

From Petra back to Mecca – From “*Pibla*” back to *Qibla*

A critique of Dan Gibson, *Early Islamic Qiblas: A Survey of mosques built between 1AH/622 C.E. and 263 AH/876 C.E. (with maps, charts and photographs)*, 296 pp., Vancouver BC: Independent Scholars Press, 2017

by

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Preliminary note: *Dan Gibson's new book claims to turn upside down all of what we know about one aspect of early Islamic practice, namely, the sacred direction (qibla) toward the Kaaba in Mecca. He believes that Islam began in Petra, not Mecca, and that the focus of Muslim prayer for the first two centuries was toward Petra, not Mecca. As evidence for this he attempts to show that dozens of early mosques face Petra with remarkable accuracy. Since his revolutionary ideas ignore what modern scholarship has established about the early qibla, I present an overview of how things actually were. I then show how Gibson has misunderstood most of the data at his disposal, comparing medieval mosque orientations with modern directions of Petra and Mecca, and why his interpretation is completely flawed. In brief, he has wrought havoc with information that he cannot master, and has – wittingly or unwittingly – produced an amateurish, non-scholarly document that is both offensive to Muslims and also an insult to Muslim and Western scholarship. None of the mosques investigated by Gibson has anything to do with Petra. Nor, indeed, has early Islam.*

Introduction

The *Qur'ân* enjoins Muslims to pray toward the sacred precincts, which they have considered to mean the Kaaba in Mecca. This direction is called *qibla* in all the languages of the Muslim commonwealth. Thus mosques should face Mecca, the *mihrâb* or prayer-niche indicating the *qibla*. In fact, Muslims all over the world have been praying toward Mecca for over 1,400 years. Imagine how they might feel if somebody comes along and tells them they should have been praying all this time toward a Kaaba somewhere else, namely, in Petra. They would consider such a person deranged, to say the least.

Yet suppose that person, the Canadian amateur archaeologist Dan Gibson, produced what he thought was evidence to show that the earliest mosques – say from the first century and a half of Islam, that is, from the early 7th century to the late 9th century – were actually facing Petra, not Mecca. Gibson purports to document when the *qibla* was changed away from (his true) Kaaba at Petra to (everybody else's true) Kaaba at Mecca. Most Muslims and most Westerners who know anything about the subject would say that his “findings” are absurd. And indeed they are.

Gibson published his book *Qur'ânic Geography* in 2011. In it he proved to his own satisfaction that the *Qur'ân* contains so few references to actual locations, including Mecca, that its origins must lie elsewhere, namely, Petra. (Funnily enough, the authoritative Encyclopaedia of Islam has no entry for Petra, for nothing of consequence in early Islamic history happened there.) Gibson then briefly discussed some 30 early mosques which, according to him, face toward Petra and not toward Mecca; his argumentation was weak indeed, not least because he did not present any orientations. The bibliography included not a single work on the *qibla*.

Gibson's new book contains a dazzling array of information and plans of some 60 early mosques, treated more or less in chronological order, but therefore not by region, and is intended to show how the earliest mosques faced Petra, then between Petra and Mecca, then the “false” *qibla* toward Mecca, with variations on this theme.

Such revolutionary findings, if true, would challenge both historical studies and also the Muslim community at large. However, Gibson disdains the few modern studies on the *qibla* that have come to his attention, but he has a strong conviction and an ultimate purpose: to show that **Muslims are**

misguided and naïve enough to have prayed in the wrong direction for over a millennium. Gibson appears on the scene at the same time as the English historian Tom Holland, the self-styled “leading writer on the Ancient World”, who has had the audacity to claim on the basis of one very dubious late medieval non-Arabic text, that **Muslims have been praying at the wrong times for over a millennium.** Both Gibson and Holland write in total ignorance of research on the institutions of the *qibla* and prayer times over the past century.

Gibson discovers the opposition

Gibson was inspired to undertake his survey of early mosques not only because of his pro-Petra inclinations but because he wanted to disprove a claim I made some 40 years ago that medieval mosques are not always oriented toward Mecca as we moderns think they should be. He begins his book by quoting from my very technical 1986 article “Kibla (astronomical aspects)” in the *Encyclopaedia of Islam* (without attributing it to me), first omitting what I wrote that even though the *qibla* might have been calculated by a competent mathematician the accuracy of the result would depend on the accuracy of the geographical data he had at his disposal. He then quotes me, again not by name, as follows (p. 1):

[King writes:] “Another reason why mosques may be incorrectly aligned is that their *qiblas* were not computed from geographical data at all but were inspired by tradition. Thus, for example, mosques in the Maghrib and the Indian subcontinent generally face due east or due west, respectively. Likewise, in early Muslim Egypt the *qibla* adopted was the azimuth of the rising sun at the winter solstice. Several mosques in Cairo face this direction, which was favored as the *qiblat al-ṣaḥâba*, but which is about 10° off the *qibla* computed mathematically using mediaeval geographical coordinates No survey has yet been made of the orientation of mediaeval mosques. Such a survey would be of considerable interest for the history of Islamic architecture as well as the history of science.”

Gibson wishes to ingratiate himself with Muslim readers by showing by means of a survey of early mosque orientations that these early mosques are correctly aligned, but the catch is that they are correctly aligned toward Petra. But they are not. The quoted passage asserts that “the *qibla* of the Companions of the Prophet (who built the first mosque in Egypt)” was

toward winter sunrise, not Petra. Gibson errs in thinking that the *qibla* is toward the Black Stone, rather than toward the Kaaba itself.¹

Gibson completely misunderstands my findings on the determination of the *qibla* and mosque orientations. Essentially I found that the Muslims for the first two centuries used folk astronomy, particularly astronomical horizon phenomena, the cardinal directions and solar risings and settings at the solstices. Thereafter they also used *qiblas* based on geographical coordinates and mathematical procedures. I claim that all mosques face the *qibla* in ways most of which we can only now understand. I also say that early mosques do not always face the directions we moderns think they should. Now comes Gibson to claim that they face Petra – and accurately at that.

Gibson's book is not a scholarly work, for its text is of the kind one would expect from a first-year college student. Where my works are quoted and misquoted it is unclear who is the author. Gibson is not competent to write on early Islamic history, and often misinterprets the few serious sources he does consult. He writes (p. 127) that:

“Much has been written over the last thousand years on the topic of how Muslims can correctly identify the *qibla* direction when they pray. From about 900 until 1800 thousands of Arabs [!] wrote thousands [!] of books and articles on how this could be done using astronomy and geography. Despite this, there is still disagreement on the technique used by the earliest Muslims.

In relation to finding the *qibla* direction, King and Hawkings [*sic*] divide Islamic history into two parts. First, they suggest that the earliest Muslims used “folk astronomy” to determine the *qibla*, and King claims they were wildly inaccurate. For the second section (9th-16th century), King and Hawkings [*sic*] note that “the techniques of folk astronomy were employed by the legal scholars to determine the *qibla*” but the era really belongs to the mathematicians. It is on this second era that King, Kawkings [*sic!*], Hogendijk and others focus most of their attention.”

First, what I actually wrote is that there are altogether some 10,000 medieval manuscripts, in Arabic, Persian and Turkish still surviving which deal with **astronomy and mathematics**, and that we know of some **1,000 scholars** who worked on these two vast subjects over the centuries. Those remarks of mine did not refer to the *qibla* at all.

Second, there is no disagreement about the *qibla* techniques used by the first generations of Muslims. It is obvious that, without knowledge of mathematics and geography, they would have used simple techniques of folk astronomy, knowledge of which was widespread before the advent of Islam. No-one has ever objected to what I have written on this (until Gibson).

Third, Gerald Hawkins (famous for his astronomical analysis of Stonehenge) had nothing to do with the *qibla*. He and I wrote a joint paper on the astronomical alignment of the Kaaba, Gerald using satellite images and I using medieval texts.² We did this because we had found that our conclusions from the two sources were the same! Modern measurements confirmed medieval documents; or medievals already knew what moderns had just discovered. **Gibson fails even to mention the astronomical orientation of the Kaaba, which was of prime importance for mosque orientations, because mosques are oriented toward the Kaaba, not toward Mecca.** (For Gibson, of course, the “real” Kaaba was in Petra!)

Fourth, Gibson cannot understand that the *qibla* was determined either using **folk astronomical techniques from the 7th to the 21st century** (not just till the 9th century!) or using **mathematical methods from the 9th to the 21st** (certainly not from the 7th century!). For example, a controversy has raged in recent years between two factions of Muslims in the US, one who believe that the *qibla* is toward south-east (look at a map of the world) and the other who believe that it is toward north-east (fly Saudia to KSA from JFK!).

Fifth, Jan Hogendijk’s contribution is worth more than a passing mention. As a leading historian of Islamic mathematics he has contributed a great deal to our understanding of how Muslim scientists worked on the *qibla*-problem, always using medieval manuscripts.³

Finally, Gibson claims that I wrote that mosque orientations were “wildly inaccurate”. But I never wrote this, not least because it is not true.

An old-school orientalist and historian of science reacts

The ultimate purpose of this essay review is to demolish the Petra thesis for all time. I counter Gibson’s agnotological *tour de force* with the simple argument that the earliest Muslims could never have aligned mosques accurately toward Petra, or, for that matter, toward Mecca either. It is even easier to demolish Gibson’s necessary back-up thesis, which is that the first generations of Muslims had all of the necessary technical equipment –

trigonometry, geometry, geographical coordinates, astronomical instrumentation – to derive the direction of Petra accurately for any locality from al-Andalus* to China. Since this equipment in fact became available to the Muslims in Iraq only in the late 8th and early 9th century, Gibson’s attempt to fabricate the evidence for an earlier epoch falls flat.

