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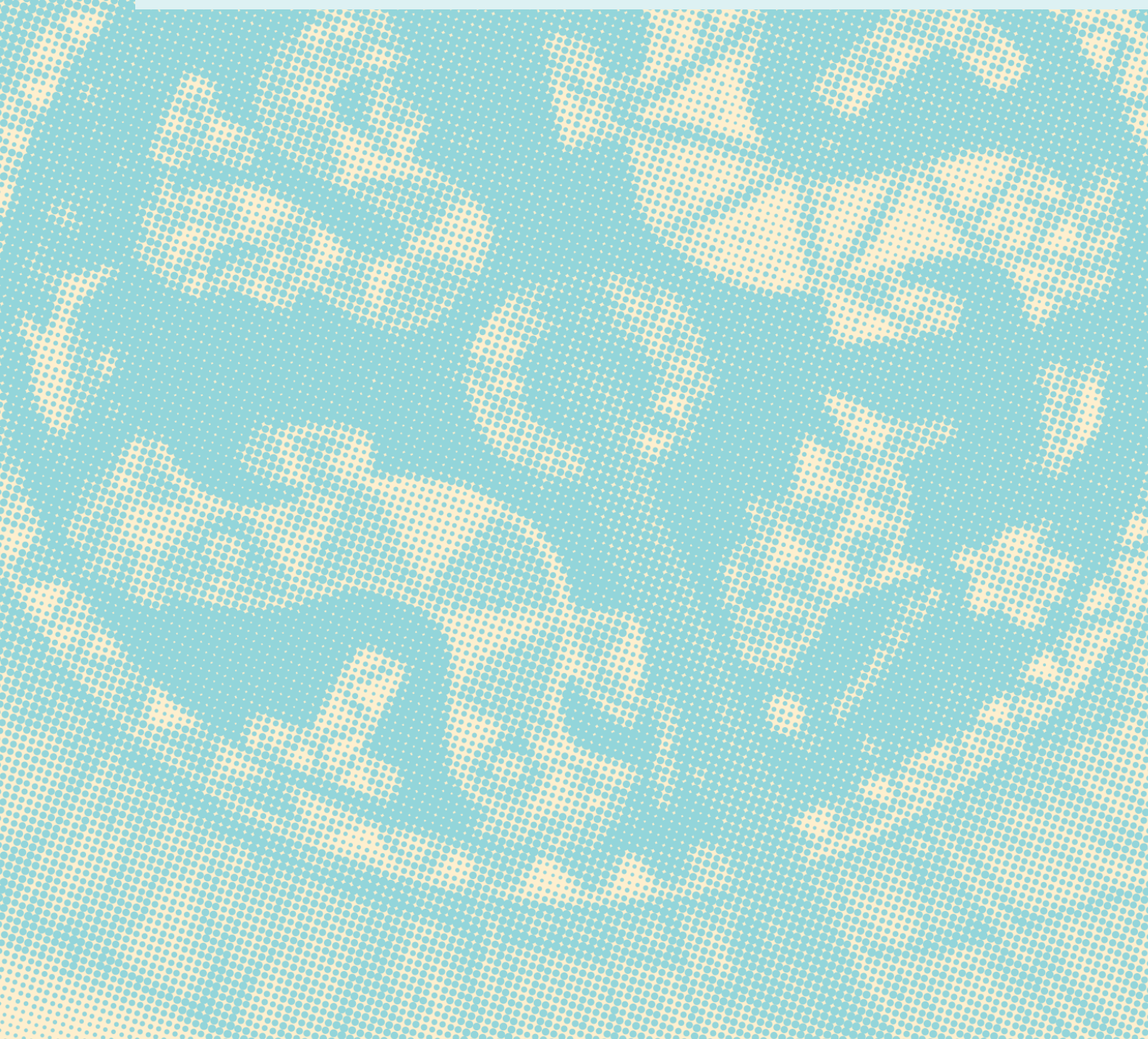

Cosmology: an Intangible Heritage Exhibition and Educational Programme at the Museum of Astronomy, Rio de Janeiro

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ABSTRACT

The intangible heritage is not easy to present in a museum exhibition, and this is perhaps especially so in the case of what the 2003 UNESCO Intangible Heritage Convention terms 'knowledge and practices concerning nature and the universe'. The Brazilian Federal Museum of Astronomy and Related Sciences (MAST), Rio de Janeiro, initiated an exhibition and educational programme on this theme for International Museums Week in 2004, focusing particularly on four very different cosmologies (i.e. narratives that attempt to explain the origin of the Universe): the Biblical story in Genesis, the contemporary scientific 'Big Bang' theory, and the creation stories of two Brazilian indigenous populations: the *Tukâno* people of the Amazon Region, and the *Guarani* of southern Brazil and some neighbouring countries. The event, called *Myths of Origin - man and his comprehension of the Universe and of the planet on which he lives,* consisted of a conceptual, sensory and educational experience whose principal objective was to challenge preconceptions while questioning also the visitors' perceptions which arise from an educational system where many of these ideas are taught as absolute truths. Following Paulo Freire's theory of learning and a non-restrictive understanding of the sciences, we chose to present the four different narratives on an equal basis and invited the visitor to explore these without preconceptions. The underlying objective was to establish a dialogue among these diverse discourses about the cosmos, which we hoped would encourage visitors to take a critical view of the sciences and the way they are interpreted in museums.

The Challenge

The Brazilian Federal Museum of Astronomy and Related Sciences (Museu de Astronomia e Ciências Afins - known as MAST), in Rio de Janeiro, founded in 1985, is based on the historic site and buildings of the National Observatory. Originally established in 1827, the Observatory developed major programmes of research and the provision of data on meteorology, astronomy, geophysics, and the measuring of national standards of time. The Observatory relocated to the present site in 1909, and with its related institutions is still based there.

