

READING, SIGHTING, AND CALCULATING

From Moon Sighting to Astronomical Calculation

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هُوَ الَّذِي جَعَلَ الشَّمْسَ ضِيَاءً وَالْقَمَرَ نُورًا وَقَدَرَهُ مَنَازِلَ لِتَعْلَمُوا عَدَدَ السِّنِّينَ وَالْحِسَابَ مَا خَلَقَ اللَّهُ ذَلِكَ إِلَّا بِالْحَقِّ يُفَصِّلُ
الآيَاتِ لِقَوْمٍ يَعْلَمُونَ (يونس ٥)

It is He who made the sun to be a shining glory and the moon to be a light (of beauty), and measured out stages for it; that you may know the number of years and the count (of time). Allah has not created this but in truth. (Thus) does He explain His signs in detail, for those who understand. (10:5)

The debate over the determination of the birth of the new crescent (*Hilal*) has taken a new urgency in North America after the Fiqh Council of North America (FCNA) announced, in August 2006, its new ruling (*fatwa*) on the use of calculation for establishing the beginning of the Islamic lunar month. The ruling established for the first time in recent history astronomical calculations as the sole criteria for deciding the birth of the new crescent.¹ Thus for the first time we come face to face with the prospect of confirming the beginning of Ramadan and Eids without the recurring hassle and flare.

The debate over confirming the *Hilal* is an old one dating back to the second century of the Islamic era. The debate intensified in the second half of the last century as many Muslim scholars became concerned about the inconsistency of sighting reports and the fragmentation of Muslim communities over the determination of the first day of Ramadan and the two *Eids*. Although strong arguments were made several decades ago by illustrious scholars, such as Muhammad Mubarak and Ahmad Shakir, in support of replacing the practice of sighting the moon with astronomical calculation, Muslim communities, by and large, continued to follow the moon sighting tradition.

The debate over how the new Islamic lunar month is to be decided transcends beyond just that of a debate in favor of one method over the other, and the transition from moon sighting to astronomical calculation is more than a transition from one *fiqhi* (juristic) position to another. The debate is, indeed, about how to read Islamic sources, and how to relate Islamic precepts to contemporary society; and the transition is about the ability of contemporary Muslim scholars to truly reclaim the authority of independent judgment (*ijtihad*), and hence build on the knowledge and achievements of early scholarship to reach better grounded consensus (*ijma'*).

FCNA's ruling in favor of using astronomical calculation for determining the beginning of the Muslim lunar month provoked a strong response, and the American Muslim community continues to be divided over this issue. Scholars on the two sides of the divide present arguments rooted in Islamic traditions, and often support their views by citing the same Qur'anic and Prophetic sources, or by referring to statements by early Muslim scholars.² It does

¹ See the full text of the fatwa at (http://www.fiqhcouncil.org/articles/Lunar_Calendar.html, accessed on November 5, 2006). FCNA has also produced a video in which FCNA chairman, Dr. Muzammil Siddiqi, discussed the basis of the fatwa, see <http://www.fiqhcouncil.org/articles/video.html>

² In addition to the FCNA's statement on the Islamic Lunar Calendar, two elaborate papers are presented by two North American scholars on this issue. The first one was authored by Zulfikar Ali Shah (<http://www.isna.net/fileadmin/temp/FIOH/Calculations-Final%202.pdf>) and the other by Hamza Yusuf, *Cesarean Moon Births* (<http://www.zaytuna.org/articleDetails.asp?articleID=100>, accessed on November 8, 2006).

not take much for an observer to realize that the division and disagreements are not about the sources themselves, but about the interpretations and rationalizations of those sources. The division is between scholars who place emphasis on the apparent meaning of the text (*Zahir*) and those who emphasize its intended meaning and purpose (*maqsid*).

The tendency to split over interpretations has always been part of the Muslim experience. It can be traced to the split between the companions over the interpretation of the Prophet's command to pray the *asr* prayer at Banu Qurayza:

حدثنا عبد الله بن محمد بن أسماء حدثنا جويرية بن أسماء عن نافع عن ابن عمر رضي الله عنهما قال قال النبي صلى الله عليه وسلم يوم الأحزاب لا يصلين أحد العصر إلا في بني قريظة فأدرك بعضهم العصر في الطريق فقال بعضهم لا نصلي حتى نأتيها وقال بعضهم بل نصلي لم يرد منا ذلك فذكر ذلك للنبي صلى الله عليه وسلم فلم يعنف واحدا منهم (حديث متقف عليه)

Bukhari reported on the authority of [Abdullah] Ibn Omar, may Allah be please with both, who said that the Prophet, Allah's mercy and peace be with him, said on the day of the [battle of] Alliances: "No one should pray *asr* except in the [territories] of Banu Qurayzah." Some were still on the road at the *asr* time and said: "we will not pray *asr* until we reach it [Banu Qurayzah]. Others said: "we will indeed pray; this is not what was intended." The Prophet, Allah's mercy and peace be with him, was informed about [the disagreement], and he did not rebuke any of them.³

Evidently, some of the Prophet's companions understood his statement literally and continued their journey until they reached the territory of Banu Qurayza, while others stopped on the way to pray *asr* on time. It was also reported that the Prophet approved the actions of both, signaling that differences in opinion are abound to arise, and that the *ijtihad* of one group does not invalidate that of another.

For centuries, moon sighting was a better and more reliable method for deciding the beginning of the Islamic lunar month. Today, with the advancement of the science of astronomy, and the improvement of computing tools, astronomical calculations provide a much superior method, and are more in keeping with the Islamic requirements. Islam requires that we base certain religious duties, including fasting Ramadan and performing Hajj, on the lunar calendar, but does not regard the act of deciding the beginning of the Islamic month a religious act *per se*. The movement of the moon belongs to the natural order and its determination can better be handled by astronomy, which can today provide very precise calculation, and is by far more reliable and certain than moon sighting.

