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Museographic Transposition: discussing scholarly knowledge of Biodiversity in the organization of museum exhibitions

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The aim of this article is to address present issues concerning the characteristics of scholarly knowledge on the concept of biodiversity in the organization of science museum exhibitions. It is part of a major (master's) study that analyses the changes this concept undergoes in the transformation from the scientific field to the museum; more specifically to diorama type exhibitions. In this paper, we show that themes, such as that of biodiversity, challenges the unambiguity of scholarly knowledge by unveiling its heterogeneity; a heterogeneity that in turn is influenced by both scientific and social aspects. To demonstrate how we establish the relationship between biodiversity, science museums and dioramas we will briefly present the polysemy of the concept of biodiversity and how from a historic point-of-view, life diversity has been exhibited in museums especially with the use of dioramas, which are considered display pieces with an educational role. We will also address aspects relating to processes of museum transposition, i.e., museographic transposition and an analysis of dioramas as a praxeology.

Este artículo tiene como objetivo abordar los cuestionamientos presentes en la caracterización del saber sábio, revelando su heterogeneidad sobre el concepto de biodiversidad en la elaboración de exposiciones de museos de ciencias. Para compreender como se estabelece la relación biodiversidad – museos de ciencias – dioramas, presentamos brevemente los aspectos pertienentes a la polisemía del concepto de biodiversidad y de como, desde el punto de vista histórico, la diversidad de la vida viene siendo expuesta en museos, en especial por dioramas, considerados aparatos expositivos con un papel educativo significativo. Abordaremos, también, aspectos relacionados a los procesos de transposición en museos, la transposición museográfica y un análisis de los dioramas como praxeología

Method

We studied dioramas in two museums: the Natural History Museum of Capão da Imbuia/PR and the Museum of Sciences and Technology of PUC/RS. We carried out a qualitative survey in which data were collected from semi-structured interviews with scientists who study biodiversity and from the analysis of extracts from books and manuals that treat the theme of biodiversity. Here, the aim was to map the scholarly knowledge on biodiversity. We also interviewed exhibition staff at each museum we studied to collect information on the production process of dioramas. Finally, we studied the dioramas in the two museums and analysed the official documents of the institutions. The categories for analysis were constructed from the collected data on the basis of theoretical considerations of biodiversity and the theory of museographic transposition.

The main focus of this article is the status of the scholarly knowledge. Therefore, from the data collected in our investigative universe we will focus only on the interviews conducted with scientists that study biodiversity and books and manuals that define the concept[1]. The texts chosen are widely used in academia – they are scientific and also for dissemination. Our research of these materials shows that when authors define biodiversity they often characterise its structure in *organizational levels*, and discuss which *values* may be assigned to the concept when addressing it. These aspects were used as a guide for us to prepare the categories of analysis which are divided into two major axes: biodiversity organizational levels – genetic, species and ecosystem diversity, and biodiversity values – economic, ecological and conservationist values. Three researchers from the Institute of Biosciences of the University of São Paulo (USP), who were chosen from different departments: genetics, ecology and botany, were interviewed. The choice of subjects from different areas of biology was intended to enrich the investigation of how biodiversity is studied and interpreted in the scientific and academic spheres.

Based on the data we produced on how biodiversity is presented and discussed in the scientific and academic fields, we noted peculiarities of what refers to the conception of scholarly knowledge found in the theory of didactic transposition.

Biodiversity and Natural History Museums

Due to the long-time and wide use of the term biodiversity, it has become imprecise as a concept within the scientific community, in particular in biology. Since its origin, the definition of biodiversity has been a focus of discussion in scientific scope and the term

[1]GASTON, K. J. 1996; LÉVÊQUE, 1999; PRIMACK, R. B. & RODRIGUES. E. 2001; RAVEN, P. 1992; WILSON, E. O. 1997.

amplified its impact as a resulting from the *Rio – 92* meeting held in Brazil. In that meeting, the "Convention on Biological Diversity" or CBD was ratified and recognized as the first world agreement aimed at sustainable use of all biodiversity components. In Oliveira's opinion (2005, p.43), the meeting "represented a dividing of the waters and enabled a widening the meaning of the term which went on to be used in other social, political, and economic contexts".

