

Samantha Balleste
Natalia Naoumova



ZOOLOGICAL GARDENS DESIGN
AND PLANNING: ASPECTS TO
CONSIDER IN CONTEMPORARY
PROJECTS

pós- | 1

ABSTRACT

The literature indicates that architects and landscapers with historical knowledge and experience in the design and planning of zoological gardens are scarce. Due to this fact, most of the projects of these institutions are performed by professionals without proper instruction, which often makes copies of the design other zoological gardens, causing errors already exalted in the literature to be repeated. Thus, this study aims to provide foundations to professionals responsible for these institutions projects. Providing an evolution overview of its concepts and design proposals and identifying the main aspects that should be considered in the planning and design of the contemporary zoological gardens open spaces. It is expected that this brief overview contributes to the qualification of professionals responsible for zoological gardens projects in Brazil, where there is no specific training area, helping them to understand the peculiarities of zoological gardens.

KEYWORDS

Zoological garden. Design. Planning. Open spaces.



[HTTP://DX.DOI.ORG/10.11606/ISSN.2317-2762.POSFAU.2019.156468](http://dx.doi.org/10.11606/ISSN.2317-2762.POSFAU.2019.156468)

Pós, Rev. Programa Pós-Grad. Arquit. Urban. FAUUSP. São Paulo, v. 26, n. 49, e156468, 2019.

DESIGN E PLANEJAMENTO DE JARDINS ZOOLOGICOS: ASPECTOS A SEREM CONSIDERADOS EM PROJETOS CONTEMPORÂNEOS

RESUMO

A literatura indica que são escassos os arquitetos e paisagistas com conhecimento histórico e experiência em design e planejamento de jardins zoológicos. Devido a isso, a maior parte dos projetos dessas instituições acaba sendo realizada por profissionais sem instrução adequada, que muitas vezes copiam o design de outros jardins zoológicos, fazendo erros já exaltados pela literatura serem repetidos. Assim, este estudo busca proporcionar fundamentações aos profissionais responsáveis pelos projetos dessas instituições, fornecendo um panorama sobre a evolução dos seus conceitos e propostas de design e identificando os principais aspectos que devem ser considerados no planejamento e design dos espaços abertos de jardins zoológicos contemporâneos. Espera-se que este breve panorama contribua para a qualificação dos profissionais responsáveis pelos projetos de jardins zoológicos no Brasil, área para a qual não há formação específica, auxiliando-os a compreender as peculiaridades desses espaços.

PALAVRAS-CHAVE

Jardim zoológico. Design. Planejamento. Espaços abertos.

INTRODUCTION

The maintenance of wild and exotic animals in captivity has been going on since ancient times. However, as we know it today, zoological gardens came into existence only from the mid-eighteenth century onwards, when the homocentric view was put aside and plants, animals, and it began to unite plants, animals and people in the same environment, with the same degree of importance (BARATAY; HARDOUIN-FUGIER, 2002). It can be said that zoological gardens reflect the different postures of man in relation to nature, technological advances and changes in society, so they present very different characteristics from one generation to another (HANCOCKS, 2003; MULLAN; MARVIN, 1999).

The literature indicates that the teams responsible for the planning and design of zoological gardens should be composed of experts from various fields, such as architects, landscapers, engineers, botanists, biologists (zoologists), ecologists, psychologists and economists. However, Coe (2011) states that architects and landscapers with extensive knowledge and experience in zoological gardens design are located only in North America, Australia, India, and Singapore. Thus, in many cases (including in Brazil), new open spaces and zoological gardens' facilities are planned by staff of these institutions, with little knowledge of aesthetic design of open spaces, or by building professionals with insufficient understanding of the nature of zoological gardens. Often, because there is no specific knowledge, design copies of other, often outdated zoological gardens emerge, which slow the advance of design.

It is important that the key professionals responsible for the design and planning of these spaces - architects and landscapers - have a broad and well-grounded knowledge of the subject so that the mistakes of the past are never made again. It is known that the design of open spaces in a zoological garden must be able to engage the public with the environment, so it is necessary that professionals are aware of the possibilities of planning the spaces, whether in relation to physical aspects or sensory aspects. Thus, this study aims to provide an overview of the evolution of the concept and design of zoological gardens from ancient times to the present time, identifying the main aspects that should be considered by professionals in the area, in the design and planning of open spaces of contemporary zoological gardens.

THE EVOLUTION OF THE ZOOLOGICAL GARDENS CONCEPT AND DESIGN

Since ancient times man has been fascinated by animals. In ancient times, this fascination was common mainly among Egyptian pharaohs and Chinese and Aztec emperors, who kept living animal collections. One of the oldest records dates from 5,500 years in ancient Egypt, based on paintings in the Saqqara pyramid (HANCOCKS, 2003).