Distinguishing Religious Obligations from the Natural Order

Is moon sighting an *ibadah*? This question is a key for understanding the debate over replacing the practice of moon sighting with that of astronomical calculation.

The arguments for relying on sighting the new crescent as a means to determining the Islamic calendar confound religious duties with the empirical knowledge and practical skills required to identify the days on which these religious duties commence. Observing Ramadan and performing Hajj is *ibadah*, but observing the birth of the new crescent to determine the beginning of the lunar month is not. The latter relate to the human capacity for determining

Shaykh. Zulfikar's paper argued for adopting astronomical calculation, while Shaykh Hamza's paper adopted the traditional position, which favors moon sighting.

³ The hadith was reported on the authority of Abdullah bin Omar in Sahih Bukhari, the book of maghazi (morales), no. 3804.

the beginning of the lunar month, and it is a function of the observer's scientific and physical capacity to identify the moment of the birth of the new crescent with increased precision. This capacity varies, needless to say, with the knowledge of the position of the new crescent in the sky, the sharpness of the eye-sight of the observer, the access to refined tools, the climatic conditions, etc.

The Qur'an commands Muslims to fast the entire month of Ramadan, and to perform the Hajj. And the Prophet, Allah's mercy and peace be with him, taught Muslims to perform Hajj during the month of *Dhu Alhijja*, and to celebrate the first of *Shawwal* and the tenth of *Dhu Alhijja*.

Although some Muslims tried to root the practice of moon sighting, particularly for the month of Ramadan, in the Qur'anic injunctions, on a closer examination one finds that the Qur'an only requires that Muslims observe fasting during the month. Two verses are relevant in this regard:

"فمن شهد منكم الشهر فليصمه"

"So whoever witnesses the month, let him fast" (2:185)

Some scholars, mostly contemporary, use this verse as evidence for the requirement of moon sighting. The term *shahida*, translated here as "witness," means, they insist, to "see it with one's eyes."⁴ However, on examining the Qur'anic usage of the term, it becomes evident that the Qur'an does not confine "*shahida*" to eye witnessing, but also uses it in reference to expert witnessing. In *Surat Yusuf*, for example, the Qur'an uses the term "*shahida*" to refer to an act of witnessing in which the witness provides a testimony based on rational argument, rather than actual eye-witnessing:

قال هي راودتني عن نفسي، وشهد شاهد من أهلها إن كان قميصه قد من قبل فصدقت وهو من الكاذبين، وإن كان قميصه قد من دبر فكذبت وهو من الصادقين. (يوسف ٢٦-٢٧)

He said: "It was she that sought to seduce me, from my (true) self." And one of her household bore witness, (thus) "If it be that his shirt is torn from the front, then is her tale true, and he is a liar! But if it be that his shirt is torn from the back, then is she the liar, and he is telling the truth! (12:26-7)

The witness to whom these verses refer, who testified in the case of Prophet Yusuf and the king's wife, was not present in person when the disputed incident took place. Rather, his testimony was a rational argument based on his knowledge of the habitual behavior and the physical limitations of human beings. The witness testified that if Yusuf's shirt was torn from the back, this would then be good evidence that the king's wife was lying as she would have made an attempt to grab him from the back as he ran away from her. But if his shirt was torn from the front, this would be evidence that she was trying to defend herself against his unwanted advances, and he would be the person who lied.

The other Qur'anic verse relevant to the determination of the new lunar month refers to the crescent (*hila*), and has been cited by scholars who favor sighting the Moon, as well as scholars who support astronomical calculations:

يَسْأَلُونَكَ عَنِ الْأَهِلَّةِ قُلْ هِيَ مَوَاقِيتُ لِلنَّاسِ وَالْحَجِّ (البقرة ١٨٩)

They ask you concerning the crescents. Say: They are but signs to mark fixed periods of time in (the affairs of) men, and for Hajj. (2:189)

Those who require moon sighting see in the Qur'anic reference to the crescent an evidence to support their claims, while those who permit calculation take the correlation between the crescent and the infinite form of the verb "time," i.e. *mawaqit*, in the above verse as an

⁴ See for instance, Hamza Yusu, *Cesarean Moon Births*, Part I, p. 15

additional indication that the crescent birth may be calculated. The word “mawaqit” connotes “measure” (*taqdir*), and refers to a specific time or place for performing a required act.⁵

What is clear, though, is that the above *ayah* (verse) is inconclusive, one way or the other, in settling the dispute between those who favor moon sighting and those who privilege calculation.

In several *ayahs*, the Qur’an relates the movement of the sun and the moon with the human ability to learn the passage of time and measure it:

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الآيَاتِ لِقَوْمٍ يَعْلَمُونَ (يونس ٥)

It is He who made the sun to be a shining glory and the moon to be a light (of beauty), and measured out stages for it; that you may know the number of years and the count (of time). Allah has not created this but in truth. (Thus) does He explain His signs in detail, for those who understand. (10:5)

فَالِقُ الْإِصْبَاحِ وَجَعَلَ اللَّيْلَ سَكَنًا وَالشَّمْسَ وَالْقَمَرَ حُسْبَانًا ذَلِكَ تَقْدِيرُ الْعَزِيزِ الْعَلِيمِ (الأنعام ٩٦)