(* The term al-Andalus refers to that part of the Iberian Peninsula under Muslim hegemony at any time.)

The first thing to make clear is that early mosques cannot be expected to be oriented in the modern direction of Mecca (or Petra), and they should not be labelled “incorrect” if they do not face that direction. Alas, we still find an occasional architectural historian who dares to write something as naïve as: “this mosque is incorrectly aligned toward Mecca”, when he or she has no idea what the medieval *qibla* was in that location, and which *qibla*? or whose *qibla*? For in each major centre there were several *qibla* directions used over the centuries, sometimes associated with particular interest groups. The subject of the *qibla* and orientations of religious architecture is extremely complicated, but we are beginning to understand it.⁴ It could take a mighty step backward with the appearance of this new book, because even the basics of how the *qibla* was determined and how it was applied to religious architecture over the centuries are not generally known, certainly not to most Muslims, and not to most Westerners involved with Islamic architecture either.

Mosque orientation is far more complicated than Gibson thinks. Why, for example, does the Great Mosque of Córdoba, built in the 780s, face the deserts of Algeria rather than the deserts of Arabia? Why does some medieval architecture in Cairo have different alignments for the insides and the outsides of the *qibla*-wall? In Samarqand, why do some religious edifices face due west and others due south? Historians of Islamic architecture are notoriously ill-informed on the subject of orientations. They even ignore what some historians of Islamic science, with access to medieval Arabic texts on the *qibla* in different regions, have contributed, and they ignore what some urban historians have written after measuring orientations in the light of our knowledge of which *qiblas* were accepted in those regions.

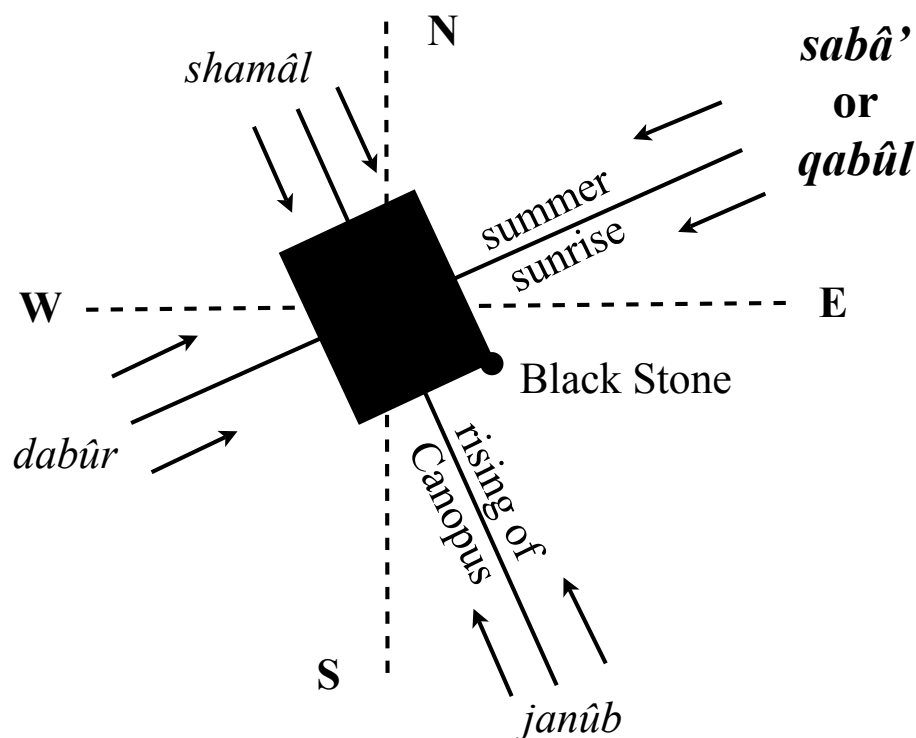
The way it was

Before the 9th century Muslims used exclusively tradition and folk astronomy – notably, astronomical risings and settings – to find the *qibla*. Early Islamic religious architecture, however, was often laid out in accordance with the foundations of pre-Islamic religious edifices. The general direc-

tion of Mecca, as indicated by the road leaving a given location toward Arabia, would sometimes suffice.

We should not forget that the *qibla* is toward the Kaaba, and not toward Mecca. The rectangular base of the Kaaba is itself astronomically aligned, with its main axis toward the rising of Canopus and its minor axis toward summer sunrise and winter sunset. In a society without serious geographical notions or mathematical science beyond commercial arithmetic, how does one locate a distant edifice to face it? The answer is astronomical alignments, of which the cardinal directions are the most obvious, less so sunrise and sunset at the winter and summer solstices, but also risings and settings of select *qibla* stars.

The astronomical alignments of the rectangular base of the Kaaba and its relationship with the winds in pre-Islamic astronomical folklore. This information was first rediscovered in the 1970s in medieval Yemeni texts on folk astronomy.



Muslim efforts to view the world about the astronomically-aligned Kaaba resulted in a colourful tradition of sacred folk geography, with sectors of

the world around the Kaaba associated with segments of the perimeter of the Kaaba and their *qiblas* being defined in terms of astronomical horizon phenomena. The scholars who favoured such *qibla* methods by folk astronomy for over a millennium were invariably scholars of the sacred law in addition to being knowledgeable in folk astronomy.

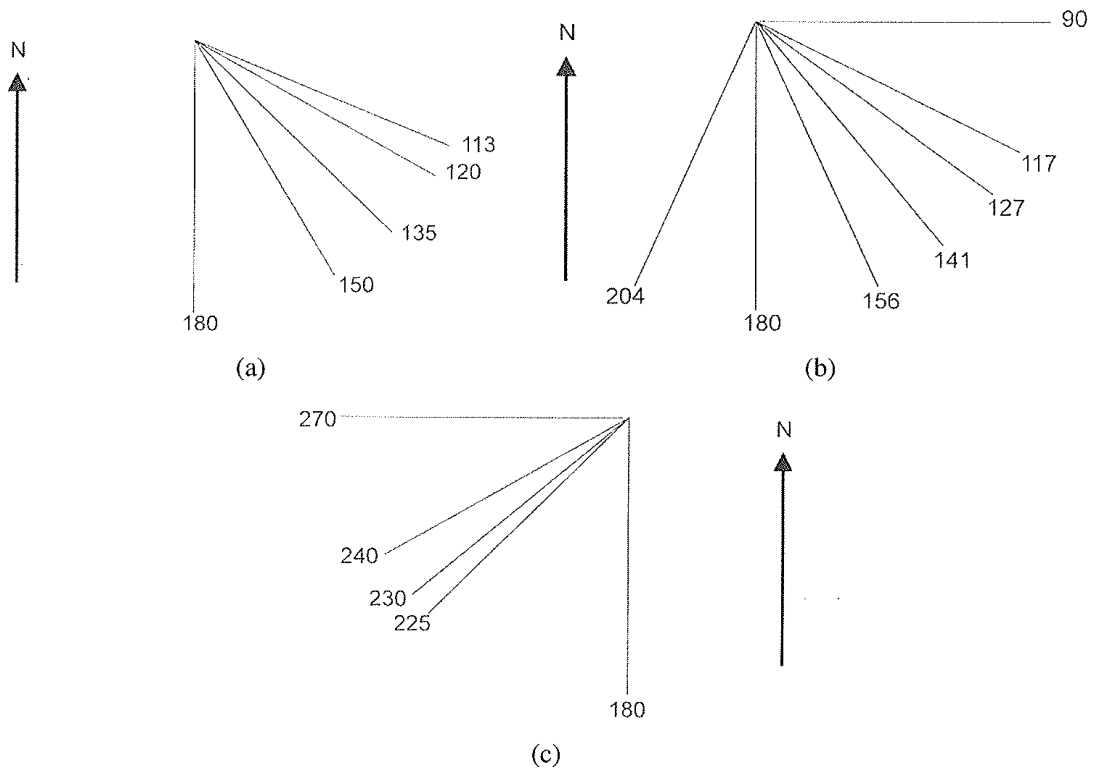
By the beginning of the 9th century the Muslims had acquired the geographical knowledge (mainly from Greek sources) to realise what the *qibla* problem involved and the mathematical knowledge (mainly from Indian and Greek sources) to solve it – within medieval parameters. The solutions were trigonometrical or geometrical, either simple and approximate, or complicated and accurate, within the limits of the accuracy of medieval geographical coordinates. Thereafter mosques could be oriented in the mathematical *qibla* directions if a competent person were involved in the layout. The scientists took the problem to its natural (medieval) conclusion, with tables of *qibla* values for the whole Muslim world and cartographic grids centred on Mecca with which one could simply read off the direction and distance to Mecca for any locality.

Not only do we have access to what the astronomers and legal scholars wrote on the determination of *qibla*, we also have discussions of the palettes of *qibla* values that were used in such medieval centres as Córdoba, Cairo, and Samarqand. What has failed us is a survey of mosque orientations from one end of the Muslim world to the other, although some areas (al-Andalus, the Maghrib, Turkey) have already been well-served.

Various qiblas accepted in Cordoba, Cairo-Fustat and Samarqand by different interest groups.

