The Notion of Praxeology as a Tool to Analyze Educational Process in Science Museums

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Introduction

Museums are considered to be educational institutions, and since their origin they have changed their operational focus from caring for the collections to directing their attention to the public (Fayard 1999). The move toward the public has been acknowledged in the exhibitions as their production involves the transformation of scientific knowledge for education and dissemination purposes in order to make it comprehensible. In this chapter our goal is to analyze the knowledge presented at an exhibition, considering that it is a result of the transformation process from scientific knowledge to disseminated/exposed knowledge at museums (Mortensen 2010). The theoretical framework was finded in Anthropological Theory of the Didactic (ATD), especifically in the concept of praxeology (Chevallard 2007; Bosch and Gascón 2006), and it was able to reveal and to identify how the knowledge of biodiversity is presented in museum dioramas. We use praxeology as a tool to analyze the production of a diorama in order to answer our research question: how does the teaching process occur in an exhibition object – the diorama – in a science museum?

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The ATD and the Educational Proposal of Exhibitions in Science Museums

The Anthropological Theory of the Didactic (ATD) studies the manipulation of knowledge with didactic purposes. It has become an important instrument to disclose the theoretical and practical framework of exhibition activities present in museums, because it enables the identification of the tasks (praxis) proposed for an exhibition's object, correlating them with a conceptual body of knowledge (logos) that supports its execution (Mortensen 2010). By identifying the tasks of the exhibition's objects, such as a diorama, their educational potentials can be revealed, which can contribute to the production processes of exhibitions in science museums.

It is important to emphasize that assembling an exhibition, which includes selecting its objects and texts, is intended to teach and communicate concepts and ideas from a specific format, that is, a museography. The teams that execute this selection have control, or vigilance, over the decisions oriented from an epistemological point of view (concerning the knowledge to be taught) as well as the museological point of view (concerning communication, educational, and artistic strategies that will be used). The idea of epistemological vigilance points out that if, on the one hand, the knowledge taught or divulged is maintained in the relationship of distance and proximity with the reference knowledge, it should, on the other hand, also correspond to a given reality and context and to different social practices (e.g., develop museum exhibits). The epistemological vigilance concept highlights that the objects of knowledge that will be taught are not misrepresented, replaced, but changed (Souza et al. 2012). By "change" we mean that knowledge goes through modifications that imply simplifications and adaptations in order to make it understandable to the general public. The work of actors who exercise epistemological vigilance is to control these changes so that knowledge does not present itself in the wrong way but is rather easier understood.

The decision on what will be chosen or not for an exhibition or for producing a diorama is associated with the development of an efficient means to communicate the selected content (Oliveira 2010). In this sense, we understand ATD as a framework that involves the theory (knowledge) and practice dimensions and which does not simply rely on understanding how the transposition of a certain knowledge into another occurred. It also allows objective descriptions in order to reveal the various steps of transposition as an epistemological reference model. To build this model, in order to bring relevant results, this theory proposes an anthropological study of the theory and the practice which goes beyond simply modeling and revealing the explicit and general forms of how scholarly knowledge turns into knowledge to be taught.

Chevallard (2006) developed the notion of praxeology, defined as the basic unit that analyzes human action, called praxeological organization (PO). A PO, according to the reference subject, can be modeled into two parts: one, the teaching part, associated with how to present a particular content – the didactic organization (DO) – and another, the part related to the body of knowledge socially produced by

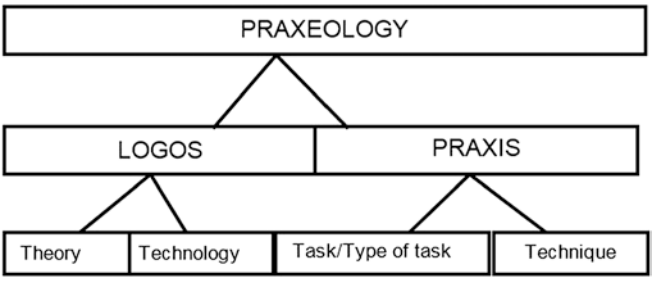

Fig. 1 Schema of a praxeological organization. Based on Machado (2011)

a group, which substantiates a theory and is justified in a technology, the mathematics organization or biological organization (BO). In the case of museums, we consider that the DO can also be called a museographic organization (MO), since it is through museography that the teaching strategies are expressed in a museum.