He it is that cleaves the daybreak (from the dark): He makes the night for rest and tranquility, and the sun and moon for the reckoning [of time] (*husban*), such is His judgment and ordering, the Exalted in Power, the Omniscient. (6:96)

وَجَعَلْنَا اللَّيْلَ وَالنَّهَارَ آيَاتَيْنِ فَمَحَوْنَا آيَةَ اللَّيْلِ وَجَعَلْنَا آيَةَ النَّهَارِ مُبْصِرَةً لِتَبْتَغُوا فَضْلًا مِنْ رَبِّكُمْ وَلِتَعْلَمُوا عَدَدَ السِّنِينَ وَالْحِسَابَ
وَكُلَّ شَيْءٍ فَصَّلْنَاهُ تَفْصِيلًا (الإسراء ١٢)

We have made the night and the day as two signs; the sign of the night have We obscured, while the sign of the day We have made to enlighten you; that you may seek bounty from your Lord, and that you may know the number and count of the years: all things have We explained in detail. (17: 12)

Evidently, the Qur’an does not consider sighting of the new crescent an act of worship that has to be performed for its own sake, but states clearly that the moon and the sun are means through which people can learn of the passage of time, and can count and measure the days, months, and years. While the words “*hisban*” and “*hisab*” have affinity with such words: count, measure, and calculation, it is fair to say that the Qur’an does not, however, provide any conclusive evidence one way or the other.

It is abundantly clear that while the Qur’an places fasting of Ramadan and performing of Hajj as religious obligations, it considers the sun and moon movements as part of the natural order. It follows, therefore, that fasting and Hajj obligations must be studied in accordance with *shari’ah* sciences, while the elaboration of the moon movement must be entrusted to astronomers and the science of astronomy.

If the distinction between these two areas of knowledge is confirmed, then the only reason for moon sighting to be favored over astronomical calculation is when the former is more certain in determining the birth of the new crescent than the latter. On the other hand, the *faqih* (Muslim jurist) must follow the calculation of the astronomer at any time the latter provides a higher level of certainty. As I will show below, the lack of confidence in the precision of the calculation of the astronomer was a main hindrance for relying on astronomical calculations by the bulk of early Muslim jurists.

However, before we examine the key positions of early Muslim scholars, let us see whether the Prophetic tradition require Muslims to rely exclusively on moon sighting.

⁵ See Ibn Manzoor, *Lisan al-Arab* (Cairo, Egypt: Dar al-Ma’arif), pp. 4887-8

The Prophetic Tradition on Moon Sighting

Scholars who insist that sighting the waxing crescent is the only acceptable way for determining Ramadan rely on the Prophet's injunction that Muslims should see the crescent to begin their fasting and see the next crescent to conclude their fasting. The various *hadiths* cited in this regard follow variations of the following two authentic *hadiths*:

روى الإمام البخاري في صحيحه من طريق آخر عبد الله بن عمر رضي الله عنهما أن رسول الله صلى الله عليه وسلم قال الشهر تسع وعشرون ليلة فلا تصوموا حتى تروه فإن غم عليكم فأكملوا العدة ثلاثين.

Imam Bukhari reported in his *Sahih* through a different chain of narrators on the authority of Abdullah bin Omar, may Allah be pleased with both, that the Prophet, Allah's mercy and peace be with him, said: The month is twenty nine days, so do not fast until you see it [the crescent], but if it was obscured from you then complete your count to thirty.⁶

روى البخاري ومسلم في عن عبد الله بن عمر رضي الله عنهما أن رسول الله صلى الله عليه وسلم ذكر رمضان فقال لا تصوموا حتى تروا الهلال ولا تفطروا حتى تروه فإن غم عليكم فاقدروا له.

Bukhari and Muslim reported in their *Sahih*s on the authority of Abdullah bin Omar, may Allah be pleased with both, that the Prophet, Allah's mercy and peace be with him, said: Do not fast until you see the crescent and do not end your fast until you see it, but if it was obscured from you then estimate for it.⁷

In both *hadiths*, the Prophet, Allah's mercy and peace be with him, directs Muslims to rely on actual sighting of the new crescent to commence and conclude fasting. Scholars who favor moon sighting take these *hadiths* as the ground for rejecting calculation. We need to once again raise the question we addressed in the previous section: Is moon sighting an *ibadah* that has to be followed without examining the efficient reason ('illah) of the rule (*hukm*), or is it a reasoned rule (*hukm mu'allal*)?

It is important to recall the conclusion we reached in the previous section, that while the act of fasting is an *ibadah*, the act of determining the beginning of the lunar month is an act of knowledge of the natural order. The Prophet himself asked Muslims to rely on their own practical knowledge in matters that relate to the natural order.

حدثنا عبد الصمد حدثنا حماد عن ثابت عن أنس قال: سمع رسول الله صلى الله عليه وسلم أصواتا فقال ما هذا قالوا يلحقون النخل فقال لو تركوه فلم يلحقوه لصلح فتركوه فلم يلحقوه فخرج شبيصا فقال النبي صلى الله عليه وسلم ما لكم قالوا تركوه لما قلت فقال رسول الله صلى الله عليه وسلم إذا كان شيء من أمر دينكم فأنتم أعلم به فإذا كان من أمر دينكم فإلي

Ahmed reported in his *Musnad* on the authority of Anas bin Malik that the Prophet, Allah's mercy and peace be with him, heard noise and asked about the source, and was told that it [resulted from the process of] the pollination of palm trees. He said: "if they left [the palms] alone without pollination they would be fine, and so they did. The next year the palms produced infertile dates. When the Prophet, Allah's mercy and peace be with him, inquired about the reason, they told him that they did not pollinate as he suggested. He then said: If the question relates to your worldly matters (*dunyakum*), you would know better about it, but if it relates to your religion (*dinakum*), then to me it belongs.⁸

⁶ Shahih Bukhari, Kitab al-Sawm, no. 1774.