Although there is agreement on the meaning of the term biodiversity, we still do not have a consensus on its use among biologists (Motokane, 2005). Corroborating this idea, Gaston (1996) goes a little bit further, pointing out the unlikelihood of assigning the term a common denominator. Weelie & Walls (2002) are categorical when they say that biodiversity is an ill-defined concept, unable to offer a simple or universally applicable definition of the term. They go on to say that it is not difficult to find scientific, political or symbolic meanings all being used by the same person. Oliveira (2005), in turn, attributes this condition to the wider function the concept has, as there is not consensus in the different contexts in which it is used. In his analysis of the conceptions of biodiversity by teachers from different levels (elementary, secondary, and higher education) it was seen that a teacher's construction of a biodiversity concept is strongly related to the context and the teacher's own references.

The non-conformity in the field of biology mentioned in the works above, together with the popularization of the term seen after the CBD demonstrates how wide the concept of biodiversity is, and that it is not exclusive to biology and even less so to science. Although it originated from the concern with environmental changes that arose in the field of biology, we cannot deny the magnitude of the concept in society. However, in determining how precise it is as a concept we can only agree with Gaston (1996), who states that terminology mainly serves as a convenient human construction.

This adoption of concepts by actors outside the scientific context is a recurring event; however working with concepts outside this scope seems to be more and more challenging and at the same time necessary at different educational levels. At present, some concepts such as that of stem cells are being discussed beyond the academic environment such as in schools, in the media and at exhibitions. The term biodiversity was inflated and presently goes beyond scientific limits with new meanings being incorporated which in turn have demanded new educational strategies from the places that intend to use it as a tool of articulation in education for science.

In light of the specific characteristics that the concept of biodiversity assumes in the different contexts where it circulates, we must understand how the changes it undergoes are processed because it is a widely used term both in academia and in communication and education. In order to map how the concept changes, the aim of this study is to analyse how science and non-formal scientific and educational spaces work with the theme of biodiversity.

Museums, in particular those of natural history, from the beginning established a relationship with the diversity of life on the planet. In addition, from the beginning, museums have enabled contact between the public and the wealth of their collections and exhibitions. This legacy originated in private collections of noble Europeans in the 16th century. Having no scientific purpose at that time, these collections represented social status for those who owned them. Another value given to them was to be able to appreciate all the richness that God had put on earth to the benefit of mankind. These collections, formed by samples of plants, animals and historic objects, later formed the basis of the famous Cabinets of Curiosities whose goal was to exhibit all "things in the world". The 17th century was marked by great expeditions and with there was a significant increase in the collections of animals and plants leading to the construction of buildings intended to house them (Bragança Gil, 1988; Merhoff, 1997). The development of Natural History as a science in the 18th and 19th century led to the construction of various museums around the world with a view to safeguarding life diversity by means of their collections. Up to this moment the collection was also an exhibition – there was no distinction between them.

Natural history museums were virtually the first places to register and document life diversity. Mehrhoff (1997) points out that these places constitute important documents of the diversity that has existed on the planet, as large parts of what we currently know originate here. Further, museums continue to provide new information because they continue to receive new specimens and have species classified in their collections. Mehrhoff further states that the real value of collections lies in the fact that they represent irreplaceable knowledge on life diversity, a document of biodiversity in time and space, and to preserve them will help us to understand the richness of life on earth.

In Mehrhoff's opinion (1997), rather than seeking to promote such understanding, museums should seek with their exhibitions to arouse people's interest in biodiversity. In our opinion, this is the major challenge that is faced today not only by natural history museums but by any museum that proposes to exhibit biodiversity. Museums are structured and organized to combine their needs as research institutions with establishing a space of relationship with the public via exhibitions. This clear intention of the best possible public education brought to museums new professionals and consequently new and different interests in developing exhibitions with themes as comprehensive as that of biodiversity.

An example of how a new scientific trend is reflected in natural history museums in this novel structure is the consolidation which took place in the 20th century of ecology as a scientific procedure. According to Van Präet (1989), at that time studies relating to a species no longer focused on the organism per se, but on its relation with the environment. In order to exhibit this complexity, museums used new resources such as dioramas in order to exhibit to the public a representation of nature, including among

other aspects new values such as conservation and biological relations that went beyond the diversity of organisms (Van Präet, 1989). In the present survey, we analysed these objects as important milestones in the change of natural history museums into educational places in which the intention of teaching and divulging biological concepts was materialized.

