously by individual gnomonists? The first Serbian astronomers (19th and 20th century) were educated in France, in Paris, so it can be assumed that they introduced in Serbia both gnomonic and astronomical terminology. After the Second World War, the influence of the French astronomical school decreased and Serbia (within Yugoslavia) turned to the USSR and the Soviet science in which gnomonics did not have a long tradition, so that almost until the end of the 20th century (until the disintegration of Yugoslavia) it was not realistic to expect evident progress of the Serbian gnomonics nor was it possible to find gnomonic terminology explained inseparably from the astronomical and mathematical-geographical terminology.

The origin of gnomonic terms in the Serbian language

Gnomonics lies on the border of astronomy (spherical astronomy, chronometry) and geography (mathematical geography, mathematical cartography) and therefore uses the knowledge and terms of both sciences, just as it uses the knowledge and terms of mathematics (descriptive geometry, analytic geometry and spherical trigonometry). Gnomonics is unimaginable without terms such as celestial meridian, declination, and hour angle, which belong to terminology of spherical astronomy. The input data for the construction of a sundial are latitude and azimuth – the terms that belong to geographical terminology. Also, not a single calculation in gnomonics can be done without the following terms: great circle, spherical angle and spherical triangle, which all belong to spherical trigonometry terminology. For this reason, dictionaries of gnomonic terminology include a large number of terms borrowed from other scientific disciplines. When they are excluded, the number of terms is significantly reduced, and when the terms introduced in the past for various forms of sundials and their parts are excluded as well, the list of terms is reduced to the fundamental ones: *gnomon, gnomonics, gnomonic projection* and *sundial.* For the purpose of this paper, these are the terms on the basis of which the search was conducted in publications, primary and secondary, published in the Serbian language. Dictionaries, monographs, textbooks and research papers in Serbian in the field of mathematical geography and astronomy were browsed through in chronological order. Then gnomonic terms and their definitions were selected and compared first with each other and then with the corresponding terms explained in the dictionaries in foreign languages (Italian, English).

The oldest known text related to gnomonics (determining the part of a day according to the length of one's own shadow expressed in feet) is found in the 16th century Serbian manuscript known as Bogišić's manuscript (Novaković, 1884). Because of the Ottoman rule Serbia was cut off from the Western civilization for a long time, so the interest in exact sciences and the need to form appropriate terminology emerged rather late, not until the 19th century. Among the terms registered in books, textbooks and articles in the field of mathematical geography and mathematical cartography printed in Serbia in the 18th and 19th centuries (Bjelaković, 2017), the previously mentioned gnomonic terms were not recorded. Likewise, the same terms are not present among the astronomical terms recorded in scientific works published in the Serbian literary language between 1783 and 1867 (Bjelaković, 2018). Also, there are none of them among the terms recorded in astronomy textbooks printed in Serbia in the period 1850-1918 (Jovanović, 2002), not even in the first comprehensive textbook of astronomy in the Serbian language for higher grades of secondary and teacher education schools, authored by professor Milan Andonović (1888), who established the Serbian scientific terminology in geodesy and astronomy. In the first university geography textbook printed in Serbian, Vujević (1923) translated the term "gnomon" as "pointer" and defined it as "a stick fixed on a horizontal board" (p. 12).

Milan Nedeljković (1902), a professor of astronomy and meteorology at the Great School and the first director of the Astronomical and Meteorological Observatory in Belgrade, wrote the first book in the Serbian language in the field of gnomonics (Tadić, 1998). Nedeljković wrote the book in order to facilitate weather forecasting at weather stations and to enable regulation of ordinary clocks "for which we know and have said that they do not usually show exact time" (p. 22). Without specifying the sources, he explained in great detail how to make a gnomon for determining the real solar noon, with a note (VII) on how this device can be converted into a real sundial. In this sense, on behalf of the Observatory, he offered to readers, besides all elements indispensable in the construction of a gnomon, a "special rod (which must be inclined towards a dial's plate at an angle corresponding to the latitude of a sundial)" (p. 78). Nedeljković does not even mention the term *gnomonics*, instead of *gnomon* he uses the word *šipka* (rod), and for a slot in the centre of a shield at the tip of a gnomon, which is important for our consideration, he uses a phrase *kazaljka* (clock hand) (Table 1). He names a sundial *sunčanik* (sun clock, Lat. *solarium*).