The study of praxeology in museums has been recently developed in order to investigate the learning environment of museum exhibitions, producing practical and theoretically grounded principles, with the conditions to be applied to the alignment between the design of exhibitions and the educational outcomes (Mortensen 2010). Such knowledge enables the identification of the *tasks* (praxis) proposed for the exhibition, correlating them with a body of conceptual knowledge that maintains its implementation (logos).

Figure 1 shows the identification of the elements that comprise the logos (*theory* and *technology*) and praxis (*task/type of task* and *technique*).

The study of praxeology in museums is relevant because when the *tasks* that involve the exhibition object are identified, it is possible to reveal the educational potentials of the diorama and therefore contribute to understanding the didactical intentions of the exhibitions at science museums, assuming that teaching and learning experiences occur in an informal education context.

Methodology

A long-term exhibition called "Zoology Research: biodiversity in the perspective of a zoologist" at the Museum of Zoology of the University of São Paulo, Brazil, was open from 2002 to 2011 and allowed the museum visitors the opportunity to get to know the aspects involved in the routine and work of zoologists, in order to highlight the importance of their research, to understand the origins of animal life, the natural processes that promoted morphological, genetic, and ecological diversification throughout the history of the planet, as well as the patterns that led to the current distribution between the different environments and continents. According to Marandino et al. (2009), this exhibition was divided into four modules in order to show the contents and objects that communicate aspects of ecology (with regard to

the ecological relationships between the organisms and the physical world represented in the diorama) and biodiversity (with regard to the quantity and the diversity of animals exhibited). The modules are "Presentation and history of MZUSP;" "Origin of the species and large zoological groups;" "Evolution, diversity, and phylogeny – Activities of the zoologist;" and "Neotropical Fauna and Marine Environment." This last module is composed of representations of the Neotropical ecosystems and had five dioramas in the following environments: Atlantic Forest, Amazon Forest, Cerrado, Caatinga, and marine environment. Also in this module, there was a large map of the Neotropical region covering the floor, and taxidermy specimens of migratory birds representing a flock were suspended from the ceiling. In this chapter we analyze the diorama called "Amazon Forest" that was part of the "Neotropical Fauna and Marine Environment" module (Fig. 2).

The methodology of this research was based on a qualitative approach, and it includes data obtained by three collection tools:

(a) Documents: curatorial project and folders of the exhibition were analyzed looking for the concepts of ecology and biodiversity and also the educational and communicational purposes of the exhibition. Using the perspective of textual discursive analysis (Moraes and Galiazzi 2007), we selected and transcribed parts of the documents and classified them in two units: (1) parts of the text related to concepts of ecology and biodiversity and (2) parts of the text related to the objectives and the scientific and museographic conceptual proposal of the exhibition as a whole and about the Amazon Forest diorama. These units were used to characterize the logos – *theory* and *technology* – of the Amazon Forest diorama (as indicated in Table 1).

Fig. 2 Module "Neotropical Fauna and Marine Environment" of the MZUSP exhibition

Table 1 Intended praxeology of the "Amazon Forest" exhibition set – MZUSP – logos characterization

Theory Θ	Diversity of species and ecosystems of the Amazon Forest
Technology θ	An ecosystem composed of different environments and with great plant and animal diversity and also different ecology

(b) Interviews: conducted with two exhibition designers, following a semi-structured questionnaire to identify the intentions related to the understanding of ecology and biodiversity and the educational and communicational purposes of the exhibition. The interviews were tape recorded and transcribed as a whole, and the analysis was conducted using textual discursive analysis (Moraes and Galiazzi 2007) where parts of the interviews were selected in relation to the two units mentioned before: (1) related to the concepts of ecology and biodiversity and (2) related to the objectives and the scientific and museographic conceptual proposal of the exhibition as a whole and about the Amazon Forest diorama. Data from documents and interviews were used to characterize the logos – *theory* and *technology* – of the Amazon Forest diorama, helping to build Table 1.

