Locating the festival, positioning the feast: natural and calendar festivals in medieval Slovenia

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ARTICLE

Natural and calendar festivals in medieval Slovenia

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ABSTRACT

The astronomical cycles and occurrences of the Sun, Moon, planets and certain star constellations were well known to prehistoric, Roman and medieval communities. Archaeoastronomy studies how ancient societies incorporated this knowledge into various aspects of past cultures. The discipline draws on modern astronomy, geodesy, physics, statistics, anthropology, ethnology and archaeology to study and interpret a wide range of source materials, from structural alignments to art, artefacts and inscriptions. This paper presents archaeoastronomical research on the orientation of Romanesque churches across the territory of modern-day Slovenia, focusing on an array of medieval festivals associated with the solstices and equinoxes. It demonstrates a profound connection between these festivals and the alignment of churches.

KEYWORDS
Cultural astronomy; archaeoastronomy; church orientation; medieval period; festivals; Slovenia

Introduction

Archaeological materials relating to religion and ritual are fragmentary (Fogelin 2007); however, modern developments in the discipline have equipped us to infer the intangible from the material culture. Religion in past cultures was expressed through ritual practice. These practices could incorporate unique locations and specific moments in time (Renfrew 1985; Insoll 2011). To understand these two aspects of ritual, we have to understand which strategies were used to define a meaningful location, and how specific time markers were determined as important and subsequently incorporated into the event. Archaeoastronomy provides a methodology that teases out the significance of both temporal and spatial facets of rituals and celebrations.

This paper explores the largely neglected connections between church alignments and festivals in the Middle Ages, drawing on the rich corpus of data from the territory of modern Slovenia, part of the historical Holy Roman Empire. The research on Romanesque church orientations presented here highlights the importance of the specific juxtaposition of location and time – a combination producing a moment of religious significance – following the widespread acceptance of Christianity in the south-eastern Alpine region.

Medieval astronomy, 'sacred direction' and the Church

Much inherited knowledge of astronomy was lost towards the end of the Roman period, only to be rediscovered in the Arab world at the end of the first millennia (McCluskey 1998, ix). The medieval

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astronomical traditions that survived through the early Middle Ages included: (1) the observations of the rising and setting sun to determine cyclically and ritually critical dates; (2) monastic time-keeping, which was concerned with identifying and marking ritual times over the course of a day and night by observations of the movement of the stars to specify correct times for prayer; and (3) the *computus*, a precise discipline built upon arithmetical formulae and devoted to the calculation of the date of Easter and other movable feasts of the liturgical year (McCluskey 1998, x–xiii; Goldstein 1972; Helms 2004; Eastwood 2007, 1, 96–103; Nothaft 2018, 2).

Astronomical traditions reflect, and contribute to, socio-cultural values. For instance, the significance of particular cardinal directions is designed by the specificities of a given culture and it becomes all the more powerful and articulate if and when it is linked to a supernatural principle, belief or religion. The positions taken in prayer, and the layout of sacred structures, are not happenstance; they have been determined according to the predominant religious outlook (Landsberger 1957, 181). The Old Testament mentions 'four corners of the earth' and a four-part division of the mythical landscapes beyond Earth (Gordon 1971). One of the four is east. But what *is* 'east'? In strictly geographical terminology, it is a cardinal direction with an azimuth of 90°. However, more generally it is comprehended as one-quarter of the horizon: a quarter or 90° of a plane within which we interact with people, objects and space. East has been a sacred direction for many cultures and religions, its adoration seemingly associated with the rising of the Sun (Thijm AQ3 1858; Landsberger 1957; Gordon 1971; Podossinov 1991; Xiaojian 2010 ; Taylor 1993).

Churches are generally aligned towards the east. However, there is more to the term *orientation* and especially to the practice of structure alignment itself. Today orientation is understood as a positioning in relation to surroundings or circumstances. The word originates from the Latin word *orient*, which means 'east' or 'rising'. Architectural orientation is an ancient tradition, treated in detail in Vitruvius' *De architectura* (BC 30–15), one of the oldest and most influential works on architecture. The author discussed private, secular and sacred building orientation, in its horizontal (generally E–W direction, mainly due to the impression of sunrise and sunset) and vertical dimensions (the penetration of light into the building, relying on the movement of the Sun during the day) (Rowland and Howe 2001; Incerti 2013; cf. Heilbron [2001]). While early Christian works, such as *Didascalia Apostolorum*, and theological scholars, including Tertullian of Carthage, Origen and Clement of Alexandria, wrote about the orientation of churches and the direction of prayers towards the east, the first Ecumenical Council in Nicaea in AD 325 determined both as a decree (Kocik 2003): churches had to be aligned towards the east. Nevertheless, many early churches in Rome, Jerusalem, Antioch and elsewhere, while having eastward alignment, had their altar on the western side of the building. Therefore, during the religious ceremony, unlike the believers, the priest was facing the east, towards the source of the light (de Blaauw 2012, 2014, 326). Due to the range of possible eastern orientations, the proper direction for church alignments and prayer remained a much-debated topic within many medieval treatises. Among many authors, St Augustine (AD 354–430) thought that regardless of the fact that God is omnipresent, people should pray turned to the east (Vogel et al. 1962, 182; McCluskey 2004, 203). St Paulinus of Nola (AD 354–431) believed that the apse should be to the east of a church (Vogel et al. 1962, 187). St Columban (AD 543–615), in his monastic rules *Regula coenobialis*, mentioned the single permissible reason for monks not turning east when crossing themselves, which speaks of the importance of the east in liturgical tasks (McCluskey 2004, 203). In his prominent *Etymologiae*, St Isidore, Archbishop of Seville (AD *ca.* 560–636, discussed the eastward direction at prayer and of shrines from prehistory and the time of pagan temples to well into Christianity. He used the word temple as a common name for sacred buildings, including churches, and advocated for them to be built with their altar to the east, the entrance to the west, and the left and right sides of the building aligned to the north and south respectively (Thijm 1858, 11; McCluskey 2004, 201). Following Isidore's evocation of the past, Walafrid Strabo (AD 808–849) reflected that Christian churches should imitate the orientation of Solomon's temple, i.e. toward the equinoctial sunrise (McCluskey 2004, 204).

The twelfth- and thirteenth-century authors shifted from 'the east' to more specific 'the equinoctial east', with Jean Beleth, Sicard of Cremona and the bishop Guillaume Durand explicitly declining the solstitial orientation (Vogel et al. 1962, 206). The medieval French astronomer William of Saint Cloude added a scientific and practical dimension with his *Kalendarium Regine*, where he described how to determine true east on any day of the year, since 'churches should be oriented with this line [of the eastern east], because only the right east indicates our Lord.' As the *right* or the true east (A = 90°, *vide infra*) lies in the same direction irrespective of geographical location, and since the churches with their orientation 'point to Jesus', the author believed that all churches should have such alignment (McCluskey 2004, 205).

In current scholarship on archaeoastronomy, the astronomical orientation of sacred structures is the more studied theme, although sacred spaces also interface with local physical conditions and have not been based on purely religious lines (cf. Ratzinger [2014, 77]; Gangui et al. [2016]). The impact of landscape is clear in the distribution of early churches in Slovenia, with most positioned on highly visible hilltop locations, which often directed their orientation (cf. Čaval and Šprajc [2011]). Several hypotheses about churches with astronomically motivated alignments include, among others; the orientation towards the true or cardinal east; towards the sunrise on the church's patron-saint festival; towards the sunrise of both solstices; and keeping the alignment of previous sacred structures (McCluskey 2015, 1707). The latter hypothesis, of churches being built on the base of sacred pagan structures, retaining a pre-Christian orientation, stems from two prominent sources. First, the Western Roman Emperor, Honorius, issued an edict in AD 408 forbidding the destruction of pagan temples, instead requiring that they be converted into churches (Boyd 1905, 15–32; Coleman 1914, 219–41; Barnish 2001; Bradley 2002, 112–24). Second, in the well-known AD 601 correspondence between St Gregory the Great and St Augustine, Archbishop of Canterbury, the pope recommended that 'the temples of the idols' should not be destroyed but converted into Christian churches. He also advocated overlying pagan festivals with a Christian 'solemnity', either in the form of a 'day of the dedication or the nativities of the holy martyrs' (Bede 1907, 103).

The astronomical orientation of churches was thought to become largely irrelevant either by the end of the Romanesque period (Firneis and Köberl 1988, 431), or by the seventeenth century (Thijm 1858, 13). However, a recent study of churches from the fifteenth to the nineteenth centuries on Lanzarote, Canary Islands, proved this idea inaccurate (Gangui et al. 2016).

Today the symbolism of the east remains powerful and authoritative. Indeed, the original and still practised Coptic rite keeps in its liturgy a warning before a prayer: 'Turn to the east!' (Kocik 2003, 26). Likewise, prior to becoming pope, Benedict XVI stressed the importance of performing present-day liturgical activities in the direction of east (Ratzinger 1986, 139–41). The meaning of church orientations maintained in the Romanesque architecture of Slovenia is the subject to which I now turn.