Dioramas: a brief history and its educational potential

The term diorama comes from the Greek with *dia* meaning "through" and *"horama*" "to see". It emerged in the theatre in the early 1800's when theatre professionals built sceneries with a translucent structures in order to create greater realism or include more details to the production. Its migration to museums originated in the need to exhibit a representation of the natural environment to visitors. This need was resulted from the increased focus on ecology in the scientific environment as discussed in the preceding. However, in order for the diorama to become a viable museum exhibition tool, a convergence of factors that would enable its success was necessary, such as a specialization of taxidermists and painters geared to the construction of these devices. In short, the emergence of dioramas brought to museums a mixture of professionals with new profiles for a new way of exhibiting in detail the richness of life and complexity of the environments that science was studying.

Since then, dioramas have been widely disseminated in museums and as a result have been attributed different definitions. The literature that seeks to define dioramas likens them to the idea of representation (Lurie, 1983; Shon, 1987; Asensio & Pol, 1996; Ash, 2004; Breslof, 2005). We also point out that for some authors this representation includes the real object, the proper specimen, whereas for others this aspect is not so evident; however, they all underscore the importance of the scale of the objects that are presented in their real size.

Regarding the impact on the public, writers point out that in addition to an environmental representation, dioramas played an important role in reminding the public to preserve nature as well as enabling contact with the environment that perhaps many of these people have never come across.(Ash, 2004; Breslof, 2005; Quinn, 2008).

The intention to reach people is a strong indication of use of dioramas as educational objects in museums. In Ash's opinion (2004), the intention to educate people all over the world is the main motivation for existence of these resources.

> *Learners are encouraged by dioramas to observe, point at, seek more information and raise questions. As they start to link their own experiences lived with the artefacts in the dioramas, they can personalize concepts such as*

> *conservation of habitats and species. All this through observations, questions, explanations and other processes.* (Ash, 2004, p.84-85)

In Ash's opinion, dioramas promote an interactivity of visitors with the scientific aspects involved because according to her the behaviour of an observer is similar to how a naturalist observes a new environment. Quinn (2008) corroborates this view in his comment about the proximity of a diorama with the natural environment and what this may arouse in visitors. In Quinn's (2008, p. 1) opinion this potential is the result of the exactness with which a diorama represents an environment. "This is possible because dioramas bring more faithful representations than zoos, for example, they re-create the space where organisms are found more precisely".

However, authors like Van Praet (1989), bring up some aspects that put dioramas in another perspective. In his opinion, the ecological conceptions that the public may construct when they observe a diorama are much closer to those of the exhibition developers than those of scientists.

As described in the preceding, the intention of educating visitors through dioramas is ubiquitous. However, in the present study we observed that although they appear to be static objects, some visitors believe that dioramas are interactive, reinforcing even further their educational role. This characteristic is believed to lie in the potential to transpose and/or "take" the visitor to the natural environment reproduced there. The combination of scientific and artistic knowledge aiming at giving greater relevance to dioramas is also a strong indication that this exhibition form was conceived for educational purposes. The question whether dioramas reflect what science produces, or whether they are only recreations to entertain and educate the public reinforces even further how important they are for museums, and for us are a significant indication of the educational intention behind them. From this perspective, it is important to analyze the didactic transposition process of scientific knowledge into the knowledge mediated by museum exhibitions especially in the development of dioramas.

Didactic transposition in museums or museographic transposition

In her doctoral dissertation, Marandino (2001) studied the issue of transformation and production of knowledge in non-formal educational spaces such as museums. In continuation of this investigation theme, she has developed other works with the aim of consolidating the idea that these educational spaces have their own epistemology for production of knowledge in the field of education (Marandino, 2004; 2006).

In a literature review informing her study, Marandino (2001) showed that some authors acknowledged the presence of didactic transposition in museums, although none of them analysed the transposition processes to the extent that Yves Chevallard (1991) did in school contexts. Simonneaux & Jacobi (1997), using Chevallard's work (1985),

proposed the term museographic transposition in their study of the production of posters at a biotechnology exhibition. Here, the authors conducted a formative evaluation of a biotechnology exhibition and showed that the museographic transposition is a process that involves different elements such as space, language, concepts and texts.

Asensio & Pol (1999) described exhibit transposition as the complex adequacy whereby scientific knowledge goes on to be exhibited and received by the public at an exhibition. The authors clearly state that when studying didactical transposition in museums, it is important to take into account the characteristics of these locations because they are distinct from schools.

Marandino (2001) concluded that scientific knowledge is just one of the various types of knowledge involved in the construction of science museum exhibitions. She further states that organizing exhibitions is a game of power between the various types of knowledge involved in the production where some are legitimate and others are not.