CORDOVA: According to a 12th-century Andalusî treatise on the astrolabe, mosques in Cordova were oriented in these different directions: 113°, the qibla computed by the standard approximate formula (which works well for localities in the central regions of the Islamic world, but not for al-Andalus, where the error is more than 10°); 120°, winter sunrise; 135°, a compromise between due east and due south; 150°, the direction of the Great Mosque (which is 'parallel' to the major axis of the Kaaba); and 180°, due south (not specifically mentioned).

CAIRO: The Egyptian historian al-Maqrîzî (d. 1442) mentioned these qiblas as being used for mosque orientation in Cairo: 90°, due east (not specifically mentioned in this text);



117°, winter sunrise, the qibla of the Companions of the Prophet; 127°, the qibla of the astronomers, computed according to an exact procedure and first attested in the writings of the 10th-century Fatimid astronomer Ibn Yûnus; 141°, the qibla of the Mosque of Ibn Tûlûn, variously explained; and any direction in the range ca. 156° - ca. 204°, between the rising and setting of Canopus.

SAMARQAND: The legal scholar Abu 'l-Yusr al-Bazdawî (d. 1089) reported these qiblas as being used for mosque orientation in Samarqand: 270°, due west, used by the Hanafite school of law and corresponding to the direction in which the road to Mecca left the city; 240°, winter sunset, as used for the Great Mosque; 230°, a value underlying a table for the altitude of the sun in the azimuth of the qibla, presented by al-Bazdawî but lifted from some earlier source; 225°, south-west, a compromise between the Hanafite and Shâfi'ite qiblas; and 180°, due south, used by the Shâfi'ite legal school, intended to correspond to the qibla of the Prophet in Medina.

Historians of Islamic architecture, with a few notable exceptions, are clueless about orientations, not knowing what people in past centuries thought was the qibla in any given place, and most not being able to

measure orientations properly anyway. For both of these shortcomings they can be (almost) forgiven. Yet some colleagues in architectural history still persist on ignoring orientations altogether, which is particularly annoying when the orientation has been deliberately changed from the orientation of neighbouring edifices (as in Cairo). Now with satellite imagery anybody can zero in on any mosque and actually visualise its orientation. And with the way open to just anybody, Dan Gibson has measured many of the significant mosques and – innocent of most research in the history of Islamic architecture and the history of Islamic science – has come up with some very challenging conclusions.

Excursus: What do mosque orientations tell us?

First, a general remark: We wish to investigate the way in which a given medieval mosque at location X was laid out, with the ultimate purpose of determining whether it was laid out facing location P or location M. Suppose the mosque faces 120° (30° S of E). Suppose the direction of P from X is 130° (40° S of E) and the direction of M from X is 140° (50° S of E). It would be tempting to think that the mosque was deliberately laid out to face location P. But the two directions we have given toward P and M are **modern directions, based on modern geographical coordinates and an accurate mathematical formula**. They are not at all relevant to the layout of a medieval mosque, except to fill a vacuum in our minds. Therefore, we cannot claim that the mosque at X was deliberately aimed at P (or M). It would be silly to say the mosque is inaccurately oriented toward Mecca by 20° (or toward Petra by 10°) when we have no idea how the people who built the mosque found the *qibla*. And suppose the mosque was actually oriented toward M using winter sunrise, for we know from medieval texts that this did happen. Then it is not surprising that the mosque faces 120° (30° S of E), for that is roughly winter sunrise (which depends on local latitude). Centuries later a medieval astronomer equipped with geographical data (different from modern data) and mathematical knowledge might have calculated the direction of M as 135° (45° S of E) so that someone could build another mosque. This direction happens to be halfway between the (modern) directions of P and M, but so what? That mosque will face M at 135° (45° S of E). A modern mosque, if properly laid out, would be aligned toward 140° (50° S of E).

It is statistically possible that some medieval mosque plans suggest a focus of a point P rather than M. Given the shape of the medieval Muslim world stretching from al-Andalus to China with M somewhere in the middle, and most areas being north of M, it is conceivable that there might be a suitable focal point P to the north of M, but not too far. If many of those mosques are facing astronomically-defined directions, including cardinal and solstitial alignments, this will inevitably raise havoc with the analysis and render the investigation futile.

When confronting a given medieval mosque one also needs to measure its orientation properly within the surrounding city plan with its physical features. One then needs to know which directions were proposed by the legal scholars and by the astronomers for that location. Then one can perhaps begin to make comment meaningfully about how the mosque might have been laid out. And one can hardly expect that practices in different regions should be the same. Any large-scale investigation should consider the orientations chronologically within each region.

The orientations of medieval churches – toward Jerusalem, due east, sunrise at solstices, sunrise on saints' days – have been investigated in recent years by colleagues in medieval Christian history and archaeoastronomy. The wide spectrum of results attest to the ingenuity of the human spirit, as is the case with medieval mosques. But suppose we discover that many churches face accurately toward Constantinople; does this mean they were deliberately intended to face Constantinople. No, it does not. We return to Gibson's mosques facing Petra.

The revisionists revise themselves

Gibson is not to blame for his basic premise that Islam did not begin in Mecca. It goes back over 40 years ago essentially to three Arabists (Wansbrough and his students Crone & Cook) at the University of London (SOAS), who expressed the daft "revisionist" idea – though they were serious – that the origins of Islam were not in Mecca, but somewhere else in N.W. Arabia. The latter two of these, in their unfortunate 1977 book *Hagarism*, "written by infidels for infidels", claimed to have proven this by demonstrating that the earliest mosques in Egypt and Iraq indeed faced N.W. Arabia rather than Mecca. I was happy to point out to Cook in person that the Egyptian mosque faced winter sunrise and the Iraqi mosques faced winter sunset, so one could hardly expect them actually (in modern terms) to face Mecca.

For me as a non-specialist in most aspects of early Islamic history it is rather difficult to criticise any of the so-called “revisionist” historians of early Islam. I personally need a higher authority, and therefore I refer to Robert B. Serjeant’s brilliant and devastating review of *Hagarism*.⁵ Bob wrote:

“*Hagarism* ... is not only bitterly anti-Islamic in tone but anti-Arabian. Its superficial fancies are so ridiculous that at first one wonders if it is just a ‘leg-pull’, pure ‘spoof’ Given the authors profess to be Islamic historians, they are sadly out of touch with contemporary research on Islam tiresome travesty of history ... pretentious humbug.”

By 1991 Crone and Cook had retracted their wretched book, Crone admitting that “we were young, and we did not know anything.” But their playful nonsense caused a lot of damage, and the “revisionists” continue to work with disregard for the early Muslim sources (but less for the contemporaneous Christian ones).

Enter the revisionist Dan Gibson

In his 2011 book *Qur’anic Geography* Dan Gibson claims that Islam started in Petra, not Mecca. I will not comment on this except to remind the reader that his starting point was the long-disproved premise of Crone & Cook. Gibson, like his predecessors, has no idea that the mosques faced astronomically-defined directions, so that they might not *actually* face Mecca (those who built them certainly intended them to face the *qibla* toward the Kaaba in Mecca). He played around with the orientations of various early mosques but was clearly out of his depth.

In his new book Gibson sets out to show that early mosques face Petra, not Mecca. He presents satellite images of dozens of early mosques, and for each he gives the actual orientation, the direction to Petra, the direction to Mecca, and, just in case, the direction to Jerusalem. Of course, these three directions are the **modern** values, unattainable to anyone before modern times, which is unfortunate because both the information presented and his conclusions based thereon are all invalid, since modern directions based on modern coordinates are totally irrelevant to the study of early mosques.

Gibson’s “discovery” that most early mosques face accurately toward Petra is fortuitous because the first generations of Muslims had no means whatsoever for finding the direction of Petra accurately to within a degree or two, not least because they had no access to any geographical coordi-

nates, let alone modern ones, and no mathematics whatsoever. He overlooked the fact that many of his mosques are aligned either cardinally or solstitially. That the early mosques do not face Mecca as we moderns think they should is hardly surprising, because the early Muslims had no means to find the direction of Mecca accurately either, though they did this as best they could with the means at their disposal. It is of little interest to compare medieval orientations with modern directions based on modern geographical knowledge and accurate trigonometric formulas. **Modern values of directions from one place to a distant other one are irrelevant to investigating the orientations of historical edifices. I repeat this in the hope that even Gibson may understand.**

The satellite images collected in this volume will surely be deemed useful by some. However, **anyone who ventures to use the raw materials Gibson presents should do so with extreme caution.**

Excursus: Astronomical alignments

The north celestial pole defines the cardinal directions on the local horizon, for the north-south line is defined by the meridian, and the east-west line is defined by the celestial colure perpendicular to the colure through the zenith. Unfortunately, perhaps, the celestial pole is not visible, and neither are the meridian or colure. That leaves us with the horizon. The sun rises in the east and sets in the west, more or less. In fact, the sun rises due east and sets due west only twice a year, at the equinoxes. Sunrise and sunset are about 30° north of east and west at midsummer, and about 30° south of east and west at midwinter (for latitude 36° , the middle of the ancient world). Many early mosques – those from before the scientific age – were oriented in the cardinal or solstitial directions. The intermediate directions between the cardinals were also used.

