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STUDIA MYTHOLOGICA SLAVICA
ISSN 1408-6271 www.ISSN 1581-128x

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Izdajata / Znanstvenoraziskovalni center Slovenske akademije znanosti in umetnosti, Inštitut
Publicato da / za slovensko narodopisje, Ljubljana, Slovenija
Published by in / e / and

Università degli Studi di Udine, Dipartimento di Lingue e Letterature, Comunicazione,
Formazione e Società, Udine, Italia

Založnik / Casa editrice / Založba ZRC / ZRC Publishing, ZRC SAZU
Publishing house

Spletna stran / <http://sms.zrc-sazu.si/>
Sito internet / Website <http://ojs.zrc-sazu.si/sms/>

Prispevki so recenzirani / Gli articoli sono sottoposti a referaggio / The articles are externally peer-reviewed

Izhaja s podporo Agencije za raziskovalno dejavnost RS / Pubblicato con il sostegno finanziario deli' Agenzia per
la ricerca scientifica della Repubblica di Slovenia / Published with the support of the Slovenian Research Agency

Studia mythologica Slavica is included in the following databases: MLA Bibliography; SCOPUS, Sachkatalog
der Bibliothek - RGK des DAI; IBZ; FRANCIS; HJG (The History Journals Guide); OCLE; INTUTE: Arts
and Humanities UK, EBSCO, ERIH plus, ANVUR.

Slika na ovitku / Fotografia sul copertina / Cover photo:
Gvido Birola, Kuga (Peste / Plague), 1972.

Naklada / Tiratura / Imprint 300

Tisk / Stampato da / Printed by Collegium Graphicum, d. o. o.



Kako vemo, da so stari Slovani poznali gnomone?

— Andrej Pleterski —

Pokončni stebri so tudi del mitične pokrajine starih Slovanov. Na dejstvo, da je bil tak steber uporabljen kot gnomon, je mogoče sklepati iz obstoja učinkov njegovega delovanja, ki jih najdemo v pokrajini: smeri neba, datumsko pomembni azimuti sončnega vzhoda in sončnega zahoda, kot, ki ustreza nagibu ekliptike. Domnevni krožni argument, da trikotniki definirajo kot in isti kot definira iste trikotnike, je Bilićev konstrukt in je matematično nemogoč, saj trikotnika ne moremo definirati samo z enim kotom. A tudi če so astronomsko znanje starih Slovanov res utemeljevali v sedanjosti s povsem krožnim dokazom (kar pa niso), to še ne pomeni, da stari Slovani niso imeli astronomskega znanja.

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Ključne besede: stari Slovani, astronomija, gnomon

Upright pillars are also part of the mythical landscape of the ancient Slavs. The fact that a column was used as a gnomon can be inferred from the existence of the effects of its action found in the landscape: the cardinal directions, the azimuths of sunrise and sunset significant for the date, an angle corresponding to the obliquity of the ecliptic. The alleged circular argument that triangles define an angle and the same angle defines the same triangles is a Bilić construct and mathematically impossible, since we cannot define a triangle with only one angle. However, even if the astronomical knowledge of the ancient Slavs in the present were really justified by a purely circular argument (which is not the case), it does not mean that the ancient Slavs had no astronomical knowledge.

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Keywords: ancient Slavs, astronomy, gnomon

Vesel sem, da Tomislav Bilić vztraja v diskusiji o astronomskem znanju starih Slovanov in urejenosti njihove mitične pokrajine. To mi daje upanje, da jo bova pripeljala do konstruktivnega zaključka. V repliki (Bilić 2022) na moj odgovor (Pleterski 2021) na začetek, ki ga je sprožil (Bilić 2020), daje nekaj dobrih iztočnic za bolj osredotočeno razpravo. Opažam namreč, da sva doslej v nemajhni meri govorila eden mimo drugega. Potem, ko je v repliki nekoliko izjasnil svoja stališča, je potrebno, da to storim tudi jaz, ker bo nadaljevanje potem mnogo lažje.