Materials and methods

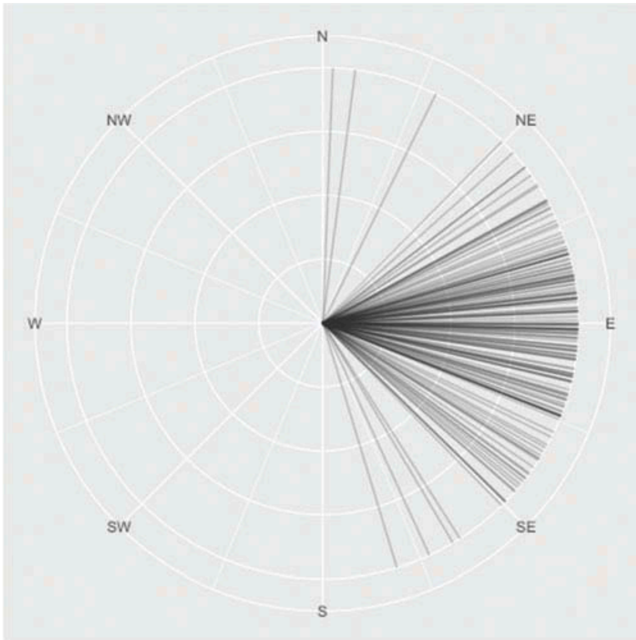
The Romanesque style was the first distinctive pan-European artistic form to dominate western and central Europe. It spanned the tenth to the end of the thirteenth centuries, depending on the region. Romanesque architecture is characterized by a large and heavy outlook, thick walls, a few small windows, semi-circular arches, large towers and ornamental arcading, as well as regular, symmetrical plans (Fernie 2014). Most Slovenian Romanesque churches are predominantly single-nave, with either a semi-circular apse, i.e. the Mediterranean type, or a square presbytery, i.e. the northern type. The circular apse followed Late Antique architectural design, which existed in the region from the Early Christian period and became the primary church type in the wider area due to the Aquileian influence. The square presbytery arrived in the Adriatic region from the north; it originated in Nordic wooden architecture and was brought to central Europe by Irish and Scottish missionaries (Zadnikar 1982, 59; cf. Andrén [2013]). Representative for the area of the Salzburg archdiocese, the square presbytery was in use until the Gothic style period in the fourteenth century (Zadnikar 1982, 2001; Höfler 2016).

In total, 174 churches form the corpus of data upon which the present research is based, accounting for some 80% of all Romanesque churches in Slovenia, and as such representing a significant and robust dataset. Ideally, all period-relevant churches would have been included, but this was not possible due to the fact that in some churches the key Romanesque features, such as the nave, or the phase itself, had not been preserved. Most churches have been architecturally embellished and/or extended over time, with a narthex, transept, side chapels or a bell tower added, along with the chancel and the altar area re-built.

Archaeoastronomy borrows a large portion of methodology from modern astronomy and physics. The analyses of the azimuths (A) (Figure 1) and declinations (δ) have been instrumental for the present case (Figure 2, Figure 3). The study focused on both eastern and western horizons. The main axes of churches were defined by measuring both longitudinal walls and averaging the results. The fieldwork and computational methods for the alignment determination have been published elsewhere (Schaefer 1993; Aveni 2001; Ruggles 1999; Čaval, Zakšek, and Šprajc forthcoming); therefore, methodological particulars are summarized here:

(1) All measurements were taken with a theodolite to avoid global magnetic declination and local magnetic deviations (due to iron rods in the walls, local anomalies influencing the magnetic compass bearing, and so on) (Aveni 2001; Magli 2016, 31–5).
(2) The astronomic reference for the measurements was the Sun.
(3) Altitudes of the two horizons were measured in the direction of azimuths of the churches' outside longitudinal walls, respectively. When the horizon was obscured, an algorithm using DEM was employed (Čaval, Zakšek, and Šprajc forthcoming).
(4) For statistical calculations, the margin of error had to be estimated for A, horizon altitudes and rough datation of churches respectively and considered when interpreting the declinations.

Once these data were collected and processed, they needed to be related to celestial objects. The two brightest celestial bodies in our solar system, when viewed from Earth, are the Sun and the Moon. Their symbolic representations are widely acknowledged and discussed elsewhere (for example, but not limited to, Hutton [2001]; Heilbron [2001]; Penprase [2017]). The Sun in particular emerged as the most obvious inspiration for the



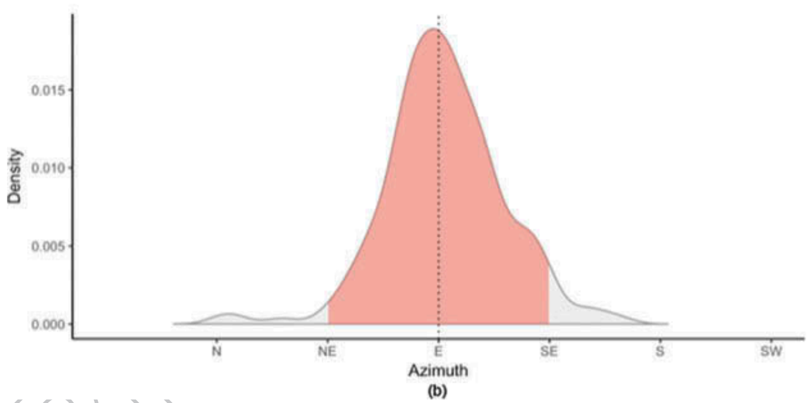


Figure 1. (a, b) The azimuth diagrams of the Romanesque churches in Slovenia show that 97.4% of churches have eastern azimuths (A), with the highest density a few degrees off the true east (E), towards the north (N). A is the angle measured in the horizontal plane clockwise, starting from the N, having values from 0° to 360°. The values between 45° (NE) and 135° (SE) are defined as east; however, only A = 90° corresponds to the true E. The 1b diagram was produced using Gaussian kernel density estimate (Graphics by Claudia Engel, Stanford University, U.S.A.).

orientations. The calendar is another crucial factor that has to be acknowledged when studying astronomical alignments. During the period and geographical region under study, the solar-based Julian calendar was in use (*vide infra*). Therefore, the data were converted into Julian dates.

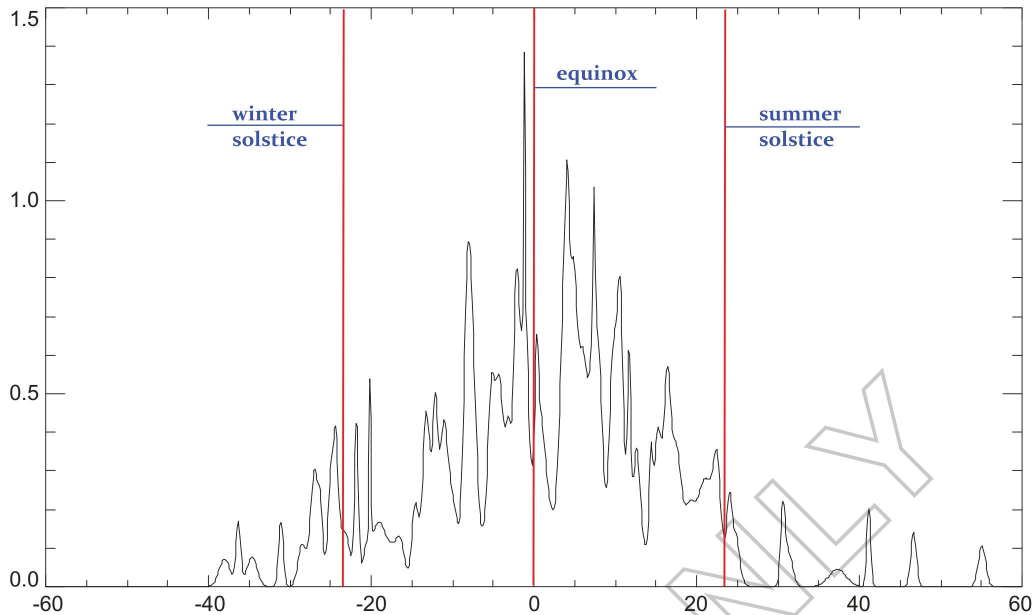


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Figure 2. The cumulative histogram of the declinations (?) on the eastern horizon. ? is the angle between the plane of the celestial equator (Earth's equator projected onto the celestial sphere) and the position of a given celestial object on a celestial meridian, having values from 0° at the celestial equator to + 90° and −90°. ? greater than 90° do not occur, as both poles are the most northern and southern points of the celestial sphere; hence NP ? = + 90° and SP ? = −90°.

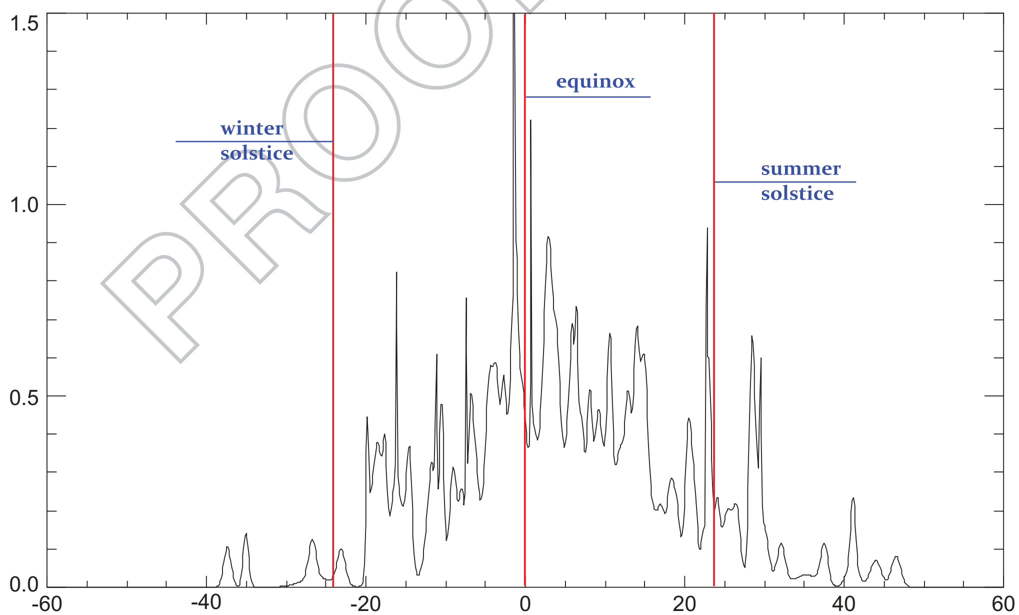


Figure 3. The cumulative histogram of the declinations (?) on the western horizon (Algorithm and graphics by Krištof Oštir, ZRC SAZU, Ljubljana, Slovenia).