Table 1. Basic gnomonic terms in Serbian (in Cyrillic and Latin script) in the works of Nedeljković (1902) and Mišković (1930; 1932)

A gnomonic term	Nedeljković (1902)	Mišković (1930; 1932)
Gnomon	Шипка / šipka, [rod]	Гномон / gnomon, [gnomon]
Gnomonics	–	Гномоника / gnomonika, [gnomonics]
Sundial	Сунчаник / sunčanik, [sundial]	Сунчани часовник, сунчани кадран / sunčani kadran, sunčani časovnik, [sundial]
Sundial plate	Плоча / ploča, [plate]	Кадранова табла / kadranova tabla, [sundial plate]
Polos	–	Кадранова осовина / kadranova osovina, [sundial axis]
Nodus	Казаљка / kazaljka, [hand]	Око / oko, [eye]
Sundial pole	–	Кадранов центар / kadranov centar, [sundial centre]
Hour line	Часовна линија / časovna linija, [hour line]	Часовна линија / časovna linija, [hour line]

Note: literal translation of the terms in Serbian is provided in square brackets

Almost three decades later, the first articles were published (Mišković, 1930; 1932) in which the author, professor Vojislav V. Mišković, also a director of the Observatory and a French student like Nedeljković, without mentioning the predecessor's book, explaines what sundials are and how they are constructed (Tadić, 1998). In a simple way, without complicated theoretical explanations and formulas, Mišković presents the elements of gnomonics, probably basing his publication on the most famous French book on gnomonics (Bigourdan, 1922). He copies the gnomonic terms from this book and translates them into Serbian (Table 1), sometimes combining the Serbian and French language, as in the case of a compound noun "sundial" which he translates as *sunčani kadran* (sun cadran). Mišković (1932, p. 274) mentions the term *gnomonics*, defining it simultaneoulsy as the science of sundials and the theory of sundials.

Because of the unfavourable historical circumstances, continuity in development of the Serbian gnomonics was interrupted, so that the terminology introduced by the professors Nedeljković and Mišković was not retained. Leaving aside the gnomonic terminology in the Serbian language introduced in the articles that appeared since the 1980s, including a monograph (Tadić, 2002), we will return to the previously mentioned works of professors Nedeljković and Mišković, not because they were pioneering, but because they contain formulations that are invaluable for the correct definition and reorganization of the key gnomonic terms in the Serbian language.

Definition of the key gnomonic terms

As we have previously mentioned, the key gnomonic terms are: *gnomon, gnomonics, gnomonic projection* and *sundial*. The word *gnomon* is the most important. However, it should be emphasized that this word is not listed in the *Dictionary of the Serbian Language* (Nikolić, 2007). This is a Greek word (γνομον) that literally means *investigator, expert, judge*: "The term gnomon actually has a double meaning in relation to knowledge: it identifies what provides knowledge, what demonstrates, but also the one that possesses knowledge, one that knows how to evaluate and therefore has the role of a judge" (Perrucci, 2013, p. 10). Free interpretation of the term gnomon could be "a pointer" (a shadow pointer) or in the most general sense "everything that casts a shadow". However, it is often erroneously defined. All definitions undisputedly imply that it is a vertical stick/rod and wrongly that: 1) it is only a vertical stick/rod; 2) it is fixed to a surface; 3) it is placed on a flat surface; 4) it serves only as timekeeping device. Let's consider these erroneous assumptions.

A gnomon is not just a vertical stick/rod. A vertical stick/rod becomes a gnomon only when a shadow is cast – although incorporeal, a shadow is an integral part of a gnomon. A vertical stick/rod that casts a shadow is not a satisfactory definition as well. A stick/rod can only be called a gnomon when its shadow has a scientific purpose, that is, when it serves for "observing and measuring altitudes and determining only what could be derived from them" (Mišković 1932, p. 183). This concise definition shows that by calculating the ratio of the length of a gnomon to the length of a shadow, the height of the sun can be determined. By using the method of equal sun altitudes, the sun's noon line can be determined, and when the noon line is determined, the sun's midday altitudes can be calculated, and the azimuths can be measured throughout the day (Tadić, Marković, & Prnjat, 2018). Then, on the basis of the sun's midday altitudes, the inclination of the ecliptic towards the equator and the inclination of the celestial axis to the level of the horizon (the height of the celestial pole or the latitude of a place) can be determined, and in relation to the latitude, the longitude of a place and the length of daytime. All these terms are related to the apparent movement of the sun across the celestial sphere, which a shadow of a gnomon faithfully reproduces, that is, they are all elements of the solar geometry.