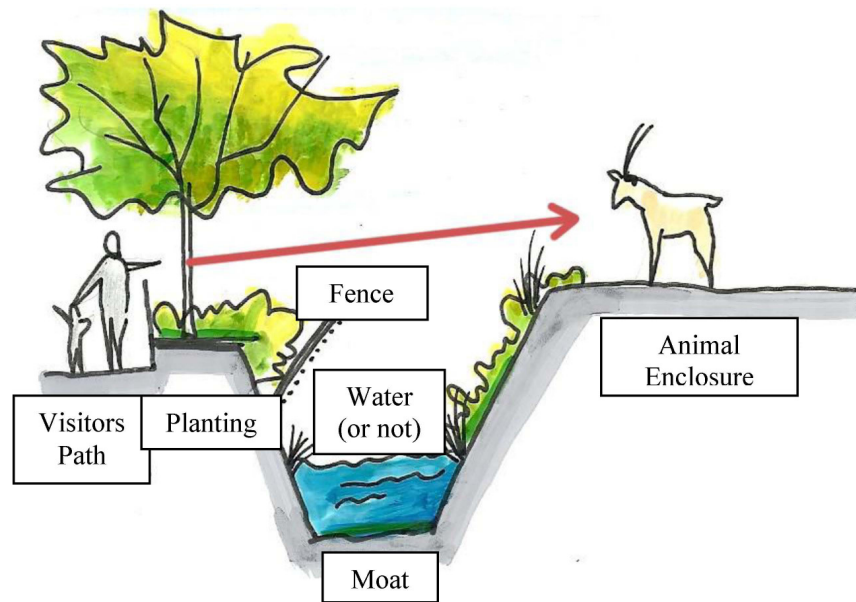
The Greek people were the first in Europe to exhibit animals in zoological collections from the 4th century BC. In the 16th century, virtually all major European civilizations kept animal collections (HANCOCKS, 2003). At that time, the animals were kept in cages or in the trap itself. The *ménageries*, as they became known, were seen only by the owners of the collections, their family, friends and high status people because of the high cost of capturing, transporting and maintaining the animals. These collections played only the role of entertainment, and human control over animals was evident (BARATAY; HARDOUIN-FUGIER, 2002; VILJOEN, 2012).

In the seventeenth century, baroque and humanistic influences materialized in the design of the *ménageries*. The large flower gardens became the inspiration for the new wave of animal collections, and so the *ménageries* became structurally similar to the botanical gardens. Thus, they came to be called zoological gardens (BARATAY; HARDOUIN-FUGIER, 2002; HANCOCKS, 2003). According to Hancock (2003), the zoological collection of the Versailles garden, built in 1664, represented the first zoological garden and symbolized the end of bourgeois wildlife collections for a collection for the benefit of visitors. However, the architecture of space was not yet designed to accommodate animals but to infuse what was considered a cultural quality associated with animals (MULLAN; MARVIN, 1999). In the late 17th century, the style implemented by the zoological collection of the Versailles garden spread throughout Europe.

In the eighteenth century, different conceptions of garden landscaping also influenced the layout and design of zoological gardens, which were based mainly on two distinct models: one French and one English. The French model, known as the “style of kings”, was based on radial symmetry and geometric formality. The English model, on the other hand, was based on an organic and informal design, in which man was immersed in nature. The English claimed that the French style’s formality, artificiality and humanity subjugated nature to a regularity that made it boring, uniform, and embarrassing (BARATAY; HARDOUIN-FUGIER, 2002; HANCOCKS, 2003). After the French Revolution at the end of the century, the French also adhered to the English model.

In the nineteenth century, the creation of the Zoological Society of London, in 1826, and the London Zoological Garden, in 1828, was a milestone in changing thinking and attitudes toward zoological gardens and nature (HANCOCKS, 2003). All the design and planning of the London Zoological Garden was based on scientific methods, picturesque style and the pursuit of “absolute truth”. It was proposed as a place where zoology could be taught, studied and observed. In the design of buildings, both public and animal interests were considered (BARATAY; HARDOUIN-FUGIER, 2002; HANCOCKS, 2003; VILJOEN, 2012).

Figure 1 – Representation of a moat, in section
Source: Author's illustration



Early 20th-century zoological gardens were largely established following the precepts of the London Zoological Garden.

Still in the first decade of the twentieth century, there was a change of attitude, and nature again lost its role of protagonist, once again belonging to visitors (HANCOCKS, 2003). In contrast, there were also projects that went the other way, seeking to enhance and improve aspects of captive wildlife maintenance. The animal collector Carl Hagenbeck was one of them (HANCOCKS, 2003). In 1907, Hagenbeck was the first to propose the combination of a natural landscape, without caged enclosures, in a romantic vision of habitat creation closer to reality. Hagenbeck's major contribution was the replacement of iron bar barriers within these enclosures by large moats and ditches (Figure 1), creating the illusion that there was no separation between animals and the public (COE, 2011; EBENHÖH, 1992).