Another study that addresses transposition of scientific knowledge in museums is that of Sousa *et al.* (2002). The aim of this research was to investigate the transposition of scientific knowledge for two exhibitions at the Museum of Astronomy and Related Sciences (Museu de Astronomia e Ciências Afins [MAST]). The authors were guided by the following questions: What are the steps in the process of museographic transposition? How do we establish the relationship between knowledge to be mediated and the communicational resources in the process of museographic transposition? The authors recorded how selected concepts were treated in the scientific reference knowledge and also how these concepts were exhibited. In addition, they studied the observations made by families who visited the exhibitions and conducted interviews with them.

In light of the preceding discussion of knowledge transformation in exhibition development, we asked ourselves what led to the belief that dioramas undergo transposition process? At first, as shown, it was clear that dioramas are used as educational tools in museums. The history of the museums reveals the educational rationale for introducing dioramas in exhibitions: as a way to contextualize the organisms and the environment and facilitate the comprehension of the biological information to the public (Van-Präet, 1989).

Using the anthropological theory of didactics as reference to understand a diorama as an educational tool, one could say that this object has a *didactic organisation* – a praxeology (Chevallard, 2007; Artigue and Winsløw, 2009). In our case, as the diorama is about biodiversity, is possible to identify parts of its praxeology. As Chevallard (2007:133) points out:

> *A praxeology is essentially made up of two parts, the* praxis *part and the* logos *part. Each part in its turn consists of two components. The praxis part is the*

> *union of a* type of task *(such as solving quadratic equations, blowing one's nose, composing a fugue) and a* technique *– a way of doing – which purportedly allows one to carry out at least some tasks of the given type – those in the 'scope' of the technique. The logos part is the union of a whole set of notions and arguments arranged into a more or less rational 'discourse' (logos), the so-called* technology *of the technique, which is intended to provide justification for the technique.*

In the case of biodiversity dioramas seen as praxeologies, one could say that the *praxis* part is composed by a task – expose the diversity of organisms and environment – and a *technique* – knowledge about animals taxidermy and plants conservation, woodwork, plastic art, painting, how to write a label or a panel. The *logos* part is composed by the rational discourse of biodiversity – which, as we will see, is not homogenous – and the *technology* – the knowledge from the fields of museology/museography, communication, design, arts, which is provide justification to the technique.

The production of a diorama is a praxeology, which involves many techniques related to the way the objects are prepared – animal taxidermy, conserved plants, painting of the environment or ecosystem. In fact, there is a distance between the organisms intended for scientific research produced by museums, and the organisms used for design of dioramas since the production of these latter is subject to the influence of exhibition related constraints, something that does not happen with material intended only for collection.

These aspects mark the complete dissociation between research that is collection oriented and research with mediational and educational purposes (Van Präet, 1989). Thus, dioramas are kept apart from specific interests of scientific research and closer to those that seem to be more targeted towards public exhibition. However, authors like Quinn (2008) and Ash (2004) are clear when they state that what makes dioramas effective in representing an environment results from information obtained from scientific research. This aspect emphasises the important link with scientific knowledge and at the same time distances the diorama from it because of the educational and dissemination objectives of the exhibitions.

In other words, to create a diorama is to be concerned with both scientific and educational questions – logos and praxis. This characteristic – the dual focus on educational apprehendability and scientific rigour – located in the development process of a diorama, provides evidence of the existence of a process of transformation of knowledge. A possible conflict of interests may exist regarding what researchers and educators perceive as being more relevant to exhibition. This conflict may in turn ensure something similar to Chevallard's (1991) notion of epistemological vigilance in the development of a diorama. Thus, those actors – researchers and teachers – participate, among others, in the noosphere of the museum exhibition which is regulated by cultural, science and technology and educational policies from state, city or region, the history of

the museums and of each institution, and other elements (Marandino, 2001) – all of which represent the levels of didactic determination (Artigue and Winsløw, 2009).

Biodiversity in scholarly knowledge

One of the main aspects in the study of didactic transposition is to outline the origin of knowledge – scholarly knowledge. It is important to outline that, as Chevallard (2007:132) proposes, the knowledge should not be seen as something homogeneous, isotropic or unquestionable. However, many teachers seem to hold this view. Understanding that scholarly knowledge is epistemologically heterogeneous and recognizing political, ideological, sociological and cultural influences on it is a way to demystify this idea.

As we have seen, scholarly knowledge in our research represents the discourse of scientists who work with research on biodiversity and the books and manuals used in higher education which seek to define this concept. The present survey identified at first that biodiversity is expressed both in conceptual terms as well as in relation to the values attributed to it. Furthermore, we analysed the relationship between what is found in the studied literature and the conceptions of interviewees in relation to both biodiversity concepts and values.