⁷ Ibid., no. 1773.

⁸ Musnad Ahmad, *hadith* no. 12086; and Sunan Ibn Maja, *hadith* no. 2462

In fact, the Prophet himself shared with his companions the reason for his specific directive to rely on moon sighting. In a *hadith* that was reported by Bukhari and Muslim on the authority of Abdullah bin Omar, the Prophet, Allah's mercy and peace be with him, said:

إِنَّا أُمَّةٌ أُمِّيَّةٌ لَا نَكْتُبُ وَلَا نَحْسِبُ الشَّهْرَ هَكَذَا وَهَكَذَا يَعْنِي مَرَّةً تِسْعَةً وَعِشْرِينَ وَمَرَّةً ثَلَاثِينَ

We are illiterate community that does not write or calculate; month is this much and this much, indicating with his fingers 29 days once and 30 days once.

In the absence of astronomers who have the know-how and the tools to determine with accuracy the beginning of the lunar month, moon sighting was the only tool available for the early Muslim community.⁹ The absence of the scientific knowledge for calculating the beginning of the month was the '*illah*' (efficient reason) for the Prophet's directive for sighting the moon, and the removal of the '*illah*' will render the directive inapplicable. It is a well established principle of *fiqh* (*qa'ida fiqhiyah*) that the rule or judgment is dependent on its '*illah*', and revolves around it, when the '*illah*' is no longer in operation, the rule is no longer applicable:

الحكم مقرون بعلته يدور معها وجودا وعدمًا

The rule is interconnected with its efficient reason, and revolves around it in both its presence and absence.¹⁰

The claim¹¹ that the Prophet, Allah's mercy and peace be with him, chose moon sighting over calculation because he chose not to use advanced astronomical knowledge already acquired by the pre-Islamic Arabs is unfounded. The assertion that pre-Islamic Arabs have had access to astronomical knowledge is refuted by both the above *hadith* and historical facts. Yes, astronomy was known by the ancient Egyptians and Greeks prior to Islam, but this knowledge was limited, and was not spread throughout the pre-Islamic world. There is no historical account of established astronomers in the Arabian Peninsula. As we will see in the next section, calculation of the new moon was often part of the pseudo-science of astrology. Many Muslim jurists believed that early astronomers were magicians and fortunetellers. Although astronomy made great strides with the contributions of Muslim astronomers such as Khawarizmi, Bayruni, and Altusi, predicting the moon movements with precision had to wait until the late nineteenth century. A major complaint by early Muslim scholars was that the astronomers of their times did not provide accurate predications, and that their predications had a margin of error of up to two days.

It is also true that pre-Islamic Arabs practiced intercalation (*nasi'*), whereby they moved the months around to avoid their obligation to observe the Sacred Months. But the practice was based on irresponsible tinkering, rather than an establish science.

إِنَّمَا النَّسِيءُ زِيَادَةٌ فِي الْكُفْرِ يُضَلُّ بِهِ الَّذِينَ كَفَرُوا يُجْلُونَهُ عَامًا وَيُحَرِّمُونَهُ عَامًا لِيُوَاطِّئُوا عِدَّةَ مَا حَرَّمَ اللَّهُ فَيُجِلُّوا مَا حَرَّمَ اللَّهُ زَيْنٌ لَهُمْ سُوءُ أَعْمَالِهِمْ وَاللَّهُ لَا يَهْدِي الْقَوْمَ الْكَافِرِينَ (التوبة ٣٧)

Verily intercalation (*nasi'*) is an increase in disbelief: the disbelievers are led to wrong thereby: for they make it lawful one year, and forbidden it another year, in order to adjust the number of months forbidden by Allah and make such forbidden ones lawful. The evil of their course seems pleasing to them. But Allah guides not those who reject Faith. (9:37)

The Qur'an has, indeed, put an end to the practice of intercalation, but this cannot be used by any stretch of imagination as ground to reject astronomical calculations.

The Shifting Ground of Consensus

⁹ Sunan Abu Dawud, no. 1975.

¹⁰ For elaboration on this point, please see Abu Ishaq Al-Shatibi, *Al-Muwafaqat*, vol. 3, pp. 43-52, and 78-81.

¹¹ See Hazma Yusuf, *ibid*.

Perhaps the most serious challenge to contemporary scholars who advocate astronomical calculation is the historically established consensus (*ijma'*) among early Muslim scholars on this issue. Early scholars, by and large, rejected calculation and agreed on moon sighting as the only acceptable way for determining the beginning of the new lunar month.

Consensus is a very important principle of Islamic jurisprudence (*usul al-fiqh*). It helps to substantiate the independent judgments (*ijtihad*), of individual jurists and hence confer on them a higher degree of certainty and authority. The claim of certainty and authority is derived from the assertion that as legal decisions move from the domain of the individual to that of the community, they give up their individual certainty and acquire general certainty and objectivity.

However, when the facts upon which an early *ijma'* is acquired have changed, the *ijma'* loses both certainty and authority. The consensus reached by early Muslim jurists on rejecting astronomical methods resulted from the lack of any clear line of demarcation between astronomy and astrology. Most early Muslim scholars equated astronomy with magic and fortunetelling. A quick review of the understanding of leading Muslim jurists reveals this serious confusion.

Al-Sarakhsi, a leading Hanafi jurist, argued against calculation on the basis that it was done by an astrologists and fortunetellers:¹²

ومنهم من قال يرجع إلى قول أهل الحساب عند الاشتباه , وهذا بعيد فإن النبي صلى الله عليه وسلم قال: "من أتى كاهنا أو عرافا وصدقته بما يقول فقد كفر بما أنزل على محمد."