Patrick Geddes was also an important developer of contemporary zoological gardens ideas and concepts and his main contribution is related to his learning method applied in these institutions. His "living, we learn" method is based on a multisensory education of people with the environment, which takes place through perceptions of lived experiences, evoking the most emotional, active, sensory and perceptive side of man. Geddes believed that the learning process should start in the senses and only then reach the intellect (THOMPSON, 2006).

In the 1930s, with the arrival of the modern movement in architecture, the design of zoological gardens underwent intense modification, and many of the innovations of Hagenbeck and Geddes were forgotten. The "modern age", called the "disinfectant era" in the history of zoological gardens (HANCOCKS, 2003), was a phase when these environments adopted a style of "scientific purity". In the modernist proposal, the zoological garden is a space made up of a series of sculpturally constructed enclosures in which animals only served to animate the

mathematical and technical precision of the use of building materials, mostly concrete. The enclosures for animals were made of concrete, steel and tiles, forming long straight lines, circles or squares. The sterile and glazed enclosures did not allow any kind of contact, except the visual, between the public and the animal, and were spaces practically devoid of additional elements (HANCOCKS, 2003).

In the 1950s, two books were published by Heini Hediger – *Wild animals in captivity: an outline of the biology of zoological gardens* (HEDIGER, 1950) and *Studies of the psychology and behavior of animals in zoological gardens and circuses* (HEDIGER, 1955). Such publications came in clear break with modernist principles applied to zoological gardens, being as extensions of the principles advocated by Carl Hagenbeck and thus marking the end of the “modern era” in zoological gardens (EBENHÖH, 1992).

The influence of the environmental movement of the 1970s was a crucial moment in the zoological community. At this time, ecology and nature conservation became the basic concepts and principles for the management, maintenance and planning of zoological gardens, giving rise to a new concept called landscape immersion. The first occurrence of landscape immersion was in the gorilla exhibit at Woodland Park Zoo, in the United States, supported by its director at the time, David Hancocks. This new concept was based on the principles defended by Hagenbeck and had as a philosophical foundation the concepts of biocentrism, conception according to which all life forms are equally important, not being humanity or nature the center of existence (COE, 2011; HANCOCKS, 2003; VILJOEN, 2012).

Landscape immersion is about nature with more emphasis and is governed by the intention to create perfect illusions of landscapes, where the animal is an integral part of the ecosystem, not just the centerpiece of a painted scene. In addition, it has no visible separations between animal and visitor areas in an effort to connect people to land and inspire respect for natural places. This type of exhibition seeks to make man see himself as part of the natural world and possibly of the animal kingdom (VILJOEN, 2012). The design and planning strategies that support this concept have as one of their main intentions to reach the emotional side of the public and only then the intellectual side, making them immerse both physically and psychologically in the natural habitat (COE, 2011; EBENHÖH, 1992; HANCOCKS, 2003).