Results

Results were based on azimuths (A), declinations (δ) and calendar dates (the Julian and Gregorian).

Azimuths

Out of 174 churches studied, the vast majority (97%) had their longitudinal axes in an east–west direction, which corroborates medieval written sources. These azimuths are not distributed evenly but are arranged into distinctive groups, which is the first indicator of their astronomical conditionality (Figure 1).

Declinations

While the examination of azimuths shows the church alignments regarding cardinal direction, the analysis of declinations sheds light on relevant celestial factors. Today, the δ of the Sun ranges between + 23° 26′ 24″ and −23° 26′ 24″. However, in medieval times, due to the angle between the ecliptic and the equator gradually decreasing, the extreme δ were ± 23°54′ (Aveni 2001, 103). The distribution of δ of churches' longitudinal axes demonstrates that most alignments can be linked to sunrises and sunsets on specific days of the year (Figure 2, Figure 3), which again corroborates the written sources. Effectively, these δ form groups around specific values. When the δ is converted into calendar dates, two dates are generated for each δ, because the Sun on its annual path moves through each point – except the solstices – twice a year: from the winter solstice (δ = −23.5°; 21 December in 2016) to the vernal equinox (δ = 0°; 20 March in 2017), towards the summer solstice (δ = + 23.5°; 21 June in 2017), and back to the autumn equinox (δ = 0°; 22 September in 2017) and the winter solstice (δ = −23.5°; 22 December in 2017). Thus, we obtain two dates per cardinal direction per δ, i.e. two dates for the eastern horizon and two for the western horizon, or, four dates for each church.

Understandably, not all four were intentionally targeted. The final interpretation has to be individually considered and involves the date that best fits with the church's contextual information; a date that conveys insight into the strategy used to determine the church's orientation at the time of construction. Thus, the alignment to a specific date had significance, either for the broader community or a particular benefactor of the church and had to be carefully determined. It may also have matched the alignment of a pre-Christian sacred structure on top of which the church was built.

Calendar dates

When converting δ into dates, we have to be aware of the correct calendar. The Julian calendar was the predominant calendar in Europe from BC 45, when Caesar reformed the old calendar to bring the festivities back into agreement with the seasons, in particular with the equinox (Mommsen 1859). In AD 1582, Pope Gregory XIII was compelled to do likewise. Thus, while the Gregorian calendar harmonizes with a solar year for more than 3030 years before the insertion of one day is required, in contrast, the Julian calendar accrued one day every 128 years. Hence, from BC 45 until AD 1582 almost 13 days of difference accumulated. Since the Gregorian calendar more accurately corresponds to the solar year, δ in this study were converted into proleptic Gregorian

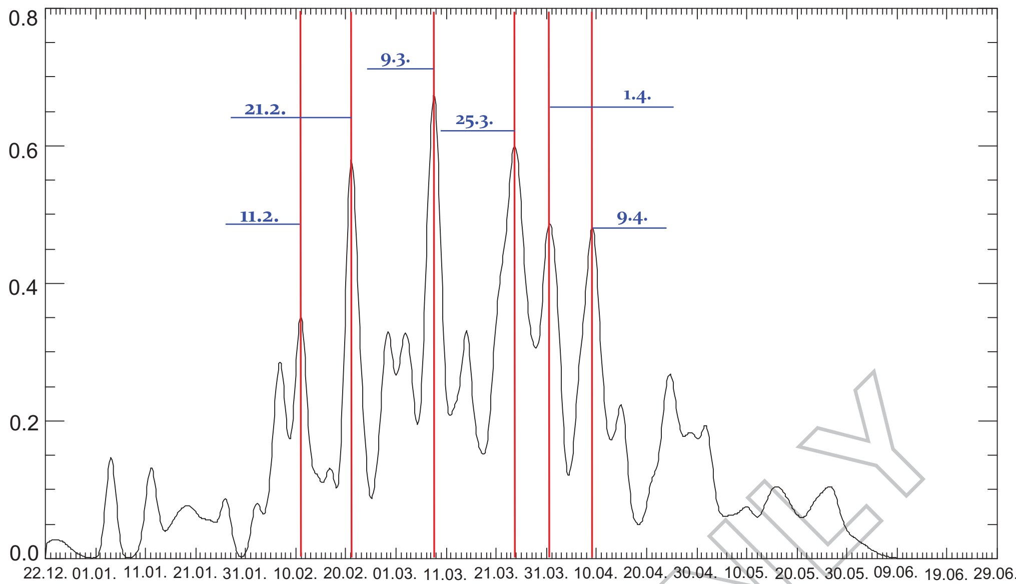


Figure 4. The cumulative histogram of Julian calendar dates in the first half of a year, corresponding to the declinations on the eastern horizon (Algorithm and graphics by Krištof Oštir, ZRC SAZU, Ljubljana, Slovenia).

calendar dates using conversion tables termed geocentric ephemeris, and, subsequently, according to the datation of each church, into Julian calendar dates. The latter are depicted in cumulative diagrams (Figure 4, Figure 5), where the peaks generally align with dates of particular significance in the medieval calendar.

Natural and calendar festivals

As a way to provide boundaries, the significant moments in a year were characterized as 'natural' and 'calendar' festivals, depending on the timekeeping method. Natural festivals are those that mark specific moments in the cycles of celestial bodies as recognized from Earth: for the Sun, this includes equinoxes and solstices; for the Moon, its phases; for the planets, the first and last appearances or other phenomena within their synodic periods; and so on. Prehistoric structural orientations register predominantly natural festivals. Those can be identified through observation of the movement of celestial bodies, usually regarding the horizon, i.e. their rising or setting. Natural festivals correspond to various calendar festivals. These are linked to specific calendars that display timekeeping records of particular cultures, and are shaped both by the society's cultural background and by the context of the historical moment. They correspond to what Victor Turner (1979) called the time of 'a calendrical ritual'. For example, the festival of St Peter's Chair on 22 February is a calendar festival, as it does not originate from an astronomically significant moment, but from a moment in the history of a specific culture/religion, thus having a special meaning only to the members of that culture/religion. Its historical context is captured in the fact that on this day the apostle Peter became the Bishop of Rome and therefore the leader of all Roman Catholic Christians. This day was a major festival in the early Christian and medieval periods (Balboni 1967), but lost its significance in modern times (Murphy 1960). An interesting example of a calendar festival is Easter, as it is based on a specific combination of natural festivals.

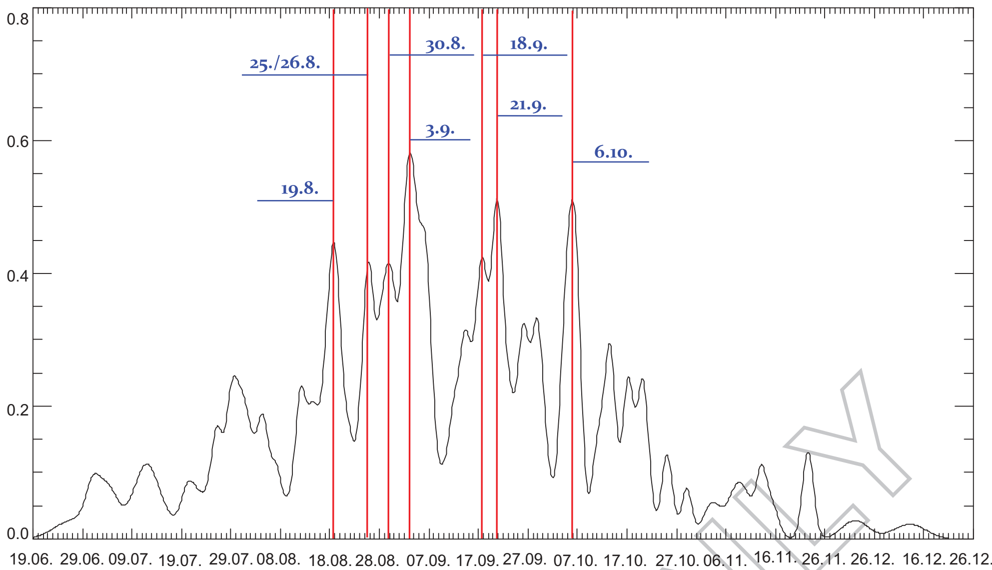


Figure 5. The cumulative histogram of Julian calendar dates in the second half of a year, corresponding to the declinations on the eastern horizon (Algorithm and graphics by Krištof Oštir, ZRC SAZU, Ljubljana, Slovenia).