MAST is centred on the original 1909 main building of the National Observatory, but also cares for the surviving historic structures, buildings, telescopes and other observation instruments no longer in use, all of which were designated as being of national cultural heritage importance by IPHAN (Instituto Brasileiro do Patrimônio Histórico e Artístico Nacional, the Brazilian Federal heritage agency) in 1986. In addition to its important museum and educational roles and conservation responsibilities in relation to the scientific collections, and the official and individual scientific archive collections and the historic monuments in its care, MAST is also designated as a national research centre devoted to the study of the history of science and of advanced science education. The regular museum displays and exhibitions aim to contribute to a better and more widespread understanding of the history of scientific policy and practice in Brazil. Therefore, since its establishment in 1985, MAST has created regular cultural and educational programmes offering visitors opportunities for individual scientific cultural improvement.[1]

MAST regularly supports the annual International Museums Day of ICOM (the International Council of Museums), which in Brazil is presented within a national Museums Week, and which offers a series of activities across the country related to each year's international theme for Museum Day. Examples of such activities at MAST have included a special exhibit and a related series of debates focusing on advances in the scientific field, or research results and discussions about a pre-selected theme. More than just a challenge, these also provide an excellent opportunity to reinforce knowledge of the work of the research teams in the history of science and in science education and communication, with the aim of breaking down stereotypes and preconceived judgments that have developed about science and its practices.

For 2004, the selected International Museums Day theme was Museums and the Intangible Cultural Heritage (otherwise known as the immaterial heritage), and at first this did not seem to be of very obvious relevance to a specialised science museum such as MAST. However, discussion eventually focused on the definitions in the recently adopted UNESCO Intangible Heritage Cultural Convention, and in particular the fourth category of *'knowledge and practices concerning nature and the universe'*.[2] With this in mind, it was decided to look at problems related to scientific theory and knowledge, especially since we consider that science (like any form of knowledge production) is a specific type of socio-cultural outcome, and hence has a distinct intangible knowledge aspect. In order to respond to the challenge presented by the week's theme, we therefore agreed to focus on the production and consumption of scientific knowledge, while not restricting this to the processes, elaborations and understanding of science in the modern academic world alone, but to include traditional views of scientific phenomena as well.

Figure 1
Front of the main Brazilian National Observatory building of 1909, Rio de Janeiro - since 1985 the headquarters of the Museum of Astronomy and Related Sciences (MAST)

Figure 2
Aerial view of part of the MAST site showing five of the historic telescope observatory buildings

Within this theme, and having regard to the central museological and educational role of MAST, different views of cosmology were adopted as the key theme upon which we would base the series of activities at MAST to mark Museum Week 2004, on the assumption that cosmology in its widest sense - covering all systems of thought, ideas and knowledge about the Cosmos - can be considered as significant parts of the intangible cultural heritage. Reflecting, among other things, recent work of the IPHAN[3] and of MAST itself, we now consider that the products and testimonies of different peoples, whether traditional or contemporary, are part of the culture of the people and of their multiple cultural-historical traditions, alongside their movable and immovable cultural assets and their artistic expressions. Equally, knowledge produced by the observation and scrutiny of nature, including mythology, technology, rituals, forms of nutrition and everything relating to the ethnic and social diversity of human beings, needs to be considered part of the cultural heritage (both tangible and intangible) of the populations or other groups concerned.

It is clear that over recent decades a broader, people-oriented rather then object-oriented, concept of the cultural heritage has become widely accepted and notably now includes the intangible cultural heritage, which, almost by definition, requires a broader intellectual awareness and an openness to new sorts of knowledge.[4] This is certainly the case with the world's wide range of cosmological narratives, whether representative of traditional knowledge systems or of modern, academically-constructed, scientific systems. In planning for MAST's involvement with the intangible heritage of views of the nature of the universe, we deliberately placed scientific and traditional cosmologies in the same epistemological category, since both are seen to represent examples of the systematic or non-systematic theories which are part of people's attempts to understand the universe.

Having adopted cosmology as our subject, we decided to present some examples of 'origin' myths, as we were convinced that from these narratives we would be able to focus on some fundamental ideas about the views on the origin of the universe, referring in particular to the point of view expressed over recent years by the Brazilian cosmologist Mario Novello, especially his argument that *'cosmology is the study of the nothingness and the processes through which it had evolved from being as such'*.[5] We also decided that we should examine theories of the origin of the universe derived from scientific knowledge of recent centuries alongside those of traditional mythology and on an equal basis without any hierarchical distinction, instead regarding them all as outcomes of different human interactions with the environment.

In order to achieve our purpose we needed to focus on one central aim: to show that curiosity, inquiry and ideas about the Cosmos exist in all human societies, past or present.[6] We therefore proposed to launch a temporary new exhibition and a multi-faceted programme of activities for the visitors for the 2004 Museums Week programme. The aim was that this should not only disseminate knowledge about myths and theories on the origin and nature of the universe, but also provide scientific information and knowledge - whether erudite or not - in order to communicate an overview about the existence and nature of the Cosmos.

In planning the exhibition, we felt certain that a four-way dialogue amongst the many and diverse discourses about the Cosmos that would give an interesting

perspective on science and how it is interpreted in museums, could be built around four cosmological models:

1. one example of contemporary scientific cosmology: the 'Big Bang' theory,
2. one religious narrative: the Biblical account of the Creation of the World in the Book of Genesis,
3. & 4: two different traditional cosmological narratives regarded as representative of Brazilian ethnic diversity: those of the *Tukâno* people of the Amazon Region, and the *Guarani* of the south of Brazil.