Among them those who say: we should consult with the people of calculation (*hisab*) when we are uncertain [about the birth of the new crescent]. This is a far cry because the Prophet, Allah's mercy and peace be with him, said: "whoever consults with a magician or fortuneteller and believed them in what they said, he has rejected what was revealed to Muhammad."

Ibn Qudamah cites the same reason for rejecting calculation, as he evidently confuses calculation with fortunetelling:¹³

لو بنى على قول المنجمين وأهل المعرفة بالحساب , فوافق الصواب , لم يصح صومه , وإن كثرت إصابتهم , لأنه ليس بدليل شرعي يجوز البناء عليه , ولا العمل به , فكان وجوده كعدمه

If the determination [of birth of the crescent] was based on the sayings of the fortunetellers and those who know calculation, and if their sayings were correct, his fasting was still invalid, even if they were correct frequently, because this is not based on an evidence acceptable by *shari'ah* to rely on or to follow: its presence and absence are the same.

Ibn Taymiyyah, who is often cited by contemporary authors opposed to calculation, indicated clearly that his objection for the use of astronomical calculation stemmed partially from the fact that the calculation lacks the accuracy and reliability needed to decide with certainty the birth of the new lunar month. He gives us a deep insight into the state of astronomy of his time in his voluminous work, *Al-fatawa al-kubra*:¹⁴

والمعتمد على الحساب في الهلال، كما أنه ضال في الشريعة، مبتدع في الدين، فهو مخطئ في العقل وعلم الحساب. فإن العلماء بالهيئة يعرفون أن الرؤية لا تنضبط بأمر حسابي، وإنما غاية الحساب منهم إذا عدل أن يعرف كم بين الهلال والشمس من درجة وقت الغروب مثلا؛ لكن الرؤية ليست مضبوطة بدرجات محدودة، فإنها تختلف باختلاف حدة النظر

¹² Al-Sarakhsi, *Al-Mabsut*, vol 3, p. 78

¹³ Ibn Qudamah, *Al-Mugni*, vol. 3, p. 9.

¹⁴ Ibn Taymiyyah, *Al-fatawa al-kubra*, vol. 2, pp. 464-65.

وكلاله، وارتفاع المكان الذي يترأى فيه الهلال، وانخفاضه، وباختلاف صفاء الجو وكدره. وقد يراه بعض الناس لثمانى درجات، وآخر لا يراه لثنتى عشرة درجة؛ ولهذا تنازع أهل الحساب في قوس الرؤية تنازعا مضطربا، وأئمتهم: كبطليموس، لم يتكلموا في ذلك بحرف، لأن ذلك لا يقوم عليه دليل حسابي. وإنما يتكلم فيه بعض متأخريهم، مثل كوشياز الديلمي، وأمثاله. لما رأوا الشريعة علقت الأحكام بالهلال، فرأوا الحساب طريقا تنضبط فيه الرؤية، وليست طريقة مستقيمة، ولا معتدلة، بل خطأها كثير، وقد جرب، وهم يختلفون كثيرا: هل يرى؟ أم لا يرى؟ وسبب ذلك: أنهم ضبطوا بالحساب ما لا يعلم بالحساب، فأخطئوا طريق الصواب

The person who relies on calculation (*hisab*) for the birth of the crescent (*Hilal*), in addition to being in error in matters of *shari'ah* and innovator in religion, is mistaken in matters of reason and calculation. For the scholars of physics know that sighting the moon cannot follow mathematical formula. The best they can do in way of calculation is, for instance, to estimate the distance between the crescent and the sun at the time of sunset. Sighting the moon cannot, however, be determined with precise angulations, because it varies with the sight sharpness, the altitude of the observatory, and weather conditions. Some people can see it at 8 degrees, while others at 12 degrees. For this reason, the people of calculations are in dispute over the arc of observation a great deal. The leading among them, such as Ptolemy, never addressed the question because it is not subject to any mathematical rendering. The latter [astronomers], such as Koshiaz al-Daylami mentioned it as they realized that *shari'ah* has based the ruling on moon sighting, so they thought that calculation can guide sighting. But this is not a sound and measured method, as it has many flaws. The [method] has been tried, leading to many disagreements: can it be seen or cannot? The reason for that is that they have tried to predict through calculation that which cannot be known by calculation, and hence they mistaken the true way.

Other early jurists have repeatedly objected to the use calculation by pointing out to the speculative and imprecise nature of calculation, and by equating astronomy with astrology and fortunetelling.¹⁵

It is not difficult to understand why Ibn Taymiyyah, or any other scholar for that matter, would count out imprecise and inaccurate method for deciding on the birth of the new Moon. It is disturbing, though, to see contemporary jurists espouse the same position when modern astronomy is now capable of providing a high degree of precision.

Despite the lack of confidence in the precision and accuracy of astronomical calculations, there were considerable opinions among early jurists that favored and allowed calculation as a viable alternative during adversarial weather conditions, advanced by such leading scholars as Al-Shafi'i, Ibn Sarij al-Shafi'i, Ibn Qutaybah, Mutarif bin Abdullah al-Shakhir, as reported by Ibn Zar'ah and al-Nawawi. These opinions, which received significant following during the first five centuries of Islam, were subsequently discounted by the latter-day scholars, who formulated a new consensus that completely rejected calculation and insisted on moon sighting.¹⁶

Abu Zar'ah identified another reason as to why astronomical calculation was not endorsed by early jurists. Quoting al-Mazari, he writes:

قال المازري عن الجمهور ولا يجوز أن يكون المراد حساب المنجمين؛ لأن الناس لو كلفوا به ضاق عليهم؛ لأنه لا يعرفه إلا أفراد والشرع إنما يعرف الناس بما يعرفه جماهيرهم.