Theoretically speaking, it is not necessary to mention any type of stick/rod when defining a gnomon, because in gnomonics the imaginary gnomon is considered, whose tip is the *nodus* (node), a point in which the light cone whose base represents a certain apparent path of the sun and the congruent shadow cone delineated by the marginal sun ray converge: the cross-section of the shadow cone with the gnomon base represents the gnomonic projection of the day arc of the sun’s apparent path.

In gnomonics, therefore, gnomonic projection of a *nodus* (not a gnomon as a stick/rod) on a selected surface is analyzed, since it represents the apparent movement of the sun across the celestial sphere. As the key point, a nodus becomes materialized in some way, usually in the form of a slot in a metal shield circular or stylized in the shape of the sun disc. A sunbeam passes through a nodus and in the shadow of the shield projected on the surface creates a light spot whose position is easy to observe and determine. As we have already mentioned, Nedeljković calls a nodus *kazaljka* (clock hand), and Mišković *oko* (eye) (Table 1).

A gnomon can be fixed or portable: for example, when in “Book 1” of *The Ten Books on Architecture* Vitruvius (trans. 1999, 1.6.6) describes a gnomon, he calls it *sciateric* (Gr. σκιαθήρας) and has a portable gnomon in mind. A gnomon can be placed on a horizontal surface, but also in a concave hemisphere, with the base in “nadir” and the tip in the center of the hemisphere. It is assumed that Eratosthenes used such device (*scaphen*) when he measured the zenith distance at Alexandria on a summer solstice. The first advantage of a scaphen over an ordinary gnomon is that the hemispherical base “hunts”/concentrates all shadows during each daylight period, and the second – it is fairly easy to draw the lines necessary for the direct reading of the elements of the solar geometry on the interior side of a hemispherical base, which presents a reversed model of the visible celestial sphere.

A scaphen was originally used to measure the altitude of the Sun. When the ancient astronomers drew the projections of arcs of the sun’s apparent paths on solstices and equinoxes in the hemispherical interior of a scaphen, they divided each of these circular arcs into 12 equal sections and connected the points with identical measurements, thus obtaining a grid of the simplest sundial that Vitruvius (IX) calls *hemispherium*. This is how a gnomon acquired its new function — it became the *shadow-caster* of a sundial. The daylight hours (daily temporal hours) were read according to the end of a shadow of a gnomon. The tip of a gnomon, nodus, is the key point in the theory of gnomon, and an illustration of this claim is a structural form of the ancient sundial that Vitruvius attributes to Eudoxus and calls “spider“ (*arachne*) (trans.1999, 9.8.1). This type of sundial does not have a gnomon but has a nodus: in the “zenith“ of a spherically carved stone block there is a round slot, a nodus, through which a narrow beam of sunlight passes and on a “spider’s web“, shaded by the interior part of a sundial, leaves a light spot ("sunlet") according to which a daylight time is read (Tadić, 1989).

In the described hemispherical sundial the tip of the shadow never comes out of the "working field" limited by the projections of the celestial tropics. This means that the other part of the sphere becomes unnecessary and can be removed. Thus, a sundial raised to a sufficient height opens itself to the eye of the observers. By removing the half of a sphere in which a gnomon is fixed, a "real" gnomon is replaced by a horizontal one whose tip also ends in the centre of the hemisphere.

In other words, if the hemispherical base of this type of sundial is viewed as a reversed model of the visible celestial hemisphere, then the gnomon, which extends from the nadir to the centre, has to be moved to a horizontal position – in the noon line, from the north point to the centre. This is important for determination of gnomonic terminology, a "real" gnomon has become a *horizontal gnomon*. Consequently, if a gnomon is defined only as a vertical stick/rod, then this term is contrary to the definition of a gnomon, but if in theory a gnomon is reduced to a nodus, then this contradiction ceases to exist: reading is done according to the end of the shadow and theoretically speaking it is of no consequence where the base of the shadow-caster is fixed.