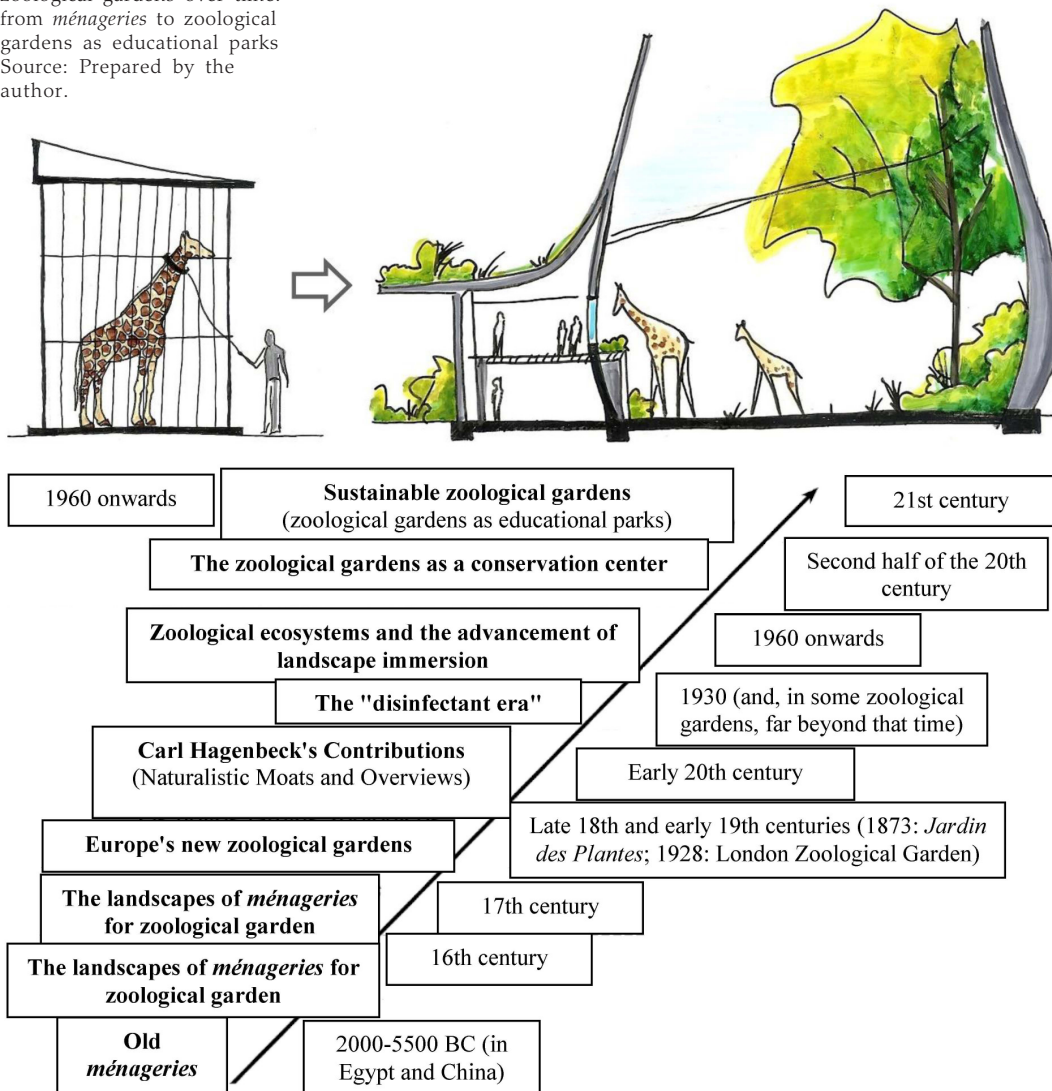
In the 1980s, zoological gardens also began to incorporate the ideas of “living, we learn” introduced by Geddes into the design of their spaces (THOMPSON, 2006). Therefore, they began to invest in increasing visitor knowledge by introducing learning programs. The assumptions made in the concept of landscape immersion remain in use to this day; however, today it is named as immersive design (COE, 2012). Immersive design has become part of zoological garden culture that any unplanned exhibit in this way is questioned in the literature for its validity and its chances of success.

However, in contemporary zoological gardens, in addition to enclosures based on the concepts of immersive design, there are also three variations of

enclosures inspired by modern architecture, but different from the era of Modernism, namely: thematic modernism, postmodernism and hidden modernism (COE, 2011). The architecture of the enclosures of thematic modernism is characterized by the use of themes, inspired by objects or places, combined with high-tech elements and materials. The architecture of postmodernism is characterized by the inclusion of allegories and fantasies that symbolize elements and are inspired by natural elements and animals. Lastly, the architecture of the enclosures with hidden modernism is characterized by the construction of functional buildings, submerged in the landscape and often hidden by vegetation. However, these artistic inspirations in modern architecture are not well regarded by the zoological community.

Figure 2 summarizes the evolution of zoological gardens over time.

Figure 2 – The evolution of zoological gardens over time: from *ménageries* to zoological gardens as educational parks
Source: Prepared by the author.



THE PLANNING OF THE CONTEMPORARY ZOOLOGICAL GARDENS

Over the past 100 years, the planning process for zoological gardens has evolved from merely spatial planning (buildings, exhibitions, traffic flows, maintenance, etc.) to one that encompasses issues such as space management, nature conservation and education programs, public entertainment, species protection and scientific research. Mullan and Marvin (1999) indicate that the construction of a zoological garden is a complex process, as it is necessary to ensure not only the animals quality of life and that they do not run away, but also the quality of the visitors' space, so that they can learn from it and enjoy the walk. Architecture is understood to be a process of creating and modeling space, and in zoological gardens, the space has to be created for both types of creatures: animals and humans (EBENHÖH, 1992; MULLAN; MARVIN, 1999).

Mullan and Marvin (1999) argue that animals should never be second in importance in a zoological garden, and that visitors should leave the zoological garden enchanted by animals, not architecture. However, it is clear that contemporary zoological gardens architects and designers want to create something to be obvious, that is, they seem to think first in terms of art and aesthetics and forget the purpose for which buildings and spaces are designed. Since Hagenbeck's studies, it is noteworthy that the concepts of nature and animal life must be found in all parts of a zoological garden and that this space should not only be a work of art (M (MULLAN; MARVIN, 1999).