(c) Observation: the Amazon Forest diorama was observed, filmed, and photographed, and a detailed description was elaborated in order to identify ideas of ecology and biodiversity in their museographic elements, especially in the objects, text, and supporting images. The observation and description of the diorama were prepared using a "scanning" technique in order to identify and record each object and the ecological relationship in the scene. This procedure was based on the work of Oliveira (2010), who in turn based his work on Dean (1996) to develop the scanning technique, as this author discusses the production and analysis of exhibitions and studies how the public establishes relationships with these elements. Therefore, a description of the diorama Amazon Forest was performed, starting from right to left and from top to bottom, always starting from the back plane (painting in the bottom and/or on the side) to the front (the objects). Because there is a difference in planes between painting and objects and due to the size of the studied dioramas, this procedure was fragmented into smaller pieces, called quadrants, and each one was described following the procedure indicated (Fig. 3). The use of this technique was critical to the analysis, since it provided a detailed and accurate description of the elements exposed in the scene.

During the description process, a text was produced narrating in detail each element that composes the diorama, as the example below of the first quadrant description. The elements cited in the text and the forms that they represent in the scene were used to define the praxis or practical block of a praxeology: the *tasks*, the *type of tasks*, and the *techniques* in the diorama (as indicated in Table 2).

> **First quadrant (back to front, top to bottom and right side)**: In the upper back plane there are two trunks without the canopy. The one on the right is darker; the one on the left, lighter and thicker. These trunks descend to the ground and from them come vines that are entangled with each other with small leaves distributed on the surface. In the previous frame

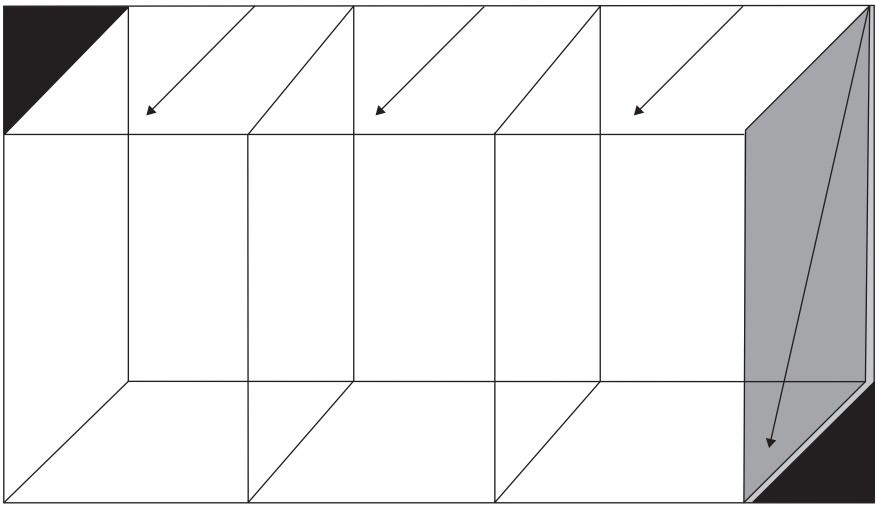

Fig. 3 Representation of the scanning technique developed by Oliveira (2010)

Table 2 Intended praxeology of the exhibition set of the "Amazon Forest" diorama – MZUSP – praxis characterization

Type of task (T) Tasks (t)	Support	Technique (τ)
T1: recognize ecological relationships	Panel	Identify organisms in the legend drawing; compare the organisms that are exposed in the diorama and raise assumptions about cause and effect
t: recognize the epiphytism		
T2: distinguish the species that compose the animal diversity	Diorama	Identify the species in the legend; observe, recognize, differentiate, and classify taxidermized and exposed species in the diorama or display case
	Display case	
t1: distinguish one iguana		
t2: distinguish the insect diversity		
T4: evidence the plant and animal richness	Panel	Read the informative text on the panel; identify organisms in the legend; observe, interpret, and verify observable aspects in the diorama, generalizing concepts
	Legend	
t: evidence the high plant and animal endemism	Diorama	

there are trunks of cut trees, covered with vines and a model of bromeliad with red flower. Next to the bromeliad, 1.5 m from the ground, is a specimen of sauin (Calliithix chrysolena) holding a small orange fruit facing the back plane of the diorama. About 10 cm below there is a specimen of another species of sauim (*Saguinus fuscicollis*), and below, about 50 cm from the ground, there is a specimen of a monkey (*Saimiri boliviensis*) holding a piece of brown food. Near the ground (10 cm) there are two specimens of squirrels (*Sciurus spadiceus*) resting on cut logs, one facing the public, holding a yellowish fruit, and another, with its back to the public. The soil is sparsely covered by shrubby vegetation 20–30 cm high, with some elevations, representing rocks or exposed roots of plants, and the presence of moss in some regions.