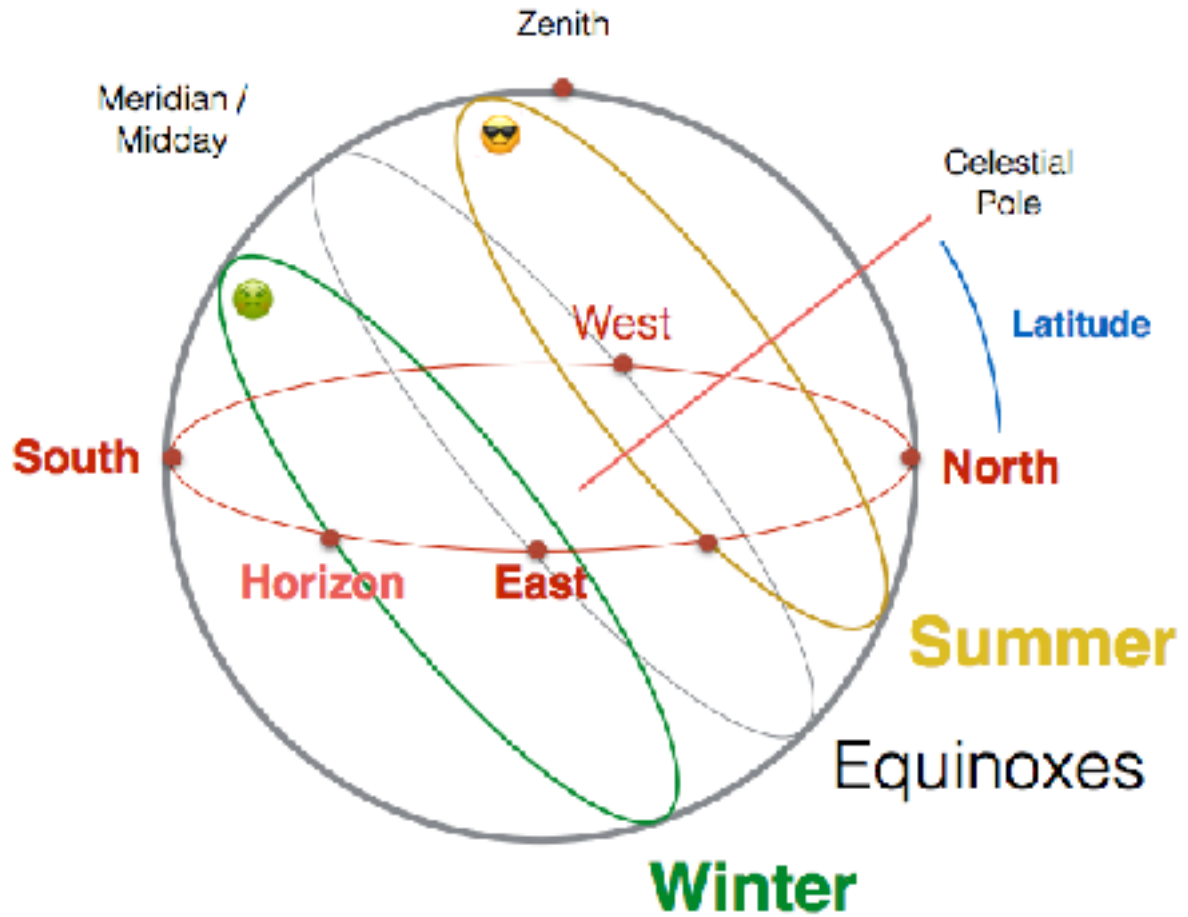
To find the cardinal directions on a given day, many moderns would be flummoxed unless they know what is contained in the previous paragraph or they have a phone at hand with astronomical software. By night, the Pole Star, a modest asterism near the celestial pole, is a close north marker in the northern hemisphere, and Canopus, the brightest star in the southern sky, is a south marker in the southern hemisphere; however, Canopus rises and sets, so that south is actually midway between its rising and setting. In the recent past people used magnetic compasses to find directions, and, in historical investigations, it helped to know that magnetic north varies from true north with the exact variation depending on epoch and location.

When I worked at New York University in 1982, one early morning in late December, I was jogging around the rectangular Washington Square and I saw the sun come up directly at the end of the street forming the southern major axis of the Square. It was an impressive sight. But more significant for me was to realise that not only the Square but the entire orthogonal street plan of Manhattan was more or less solstitially aligned. Wow! I wondered how many denizens of NYC knew that. You would never know it from the maps of the City because the street-plan of Manhattan is always rectified to be aligned with the paper on which it is printed. Nowadays you can read about all this in the *Wikipedia* article “Manhattanhenge”.⁶

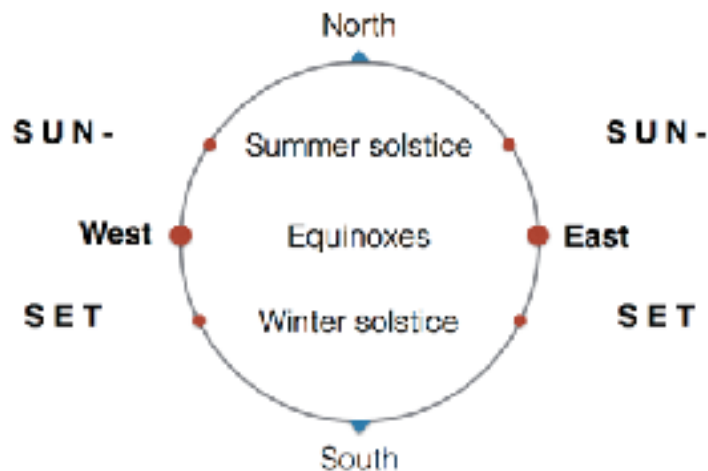
About the same time I was working with Gerald Hawkins on the astronomical orientation of the Kaaba. I had found information on this in a medieval Yemeni text on folk astronomy, and Gerald had access to satellite images which enabled him to find the orientations of the rectangular base of the edifice and ascertain the height of the surrounding hills and mountains on the local horizon. His data confirmed the information in my source. Or, to put it another way, some Muslim scholars in the medieval period knew already what we had just discovered. Basically, the major axis aligns with the rising of the brightest star in the southern sky, Canopus, and the setting of Ursa Minor, and the minor axis is aligned with summer sunrise and winter sunset. These directions happen to be perpendicular at the latitude of Mecca. One cannot claim that the Kaaba was originally laid out in this way, but that’s the way it was centuries ago and it hasn’t changed, although one would never know this from looking at the Kaaba in its present setting.

Again, in the years preceding that time, I had identified some 30 medieval Arabic, Persian and Turkish manuscripts in which 20 different schemes of Islamic sacred geography are preserved. The Kaaba is at the centre of the world, which is divided in sectors about the centre, each sector associated with a segment of the perimeter of the edifice. The *qibla* in each sector is defined in terms of astronomical risings and settings. Such information for specific regions is attributed in some sources to 7th-century authorities such as Ibn ‘Abbâs and al-Hasan al-Basrî. Needless to say, these schemes are focused on the Kaaba in Mecca, not Petra.

The paths of the sun at the equinoxes and solstices



The sun on the horizon



(Solstitial amplitudes depend on local latitude.)

Numbers galore, mainly misinterpreted by Gibson

None of the mosques which Gibson thinks were built facing Petra has anything to do with Petra, nor do those he vainly finds facing “between Petra and Mecca”.

I shall not demonstrate this for all of the mosques he investigated (pp. 11-114), but the following examples should suffice to show that not only are his interpretations erroneous, but also that the whole idea of assessing the “errors” of medieval orientations by comparing them with **modern** directions is flawed. In particular, even readers non-versed in numbers will recognise that Gibson has “discovered” that certain mosques have an orientation associated with Petra, but we know that they were laid out in accord with pre-Islamic religious edifices (Damascus, Jerusalem, Córdoba). Inevitably, problems arise when one investigates mosques that have been rebuilt in different directions.

Gibson’s section on how he derived the orientations is risible. Nevertheless, I shall risk using his orientations, assuming that they are more or less accurate, which is not always the case (see Tunis below). In his analysis, it suits his purpose to continuously ignore the cardinal and solstitial bearings and pre-Islamic fundamentals. It now suits my purpose to use his modern directions to Mecca and to Petra even though they are irrelevant to any historical investigation, but they are necessary to counter his interpretations of the mosque alignments.

In the following overview of Gibson’s findings, all orientations and bearings are given to the nearest degree clockwise from 0° at north, 90° at east, 180° at south, and 270° at west. **The reader should keep in mind that I have not measured a single mosque myself.**

China

We find that the Mosque in Guangzhou (China), which Gibson claims was built in 627 [!], although the present edifice is apparently no earlier than the 15th century, supposedly faces Petra to within 3° , Mecca to within 7° . Gibson claims it was deliberately laid out to face Petra. One could contend that it was built by eager Muslims from Petra, who had no ships and who must have arrived in China on a flying carpet. But how did they know where they were? Where Petra was? Did they really know about great circles on the terrestrial globe? In fact, the early date for this mosque stems from a legend without credibility. To confirm the Petra victory, Gibson

needs to fabricate some distortions of standard knowledge regarding the history of science, which he will do in a future chapter.