Bilić poudarja, da ne dvomi o pokrajini kot pomembnem elementu naše intelektualne preteklosti. Prav tako ne dvomi o obstoju pokončnih stebrov in drugih objektov v staroslovanski pokrajini ter o kulturnih sestavih. Glede vsega tega se torej strinja. To je dovolj, da omogoča različne nadaljnje interpretacije in zato vsaj meni povsem zadošča. Ker pa je že v naslovu replike zastavil povsem jasno vprašanje, kako vemo, da so tudi stari Slovani poznali gnomone in ker trdi, da moje izpeljave temeljijo na krožnem dokazu, si zasluži tudi povsem konkretna odgovora.

Polovico odgovora na prvo vprašanje je ponudil že Bilić sam s koristno podrobno definicijo gnomona, po kateri je to mnogonamenski astronomski instrument, navpičen predmet, ki meče senco. Z njim je mogoče določiti lokalno poldne, linijo sever–jug (poldnevnik), (približni) datum solsticija in (v praksi bolj sporno) enakonočja, (približno) vrednost naklona ekliptike, zemljepisno širino opazovalca, sončni azimut (vključno s solsticijskimi azimuti sončnega vzhoda/zahoda), čas dneva (Bilić 2022, 277).

Že pri branju te definicije se izpostavi morda temeljni nesporazum med Bilićem in menoj. Gre za vprašanje, kako sta povezana gnomon in naklon ekliptike. Bilić govori o vrednosti naklona ekliptike pri uporabi gnomona in se sklicuje na Dirka Couprieja. Ta o tem pove nekaj več in drugače: »The angle made by the top of the gnomon and the end of its shadow at the time of the solstices can be measured and will show to be about 47° . This angle equals twice the inclination of the ecliptic« (Couprie 2011, 31) – »Kot, ki ga tvorita vrh gnomona in konec njegove sence v času solsticijev, je mogoče izmeriti in pokaže se, da je približno 47° . Ta kot je enak dvakratnemu naklonu ekliptike.« Couprie govori o kotu in o merjenju tega kota., kar sta dve stvari, Bilić govori samo o vrednosti naklona ekliptike, kar pa seveda predpostavlja vednost o obstoju sferičnosti Zemlje. Couprie na istem mestu posebej poudari, da ta vednost, za določitev kota ni potrebna. Gre za to, da vrh gnomona in konec dolžine njegove sence v dveh skrajnih točkah leta – torej tri točke, določajo nek kot. Ta kot je na ta način podan geometrijsko. Merjenje z neko vrednostjo lahko pride na vrsto šele, ko smo ga določili. Bilić govori o vrednosti (v angleškem besedilu *value*, v hrvaškem *iznos*), jaz govorim o določitvi kota. Bilić je prepričan, da stari Slovani vrednosti opisanega kota niso poznali, jaz trdim, da so bili na ta način določiti kot sposobni tudi stari Slovani. Sva zato nesoglasna? Ne. Tudi jaz ne verjamem, da bi Slovani poznali vrednost kota in tudi Bilić dopušča možnost, da bi ga lahko z gnomonom določili (Bilić 2020, 44).

Ostaja torej vprašanje, ali so stari Slovani uporabljali gnomone. Bilić priznava, da so del njihove mitične pokrajine tudi pokončni stebri. Jaz priznavam, da vsak pokončen steber ali podobno telo še ni gnomon. Spomnim pa, da je vendarle vsak gnomon tako telo. In se zavedam, da na noben staroslovanski steber ni pritrjena ploščica z napisom »gnomon«. Oblika stebra tako sicer omogoča funkcijo gnomona, vendar je sama še ne določa. Zdi se mi, da je Bilić želel povedati tudi to. In tudi v tem se z njim strinjam.

