

ASTRONOMY IN CULTURAL LANDSCAPES: NEW CHALLENGES FOR WORLD HERITAGE ISSUES

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**Paper Presented at the Forum UNESCO University and Heritage
10th International Seminar
“Cultural Landscapes in the 21st Century”
Newcastle-upon-Tyne, 11-16 April 2005**

Revised: July 2006

INTRODUCTION

The world of science and high technology is changing at a rapid pace. New objects and tools, information sources and technologies are available in increasing amounts and improved qualities. Modern science and technology expanded to all places of the world introducing changes that have eroded traditional systems of knowledge and conventional techniques.

Astronomy has traditionally been regarded as the oldest of all sciences. Since the beginning of humankind, the fascination with the sky has been an important element in human life and history. The regularity of the motions of celestial objects enabled peoples around the world to create worldviews, i.e. “culturally organized systems of knowledge (Kearney, 1975, p.248), and generations of skywatchers carefully tracked the positions of the heavenly bodies in order to understand how to conduct the human life on the earth. From the sky, and from naked eye astronomical observations, they gained practical knowledge of their natural environment. The correlation of terrestrial and celestial phenomena enabled them to move in space and time. Regularities formed by the motions of celestial objects provided the necessary context upon which many structural-symbolic patterns were built to regulate human activities. Increasingly, skywatching has been associated with calendar-making, and homogeneous time reckoning. On the other hand, the order perceived and imposed by the sky gave form to the ways with which peoples perceived their world, conceptually organizing the universe.

Although people see the same sky, their perceptions and conceptualizations of what they perceive in the sky are culture-dependent. Astronomy, as a cultural product is at the same time integrated with a particular culture. Because world views and time concepts are always socially determined, the study of indigenous systems of knowledge may offer us important insights into cultural diversity and different ways of perceiving the world.

Archaeoastronomy as a scientific field of inquiry that embraces the diversity of interactions between people and their celestial part of environment incorporates not only investigations of ancient astronomical practices and systems of knowledge, but also complex studies of roles which this knowledge has played in specific cultures.

The history of astronomy, like the history of science, is closely related to the history of mankind. Though modern tools and methods much differ from naked-eye observations, today's astronomers are asking questions already asked for centuries. Understanding how the world was created is just as important to indigenous stargazers as to modern astronomers. All are attempting to comprehend and interpret the world in which they live.

Although the range of questions reflects the specific needs and methods of particular societies, the knowledge of the heavens required particular kinds of techniques designed for observing, recording and transmitting this knowledge over larger periods of time. These techniques and methods, invented, designed, selected, and maintained by generations of skywatchers and stargazers, today attest for their knowledge and experience gained from systematic observations of the sky. However, we observe that with an increased number of people migrating to urban areas, all information about how non-western and folk societies conceptualized their environment (including their sky environment) may definitely be lost. Today the astronomical elements contained within monuments, sites and landscapes are regarded as valuable and important to our universal heritage. Not only they hold significance and meaning for traditional groups and communities, but also for the heritage of all peoples. The desire for the preservation of ancient, indigenous or modern systems of astronomical knowledge is therefore justified by the wider public interest.

We see therefore, that the indigenous knowledge is increasingly threatened by changing social and economic conditions and the marginalization of local cultures. Not only nonwestern and traditional societies feel obliged to alter their own traditions to cope with various internal and external pressures, but also an increasing number of people migrating to urban areas contributes to the continuous impoverishment and/or disappearance of their experience and knowledge of the natural environment. Due to important changes of the land use, the present degradation of the environment is affecting patterns of climatic-vegetation zones on a large scale, making traditional knowledge useless and less desirable. Though they started centuries ago, today these changes are much more accelerated dramatically affecting peoples' ways of understanding the world. Surrounded by the modern West, traditional perceptions and understandings of the sky are increasingly exposed, affected or replaced by cosmologies and astronomies derived from our modern Western culture. Moreover, continuous degradation of indigenous knowledge of the heavens is associated with the destruction of those material remains of the past that can attest for ancient astronomical systems. Like other historical monuments and cultural and natural landscapes, the archaeoastronomical record is destroyed at an extremely fast pace. Important changes of the land use (such as the environmental changes caused by rapid urban development, industrialization, changes in agricultural practices) caused nearly a total transformation of natural habitats. Since the landscape today is irreversibly altered, those archaeological and historic monuments, sites or landscapes which attest for the architectural skills and astronomical abilities of their ancient constructors become the only means which offer us insights into the diverse ways of understanding the universe. As they inform us about beliefs and concepts about the world as it was perceived by human groups in the past and/or belonging to the nonwestern present, the deterioration and disappearance of any of them constitutes an impoverishment of the (scientific) heritage of all mankind.