Egypt

For the Mosque of ‘Amr in Fustat (Egypt), first erected in 642, no information is given on orientations but our author claims it faces Petra. This contradicts medieval sources which say that the *qiblat al-sahâba*, “the *qibla* of the Companions of the Prophet”, was toward winter sunrise. Although Gibson does not mention them, the late-10th-century al-Azhar and al-Hâkim Mosques are laid out in the *qibla*-direction computed by the Caliph al-Hâkim’s astronomer Ibn Yûnus, namely, 127° . For the Mosque of Ibn Tûlûn, founded in 876, Gibson gives the orientation as 145° , with Petra at 84° and Mecca at 136° . He states that this is a Mecca-orientation, and so it is. But it is not the first *qibla* in Egypt, namely winter sunrise (117°), and it is not the later mathematically-computed *qibla* (127°). Indeed, a legend claims that the inspiration for the orientation of Ibn Tûlûn’s Mosque involved the orientation of the Prophet’s Mosque in Medina and another maintains that the *mihrâb* was laid out by the Prophet Muhammad himself whilst Ibn Tûlûn was asleep.

In 1984 I published a paper showing how the axis of the Fatimid city of al-Qâhira, laid out alongside the Roman Red Sea Canal, which was fortuitously perpendicular to this first *qibla* (117°), and the later mathematically-derived *qibla* (127°) both influenced the development of the Fatimid city of Cairo founded in 969 and the later Mamluk city and funerary suburbs.⁷ In some edifices the outside is oriented perpendicular to the city axis, that is, toward the old *qibla*, and the inside is oriented in the new *qibla*, 127° ; one can see the 10° difference at the windows. These results are, of course, quintessential to an understanding of urban development and religious edifices in medieval Cairo, but they have not yet been exploited by any historian of medieval Cairene architecture.

Yemen

The Great Mosque in Sanaa (Yemen) from 705 at 334° is pointing toward Petra at 334° , Jerusalem at 335° , Mecca at 326° . But lo! its major axis is parallel to that of the Kaaba in Mecca (and it even has a miniature Kaaba inside).

Jerusalem

The al-Aqsâ Mosque in Jerusalem, dated 709, faces 170° ; with Petra at 173° and Mecca at 157° Gibson would have this facing Petra, but it is

clearly oriented along with *al-Haram al-sharîf* complex, which is off the cardinal directions by 10° . The *qibla* of Jerusalem according to medieval astronomers was about 135° , a far cry from due south, and need not concern us here (but architecture historians should take note).

Jordan, Syria, Lebanon

The Umayyad Mosque in Amman (Jordan), from 701, may face 183° , with Petra at 194° and Mecca at 161° , but the mosque was clearly intended to face due south, certainly not to face Petra. The Khirbat al-Minyâ complex, built in 706, is at 183° , so Gibson favours and orientation toward Petra at 182° (Mecca is at 161°). The complex was obviously intended to face due south. The Mosque at Khirbat al-Mafjar, built in 714, faces 180° , which Gibson sees as facing Petra at 181° , rather than Mecca at 159° . Another example is the Mosque at Ba'albek (Lebanon), dating from 740. It faces 177° , with Petra at 190° , Mecca at 165° , and the line from Petra to Mecca at 178° . For Gibson it faces the last of these. All of these mosques are trying to tell us that they face south, and that those who built them took south as the *qibla*.

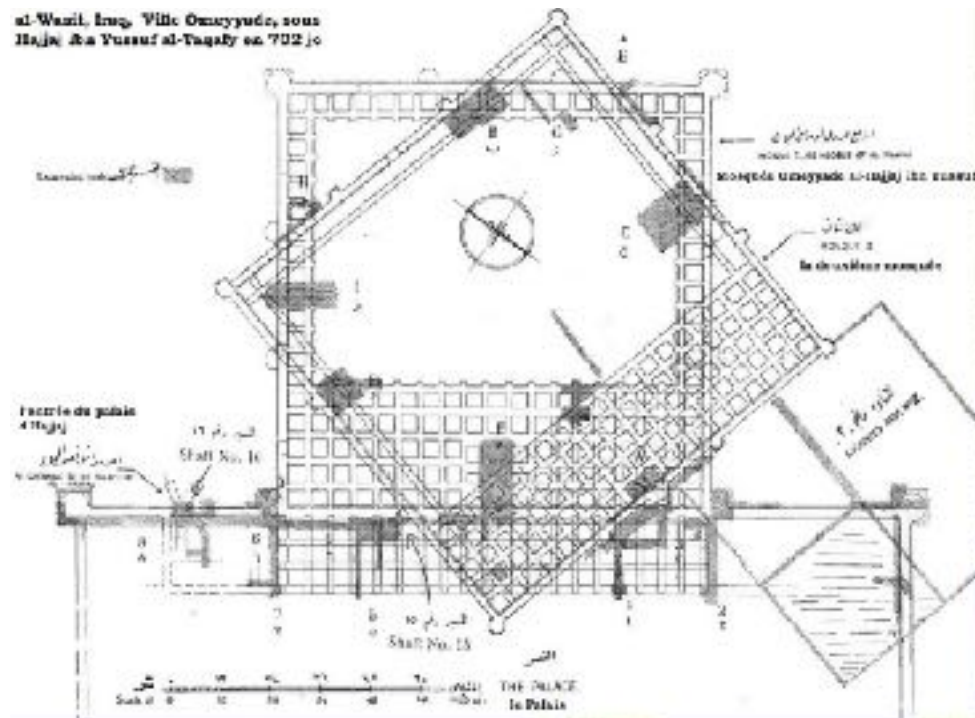
Gibson introduces the interesting idea that some mosques face “between Petra and Mecca”. The Umayyad Mosque in Damascus (Syria) built in 709 (not from scratch) is at 177° , with Petra at 193° and Mecca at 165° ; therefore, “this mosque points between Petra and Mecca”. The Mosque was in fact built on the site of a Byzantine cathedral, itself replacing a Roman temple, which was cardinally aligned. The *qibla*-wall is off due south by 3° . Many Syrians throughout the Middle Ages and up to this day thought the *qibla* in Damascus was due south. Actually the *qibla* in Damascus according to medieval astronomers was about 150° . The Mosque in Ba'albek from 740 faces likewise 177° , more or less due south, and certainly not deliberately “between Petra and Mecca”. See below on a curious group of edifices over a wide swathe of Syria, all facing about 195° .

Iraq

Gibson adds to the falsehoods that have been committed by Creswell onward, including Crone & Cook, about the Mosque at al-Wâsit (Iraq). This was originally built in 706 and then demolished and rebuilt in between 1009 and 1155 in a completely different direction, at about 50° further south. (For this, the most controversial of mosque orientations, Gibson does not reproduce the splendid plan by F. Safar, who conducted the 1936-42 excavations, nor does he give any orientations – I reproduce the plan here. This shows the first two out of a total of four mosques built on the

same site over the centuries.) The first Mosque faces about 245° and the second Mosque faces about 195° . Creswell said the first Mosque first faced Jerusalem; Crone & Cook said it first faced an unidentified site in N.W. Arabia; Gibson now says it was first built deliberately facing “between Petra and Mecca”.

*The model plan of the first two mosques at Wâsit
by the Iraqi archaeologist F. Safar.*



Whoever knows anything about the ways the earliest Muslims found the *qibla* one is not surprised to find the first mosque facing winter sunset: this was taken as the *qibla* by the first generations of Muslims in al-‘Irâq. The second mosque was oriented in a *qibla* for Wâsit that had been derived by someone familiar with (medieval) geographical coordinates and mathematics (we find 201° in a 15th-century Central Asian geographical table with medieval *qiblas* for over 250 localities; of course, we do not need the modern *qibla* for Wâsit). The orientation of the two mosques has never been previously explained in modern times. More careful measurements and calculations using geographical tables from the 9th, 10th and 11th centuries would surely confirm this explanation.

The Mosque of Basra (Iraq), dating from 721, is at 184° , with Petra at 203° , Mecca at 164° . Gibson has it deliberately facing “between Petra and Mecca” at 183° . In fact, the mosque was built facing due south and a 4° error is not bad for that time.

Central Asia, Indian subcontinent

For the Cheraman Juma in Kerala (India), supposedly built in 629 [!], we have the mosque at 305° , with Petra at 304° , and Jerusalem at 306° , whereas Mecca is at 230° (with an incorrectly-marked pointer). Gibson favours a Petra orientation. I see no obvious explanation, but I smell a rat.

The Mosque at the site of Banbhore (Pakistan) dates from 727. It faces 266° , with Petra at 289° , Mecca at 268° and Jerusalem at 292° . For Gibson this mosque faces toward Mecca, indeed he thinks it is the earliest known mosque that faces Mecca. It does indeed face Mecca, but not in the way Gibson thinks. For it faces due west, which is the direction the builders took for the *qibla* toward Mecca. The first mathematical determination of the *qibla* known to us comes from Baghdad *ca.* 825. The lists of *qiblas* for hundreds of locations from one end of the Muslim world to the other that were available in Greater Iran from the 15th century onwards do not include Banbhore, which was destroyed in the 13th century.