Da je bil nek steber uporabljen v funkciji gnomona, lahko sklepamo po obstoju učinkov njegovega delovanja v skladu z zgornjim Bilićevim popisom. Te učinke vidimo kot arheoastronomske strukture v prostoru. Sestavljajo jih ustrezno razporejene, kulturno določene prostorske točke. V primerih, ki jih obravnavam v Kulturnem genomu (Pleterski 2014), te točke med drugim določajo smeri neba in datumske pomembne azimute sončnih

vzhodov in zahodov ter določajo kot, ki je enak nagnjenosti ekliptike. In ponavljam, eden od tehničnih pogojev za to je opazovališče z gnomonom. Zato lahko o obstoju gnomona sklepamo, tudi če ga danes ni več. To je odgovor na prvo Bilićevo vprašanje.

Ker pa si želi tudi zelo oprijemljiv primer, ki ga nisem sestavil jaz, opozarjam na članek Piotra Banasika in Władysława Górala, ki povsem neodvisno od mojih raziskav obravnava arheoastronomski značaj Krakove gomile v Krakovu. Takoj povem, da besede gnomon v članku ne uporabita. Ugotovila pa sta, da imajo nekatere od ravnih črt plotov, ki potekajo radialno od središča gomile z ostanki navpičnega stebra proti obodu gomile, astronomske azimute, ki se ujemajo s koledarsko pomembnimi datumi, tudi z zimskim solsticijem. Nadalje določajo dva kota, katerih simetrala je točno v smeri zahod–vzhod (Banasik, Góral 2016). To komentiram s parafrazo znane retorične uganke o raci. Če je videti kot gnomon, če stoji kot gnomon, če so ob njem sledovi uporabe gnomona, kaj je to?

Sedaj pa še k vprašanju krožnega dokaza, ki mi ga Bilić pripisuje: »the ancient Slavs were familiar with the value of the obliquity of the ecliptic solely by the existence of sacred triangles, simultaneously proving the existence of sacred triangles themselves by the familiarity of the ancient Slavs with the solar angle (i.e., the value of the obliquity of the ecliptic)« – »[Avtorji bi radi dokazali, da so] stari Slovani poznali vrednost poševnosti ekliptike zgolj na podlagi obstoja svetih trikotnikov, hkrati pa dokazujejo obstoj svetih trikotnikov na podlagi staroslovanskega poznavanja sončnega kota (tj. vrednosti poševnosti ekliptike)« (Bilić 2020, 44; Bilić 2022, 278–279).

Bilićeva trditev o obstoju krožnega dokaza in ničnosti vsega, na kar se ta dokaz nanaša, je zmotna v kar treh pogledih: faktografsko, matematično in logično. Naj najprej, vendar pa najmanj pomembno povem, da tehničnih izrazov sončni kot, sveti trikotniki jaz ne uporabljam. Res pa sem sprva uporabljal izraz sveti kot, a sem ga nato zamenjal z izrazom obredni kot, ko sem opazil, da že tradicionalno pomeni tisti kot v hiši, ki je povezan s svetim vidikom življenja v njej (prim. Ränk 1949). In sedaj faktografski vidik. V svoji prvi razpravi o mitični pokrajini starih Slovanov sem najprej določil trojice kulturno pogojenih prostorskih točk. Kot take so določale trikotnike in opazil sem, da se en kot ponavlja (samo to v prvi različici članka: Pleterški 1995). To je bil kot približno 23°. In ko sem razmišljal, kaj v naravi bi ustrezalo temu kotu, sem prišel do nagnjenosti ekliptike (Pleterški 1996). Toda trikotniki in koti so bili že definirani. Nadalje poudarjam, kar sem povedal že zgoraj, menim, da so stari Slovani obredni kot določali geometrijsko in zato nikjer ne govorim, da so poznali vrednost poševnosti ekliptike, kot mi pripisuje Bilić. Trdim pa, da so poznali razliko v višini sonca pozimi in poleti ter bili sposobni to razliko z gnomonom tudi določiti. V tem ni nobene argumentacijske krožnosti. Formulacije in njihova argumentacijska krožnost so Bilićev konstrukt.

Matematična zmotnost. Bilićev krožni dokaz je matematično nevzdržen. S tremi točkami lahko določimo trikotnik in vse kote v njem, tudi obrednega, če tam je. Ne moremo pa z enim samim kotom in četudi je obreden, definirati trikotnika. Tudi če bi želel, krožnega dokaza nisem mogel sestaviti.