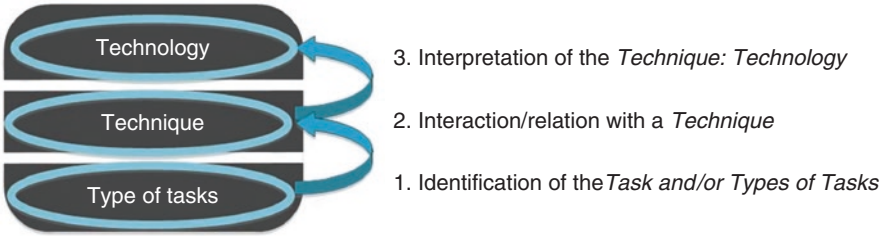

Fig. 4 Schema that indicates the construction of a praxeology (Achiam 2013)

The data obtained through the collection tools were analyzed by selecting and organizing them in order to construct the praxeology, understood here as a theoretical framework that at the same time works as a tool that is informed by the theoretical perspective of ATD. This procedure was done in a search to reveal the didactic potential of the Amazon Forest diorama. Achiam (2013) proposed a scheme that was used here as reference to build the praxeology (Fig. 4). Using data from the observation and description of each element of the diorama, we identify the *task* and the *type of tasks* and also, in relation, the *technique*, as suggested at the scheme. Together with the data from documents and interviews, we also interpret the *technology* and, in our case, the *theory* (Fig. 4).

For a characterization of the praxis, the data used were mainly the observation of the diorama and its expositive set. In order to identify the *task*, the *type of tasks*, and the *technique*, a focal question was used to help. The question defined was: "How can the visitor perceive ideas and concepts of biodiversity represented by Amazon Forest diorama and its exhibition set?" The identification of a *task* means determining the "action to be achieved" in relation to a particular item that is meant to be known and which involves human activity. In the case of the diorama, for example, it would be the action to recognize in a scene an Amazonian plant or distinguish an animal that lives in a given environment. After the *tasks* were identified, the next part involved the characterization of the *type of task* that groups the actions identified in the *task*. For example, actions such as "distinguish," in the diorama, an iguana or the insect diversity, comprise a specific *task* and can be grouped into a single *type of task*, for example, to "distinguish the species that compose the animal diversity." The identification of the *technique* represents "how to perform" a certain task and indicates the selection of a tool or museographic strategies to accomplish the *task*, that is, how to present a certain content. In our case, the *technique* in a diorama is given by expressions that indicate "how" the visitor accomplishes, for example, the *task* of recognizing the epiphytism, such as "identify" organisms in the legend drawing, "compare" the organisms that are exposed in the diorama, and "raise assumptions" about cause and effect.

To characterize the logos and the description of *theory* and *technology*, the data were obtained from interviews, documents, and observation of the exhibition set. The logical block of a praxeology comprises *technology* and *theory*, which are identified after listing the *tasks, type of tasks*, and the *technique* of the practical block of

praxeology. To identify the *technology* means to relate the practical block with the logical block (Mortensen 2010). The *technology* emerges in order to justify the choices made; in other words, it requires looking at what is being placed into the practical block and theoretical block and can involve more than one exhibition set if we consider the MZUSP exhibition as a whole. In this chapter, the *theory* and *technology* were constructed based on the data identified for the diorama of the Amazon Forest and its supporting elements.

