An Investigation of the Role of Architectural Orders in Greek Temple Orientation

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1 Introduction

The principles behind Greek temple orientations have troubled scholars for more than a century, in relation to broader archaeoastronomical investigations on the positioning of ancient religious sites across the globe. The idea behind such endeavours originates in the notion that astronomical knowledge and observations may have played a role in, or even determined, the placement of religious structures.

Between 2002–2010, Clive Ruggles and I explored the idea that astronomical principles governed the positioning of ancient Greek temples (e.g. Boutsikas, 2009; Boutsikas & Ruggles, 2011). During this time, I was most privileged to receive the supervision, training, support and unceasing enthusiasm for research of the person whose prolific career and inspirational work has led to his recognition as a leading authority in all things archaeoastronomical. Our endeavours resonated from the aim to understand the function of temples in relation to astronomy and the environment (land- and skyscape) within which they are situated. This research indicated that, although certain general patterns may be present, it is not possible to establish one general governing principle in relation to the rising and setting of the sun or the moon that may have been responsible for determining temple orientations in ancient Greece. The current paper revisits this question in order to account for one aspect not previously investigated: whether a temple's architectural order may have determined its orientation.

Orienting structures in relation to astronomical bodies and meteorological phenomena seems a familiar concept in ancient Greek thought. To our knowledge, these concepts appear with Anaximander (sixth century BCE), who first introduces the

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notions of geometry in the city and the universe (Vernant, 1983: 180–181, 186), but it is likely that the origins of this idea date to an earlier period. This earlier period coincides also with the beginnings of monumental religious architecture in Greece. Monumental architecture, does not become widespread in the Greek space though until the seventh to sixth centuries BCE. By the time of Kleisthenes of Athens and his numerologically based political reforms at the end of the sixth century BCE though, ancient written sources suggest that cities reflect what happens in the heavens, so that the microcosm of the city participates in the macrocosm of the universe (Shipley, 2005; Vernant, 1983: 224). This idea becomes rather prominent in the Roman period, where we have explicit references to the importance of astronomy and cardinal orientations both in city planning and in the layout of religious structures (Vitruvius, *de Architectura,* 1.1.3, 1.6, 4.5.1, 4.9.1; González-García, Rodríguez-Antón, & Belmonte, 2014; Peterson, 2007).

The Doric[1] was the first of the three Greek architectural orders to emerge around 650–600 BCE, shortly followed by the Ionic,[2] which appeared in eastern Greece (the Aegean islands and Asia Minor). The earliest archaeological date for the Corinthian order is the fifth century BCE, when it is first attested in the singular interior column of the temple of Apollo at Bassae (Jenkins, 2006: 14–20). The choice of one architectural order over another is not necessarily related to the date of a structure. In a number of cases, it seems to have been linked to tradition and preference. Certain geographical areas display distinct partiality between the two older orders. We observe for example, that Doric is preferred in the Saronic islands, the Peloponnese, Southern Italy and Sicily. Some locations display use of both Ionic and Doric, such as Delos, Kos and Samothrace, whereas in Asia Minor and some Aegean islands such as Naxos, the Ionic is more widespread. The distinction in the use of the two orders becomes more prominent in the Greek colonies, but this relates to influences from the mother cities and to local traditions. The Greek Sicilian and South Italian colonies make extensive use of the Doric, whereas the Ionic order is indisputably favoured in the Greek sanctuaries of Asia Minor. In some cases, we observe that the oldest cults are housed in Doric temples, as seen for example in Delphi, Delos and Olympia. In a number of these sanctuaries, the Ionic order is also present concurrently with the Doric, as attested for example, in the Athenian Acropolis and the Acropolis of Pergamon. In these cases, the choice of architectural order does not seem to be determined by the date of construction, but rather by regional preferences. For instance, the Archaic *Oikos* of the Naxians in Delos is

[1] The Doric order is characterised by the absence of decorative elements in the treatment of the columns, the absence of a column base and the overall stocky and thicker appearance of the building. The frieze of the Doric order is divided to *triglyphs* and *metopes*. Examples of this order are the temple of Apollo in Delphi, the temple of Hephaistos in the Athenian Agora and the exterior of the temple of Zeus in Nemea.

[2] The Ionic order has more slender columns (compared to the Doric), supported by a base and distinctive volute shaped capitals. It also differs in the treatment of the frieze, which forms a continuous band adorned with sculptural decoration. Examples of Ionic order are the Erechtheion and the temple of Nike on the Athenian Acropolis.

Ionic, whereas the Classical temple of the Athenians and the *Poros* temple of Apollo built only a few meters away, in the same sacred space, were Doric.

From the fifth century BCE, we witness the marrying together of more than one orders within the same structure. This is more commonly manifested in the combination of Doric and Ionic elements, with the earliest examples encountered in some of the Classical temples on the Athenian Acropolis. Less than four decades later emerges the earliest extant combination of all three orders in one structure, in the Temple of Apollo at Bassae, reputedly constructed by the Parthenon's architect: Doric exterior, Ionic interior and a sole Corinthian column prominently placed in the temple's *sekos*. Within less than a century, the combination of the Doric and the Ionic is explored fully, as seen in *Andron* B at the Sanctuary of Zeus at Labraunda (in Asia Minor), which unorthodoxly combined the two orders in the building's façade: Doric frieze carried by Ionic columns (Karlsson, 2013). The plasticity and playfulness of Hellenistic art finds it hard to maintain the austerity and heaviness of the Doric order. This results in the gradual abandonment of the Doric, eventually replaced by the Ionic and Corinthian orders, although use of the latter does not spread widely in Greece before the Roman period.

It is clear, that the choice of architectural orders was determined by a number of factors, relating to aesthetics, fashion, function and visitor experience. Such striking examples, are the temples of Apollo in Bassae and Didyma. The former, copies to a large extent its Archaic predecessor, maintaining the austere Doric exterior, but as mentioned, employs all three architectural orders along with a number of other unique architectural features, in order to enhance visitor experience (Boutsikas, 2020). The latter, plays with perception: it is an Ionic unroofed shell of colossal proportions, visible from a great distance and particularly imposing once approached. The actual entrance to this structure though, of much more modest size, was in the shape of two extremely narrow passages leading to an interior grove, which encompassed a small-scale Ionic temple. This small prostyle structure was the actual temple of Apollo and the seat of his oracle. Since it is possible that the orientation of a temple was influenced by the intention to enhance visitor experience by its architecture, it may be possible to trace a preference towards specific orientations employed by each architectural order. An indication that his may have been the case could be the Greek Sicilian temples, all of which are Doric and oriented towards the east. In the following sections, we will test the idea of architectural orders favouring specific orientations by examining a sample of 131 Greek temple orientations.