The basic problem faced is that architecture is a cultural process, and the architects themselves are shaped by a complex of aesthetic, technical, cultural and historical forces, so that it is rare to see replicas in the natural world in contemporary designs without monumental architectural interventions. This is noticeable, for example, in the aviaries at the Öhringen zoological garden in Germany¹, where the architectural form of the cages draws the most attention and, perhaps, is more marked in visitors' memory than the animals themselves being presented at that exhibition. Understanding the cultural process of contemporary architecture, it should be sought that the inevitable aesthetic-architectural interventions in zoological gardens always prioritize better highlighting animals and increasing the attractiveness of space, following the concepts of immersive design as much as possible. It is essential that the entire space is planned so that the visitor feels immersed in the natural environment presented (COE, 2011; 2012; EBENHÖH, 1992;).

In relation to the open spaces of zoological gardens, the human space of these institutions, the literature indicates that designers should consider the visitors' point of view fundamentally (EBENHÖH, 1992; GRAETZ, 1995). All planning for the human space of a zoological garden should aim to make the visit to the space an educational, enriching and memorable experience to be repeated. For this, it is indicated in the literature that some aspects of space are considered and thought by the designers.

¹Öhringen zoological garden / Kresings Architektur. Öhringen, Germany. Available at: <https://bit.ly/2qs9JpJ>. Accessed on: Jan 7 2019.

The *perceptive richness* of the space is one such aspect. It is suggested that the strategy of planning and design of open spaces in zoological gardens aims to make the space as rich as possible, that is, a mosaic of various physical and visual stimuli. However, at the same time, it must be designed in such a way that the public clearly perceives all these stimuli presented, from animals to vegetation and water, equipment and paths.

With this in mind, it is essential to avoid obstructing important sights and the presence of unnatural elements in space (EBENHÖH, 1992). Considering that contemporary zoological gardens and their immersive design habitats often have a dense vegetation and topographic variety, the proximity of the visitor to the enclosures is also essential to enhance the possibility of viewing the animals. The proximity between the public and animals is one of the factors that can most influence the impact that a zoological garden visit can have, as the closer the animal is, the greater the impact on the visitor and the greater the learning potential (COE, 1985, 2011, 2012). People crave the possibility of touching animals, but because they cannot be touched, they want to be as close to the animal as possible. They want to interact and get a reaction from the animals. However, some care should be taken regarding these visitors' wishes.

The psychology applied in zoological garden enclosures, developed by Jon Coe (1985), explains that simply positioning an animal higher than the observer may predispose you to want to learn from the animal and perhaps be more respectful of that animal. The positioning of the animal at a lower height can stimulate the visitor's behavior of domination, triggered by the feeling of frustration due to the animals' lack of attention to the visitor, which can lead to the animal's harassment (Figure 3).

Still, questions such as these "will the roller coaster, passing through the orangutan enclosure, subconsciously, incorporate into the visitor lower value in relation to the animal or will it increase the emotion of the experience, thereby

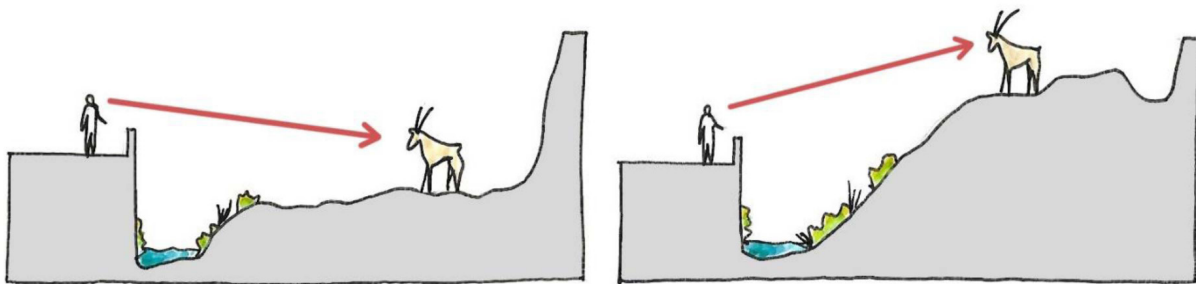


Figure 3 – Psychology applied in zoological garden enclosures: relative position affecting visitor perception
Source: Author's illustration.

increasing the emotion associated with all aspects of the experience, including the related animals?" or "does placing text plates throughout the exhibition make the exhibition less fun for the visitor or makes the information more accessible to them?" should be analyzed before installing any unnatural objects in zoological gardens environments. Jon Coe is, unquestionably the godfather of contemporary zoological garden design.

The *orientability* of visitors in space is also one of the main aspects to be considered in the planning of zoological garden spaces, according to the literature. In addition, the circulations closely influence this aspect, as they define the audience's experience. Bitgood (2011) indicates that the circulations should be designed along a main line, to generate a clearly understood logical circulation structure that facilitates the wayfinding of visitors. Coe (2011) states that the most effective way to plan the circulation system is to create a one-way system or a path hierarchy system. With this method, visitors move in space through exhibitions that are distributed to tell a story and with their own logic. By telling a story and following a certain logic, the circulation system has a continuity of ideas and a clear intention to motivate the public to keep them interested in space. However, the circulation configuration most seen in zoological gardens has no hierarchy, with many random circulations. In this type of circulation, the orientation of visitors in the zoological garden spaces is inefficient, requiring effective devices of wayfinding (signaling).