After having realized that the properties associated with science and knowledge are among the most under-represented on the World Heritage List, the World Heritage Center saw its role as encouraging experts from different scientific fields (ranging from archaeology to astronomy and cultural resources management) to discuss the possibility of establishing an effective strategy for protecting the properties related to astronomy.

SOME BACKGROUND INFORMATION

In March 17-19, 2004 the World Heritage Center together with the UNESCO Venice Office –regional bureau for Science in Europe (ROSTE) and ICOMOS organized an expert meeting to examine the possibility of introducing the category of astronomical heritage and methodology for its definition and implementation. The meeting adopted categories of astronomical heritage under the following provisional criteria:

- (i) Properties whose design and/or landscape setting have significance in relation to celestial objects or events;
- (ii) Representations of the sky and/or celestial bodies and events;
- (iii) Observatories and instruments;
- (iv) Properties with a strong connection to the history of astronomy.

Some of the landscape specialists may be intrigued by the idea that I am discussing celestial environment during this meeting. Landscapes may be considered both as a means of expressing conceptions of the world and as a method of referring to physical features (Layton & Ucko, 1999, p.1). As historical products, landscapes are embodying the long history of the humankind, including human connections with celestial phenomena. In spite of this, the perception of the sky has not received sufficient attention in landscape studies. Although all cultures, both past and present, consider the heavens an integral part of their world, in practice, landscape specialists (ranging from geographers and policy makers to anthropologists and heritage managers) ignore this critical aspect despite the fact that this prevents an adequate understanding of local forms of knowledge. Local knowledge and indigenous practices concerning nature and the universe cannot correctly be approached if we use our Western epistemologies.

Until now, prominent topographical features such as mountains, bodies of water, woodland and desert environments together with aesthetic, religious, spiritual, technological (mostly agricultural), and identity-producing (ethnic, national) dimensions of landscapes have gradually been considered as forming an integral part of the landscape (for the history of cultural landscape concepts consult Fowler, 2003). This being so, we are faced with the problem of integrating all of them within a single homogenous framework. The recognition that landscape is a social construct in which “natural” elements interact with “human-made” elements and that conceptualizations of the landscape are also products of historical and cultural specificities, presents a challenge to the World Heritage since it intends to develop abstract definitions referring to landscape categories. Indeed, our notions of cultural or natural landscapes are defined in the ethnocentric terms of modern scientific language, and with the exception of a few anthropologists or archaeologists, the majority of scientific academia pay little attention to how traditional and non-western cultures have conceptualized their physical surroundings and their relation it. In other words, our concepts of landscape may greatly impede taking into serious considerations those aspects of the environment which do not fall within the Western notion of landscape. As a consequence, our Western dichotomy that separates the heavens from the Earth no

longer can be taken for granted and applied as a universal rule to all cultures and places. An alternative model emphasizes that the sky forms an integral part of the landscape. Many traditional societies carefully track the movements of the celestial bodies to know how to act in the earth. Traditional and indigenous worldviews usually do not separate the sky from the rest of the world, and though they frequently oppose the flat surface of the earth to the celestial vault, there is no reason to believe that our modern Western idea that makes a distinction between the celestial and terrestrial environment is universal. The inclusion of the sky as a theme into the World Heritage is a step in recovering the total human environment.

Archaeoastronomy shows how human understanding of the sky may be reflected in the design of the architecture, ranging from domestic assemblages to architectural monuments and from urban layouts to whole landscapes. While some of architectural and landscape complexes may serve in an instrumental sense to observe specific celestial phenomena, other mark the position of already known astronomical phenomena. Both types of record are assumed to convey meanings that reflect the way people see the world. Architectural remains and cultural landscapes usually convey a specific conception of the cosmos, of space and of time. Diverse architectural structures and landscape forms often materialize different facets of the same world-view and encompass both direct and indirect connections to astronomy. Astronomically oriented monuments or astronomically related patterns of human activity in the landscape inform us of people's understanding of the cosmos. Obviously, people's world-views are not restricted to astronomy, but some knowledge of the sky is necessary to construct worldviews. As cultural diversity becomes more scarce and valuable, the information about indigenous astronomies, calendars, world views that is contained in the landscape should also become more valuable. Therefore, policies for the conservation of landscapes should be integrated with actions developed to protect astronomical sites and landscapes.