2 Survey Methods

The data included here comprise structural orientation measurements taken using a magnetic compass and clinometer, which offer a level of accuracy considered sufficient for the purpose of this study. Accuracy higher than one degree of arc would exceed what the ancient Greeks were able to achieve. It was not until after the time of Hipparchos (190–120 BCE) that improved *dioptra* were made. For his astronomical observations (and the composition of the first comprehensive star catalogue) Hipparchos may have used an armillary sphere (Lloyd, 1984: 344–345), which, similarly, would not be more precise than the error of the magnetic compass.[3] This margin of error becomes more evident if we consider the discrepancies found between ancient star measurements. For example, Plutarch's claim of his star coordinates deriving from measurements he made using an armillary sphere has been challenged by a number of modern studies as untrue (Duke, 2002: 36; Graßhoff, 1990; Rawlins, 1982: 359–373). Similarly, it has been noted that the discrepancies in the measurements of the position of stars between Hipparchos' *Commentary to Aratus* and Ptolemy's *Almagest* are too large and statistically correlated (systematic) to be accidental. Instead, it has been argued that perhaps Hipparchos created a catalogue of star positions by taking measurements in equatorial coordinates and that these were subsequently converted to ecliptical coordinates using analog computation (Duke, 2002). A discussion on the importance of precision in ancient Greek astronomical calculations is superfluous here, but it is important to note that pursuing a higher degree of precision than the ancient Greeks would have been capable of, is unnecessary and could introduce a meaningless and false sense of extreme accuracy.

For all but one of the sites included in this study, no magnetic anomalies and no systematic instrument error were detected. The only exception is the temple of Isis at Dion (Greece), where a metal bridge has been constructed to give access to the site, as a result of the rising water table. Since a magnetic compass is almost useless in this environment, the orientation of this temple was deduced based on Google Earth, using the compass readings only as a general guideline.[4]

Magnetic readings were corrected to true azimuths by applying the relevant magnetic correction computed for the date and place of each survey.[5] The readings were taken along the surviving walls of the structures and as close to the foundations as possible. In order to minimise erroneous orientation measurements, multiple readings were taken for each structure (e.g., on either side of a wall and along more than one wall). As a means of verifying the accuracy of each measurement, a minimum of three readings (where there was agreement between readings) and maximum of five (until there was agreement between more than two readings) were recorded for each structure.

[3] See for example the slightly later, first century BCE Taichu calendar in China, which seems to have been created using an armillary sphere, but its measurements are one degree off from complete accuracy (Xiaochun & Kistemaker, 1997: 64). For a discussion on difficulties in obtaining accurate measurements of stars using an armillary sphere consult Duke, 2002: 37–38.

[4] In those cases where metal poles are used to rope off the temples (as for example at the Erechtheion and the Parthenon in Athens), the survey permits granted entry to the structures, thus allowing sufficient distance between these objects and the points from where the orientation measurements were taken. The multiple readings taken from several points in these structures, and their cross referencing with Google Earth, confirmed the accuracy of the measurements.

[5] Magnetic corrections were calculated using the online Magnetic Field Calculator of the National Centres for Environmental Information (https://www.ngdc.noaa.gov).

Temple orientations were subsequently converted to (astronomical) declinations (the angular distance between a celestial object and the celestial equator, an exact point in the celestial sphere (or horizon)), in order to allow for direct comparison with the rising and setting points of stars.[6]

3 Analysis

The data presented here comprise 131 orientations of Doric and Ionic temples, belonging to some 121 temples. The discrepancy between the number of surveyed structures and the actual orientations is due to the side entrances featured in a number of temples. In some cases as many as three entrances are present in one structure (e.g. Telesterion in Eleusis). Table 1 lists the temples included in the dataset, indicating also the side entrance measurements where appropriate. The collected orientations were divided to two groups: Doric and Ionic. A number of temples employing more than one order are included in the data set. These are located in mainland Greece. For instance, the Parthenon combines two orders: Doric exterior with Ionic interior. Three temples located in extra-urban sanctuaries in the Peloponnese employ all three architectural orders: the temple of Apollo at Bassae; the temple of Zeus in Nemea (Doric exterior with a Corinthian interior topped by a second story in Ionic order); and the temple of Athena Alea in Tegea (Doric exterior with a Corinthian interior topped by an upper Ionic story). The Bassae and Tegea temples are situated in Arkadia and both have a main and a side entrance. The temple at Bassae has a northern main orientation with an eastern side entrance and that in Tegea an eastern main orientation with a north side entrance. It is possible that these features were the result of local tradition and preference, paired with a very talented architect (Jost, 1985: 94–95). Similarly, the Classical temple of Zeus at Nemea employs all three architectural orders, but has the same orientation as its Doric Archaic predecessor, indicating once more that this architectural pluralism was the result of fashion, preference and intention to impact on spatial perception. It is noteworthy though, that all temples combining multiple architectural orders have a Doric exterior. For these reasons, these three temples and the Parthenon have been included in the Doric temple sample, as the order employed in a temple's exterior is considered the dominant order. The Doric sample is almost three times as large as the Ionic.

Figures 1 and 2 show that the data are divided in three data clusters: an east/west in the centre, a southern (from ca. –35° to −55°) and a northern (from ca. +34° to +65°). These match the clusters detected in a larger sample of 237 temple orientations, which combines all architectural orders and religious structures with forms

[6] Declinations have been calculated using the software GETDEC created by Clive Ruggles. GETDEC is purpose-designed for use by archaeoastronomers in that it adjusts its astronomical computations to account for empirical experience with refraction and other kinds of real-world atmospheric conditions to which naked-eye observations of sunrise and sunset phenomena are actually subject.

Table 1 Raw data set (western orientations highlighted in grey)

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
1.	Aegina	Sanctuary of Aphaia	Temple of Aphaia	Archaic	Aphaia	Doric	37° 45′ 19″	23° 32′ 2″	+18° 39′
2.	Agrigento	Valley of temples	Temple of Hera (D)	Classical	Hera	Doric	37° 17′ 19″	13° 36′ 01″	+05° 57′
3.	Agrigento	Valley of temples	Temple of Concordia (F)	Classical	Concordia	Doric	37° 17′ 23″	13° 35′ 32″	+01° 30′
4.	Agrigento	Valley of temples	Temple of Herakles (A)	Archaic	Herakles	Doric	37° 17′ 25″	13° 35′ 11″	+01° 30′
5.	Agrigento	Valley of temples	Temple of Olympian Zeus (B)	Classical	Zeus	Doric	37° 17′ 27″	13° 35′ 4″	+11° 41′
6.	Agrigento	Sanctuary of Chthonic deities	Temple of Dioskouroi (I)	Classical	Dioskouroi	Doric	37° 17′ 29″	13° 34′ 53″	+07° 52′
7.	Agrigento	Sanctuary of Chthonic deities	Temple L	Classical	Demeter?	Doric	37° 17′ 57″	13° 36′ 12″	+11° 22′
8.	Argos	Heraion	Old Temple	Geometric	Hera	Doric	37° 42′ 00″	22° 46′ 56″	−19° 12′
9.	Argos	Heraion	New Temple	Classical	Hera	Doric	37° 41′ 58″	22° 46′ 52″	−19° 56′
10.	Athens	Acropolis	Archaios Naos	Archaic	Athena	Doric	37° 58′ 18″	23° 43′ 33″	+10° 13′
11.	Athens	Acropolis	Parthenon	Classical	Athena	Doric/Ionic	37° 58′ 21″	23° 43′ 40″	+11° 13′
12.	Athens	Acropolis	Temple Athena Polias	Classical	Athena	Ionic	37° 58′ 23″	23° 43′ 38″	+5° 48′
13.	Athens	Acropolis	Erechtheion	Classical	Erechtheus	Ionic	37°58′24″	23°43′37″	+54° 15′
14.	Athens	Agora	Temple Apollo Patroos	Classical	Apollo	Ionic	37° 58′ 36″	23° 43′ 22″	−5° 19′
15.	Athens	Agora	Temple Zeus & Athena Phratria	Classical	Zeus & Athena	Doric	37° 58′ 36″	23° 43′ 22″	−4° 33′
16.	Athens	Agora	Hephaisteion	Classical	Hephaistos	Doric	37° 58′ 36″	23° 43′ 20″	−8° 6′
17.	Athens	South slope	Old temple of Dionysos	Archaic	Dionysos	Doric	37° 58′ 16″	23° 43′ 42″	+13° 25′