In addition to the *perceptive richness* and *orientability*, the literature also highlights the need for facilities and other space equipment to be *adapted* to the needs of visitors. When planning them, the designer should be concerned with characteristics such as their capacity, maintenance and location. The facilities need to be attractive and visually adjusted with the zoological garden's mission. This reveals the importance of visitor studies: number on peak days, age and circulation patterns (EBENHÖH, 1992). Visitors need an overview of the park to find restrooms, restaurants and drinking fountains. When they get tired, they need places to sit and rest. They need the shade of trees or built structures, mirrors and other sources of water that create a microclimate and prevent excessive heat and cold.

The following are detailed facilities and equipment for zoological garden open spaces that should be known and understood by the professionals responsible for the design and planning of these institutions.

Visitor Support Structures and Facilities

To make the visit to the zoological garden enjoyable, the literature indicates that it is necessary to provide space for public support structures. Such structures are translated as: (i) rest zones; (ii) parking lots; (iii) restaurants; (iv) picnic areas; (v) restrooms; (vi) information kiosks; (vii) gift shops; (viii) buildings for environmental education; and (ix) squares (EBENHÖH, 1992). Zoological gardens are places where walking is generally required, so resting

places for visitors should be available throughout the visitation area (EBENHÖH, 1992). Zoological garden parking design should consider characteristics such as capacity, traffic flow, safety, signage, materials and landscaping. It is recommended that over the zoological garden access area, a combination indicating “entry and exit” to the public is most advantageous. Ebenhöh (1992) also points out that many zoological garden visitors bring their own food, so picnic areas are considered important.

Enclosures / Exhibitions Elements

The physical elements of the exhibits are: (i) mesh structures - either flexible or rigid (Figure 4a); (ii) moats; (iii) handrails; (iv) vegetation; and (v) environmental enrichment structures. Metal mesh is present in most zoological gardens and is used as a relatively transparent barrier between the public and animals (GRAETZ, 1995). As for the moats, the literature describes them as an excavation in the ground, with or without water, with varying sizes and shapes according to the type of animal that will live there. Their function is the containment of animals, without the visitor being aware of it. Near the moats, most zoological exhibits have handrails. One solution to hide them is to replace them by planting some vegetation with sufficiently deterrent width.

Moat barriers can also be used as environmental enrichment structures, as they may include rock outcrops for climbing and water for swimming, making exposures more attractive (GRAETZ, 1995). Environmental enrichment elements are generally resting places and structures for animals or distracting objects for them, such as logs, climbing plants and rocky elements, which visually contribute to the natural effect (Figure 4b).



Figure 4 – Mesh barriers in zoological garden enclosures: a) Bird enclosure with wire mesh barrier in Salvador Zoo Botanical Park, Salvador / BA; b) Environmental enrichment element for anteaters in the Beto Carrero World Zoological Park, Penha / SC

Source: Author's Photos.

Vegetation and Natural Resources

The function of vegetation in contemporary zoological gardens can be: (i) to define spaces; (ii) create microclimates; (iii) use it as a decorative element; (iv) use it as a recreational element for animals and visitors; (v) offer fragrances; (vi) use it as an educational element for visitors; (vii) suggest visual experiences; (viii) provide environmental variety (colors and textures); and (ix) simulate the natural habitats of animals (EBENHÖH, 1992). Simulation of vegetated habitats serves not only as a decorative but also educational purpose, as they portray the natural context of the animal and demonstrate ecological agreement. Zoological gardens often do not apply ornamental vegetation within exhibits for various reasons, but mainly because animals destroy them (Figure 5a). Thus, zoological gardens treat the areas surrounding the enclosures for this type of ornamental planting (GRAETZ, 1995).

It is indicated that, in a qualified zoological garden, the vegetation is capable of transmitting to the public a sensation of fluidity and naturalness in the passage from one exhibition to another. Vegetation also assists in increasing the use of spaces, especially if vegetation arrangements have variety and quality of texture, color, mass, fluidity and olfactory effects. Trees offer shade, which is a very important aspect for the comfort of visitors on hot days (EBENHÖH, 1992). They provide vertical scale, intimacy and warmth to a space. They serve as a recreational element for children who can play with their low branches. Climbing plants can provide moderate shade and create more pleasant environments for visitors. Lawns determine where people can sit, play and do a picnic or just rest and sunbathe.

Lakes and water sources (Figure 5b) are often present in zoological gardens and play an important role in design and spatial planning. In addition to the aesthetic qualities of water bodies, it is possible to display some types of animals, birds and fishes that can be very attractive. Such natural resources also help in the comfort of animals and visitors as they help in the creation of microclimates.



