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Promoting astronomy in developing countries: an historical perspective

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Abstract. Any international effort to promote astronomy world wide today must necessarily take into account its cultural and historical component. The past few decades have ushered in an age, which we may call the Age of Cultural Copernicanism. In analogy with the cosmological principle that the universe has no preferred location or direction, Cultural Copernicanism would imply that no cultural or geographical area, or ethnic or social group, can be deemed to constitute a superior entity or a benchmark for judging or evaluating others.

In this framework, astronomy (as well as science in general) is perceived as a multi-stage civilizational cumulus where each stage builds on the knowledge gained in the previous stages and in turn leads to the next. This framework however is a recent development. The 19th century historiography consciously projected modern science as a characteristic product of the Western civilization decoupled from and superior to its antecedents, with the implication that all material and ideological benefits arising from modern science were reserved for the West.

As a reaction to this, the orientalized East has often tended to view modern science as "their" science, distance itself from its intellectual aspects, and seek to defend, protect and reinvent "our" science and the alleged (anti-science) Eastern mode of thought. This defensive mind-set works against the propagation of modern astronomy in most of the non-Western countries. There is thus a need to construct a history of world astronomy that is truly universal and unselfconscious.

Similarly, the planetarium programs, for use the world over, should be culturally sensitive. The IAU can help produce cultural-specific modules. Equipped with this paradigmatic background, we can now address the question of actual means to be adopted for the task at hand. Astronomical activity requires a certain minimum level of industrial activity support. Long-term maintenance of astronomical equipment is not a trivial task. There are any number of examples of an expensive facility falling victim to AIDS: Astronomical Instrument Deficiency Syndrome. The facilities planned in different parts of the world should be commensurate with the absorbing power of the acceptor rather than the level of the gifter.

Keywords. History and philosophy of astronomy, "Cultural Copernicanism", astronomy and civilization, astronomy in relation to Eastern and Western thought and culture

1. Introduction

Astronomy today is at the cutting edge of intellectual enquiry, and, at its most glamorous, a child of high technology. But it is more than a branch of modern science. It is a symbol of the collectivity and continuity of humankind's cultural heritage. This mixture of science and culture is astronomy's strength as well as dilemma. Strength, because support for astronomy transcends all boundaries: dilemma, because this support transcends science also.

For promoting astronomy in developing countries with memories of past contributions to science, scientific astronomy and cultural astronomy would need to be placed in a composite context, even though the question of judicious jettisoning of part of the cultural baggage is not going to be easy to address. Even more importantly, modern

(post-Copernican) astronomy, or modern science in general, would need to be repositioned in a more extended evolutionary sequence.

2. Cultural Copernicanism

The past few decades have ushered in a new age, which we may call the Age of Cultural Copernicanism (Kochhar 1999). Analogous to the cosmological principle that the universe has no preferred location or direction, Cultural Copernicanism would imply that no cultural or geographical area, or ethnic or social group, can be deemed to constitute a superior entity or a benchmark for judging or evaluating others. In this framework, astronomy (as well as science in general) is perceived as a multi-stage civilizational cumulus where each stage builds on the knowledge gained in the previous stages and in turn leads to the next.

This framework is, however, a recent development. The 19th century historiography consciously projected modern science as a characteristic product of Western civilization, decoupled from and superior to its antecedents, with the implication that all material and ideological benefits arising from modern science (and technology) were reserved for the West.

As a reaction to this, the orientalized East has often tended to view modern science as Western science, distancing itself from its intellectual aspects, and seeking to defend, protect and reinvent their "own" science and the allegedly "anti-science" Eastern mode of thought. This defensive mindset works against the propagation of modern astronomy in most non-Western countries. There is thus the need to construct a history of world astronomy that is truly universal and unselfconscious.

It is customary for history books and modern astronomical texts to periodize astronomical developments in terms of Babylonian astronomy , Greek astronomy, Hindu astronomy, Arab astronomy, and modern astronomy. This approach can be faulted on a number of counts. Thus presented, modern astronomy becomes a synonym for European or Christian astronomy, which owes nothing to anybody else. The term Arab astronomy is insensitive and factually incorrect, because most of the astronomers in this phase were of non-Arabic ethnicity. It would be appropriate to use the term Zij astronomy, since the main concern in this phase was the construction of astronomical tables based on observations. Similarly a better term than Hindu astronomy is Siddhantic astronomy, because the main focus was mathematical calculations on the basis of algorithmic texts known as Siddhantas.

Interestingly, while terms like ancient China, ancient Egypt and ancient India are commonplace, ancient Iraq is not used. By using obscure phrases such as the Mesopotamian, Sumerian, Babylonian and Chaldean, we are denying the present inhabitants of these lands connectivity to and pride in their own remote past, forcing them to seek their identity from later events.

The philosophy behind this periodization mars the historical analysis also. Indians were told that their millennia-long astro-mathematical tradition was a derivative of Greek scholarship and lacked originality, although from about AD 500 till Kepler's laws, Indian astronomers were the only ones anywhere in the world who could calculate eclipses with a reasonable accuracy. As a reaction, some Indian historians have defensively asserted that the Greek inputs came into astrology but not into astronomy. Making a distinction between astronomy and astrology in older time-frames is an exercise in anachronism. Quite obviously bad scholarship does not encourage corrective research but begets more of its own kind.