Al-Mazari, referring to the opinion accepted by the majority of scholars (*jumhur*), said: calculation cannot rely on what the astrologists produce, because if this was required from

¹⁵ See also Al-Jassas, *Ahkam al-Qur'an*, vol. 1, pp.279; Al-Shanqiti, *Adwa' al-bayan*, vol. 6., p. 347; and Abu Zar'ah al-Iraqi, *Tarh al-Tathrib*, vol. 4. p. 112.

¹⁶ Abu Zar'ah, *ibid*.

people it would have placed great burden on them; this is because [calculation] is known to few people, and the *shari'ah* requires what is known to the majority.¹⁷

Al-Nawawi cites similar concerns for the opposition of calculation:¹⁸

ومن قال بحساب المنازل فقولهُ مردود بقولهِ صلى الله عليه وسلم في الصحيحين: "إِنَّا أُمَّةٌ أُمِّيَّةٌ لَا تَكْتُبُ وَلَا نَحْسِبُ الشَّهْرُ هَكَذَا وَهَكَذَا." الحديث. قالوا: ولأن الناس لو كلفوا بذلك ضاق عليهم، لأنه لا يعرف الحساب إلا أفراد من الناس في البلدان الكبار.

Whoever argues for the calculation of the moon mansions, his argument is refuted by the saying of the Prophet, Allah's mercy and peace be with him, "We are illiterate community that does not write or calculate; month is this much and this much," the *hadith*. The [majority] says: This is also because if people were required to do it, they will find it cumbersome, since few individuals from big towns know calculation.

It should have become evident by now that the consensus that was reached towards the sixth century of Islam was greatly influenced by the state of the science of astronomy, as well as the lack of direct access by the scattered Muslim villages and towns to reliable astronomers. Four elements of this consensus are of particular interest to contemporary scholars:

1. Astronomy, and its corollary science of mathematics, was considerably less developed and mathematical precision was still lacking around the time the consensus against calculation was reached. This is also apparent in the fact that many Muslim jurists equated astronomy with astrology and fortunetelling.
2. Even with the willingness of eminent Muslim scholars to use calculation during obscure days, the fact that few people in big towns mastered the art of calculation has compelled Muslim jurists to reject calculation to avoid creating undue hardship for those who lived in small cities and towns, thus have had no access to astronomical calculations.
3. Communication and transportation were not advanced enough to allow consultation and exchange of information in a timely fashion across the vast expanses of Muslim lands.
4. The desire to keep central authority away from imposing a particular *fiqhi* opinion adopted by a particular school on the rest of the Muslim society was another factor in discounting astronomical calculations. Al-Dhahabi reveals this concern in *Siyar al-Alam* when he refers to the tragedy that struck the Qadi of Burqah in North Africa when he objected to Al-Mansour, the 'Ubaydi Caliph, and refused to follow his decision to follow calculation, and chose to stick to the opinion of his maliki school of *fiqh*. He was executed for refusing to acknowledge and support Al-Mansour's ruling.¹⁹

None of the above factors that influenced early Muslim scholars who opposed calculation is in operation today: (1) Astronomy, as we will see in the next section, has developed into an advanced science, employing advanced technologies, and providing accurate and precise predications of celestial body movements; (2) scientific information and knowledge is fairly widespread and, with the availability of advanced means of communication, it can be shared expeditiously across the globe; and (3) Muslim communities do follow decisions made by relevant authorities within the body politic to which they belong.

The Question of Certainty

One central and decisive factor in deciding between calculation and moon sighting concerns the question of certainty: which of the two methods provides a higher degree of certainty and confidence?

¹⁷ Ibid.

¹⁸ Al-Nawawi, *Al-majmu'*, (Cairo: Almuniriya), vol. 6, p. 270

¹⁹ Al-Dhahabi, *Siyar al-alamal-nubala'*, vol. 15, p. 114

On its face value, the choice seems to be between the certainty of seeing and that of calculating. The question may be formulated, initially, as: Which method is more certain for verifying an empirical reality, a direct observation or mathematical calculation?

To simplify the question and reduce it to its essential elements, it would help to consider a straightforward example. If the empirical reality to be verified was the determination of the time at which an object (say a stone) that was thrown from the top of a building would hit the ground, then both methods would enjoy a similar degree of certainty. A trained timekeeper would be able to provide as close measurement of the time of the impact as would a mathematician who has knowledge of the building height. However, if the person who was asked to measure the time of impact was a novice observer, or the degree of accuracy required was raised to a split of a second, then the mathematician would predictably provide more reliable results.

When we come to consider a more complex empirical reality, such as the beginning of the lunar month, which is a function of the complex movement of the earth, the Moon, and the Sun, calculation becomes considerably more elaborate and intricate. Yet, with all its complexity, astronomical calculations are done with a great precision, a precision that cannot be matched by any level of experience acquired by the human observer. To understand the nature of this complexity, let us break it down to its constituting components.

The complexity in deciding the beginning of new lunar month stems from four basic factors:

1. The complexity of the movement of the moon in relation to both the earth and the sun, and the degree of precision of the mathematical formula used to calculate the moment of conjuncture;
2. The size and brightness of the lunar crescent, which depends on the apparent angular distance between the centers of the moon and the Sun. This distance is what astronomers call the elongation of the moon from the Sun.
3. Sky conditions, including air density and humidity, the presence of objects in the sky that obscure the young crescent. In recent times, the increase in the level of air pollutants, particularly around cities, has impacted negatively sky conditions.
4. The observer's situation and conditions, including location, experience, and preparation. An observer who is located at low latitude and high altitude, and who knows where and when to look for the waxing crescent has a better chance of observing the new Moon.