Figure 5 – Vegetation and bodies of water in zoological gardens: a) Planting of Pitangueira (*Eugenia uniflora*) in the toucans' enclosure in the Zoological Park of the Zoo Botanical Foundation of Rio Grande do Sul, Sapucaia do Sul / RS; b) Lake for waterfowl at Beto Carrero World Zoological Park, Penha / SC
Source: Author's Photos, 2017.

Furniture

The most frequently found furniture in zoological gardens are: (i) benches; (ii) dumpsters; (iii) luminaires; and (iv) drinking fountains. Ebenhöh (1992) states that it is indispensable to provide plenty of benches for visitors to rest in these spaces, as walks are often necessary in zoological gardens and, in many cases, they are long. Due to the heterogeneity of the visitor groups of these institutions, often only some part of the group wants to rest, while the more energetic members want to enjoy the activities. Thus, it is indicated in the literature that the seats are positioned in such a way that they offer comfort and a good view to the visitation area (EBENHÖH, 1992). Ebenhöh (1992) also indicates that garbage bins are provided around all structures and facilities, as these locations are concentration points for visitors. These types of furniture can be specially designed as simple (traditional, urban) or with some theme, which also contributes to the environmental education of visitors.

Recreational Resources

These are entertainment and learning devices that offer the possibility of interaction. They usually consist of passive or active devices that involve one or more senses or physical activities and always make the visitor act or react. The source of satisfaction is in achievement and activity (EBENHÖH, 1992). Recreational resources that can be found in zoological gardens are: (i) little squares for children; (ii) sculptures and other educational elements; (iii) panels and paintings; and (iv) structures for games and entertainment. The little squares can be specially designed as simple, colorful or with some theme, which also contributes to the education of children. Already the sculptures of animals or natural elements present in zoological gardens provide children, and even adults, new possibilities to know the nature. The representation of species in realistic sculptures, which unlike zoological gardens' animals, can be touched and explored, is highly valued as direct contact with the actual animals on exhibition is not allowed. Among the most common sculptures found in zoological gardens are: (i) animal footprint markings; (ii) leather textures; (iii) eggs; (iv) claws; (v) shells; and (vi) animals themselves.

Circulation Elements

As indicated earlier, spaces intended for both the public and the animals must appear as one, and this is one of the key challenges for those responsible for the design and planning of these environments. When designing a zoological garden, it is necessary to think about various aspects related to the circulation of visitors, such as direction, path width (flow), type of paving, accessibility, need for bridges, stairs and observatories (BITGOOD, 2011; EBENHÖH, 1992). Circulation can also be thought of according to the sensory effects desired in space.



Figure 6 – Wayfinding devices: a) directional signal at the Zoological Park of the Zoo Botanical Foundation of Rio Grande do Sul, Sapucaia do Sul / RS; b) “you are here” map in Salvador Zoo Botanical Park, Salvador / BA
Author’s Photos.

Wayfinding devices

The literature indicates that there may be a large number of decision-making points in zoological gardens (BITGOOD, 2011; EBENHÖH, 1992), so visitors need to be able to determine where they want to go. Thus, wayfinding devices are important in these environments as they allow people to locate themselves. When they get lost, they do not absorb all the educational and recreational information provided by space (EBENHÖH, 1992). Children and people with low cognitive abilities can best understand guiding devices with photos, graphics and color-coded icons that appeal to all ages. The most common wayfinding devices in zoological gardens are directional signs (Figure 6a), identification and educational signs, “you are here” maps (Figures 6b), and hand maps. Studies suggest that it is interesting to provide multiple guidance devices, as visitors use more than one suggestion when trying to orient themselves in a new environment. In addition, there is no device that visitors prefer more. Some visitors prefer direction arrows, others prefer maps, and some ask for directions from employees (BITGOOD, 2011).

CONCLUSIONS

After reviewing the literature on the evolution and concept and design of zoological gardens, it can be seen that these institutions underwent many changes not only in concept but also in physical structure. With simple and unnatural spaces, they have become true conservation parks of natural life, with a structure designed for the welfare of both the captive species that live there and their visitors, which are the fundamental part of the educational function of the function of contemporary zoological gardens.

It has been found that the literature on open spaces in contemporary zoological gardens indicates that the planning and design of these

environments should be planned in such a way as to provide the visitor with the most natural space possible, in which architectural interventions aim to exalt the naturalness and animal life, not architecture itself. It is considered, of course, that it should be employed in an artistic and contemporary way in these institutions, but always seeking to praise nature first. Finally, it is deemed necessary for the designer to set aside his critical sense of applied design, for example, in parks and urban squares.