Solstice

The solstices are the two critical moments, the dividing points, in a solar year. The change in the length of a day had an immense impact on societies and cultures, and on conceptions of their spiritual and earthly world. In prehistoric societies, the orientations towards solstice sunrise and sunset were equally important (Ruggles 2005), while in medieval Christian communities the east, therefore the sunrise, was the most prominent (*vide supra*).

Determination of the solstice by observing the movement of the Sun on the horizon can be problematic, as the Sun at that time of a year moves very slowly. From ethnographic accounts of Native American societies, we learn that the movement of the Sun in respects to the horizon is observable with the naked eye only about a week before or after the solstice, when the Sun moves for about 10 arc minutes (10′). During these two weeks the Sun seems to be still (Zeilik 1985; McCluskey 1982; cf. Ruggles [1999]).

The early Christian calendar indisputably embraced traditional Roman dates for solstices and equinoxes, as noted by Pliny, AD 23–79: *VIII Kal* in January, April, July and October. Bede the Venerable defined the four cardinal points of the year following this designation and compared the turning points in Jesus's life with the Sun's annual phenomena. Not surprisingly, the four dates became major Christian festivals and particularly worthy of being recorded in the orientation of sacred architecture:

> This is what some of the pagans say; and very many of the church's teachers […], saying that our Lord was conceived and suffered on the 8th before the kalends of April [25th March], at the spring equinox, and that he was born at the winter solstice on the 8th before the kalends of January [25th December]. And again, that the Lord's blessed precursor and Baptist was conceived at the autumn equinox on the 8th before the kalends of October [24th September] and born at the summer solstice on the 8th before the kalends of July [24th June] … [I]t was fitting that the Creator of eternal light should be conceived and born along with the increase of temporal light, and that the herald of penance, who must decrease, should be engendered and born at a time when the light is diminishing. (Nothaft 2011, 101)

Bede was already aware of the incongruence between the Julian calendar and the mean tropical year, as he mentioned that:

> […] as we have learned in connection with the calculation of Easter […], it is in particular agreement that the spring equinox is on the 12th before the kalends of April [21 March], we think that the three other turning-points of the seasons ought to be observed a little before [the date] given in the popular treatises. (Nothaft 2011, 101)

Bede published the *Reckoning of Time* in AD 725, when the difference between both was four days (Tierney 1911; Newton 1972; Nothaft 2011), whereas the present study is focused on the period between the tenth and the end of the thirteenth century when the difference was six to seven days.

Acknowledging the uncertainties regarding the observations and the calendar and considering as solstitial orientations those with the δ = ± 23.54° and the margin of error ± 0.5°, there are 22 churches (13%) oriented towards this natural feast: 16 churches towards summer solstice, five towards winter solstice and one towards both (Figure 6, Figure 7).

Equinox

Although measuring the exact day of the solstice is challenging, observation of a sunrise or sunset around equinoxes is straightforward. The position of the Sun on the horizon changes dramatically,

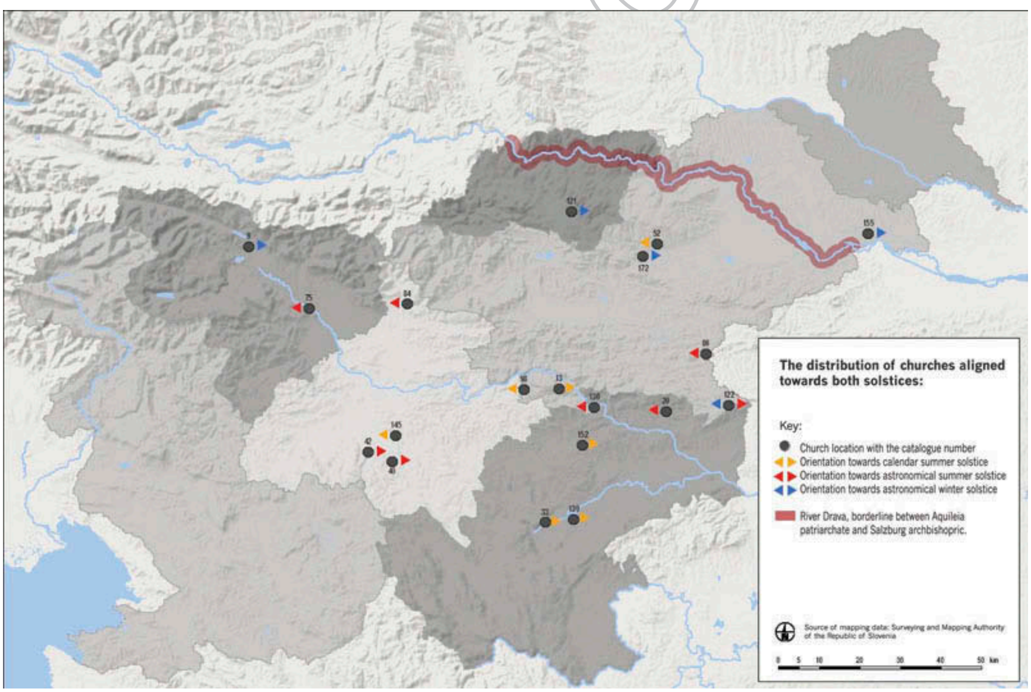


Figure 6. The distribution of churches aligned towards both solstices. The catalogue numbers with churches' locations: 8 – Breg pri Žirovnici, 13 – ?imerno, 20 – Dovško pri Senovem, 33 – Gorenja Straža, 36 – Gorenji Mokronog, 40 – Gradiš?e nad Želimljami, 42 – Iška vas, 43 – Jakovica pri Planini, 49 – Kamnik, Mali grad, 52 – Koritno nad Oplotnico, 75 – Okroglo, 84 – Planina nad Kamnikom, 86 – Pod?etrtek, 98 – Rodež pod Kumom, 121 – Sv. Magdalena na Brdah, 122 – Svete gore, St. Goerge, Bistrica ob Sotli, 130 – Šentjur na Polju, 139 – Šmihel pri Novem mestu, 145 – Tlake, Šmarje Sap, 152 – Tržiš?e pri Mokronogu, 155 – Velika Nedelja, 172 – Zre?e (Graphics by Peter Pehani, ZRC SAZU, Ljubljana, Slovenia).

ID	Location	Patron-saint	Archaeol. continuity	East		West	
				Declination	Margin of error	Declination	Margin of error
13	Čimerno	Trinity	P	21,895	2,4333	-14,93538	0,8333
40	Gradišče nad Želimljami	Primož,Felicijan	P, R	23,9787	0,1433	-19,51294	0,1966
42	Iška vas	Michael	P, R, M	22,95463	1,3916	-0,32174	0,4583
121	Sv. Magdalena na Brdah	Magdalene	/	-23,09232	0,7283	35,25471	2,3283
122	Svete gore nad Bistrico ob Sotli	George	P, R, M	24,76685	0,325	-23,14407	0,4583
152	Tržišče pri Mokronogu	Mary	P, R, M	22,35523	2,3416	-2,51560	0,9416
172	Zreče	Egidij	P, R	-23,55377	0,6425	28,96325	0,6425
20	Dovško pri Senovem	Jacob	P	-21,80205	0,0866	23,97005	0,1533
36	Gorenji Mokronog	Peter	P, R, M	-14,31229	0,5720	19,39444	8,4387
43	Jakovica pri Planini	Mary	P, R	41,09876	0,0991	-26,20356	4,0325
75	Okroglo	Magdalene	/	-21,89894	0,0920	23,07482	0,0920
84	Planina nad Kamnikom	Primož,Felicijan	P	-18,76538	0,7833	24,62634	0,7166
86	Podčetrtek	Lawrence	P, R	-5,76497	0,8225	24,94477	2,6225
130	Šentjur na Polju	George	P, R	-14,68489	0,22	23,21071	0,1
8	Breg pri Žirovnici	Radegunda	P, R, M	-24,36857	0.1154	28,34882	0.1820
33	Gorenja Straža	Thomas	P, R	22,49644	0,2029	-18,19072	0,2562
49	Kamnik, Mali grad	Egidij	M	20,9548	1,7912	-0,27333	4,9912
139	Šmihel pri Novem mestu	Michael	R	22,12265	0,4216	-19,88413	0,035
155	Velika Nedelja	Trinity	R	-24,47208	0,3012	26,52872	0,3012
52	Koritno nad Oplotnico	Nicholas	P, R	-20,19345	0,0216	22,85922	0,035
98	Rodež pod Kumom	Lenart	P, R, M	-11,09084	6,5387	22,68079	0,0054
145	Tlake, Šmarje Sap	Cross	R	-20,52295	0,4858	22,35263	0,2058

Figure 7. The data records for the churches oriented towards both solstices (Figure 6).

for three quarters of the Sun disc's diameter per day (Ruggles 1999). In the astronomical sense, equinox is the moment when the Sun, while circulating on its ecliptic path, intersects the celestial equator. This occurs twice a year, on the vernal and autumnal equinox: around 21 March and 23 September in Gregorian calendar (cf. Ruggles [1997]; cf. González-García and Belmonte [2006]). These are the only two moments in a solar year when the terminator – the line that parts the day from the night – is perpendicular to the Earth's equator, and both southern and northern hemispheres are equally illuminated. In the medieval period various calendar dates corresponded to equinoxes (McCluskey 1998, 2007; González-García and Belmonte 2006) (Figure 8, Figure 9).

A similar situation can be found in the second half of the year (McCluskey 1998, 2007).