The Findings: Teaching with Dioramas in a Science Museum

The dioramas are specially assembled scenes that have been used since the nineteenth century in museums, in order to promote a realistic perception and therefore combine, in the case of natural sciences museums, scientific knowledge of plant and animal species, with reproduction techniques of scenes. These are built through light effects, painted backgrounds, and stuffed animals, that is, they exhibit a type of motionless theater, which places us in make-believe habitats that impress by their degree of realism (Almeida 2012). The history of these elements communicates the educational arguments for their inclusion in the exhibition: to contextualize the organisms and the environment and to facilitate the public's understanding of the information (Van Präet 1989).

The biological knowledge, in the case of dioramas, is usually connected to the observation, identification, and recognition of species of plants, animals, or fungi, their relationships with each other and with the environment, and also the identification of geophysical phenomena, such as rock formations, soil types, types of biome, and other topics.

Ash (2004) shows that a number of studies emphasize the potential of dioramas for such exhibitions as a means to promote the understanding of ecology, biodiversity, and conservation issues through contact with environments never before experienced by the public. In that view, dioramas are teaching objects, produced as a result of a museographic transformation which combine scientific, artistic, educational, and communication knowledge. From the perspective of ATD, it can be stated that dioramas have a PO, and this can demonstrate the contents and actions intended by their designers and producers.

In our research, the Amazon Forest exhibition set was composed of the diorama and of the supporting elements: display case and panel containing text, image, and layout with subtitles, as seen in Fig. 5.

According to Fig. 5, the diorama of the Amazon Forest has an "L" shape of about 3 m high, 4.5 m long, and 2.4 m wide at the larger part of the "L" and 1 m at the smaller part. The display case is open and has guardrails. Its illumination is at the front and it is directed toward the rear. It comprises stuffed animals and plant models with flowers and trees.

Fig. 5 Front view of the "Amazon Forest" exhibition set

There is a display case, at the lower part, 50 cm from the floor with three glass covered boxes with light in the background. Two of them include the invertebrates, and the other has a legend to identify some of the vertebrates.

Another element is the panel that includes a text, a schematic map of the area, and a scheme with the legend, which together display the characteristics of the Amazon Forest.

Based on the data obtained, we will now describe the logos, that is, the *theory* and *technology* identified in the Amazon Forest diorama. To do that, we selected two excerpts from the interviews with the exhibition designers of MZUSP. When asked about the role of the dioramas at MZUSP, the respondents indicated that:

> The purpose of the objects is to provide the contexts of the animals. How these different life forms live in the same habitat. (C1)

> [...] The diorama of the Amazon, we wanted to show the structural differences of ecosystems [...]. The diorama shows the ecosystem, the animals interacting, it shows the taxonomic biodiversity and the ecosystem biodiversity. (C2)

Considering the aspects cited and the data from the documents, the logos dimension of the praxeology of the "Amazon Forest" diorama is proposed as the following (Table 1):

To characterize the praxis of the diorama, we used the observation of the diorama and its exhibition set to answer the focal question: "How can the visitor perceive the

ideas and concepts of ecology and biodiversity represented by the diorama of the Amazon Forest and its exhibition set?" This question directed us to a specific exercise, aiming to detail each element of the exhibition set, which in terms of praxeology meant to identify the *tasks*, *types of tasks*, and *techniques*.

The excerpt below provides part of the description of the diorama, developed using the scanning technique, which supported the construction of the praxis:

> In the 2nd quadrant, in the center, there is a cut tree trunk with ferns, vines, a pink orchid in tree trunks, a cuxui specimen (*Chiropotes satanas*) facing the back plane, standing on all four legs, and immediately below, 15 cm away, a night-monkey specimen (*Aotus sp*) inside a hollow trunk. In the front plane, sitting on a branch of a cut trunk, there is a dusky titi specimen (*coppery titi*) standing on all four legs and facing the public. At the bottom, on a branch of the cut trunk, there is an iguana *(Iguana iguana)* with its tail extending to quadrant 1.

The *tasks* identified were defined according to the role that each object plays in the museographic organization. For example, the *task* identified by "recognize the epiphytism" was determined by the observation and the description of the second quadrant of the diorama, shown in Fig. 6. To accomplish this *task*, the visitor should be able to perform the following *techniques*: observe the diorama; identify and recognize the plant's habitat, as the bromeliad and orchid were exposed in the diorama; and raise the assumption of cause and effect, i.e., the assumption that the scene reveals an example of epiphytism, since this is an ecological relationship that indicates the epiphytic way of life of an orchid growing on other plants.