As for the aspects to be considered and thought by the designers, it was found that it is indicated that the design and planning of the space be applied to provide the visitors: (1) perceptive richness, referring to the variety of elements, effects and activities that can be performed in a zoological garden and its possible organizations; (2) orientability, related to the visitor's ability to perceive, access the spaces and move through it without getting lost; and (3) adequacy, referring to the degree to which the space is adjusted to the needs of the visitors. It is noteworthy that the main challenge for designers is to make visiting these spaces a process in which the public simultaneously has fun, interacts with animals and acquires knowledge about nature.

It is also highlighted the need for those responsible for the design and planning of zoological gardens to have knowledge about the facilities and equipment of the spaces of these institutions, namely: *structures and facilities to support visitors*, translated into spaces such as rest areas, parking lots, restaurants, picnic areas, restrooms, information kiosks, gift shops, environmental education buildings and small squares. *Enclosures / exhibitions elements*, referring to mesh barriers, moats, handrails, vegetation and environmental enrichment structures; vegetation and natural resources, which can be used to define spaces, create microclimates as educational and recreational elements for visitors as decorative elements, provide environmental variety (colors and textures) and simulate the natural habitats of animals. *Furniture*, such as benches, dumpsters, lamps and drinking fountains; recreational resources, which may be panels and paintings, educational entertainment elements and games, sculptures and other educational elements and little squares for children; circulation elements, related to the direction, width (flow) and type of paving of the paths, accessibility and the need to build bridges, stairs and observatories. Finally, *wayfinding devices*, which mainly refer to directional signs, identification signals, "you are here" maps, and hand maps.

It is hoped that this brief overview will contribute to the qualification of professionals in the area, making them understand the peculiarities of zoological gardens and that, knowing their history, do not emerge copies of the design of other zoological gardens, often outdated.

REFERENCES

- BARATAY, Eric; HARDOUIN-FUGIER, Elisabeth. *Zoo: a history of zoological gardens in the west*. London: Reaktion Books, 2002.
- BITGOOD, Steve. *Social design in museums: the psychology of visitor studies*. Edinburgh: MuseumsEtc, 2011. (Collected Essays, v. 1).
- COE, Jon Charles. Design and perception: making the zoo experience real. *Zoo Biology*, New York, v. 4, n. 2, p. 197-208, 1985.
- COE, Jon Charles. Zoo environments for people, plants and animals. In: WORKSHOP OF THE ZOO DIRECTORS, 2011, New Delhi. *Proceedings* [...]. New Delhi: Central Zoo Authority of India, 2011. p. 1-93.
- COE, Jon Charles. Design and architecture: third generation conservation, post-immersion and beyond. In: FUTURE OF ZOOS SYMPOSIUM, New York. *Proceedings* [...]. New York: Canisius College, 2012.
- EBENHÖH, Monika. *Evaluating zoo design: the importance of visitor studies*. 1992. Dissertation (Master of Landscape Architecture) – University of Agricultural Sciences, Institute of Wildlife Biology and Game Management, Vienna, 1992.
- GRAETZ, Michael. *The role of architectural design in promoting the social objectives of zoos: A study of zoo exhibit design with reference to selected exhibits in Singapore zoological gardens*. 1995. Dissertation (Master of Architecture) – National University of Singapore, Singapore, 1995. Disponível em: <https://bit.ly/32k5vOn>. Acesso em: 23 nov. 2016.
- HANCOCKS, David. *A different nature: the paradoxical world of zoos and their uncertain future*. Berkeley: University of California Press, 2003.
- HEDIGER, Heini. *Wild animals in captivity: an outline of the biology of zoological gardens*. New York: Dover Publications, 1950.
- HEDIGER, Heini. *Studies of the psychology and behavior of animals in zoos and circuses*. Amsterdam: Butterworths Science Publications, 1955.
- MULLAN, Bob; MARVIN, Garry. *Zoo culture: the book about watching people watch animals*. 2nd. ed. Chicago: University of Illinois Press, 1999.
- THOMPSON, Catharine Ward. Patrick Geddes and the Edinburgh Zoological Garden: expressing universal processes through local place. *Landscape Journal*, Madison, v. 25, n. 1, p. 80-93, 2006.
- VILJOEN, Rynette. *Third nature: re-evaluating the boundary of zoological gardens*. 2012. Dissertation (Master in Architecture) – University of Pretoria, Hatfield, 2012.

Editor's note

Date of submission: 4/4/2019

Acceptance: 10/30/2019

Review: Tikinet

Samantha Balleste

Universidade Federal de Pelotas. Faculdade de Arquitetura e Urbanismo. Rua Benjamin Constant, 1.359, Centro – 96010-020 – Pelotas – RS

ORCID: <http://orcid.org/0000-0002-8366-2928>

samantha_balleste@hotmail.com

Natalia Naoumova

Universidade Federal de Pelotas. Faculdade de Arquitetura e Urbanismo. Rua Benjamin Constant, 1.359, Centro – 96010-020 – Pelotas – RS

ORCID: <https://orcid.org/0000-0002-8180-5454>

naoumova@gmail.com