Vernal Equinox	March 18th	The astrological moment of the sun's entry into Aries defined the vernal equinox in the Middle Ages and was marked in medieval manuscript calendars as the beginning of the world (McCluskey 1998; Newton 1972). Indeed, today the vernal equinox is also termed the first point of Aries (cf. NASA Vernal Equinox).
	March 21st	Greek traditional vernal equinox
		Egyptian traditional vernal equinox
		Ecclesiastical equinox, declared as such at the 1st ecumenical council in Nicaea, in 325 AD
	March 25th	Roman traditional vernal equinox, with five days of celebration (March 19th to 24th, between *XIV* and *X Kal. Apr.*), called *Quinquatras*, dedicated to Mars and Minerva.
		The conventional Christian vernal equinox in the whole medieval Christian world (in parallel with the ecclesiastical vernal equinox!), persisting in Latin ecclesiastical calendars since the time of Bede.
		The liturgical festival, Annunciation of St. Mary, one of the most significant Christian festivals, initially celebrated from around 400 AD on in the East.

Figure 8. Calendar dates for vernal equinox.

AUTUMNAL EQUINOX	SEPTEMBER 17TH	The Sun's entry into the sign of Scales, i.e. the autumnal equinox in the last centuries of the 1st millennium.
	SEPTEMBER 21ST	Greek traditional autumnal equinox
		The liturgical feast of the apostle and evangelist St. Matthew
		The folk festival marking the beginning of winter in central European countries, important as the medieval Slovenian territory was under the Germanic ascendancy (Schauber and Schindler 1995).
	SEPTEMBER 24TH	Roman traditional autumnal equinox
		The liturgical feast marking the Conception of St. John the Baptist
		The liturgical feast of St. Rupert, the first bishop of Salzburg and preferred patron saint of the archbishopric (Smolik 2000b; Höfler 2016)

Figure 9. Calendar dates for autumnal equinox.

Churches were interpreted as intentionally aligned towards the equinoxes when the δ = 0° or when the calendar dates corresponded to any of the aforementioned dates (Figure 2, Figure 3). The total number of those is 66 (37.9 %). If we take as equinoctial orientations only those with the δ within the span of ± 0.2°, we find 15 churches (9%) oriented towards either of the astronomical equinoxes. This is a small number at first glance. However, these 15 churches also have a meaningful alignment on the other horizon, either eastern or western. Seven of those 15 churches cluster quite closely around the beginning of April/end of August and end of April/beginning of August, suggesting the orientations towards liturgical festivals of St Agape, Chionia, and Irene on 1 April (also on 3 April or 5 April) (Smolik 2000a, 44; Schauber and Schindler 1995, 132), the Roman festival of Magna Mater on 4 April (with an exciting correlation
AQ6 to Cybele and her festivals in March, including 25 March; see Lane [1996]; Takács 1996; Šašel Kos 2010), St Augustine on 28 August or the Beheading of St John the Baptist on 29 August. The other eight churches record an unexpected range of festivals: one church, a solstice; two, the ecclesiastical equinox; another two, the Sun's entry into the astrological sign of Scales; and three churches, the Christian equinox of 25 March. To summarize, the latter eight churches on one horizon register the natural feast – the astronomical equinox (δ = 0° ± 0.2°) – while on the opposite horizon, they simultaneously record the calendar festival associated with a natural festival, mostly with the spring equinox (Figure 10). All of these churches were built on or in the immediate vicinity of prehistoric or Roman period archaeological sites (Figure 11), although the continuity of the exact sacred location has not been archaeologically confirmed.

The vernacular calendar

The aforementioned calendar festivals all refer to the related official calendars. The vernacular calendar provides another aspect of a community's timekeeping and festivities. The Slovenian medieval vernacular calendar was formed on the base of the period's prevailing economy, agriculture (Makarovič 1995, 15). It characterizes phases of agricultural processes and indicates agrarian turning points within a year. Through contacts with ecclesiastical and urban culture, the
AQ7 institutional temporality (Mills 2000), such as the liturgical seasons (cf. Hickman [1992, 13]), started to enter the vernacular calendar. By the late medieval period the church calendar merged with the rural populations' agrarian rhythm of life, and liturgical festivals became calendric estimates for agricultural tasks, fairs and festivities (Makarovič 1995, 45).

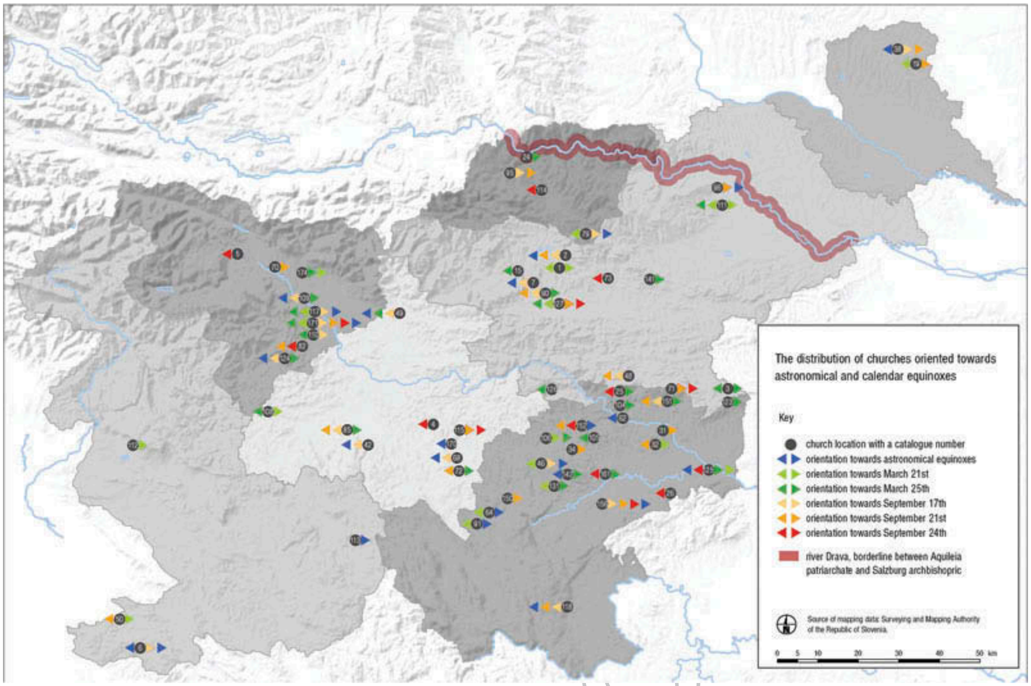


Figure 10. The distribution of churches with both calendar and astronomical orientations towards both vernal and autumnal equinoxes on both eastern and western horizons (Figure 8, Figure 9, Figure 11). The catalogue numbers of churches' locations: 1 – Arna?e, 2 – Bev?e, 3 – Bistrica ob Sotli, 4 – Ble?ji vrh nad Višnjo goro, 5 – Bled, otok, 6 – Boršt nad Koprom, 7 – Braslov?e, 15 – Dobrovlje nad Mozirjem, 19 – Domanjševci, 24 – Dravograd, 25 – Drožanje, 26 – Frluga, 31 – Gora pri Krškem, 32 – Gorenja Lepa vas, 34 – Gorenje Laknice, 38 – Gorenji Petrovci, 42 – Iška vas, 46 – Jezero pri Trebnjem, 48 – Jurklošter, 49 – Kamnik, Mali grad, 50 – Koper, 62 – Log pri Sevnici, 64 – Lopata, 68 – Malo ?rnelo, 70 – Mošnje, 71 – Mrzla Planina pri Sevnici, 72 – Muljava, 73 – Nova cerkev, 79 – Paški Kozjak, 82 – Pevno pri Škofji Loki, 85 – Planinca nad Jezerom, 90 – Polzela, 91 – Prevole, 95 – Ravne na Koroškem, 96 – Razvanje pri Mariboru, 104 – Sevnica, 105 – Slan?ji vrh, 106 – Slepšek, 108 – Smre?je, 109 – Spodnja Besnica, 110 – Spodnje Bitnje, 111 – Spodnje Ho?e, 112 – Spodnje Vitovlje, 113 – Stari trg pri Ložu, 114 – Stari trg pri Slovenj gradcu, 115 – Sti?na, 117 – Stražiš?e, Kranj, 118 – Stražnji vrh, 123 – Svete Gore, 124 – Sv. Tomaž nad Škofjo Loko, 125 – Sv. Vid nad Brežicami, 126 – Svibno, 127 – Šempeter v Savinjski dolini, 131 – Šentjurij na Dolenjskem, 141 – Špitali?, 142 – Štatenberk, 150 – Treb?a vas, 151 – Trnovec nad Sevnico, 152 – Tržiš?e pri Mokronogu, 156 – Velike Brusnice, 161 – Vinji vrh pri Beli cerkvi, 170 – Zgornja Draga, 171 – Zgornje Bitnje, 174 – Žiganja vas (graphics by Peter Pehani, ZRC SAZU, Ljubljana, Slovenia).

