

Al-Kindi and Cosmopolitanism in Science

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Kitab Yakub ibn Ishaq al-Kindi fi al-Shu`a`at a treatise on light rays in Arabic, whose translation into English I am working on, is a work by the distinguished philosopher-scientist al-Kindi (805-870 CE), who was a scholar at the court of the Caliphs Ma`mun (813-833 CE) and Mu`tasim (833-841 CE). This was a time when scholarship flourished under the Abbasid caliphate, then at the peak of its military and political powers - its borders extending from the Bosphorus in the North to the Arabian Sea in the South and from Andalusia in the West along the rim of Africa to Persia in the East.

Al-Kindi as a Cosmopolitan

The treatise begins by referring to the story of Archimedes using an array of mirrors to burn the Roman galleys in the harbour of Syracuse during the siege of 215-212 BC. This was discussed in a book by Anthemius of Tralles, a Greek mathematician who lived around 500 CE and was the chief architect of the basilica of Hagia Sophia built in Constantinople under Justinian I. Al-Kindi starts his treatise with a reference to this work (most likely *On Paradoxical Devices*) with the comment that it was unbecoming of a scientist of the standing of Anthemius, not to have given a clear explanation of how this could be accomplished and he would try to overcome this deficiency by showing, in as simple a manner as possible, how an arrangement of 25 hexagonal plane mirrors could be used to focus the sun's rays at a point a specified distance away.

Al-Kindi then proceeds to do so in about 35 folios. In the process he demonstrates a knowledge of the principles of geometrical optics, the laws of the reflection of light from plane and spherical surfaces, implicitly uses the property that light rays travel in straight lines and that the sun is a great distance away so that when its rays reach the surface of the earth they are all parallel to each other. He also demonstrates awareness of the property that although the focus of a concave spherical mirror lies

on the axis of the mirror, it is not the centre of the sphere of which it is a part.

It is not known how the manuscript came into the collection of the Khuda Bakhsh Oriental Public Library in Bankipore, Patna but in an annotation at the end, the scribe says that the copy was completed during the second third of the night of Tuesday the seventh day of the eleventh month of Dhul al-Qaideh of 890 HE (15 November 1485 CE¹), at his residence near the Madrasah al-Kamiliyah in Cairo², the night before the morning of his travel.

The Abbasid caliphate was the third of the Islamic caliphates to succeed prophet Muhammad. In 750 CE they took over the Muslim empire by overthrowing the Umayyad dynasty claiming to be the true successors of the prophet. In 762 CE the Caliph al-Mansur founded the city of Baghdad, which soon became a centre of science, culture and philosophy. Al-Kindi was given charge of the *Bayt al-Hikmah* – the House of Wisdom, established by al-Ma`mun around 830 CE, where both Muslim and non-Muslim scholars worked to collect and translate knowledge from all over the world into Arabic. Many classic works that would otherwise have been lost were translated into Arabic and these were subsequently translated into Persian, Turkish, Hebrew and Latin. During this period, the Islamic world was a melting pot of different cultures and it collected, synthesized and advanced the knowledge gained from the Roman, Chinese, Indian, Persian, Egyptian, Greek and Byzantine civilizations. In disciplines such as astronomy, mathematics, medicine, physics – Arab scholars were at the forefront of scholarship of the times.

Al-Kindi devoted himself to the study of Greek Science and Philosophy with the help of these translations and in interaction with non-Muslim scholars. His own research output was prodigious – over 350 treatises on a variety of subjects of which however only some 60-70 survive. He made original contributions to philosophy, optics, metaphysics, psychology, astronomy/astrology,

cosmology, meteorology, chemistry/alchemy, and music. For his original contributions in philosophy he is often referred to as the 'Philosopher of the Arabs'.

He had a broad and inclusive stance in his early writings – truth is truth no matter where it comes from; discoveries whether or not made by Muslim scholars should be welcomed; the search for knowledge was a collective enterprise of all people and all valid knowledge should be respected... Such views were acceptable in early Islamic times when the new religion was trying to establish itself and although it believed that it was based on the final revelation of religious truth, it was willing to accept that it was by no means the first.