In the same spirit, Arabs were dismissively told that their role had been no more than as librarians and archivists for preserving Greek science till Europe was in a position to take its heritage back. (Copernicus' own use of Al Tusi couple (Saliba 1995) was assigned to a dusty endnote in scholarly papers; it never made to the mainstream texts.) And yet when the Indians proudly pointed out that the Buddhists had worked extensively on health-related chemistry, they were told with a straight face that when their ancient texts mentioned the Buddhists, they probably meant Muslims!

Antecedents of western astronomy have been tunnelled backwards into a hypothetical unresolved monolithic period of classical Greek antiquity extending from the 6th century BC (Thales) to 2nd century AD (Ptolemy). In reality, Alexander represents an intellectually significant transition within this period. His conquests brought Greeks to Egypt and Mesopotamia, both of which had an older civilization, bigger economy and geography, as well as higher levels of practical knowledge and technological developments. The combination of these with the classical Greek tradition gave rise to a hybrid culture that produced science as we know now (Russo 2004). Thus the vastness of Egypt made possible the celebrated experiment by Eratosthenes to measure the circumference of the Earth. (Just as, centuries later, the vastness of British India permitted the measurement of the great meridional arc under George Everest.)

The standard reviews of astronomical history very often do not make any effort to synthesize into the main narrative the contributions from the Americas. It is mandatory for modern astrophysical texts to include a chapter on historical background. Since the book writers are not experts in this area they normally take recourse to copy-and-paste. Thus it has been stated that since Muslims must pray towards Mecca this directional constraint encouraged them to take to observations. It is difficult to say how this "insight" developed. But an obvious counter-example may be noted. The most spectacular Muslim empire anywhere was the Mughal in India. And yet in its entire golden age which lasted from the mid-16th century till the closing decades of the 17th, no observatory was ever built.

Insensitivities and casual remarks in the popular text books may leave most western students untouched, but they strengthen feelings of alienation elsewhere and thus work against the promotion of astronomy worldwide. Many former European colonies house old telescopes. They however do not view these telescopes as part of their scientific heritage. They are tolerated as signs of foreign presence.

In short, there is a pressing need for constructing a universal history of astronomy which emphasizes continuity and evolution, so that the whole world can relate to modern astronomy and participate in its furtherance. The International Astronomical Union, UNESCO and other agencies can join hands in initiating a campaign for creating an on-line source for a universal history of astronomy. Planetariums can play an important role in creating awareness about astronomy. Unfortunately, the tendency these days is to use pre-supplied programmes, which since they are produced for a diversity of audiences are bereft of cultural content. There is a need to produce cultural-specific modules to supplement reports on modern developments. The International Astronomical Union and other international agencies can help in this direction.

Combining cultural and modern scientific aspects of astronomy is a non-trivial task. Care needs to be taken to interpret past accomplishments and notions in a framework relevant for the period. There is a prevalent tendency to seek modern validation for old concepts. Indiscriminate use of modern-day judgmental terminology while discussing the past can only complicate matters further.

3. Modern astronomy and the non-West

So far we have focused on a conceptual framework which astronomy of today requires. There are certain difficulties in actual practice also. It is the Brahiminical aspects of astronomy that lend glamour to it. It is often forgotten that behind these results lies a very high level of coordinated artisanal activity. Indeed historically astronomy and industrialization have grown hand in hand in Europe. Thus while in the industrial economies, astronomical pursuits are an extension of military -industrial activity, it is difficult for semi-industrialized or non-industrial countries to maintain astronomical equipment. If sophisticated instruments are installed by a donor that are far above the maintenance capabilities of the host country, the experiment will fail, no matter how well intentioned the exercise was. As the contribution of service sector in national economies increases, interest in nut-and-bold activities is going down, shifting interest from observations and experimentation to applied mathematics.

If even modest observational facilities are to be sustained in developing countries, a certain minimum amount of industrial activity has to be ensured. Astronomy cannot be practised as a purely cultural activity. Historically, astronomy has benefited from industrial and strategic developments (the Dutch invention of the telescope, the silver-on-glass technique, pre-Hubble telescopic satellites, the CCD, etc.). It has grown in conjunction with the nut-and-bolt economic activity. Can this trend be reversed? In other words can the initiation of astronomical activity induce shop-floor culture? The question is not easy to answer, but the effort is worth making.

Unlike in laboratory sciences where a new facility renders the older ones redundant, the field science of astronomy requires cooperation and collaboration from facilities old and new. No matter how powerful or rich or industrially advanced a nation or how well-equipped its observatories, it still is permitted a view of only half of the celestial sphere. Understanding the celestial environment has been humankind's passion since times immemorial. This common heritage needs to be emphasized and strengthened so that the depth of our understanding about the cosmos, both literally and figuratively, can be enhanced.

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