We decided that in order to better capture the local colour of the two indigenous narratives, these should be presented in their original languages accompanied by a Portuguese translation, and supported by selected images and indigenous music relating to each of the Brazilian cosmological representations that we had chosen. With this mixture of elements, and similar supporting material for the Big Bang and Biblical cosmologies, we created an audio-visual piece of work, on a CD-ROM, the showing of which became the centerpiece of the Museums Week special programmes. In accordance with our chosen educational strategy (discussed below), the images, sounds and narratives were deliberately not depicted in a simultaneous or linear manner, since our chief purpose was to break down stereotypes and to invite visitors to think outside of their established scholarly assumptions.

The event, called *Myths of Origin - man and his understanding of the Universe and the planet on which he lives*, which took place from 18 to 23, May 2004, provided a scientific and cultural experience of a kind that in its conceptual and museological approaches had never before been tried in MAST. Generally, MAST's educational activities focus on themes directly related to the sciences as they are today defined and presented in universities, research institutes, laboratories, museums and so on. The originality of the proposal was that it involved conceptual, sensory and educational experiences the main objective of which was to challenge established and even commonsense assumptions, and especially to question the visitors' mental models developed during their education.

Rolling the Dice

In particular, we were proposing quite new, or at least very different, 'readings', separating these from those that had long been regarded as common ground within the scientific field. Above all, the programme challenged what had, since at least the Enlightenment of the 18th century, been regarded as a commonsense, indeed fundamental, separation of science from myth: within the positivist scientific tradition science and myth have long been considered as irreconcilable. The word 'science' has become a synonym for truth, while 'myth', a Greek word meaning 'narrative', is nowadays commonly used as a synonym for 'false'. In contrast with that view, and based on a general 'gnosiological' (i.e. philosophy of cognition) perspective, we decided that we should consider science and myth as two constitutive and legitimate forms of the process of acquiring knowledge, with each of them in their own way following a particular logic and a set of historical-cultural rules.

Consequently, one the objectives in our proposal for a multimedia presentation of contrasting themes in cosmology, was to get the visiting public to re-evaluate the information they had learned from teachers in the classroom as pupils and students, from reading, or even from the bastardised versions of science presented by the media. At the same time we wanted to reflect the provisions of Article 14 of the 2003 UNESCO Intangible Heritage Convention, which deal with education, awareness-raising and capacity-building, and in particular that:

Each State Party shall endeavour, by all appropriate means, to:

(a) ensure recognition of, respect for, and enhancement of the intangible cultural heritage in society, in particular through:
(i) educational, awareness-raising and information programmes, aimed at the general public, in particular young people;
(ii) specific educational and training programmes within the communities and groups concerned;
(iii) capacity-building activities for the safeguarding of the intangible cultural heritage, in particular management and scientific research; and
(iv) non-formal means of transmitting knowledge

We therefore proposed that the exhibition: (1) should propose an open approach to cosmology, and (2) should not encourage pre-conceptions about the way we learn.

However, the main purpose was to call the attention of the public to the need to respect cultural diversity. When it comes to questions related to the Brazilian Indian nations, we are frequently confronted with cultural and historical bias. The most common idea about the Brazilian Indians is that they represent something from the past and that they did not have any ways of learning, and it was to counter this that we decided to give equal weight to each of the four scientific, mythic and religious stories about the origin of the universe that we were examining and explaining. Despite the fact that most of the Brazilian indigenous communities suffered a process of aggressive culturalisation as a means of integrating them into the dominant society, a considerable number of ethnic groups succeeded in standing up for their right to keep their ancestors' heritage.

The best example of this historic and cultural persistence are the *Guarani* people, who nowadays spread across not only the southwestern and southern states of Brazil, but also parts of Uruguay, Argentina and Paraguay, and who remain one of the most important ethnic nations in Brazil. Historically, ever since Brazil's discovery and conquest by the Portuguese in the XVIth century, the *Guarani* people have had considerable cultural interaction with the dominant European colonial, and now postcolonial, society, but they have still been able to preserve their ancient traditions.

The traditional *Guarani Mbya* account of cosmology, which we recorded live, was very succinct. The interviewee was Nhamandu Vera Mirim, a school teacher at the *Tekoa Itatim*.[7] He explained that the *Guarani* universe was created by Nhamandu by continuously expanding his divine body. They believe that what is real and perfect belongs to the divine or ideal world, that is why they consider what is visible to be only an ephemeral image (therefore subject to change, and thus considered to be only an ephemeral image, or an elusive copy, of the real world). The sky, people, plants, animals and all historic time and events are seen as imperfect images of their celestial counterparts. For the *Guarani*, true beauty and perfection are related to the invisible world, which for them is the home of the gods, a world that is not subject to change or decay, rather, it is a place of everlasting life and of true knowledge. The *Guarani* refer to this cosmic and sacred place as *Yvy Mara'ey*, the land of no evil.

The *Tukâno* Indians, who call themselves *Ye'pe Mahsã, or Dasea*, are also an example of resistance in terms of their cultural development and the preservation of their ethos. They live in the Amazon region of Brazil and are culturally and linguistically the dominant ethnic group in the area of the Rio Uaupes (Uaupes River) and its surrounding area. There they have formed a complex and unique linguistic and cultural community with other indigenous peoples in the region, reflecting historic domination patterns and economic co-operation (with several groups producing and trading goods amongst themselves), and also because of the establishment of new family relationships, especially through inter-tribal marriage. One of the outcomes of this cultural complexity is that an average adult in the region is able to speak about five languages.[8]

We interviewed a *Tukâno* teacher called Doethyró Tukâno. According to him the *Tukâno* universe was created by an entity the *Tukâno* know as 'the Grandmother of the Universe' out of the smoke of her pipe. This pipe smoke was the very substance from which the universe was formed. She also created a lineage of celestial entities called the 'thunder-beings', who, in turn, had the duty to create all other beings. The *Tukâno* heroic genealogy states that all humanity originated from a trip that the divine beings took across the Rio Negro (Black River) on a gigantic device which was part snake, part canoe. This floating device also took along with it some invisible beings who were transported in the form of crystal stones. Once those invisible beings touched land, they were immediately transformed into people from whom a diversity of ethnic groups were derived, each of them speaking a different language and displaying the cultural signs of their ethnic identities.