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
18.	Athens	South slope	New temple of Dionysos	Classical	Dionysos	Doric	37° 58′ 15″	23° 43′ 42″	+14° 28′
19.	Athens	Agora	Metroon	Hellenistic	Mother of Gods	Doric	37° 58′ 34″	23° 43′ 22″	−6° 43′
20.	Bassae	Sanctuary of Apollo	Temple of Apollo Epikourios	Classical	Apollo	Doric/Ionic/ Corinthian	37° 25′ 47″	21° 54′ 01″	+66° 20′
21.	Bassae	Sanctuary of Apollo	Temple of Apollo (side entrance)	Classical	Apollo	Doric/Ionic/ Corinthian	37° 25′ 47″	21° 54′ 01″	−2° 37′
22.	Delos	Sanctuary of Apollo	Stoa (portico) of Antigonos	Hellenistic	Apollo	Doric/Ionic	37° 24′ 08″	25° 16′ 03″	−51° 30′
23.	Delos	Sanctuary of Apollo	Artemision	Hellenistic	Artemis	Ionic	37° 24′ 07″	25° 16′ 01″	−12° 37′
24.	Delos	Sanctuary of Apollo	Oikos of Naxians	Archaic	Apollo	Ionic	37°24′01″	25°16′00″	−8° 57′
25.	Delos	Sanctuary of Apollo	*Oikos* of Naxians (back entrance)	Archaic	Apollo	Ionic	37° 24′ 01″	25° 16′ 00″	+10° 00′
26.	Delos	Sanctuary of Apollo	*Oikos* of Naxians (side entrance)	Archaic	Apollo	Ionic	37° 24′ 01″	25° 16′ 00″	+52° 53′
27.	Delos	Sanctuary of Apollo	Poros temple of Apollo	Archaic	Apollo	Doric	37° 24′ 06″	25° 16′ 03″	−4° 12′
28.	Delos	Sanctuary of Apollo	Temple of Athenians of Apollo	Classical	Apollo	Doric	37° 24′ 06″	25° 16′ 03″	−5° 23′
29.	Delos	Sanctuary of Apollo	Great temple of Apollo	Classical	Apollo	Doric	37° 24′ 05″	25° 16′ 03″	−4° 59′
30.	Delos	Sanctuary of Mt. Kynthnos	Temple Zeus Hypsistos	Hellenistic	Zeus	Ionic	37° 23′ 45″	25° 16′ 28″	+12° 27′

(continued)

Table 1 (continued)

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
31.	Delos	Sanctuary of foreign gods	Heraion	Archaic	Hera	Doric	37° 23′ 53″	25° 16′ 18″	−45° 8′
32.	Delos	Sanctuary of foreign gods	Temple of Isis	Hellenistic	Isis	Doric	37° 23′ 54″	25° 16′ 07″	−1° 47′
33.	Delos	Sanctuary of foreign gods	Samothrakeion	Classical–Hellenistic	Kabeiroi (assoc. Dioskouroi)	Ionic	37° 23′ 55″	25° 16′ 12″	−0° 43′
34.	Delos	Sanctuary of foreign gods	Monument of Mithridates	Hellenistic	Mithridates	Ionic	37° 23″ 54″	25° 16′ 12″	−42° 06′
35.	Delos	Sanctuary of Apollo	Monument of the Bulls	Hellenistic	Apollo	Doric	37° 24′ 04″	25° 16′ 05″	−49° 45′
36.	Delos	Sanctuary of Apollo	Monument of the Bulls	Hellenistic	Apollo	Doric	37°24′ 04″	25° 16′ 05″	+01° 25′
37.	Delos	Sanctuary of Apollo	Monument of the Bulls	Hellenistic	Apollo	Doric	37°24′ 04″	25° 16′ 05″	+02° 09′
38.	Delos	Sanctuary of Apollo	Dodekatheon	Hellenistic	12 Olympians	Doric	37° 24′ 08″	25° 15′ 57″	−3° 42′
39.	Delphi	Sanctuary of Athena Pronaia	New temple of Athena Pronaia	Classical	Athena	Doric	38° 28′ 52″	22° 30′ 30″	−46° 59′
40.	Delphi	Sanctuary of Athena Pronaia	Old Temple of Athena Pronaia	Archaic	Athena	Doric	38° 28′ 52″	22° 30′ 33″	−45° 7′
41.	Delphi	Sanctuary of Apollo	Temple of Apollo	Archaic	Apollo	Doric	38° 28′ 56″	22° 30′ 03″	+47° 38′
42.	Delphi	Sanctuary of Apollo	Temple of Apollo	Classical	Apollo	Doric	38° 28′ 56″	22° 30′ 03″	+47° 38′
43.	Didyma	Oracle of Apollo	Temple of Apollo	Archaic	Apollo	Ionic	37° 23′ 05″	27° 15′ 22″	+32° 56′
44.	Didyma	Oracle of Apollo	Temple of Apollo	Hellenistic	Apollo	Ionic	37° 23′ 06′	27° 15′ 24″	+32° 27′
45.	Dion	Sanctuary of Isis	Temple of Isis	Roman	Isis	Ionic	40° 10′ 38″	22° 29′ 45″	+16° 6′