Logična zmotnost. Zmotna zmota (znana tudi kot argument iz zmote) je logična zmota, ki se pojavi, ko nekdo domneva, da če argument vsebuje logično zmoto, potem mora biti njegov sklep napačen. Z drugimi besedami, tudi če bi bilo astronomsko znanje

starih Slovanov res v sedanjosti utemeljeno zgolj s krožnim argumentom (a ni), to še ne pomeni, da stari Slovani niso imeli astronomskega znanja.

Ne vem, ali bo Bilić zmožl biti zadovoljen z mojimi odgovori, a to tudi ni moj cilj. Ga pa želim za konec pohvaliti, da mi priznava strastno vztrajanje pri mojih prizadevanjih. Hvala! Upam, da me ta strast nikoli ne bo zapustila.

HOW DO WE KNOW THAT THE ANCIENT SLAVS KNEW GNOMONS?

ANDREJ PLETERSKI



I am glad that Tomislav Bilić insists on discussing the astronomical knowledge of the ancient Slavs and the order of their mythical landscape. This gives me hope that we will bring them to a constructive conclusion. In his rejoinder (Bilić 2022) to my reply (Pleterski 2021) to the opening he raised (Bilić 2020), he gives some good pointers for a more focused discussion. I note that we have talked past each other. Having made his views a bit clearer in his rejoinder, it is necessary for me to do the same, because then it is much easier to move on.

Bilić emphasises that he has no doubt about the landscape as an important element of our intellectual past. Nor does he doubt the existence of upright columns and other objects in ancient Slavic landscape and/or cultic arrangements. So we are in agreement on all these points. That is enough to allow for various further interpretations and is therefore, at least for me, quite sufficient. However, since he has already asked a very clear question in the title of his rejoinder as to how we know that the ancient Slavs also knew gnomons, and since he claims that my deductions are based on circular evidence, he also deserves a very concrete answer.

Half of the answer to the first question has already been given by Bilić himself, with a useful, detailed definition of a gnomon, according to which it is a multi-purpose astronomical instrument, a vertical object that casts a shadow. It can be used to determine the local noon, the north-south line (meridian), the (approximate) date of the solstices and (more controversially in practise) equinoxes, the (approximate) value for the obliquity of the ecliptic, the latitude of the observer, the solar azimuth (including the azimuths for sunrise and sunset), and the time of day (Bilić 2022, 277).

Even reading this definition may highlight the fundamental misunderstanding between Bilić and myself. The issue is how the gnomon and the obliquity of the ecliptic are related. Bilić talks about the value of the obliquity of the ecliptic when using a gnomon and refers to Dirk Coupric. »The angle between the tip of the gnomon and the end of its shadow at the time of the solstices can be measured and is about 47°. This angle corresponds to twice the inclination of the ecliptic«

(Couprie 2011, 31). Couprie speaks of the angle and of the measurement of this angle, which are two things; Bilić speaks only of the value of the obliquity of the ecliptic, which of course presupposes knowledge of the existence of the sphericity of the earth. Couprie explicitly points out in the same place that this knowledge is not necessary to determine the angle. The point is that the tip of the gnomon and the end of the length of its shadow at two extreme points of the year - that is, the three points - determine an angle. This angle is therefore given geometrically. A measurement with a value cannot come into play until we have determined it. Bilić speaks of value (in Croatian *iznos*), I speak of determining the angle. Bilić is convinced that the ancient Slavs did not know the value of the angle described, I maintain that the ancient Slavs were also able to determine the angle in this way. So are we in disagreement? No. I also do not believe that the Slavs would have known the value of the angle, and Bilić also allows for the possibility that it could have been determined by a gnomon (Bilić 2020, 44).