In between the sequence of both of these indigenous narratives, we presented first the 20th century scientific 'Big Bang' theory in a didactic manner, and then a narrated version of the Biblical account of the origin of the universe.[9] The cosmological model commonly known as the 'Big Bang' theory, was presented in a recording by the physicist Dr. Henrique Lins de Barros. In this he affirmed that the initial state of the universe was a

condensation of electromagnetic particles containing radiation with large densities and high temperatures. The universe would have originated from a single initial cosmic event which caused the disintegration of one original atomic nucleus, and it is that initial event which is generally summed up as the 'Big Bang'. The theory derives from Einstein's theory of gravitational relativity and had been well known in the scientific community since the 1920s (Einstein was the most famous scientific visitor to what is now the main MAST building, when visiting the National Observatory in 1925.). However, the Big Bang theory only became the preponderant popular late 20th century scientific model explaining the origin of the universe from the early 1970s, through the efforts of scientists such as Edwin Hubble, and the popularisation of Einstein's Theory of Relativity in the media.

In the interests of scientific precision, we must observe that, contrary to the widespread notion that a single explosion generated the universe, the 'Big Bang' theory more accurately refers to a model of a universe conceived as a structure made of matter and energy that: (a) is in constant movement and (b) does not reduce to a point of equilibrium. That means that since the universe is geometrically homogeneous, the same physical properties are displayed throughout. This depiction implies that the universe does not have one centre which would have resulted from a primal explosion, despite what is commonly published by the media. To be more precise, the well known popular expression 'Big Bang' is a metaphor for the process *by which all of space comes into homogenous existence from one single time of origin.*[10]

In the case of the presentation of the Biblical cosmology MAST's librarian Lucia Lino, as the narrator for this, chose to read the account of the six days of creation that forms the first Chapter of the Book of Genesis, describing how God created the Earth, the stars and everything else, through to *'And God saw every thing that he had made, and, behold, it was very good. And the evening and the morning were the sixth day'* in verse 31.

Making the Intangible Material

We were aware that a side effect of the methodology we had chosen was that it would be more difficult to transmit concepts and abstract theories in this way, especially when confronting the conceptual issue of the intangible heritage. Moreover, we knew that our proposition would be awkward to manage both because of its formal approach and because of the content we had selected. A few of the questions with which we would have to deal were:

(a) how to select, capture and present abstract and intellectual concepts to a diverse audience,
(b) how to explain something that is intrinsically intangible,
(c) what resources to use, and

Figure 3
An early 1920s telescope observatory building: part of MAST's historic site and collection. Photo. Luiz Carlos Borges

Figure 4
The Guarani School, Tekoa Itatim, in Paraty, Rio de Janeiro. Photo. Ana Claudia Bastos, used by permission

(d) how to define and explain concepts inextricably related to the notion of intangible heritage, while at the same time using language that would allow the public to interact actively and critically with what we were presenting to them.

These four questions presented challenges in three distinct areas in relation to our theme. The first was about methods of interpretation, the second concerned the definition of cosmology, and the third was related to the definition of intangible heritage and how to deal with this rapidly growing field of the cultural heritage, both theoretically and as a presentation in a museum setting.

The first part was a continuous public showing of a specially made CD-ROM containing images, cosmological narratives and music. This material focused on a few of the theories about the creation of the universe[11] relating to the three principal types of cosmological thinking: the religious, the scientific/philosophical and the mythical.[12] The CD-Rom was exhibited in a special location, called the 'Dark Room' - which is in fact part of MAST's long term exhibit called *Four Corners of Origin*. The Dark Room displays a graphic representation of the universe, in which the visitor finds some reproductions of the area of sky known as the 'Zodiac Zone'. The effect produced by the use of a black light in a dark atmosphere attempts to simulate for the visitors the sensation of having been transported into the centre of the universe (that is, moving from an Earth-centric view to a Cosmos-centred perspective), and challenging the geocentric perspective of most visitors. For the same reason, we thought that this particular room would fit our purposes, due both to its environmental characteristics and to its effect on the visitors' existing knowledge.

A different, more participatory, approach was adopted in a different part of the overall cosmology programme. In contrast with the four cosmologies already outlined, this placed a particular emphasis on the Graeco-Roman mythological tradition, addressing questions and answers about the solar system, planets and myths. MAST also offered some other activities related to the International Museums Day theme, although they were not directly integrated to our methodological approach. This is the case of the Observation of the Sky Programme which discussed issues related to the preservation of the sky we see. The Museum Tells a Tale was another of these activities and the stories that were told induced the audience to discuss about the preservation of immaterial heritage.

Finally, we organised a cycle of public lectures and debates in which specialists discussed specific themes in cosmology and in intangible heritage. These were: *Is it possible to consider difference as heritage?* (by Regina Abreu, Professor of the Master's Programme in Social Memory at the Federal University of the State of Rio de Janeiro/UNIRIO), *The Cosmology of the XXIst Century* (by Cesar Caretta, MAST Astronomer), *Does a Cosmological Darwinism Exist?* (by Gastão Galvão, MAST historian of science), and *Looking at the Guarani sky, or a walk on the Tapir Path* (by Luiz C. Borges, MAST historian of science).