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
46.	Dodona	Oracle of Zeus	Temple of Themis (Z)	Hellenistic	Themis	Ionic	39° 32′ 53″	20° 47′ 25″	−23° 51′
47.	Dodona	Oracle of Zeus	Temple of Herakles	Hellenistic	Herakles	Doric	39° 32′ 54″	20° 47′ 27″	−42° 35′
48.	Eleusis	Sanctuary Demeter & Kore	Telestirion-Peisistratid	Archaic	Demeter & Kore	Doric	38° 2′ 31″	23° 32′ 21″	−18° 06′
49.	Eleusis	Sanctuary Demeter & Kore	Telestirion-Periklean	Classical	Demeter & Kore	Doric	38° 2′ 31″	23° 32′ 21″	−17° 38′
50.	Eleusis	Sanctuary Demeter & Kore	Telesterion (side entrance)	Classical	Demeter & Kore	Doric	38° 2′ 31″	23° 32′ 21″	+49° 19′
51.	Eleusis	Sanctuary Demeter & Kore	Telesterion (side entrance)	Classical	Demeter & Kore	Doric	38° 2′ 31″	23° 32′ 21″	−44° 28′
52.	Eleusis	Sanctuary Demeter & Kore	Ploutoneion	Archaic	Hades	Doric	38° 2′ 33″	23° 32′ 21″	−9° 18′
53.	Ephesos	Sanctuary of Artemis	Temple of Artemis	Archaic	Artemis	Ionic	37° 56′ 59″	27° 21′ 50″	+12° 10′
54.	Ephesos	Sanctuary of Artemis	Temple of Artemis	Hellenistic	Artemis	Ionic	37° 56′ 59″	27° 21′ 50″	+12° 10′
55.	Himera	Sanctuary of Athena	Temple of Victory	Classical	Victory	Doric	37° 58′ 26″	13° 49′ 26″	+15° 38′
56.	Isthmia	Sanctuary of Poseidon	Old temple of Poseidon	Archaic	Poseidon	Doric	37° 55′ 0″	22° 59′ 61″	−6° 35′
57.	Isthmia	Sanctuary of Poseidon	New temple of Poseidon	Classical	Poseidon	Doric	37° 55′ 0″	22° 59′ 61″	−5° 49′
58.	Kalydon	Ancient Kalydon	Temple of Apollo	Archaic	Apollo	Doric	38° 22′ 22″	21° 31′ 50″	−29° 4′
59.	Kalydon	Ancient Kalydon	Heroon of Leon of Kalydon	Hellenistic	Leon (hero)	Doric	38° 22′ 25″	21° 32′ 02″	−51° 36′

(continued)

Table 1 (continued)

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
60.	Kalydon	Ancient Kalydon	Temple of Artemis	Classical	Artemis	Doric	38° 22 ′23″	21° 31′ 50″	−22° 34′
61.	Klaros	Oracle of Apollo	Temple of Apollo	Hellenistic	Apollo	Doric	38° 00′ 18″	27° 11′ 35″	−04° 27′
62.	Korinth	Agora	Temple of Apollo	Archaic	Apollo	Doric	37° 54′ 44″	22° 52′ 82″	+12° 25′
63.	Kos	Asklepieion	Large Doric temple of Asklepios	Hellenistic	Asklepios	Doric	36° 52′ 35″	27° 15′ 26″	+46° 47′
64.	Kos	Asklepieion	Prostyle Ionic temple of Asklepios	Hellenistic	Asklepios	Ionic	36° 52′ 36″	27° 15′ 27″	−18° 13′
65.	Kos	Agora-Limenas	Temple of Pandemos Potnia Aphrodite	Hellenistic	Aphrodite	Ionic	36° 53′ 41″	27° 17′ 28″	+50° 45′
66.	Lebadeia	Sanctuary of Zeus Basileus	Temple of Zeus Basileus	Hellenistic	Zeus	Doric	38° 25′ 54″	22° 51′ 52″	+19° 42′
67.	Lemnos	Kabeirion	Hellenistic Telesterion	Hellenistic	Kabeiroi	Ionic	39° 58′ 45″	25° 20′ 30″	−36° 24′
68.	Lykosoura	Sanctuary of Despoina	Temple of Despoina	Hellenistic	Despoina	Doric	37° 23′ 23″	22° 01′ 52″	−0° 21′
69.	Lykosoura	Sanctuary of Despoina	Temple of Despoina (side entrance)	Hellenistic	Despoina	Doric	37° 23′ 23″	22° 01′ 52″	−21° 37′
70.	Magnesia	Sanctuary of Zeus	Temple of Zeus Sosipolis	Hellenistic	Zeus	Ionic	37° 51′ 10″	27° 31′ 36″	+01° 56′
71.	Magnesia	Temple of Artemis	Temple of Artemis Leukophryne	Hellenistic	Artemis	Ionic	37° 51′ 12″	27° 31′ 38″	−11° 56′
72.	Messene	Sanctuary Asklepeios	Temple Asklepios	Hellenistic	Asklepeios	Doric	37° 10′ 32″	21° 55′ 13″	−12° 16′
73.	Messene	Sanctuary Asklepeios	Temple Artemis Orthia	Classical	Artemis	Doric	37° 10′ 33″	21° 55′ 12″	−22° 00′
74.	Messene	Sanctuary Asklepeios	Temple Artemis Orthia Phosphoros	Hellenistic	Artemis	Ionic	37° 10′ 32″	21° 55′ 12″	−12° 16′

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
75.	Miletos	Agora	Delphinion	Classical on Archaic foundations	Apollo	Doric	37° 31′ 48″	27° 16′ 51″	−16° 25′
76.	Miletos	Agora	Serapeion	Roman	Serapis	Ionic	37° 31′ 41″	27° 16′ 40″	−42° 19′
77.	Miletos	Agora	Temple of Athena (early)	Archaic	Athena	Ionic	37° 31′ 41″	27° 16′ 18″	−11° 10′
78.	Naxos	Sagri	Temple of Demeter	Archaic	Demeter	Ionic	37° 01′ 49″	25° 25′ 54″	−42° 23′
79.	Naxos	City	Temple of Apollo Portara	Archaic	Apollo	Ionic	37° 06′ 40″	25° 22′ 23″	−38° 14′
80.	Naxos	Sanctuary of Dionysos	Temple of Dionysos (early)	Archaic	Dionysos	Ionic	37° 04′ 43″	25° 22′ 53″	−43° 46′
81.	Naxos	Sanctuary of Dionysos	Temple of Dionysos	Archaic	Dionysos	Ionic	37° 04′ 43″	25° 22′ 53″	−44° 11′
82.	Nemea	Sanctuary of Zeus	Temple of Zeus	Classical	Zeus	Doric/Corinthian/Ionic	37° 48′ 63″	22° 42′ 66″	+16° 8′
83.	Nemea	Sanctuary of Zeus	Temple of Zeus	Archaic	Zeus	Doric	37° 48′ 63″	22° 42′ 66″	+16° 8′
84.	Olympia	Sanctuary of Zeus	Temple of Zeus	Classical	Zeus	Doric	37° 38′ 20″	21° 37′ 51″	+7° 28′
85.	Olympia	Sanctuary of Zeus	Heraion	Archaic	Hera	Doric	37° 38′ 24″	21° 37′ 51″	+3° 39′
86.	Olympia	Sanctuary of Zeus	Pelopeion	Classical	Pelops	Doric	37° 38′ 22″	21° 37′ 50″	−42° 8′
87.	Orchomenos	Upper city Agora	Temple of Artemis Mesopolitis	Hellenistic	Artemis	Doric	37° 43′ 46″	22° 18′ 94″	+27° 23′
88.	Perachora	Heraion	Temple of Hera Limenia	Geometric	Hera	Doric	38° 01′ 67″	22° 51′ 27″	+61° 33′
89.	Perachora	Heraion	Temple of Hera Akraia	Archaic	Hera	Doric	38° 01′ 75″	22° 51′ 18″	+03° 50′
90.	Pergamon	Acropolis	Temple of Athena	Hellenistic	Athena	Doric	39° 07′ 54″	27° 11′ 02″	−44° 19′