Fig. 6 Inset of the diorama: tree trunk, ferns, and orchids

Similarly, with the presence of an iguana (*Iguana iguana*; Figs. 7 and 8) in the diorama, there is a *task* that reveals the intention to "distinguish species that compose the animal diversity of the Amazon Forest." For this *task* the visitor should perform the following *techniques*: read the legend; identify in the legend the popular and scientific names of the organisms; observe the diorama; relate the popular and scientific names of the stuffed organisms that are exhibited in the diorama; raise an assumption of cause and effect, for instance, assume that by exposing a wide variety of animals, the diorama reveals a characteristic of this biome, which is animal diversity.

Part of the exhibition set includes the preserved organisms presented in the display cases. Here, the identified *tasks* mobilize visitors to "distinguish the taxonomic diversity of the organisms exposed in the display cases," such as the organisms (invertebrates) in Fig. 9 and that infers the following *techniques*: read the legend; identify the phyletic group written in the text of the legend; observe the display case; recognize and relate a taxonomic group to the invertebrate specimens exposed in the display case.

Considering the aspects shown, we can express the praxeology in terms of *tasks, type of tasks*, and *technique*, like in the example above, for the Amazon Forest diorama as shown in Table 2.

The characterization of the logos and praxis of the intended praxeology of the Amazon Forest diorama allowed to indicate the intentions and choices made by

Fig. 7 Iguana specimen in the diorama

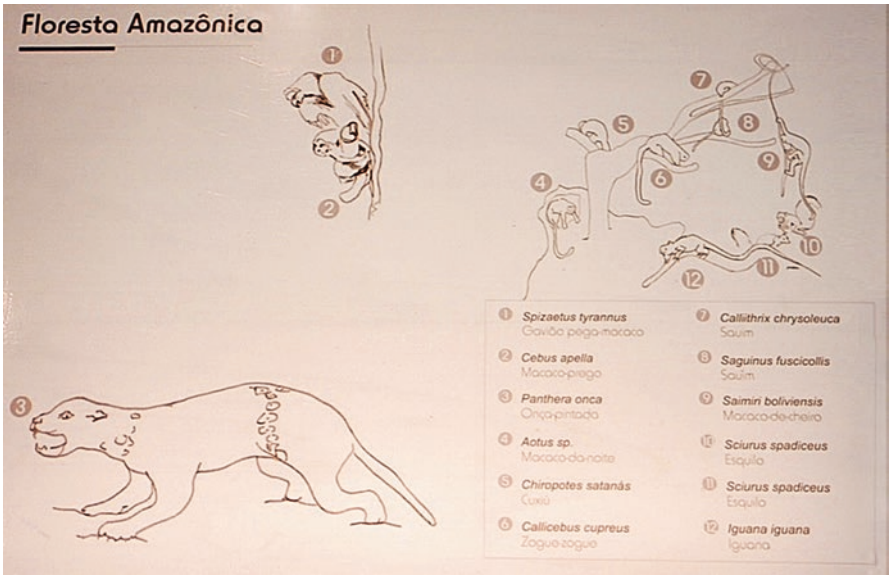

Fig. 8 Display case: legend and schema of each animal in the diorama

Fig. 9 Display case: invertebrate animals. Class: Insecta

designers in the production of this object, in addition to the concepts related to ecology and biodiversity expressed in it. It was also possible to identify the missing concepts and simplifications of ideas and concepts and discuss the potential and limitations of the teaching and learning process during the visits to the diorama. We point out these aspects in the following section.

Discussion

In this research, we show that the use of praxeology can be useful as a theoretical and methodological tool to highlight the different aspects of the educational process in museum exhibitions. The knowledge and the educational practices pass through in the museographic transposition from an established reference model and help to reveal "what is meant to be taught," "how knowledge is taught," and "what is actually taught." Revealing this process is part of the research program of the ATD, which seeks to model the institutional conditions under which a given knowledge and its teaching are built, articulated, and operated. Through the praxeology and the focal question, it was possible to identify each element of the exhibition set which has the potential to inform and teach scientific contents, using the ATD framework concepts as *tasks*, *type of tasks*, *and techniques* and hence write in a detailed manner how a diorama, as a teaching object, carries out its capacity to teach and disseminate aspects of the ecology and biodiversity of the Amazon Forest.