Figure 5
The Opi (house of praying), the most important building: this is the heart, both social and religious, of any Guarani village. Photo. Ana Claudia Bastos, used by permission

Figure 6
Guarani representations of some of the constellations of their sky on the wall of a village school. Photo. Luiz Carlos Borges

Figure 7
A sky-wheel: one is found in the house of every Wayana (a group living in Amapa, north of Brazil). Photo. Luiz Carlos Borges

Figure 8
Mekaton, a ceremonial hat of the *Kapayo* of southern Para. It shows what they knew of the sky and of their mythical origins.

One important question troubled us throughout the whole process of developing the exhibit: how to define our understanding of cosmology within the emerging framework of intangible heritage studies and, most importantly, how to explain it in didactic museological language while emphasising that in considering cosmological concepts we were dealing with a type of asset whose essential characteristic is to be intangible. As part of this we began to analyse the new Brazilian federal policy which concerns the identification and drawing up of sets of inventories regarding the respect and protection of intangible cultural heritage as stated by the *Decree 3.551*, issued in August 4, 2000. This was based upon the 1989 UNESCO General Conference *Recommendation on the Safeguarding of Traditional Culture and Folklore*, which recommended Member States to institute the making of inventories of their intangible cultural heritage.

It was nevertheless necessary to consider some conceptual and practical problems that arose. These included (1) defining what cultural heritage is and for whom an object is defined as 'cultural' and as 'heritage', (2) distinguishing between material and immaterial heritage, since in many cases such a distinction just does not seem to apply, and (3) how to define what is 'traditional' and for whom this applies, particularly as the Intangible Heritage Convention's Operational Guidelines, policies and precedents are still under discussion and negotiation. The anthropologist Regina Abreu, whose studies focus mainly on heritage, proposes a definition which, though we accept it is provisional, helped us to relate different systems used for the production of knowledge to each other. According to this author, when looking for traditional knowledge we need to understand the types of knowledge that are *defined as innovations and creations from the traditional base, resulting in intellectual activity* from communities which are *producers of singular, specific and unique knowledge.*[13]

With respect to the intrinsic material aspects or associations of expressions of the intangible heritage, there were some important issues we needed to consider. Firstly, there is the assertion that *what is subject to preservation as cultural heritage are not the objects, but their meanings and interpretations.*[14] Secondly, as Patrick Boylan shows, over the centuries the traditional concern of most museums and national laws and policies has been to emphasise the material or tangible aspects of the cultural heritage rather than the intangible aspects of it.[15] What worried us is what we saw as a bureaucratic perspective which largely ignored the associated immaterial qualities and values - as may be deduced from statements such as: *'museums have yet to consider questions that lies behind the materiality of objects'.*[16] The principal focus of official heritage policies places the emphasis upon identification, inventory, protection and preservation of those organised cultural elements arbitrarily classified as 'heritage'. If this is the core of heritage policies, we should then ask ourselves what lies behind this over-emphasis on the material, and consequently on what parts of cultural heritage should continue to be preserved?

In respect of temporal factors, contrary to Oliven's claim[17] we believe that the idea of heritage is not defined

by the past, but precisely by what exists in the present, even allowing that, as an historical construction, all heritage has strong specific socio-cultural characteristics due to its construction and the institutionalising of social memory. We agree with the Greek-born philosopher Cornelius Castoriadis (1922-1997) when he states that heritage can only be defined *'to the extent that it relates concomitantly to the social institution and to other heritage to which it is similar'*, that is, when it co-exists and co-operates diachronically and synchronously with all others aspects of heritage and society. To summarize, in order to exist as heritage, it is necessary that any object or process lends itself to representation. In other words, to be classed as heritage, an object must become institutionalised in the socio-historical memory; it has to become a part of the *'imaginary social meanings to which it belongs'.*[18] In Boylan's words, any policy concerning heritage must take into account *'the need to understand the interactions between communities' development and the processes which originated from communities' efforts'.*[19]

In any case, besides all the questions about heritage, we still had to deal with another very elusive issue: the definition of cosmology. This proved to be a challenging task, firstly because of the implications of our approach in the face of the nature of the development of scientific knowledge, and secondly, as Mario Novello[20] would argue, because the epistemological realm of cosmology finds itself in the middle of a dispute for hegemony among various domains of science. We were, however, concerned mainly with finding an appropriate type of museum presentation, and were attempting to create a design flexible enough to cover all the mythological/cosmological theories found in a range of cultural traditions. For us, a generic definition such as *cosmology is the study of the nothingness and of the processes through which it has evolved from being as such*[21] would suffice.

Within the aims and scope of our project, we therefore defined cosmology as a specific field of knowledge whose analytical framework consists of a systematic, though heterogeneous, body of statements, based on observation and expertise, which convey a series of explanations - each of them claiming to be true - for the intrinsically problematic question of the origin of the universe. This definition also included the formation, creation and expansion of the space-time dimension, of all celestial entities and objects, as well as all the origin narratives that attempt to explain this phenomenon. It was beyond the scope of our project to discuss the deeper theoretical issues, whether philosophical or physical, raised by the above statement (such as defining 'nothingness', or the scope and boundaries of the cosmologic field).

Again, it is in Novello's work that we find the key reference to justify the reasons why we decided to present different types of knowledge about the origins of the universe in a non-hierarchical format. According to him, a cosmologist is someone whose eyes, while scrutinising the world, try to capture the whole in a way that recognises as legitimate the diverse models which, throughout time and despite different types of socio-cultural development, have attempted to explain the origin and meaning of the universe. We were well aware that there were both scientific and political tensions in trying to link these ideas, as Pierre Bourdieu[22] clearly demonstrates. Furthermore, we had to bear in mind that all bodies of knowledge are engaged in a permanent struggle for supremacy against all other bodies of knowledge. As a result, to try to discredit other bodies of knowledge became a common strategy in the scientific field.[23]

The Exhibit the Visitors See

After having been exposed to the mythological cosmologies presented in the Dark Room, the visitors passed on to another activity called *Myths of the Solar System*, which was developed specially for a more scholarly audience. The idea behind this exhibit was simple and clear. It consisted of a brief introduction to Graeco-Roman mythology, following which participants were invited to choose a number between one and eleven. The number chosen was then linked to a question about a divinity from this mythology. One of the astronomers from MAST had produced a list of the names of the planets of the solar system along with a brief narrative to describe the relationship between the planets and the mythical entities after whom they were named. While the questions were simple, they still caused some controversy. After the visitors had given their responses, a PowerPoint presentation was given about each planet and its corresponding mythological history. During the discussion, many other parallel questions came up, and it is not surprising that astronomy generally excites people's imagination.