(continued)

Table 1 (continued)

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
91.	Pergamon	Acropolis	Temple of Dionysos	Hellenistic	Dionysos	Ionic	39° 07′ 56″	27° 10′ 57″	−46° 46′
92.	Poros	Sanctuary Poseidon	Temple of Poseidon	Archaic	Poseidon	Doric	37 °31′ 26″	23° 28′ 51″	+18° 17′
93.	Priene	Sanctuary of Zeus	Temple of Zeus	Hellenistic	Asklepeios or Zeus	Ionic	37° 39′ 31″	27° 17′ 53″	+1° 36′
94.	Priene	Sanctuary of Athena	Temple of Athena Polias	Classical	Athena	Ionic	37° 39′ 33″	27° 17′ 46″	+1° 43′
95.	Priene	Sanctuary of Demeter	Temple of Demeter	Classical–Hellenistic	Demeter	Doric	37° 39′ 39″	27° 17′ 46″	+4° 18′
96.	Rhodes	Kameiros	Temple of Pythian Apollo	Hellensitic	Apollo	Doric	36°20′ 17″	27° 55′ 17″	+53° 36′
97.	Rhodes	Kameiros	Temple of Athena Kameiras	Hellenistic	Athena	Doric	36° 20′ 10″	27° 55′ 17″	+09° 12′
98.	Rhodes	Ialyssos	Temple AthenaPolias	Hellenistic	Athena	Doric	36° 24′ 00″	28° 08′ 40″	−53° 57′
99.	Rhodes	Lindos, Acropolis	Temple of Lindia Athena	Archaic	Athena	Doric	36° 05′ 31″	28° 05′ 19″	+41° 21′
100.	Rhodes	Lindos, Acropolis	Temple of Lindia Athena	Hellenistic	Athena	Doric	36° 05′ 31″	28° 05′ 19″	+41° 21′
101.	Rhodes	Acropolis-Monte Smith	Temple of Pythian Apollo	Hellenistic	Apollo	Doric	36° 26′ 28″	28° 12′ 40″	−3° 58′
102.	Rhodes	Acropolis-Monte Smith	Temple of Athena Polias & Zeus Polieus	Hellenistic	Athena & Zeus	Doric	36° 26′ 42″	28° 12′ 43″	+10° 50′
103.	Samos	Heraion	Great temple of Hera	Archaic	Hera	Ionic	37° 40′ 22″	26° 53′ 10″	+8° 47′
104.	Samos	Heraion	Rhoecus temple	Archaic	Hera	Ionic	37° 40′ 22″	26° 53′ 10″	+8° 47′
105.	Samothrace	Sanctuary of Great Gods	Hall of Choral Dancers	Classical	Great Gods & Kabeiroi	Ionic	40° 30′ 03″	25° 31′ 49″	+31° 30′

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
106.	Samothrace	Sanctuary of Great Gods	*Hieron*	Hellenistic	Great Gods & Kabeiroi	Doric	40° 30′ 01″	25° 31′ 49″	+45° 28′
107.	Samothrace	Sanctuary of Great Gods	*Hieron*	Hellenistic	Great Gods & Kabeiroi	Doric	40° 30′ 01″	25° 31′ 49″	+23° 18′
108.	Samothrace	Sanctuary of Great Gods	Altar Court	Hellenistic	Great Gods & Kabeiroi	Doric	40° 30′ 03″	25° 31′ 49″	+23° 18′
109.	Segesta	Segesta	Doric temple	Classical	unknown	Doric	37° 56′ 29″	12° 49′ 56″	+7° 37′
110.	Selinous	Sanctuary of Demeter Malaphoros	*Megaron* of Demeter Malophoros	Archaic	Demeter	Doric	37° 35′ 13″	12° 49′ 03″	+21° 58′
111.	Selinous	Sanctuary of Demeter Malophoros	Temple of Zeus	Archaic	Zeus Melichios	Doric	37° 35′ 13″	12° 49′ 03″	+31° 37′
112.	Selinous	Sanctuary of Demeter Malophoros	*Megaron*	Archaic	Demeter	Doric	37° 35′ 13″	12° 49′ 03″	−03° 45′
113.	Selinous	Sanctuary of Demeter Malophoros	Hekataion	Archaic	Hekate	Doric	37° 35′ 13″	12° 49′ 03″	+33° 04′
114.	Selinous	Acropolis	Temple of Hera	Archaic	Hera	Doric	37° 35′ 12″	12° 50′ 05″	+02° 14′
115.	Selinous	Acropolis	Temple C	Archaic	Apollo?	Doric	37° 34′ 60″	12° 49′ 31″	−02° 58′
116.	Selinous	Acropolis	Temple D	Archaic	unknown	Doric	37° 34′ 60″	12° 49′ 31″	−03° 03′
117.	Selinous	Acropolis	Temple A	Classical	Leda & Artemis?	Doric	37° 34′ 60″	12° 49′ 31″	−05° 20′
118.	Selinous	East hill	Temple E	Classical	Hera	Doric	37° 35′ 06″	12° 50′ 09″	−04° 37′
119.	Selinous	East hill	Temple F	Archaic	unknown	Doric	37° 35′ 14″	12° 50′ 06″	−03° 26′

(continued)

Table 1 (continued)

	Location	Site	Structure	Date	Deity	Order	Latitude	Longitude	Dec.
120.	Selinous	East hill	Temple G	Archaic	unknown	Doric	37° 35′ 14″	12° 50′ 06″	−03° 26′
121.	Sikyon	Agora	Temple of Artemis Limnaia or Apollo	Archaic	Artemis or Apollo	Doric	37° 59′ 10″	22° 42′ 85″	−02° 49′
122.	Sikyon	Agora	Temple Artemis Limnaia or Apollo	Hellenistic	Artemis or Apollo	Doric	37° 59′ 10″	22° 42′ 85″	−02° 49′
123.	Sounio	Sanctuary Poseidon	Temple of Poseidon	Classical	Poseidon	Doric	37° 39′ 04″	24° 01′ 30″	−11° 37′
124.	Sounio	Sanctuary Poseidon	Great temple of Athena	Archaic	Athena	Doric	37° 39′ 14″	24° 01′ 40″	−6° 31′
125.	Sounio	Sanctuary Poseidon	Small temple of Athena	Classical	Athena	Doric	37° 39′ 15″	24° 00′ 41″	−10° 3′
126.	Sparta	Sanctuary of Artemis Orthia	Temple of Artemis Orthia	Archaic	Artemis	Doric	37° 05′ 03″	22° 26′ 15″	−5° 52′
127.	Sparta	Sanctuary of Artemis Orthia	Early temple of Artemis Orthia	Geometric	Artemis	Doric	37° 05′ 03″	22° 26′ 15″	−00° 44′
128.	Tegea	Temple of Athena Alea	Temple of Athena	Classical	Athena Alea	Doric/Corinthian/Ionic	37° 27′ 39″	22° 25′ 27″	+5° 29′
129.	Tegea	Temple of Athena Alea	Temple of Athena (side entrance)	Classical	Athena Alea	Doric/Corinthian/Ionic	37° 27′ 39″	22° 25′ 27″	+55° 11′
130.	Thermon	Ancient Thermon	Temple of Apollo Thermios	Archaic	Apollo	Doric	38° 33′ 39″	21° 40′ 08″	−45° 26′
131.	Tinos	Sanctuary Poseidon & Amphitrite	Temple of Poseidon	Hellenistic	Poseidon	Doric	37° 33′ 11″	25° 08′ 33″	+05° 05′