As pointed out by Winslow (2011), building praxeologies and defining epistemological reference models are not something that is natural or obvious a priori. It is a process to model a given didactic situation through description, experiments, and analyses, and its validity is determined according to its usefulness to explain the didactic phenomenon under study. In this sense, for Winslow, the ATD is an extremely descriptive research program, which does not mean it is neutral or disinterested, since it reveals flaws and inconsistencies that can inspire interventions or curricular reforms.

Achiam (2013) states that while often successful in prompting visitors to carry out intended actions, exhibits do not necessarily promote the intended interpretations of these actions among visitors. In her work she used the notion of praxeology as a model to remedy this shortcoming and suggested using it as a means to operationalize the link between exhibit features and visitor activities. In this work, we assume the same perspective, since through praxeology, it is possible to reveal the intentions, the presence, but also the absences and simplifications of the conceptual and didactic content in the production of a diorama, therefore contributing to inspire interventions and reforms in this didactic object in order to ensure that the desired discourse is closer to that understood by the public, as we shall see ahead.

The dioramas, in general, as well as other didactic objects, are human works and outcomes of didactic transposition processes and thus undergo simplifications and reductions but also add information or segregate them according to the teaching and learning goals. Without this, according to Chevallard (1991), as teachers (and more

broadly as educators), we would be denying access to information and failing to exercise a fundamental activity of maintaining societies. In the museum context, transpositive processes occur for a broader socialization of knowledge, and in the case of museum exhibitions, this is done through objects, images, and texts.

As can be observed from the praxeology analysis, the Amazon Forest diorama and its exhibition set represent aspects of the biodiversity and ecology of a particular ecosystem. The production of this object involves selecting a conceptual content on this topic. However, it also fails to consider other conceptual contents that involve this subject. To analyze the presence and absence of ideas of the biodiversity and ecology in the diorama, we rely on the concept of epistemological vigilance proposed by Chevallard (1991).

Considering the diorama researched here, our study indicates that epistemological vigilance was present during its assembly, controlled by the agents of the noosphere. To Chevallard (1991), the *noosphere* is a central concept of this theory, and it is the space occupied by actors who are involved in the didactic work, and within it the actors face each other and seek to equate problems that emerge from the demands that come forth from society. Noosphere is the place where conflicts are developed, where negotiations are conducted, and where solutions mature. According to Brockington and Pietrocola (2005), the subjects of the noosphere proceed, mediating the needs of both society and the school system. In our case, the museum noosphere is formed by individuals who are involved in the production of the exhibition and who negotiate the objectives and purposes, that is, the "what" and "how" to exhibit the objects within the studied diorama. The actors of the museum noosphere had control of the knowledge defined to be presented through the objects, texts, and images. As the exhibition designers (C2) pointed out, they wanted to show the structural differences of ecosystems, using the diorama to show the ecosystem, the animals interacting, the taxonomic biodiversity, and the ecosystem biodiversity. However, it can be noticed that some ecological relationships were not shown in the exhibition set and some animal classes were also not represented.

The absence of some conceptual aspects in the exhibition set may give the impression that only those ecological relationships and species of plants and animals represented comprise the biodiversity of the Amazon Forest ecosystem. On the one hand, we understand that it is not possible to express all these elements through a single diorama and this is also pointless. On the other hand, these absences express the choices made by the designers, which can be justified both from an epistemological point of view and from a museological point of view. In this context, our study indicates that in addition to the epistemological control, there was also a museological control performed by the actors of the noosphere, based on the notion of how communication will be achieved in museums through dioramas. We call this museological control as museographic vigilance, which reveals that designers have intentions and constraints not only in terms of content but also on how to teach and disseminate in museums.

Our data allowed to identify how the choices made by the noosphere actors reveal the action of museographic vigilance on the production of the diorama, showing the regulatory capacity of this institutional sphere in the preparation of dioramas in science museums. As one of the exhibition designers (C1) stated, "The intention

was to provide *a context for the animals* and the diorama was chosen as a museological object that best expressed this proposal," indicating the action of the designers, who selected the particular way for the exposition: through models of plants and animals conserved in a scene.