The question remains, then, whether the ancient Slavs used gnomons. Bilić admits that upright columns are also part of their mythical landscape. I concede that any upright column or similar body is not yet a gnomon. But I remind that every gnomon is such a body. And I know that there is no plaque on any ancient Slavic column that says 'gnomon'. The shape of the column enables the function of a gnomon, but does not itself define it. It seems to me that this is what Bilić was trying to say as well. And I agree with him there as well.

The fact that a pillar was used as a gnomon can be inferred from the existence of effects of its action according to Bilić's inventory above. These effects are seen as archaeoastronomical structures in the landscape. They consist of appropriately arranged, culturally defined spatial points. In the examples I discuss in *The Cultural Genome* (Pleterski 2014), these points determine, among other things, the cardinal directions and date-relevant azimuths of sunrises and sunsets, as well as an angle corresponding to the obliquity of the ecliptic. And I repeat, one of the technical requirements for this is an observatory with a gnomon. Therefore, we can infer the existence of a gnomon, even if it no longer exists today. This is the answer to Bilić's first question.

Since he also wants a very concrete example, not compiled by me, I would like to point to an article by Piotr Banasik and Władysław Góral, which deals with the archaeoastronomical character of Krak's Mound in Kraków, quite independently of my research. I should note right away that they do not use the word gnomon in their article. However, they have found that some of the straight lines of the fences running radially from the centre of the mound with the remains of the vertical column to the perimeter of the mound have astronomical azimuths that coincide with calendrically important dates, including the winter solstice. They also define two angles whose bisectors lie exactly in the west-east direction (Banasik, Góral 2016). I comment on this by paraphrasing the famous rhetorical conundrum of the duck. If it looks like a gnomon, if it stands like a gnomon, if there are traces of the use of a gnomon beside it, what is it?

Now to the question of the circular proof that Bilić attributes to me: 'the ancient Slavs knew the value of the obliquity of the ecliptic by the existence of sacred triangles alone, and at the same time proved the existence of sacred triangles themselves by the ancient Slavs' familiarity with the angle of the sun (i.e. the value of the obliquity of the ecliptic)' (Bilić 2020, 44; Bilić 2022, 278–279).

Bilić's claim about the existence of the circular proof and the nullity of all that this proof refers to is false in no less than three respects: factually, mathematically, and logically. Let me begin by saying that I do not use the technical terms solar angle and sacred triangles. I did, however, initially use the term sacred angle, but then replaced it with the term ritual angle when I realised that it traditionally meant the angle in a house associated with the sacred aspect of dwelling in that house (cf. Ränk 1949). And now to the factual aspect. In my initial discussion of the mythical landscape of the ancient Slavs, I first identified the triads of culturally conditioned points of space. As such, they defined triangles, and I noticed that one angle was repeated (only this in the first version of the article: Pleterski 1995). This was an angle of about 23°. And when I thought about what would correspond to this angle in nature, I came up with the obliquity of the ecliptic (Pleterski 1996). But triangles and angles had already been defined. To reiterate what I said above: I believe that the ancient Slavs defined the ritual angle geometrically, and therefore nowhere do I say that they knew the value of the obliquity of the ecliptic, as Bilić implies to me. But I do assert that they knew the difference in the altitude of the sun in winter and summer, and were able to determine that difference with a gnomon. There is no argumentative circularity in this. The formulations and their argumentative circularity are a Bilić's construct.

The mathematical fallacy. Bilić's circular proof is mathematically untenable. With three points we can define a triangle and all the angles in it, including the ritual angle if it exists. But we cannot define a triangle with a single angle, even if it is ritual. Even if I wanted to, I could not construct a circular proof.

The logical fallacy. The fallacy fallacy (also known as the argument from fallacy) is a logical fallacy that occurs when someone assumes that if an argument contains a logical fallacy, then its conclusion must also be false. In other words, even if the astronomical knowledge of ancient Slavs were justified in the present by a purely circular argument (but it is not), that does not mean that ancient Slavs had no astronomical knowledge.

I do not know if Bilić will be satisfied with my answers, but that's not my goal either. However, I would like to conclude by thanking him for acknowledging my passionate persistence in my efforts. Thank you. I hope this passion will never leave me.

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