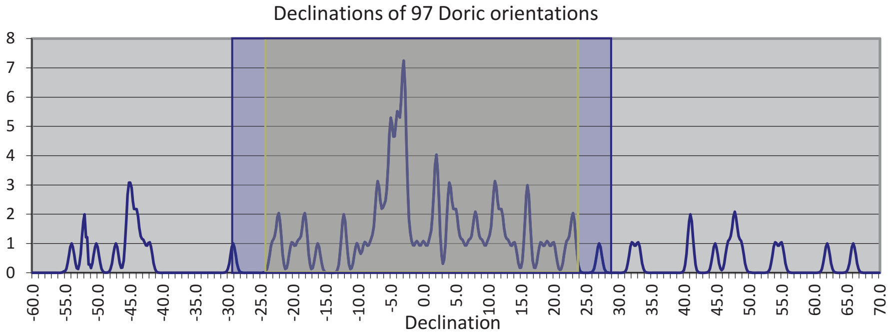

Fig. 1 Graph showing the distribution of 89 Doric temples with a total number of 97 orientations (including side entrances). Southern declinations fall between −60° and −40° (12 orientations); western and eastern declinations overlap in the centre (72 orientations); northern declinations fall between +40° and +70° (13 orientations). The area shaded in yellow in the centre of the graph represents the span of declinations across the horizon visited by the sun throughout the year. The area shaded in blue on either side marks the extreme positions of the moon between the minor and major standstills

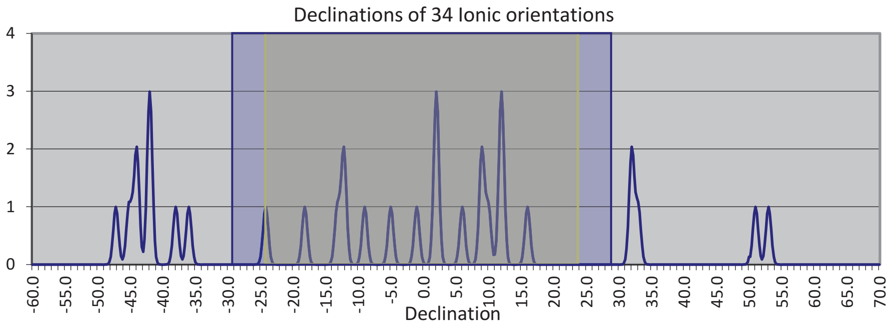

Fig. 2 Graph showing the distribution of 32 Ionic temples with a total number of 34 orientations (including side entrances). The southern cluster includes nine orientations, 19 structures are oriented in the centre of the graph (east and west) and six to the north

that do not conform to the conventional temple layout (such as altars and *tholoi*) (Boutsikas, 2020: 36–70). At first glance, no preference for certain orientations is detected for either the Doric or the Ionic orders.

On closer examination, the percentage of Ionic temples facing the sun's path during the year are fewer than the Doric. The study of 237 orientations of Greek religious structures which includes the same geographical areas as the present sample, has revealed that 55.7% of the structures are oriented in the part of the horizon visited by the sun in its annual path (Boutsikas, 2020). The present, more focused study, reveals a similar percentage: Ionic and Doric temples combined, facing this part of the horizon comprise 53.8% of the total sample of 131 orientations. When examining this trend separately for each architectural order, however, it is found that

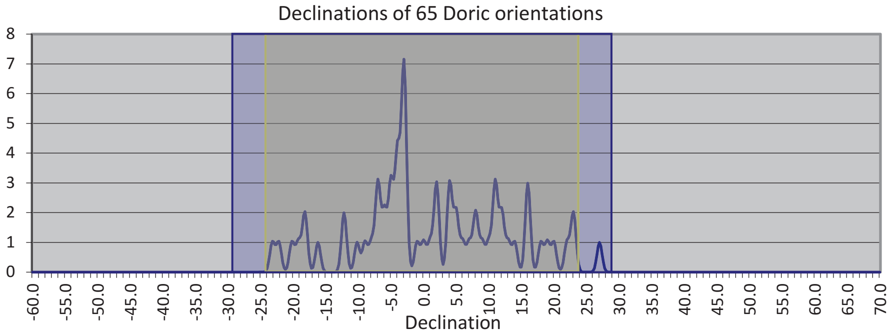

Fig. 3 Graph showing the distribution of only eastern Doric orientations

Doric temples are predominantly oriented towards the east (67%), whereas Ionic temples are less commonly oriented in this direction (40.6%).

The distribution of Doric and Ionic temples reveals a small difference in the orientations close to the sun's positions near the time of the equinoxes, whereas we observe a distinct peak and clustering of orientations between −2° and –7° in the Doric sample (Fig. 1). This data cluster is also present in the larger study of 237 orientations (Boutsikas, 2020: 36–70), but is absent in the group of Ionic orientations (Fig. 2). The orientations within this latter group are evenly distributed. If a trend is observed, this is a general clustering of the declinations falling within the solar range in general, with a few orientations at declinations +1° and +8° to +11°. The larger study of 237 orientation revealed these two peaks also. The data clusters observed in the current analysis could be interpreted as 'equinoctial', but (as is also the case in the larger study) data peaks are observed near the sun's position within a week from the equinoxes and not within ±2° of declination 0°, which is within a couple of days of the sun's position at the equinoxes. Similarly, the declinations of the sun's position on dates that approximate to the solstices show very little data concentration.

The concept of an equinoctial orientation assumes that the sun is observed from the structure, at sunrise, or sunset, since these are the moments when the sun's position will be due east and due west respectively. Since the orientations have been converted to declinations in the graphs presented here, the height of the local horizon is accounted for in the graphs, thus the peaks indicate the precise declinations when the sun would have been seen to rise or set from that location. As observed in Fig. 3, which includes only the eastern orientations of the Doric sample, the 'equinoctial cluster' comprises mostly of eastern orientations (21). Only four Doric readings are oriented to the west in the 'equinoctial cluster of Fig. 1, all from the island of Delos (the three temples of Apollo and the temple of Isis). A similar trend is also observed in the respective Ionic sample (Fig. 4).