Therefore, a gnomon can also be a part of a sundial. It is coverted from an ordinary gnomon into a part of a sundial only when a grid of hour and date lines is drawn on its base (plate) regardless of its shape (flat, spherical, conical, cylindrical). Daylight hours and selected dates are indicated by a shadow cast by a gnomon, which means that a gnomon as a part of a sundial plays the role of a shadow-caster. This role may be performed by a gnomon in the strict sense of word ("real"gnomon), a horizontal gnomon and an oblique gnomon. An oblique gnomon, directed to the celestial axis (parallel to the rotational axis of the Earth) is called *polos*.

In ancient time and the Middle Ages, a basic unit of the time system was the temporal hour defined as one twelfth of a daytime, which resulted in identical positions of the sun in the celestial sphere being connected by the arcs of great circles, without a common polar axis, that were projected as straight lines, without a common pole, on a sundial's grid: the daylight hours were read according to the end of the shadow (or according to the position of the "sunlet" in arachne). At the end of the Middle Ages in Europe, an equinoctial time system was introduced with a unit equal to one twenty-fourth of a day. In one variant of this system in which the hours were counted from sunset or from sunrise, the time lines in the sundial's grid did not have a common pole, so a gnomon was kept as a shadow-caster, vertical or horizontal one. Examples of this type of shadow-casters can be found on the old wall-mounted sundials in Italy and the Czech Republic where this time system stayed for a long time. In the contemporary version of the equinoctial time system, the identical hour positions of the sun on the celestial sphere are connected by great semicircles (declination semicircles) with a common polar axis (celestial axis), which are projected on the grid of a sundial as a string of straight lines that diverge from the common pole, *the pole of a sundial*. Accordingly, on sundials constructed for this time system, a gnomon is inclined towards the celestial axis, which allows the reading of daylight hours according to the direction of the shadow.

As we have already mentioned, a gnomon directed to the celestial axis becomes polos. The polos can be fixed in the pole of a sundial, but it does not have to; what is important is that it is directed to the celestial axis. On horizontal sundials, the polos form an angle with the base/plate equal to the latitude of a place, and on vertical (wall-mounted) sundials with east-west orientation, this angle is complementary to the latitude of a place. On horizontal sundials the orthogonal projection of the polos, a *subpolos*, lies along the noon line; on vertical sundials with east-west orientation, it lies along the vertical, and on vertical with arbitrary orientation, the subpolos makes a certain angle. On equatorial sundials, the polos are in an orthogonal position to the base and there is no subpolos. This is a division of the sundials with a flat base presented by Mišković (1930, p. 187), who uses the term *kadran* (cadran). He also divides vertical sundials depending on the azimuth of their plane. By avoiding the familiar term *declination* and *declining sundials* for vertical sundials that lie in the plane of the first vertical, he says that they are *bez skretanja* (without deviation) and distinguishes two variants: the south and the north. He names the other (*declining*) sundials as sundials *sa skretanjem* (with deviation) and distinguishes the east and the west variant, whose plane lies at the level of the celestial meridian (1932, pp. 275–277).

Vertical sundials on the walls of buildings are the most common type of sundials. Their components are the following: a *polos* with a *nodus*, *a shadow of a polos*, the basis/plate with the *sundial's grid* on which the shadow is cast and the *face* (Figure 1). The sundial's grid consists of a string of *hour lines* that, like a polos, emerge from the pole of a sundial together with the date lines for solstices and equinoxes. The sundial's grid is actually a *gnomonic projection* of arcs of declination circles with a distance of hour angles of one hour and the projection of celestial equator and celestial tropics (to which the projection of any celestial parallel within the tropical belt can be added, as the apparent paths of the sun).