We constructed a categorization scheme regarding the definition of biodiversity in the texts consulted from books and manuals. A common characteristic is present in these works which is that of structuring the concept of biodiversity at the organization levels: genetic diversity; species diversity; ecosystems diversity. This perspective was also found by Oliveira (2005) in a historic survey of the concept. As a rule, the levels are interlinked and structured hierarchically because they describe different aspects of the life system ranging from the most specific to the most complex level which addresses the relationship of organisms.

The values attributed to biodiversity refer, according to the texts studied, to the reasons that led us to be interested in biodiversity. We have identified that economic, ecological and conservationist values are the most recurring.

In contrast, the opinion of researchers is that the levels of biodiversity are one among many ways of conceptualizing biodiversity, or more generally expressing the magnitude of biodiversity rather than a structure more concerned with formal definitions. Another point that was expressed is that definitions do not always show all levels of biodiversity, nor did the interviewees emphasise the hierarchic nature of the term which is common in the literature.

Among the three levels of biodiversity studied, we identified the level of species as the most recurring in the discourse of researchers. However, when they expanded on their ideas and perceptions of what biodiversity is, the other levels were mentioned. In

relation to the values of biodiversity analysed in the interviews we found a slight emphasis on economic value. In one of the cases, the interviewee in his discourse associated the economic factor with that of conservation, where the former can trigger people's interest in the maintenance of biodiversity. One of the interviewees attributed cultural historical and social aspects as biodiversity values. He presented man as a creating and modifying agent of the diversity we know, outlining the different manners in which man relates to the environment. This aspect indicates how diverse the ways of attributing a value to biodiversity may be.

The effort made to identify how close or distant what we see in literature and what researchers who study biodiversity say is with respect to concept and values results from the need to express how our scholarly knowledge is configured..

Since various information sources may be employed for organizing an exhibition, we sought to reflect this variety by mapping several of them in order to characterise the nature of scholarly knowledge on biodiversity. Such sources may be scientific articles and academic manuals, reference texts and materials to be divulged, but also oral communication by researchers from research institutes, universities or even museums. The selected sources reinforced the existence of polysemy of the concept of biodiversity in the reference knowledge. In short, what we are assuming is that the idea of biodiversity is composed of different shades that are influenced by both scientific and social discourse.

The heterogeneity in scholarly knowledge was identified by Chevallard (2007) and other authors with respect to the social and historic construction of this knowledge as well as the influence of social practices in its constitution. According to Caillot (1996), in the school environment scholarly knowledge is not necessarily the only reference knowledge and that it can be formed, for example, by social practices that permeate this environment. To Chevallard, "(…) in social life, a *question* is raised, in some institution, and persons in that institution try to do something in order to provide an *answer* to that question. The question is not intended to belong to any established field of study – it can be anything relating to any social practice. The answer that is being looked for has the structure of a praxeology, or of a fragment of a praxeology, or is a piece of a praxeological complex".

The non-linearity of scholarly knowledge was emphasised by Marandino *et al.* (2003) where the authors' goal was to analyse the transposition of scientific knowledge especially with respect to the concepts of days and nights and seasons of the year for two exhibitions at MAST. One of the emergent points was that depending on the concept that was addressed, reference knowledge arises from "various areas of knowledge", which leads us to reflect on what this knowledge is since it does not always correspond to one single field of scientific production. The authors state that "...this survey seems to point to how important it is to consider the peculiarities of the

various areas of knowledge when seeking the knowledge of reference of certain concepts" (Marandino *et al*., 2003, p. 181).

Based on our analysis of the distances and proximities between texts that address biodiversity and conceptions of researchers with respect to the theme, we have identified that the aspects present in the scholarly knowledge corroborate what was evidenced in the works that challenge its homogeneity.

In relation to dioramas, our studies indicate that in this production, scientific knowledge on biodiversity undergoes transposition processes since the information contained in animals, plants and paintings in relation to biodiversity on exhibit is not the same as that contained in the scientific collections although they originated from it. The process of creation of a diorama produces didactic materials and accordingly, we have a process of transposition. Faced with the importance of dioramas in depicting biodiversity, it is appropriate to investigate how the concept has been addressed in these exhibition devices. Future research challenges aim at identifying whether these exhibition devices incorporate the different scientific meanings, if they emphasise some of them or if they present ideas and notions distinct from the scholarly knowledge.

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