One third of the Doric eastern orientations in the 'equinoctial cluster' (Fig. 3) belong to the temples in Selinunte (seven in total). Since Sicilian temples use exclusively Doric order and are oriented towards the east (Boutsikas, 2020), they are

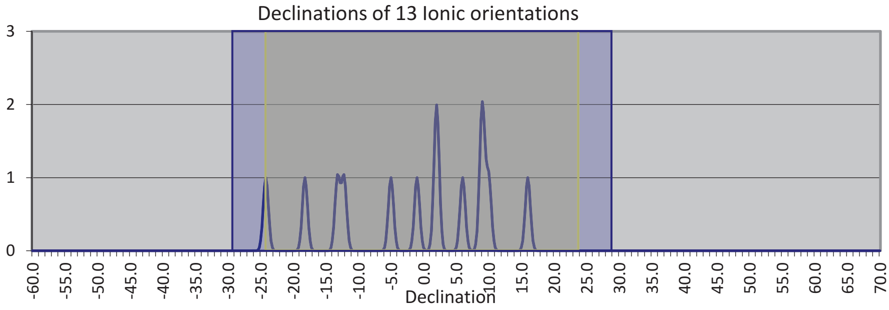

Fig. 4 Graph showing the distribution of only eastern Ionic orientations

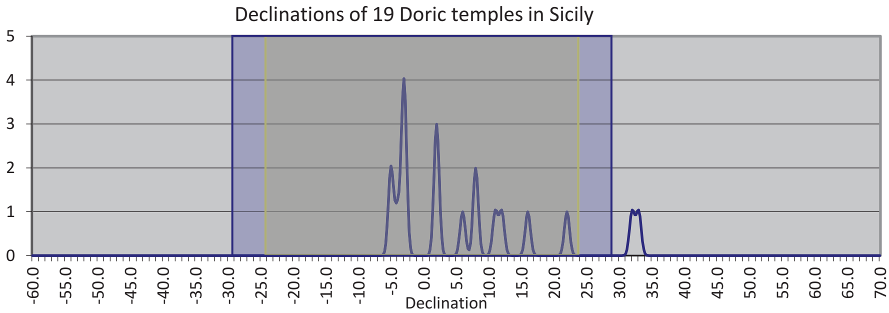

Fig. 5 Graph showing the distribution of Doric temple orientations from Sicily

good candidates for a survey of deliberate solsticial or equinoctial orientations. Of the 19 temples included in the Sicilian sample (Fig. 5), the declinations closest to the equinoxes belong to the temple of Hera in Selinunte (sixth century BCE) and the temples of Concordia and Herakles or Zeus in Agrigento (fifth century BCE). Belmonte (chapter 2 this volume) discusses an alternative idea for the orientation of the temples in Selinunte, one not linked to astronomical considerations. We cannot determine with certainty the reasons behind the orientation of these temples. However, we notice a general preference within a week from the equinoxes when isolating the Sicilian temple sample.

Of interest is also the southern cluster of data in the Ionic dataset. More orientations than those in the Doric order (relevant to the sample's size) fall between −35° to −47°: nine readings in total (Fig. 2) compared to 12 of the Doric sample, which is almost three times greater. This conclusion cannot be explained by the movement of the sun. It can also not be explained by regional, or chronological parameters, since it includes orientations from structures located in the Aegean islands (Delos, Lemnos, Naxos (four orientations from three different sanctuaries)) and Asia Minor (Miletos and Pergamon), which span from the Archaic to the Roman periods. Similarly, these structures are dedicated to different gods, even some of Egyptian origin, so a preference based on the deity venerated cannot be concluded. The cluster is quite tight, so it is possible that these orientations were determined by astronomical considerations, but since these cannot be solar or lunar, they may have been stellar and, quite possibly, not towards the same constellation or star. A further in-depth analysis of each of the specific cults and sanctuaries concerned might reveal more, but the length of such a study cannot be accommodated here.

4 Discussion

The analysis presented here reveals that if any general astronomical concerns were responsible for the placement of Greek Doric temples, the equinoxes seem to be the most likely candidate. Since the mid-90s when Clive Ruggles posed the question 'whose equinox' to conclude that archaeoastronomers should altogether do away with the term 'equinox' until models of 'conceptual structures' are developed for prehistoric cultures (Ruggles, 1997: 130), the concern of imposing cultural biases in ancient observational astronomy has been revisited a number of times (e.g. González-García & Belmonte, 2006; Ruggles, 2017: 134; and Belmonte and Steele chapters 2 and 3 respectively, this volume). These studies have offered compelling discussions on the meaning of the equinoxes when interpreting structural orientations and of potential cultural biases in such conclusions. As also noted elsewhere in this volume, the concept of the equinox is far from straightforward and could, in fact, mark three different occasions (see Steele chapter 3 this volume pp. 35–49) or as many as four (Ruggles, 1997: 127–128), since in a number of ancient cultures we do not know the precise occasion which would be defined as the equinox. This is not the case though for ancient Greece, where the equinox was identified as the time when the sun was located at the intersection of the ecliptic and the celestial equator (e.g. Steele chapter 3 this volume pp. 35–49).

In Greek culture, it was not only the change in the seasons and length of light and darkness that was of importance, but also the precise time in the year, when the day and night are of equal length. This moment in the year had eschatological significance in Greek cosmology, denoting an ideal state of balance and equality and the idea of a world composed of two opposite forms—light and day—which in ideal conditions are of equal length. Days and nights of equal length were believed to exist in the Valley of the Blessed in the underworld, but are also present in Pythagorean texts, which promote a notion of 'light and darkness having equal shares in the cosmos'.[7] Similarly, the belief in the importance of the equality of light and darkness is particularly prominent in Greek religious literature. Pindar, in particular, has been argued to have used the 'equinox as the form of the ideal cosmic equality' (Woodbury, 1966: 607), since it appears that the importance of equal day and night is a persistent idea in his Second Olympian Ode (Pindar, *Olympian,*

[7] ἰσόμοιρά τ' εἶναι ἐν τῷ κόσμῳ φῶς καὶ σκότος, Diogenes Laertius 8.26; also in Aristotle, *Metaphysics* 1.986a22; Parmenides B9.3-4*VS;* Boutsikas, 2020: 163 n. 49).

2.61–3). There is much to discuss on the connotations associated with the importance of this balance in a number of contexts, which for example, can be also conveyed to political values of equality like democracy or ancient Greek admiration of the temperate climates found in the equatorial regions, praised by Herodotos and others (e.g. Herodotos 1.142.1–2; Hippokrates, *On Airs, Waters, and Places,* 12). Although these links can offer support to the importance of the concept, they would take us away from the scope of this paper, so it will suffice to state here that for the Greeks, the equinox signified more than just an observation of sunrise or sunset in the distant horizon. It more importantly stood as an ideal state of balance and equality.

Ancient Greek astronomers defined the equinoxes as the time when the day and night are of equal length; we know that a variety of methods were used to calculate the time of the equinoxes. The philosopher Anaximander for instance, is believed to have used the shadow cast by a gnomon, in the sixth century BCE (Couprie, 2011: 31, 34–35). The equinoxes were watched for in ancient Greece also for calendric purposes, as this time marked the beginning of the year in a number of Greek cities: in Chios and fourth-century-BCE Miletos for instance, the year started around the spring equinox, whereas in Sparta, Rhodes, Crete, and pre-fourth-century-BCE Miletos around the autumn equinox, etc.