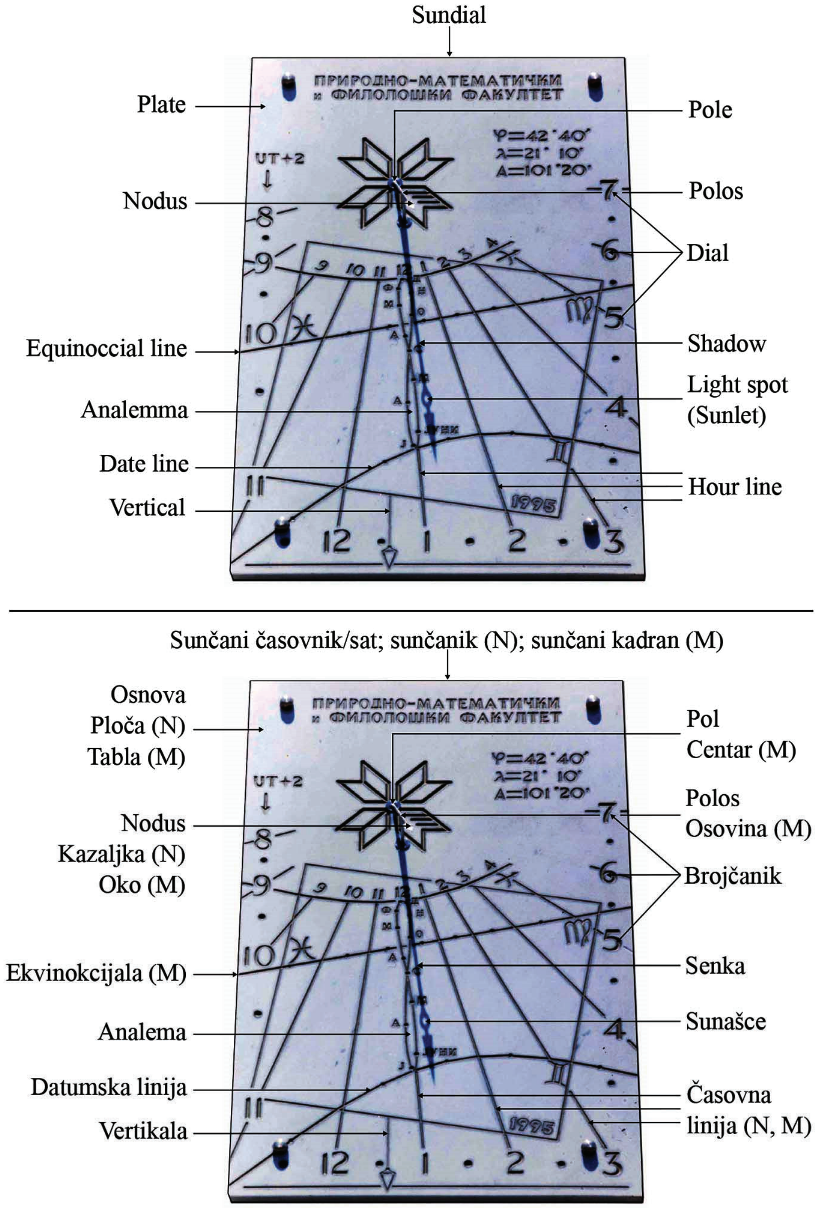

Figure 1. A sundial at the building of the Faculty of Natural Sciences and Mathematics in Priština (mounted in 1994, destroyed in 1999) with main elements marked in English (above) and in Serbian (below): (N) — terms used by Nedeljković (1902), (M) — terms used by Mišković (1930)

A gnomonic projection is a perspective azimuthal projection in which the point of perspective is at the centre of the sphere (the celestial sphere of the Earth); in a sundial the centre of perspective is a nodus. The key feature of the gnomonic projection is that all great circles are projected as straight lines, while small circles are projected as conical cross-sections, whose shape (hyperbola, parabola, ellipse) depends on the latitude of a place. Declination circles of the celestial sphere and the celestial equator are great circles, so they appear on a sundial's grid as straight lines. Hour lines start from a sundial's pole, but it is enough to draw their sections between the hyperbolas of the celestial tropics. The projection of the celestial equator, or *ekvinokcijala* (equinoccial line) as Mišković (1932, p. 279) names it, is drawn as a straight line, although theoretically it is not because the declination of the sun constantly changes. It is normal to the orthogonal projection of a polos — *subpolos,* on which the orthogonal projection of a nodus — *subnodus* falls. Subpolos and subnodus are reference points for the orientation of a polos. In a right triangle whose vertices form the pole of a sundial, subnodus and nodus form the triangle of polos. A materialized triangle of a polos can replace the polos itself, with the reading being done according to the shadow of the hypotenuse of the triangle. To avoid confusion in reading, the opposite cathetus (nodus — subnodus) is stylized in some way in order not to be bare (straight).