The first two factors, which relate to astronomical knowledge, have improved greatly over the last two centuries. Today, astronomers can calculate with great precision the date and time of conjuncture, i.e. the birth of the new Moon. Similarly, the impact of elongation on the visibility of the new moon (more accurately the waxing crescent) is estimated at 8.5 to 10 degrees for the aided eye, and 10 to 15 degrees for the unaided eye.²⁰

²⁰ See the Appendix for discussion on the calculation method adopted by FCNA. US Naval Observatory asserts that the date and time of the new lunar month can be predicted with precision, and elaborates on the impact of elongation on its visibility. See the article "Crescent Moon Visibility and the Islamic Calendar," (<http://aa.usno.navy.mil/faq/docs/islamic.html>, accessed on Tuesday, November 07, 2006). For detailed discussion of the q-parameter method, see B. D. Yallop, "A Method for Predicting the First Sighting of the New Crescent Moon," Nautical Almanac Office Technical Note No. 69, Council for the Central Laboratory of the Research Councils, June 1998: <http://www.crescentmoonwatch.org/download/NAOTN69.pdf>, accessed on November 16, 2006. See also by the same author *A Modern Guide to Astronomical Calculations of Islamic Calendar, Times, and Qibla* (Kuala Lumpur, Malaysia: Berita Publishing, 1984). Khalid Shawkat has also done extensive work on this question. His work can be accessed through his website <http://www.moonsighting.com>

The latter factors that relate to the conditions of the sky and the observers have deteriorated markedly. Muslims do not only live in middle latitude regions of mostly clear sky—as was the case in the early years of Islam—but also in high latitude regions, and in areas of high humidity and frequent rain. The sky conditions have worsened in most inhabited regions.

Observation of the new moon is quite disturbing in countries where Muslims do not employ the service of qualified observers using advance tools and facilities. Communities in the United States, for instance, rely on claims by ordinary Muslims with limited experience and astronomical knowledge. Even in Muslim countries where fairly advanced facilities are available, religious authorities accept the sighting of laymen with little or no training.

It must be asserted, therefore, that astronomical calculations provide a higher degree of certainty than an actual moon sighting by the human eye. For while astronomical calculations provide a precise date and time of the birth of the new Moon, sighting the moon produces, even with the use of advanced telescopes, less accurate and reliable results.

Yet the actual choice is not one in which we are asked to choose between astronomical calculation and moon sighting. The choice is essentially between calculations and individual testimonies. For several centuries, the Hanafi school of *fiqh* required that every qualified person must go to open fields outside his village or town to observe the new Moon. Other school of *fiqh* required two qualified witnesses, in some cases one, to verify the actual sighting of the Moon. The group requirement was intended to establish *tawatur* (the multiplicity of the sources) to ensure that the reported sighting is certain (*qat'i*), and hence to avoid the uncertainty (*zanni*) of individual reports. The Hanafi school ultimately abandoned the group requirement, and followed the practice of verifying the sighting with two witnesses.

Those who insist that Muslims abandon astronomical calculation and rely on individual testimonies are in actuality asking Muslims to abandon the certainty of reliable knowledge, for the inconsistency of unverifiable individual reports. Individual reports, every student of *fiqh* knows, produce uncertain knowledge (*ma'rifah zaniyah*). This is amply illustrated by the established records of moon sighting testimonies. These testimonies have been exceedingly inconsistent, and have resulted in numerous contradictions and reversals.²¹

The Imperative to Seek Sound Knowledge and Greater Good

As illustrate above, there is an ample evidence to convince anyone who is familiar with both *shari'ah* injunctions and contemporary astronomy that astronomical calculations provide a more reliable and certain approach for determining the beginning of the Islamic lunar calendar. The fact that contemporary Muslim scholars are reluctant to embrace this certainty underscores the challenges facing contemporary Muslim scholarship.

Many Muslim jurists are beholden to a historical consensus, even though the foundation of this consensus has shifted drastically. Early Muslim scholars had good reasons to reject the method of astronomical calculations, but it is no longer acceptable to question the certainty of this method. Rather than standing comfortably on a consensus whose foundation has shifted, it is about time that the Muslim community shifts its consensus and set it on a new and sounder foundation. Muslim jurists owe it to the traditions of Islamic learning, that have always brought

²¹ Khalid Shawkat lists on his website (moonsighting.com) and extensive list of mistaken sightings of the moon, which provide a practical illustration of both imprecision of moon sighting, and the inconsistency of testimonies and reports.

a balanced synthesis between *shari'ah* and science, to embrace more reliable methods for deciding with certainty the beginning of the Islamic month.

There are still others who have grown accustomed to the anticipation and excitement surrounding the "rituals" of moon sighting, and who regret the prospect of being asked to give up the opportunity to wonder at the majesty of Allah's creation. The Qur'an enjoins us, indeed, to constantly engage with Allah's creation—to observe and ponder His signs in our own human existence and in the universe, to watch the changing seasons, to consider the alteration of day and night, and much more. We must be in touch with the natural world to be reminded of Allah's creative power and the beauty and majesty of His creation, and this can be an important source for spiritual renewal. Yet this exercise must not be confined to, or imposed on, the question of deciding the beginning of the Islamic lunar month. The vast majority of Muslims desires accurate information on the new crescent, and is neither in a position to actively and effectively participate in moon sighting, nor are they required to do so. Those who find moon sighting spiritually uplifting owe it to every Muslim in the world to place the certainty of knowledge and the wellbeing of the *ummah* over and above personal fulfillments.²²

The Fiqh Council of North America's decision to formally adopt astronomical calculation represents a major step forward in overcoming historical inertia. Although the decision of the FCNA has not so far brought about a consensus among North American Muslims, it has set the foundation for the development of a position that can potentially bring a new consensus in deciding the beginning of Ramadan and the two *Eids* for the world-wide Muslim community.