Archaeoastronomy is the science that attempts to identify archaeological or historical features (such as architectural remains or burial orientations) in relation to celestial bodies and phenomena. Archaeoastronomy reads the "celestial" aspects of past world-views from patterns in the archaeological record (landscapes included). In doing so, archaeoastronomy uses the tools and concepts of modern astronomy that enable us to reconstruct in detail ancient skies. Astronomical reconstructions of ancient skies, when compared with other paleoenvironmental reconstructions, are among the most detailed and reliably ones. Finally, it is easier to study associations between material record and the sun, moon, planets or stars than to analyze more intangible features in the landscapes (Ruggles and Saunders, 1993, pp.9-10).

ASTRONOMY AND LANDSCAPE FEATURES

The observations of yearly solstices, equinoxes, and zenith passages of the sun by ancient societies can be inferred by light and shadow interactions at several rock art sites, or purposeful designs of architectural assemblages made in relation to the solar path in the sky. Correspondences between different dimensions in the world may be defined through architectural alignments extending towards the rising and setting positions of the sun and moon on the skyline. In brief, human made monuments, ranging from a single structure to an entire architectural assemblage (a ritual or ceremonial complex or a whole settlement) are often deliberately aligned and oriented within the landscape to establish connections with different celestial phenomena. Since sunrise and sunset at the winter and summer solstices may clearly be marked by sighting lines in the monument, therefore we may say

it contains specific astronomical knowledge. Besides, prominent features in the landscape and astronomical bodies in the sky may be invested with meanings that provide the peoples with a means to proceed with their life. The ways in which meanings are structured and ascribed to human landscapes depend upon the cultural dispositions used to create significant relationships between perceived features, movements and processes. No matter whatever media are applied to represent those relationships, they all are basically semiotic; not only they are experienced as such, but, above all, interpreted as meaningful with reference to a representational-symbolological framework situated beyond the limits of the immediate landscape perception. Both alignments and light and shadow effects are indicative of those symbolological systems that give form and structure to indigenous knowledge.

The decisive role of the sun and moon in the building of landmarks which simultaneously bisect and link features within the landscape is attested for many societies. Traditional and ancient societies have often used natural landmarks located on distant horizons to help them track and record astronomical movements. Hilltops, rock cliffs, notches, wide valleys and other natural features have been used as horizon targets linking particular sites and site directions with intended astronomical bodies. Sites with properties related to astronomy, form systems of visual relations which link them together with distant horizon features and astronomical targets. Astronomically oriented monuments are often the only features from which we can infer how ancient peoples thought about their universe. At this point a glimpse of the sky and of distant horizon targets becomes an extremely important issue. All astronomical significance of human-made structures may be lost if they no longer reproduce their relationships with the sky. The full appreciation of the astronomical knowledge through its material expressions depends strongly upon the possibility to reproduce visual alignments.

As mentioned above, architectural monuments are astronomically aligned because these orientations symbolize their connection to the cosmic order. Though now mainly associated with parks and gardens, the category of the clearly defined landscape may also serve to include some of astronomical landscapes. The baseline between Stela 12 and Stela 10 which runs across the landscape near to the Classic Maya city of Copán (Honduras) and serves to mark important calendrical cycles may be included to this category. The most appropriate landscape category however, should be related to the class of the associative cultural landscape. All sites with human-made structures oriented to prominent landmarks on the local horizon used as markers of sunrises and sunsets on significant dates, forming horizon calendars, could be included to the category (e.g. Teotihuacan in Mexico or Hallstatt in Austria; see Šprajc, 2000 and Innerebner, 1953). In other words, archaeoastronomy builds links to *associative views* of the landscape.

This new perspective moves us beyond a singular monument or site towards the wider landscape. Fixed observation points, architectural alignments, horizon markers are always positioned with regard to perceived astronomical phenomena, so there can be little doubt that the sky quality, that is, the visibility of sky events has naturally been critical to skywatching. One of the challenges for the coming years should be to ensure that wherever possible astronomical alignments, sightlines and light and shadow effects are really preserved and reproduced both in singular structures and whole landscapes. Unfortunately, rapid urban growth and changes in land development have already made it impossible to achieve the preservation of astronomical properties of sites in many areas. Not only sites themselves but also their surroundings have been modified or irreversibly damaged in such a way that they no longer can reproduce their astronomical values.

Especially the preservation of astronomical alignments running across wider landscapes becomes unrealistic, so we have to consider which of the astronomically important sites are still available to us. Since some of them are well-known tourist destinations, the potential impact of astronomical properties should at least be assessed on those sites. Otherwise, the scientific, educational, and last but not least commercial values that can eventually be exploited may definitely be lost.