The Bîbî Hânûm Mosque in Samarqand (Uzbekistan), *ca.* 1400 and thus later than Gibson thinks, is at 262° , which he says is 2° off the direction to Petra (and 22° off the direction to Mecca), but in fact the mosque is a careless 8° off due west, which the Hanafî school of religious law took as the *qibla* (the Shâfi'îs preferred due south). In 1983 I published a medieval text on the different *qiblas* used in Samarqand and measured some of the mosque orientations.⁸

Oman

Two early mosques in Oman of uncertain date face $293^\circ/296^\circ$. Gibson shows a small error in orientation to Petra (2°) and a larger error ($26^\circ/29^\circ$) for Mecca. For him, the mosques face Petra. In fact, they both face summer sunset (about 295°), and those who built them intended them to face the Kaaba at Mecca.

al-Andalus

The mosque that “takes the cake” in its orientation is the Great Mosque at Córdoba (Spain), built in 784. For Gibson the Mosque is at 157° (actually it is at 152°), with Petra at 91° and Mecca at 100° . Gibson finds that it is parallel to the line between Petra and Mecca, which is at 155° , representing a modest error of 2° . (Remember, at that time these folk had very limited geographical and mathematical knowledge.) In fact, the Mosque was laid out in accordance with the late-1st-century Roman orthogonal street-plan, which has an identical orientation, and the curious *qibla* was never

changed whenever the Mosque was later enlarged. Now the major axis of the Mosque is conveniently “parallel” to the major axis of the Kaaba, or, to put it another way, the qibla wall is “parallel” to the NW wall off the Kaaba. The major axis is solstitially aligned, as it the case of the Kaaba. So why change the *qibla*? Some schemes of sacred geography indicate that when one is in Mecca, facing the NW Wall of the Kaaba, one is standing in the *qibla* of al-Andalus. Thus when one is back in al-Andalus one faces a direction “parallel” to the major axis of the Kaaba, and that direction was popular in al-Andalus and the Maghrib.

Gibson adds to an substantial amount of rubbish that has been written about the orientation of the Grand Mosque by investigators over the past century, many of whom thought that it faced due south. Already in 1978 I published a medieval Arabic text about the different *qiblas* that were used in medieval Córdoba;⁹ later this year I shall be presenting all available data on the *qibla* in Córdoba and the alignment of the Mosque at a conference “Science in al-Andalus” held at the Casa Árabe in that city. For all orientations in the whole of al-Andalus the writings of Alfonso Jiménez, Mònica Rius and Julio Samsó are indispensable.

al-Maghrib

For the Maghrib Gibson could have spared himself considerable embarrassment by consulting the works of Monica Rius and Michael Bonine, which deal with orientations there, using respectively medieval Maghribî texts and geophysical analysis.

The Mosque of ‘Uqba ibn Nâfi’ in Qayrawan (also Tunisia), erected in 670 and rebuilt in 836, faces **151°** [Bonine: **147°**] with Petra at 97° and Mecca at 111°. Gibson concludes that it is parallel to the line between Petra and Mecca, at 155°, with an error of 4°. The Mosque called al-Zaytûna in Tunis, built in 732, faces **154°** [Bonine: **145°!**], with Petra at 100° and Mecca at 113°, and Gibson finds that it is within 1° of the line between Petra and Mecca at 155°. The Ribât or Fortress at Sousse (Tunisia), dated 770, with a small mosque, faces 183°, and was clearly intended to face due south, The neighbouring Great Mosque, from 850, faces **162°** [Bonine: **163°**], with Petra at 98° and Mecca at 112°. Gibson thinks it was deliberately laid out “parallel to a line drawn from Petra to Mecca’ at 155°.

Bonine found that the Great Mosques at Qayrawan, Tunis, Sfax, Monastir, Mahdia and Hammamet (but not Sousse) are all at **145°-147°**, and observed “when the evidence of a Roman cadastral survey is found associated with this cities, it then appears that the *qibla* and the Islamic city struc-

ture has therefore been determined by the pre-existing Roman system”.¹⁰ It is not always worthwhile to seek a Nabataean connection.

A new era begins

With the Great Mosque of Sâmarrâ (Iraq), built in 847, we are at the beginning of a new era. The Mosque is at 198°, Petra at 244° and Mecca at 197°. The Mosque has been laid out in the *qibla* of the astronomers, and the man who computed it was probably Habash al-Hâsib, the most innovative astronomer of the 9th century, some of whose works containing tables for the latitude of Sâmarrâ have survived. Gibson accepts that the Mosque is oriented toward Mecca. By this he means that the “true” *qibla* toward Petra has been abandoned and the Muslim have started to pray toward their “false” *qibla* toward Mecca.

Orientations that are not so easily explained

I shall not deal with further examples of early mosques whose orientations can be explained in terms of folk astronomical techniques or the foundations of pre-Islamic edifices. There are not a few others whose orientations defy explanation.

Syria, Jordan, and Lebanon again

Gibson investigates the Great Mosque in Hama (Syria), dating from 637. It faces **194°**, with Petra at 193° and Mecca at 168°. For Gibson it faces Petra. Next the 'Anjar Palace Mosque (Lebanon), dating from 714. Its orientation is **191°**, with Petra at 187°, Mecca at 164°, and Jerusalem at 197°. Gibson decides this mosque “points almost directly at Petra”. So it does, but nobody could have planned that at the beginning of the 8th century, toward Petra or anywhere else. An 11° deviation west from true south is too much to assume that a southern orientation was intended. The Mosque at Qasr al-Hayr al-Gharbî (Syria), dating from 726, also faces **191°**, with Petra at 205° and Mecca at 171°. The Mosque at the eastern Qasr, dating from 728, is at **193°**, with Petra at 214° and Mecca at 177°. Gibson’s false interpretation is the same as that for ‘Anjar. The same holds for the Mosque at Mushatta (Jordan), dating from 743. It is at **195°**, with Petra at 199°, Mecca at 161°. For Gibson the Mosque points to Petra; for me it remains to explain these 10°-15° deviations west of south. But we are not quite finished.

The Mosque at Raqqa (Syria) was built in 772. It faces **194°**, and Gibson has Petra at 209° and Mecca at 177°. He concludes that it faces “between” Petra and Mecca, which would be at 193° with an error of just 1°. But

there is no evidence that anyone ever tried to align an edifice “between” two distant goals, and that is certainly not what has happened here.

These orientations of 190° - 195° are not so easily explained. What is clear is (a) that the direction was not calculated, and (b) that was not derived from risings and settings of the sun at the solstices, or of a bright star. (Notice that the orientation of the newly-discovered “platform” at Petra, which Gibson (p. 259) thinks is at the origin of his would-be Mînâ, is also about 200° .)

Alas, we have no medieval discussion of mosque orientations in Syria. But certainly strange things happened there. For example, in the Mamlûk developments to Tripoli (Lebanon), mosques *and* their orientations were copied wholesale from mosques in Aleppo and Hama. Indeed, mosques in medieval Tripoli are in the range 165° - 190° , even though the astronomers knew the mathematical *qibla* was 150° . Then, in the mid-14th century, we have al-Khalîlî of Damascus preparing a superb table of *qibla* values for the whole Muslim world and a smaller one for localities in Syria and Palestine.

Gideon Avni has investigated the orientations of a dozen simple mosque layouts in the Negev Highlands, which date back to the earliest Arab expansion into S. Palestine.¹¹ He found that 10 fall in the range 162° - 172° (with two others at 158° and 182°). Again I have no explanation.

For all of these early mosques mentioned above, from China to al-Andalus, one thing is clear, namely, that **Gibson’s claim that early mosques facing Petra is nothing more than wishful thinking**. For all of these early mosques and for many hundreds of other, later mosques the investigation of their orientations would also be worthwhile. All mosques are oriented in the *qibla*, and the challenge for us moderns is to measure the orientations properly and identify the diverse ways that were used for finding the *qibla* in each location. For example, Alfonso Jiménez has measured the orientations of all mosques in the Iberian Peninsula and Mònica Rius has made a major contribution by investigating astronomical and legal texts on the *qibla* in al-Andalus and the Maghrib.¹²

Early Muslims seeking the “*qibla*” with advanced technical skills

Gibson now proceeds (pp. 135-171) to claim that his early Gibsonian Muslims were equipped to derive the “*qibla*” (my word) to Petra accurately. In a desperate hopelessly-muddled and utterly-puerile chapter he describes a

palette of procedures that he claims his early Muslims could have used to find the “*pibla*”.

He promises to correct my suggestion that before they encountered mathematics of one sort or another, the Muslims used the techniques of folk astronomy, that is, astronomical alignments. He writes (p. 131):

“So instead of King’s proposed two categories (poor early techniques followed by more accurate mathematical techniques) I would like to suggest a slightly different scenario. From my reading of Islamic writings, I have come to the conclusion that the art of determining the *qibla* direction came out of early navigation, not mathematics. In the ancient past the Arabs sought for methods to help them guide their camel caravans across the trackless deserts of Arabia. They needed to know where cities lay over the horizon in order to guarantee that their caravans arrived at the correct city, and not one of an enemy.”

The categorisation is Gibson’s, not mine, because the Muslims used folk astronomy, inherited from the pre-Islamic Arabs, *alongside* mathematical astronomy for over a thousand years. Gibson imagines that *qibla* determinations “came out of early navigation”, neglecting to say precisely what documents he means, where he found these documents, or precisely what he found in them. Nonetheless he makes his imaginings into a personal truth, but it surely doesn’t rise to the level of scholarship. All rather Trumpish. I know of no such documents.

Three examples of Gibson’s “evidence” must suffice. Gibson claims they used the astrolabe. But he does not know what an astrolabe is, and he mistakenly thinks one can use an astrolabe to find the “*pibla*”. He ignores the well-documented encounter of the Muslims with the astrolabe in N. Syria in the 8th century. We actually have two astrolabes from the 8th century, and all astrolabes from before 1100 have been published. He also introduces the Arab windrose, but this was used only in Arab navigation, certainly not for finding the *qibla* to Mecca or the “*pibla*” to Petra. Of these two devices he writes (p. 159):

“Early astrolabes were based on the Arab compass that used the rising and setting of different stars [!]. The astrolabe below has both a front side and rear side, so that calculations can be made [??]. The astrolabe was also known as a windrose [!].”