We observed the clustering of Doric temple orientations around declinations visited by the sun within a week from the equinox, but not at the equinox. In cultures where the identification of astronomical occurrences relies on observation, an important parameter needs to be considered: accuracy. Let us briefly explore one such example. Pliny, in a section of his *Natural History*, reports the time of observing the setting of the Pleiades according to three different ancient Greek observers (Hesiod, Thales and Anaximander). Following Pliny's testimony, Couprie calculated that the autumn equinox occurred between 28 and 30 September in the years between 700–350 BCE. According to this calculation, at Hesiod's time, in the seventh century BCE, the equinox occurred on 30 September of the Julian calendar. This is a calculation assigned to Hesiod following Pliny's testimony, but Hesiod's original work, from which Pliny argues to have taken this quote, does not survive (*Naturalis Historia* 18.213, DK 12A20; on this see also Couprie, 2011: 17). In the sixth century BCE, the time of Thales and Anaximander, the event occurred on 29 September. Couprie, has furthermore estimated that by the fifth and fourth centuries BCE (the time of the other two significant Greek astronomers Euktemon and Eudoxos), this occurrence took place on 28 September (Couprie, 2011: 18). But the situation is not as simple as it may seem. Couprie made these calculations based on the mentions of these ancient works, which use the autumn equinox in order to count the number of days after the autumn equinox when the cosmical setting of the Pleiades became visible. So Couprie is working backwards: Anaximander places the setting of the Pleiades 'on the 29th day from the equinox' (White, 2002: 10) and Thales on the 25th day after the autumn equinox. Couprie knows exactly when the occurrence would take place in ancient Greece during the centuries that these observations were made, and so counts backwards to estimate the time of the equinoxes. This method, however, complicates matters, as the setting of the Pleiades was determined through direct observation in antiquity and cannot be compared to modern computed simulations. Unlike computed simulations, astronomical observations are subject to weather conditions and atmospheric extinction and refraction (and light pollution in modern times), not to mention the height of the local horizon, all of which can render an event invisible for several days. Indeed, discrepancies between Thales' observation of the Pleiades' setting and that of Anaximander are noted. It has been estimated that Thales was 10 days late when he saw the Pleiades set, whereas Anaximander had supposedly sharp eyesight and saw the star cluster set less than half an hour before sunrise (Wenskus, 1990: 53, 60). However, it seems unlikely that stars of the magnitude of the Pleiades could have been observed in the west half an hour before sunrise, no matter how sharp eyesight one possessed. Instead, it has been proposed, that the aim of the two ancient astronomers, was not to fix the precise moment in time when the Pleiades were observed to set cosmically, but instead, to estimate their true cosmical setting, since these astronomers wanted to calculate the precise occurrence of astronomical events, rather than note the time they were able to observe them. In doing so, they had to estimate when they thought the star cluster would set, by estimating the time needed to elapse between the last observed setting and the true setting. This estimated calculation could have caused their 10-day discrepancy (Couprie, 2011: 19).

For archaeoastronomers, a discrepancy of 10 days is regarded too great considering that the measurements of structural orientations are quoted to within a few minutes of arc, in order to argue for the significance of precise alignments. Here could lie another culturally determined approach. What we, in modern day, consider as significant (i.e. extremely precise orientations to provide very accurate alignments), may not have been as significant to the ancient cultures on which our conclusions are inflicted. A few days earlier or a few days later may have been perfectly acceptable to ancient cultures, which may on occasion have been more concerned with true rather than apparent occurrences. To continue on the same example, this idea may be present also in Pliny's account of Hesiod, whose date of the cosmical setting of the Pleiades, would, in fact, have witnessed the star cluster set almost 2 h after sunrise. On the other hand, Hesiod, was not an astronomer and it is not certain that he had observed for himself the dates he provided for the various risings and settings in his *Works and Days*. Neither do we know whether he had collected these dates from farmers and subsequently provided them as second hand information. Furthermore, as we saw in the discussion on the cosmological importance of the equinox in ancient Greek culture, once these astronomical observations enter the religious sphere, the symbolic, and cosmological significance they acquire, detaches them from their astronomical function. In the religious sphere, the emphasis is placed on the meaning of these occurrences in the specific ritual context and the cognitive associations sought for the participants, rather than their value in timekeeping for which accuracy is required.

We see then that in the case of ancient Greece, as many as three different types of equinoxes may have existed—practical, cosmological and astronomical. As far as Greek religion and astronomy are concerned, all three types seem to indicate that the equinox was perceived as the equality of day and night. With this background in mind, let us now return to the data presented here. Around 600 BCE the sun's declination on the day that daylight and night were equal was $-0° 50'$ (Gregorian 25 March) and occurred 2 days before the sun was at declination 0° (Gregorian 27 March). Similarly, around the time of the Autumn equinox, day and night were of equal duration on 1 October, when the sun's declination was at $-0° 54'$, again within a couple of days from the day when the sun's declination was at 0°. These declinations fall at the northern extreme of the $-1°$ to $-7°$ peak seen in the Doric orientation histogram. The absence of data on the sun's declination on or near the solstices remains intriguing considering the equally important calendric significance of this time of the year in ancient Greek culture. In Athens and Delphi, for example, the year started with the first new moon after the summer solstice, whereas in Boeotia and Delos it started after the winter solstice (Thomson, 1948: 53).

We could tentatively propose that if the 'equinoctial' peak of the Doric temples was indeed deliberate. In light of the absence of 'solstitial' orientations, the reason behind this preference could be sought in the cosmological connotations that the equinox had acquired in Greek religion. The cosmological balance seen in the equality of light and darkness may have been translated to a significant concept that was subsequently incorporated in Greek temple architecture. However, it is not possible to discern why this concept is predominant in Doric structures and in the general distribution of a larger data set which includes other religious structures, but not in Ionic temples. The possibility that the long and narrow Doric *sekos* called for temple orientations towards the rising sun in order to illuminate the dark interior, cannot explain these results. In this case we would expect an even distribution of temple orientations across the declinations visited by the sun in the year, in conjunction with the time in the year the temples were mostly visited. Such an association is not present. The temple of of Apollo in Delphi for instance, does not face the February rising sun, nor do the temples of Apollo in Delos, or Artemis Orthia in Sparta, to mention but a few examples.

It is certain, nevertheless, that the data cluster within the solar range has clear boundaries. The absence of data between the major and minor lunar standstills paired with absence of ancient references to these occurrences indicate that the lunar standstills were not associated with religious architecture and festivals in ancient Greece. The present analysis has demonstrated that two thirds of the Doric temples are oriented towards the east (67%). Such a high frequency of eastern orientations is intriguing, as it is not found either in a general distribution of a much larger sample, which includes all architectural orders and altars, nor is it comparable to the distribution of Ionic temples. This frequency cannot be explained as the result of overrepresentation caused by the Sicilian temples which are all noted to face towards the east, as of the 65 Doric declinations only 17 east facing Doric temples are located in Sicily. A distinct preference for eastern orientations has been revealed for Doric temples.

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