Slovenian Protestant reformer Primož Trubar used the calendar assembled by Johannes Hildebrand, a *magister* in Tübingen, Germany, to document the first Slovenian calendar. Printed in 1557, it discerns the liturgical festivals observed as the beginnings of the agrarian seasons, and communicates the medieval tradition of associating saints' feasts with astronomical beginnings of the seasons (Trubar 1581/82, 1986; Makarovič 2006). The Trubar calendar gives the following feasts that served as an agrarian and astronomical division of a year into seasons (Figure 13). It is unknown how Trubar acquired the information he presented. However, if focusing specifically on the astronomical division it is clear that he noted the real-time movement of the Sun's cycle. Except Hildebrand did not track the actual astronomical situation for that year: the spring equinox in 1557 was on 10 March (Smith 1996; Equinox and solstice). The dates for solstices and equinoxes, chronicled in the Trubar calendar, were misaligned with the existing celestial positions and marked

ID	Location	Patron-saint	Archaeol. continuity	EAST			WEST		
				Declination	Calendar date	Margin of error	Declination	Calendar date	Margin of error
1	Arnače	Giles	P	2,4000	19. Mar / 10. Sep	2 days	2,56797	19. Mar / 9. Sep	2 days
2	Bevče	Nicholas	P	15,15788	25. Apr / 5. Aug	0,2254	-0,73426	11. Mar / 18. Sep	1,2921 / 3 days
3	Bistrica ob Sotli	Peter	P, R	4,17959	26. Mar / 7. Sep	1 day	3,68996	24. Mar / 8. Sep	1 day
4	Blečji vrh nad Višnjo goro	Benedict	P, R	10,21819	9 Apr / 20. Aug	2 days	-3,78873	3. Mar / 25. Sep	2 days
5	Bled, otok	Mary	P, R, M	11,6333	14. Apr / 16. Aug	1 day	-2,78117	6. mar / 23. Sep	1 day
6	Boršt nad Dragonjo	Roch	P, R, M	0,11879	13. Mar / 15. Sep	0,9450 / 2 days	0,59564	14. Mar / 14. Sep	1,0650
7	Braslovče	Mary	R, M	8,81372	6. Apr / 25. Aug	0,7833 / 3 days	-0,83053	12. Mar / 18. Sep	0,7833 / 2 days
15	Dobrovlje nad Mozirjem	Urban	M	6,53219	30. Mar / 30. Aug	5 days	5,14804	26. Mar / 2. Sep	2 days
19	Domanjševci	Martin	M	-2,25553	8. Mar / 22. Sep	1 day	2,28726	19. Mar / 10. Sep	2 days
24	Dravograd	Vitus	R	6,08348	29. Mar / 1. Sep	3 days	5,41680	27. Mar / 2. Sep	1 day
25	Drožanje	Martin	P	5,02895	27. Mar / 3. Sep	2 days	-4,14190	3. Mar / 26. Sep	3 days
26	Frluga	Katherine	P	7,68447	1. Apr / 26. Aug	2 days	-4,48473	1. Mar / 26. Sep	2 days
31	Gora pri Krškem	Lawrence	R	-1,84907	9. Mar / 21. Sep	1 day	1,2833	16. Mar / 12. Sep	1 day
32	Gorenja Lepa vas	Primus and Felician	/	2,9333	22. Mar / 8. Sep	1 day	-1,8010	8. Mar / 21. Sep	1 day
34	Gorenje Laknice	Judoc	P	-1,75047	9. Mar / 21. Sep	1 day	8,6500	5. Apr / 24. Aug	3 days
38	Gorenji Petrovci	Trinity	P	-1,21887	10. Mar / 19. Sep	2 days	0,6500	14. Mar / 14. Sep	1 day
42	Iška vas	Michael	P, R, M	22,95464	1. Jun / 27. Jun	1,3917	-0,32174	11. Mar / 15. Sep	0,4583 / 2 days
46	Jezero pri Trebnjem	Peter	P, R	-0,03600	14. Mar / 16. Sep	0,3338 / 1 day	2,90262	21. Mar / 8. Sep	0,3338 / 1 day
48	Jurkloštar	Martin	P, R, M	16,42200	29. Apr / 1. Aug	0,6208	-1,06425	10. Mar / 18. Sep	1,2875 / 3 days
49	Kamnik, Mali grad	Giles	P, R, M	20,95482	18. May / 13. Jul	1,7913	-0,27333	13. Mar / 17. Sep	4,9913 / 13 days
50	Koper	Mary	P, R, M	3,5833	22. mar / 7. Sep	1 day	-1,33552	11. Mar / 20. Sep	1 day
62	Log pri Sevnici	Cross	P, R	7,89130	3. Apr / 27. Aug	0,4204 / 1 day	0,94091	16. Mar / 13. Sep	1,4871
64	Lopata	Agnes	P, M	0,62836	15. Mar / 15. Sep	0,6721	2,90767	21. Mar / 8. Sep	0,1388 / 1 day
68	Malo Črnelo	Margareth	P, R	7,96378	3. Apr / 27. Aug	1 day	-0,97103	11. Mar / 18. Sep	2 days
70	Mošnje	Andrew	R, M	-1,56783	10. Mar / 21. Sep	3 days	8,2501	4. Apr / 26. Aug	3 days
71	Mrzla Planina pri Sevnici	Primus and Felician	R	-2,60507	7. Mar / 23. Sep	2 days	7,1667	1. Apr / 28. Aug	5 days
72	Muljava	Mary	P, R, M	6,10756	30. Mar / 1. Sep	5 days	-1,55512	9. mar / 20. Sep	1 day
73	Nova cerkev	Leonard	R	10,35681	10. Apr / 19. Aug	2 days	-4.9876	2. Mar / 26. Sep	2 days
79	Paški Kozjak	Hermagoras and Fortunatus	P	-1,05258	10. Mar / 18. Sep	2 days	2,34696	19. Mar / 9. Sep	2 days
82	Pevno pri Škofji Loki	Ursula	P, R, M	9,35502	7. Apr / 23. Aug	1 day	-2,64122	6. mar / 22. Sep	2 days
85	Planinca nad Jezerom	Thomas	P	3,85345	24. Mar / 6. Sep	1 day	-1,41124	10. Mar / 19. Sep	2 days
90	Polzela	Margareth	P, R	4,87706	26. Mar / 4. Sep	2 days	-1,17986	10. Mar / 19. Sep	2 days
91	Prevole	Cross	P	1,1001	16. Mar / 13. Sep	1 day	2,62471	19. Mar / 9. Sep	1 day
95	Ravne na Koroškem	Elijah	R, M	-1,24560	10. Mar / 19. Sep	2 days	6,9667	31. Mar / 28. Aug	1 day
96	Razvanje pri Mariboru	Michael	P, R	-1,51222	11. Mar / 21. Sep	1,4704 / 3 days	8,79926	6. Apr / 25. Aug	1,5904
104	Sevnica	Florian	P, R, M	5,05214	25. Mar / 1. Sep	3 days	12,7501	15. Apr / 10. Aug	3 days
105	Slančji vrh	Ulrich	P, R	-4,3667	3. Mar / 27. Sep	1 day	4,06246	24. Mar / 5. Sep	1 day
106	Slepšek	Martin	P, R	3,72018	23. Mar / 7. Sep	2 days	8,0333	3. Apr / 26. Aug	4 days
108	Smrečje nad Vrhniko	Ulrich	P, R	1,7001	18. Mar / 12. Sep	3 days	3,95882	23. Mar / 6. Sep	8 days
109	Spodnja Besnica	John the Baptist	P	4,85617	26. Mar / 3. Sep	-0,7638 / 2 days	-0,76814	11. Mar / 17. Sep	0,7771 / 2 days
110	Spodnje Bitnje	Nicholas	R	-1,03514	10. Mar / 18. Sep	2 days	4,48069	24. Mar / 4. Sep	1 day
111	Spodnje Hoče	George	R, M	1,5167	18. Mar / 13. Sep	2 days	2,96408	22. Mar / 9. Sep	2 days
112	Spodnje Vitovlje	Peter	R, M	3,2167	21. Mar / 8. Sep	1 day	6,36867	29. Mar / 30. Aug	1 day
113	Stari trg pri Ložu	George	P, R M	0,6502	16. Mar / 15. Sep	1 day	12,8667	17. Apr / 13. Aug	3 days
114	Stari trg pri Slovenj gradcu	Pancras	R, M	10,27353	10. Apr / 20. Aug	2 days	-3,45356	4. Mar / 24. Sep	1 day
115	Stična	Mary	P, R	-2,19561	9. Mar / 22. Sep	3 days	12,3667	16. Apr / 14. Aug	2 days
117	Stražišče, Kranj	Peter	P, R	0,28909	16. Mar / 17. Sep	1 day	3,20978	23. Mar / 9. Sep	1 day
118	Stražnji vrh	Nicholas	P	10,34258	10. Apr / 20. Aug	0,4658 / 2 days	-2,05776	8. Mar / 21. Sep	4,5992 / 13 days

Figure 11. The data records for the churches with both calendar and astronomical orientations towards both vernal and autumnal equinoxes on both eastern and western horizons (Figure 8, Figure 9, Figure 10).