A face of a sundial is obtained after corresponding numbers are fixed on time lines. Even if the complete sundial's grid is omitted, a sundial will continue to perform its basic function with numbers and a polos: direction of a shadow of a polos will indicate daylight hours — the hours of the apparent solar time. By introducing the longitude correction, the accuracy of a sundial can be reduced to the value of the *equation of time*. Over the year, a shadow is either "ahead" or "behind", and an array of identical hour positions of the "sunlet" of a nodus is displayed as a curve in the shape of an elongated number eight, as *analemma*, which winds itself around the appropriate hour line showing the real solar time. Usually, an analemma is drawn for the 12 noon of the standard time (Figure 1).

On a sundial with a complete sundial's grid, daylight hours are read according to the direction of a shadow of a polos, whereas solstices, equinoxes and hours according to the end of a shadow of a polos in actual standard time, that is, according to the position of a light spot ("sunlet") produced by a sunbeam passing through a nodus. When a polos is omitted and only a nodus is left, a sundial will retain the same functions, with the difference that daylight hours will also be read according to the position of the "sunlet" of a nodus. Instead of being at the end of a polos, a nodus can be at the tip of a horizontal gnomon fixed in the subnodus. It would be ideal if a nodus could stand/float without any support, "as the tip of an imaginary rod inclined at an angle of the latitude of a place," as professor Nedeljković explained (1902, p. VII).

Conclusion

Basic gnomonic terms appeared in the Serbian language only at the beginning of the 20th century. They were introduced in the works of professors Milan Nedeljković and Vojislav V. Mišković. Nedeljković limited his observations to describing the use of a gnomon, while Mišković explained in a popular way the basic theoretical foundations of gnomonics using the terminology from *Gnomonique* by Bigourdan. However, this terminology was not maintained, not even the terms *sunčanik* and *sunčani kadran* that were used for sundials.

There was a widespread revival of interest in gnomonics in Serbia at the end of the 20th century when publications on the Serbian and Yugoslav gnomonic heritage appeared and when the number of sundials in public places significantly increased. In Serbia, unlike the developed European countries, a sundial society does not exist, so the formation of gnomonic terminology in the Serbian language is left to individuals. Although gnomonic terminology is used in scientific publications, it is not yet possible to speak of standardized gnomonic terms.

European dictionaries of gnomonic terminology contain a large number of terms from neighboring sciences. They are used in gnomonics, but we cannot say that they belong to it. The key gnomonic terms are: *gnomon, gnomonic projection, sundial* and *gnomonics.* Although uniform, the definitions of these terms could be more precise, not only in Serbian. A gnomon, for example, can be a real or imaginary stick/rod/pillar, but it is important to emphasize that it is a stick/rod/pillar that casts a shadow, not any shadow, but one that has the function of presenting the apparent movement of the sun, one that has been carefully planned and calculated in connection with that movement by a gnomonist.

Accordingly, the existing definitions of the key gnomonic concepts should be corrected. They could, for example, be as follows: 1) A *gnomon* is an instrument whose shadow is used for spatial and temporal orientation; A *gnomon* is an instrument whose shadow is used for determination of the elements of solar geometry; 2) A *gnomonic projection* is a perspective azimuthal projection in which the projection is done from the center of the sphere onto the projection plane that is set tangent to the sphere at a chosen point so that all great circles are represented as straight lines and small circles as conical sections: at the plane of a sundial the conical sections are delineated by the end of a shadow of a gnomon or the "sunlet" created by a narrow sunbeam transmitted through a nodus of a gnomon; 3) A *sundial* is a type of timekeeping device with a gnomon whose shadow has the role of a clock hand; A *sundial* is a type of timekeeping device with a gnomon whose shadow shows daylight hours and selected dates; 4) Gnomonics is a scientific discipline that studies the course of a shadow of a gnomon for the purpose of spatial and temporal orientation. Finally, an individual who is an expert in gnomonics (both theory and practice) is a *gnomonist* (Serb. *gnomonist*).

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