But even with such instruments, the Arabs needed mathematical knowledge, and Gibson claims they had all they needed (p. 170):

“ ... The Arabs of Muḥammad’s time had access to the basic concepts of spherical trigonometry [!] which deals with the relationships between trigonometric functions of the sides and angles of the spherical polygons [!] (especially spherical triangles) defined by a number of intersecting great circles on the sphere. Spherical trigonometry is of great importance for calculations in astronomy, geodesy and navigation. The outside circle of numbers on the Arab compass demonstrate that the Arabs had access to spherical trigonometry and used it regularly [!].”

This is utter folly, given that spherical trigonometry was developed by Muslim mathematicians only in the 10th century. Gibson has no idea what spherical trigonometry is but does not mention *plane* trigonometry at all, which was indeed important for the first mathematical determinations of the *qibla* in the 9th century.

Gibson’s is truly a revolutionary reappraisal of Arab capabilities in the 7th and 8th centuries. His “spherical polygons” boggle the mind. He clearly has no idea what trigonometry is. His theories turn the history of science upside down. They force a rewriting of the early history of Islam. And they are, of course, complete nonsense.

Gibson mixes up astrolabes, spherical astronomy, simple nautical devices, Babylonian geometry and $\sqrt{2}$, the so-called “Theorem of Pythagoras”, poetic meters, pigeons, and more, and although he shows considerable ingenuity at producing all of these out of the bag, his entire chapter (pp. 135-171) is a pathetic attempt to justify his Petra theory.

He even makes a bold but fanciful claim that mosques in Syria, Iraq and Iran could have laid out accurately toward Petra using homing pigeons (p. 169):

“So it is possible that *qiblas* were set without any science or math, just by transporting a number of homing pigeons from Petra, and releasing them at the construction site a few at a time until an accurate direction could be established.”

Part of his conclusion (pp. 170-171) reads:

“ ... during the time of the founding of Islam, the Arabs ... taking celestial bearings and using mathematical solutions ... had an un-

derstanding of basic formulas for spherical trigonometry. With this knowledge, it comes as no surprise that the *qiblas* of early mosques [toward Petra] all over the ancient world are accurate to within several degrees.”

Mosque orientations in the post-Gibson era

For Gibson, Muslim scientific skills in later centuries regressed, whereas, in fact, for several centuries further they advanced (p. 170):

“The Arabs of the ninth to fifteenth centuries would become the world leaders in algebra which simplified trigonometry [!!]. However, as time passed, the earlier methods of establishing the *qibla* direction were lost [!], leaving us to wonder, exactly how the early Muslims could have calculated their *qiblas* [to Petra] so accurately.

There were no “earlier methods” other than folk astronomical procedures and adapting pre-Islamic edifices. Nothing was “lost”. Gibson thinks that the Muslims in later centuries who wanted to align mosques toward Mecca were less successful than the Gibsonian Arabs with their mosques facing Petra (p. 131):

“This data seems to indicate that not only were the early Arabs accurate in determining their *qibla* direction [toward Petra], there seems to be a breakdown in technique as the accuracy of [the orientation toward Mecca of] later mosques lags behind those of earlier mosques [oriented toward Petra].”

He gives no evidence of ever having worked on any mosque after about 850. He ignores all the research over the past 100 years that shows how the mathematics of *qibla* determinations developed over the centuries.

In 14th-century Damascus, the mathematical problem of finding the *qibla* for the whole Muslim world was solved for all time with the splendid table of al-Khalîlî, giving accurate values to degrees and minutes for each degree of latitude and each degree of longitude difference from the meridian of Mecca. I have described al-Khalîlî’s table as “the most sophisticated trigonometric table known to me from the entire medieval period”. In 15th-century Samarqand a table was compiled with entries for each of 275 localities from al-Andalus to China, giving longitudes and latitudes, as well as accurately-computed *qibla*-directions and distances to Mecca. From 17th-century Isfahan we have three world maps centred on Mecca, so devised that one can read off the *qibla* accurately for any locality in the

Muslim world (the underlying cartographical theory was developed several centuries earlier). These are all highly impressive by medieval standards. What people did with this information is another matter.¹³

It would still be useful to have a survey of the orientations of all significant medieval Islamic religious architecture chronologically by region. Probably the most rewarding regions will be Iran and C. Asia. And with the imagery now available, there is less need now for volunteers to work *in situ*. Someone with Gibson's talent at finding the images should be involved. But the orientations should be interpreted in the light of present historical knowledge of the *qibla* in different regions over the centuries. (Modern *qibla* values might be included, but are relevant only for modern mosques.) Gibson's book can serve as an example of how *not* to conduct such a survey.

Bibliographical mishmash

Gibson's bibliographical citations throughout the book leave a lot to be desired: many are inconsistent and incomplete. However, the bibliography tells its own story. Jamil Ali's 1967 translation of al-Bîrûnî's *Tahdîd nihâyât al-amâkin*, "On the determination of the limits of localities", the most significant Muslim work on geodesy and mathematical geography and the determination of the *qibla*, quoted from me and surely not consulted – E.S. Kennedy's 1973 commentary is inevitably overlooked. al-Bîrûnî, the greatest scientist the medieval Muslim world produced, would have been very surprised about early mosques facing Petra.

The article by Gerald Hawkins and myself on the astronomical alignments of the Kaaba is missing, deliberately suppressed (because Gibson's "Kaaba" was at Petra, and a pre-Islamic astronomically-aligned Kaaba at Mecca is an embarrassment to his theories).

On the *qibla* Gibson lists several articles and one book by myself but nothing by any of my colleagues, and **my articles dealing with orientations of Islamic religious architecture are not cited!** On Islamic architecture there is only K.A.C. Creswell's early overview and a few serious studies of individual edifices.

On the history of Islamic astronomy there is not a single item. On the history of Islamic mathematics there is not a single item. On Islamic navigation at least the excellent study by G. Tibbetts is cited. On Islamic astronomical instruments there is one amateur history of the astrolabe from the Internet.

Not a single study of Islamic folk astronomy is included. A. Heinen's excellent study of Islamic folk cosmology is quoted in a footnote but does not appear in the bibliography because the quotation is taken from my work. The enormous volumes edited by C. Ruggles on ethnoastronomy and archaeoastronomy are overlooked altogether. Even the writings of J.-A. Belmonte on the archaeoastronomy of Petra are overlooked.

In fact, most works relevant to the topic at hand have not been consulted, and most of the works cited in the bibliography are irrelevant and even many in the footnotes.

At first I was surprised that most of the work I have done on the *qibla* and the orientation of Islamic religious architecture is deliberately ignored. In this second book Gibson does mention my articles "Kibla" and "Makka as centre of the world" in the *Encyclopaedia of Islam* and my 1999 book on the spectacular newly-discovered Mecca-centred world-maps, which embody a tradition that goes back to the 10th century. That book does include an overview of what we know about the *qibla*. These studies are quoted and misquoted and liberally copied by the page, along with illustrations and footnotes. In an undergraduate paper this would be considered plagiarism. Nevertheless Gibson has not looked seriously at any of them. And on second thoughts, none of my other publications on the *qibla* would have been relevant to Gibson, hell-bent as he was on advancing and justifying his Petra theory.

Exit Dan Gibson

I refrain from comment on Gibson's reconstruction of early Islamic history – how and why Islam started in Petra, not Mecca. Gibson's theories have already caused a lot of mischief, as one can see from googling "qibla Petra". Bob Serjeant's review of *Hagarism* inspired me to write about Gibson's book:

"Early Islamic Qiblas is not only bitterly anti-Islamic and anti-Arabian in purpose. Its superficial fancies are so ridiculous that at first anybody with a vague idea about the qibla might think that this is just a 'leg-pull', pure 'spoof'. The author is sadly out of touch with contemporary research on Islam, on the history of mathematics, astronomy, instrumentation, archeoastronomy, ethnoastronomy, and more. This is a tiresome travesty of history and nothing more than pretentious humbug."

To the unwary, Gibson's book at first sight looks like a monument to what can be achieved by an eager and innovative amateur in Islamic history, even without serious knowledge of classical Arabic and without critical training in Islamic Studies. It is in fact a giant complex of scaffolding around an imaginary Kaaba in Petra, the scaffolding more than ready to collapse. Its publication, however, is a monumental disaster for historical studies (and more so for the entire Muslim community) mainly because there are so few people around who have the necessary background to judge it for what it is worth, namely, some nice pictures. There are other parts of the book that others more qualified than I must address, and I hope that they will not fall for the author's conclusions about early mosque orientations.

Gibson, having in his opinion established that Muslims have been praying in the wrong direction for well over a millennium, expresses his hope that Muslims will now see the light (p. 272). But, in reality, they have less to worry about than he thinks. All of Gibson's investigations of early medieval orientations using modern data and modern mathematical methods are of no historical value. His efforts to show that the Muslims from China to al-Andalus must have had all the necessary technical equipment to find the direction of Petra accurately to within a degree or two are ridiculous. Fortunately, his mission has self-destructed.

Bibliographical notes

In these notes no complete references are given. These can be easily retrieved from the accompanying bibliographies or from the internet. Most of the studies are based on medieval Arabic sources. Sometimes the articles themselves will be downloadable.