When we analysed the responses to visitor questionnaires about the content of the CD-ROM we came across mixed results. Some teachers appreciated the sequence of the theories presented alongside the images and said that they planned on investigating the subject further themselves. They also said they wished they had touched upon these issues with their students before bringing them to the museum. Others were more interested in the content of the narratives and wanted to learn more so that they could relay the information to their students. Some others, on the other hand, did not appreciate or understand the idea behind not associating the images with the sounds[24] - for example *'the pictures had nothing to do with the narratives,* or *the indigenous music is boring'*. Students between the ages of 12 and 14 seemed to be the ones who mostly enjoyed the general context of the activities. Some said they had really appreciated the images, drawings[25] and the way the origin of the universe was explained. Others in the same age group preferred the images of the stars. Some students, when asked which cosmological theory they thought was most interesting, replied '*the Tukâno one*'.

The gallery supervisors in the exhibition space observed that 7th and 8th grade students showed considerable interest in the Graeco-Roman mythology, and some students (mostly between the ages of 13-14) demonstrated that they had some previous interest in, and knowledge of, this subject. The opposite occurred with the older high school students who showed very little interest in the exhibit or in the questions, with the result that there was little participation by those in this group. Their responses proved that the activities planned, and the methodology used, were not stimulating and interesting enough to capture the attention and interest of these older students. To paraphrase Paulo Freire, we would say that what we offered was not sufficiently significant for those visitors: we did not manage to engage them in the theme or in its further development.

The final activity within the planned programme consisted of a cycle of debates in which specialists discussed themes related to cosmological theories and intangible heritage. Having a more specific theme, these attracted a smaller, more specialised, audience, but heated debates resulted. In response the museum's researchers and other participating institutions proposed a continuing dialogue on the issues raised, giving rise to new scientific partnerships.

When planning for MAST's future exhibits, and taking into account the feedback from the 2004 programme about the intangible heritage and cosmology, the public's reaction has encouraged us to reflect on our presentation as an educational project and product. After an internal debriefing and review, we realised, for example, that, contrary to our expectations, our chosen primary focus on 'local colour' (such as keeping narratives in their native languages, with or without translation) in fact proved to be misleading. Our deliberately non-hierarchical and non-linear narrative was intended to serve as a means to question the visitor's preconceived knowledge, but in fact it seemed that the audience did not fully understand the content of the exhibit as it was designed. Hence this approach made the overall understanding of our chosen theme and its presentation even more difficult for the general visitor.

Figure 9
Part of the Dark Room (Cosmocentric System) exhibition, showing some Zodiac constellations

Figure 10
Part of the White Room (Geocentric System). The frieze above shows paintings of the planetary system as it was understood in the Middle Ages, while below there are paintings of the seasons and monthly activities, (all reproduced from illustrations in the Les tres riches heures du Duc de Berry)

Educational Context

As previously stated, we had wanted to present our material in a non-linear, non-hierarchical form as a means of questioning, or even better, challenging, the supremacy of traditional teaching methods in order to show that, in epistemological terms, one culture or one type of knowledge does not invalidate any other one. With this presentational strategy, we had hoped that the audience would be able to avoid sterile cultural comparisons. However, as we pointed out earlier, this general expectation was not entirely fulfilled.

The main reason for this concerns the institutionalization of a mental model which is partially based on a general assumption, which is repeatedly reinforced by school textbooks and by the media, that the universe is homogeneous, and this gives rise to a legitimising discourse that is based on the authority and competence of science, the objective of which is to safeguard the mathematical modelling of the universe as rational, analysable and classifiable.[26] In respect of the interpretative approach of our project - particularly the type of teaching methods used in the museum - we followed, although not explicitly, some of the educational theory of the Brazilian educator and philosopher of education, Paulo Freire (1921-1997),[27] which contrasts strongly with traditional teaching methods. This reflected the relationship between MAST and the formal education network (both public and private). Statistically, 60% of MAST's visitors are students, so these are the main target of MAST's exhibits. This approach is reinforced by the fact that MAST is an international specialist in science educational programmes in informal spaces and therefore seeks to explore the possibilities and limits of less formal science education.[28]

Drawing on a wide range of sources and influences, from Plato, Rousseau, Dewey and Alfred North Whitehead, through Marxism and modern anti-colonialist thought, Freire criticised what he termed 'banking' approaches to education, in which he claimed the student's mind is regarded as little more than an empty space waiting to be filled by the teacher. He also rejected the traditional student/teacher divide, and instead argued for a truly democratic form of education, in which it is necessary to aim for a reciprocal teacher-student and a student-teacher relationship, with a classroom interaction and participation based on the teacher and the student learning from each other. The educational process, Freire argued, should therefore be a means for self-liberation, allowing individuals to establish a critical dialogue with what is transmitted to them, as a prerequisite to a conscientious and committed understanding of reality.