123	Svete Gore	Martin	P, R, M	5,39215	29. Mar / 4. Sep	4 days	-5.35678	1. Mar / 1. oct	3 days
124	Sv.Tomaž nad Škofjo Loko	Thomas	P	4,31295	25. Mar / 5. Sep	0,8429 / 2 days	-0,49011	12. Mar / 17. Sep	0,7763 / 2 days
125	Sv. Vid nad Brežicami	Vitus	P, R, M	4,08433	23. Mar / 5. Sep	2 days	-3,55834	3. Mar / 24. Sep	2 days
126	Svibno	Cross	P	-4,1333	3. Mar / 27. Sep	2 days	5,41129	27. Mar / 2. Sep	2 days
127	Šempeter v Sav. dolini	Peter	P, R	-2,21760	9. Mar / 22. Sep	3 days	3,81903	23. Mar / 7. Sep	1 day
131	Šentjurij na Dolenjskem	George	P, R	5,26352	27. Mar / 3. Sep	2 days	3,15801	21. Mar / 8. Sep	1 day
141	Špitalič	Mary	P, R, M	4,31017	25. Mar / 5. Sep	1 day	6,30273	29. Mar / 30. Aug	2 days
142	Štatenberk	Martin	P, R, M	4,86797	26. Mar / 4. Sep	2,6025 / 6 days	1,81734	18. Mar / 11. Sep	2,6025
150	Trebča vas	Agathius	R	-2,23799	8. Mar / 22. Sep	1 day	5,89166	28. Mar / 1. Sep	1 day
151	Trnovec nad Sevnico	George	R	4,51650	25. Mar / 4. Sep	1 day	-1,61152	8. Mar / 19. Sep	2 days
152	Tržišče pri Mokronogu	Mary	P, R, M	22,3502	27. May / 3. Jul	14 days	-2,51560	6. Mar / 22. Sep	2 days
156	Velike Brusnice	Holy Family	P, R	-0.7765	12. Mar / 18. Sep	3,1100 / 8 days	6,26942	29. Mar / 31. Aug	0,4833 / 2 days
161	Vinji vrh pri Beli cerkvi	Mary	P, R, M	4,64936	25. Mar / 4. Sep	3 days	-3,73744	3. Mar / 25. Sep	1 day
170	Zgornja Draga	Michael	P, R	6,91118	1. Apr / 30. Aug	2 days	0,8002	16. Mar / 14. Sep	1 day
171	Zgornje Bitnje	Thomas	P	-0,99223	11. Mar / 19. Sep	2 days	3,89098	23. Mar / 6. Sep	2 days
174	Žiganja vas	Ulrich	R	3,51335	23. Mar / 7. Sep	6 days	3,89733	23. Mar / 6. Sep	2 days

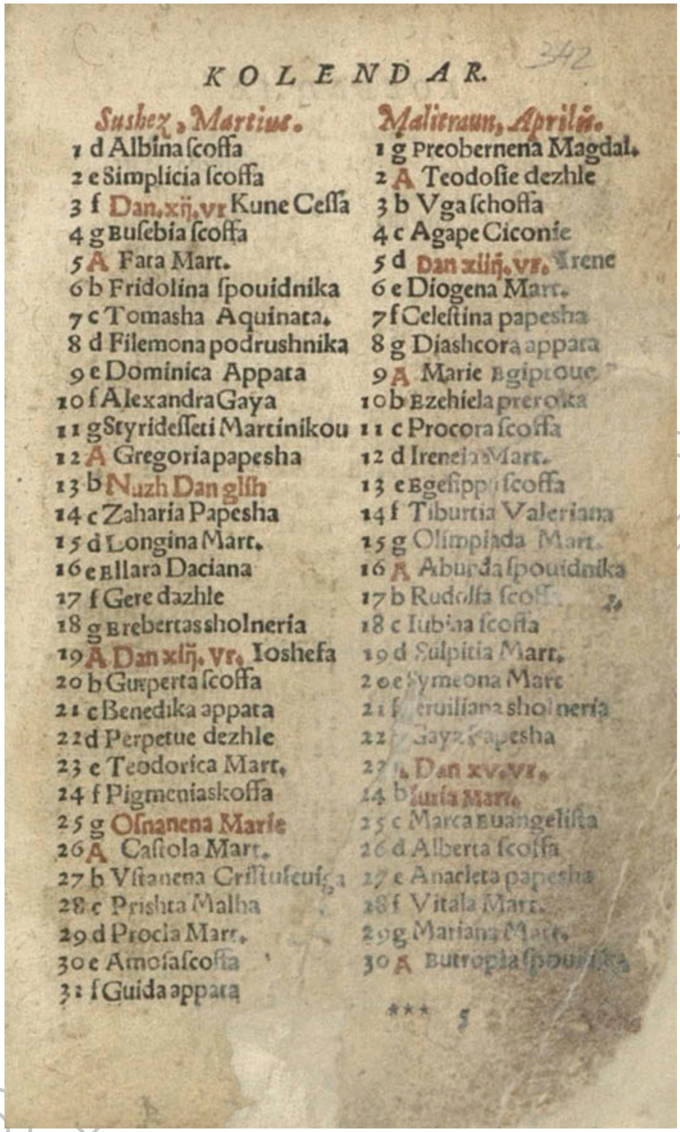
Figure 11. (Continued).

on 13 March (Figure 12). Focusing on the dates that mark the astronomical division of a year (Figure 13), we may be able to extract the more precise timeframe of the calendar on which Hildebrand and later Trubar based their records. Due to the structure of a solar calendar (the Julian and Gregorian), the δ of the Sun changes on a yearly basis on the same date. With the intercalations of a day every four years, the individual dates repeat approximately at four-year intervals, with two dates alternating until one of them prevails (Figure 14). This allows a deduction that the dates originated in a calendar for some undetermined year between the beginnings of the thirteenth to the middle of the fourteenth century (Makarovič 1995, 49; Schnurrer 1799, 26; Pintar 1908, 273).

The results confirmed the well-known importance of spring for vernacular communities and revealed the instruments that they used to mark the start of the season. The alignment to the beginning of the agrarian spring, to the Chair of St Peter, was intentionally registered in 19 churches (11%), with all marking the festival on their eastern horizon. St Gregory's festival, the last day of astronomical winter, was registered in the orientation of 22 churches (13%), almost equally on both horizons. Other dates documented within the vernacular calendar do not have any significant number of churches oriented to them.

Discussion

The results noted earlier are consistent with the concepts of space and time of past societies, which are viewed as cultural products or artefacts that remain embedded and embodied in physical objects, events and processes of the past. All human activities were and continue to be performed in space and time; therefore, space and time represent significant factors of divisions and hierarchies in a society. In fact, when anthropologists speak of space and time, they often mean concepts of social space and social time (Iwaniszewski 2015). Anthropological research can be critical in reconstructing ancient lifeways. Anthropological evidence, collected among modern traditional societies, indicates highly context-rich and context-dependent conceptions of time and space (Ruggles 1997, S48; see also Lane [2016]). Historically, people tried to make sense of the passage of time by classifying and categorizing their personal or shared events. Similarly,



KOLENDAR.

Sushez, Martius.
1 d Albina ſcoffa
2 e Simplicia ſcoffa
3 f Dan.xij.vr Kune Ceſſa
4 g Euſebia ſcoffa
5 A Fara Mart.
6 b Fridolina ſpouidnika
7 c Tomasha Aquinata.
8 d Filemona podrushnika
9 e Dominica Appata
10 f Alexandra Gaya
11 g Styrideſſeti Martinikou
12 A Gregoriapapesha
13 b Nuzh Dan glih
14 c Zaharia Papesha
15 d Longina Mart.
16 e Ellara Daciana
17 f Gere dazhle
18 g Erebertas sholneria
19 A Dan xiij. vr. Ioshefa
20 b Gurperta ſcoffa
21 c Benedika appata
22 d Perpetue dezhle
23 e Teodorica Mart.
24 f Pigmeniaskoffa
25 g Oſnanena Marie
26 A Caſtola Mart.
27 b Vſtanena Criſtuſeuiga
28 c Prishta Malha
29 d Procia Mart.
30 e Amoſaſcoffa
31 f Guida appata

Malitraun, Aprilis.
1 g Preobernena Magdal.
2 A Teodoſie dezhle
3 b Vga ſchoffa
4 c Agape Ciconie
5 d Dan xiiij. vr. Irene
6 e Diogena Mart.
7 f Celeſtina papesha
8 g Diashcora appara
9 A Marie Egiptoue
10 b Ezehiela preroka
11 c Procora ſcoffa
12 d Ireneia Mart.
13 e Egeſippa ſcoffa
14 f Tiburtia Valeriana
15 g Olimpiada Mart.
16 A Aburda ſpouidnika
17 b Rudolfa ſcoffa
18 c Iubiaa ſcoffa
19 d Sulpitia Mart.
20 e Symeona Mart
21 f Seruiliana sholneria
22 g Gaya Papesha
23 A Dan xv. vr.
24 b Iurja Mart.
25 c Marca Euangeliſta
26 d Alberta ſcoffa
27 e Anacleta papesha
28 f Vitala Mart.
29 g Mariana Mart.
30 A Eutropia ſpouidnika

*** 5

AQ8 **Figure 12.**

BEGINNING OF ...	SPRING	SUMMER	AUTUMN	WINTER
AGRARIAN DIVISION	February 22nd – The Chair of St. Peter	May 25th – St. Urban	August 24th – St. Bartholomew	November 23rd – St. Clement
ASTRONOMICAL DIVISON	March 13th – a day **after** the festival of St. Gregory, March 12th	June 14th – a day **before** the festival of St. Vitus, June 15th	September 15th – a day **after** the Feast of the Exaltation of the Holy Cross, Sept. 14th	December 14th – a day **after** the festival of St. Lucia, Dec. 13th

Figure 13. Liturgical festivals acting as partitions for annual seasons following agrarian and astronomical divisions in the Trubar calendar (AD 1557).