In the preface to his earliest work on Metaphysics, dedicated to Caliph al-Mu'tasim, al-Kindi wrote (R Walzer): "We should not be ashamed to acknowledge truth and to assimilate it from whatever source it comes to us, even if it is brought to us by former generations and foreign peoples."

Some of the questions al-Kindi addressed in his early writings were: In the debate between reason and revelation, which knowledge was to be considered superior, the rational or the prophetic? Do both quests lead to the same truth even though they follow different paths?

Al-Kindi was strongly influenced by the Greek philosophers and did not see any incompatibility between philosophy and religion. Later he was to deviate from this traditional Neo-Platonic-Aristotelian view and assert that human knowledge was inferior to the prophetic and to accept some theological positions such as the creation of the world out of nothing by an act of God and a belief in the final resurrection of the human body on the Day of Judgment. He thus came to give up one of the basic tenets of Greek philosophy - that nothing can come from nothing, and accept the omnipotence of God, above and beyond natural laws.

This may well have been due to his liberal views falling out of favour with the Caliph al-Mutawakkil (847-861 CE). As a consequence of court intrigue, his personal library was confiscated and he was allegedly beaten up for his views (shades of Galileo's treatment at the hands of the Catholic church some eight centuries later). Although his library was later restored to him, he never recovered his old influence with the Caliphs.

Many thinkers and scientists living under Muslim rule were involved in transmitting Greek and Islamic science to Europe. They also helped in the recovery of many of the ancient works on mathematics, geometry and astronomy and were instrumental in transmitting the results of Indian and Chinese scholarship to the West.

Among the many notable names of this period, Ibn al-Haytham (Alhazen) stands out in the history of science.

In his *Book of Optics* (1021 CE) he used experiments to prove that light entered the eyes of the observer rather than being emitted by them. This was one of the first examples of experiments being used to choose between two competing scientific theories.

Two Kinds of Cosmopolitanism

Many scholars are agreed that we need to enlarge the initial European understanding that Cosmopolitanism is a child of Western Modernity born out of the Enlightenment. Its genealogy has already been extended to include Islamic ancestry from the time of the Caliphate in Baghdad and the Moghuls in India. Cosmopolitanism conjures up words and phrases such as global, multiple, plural, networks, circulation, translation and transmission of knowledge, objects, and texts through a diversity of agents and actors. Thus one does not have to labour the point that al-Kindi was by all accounts a cosmopolitan scientist working in a cosmopolitan period of the Abbasid caliphate. Without doubt the sustained programme of translation of writings into Arabic from other cultures that al-Kindi supervised was imbued with a cosmopolitan vision, as he sought to understand different points of view and build upon the knowledge and experiences of different cultural communities and knowledge systems.

Having held out al-Kindi as an example of a cosmopolitan in the practice of science, let us now address the question: "What do we mean by cosmopolitan science?" which begs the question, "Is science cosmopolitan?" My answer to this is that it is and it is not.

Let me explain. Science, among other things, is an attempt to bring correspondence between phenomena in the natural world and the world of ideas. It relies on a multiplicity of methods. However, the absence of a unique method (a prescription that, if followed, would guarantee the discovery of a new and valid scientific truth), does not justify the conclusions Paul Feyerabend arrived at, that there was no method to science and therefore anything goes, and that witchcraft is as good as science. I say this because although there is no unique method of science, there is a unique validation principle, which allows you to choose between competing theories. This principle asserts that the measure of the goodness of a theory is the closeness of its predictions to the results of observations. This is the sole and only criterion of acceptance and ensures, to paraphrase Ernest Gellner, that although the practice of science can be consensual, scientific truths are not.

So the answer is yes, science can be cosmopolitan when it involves participation from different cultural groups, assembled possibly in special institutions set up essentially with support and funds from some sponsoring

agency, that are open to persons of different political, religious and cultural persuasions and that celebrate diversity and provide access to scholarship from a variety of sources. Such institutions sustain programmes of translations if necessary and facilitate rapid mechanisms of communication and the exchange of scholars and participants by organising conferences, seminars, research workshops that cut across national and state boundaries. They provide freedom to practitioners to pursue their own lines of enquiry, not requiring them to be regimented into narrow research programmes that are not of their choice and that in the final analysis promote a diversity of approaches.