In order to be effective and significant, in this sort of learning the individuals - in our case the student-visitors -, have to contribute themselves to the process, using their own prior knowledge. Consequently, this calls for an exhibition concept and educational process which are based on problem-solving and which draw on existing scientific and socio-historical knowledge and avoid

Figure 11
Interactive exhibit in the Astronomy exhibition showing the sky as seen from the southern hemisphere

Figure 12
The starting point of the outdoor exhibition on the Solar System

Figure 13
Students studying the unit on the Sun in the outdoor exhibition

sectarianism, while regarding a critical consciousness as an educational precondition that enables us to grasp our socio-historic reality in order to demystify it.

The design of the exhibit was therefore intended to simultaneously (1) provoke the visitors' mental models regarding science and its relations to other spiritual fields, (2) lead to new forms of understanding as a means to individual improvement, and (3) in relation to the presentations of the two traditional cosmologies, to stimulate discussion about the treatment of the Brazilian Indian nations, especially in school textbooks, in order to reverse the biased image which has traditionally been presented of these peoples.

Few Objects, Endless Implications

As mentioned earlier, the various categories of visitors responded to the activities to which they were exposed in different ways. Those still in formal education were the main target audience of the activities that took place in the Dark Room. The same goal motivated the didactic discussions we called *Myths of the Solar System*. While a qualitative analysis of the Dark Room activity was only possible after examining individual questionnaire responses after the visit, within the public debates there was a great deal of interaction, so we could see immediately whether or not our proposal had been successful.

The cosmological theories theme in the Dark Room had only a partial approval rate from the visitors. On the positive side the sequence of the narratives (Biblical, *Guarani*, Academic/Scientific and *Tukâno*), and their random visual and sound representations (meaning that there was no obvious or immediate connection between the narratives and the audiovisual effects), certainly had the impact which we had hoped for. In general, the public reacted somewhat awkwardly to what was shown to them. However, at the same time the typical reaction supported our supposition that the most commonly used model of knowledge communication, regularly encountered in schools, tends to present knowledge in a uniform manner, and acts as a mechanism to erase those variations and differences which are in fact central to reality. We had deliberately arranged the exhibit so that the images did not correspond to the sounds (narrative and music), and observed that visitors who were unfamiliar with, or had not previously been exposed to, this type of presentation had much more difficulty in understanding the content.

However, the interest that the four contrasting cosmologies project generated overall in the general audience suggests that MAST could continue with to explore this theme. There are other indigenous cosmologies across Brazil that deserve further investigation, and which would certainly provide interesting information, not only increasing our knowledge of different approaches to cosmology, but would also allow us to have a better understanding of the general cultural development of Brazil as a nation, and, in particular, of the history of the development of science. MAST's new long term exhibit, which is now in the planning stage, will also deal with aspects of archaeo-astronomic evidence in Brazil, and with some ethno-astronomic systems as well.

In conclusion, we evaluated the experience as having been a successful one overall, despite the somewhat negative responses to some aspects of it. We were particularly pleased that the very experimental and risky non-hierarchic presentation of cosmological myths in the Dark Room, together with the audiovisual effects and the presentation we had created, had the impact we had intended. The approach often provoked some initial discomfort among many of the visitors and led to further questioning. We believe that having initially shaken up both students and teachers by challenging their confidence in both their existing preconceptions about traditional knowledge, the exhibition achieved one of its purposes in questioning traditional approaches, not only to cosmology but to the way the subject is taught in schools.

MAST's experiment in presenting the intangible heritage in terms of cosmological traditions was both theoretically and practically stimulating. The intangible heritage is in fact quite difficult to present in exhibition terms. In this case there was no established formula or museographic pattern to follow, but each new attempt of this kind will certainly lead to our finding new approaches and new ways to reduce intangible heritage to some sort of narrative form. Insofar as scientific statements are not entirely reliable, the same may be said about intangible heritage. According to John Ziman, there is nothing in the human cognitive apparatus that can protect us from making mistakes or from uncertainty.[29] Final results, as it seems, often, if not always, fall short of the designer's and/or the audience's expectations.

Another lesson we all learned from these activities was that while throughout the course of history several questions repeat themselves, they endlessly present new and challenging responses within different strands of meaning. There is some consolation in this: we need to realise that however many questions we ask about the existence and nature of the Universe, and the more answers emerge, there will always be an infinity of new questions that will remain unanswered.