The first modern scholar to turn his attention to *qibla* determinations was Karl Schoy (1877-1925), on whom see the obituary by J. Ruska in *Isis* 9 (1927): 83-95:

- KS, "Die Mekka- oder Qiblakarte (Gegenazimutale mittabstandstreue Projektion mit Mekka als Kartenmitte)" (1917);
- – , "Abhandlung des ... Ibn al-Haitam (Alhazen) über die Bestimmung der Richtung der Qibla" (1921);

- – , “Abhandlung von al-Fadl b. Hatim al-Nairîzî: Über die Richtung der Qibla” (1922);
- – , article “Kibla” in *Encyclopedia of Islam*, 1st edn. (1913-38).

The next was Edward S. Kennedy (1912-2009), on whom see the obituary and bibliography in *Suhayl* 9 (2009-2010): 185-214:

- ESK, *A Commentary upon al-Bîrûnî's Kitâb Tahdîd [nihayât] al-amâkin*, 1973, based on the translation by Jamil Ali, *The Determination of the coordinates of cities: al-Bîrûnî's [nihâyat] al-amâkin*, 1966;
- – , “A letter of al-Bîrûnî: Habash al-Hâsib's analemma for the *qibla*” (with Yusuf 'Id, 1974);
- – , *Geographical coordinates of localities from Islamic sources* (with Mary Helen Kennedy, 1987).

On the subject of the *qibla*, I have published the following books and articles:

- “al-Khalîfî's (universal) *qibla* table (for the whole world)” (1975);
- “Some medieval values of the *qibla* at Cordova” (1978);
- “Astronomical alignments in medieval Islamic religious architecture” (1982);
- “The astronomical orientation of the Kaaba” (with Gerald S. Hawkins, 1982); and “Faces of the Kaaba” (1982);
- “Al-Bazdawî on the *qibla* in early Islamic Transoxania” (1983);
- “Architecture and astronomy: The ventilators of medieval Cairo and their secrets (regarding orientations in Cairo)” (1984);
- “The sacred direction in Islam: A study of the interaction of religion and science in the Middle Ages” (1985)
- “Kibla (mathematical aspects)” in *Encyclopedia of Islam* (1986);
- “The earliest Islamic mathematical methods and tables for finding the direction of Mecca” (1986);
- “L' Islam et la science : le problème de la *qibla*” (1987, based on DAK);
- “Makka as centre of the world” in *Encyclopedia of Islam* (1991);
- “Qibla charts, *qibla* maps, and related instruments” (with Richard P. Lorch, 1992);
- “Folk astronomy in the service of religion: The case of Islam” (1994);
- “The orientation of medieval Islamic religious architecture and cities” (1995);
- “Samt (direction)” in *Encyclopedia of Islam* (1995);
- “Islamic astronomy” (1996);
- “Two Iranian world maps for finding the direction and distance to Mecca” (1997);
- *World-Maps for finding the direction and distance to Mecca – Innovation and tradition in Islamic science* (1999);
- *Finding Qibla in Islam*, partial Persian translation by Hossein Nahid of *World-Maps* book (2016);

- *In Synchrony with the Heavens: Studies in astronomical timekeeping and instrumentation in medieval Islamic civilisation* (2004-05);
- “The sacred geography of Islam” (2005);
- “The *qibla* in medieval Córdoba and the orientation of the Great Mosque” (2017).

For many other writings on mathematical methods for finding the *qibla* by colleagues – especially Richard P. Lorch, Julio Samsó, Jan P. Hogendijk, J. Lennart Berggren and Ahmad Dallal – see:

www.staff.science.uu.nl/~gent0113/islam/qibla.htm.

For other writings on finding the *qibla* by folk astronomical methods see:

- Mònica Rius, *La Alqibla en al-Andalus y al-Magrib al-Aqsà* (2000);
- Petra G. Schmidl, *Volkstümliche Astronomie im islamischen Mittelalter. Zur Bestimmung der Gebetszeiten und der Qibla bei al-Asbahî, Ibn Rahîq und al-Fârisî* (2007).

For writings on Islamic sacred geography see also Petra Schmidl, Jean-Charles Ducène and Mónica Herrera Casais.

For writings on aspects of Islamic folk astronomy see also Paul Kunitzsch, Julio Samsó and the Barcelona school, Petra G. Schmidl and Daniel M. Varisco.

On mosque orientations in specific regions see also M. Philibert (the Maghrib), Michael Bonine (Morocco and Tunisia), Alfonso Jiménez (Spain), Mustafa Yilmaz (Turkey), and others. (Nothing of consequence has been published on this subject by historians of Islamic architecture, which is perhaps just as well.)

For medieval Arabic texts on mosque orientations see King (Córdoba, Cairo, Samarqand) and Mònica Rius (al-Andalus and the Maghrib); for legal controversies over mosque orientations see Ahmad Dallal (the Maghrib).

On many relevant topics see Clive L.N. Ruggles, ed., *Handbook of Archaeoastronomy and Ethnoastronomy*, Springer, 2015.

For an investigation by Muslim scholars primarily interested in the Jerusalem / Mecca *qibla* see M. S. M. Saifullah, M. Ghoniem, ‘Abd al-Rahman Robert Squires & M. Ahmed, “The Qibla of early mosques: Jerusalem or Makkah?” (2001), available at www.islamic-awareness.org/History/Islam/Dome_Of_The_Rock/qibla.html (consulted 2016).

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Prof. King has expanded our knowledge of this subject by using previously-unknown manuscript sources to document the ways in which Muslims applied scientific methods to regulating the lunar calendar, organising the times of prayer, and determining the sacred direction. He has also published extensively on Islamic folk astronomy and mathematical astronomy and instrumentation, as well as on aspects of medieval and renaissance European science His publications are listed at www.davidaking.org.

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- ¹ This mistake has been circulated recently in publications by various established Western historians of Islamic architecture.
- ² Hawkins & King, “The astronomical orientation of the Kaaba”, *Journal for the history of astronomy* 13 (1982): 102-109, repr. in King, *Astronomy in the service of Islam*, Variorum, 1993, XII.
- ³ It was Jan Hogendijk who was able to verify my hypothesis that the mathematical theory underlying the cartographic grids on the three 17th-century Mecca-centred world-maps from Isfahan, too sophisticated for that milieu and certainly not of European inspiration, went back several centuries. He found the underlying theory in 10th- and 11th-century works on conic sections from Baghdad and Isfahan. See his “Het mysterie van de Mekkawijzers van Isfahan”, *Nieuwe Wiskrant* 22:2 (2002: 4-11, available at www.fisme.science.uu.nl/wiskrant/artikelen/222/222december_hogendijk.pdf).
- ⁴ King, “Astronomical alignments in medieval Islamic religious architecture”, *Annals of the New York Academy of Sciences* 385 (1982): 303-312, repr. in *idem*, *Astronomy in the service of Islam*, Aldershot & Burlington VT: Variorum, 1993, XIII, and “The orientation of medieval Islamic religious architecture and cities”, *Journal for the history of astronomy* 26 (1995): 253-274, with a new version in *idem*, *In In Synchrony with the Heavens*, 2 vols., Leiden: Brill, 2004, vol. 1, VIIa: 741-771.
- ⁵ In *Journal of the Royal Asiatic Society*, 1978, p. 78.
- ⁶ <https://en.wikipedia.org/wiki/Manhattanhenge>.
- ⁷ King, “Architecture and astronomy: The ventilators of medieval Cairo and their secrets”, *Journal of the American Oriental Society* 104 (1984): 97-133, updated in *idem*, *In Synchrony with the Heavens*, Leiden: Brill, vol. 1, VIIIb: 773-823.
- ⁸ King, “Al-Bazdawī on the qibla in early Islamic Transoxania”, *Journal for the History of Arabic Science* 7 (1983/1986), pp. 3-38, repr. in *idem*, *Islamic Astronomy and Geography*, Aldershot & Burlington VT: Ashgate - Variorum, 2012, IX.
- ⁹ See already King, “Medieval values of the qibla in Cordoba”, an appendix to *idem*, “Three sundials from medieval Andalusia”, *Journal for the History of Arabic Science* 2 (1978), pp. 358-392, repr. in *idem*, *Islamic astronomical instruments*, London: Variorum, 1987/ 1995, XV.
- ¹⁰ Michael E. Bonine, “Romans, astronomy and the qibla: urban form and orientation of Islamic cities of Tunisia”, in J. C. Holbrook, R. T. Medupe and J. O. Urama, eds., *African Cultural Astronomy – Current Archaeoastronomy and Ethnoastronomy Research in Africa*, Berlin: Springer, 2008, pp. 145-178, esp. p. 176.
- ¹¹ Gideon Avni, “Early Mosques in the Negev Highlands: New Archaeological Evidence on Islamic Penetration of Southern Palestine”, *Bulletin of the American Schools of Oriental Research* 294 (1994): 83-100, esp. p. 95.
- ¹² Alfonso Jiménez, “La qibla extraviada”, *Cuadernos de Madīnat al-Zahrâ'* 3 (1991): 189-209, and Mònica Rius, *La Alquibla en al-Andalus y al-Magrib al-Aqsà*, Barcelona: Institut “Millás Vallicrosa” de Història de la Ciència Àrab, 2000.
- ¹³ Some 30 years ago I met by chance the representative of British Food in Frankfurt. Since he was an affable fellow, I asked him the obvious question. He assured me there was nothing wrong with British food. What the Brits did with it was, he said, another matter, and not his concern.