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²² In addition to being less accurate, moon sighting has created a lot of hardship, particularly to Muslims in North America. In the eastern and northern parts of North America the *hilal* is usually unsightable, residents of these areas therefore simply have to wait until late into the night checking Islamic websites or waiting for a phone call. Their "moon sighting" is a message received by the most modern of technologies, and they are exhausted on *Eid* morning after waiting late into the night for sighting results from the western half of the continent

Appendix

A Note on the Criteria Adopted by the FCNA for Deciding the Birth of the New Crescent Moon

Fiqh Council of North America (FCNA) has adopted an Islamic Calendar based on the following criteria:

1. Astronomical calculations will be used to determine the beginning of the Islamic lunar months with the consideration of the sightability of the crescent anywhere on the globe.
2. To determine a lunar Islamic calendar, a conventional point of reference must be used. The International Date Line (IDL) or the Greenwich Mean Time (GMT) may be used.
3. The new Islamic Lunar month begins at sunset of the day when the conjunction occurs before 12:00 Noon GMT. If the conjunction occurs after 12:00 UT, then the month begins at sunset of the next day. The moon born before 12:00 Noon UT will be 18+ hours (or more) old at a point just East of IDL at local sunset. This convention has a basis of visibility at a point just East of IDL, and is born before the day begins at IDL.

The selection of the 12:00 noon GMT as the time of conjunction is based on research that was done by astronomers who developed methods to calculate the sightability of the waxing crescent with high precision.

Astronomers can today calculate the first sighting of the new moon using the q-parameter method, one of the most sophisticated methods for calculating the birth of the new crescent moon. The method, developed by B. D. Yallop of the Council of the Central Laboratory of Research Councils (CCLRC), United Kingdom, combines theoretical and empirical research to produce precise predictions.

The q-parameter method synthesizes major research on first visibility of the new crescent moon. It employs the Indian method used in producing the annual *Indian Astronomical Ephemeris*, F. Bruin's method for calculating the best time for visibility, published in 1977, and the work of Edward W. Maunder (1851-1928). It also uses B. E. Schaffer's analysis of empirical data collection.

The method uses a single test parameter, the q-parameter, to predict the first sighting of the new crescent moon. The parameter "q" is calculated at the best time for making the observation of the waxing crescent from the equation

$$q = (ARCV - (11.8371 - 6.3226 W' + 0.7319 W'^2 - 0.1018 W'^3))/10$$

ARCV (the Arc of Vision) is the geocentric difference in altitude between the center of the sun and the center of the moon for a given latitude and longitude, ignoring the effects of refraction.

W' is the topocentric width of the crescent, and is calculated from the equations

$$\begin{aligned} W' &= SD' (1 - \cos ARCL) \\ SD' &= SD (1 + \sin h \sin \pi) \\ SD &= 0.27245 \pi \end{aligned}$$

Whereby SD is the semi-diameter of the moon, *ARCL (Arc of Light)* is the angle subtended at the center of the earth by the center of the sun and the center of the moon, π is the parallax of the moon, and h is the geocentric altitude of the moon.

The best time of the waxing crescent observation, T_b , is calculated from the equation

$$T_b = (5 T_s + 4 T_m)/9 = T_s + 4/9 \text{ Lag}$$

Whereby T_s is the time of sunset, T_m is the time of moonset, and Lag is the time from sunset to moonset.

Yallop empirically calibrates “q” by applying its resulting value to a standard set of 295 first sightings of the new crescent moon that cover the period 1859 to 1996. He, further, contrasts actual observations with predictions based on q-test, and the results reaffirm the reliability of the calculation.

The results also help construct six ranges for the parameter “q” that inform us as to when observation is possible with the unaided eye, and when there is a need to use optical aid, such as binoculars or telescopes.

Criterion	Range	Visibility Type
<i>A</i>	$q > +0.216$	<i>Easily visible - ARCL \geq 12 degrees</i>
<i>B</i>	$+0.261 \geq q > -0.014$	<i>Visible under perfect climate conditions</i>
<i>C</i>	$-0.014 \geq q > -0.160$	<i>May need optical aid to find the crescent</i>
<i>D</i>	$-0.160 \geq q > -0.232$	<i>Will need optical aid to find the crescent</i>
<i>E</i>	$-0.232 \geq q > -0.293$	<i>Not visible with telescope - ARCL \leq 8.5 degree</i>
<i>F</i>	$-0.293 \geq q$	<i>Not visible - Below Danjon limit or ARCL \leq 8 degree</i>

FCNA has decided that Muslims are required to use all tools available to them to investigate the birth of the moon, and therefore consider the q-test to be positive when it falls in the ranges A through D, a condition that corresponds to ARCL > 8.5 degrees.

For detailed discussion of the q-parameter method, see B. D. Yallop, “A Method for Predicting the First Sighting of the New Crescent Moon,” Nautical Almanac Office Technical Note No. 69, Council for the Central Laboratory of the Research Councils, June 1998:
<http://www.crescentmoonwatch.org/download/NAOTN69.pdf>, accessed on November 16, 2006.