NOTES

1. Valente, M.E. 2005. O museu de ciencia: espaco da Historia da Ciencia. *Ciência e Eduçãco*, 11.1, pp. 53-62.
2. UNESCO *Convention for the Safeguarding of the Intangible Cultural Heritage*, Paris, 17 October 2003. Article 2: Definitions: para. 2(d).
3. Instituto do Patrimonio Historico e Artistico Nacional (Brasil), 2004. *Cartas Patrimoniais*, Rio de Janeiro, IPHAN.
4. Boylan, P.J. 2006. The intangible heritage: a challenge and an opportunity for museums and museums professional training. *International Journal of Intangible Heritage*, 1, pp. 53-65.
5. Novello, M. 2006. *O que e cosmologia? A revolucao do pensamento cosmologico,* Rio de Janeiro, Jorge Zahar.
6. Sanches, M.A. 2006. Uma perspectiva mitologica. *Scientific American Brasil*, special issue on Historia - O homem em busca das origens, 7 (2006) , pp. 9-15.
7. The *Guarani* Indians are distributed across six states in Brazil and there are about 34,000 Guarani living in the Brazilian territory. The *Tekoa Itatim* (Village of the White Stone), where we performed our recording, is near the historical city of Paraty, in Rio de Janeiro. We thank all the *Guarani,* especially Professor Nhamandu Vera Mirim, who contributed to the success of our work. For further information on *Guarani* myth-cosmology see Borges, L.C. 1999. *A fala instituinte do discurso mitico guarani mbyá*. PhD Thesis: Programa de Pos-Graduacao em Linguistica/Instituto de Estudos da Linguagem, Unicamp, Campinas.
8. The Uaupes River runs across the northwest area of the State of Amazon and is part of the Rio Negro cultural zone. The *Tukâno* myth-cosmology is based on the divine power of transformation: the smoke of the pipe is transformed into the cosmos, as well as the invisible beings who turn into ethnic groups. Doethyro Tukano was employee at the Indian Museum, to whom we are very grateful. There about 4,000 Tukano individuals living in Brazil. According to FUNAI (Fundacao Nacional do Indio, the Federal Brazilian agency for Indian affairs) there are about 225 different Indian societies and a little more than 180 different languages in Brazil for an indigenous population of about 600,000 people. For further information on the ethnic groups and the indigenous Brazilian languages and knowledge, see, among others, Cunha, M.C. da (editor), 1992. *História dos indios no Brasil*, Sao Paulo, Companhia das Letras/Secretaria Municipal de Cultura/Fapesp; Ribeiro, B. 'Os indios das aguas pretas' in Kumu, U.P and Kenhiri, T. 1980. *Antes o mundo não existia*, Sao Paulo, Livraria Cultura Ed., pp. 7-46; Ribeiro, D. 1986. *Os índios e a civilização*, Petropolis, Vozes; Rodrigues, A.D.'I. 1986. *Línguas brasileiras. Para o conhecimento das línguas indígenas*, Sao Paulo, Loyola and Museu do Indio/Funai, 2005. *Vocabulário Básico de Línguas Indígenas do Brasil*, (CD-Rom); Borges, L.C. and Gondim, L. 2003. *O saber no mito*. Conhecimento e inventividade indigenas, Rio de Janeiro, Teatral Ed.
9. The 'Big Bang' theory was narrated by Henrique Lins de Barros, physicist and researcher at the Centro Brasileiro de Pesquisas Fisicas/CBPF (Brazilian Centre for Research in Physics). The Bible narrative was recorded by Lucia Lino, librarian at MAST. We are grateful for their kind cooperation.
10. Novello, op. cit. (see note 5) p. 119.
11. We wish to thank our colleagues at MAST Lucy Mary Guimaraes, who produced the CD-ROM, and Jose Ferreira, who edited the sound track and, during the event, operated the playback equipment in the Dark Room.
12. Since those three fields produce myth-cosmologies, the differentiation among them is merely formal and didactic. The reason why we decided to present them separately was due to our intention to show that they are all connected to the endless human speculation about the origin of all that exists.

13. Abreu, R. A emergencia do patrimonio genetico e a nova configuracao no campo do patrimonio in Abreu, R. and Chagas, M. (editors), 2003. *Memória e patrimônio: ensaios contemporâneos*, Rio de Janeiro, DP&A Editora Ltda, pp. 30-45.
14. Chagas, M. O pai de macunaima e o patrimonio espiritual in Abreu, R.and Chagas, M. (editors), 2003. op. cit. pp. 95-108.
15. Boylan, op. cit. (see note 4 above).
16. Valente, op. cit. (see note 1 above), p. 55.
17. Oliven, R.J. Patrimonio intangivel: consideracoes inicais in Abreu, R.and Chagas, M. 2003. op. cit. pp. 77-80.
18. Castoriadis, C. A psicanalise, projeto e elucidacao, in Castoriadis, C. 1987. *As encruzilhadas do labirinto/1*, Rio de Janeiro, Paz e Terra, pp. 70-131.
19. Boylan, op. cit. (see note 4 above), p. 62.
20. Novello, op. cit. For more information see also Martins, R. de A. 2005. *O universo. Teorias sobre sua origem e evolução,* Campinas, Unicamp. Available at (http://www.ifi.unicamp.br/~ghtc/Universo/html). Accessed (15/04/2007); and Veneziano, G. 2004. O enigma sobre o inicio do tempo. *Scientific American Brasil*, 3.25, pp. 40-49.
21. Novello, op. cit., p. 60.
22. Bourdieu, P. O campo cientifico in Ortiz, R. (editor), 1983. *Pierre Bourdieu: sociologia*, São Paulo, Ática, (Grandes cientistas sociais, 39); Bourdieu, P. 2003. A economia das trocas simbolicas, Sao Paulo, Perspectiva; Bourdieu, P. 2004. *Os usos sociais da ciencia. Por uma sociologia do campo científico*, Sao Paulo, Unesp.
23. See for example Borges, L.C. 2004. De teoria a mito: competencia e legitimacao cientificas in XI *Encontro Regional de História da ANPUH-RJ - Democracia e Conflito*, Rio de Janeiro, ANPUH-RJ/UERJ, pp. 53-54.
24. The sound track consisted of a mixture of music, chants and diverse spontaneous utterances.
25. A great many of the images were displayed on the CD-ROM, but only the drawings were made by the Indians.
26. Dingle, H. 2005. Aristotelismo moderno, *Scientiae Studia*, 3.2, pp. 249-255.
27. Freire, P. 1983. *Educação e mudanca*, Rio de Janeiro, Paz e Terra; Freire, P. 1985. *Educação como pratica da liberdade,* Rio de Janeiro, Paz e Terra; and Freire, P. 1987. *Pedagogia do oprimido*, Rio de Janeiro, Paz e Terra.
28. Falcão, D., Colinvaux, D., Krapas, S., Queiroz, G., Alves, F., Cazelli, S., Valente, M.E. and Gouvea, G. 2004. A model-based approach to science exhibitions evaluation: a case study in a Brazilian astronomy museum. *International Journal of Science Education*, 26.8, pp. 951-978; see also Valente, op. cit.
29. Ziman, J. 1996. *O conhecimento confiável. Uma exploração dos fundamentos para a crença na ciência*, Campinas, Papirus, (Original English title: *Reliable knowledge. An exploration of the grounds for belief in science,* 1978. Cambridge University Press).