That said, I would like to posit that in a fundamental sense science cannot be cosmopolitan because it demands adherence to a unique system of validation that has no room for pluralism. As far as science is concerned, the currency of a scientific theory in the *longue duree* is only as good as the correspondence between its predictions in as yet un-investigated situations and the results of observations carried out in those situations. It enjoins no other criterion for the acceptance of a theory.

Thus although science can be cosmopolitan in the manner of its engagement by and of its practitioners, as a discipline, rigidly bound as it is to its unique validation principle of agreement with observations, it *cannot* be cosmopolitan. I wish to submit that there are therefore in principle at least two types of cosmopolitanisms. Whereas science can and should admit to 'cosmopolitanism of the first kind', which promotes a plurality of approaches as well as a plurality of practices, and from which not just science but almost all disciplinary studies can benefit, it cannot admit to 'cosmopolitanism of the second kind'. Unlike the case of philosophy, for example, beautifully illustrated by Jonardon Ganeri in his recent essay *Philosophy as Estrangement* in the in-house journal of the Institute, in which he shows how starting from the same initial premise one can logically arrive at and, live comfortably with, at least three completely different conceptions of the Self – the Hellenic, the Buddhist and the Nyaya, each of which has been around for a few thousand years (an example of cosmopolitanism of the second kind), this is something science cannot do because in a similar situation it would strive till it found a way of falsifying at least two of them.

Finally, we must bear in mind that such efforts at cosmopolitanism can be thwarted by restrictions on the free flow of information, by strict copyright and patent regimes, by prohibitive costs of publication and dissemination and by placing restrictions on access to the results of investigations arising from considerations of commercial profit or national security. Can one even dream of the possibility of making public, for example,

the detailed workings of a fusion reactor? Or consider the case of Chemistry and Metallurgy in India, both of which were quite well developed in the 13th and 14th c. CE. Such knowledge was closely guarded and handed down only to select pupils and family members. The most sacred texts were meant only for those 'sitting nearby' which is the import of the word 'Upanishad'. This was not only true of philosophical and religious knowledge but also of secular practices. The *Rasaratnasamuccaya*, an early 14th c. CE Handbook of Gem-Mineral Chemistry contains the injunction (verse 6.71):

रसविद्या दृढं गोप्या मातुर्गुह्यमिव ध्रुवम् ।
भवेद्धीर्यवती गुप्ता निर्वीर्या च प्रकाशनात् ॥

*Rasavidyā dr̥ḍham gopyā māturguhyamiva dhruvam/
bhaved dhīryavatī guptā nirvīryā ca prakāśanāt ॥*

that translates as:

Rasa Vidya should be kept concealed like the privates of the mother. It remains potent so long as it is kept secret, but becomes powerless if made public.³

Clearly therefore Cosmopolitanism is not merely a disciplinary characteristic but also a product of the culture and the times.

Notes

1. There are a number of online programmes that can convert dates from the Hijra to the Gregorian calendar, however the conversion is likely to be in error by plus or minus one day. This is because the Hijra calendar is lunar, a new day starting at sunset with day and night each being divided into three equal periods, while the Gregorian calendar is solar with a new day starting at midnight.
2. The Madrasah al-Kamiliyah is now in ruins, but in the 13th and 14th c. CE it was a respected centre for training Islamic scholars. It went into decline after the famine of 1403-1404 CE when revenue from its lands began to decline. After their initial success, the Abbasids of the late 8th century were forced to cede authority over large tracts of their empire and their leadership was gradually reduced to a ceremonial religious function. The Abbasid presence in Baghdad ended with the killing of the caliph al-Musta'sim (1242-1258 CE) by the Tartars under Hulagu Khan when they sacked the city. Thereafter the Abbasid line of rulers relocated themselves to Cairo in 1261 CE, which then became the seat of the Abbasid caliphate.
3. I am grateful to Professor Roddam Narsimha for providing the source of this quotation.

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