Vernal equinox	Summer solstice	Autumnal equinox	Winter solstice
12th, 13th March	13th, 14th June	14th, 15th September	13th, 14th December

Figure 14. In the period around the beginning of the fourteenth century these were the dates, exchanging on a four-year base as per natural festival (source URL: https://www.timeanddate.com/calendar/seasons.html?year=1300&n=736.).

prosperous places charged landscapes with meaning and gave rise to sacred geographies (Ruggles 1997, 48; McCluskey 2010; Lopez 2015).

An extensive body of literature addresses sacred space and time within religious studies. The works of Dürkheim (2008), van Gennep (2013), Eliade (1959), van der Leeuw (2014) as well as Smith (1987), Bell (1997) and Anttonnen (1996; 2000; 2005) are highly relevant to the present study. The astronomical orientation of churches combines, conveys and communicates sacred time and space in a single cultural or religious object; it delivers a continuous catchment of a singular sanctified moment in a year within a consecrated structure. Considerable preparation and planning had to be mustered into a site for it to capture the divine interplay. A church had to be erected strategically: to register an exact time within a whole year it needed to be built in a specific place, set with a particular layout and in a precise direction while continuously considering the horizon. Although the present text addresses the festivals that are focused around the solstices and equinoxes, the same idea is conveyed in every astronomically oriented sacred structure, AQ9 without regard to a geographical area and chronological period (Ruggles 2005 ; Magli 2016; cf. Lundquist [2016, 50, 51, fn. 7]).

Lundquist's (1983, 2016) comparative study of ancient Near Eastern temples states a few theorems attesting that the temple and its rituals are linked to cosmogony and were seen as a copy or counterpart of a heavenly model (Lundquist 2016, 53; Morales 2014, 6). Judaism took over the ancient concept of a temple as a consecrated image of the cosmos and Christianity inherited and embedded it in its own temple, a church (Eliade 1974; Clements 2016; de Blaauw 2012, 15; Morales 2014, 1–10). Although somewhat out-dated within religious studies, Eliade's view is nevertheless applicable: 'The four parts of the interior of the church symbolize the four cardinal directions. The interior of the church is the universe. The altar is the paradise, which lay in the East' (1959, 61).

One of the three basic requirements of a church from Constantine's time (AD 306–337) was alignment on a 'cosmic axis' (de Blaauw 2012, 2016, 557). At some point between Early Christianity and the medieval period, the more exact orientation of churches was adopted. When and why this happened remains poorly understood. However, the topic has been well addressed in the Iberian Peninsula. An exhaustive study of Iberian pre-Romanesque churches showed that the vast majority of churches from the late fourth to eleventh centuries was orientated toward sunrise on 25 March, i.e. the Roman vernal equinox and Christian liturgical festival of St Mary's Annunciation (González-García and Belmonte 2015). In addition, the study of a sixth-century church in the hill fort of Tonovcov grad in western Slovenia showed that a more detailed and possibly politically directed orientation – not simply towards east – was incorporated in churches already in the first half of the sixth century AD in that region as well (Čaval and Šprajc 2011).

Focusing here only on the timeframe of equinoxes and solstices, the study of Romanesque churches in Slovenia exhibited that both solstices provided meaningful moments in the agricultural and ritual year. The apparent annual path of the Sun on the horizon became a significant part of the symbolic world of many cultures and religions. Whether in prehistoric, Roman pagan or Christian worlds, the two solstices became a principal moment in the calendar year (Ruggles 2005). The first ecumenical council determined 24 June and 25 December as the official dates for summer and winter solstice; the two became major Christian festivals commemorating the births of St John the Baptist and Jesus Christ respectively (McCluskey 2007; cf. Hijmans [2003]). With the lengthy observational timespan around the solstices – about two weeks – there is a possibility for a church to be oriented instead to these other days: the festival of St Peter and Paul on 29 June (Western church) or 28 December (Eastern church), St Thomas on 3 July or 21 December, St Stephen on 26 December, St Vitus on 15 June, and to St James the Greater, initially on 27 December. However, for a church to be interpreted as such, there would have to be very strong contextual support.

Much more complicated is the situation with the equinox. The pronounced variety of the dates commemorating both equinoxes spreads the timeframe only to a week (Figure 8, Figure 9). The equinoctial east was a widespread orientation of medieval churches in Slovenia. Actually, considering all possible orientations that can be interpreted as equinoctial – declinational and the calendar dates associated with the equinoxes – the final number rises to almost 40% of all medieval churches studied. This is not an isolated case, as a very similar situation can be observed in the Iberian Peninsula (González-García and Belmonte 2015). The results of both studies corroborate the works of the twelfth and thirteenth century's authors who advocated for the alignment of churches 'not just any east but specifically the equinoctial east' (*vide supra*). One intriguing outcome is that out of 15 churches that are oriented towards the point of sunrise on the day of true or astronomical equinox ($\delta = 0° \pm 0.2$), 10 register this orientation on the less significant western horizon (Figure 11). Some of those structures were planned and built in such a way that they disclosed the specific moment in both the tropical year and liturgical calendar, and on both eastern and western horizons (Figure 10). Considering the high possibility of a precise observation, is it by chance that some churches mark a natural or/and calendar festival on both horizons? This is highly unlikely; in archaeoastronomy the horizon defines the orientation of a structure. In a mountainous country such as Slovenia, if churches were planned to be oriented according to the Sun – either a calendar date or the Sun's astronomical position – the right direction had to be determined by observation. Additionally, Bede tells us about the known nonconformity of the natural year and Julian calendar in the eighth century (Nothaft 2011, 101); thus, the difference between both only grew larger by the Romanesque period. The church designers had to incorporate this difference in the church as well. Therefore, registering true and calendar equinox in a single sacred building can be seen as praise of a specific and significant date. It is an endeavour to register a liturgically important festival on the appropriate, eastern side, and, so as not to come into conflict with clerical authority, to mark a natural festival on the ecclesiastically less important, western side of a church. If those churches were built on the exact pre-existent sacred structure, this indicates that a church discloses the pagan sacred orientation on one side and Christian sacred orientation on its other. The Mozarabic church San Juan de la Peña, in Huesca province, Spain, is a similar example of such practice, although it registers both solstices (González-García and Belmonte 2015). Bearing all this in mind and removing the religious implication, it is reasonable to suggest that some medieval churches were themselves a type of gnomon or sundial. Concurrently, they would stay true to the astronomical cycles of the Sun throughout time and commemorate the contemporary calendar, which was approved by the highest ecclesiastical authority, yet misaligned with the celestial cycles. Therefore, their design could be described as scientific.

The vernacular calendar was derived from the agricultural needs of a society in the region. Hence, it is understandable why only the spring dates for both the vernacular and astronomical division of a year were registered in the church orientations. The still-performed local tradition of candles floating on water (a river, creek, lake) on St Gregory's Day is linked to the pre-Christian celebration of a new year. This custom, known from other parts of Europe as well, is always related to the spring equinox. Furthermore, the traditional Slavic New Year was the vernal equinox, though usually celebrated in the first part of March (Conrad 1985; Knific 2017, 75). Although the calendar changed, the festival of St Gregory was not transferred 10 days forward, yet the special significance of this date remained. Therefore, today St Gregory is celebrated as the vernacular beginning of spring in Slovenia, the day when 'the birds get married'.

Conclusion

This paper has examined the extraordinary interplay between natural and calendar festivals conveyed in medieval church building, which simultaneously aligned with regional cultures of timekeeping. Ruggles (1997) and González-García and Belmonte (2006), respectively, note similar interactions for prehistoric and Roman periods. Timekeeping was an essential aspect of past cultures and evidence of a developed society. Here, the focus has been on the medieval period in Slovenia, encompassing a variety of vernacular, ethnological, anthropological and historical aspects, those developed and initially used by people, purely within their economic and religious dominion respectively. Only later was religious – unnatural – time added to the vernacular calendar and the two merged (Makarovič 1995, 45).

Given that this research incorporates evidence representing some 80% of all Romanesque churches in Slovenia, it is clear that location and alignment were carefully selected, with each church having contingent reasons for its orientation. The most frequently registered dates to which churches are aligned correspond to several calendar feasts, which were mostly already celebrated before the eighth century. For the natural festivals, the plethora of equinox-related calendar dates and orientations display various concepts of the equinox, as well as non-universality in timekeeping, and exhibits the reasons behind the construction of various calendars. It also demonstrates the profound relationship of the equinox period to the beginning of spring in the northern hemisphere regarding both religious ideologies and economic factors. A considerable number of churches also register the unexpected combination of natural and calendar festivals that commemorate an astronomical moment in a tropical year. These churches exemplify eternal calendars (i.e. astronomical cycles in real time) as well as official time reckoning, i.e. Julian calendar.

In conclusion, despite the universal sacredness of, and enduring fascination with, celestial bodies, the specific significant moments in their cycles and the universal idea of east–west orientation can be refined through understanding local economic as well as religious practice. The correct location for religious rituals comes from the 'irruption of the divine' (Eliade 1959) and also from the sense of the hierarchical differentiation of space, which implies its social origin (Durkheim 2008, 11). The same applies to time, an abstract and impersonal frame that surrounds all humanity. Time is measured by a calendar, which expresses the rhythm of the collective social and sacred activities (rites, feasts, public ceremonies) and assures their regularity (Dürkheim 2008, 10–13). Astronomically oriented churches, an exclusive combination of time and location, are another form of timekeeping, an amalgamation of calendars, impervious to non-alignment of celestial cycles and the human need to measure and regulate the world around us.

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