Today, the visibility conditions are affected by a variety of elements (Iwaniszewski 2004):

1. An inadequate restoration work which eliminates the capacity of connecting a monument/site to its environment through visual alignments;
2. The placement of modern buildings nearby to archaeological or historical sites that affect original visibility conditions (unplanned construction that blocks visual alignments affect light and shadow interaction, etc.);
3. The transformation of horizon profiles through various industrial activities (stone quarries, mines, highways, deforestation processes, and so on);
4. Air and light pollution.

Comprehensive approach to sites with astronomical properties situated with the wider landscape involves therefore strategies aiming at the maintenance of the unimpeded view of the sky.

LIGHT POLLUTION

Ancient astronomy is very visually oriented. Ancient astronomical knowledge was gained from naked-eye observations of the sky. We may assume that the skies were universally contemplated by peoples in all times and places leading them to speculate about the cosmos. The celestial bodies were easily accessible for confirmation by others. By noting that the sky became a common reference frame to millions of humans, we imply they all had an unrestrictive access to the heavens. Today however, when at night we visit archaeological or historical sites, we easily perceive huge domes of light from neighbour cities which notably restrict visibility in determined directions. The sky which we often observe from those sites is not black. Light pollution, artificial light seen in the night sky, has increased so much recently that it drastically decreased possibilities to contemplate the celestial objects as did countless generations before us. In fact, a black, starry sky no longer is available to two-thirds of the world's population (Bakich, 2004, p.42), and approximately a half of world population no longer can see the Milky Way (Cinzano *et al.*, 2001, p.689). No only this light pollution separates us from our natural environment; it isolates us from the astronomical achievements of ancient societies.

Since the starry sky is our best link to past cultures, so we use the night sky as an obligatory reference to understand the beliefs about the cosmos of other peoples and societies. The spread of light pollution across the world however, prevents us from the direct perception of the night sky. Rather, we can find better visibility conditions in planetarium shows or computer displays. Think, how people who, as city-dwellers, have a limited access to the starry sky can gain insight into the relationship between astronomical motions of the Earth (rotation about its axis and orbit around the Sun) and seasonal patterns of sunshine, rain, and winds. Or, how can they appreciate those mythological narratives in which appear the sky beings, the personifications of celestial bodies and constellations, when the only objects in the night sky they can perceive are the Moon and

some brilliant planets and stars. Since most people seem not to be aware of the harm resulting from excess lighting, the loss of a black, night, starry sky must be seen as another example of the loss of our cultural resources (Richman, 2004). Light pollution is a very real threat to astronomical values represented through sites and human-made landscapes. All archaeoastronomical sites and landscapes which are already affected by the light pollution not only diminish their ability to reproduce connections to the outer world, they also increase the separation of visitors from the comprehension of ancient peoples. The thread posed by light pollution is as real as other uncontrolled processes that affect the integrity of the remarkable natural and cultural landscapes.

Ironically, we have developed strategies aiming at the preservation and restoration of the material remains of the past and the protection of the traditional cultures, but we have failed to preserve those elements without which these monuments and traditions would not exist: the night sky. In many regions of the Earth we have lost the spectacular view of the starry sky that our ancestors enjoyed in not so remote past. It is necessary to develop strategies not only to obtain more evidence concerning the relationship past societies used to have with the sky, but also to support our educational initiatives for the dissemination of the scientific heritage of those ancient or modern peripheral groups.

CONCLUSIONS

The inclusion of astronomy to the World Heritage Program offers a new challenge to the cultural landscape approach. The sky no longer can be separated from the surface of the earth. Astronomical movements and landscape landmarks constitute a holistic framework for human perception and thought. The understanding and identification of significant values in landscapes will never be complete if the sky is ignored. In this light, the sky becomes an integral part of the total environment which was perceived and utilized by human societies. The sky above is as real as the landscape around us.

In response to this growing awareness, archaeoastronomers should play a more active role in the identification, characterization, protection and management of those elements of cultural landscape which are related to the interpretations of the sky by ancient or both indigenous and scientific communities. To play this role effectively it is necessary however to broaden our view of the cultural landscape to include also the celestial vault.



Figure 1. The eastern horizon observed from the round pyramid at Cuicuilco, Mexico. City lights and skyscrapers notably affect the perception of the sunrise.



Figure 2. Round pyramid at Cuicuilco, Mexico lost within a cityscape.

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