Oliveira (2010) states that the noosphere mediates the museographic transposition process through discussions between researchers, educators, curators, and technicians of the institution in the decision-making regarding what is more important to expose to the public. These areas of knowledge and their actors exert "pressure" that can influence how the content will be composed of the knowledge to be exposed. Therefore, the limitations of the exhibition space, the characteristics of the collection, and the spatial and temporal design of the scene determine "how" the dioramas will be constructed so that they can come close to or remain far from the reference knowledge.

The epistemological and museographic vigilance are complementary. As pointed out by Mortensen (2010: 323), "one key insight that may be drawn from this collective work is that exhibit content and exhibit form are not mutually independent." The choices of concepts and of objects and scenarios impose possibilities and restrictions on *what* and *how* to exhibit in science museums and then reveal the educational implications of the exhibits.

In that perspective, a diorama is an important topic to address in the educational activities of museums because of its ecological relationships and the organisms represented. A diorama helps to understand the limitations of the representations and how the teaching processes occur in the exhibition as selected by the actors and reflected from the choices and the power relations that occur in the production of objects in the exhibitions of museums (Marandino et al. 2015).

Another observation based on the identification of the praxeology of the diorama, from the point of view of epistemological and museographic vigilance, concerns the diversity of plants represented in the scene. Plants were not identified in the legends in the exhibition set. On the one hand, it is known that the research and the activity of the zoologist at MZUSP were related to animal diversity and it was also the focus of the exhibition. On the other hand, the Amazon Forest biome had many characteristics that defined it beyond the animals, and thus other organisms that composed it could also be identified, as was done with the invertebrates, for example. Furthermore, the phylogenetic identification of plants can be relevant to zoology research as it reveals aspects about behavior and ecology of a given organism, and therefore the presence of more explicit information could be significant. In that perspective, we consider that the plants in the scene could have been identified with labels in the legend, which would have helped the visitor characterize this ecosystem in a more intricate manner. However, showing the conceptual ideas about plants in detail was not the choice of the team that planned this exhibition, which reveals the options and the selections of the designers during the diorama production, as an evidence of the museographic transposition and the museographic vigilance process.

Dioramas are very interesting objects, with a great educational potential but with some conceptual and museographical limitations. Insley (2008) in his studies about long-term exhibitions points out that the conceptual content represented in dioramas that remain in place for a long period of time can become outdated, as they are

designed to communicate information in a given period of time. The message then becomes outdated; therefore it would be useful to replace the objects with more contemporary ones. However, this can be a problem in terms of developing educational activities in museums because making changes in these objects represents high costs. According to Tunnicliffe and Scheersoi (2015), many long-term exhibitions of dioramas were disassembled and even demolished in the second half of the twentieth century, in part because they were considered old-fashioned. However, the researchers argued that we are experiencing the rebirth of these objects in the present day and that new dioramas are also being built with techniques to enhance the quality of reality, a typical characteristic of these objects.

We believe that the potential and limitations of dioramas should be elements for discussion and analysis by the public, which can be done during museum visits and in the teacher education programs, for example. In that perspective, museum educators and researchers can use praxeology as a tool to study and evaluate how the public reaches the logos and the praxis of dioramas and other type of exhibition (Mortensen 2010). In this context, Bueno et al. (2015) developed a guide to help teachers to analyze exhibitions in science museums and to help them to identify and reflect on the possibilities and limitations of these expositive objects. Bueno et al. offer a tool to analyze dioramas based on praxeology, which shows the great potential of this concept for the development and study of teaching and learning processes in museums.

The exhibition of the Museum of Zoology, which contained the Amazon Forest diorama, was discontinued in 2012 and reopened in August 2015 with another focus and a new title: "Biodiversity: know to preserve." This exhibition contains renovated dioramas conceived in a more modern museographic design. To do that, the organizing team of the museum proposed a new conceptual and museographic approach, which implied new choices related to content and objects, as well as new challenges regarding the "what" and "how" to teach and disseminate the conservation of biodiversity. Certainly, this new exhibition involves the work of the noosphere, revealing the fascinating potential of the dioramas as teaching objects in science museums.

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