VISITOR EXPERIENCE IN ZOO DESIGN: DESIGN GUIDELINES FOR GIZA ZOO

by

MARWA GEWAILY

(Under the direction of David Spooner)

ABSTRACT

Animal welfare organizations have developed criteria for zoo institutions with animal welfare as a top priority. This research aims to identify design guidelines for the Giza Zoo from the 'visitor experience' point of view, where the visitor experience is set as a base line to measure the effectiveness of zoo exhibits. The research identifies authenticity, aesthetics, recreation, education, and exploration as basic components of the visitor experience. These components are defined throughout the research, examined through case studies of the elephant and lion exhibits in three zoos, and are refined to further define visitor experience in the Giza Zoo. A redesign for the elephant and lion exhibits in the zoo is proposed based on these guidelines.

INDEX WORDS: Zoological gardens, Giza Zoo, Animal welfare organizations, Zoo history, Visitor experience, Animal exhibits, Design guidelines.

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by

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1. INTRODUCTION

1.1 Problem

The Giza Zoo is one of the oldest Middle East zoological gardens— Zoo is the short term for zoological garden. In the past decade, the zoo has been deteriorating. Animal rights organizations have been asking for improvements in the zoo, especially in "the cell-like cages used for lions and bears" (BBC News, 2009). In a 2008 interview, Mona Sadek, Zoo spokeswoman, mentioned that the zoo lost up to 25 percent of the species it once held. Furthermore, two camels were slaughtered by nighttime intruders and some zoo birds were infected with H5N1 avian influenza (redOrbit Staff & Wire Reports, 2008). In 2004 these poor conditions cost the zoo its accreditation with the World Association of Zoos and Aquariums (WAZA). WAZA is the unifying organization for the world zoo and aquarium community, leading zoos and aquariums, associations and affiliate organizations from around the world.

The deteriorating conditions in the Giza Zoo have been viewed as "not acceptable" according to WAZA Executive Director Peter Dollinger. There are currently some efforts in the new Giza Zoo administration to improve the zoo condition. The first phase for bringing the zoo back to the world society of zoos has been to rejoin the African Association of Zoos and Aquaria (PAAZAB); an organization that represents interests of bona fide zoos and aquaria in the African continent. This phase was

accomplished in 2008. In 2009 the second phase, as announced by the zoo administration, has been to join the WAZA.

Although the WAZA organization has specific criteria for zoo accreditation, most of these criteria are vague and deal only with animal welfare. Within these guidelines, there is little mention of factors that affect or enhance visitor experience in zoos. There is concern that the Giza Zoo, while going through its revitalization process, will focus only on the WAZA accreditation criteria and ignore the need to address the visitor experience. A report previously written by the author indicated some of the preliminary issues that visitors face in their daily experience at the Giza Zoo (Gewaily, 2009). The Giza Zoo has:

1. Five entrances. This results in the absence of a clear start and finish point for the zoo exhibits.
2. Overlapping pedestrian and utility circulation;
3. Cage exhibits that go back to the eighteenth century;
4. A lack of facilities like restaurants, coffee shops, and gift shops
5. No parking.

Purpose

This research is concerned with helping the Giza Zoo return on the world's list as one of the best zoological gardens in the region, and regaining the support of sponsor organizations, volunteers and the general public. In addition this thesis will provide ideas for educating visitors about environmental conservation, animal rights' awareness, and how human behavior impacts natural habitat and wildlife. This educational process

will take place indirectly throughout the visitor experience in an environment that provides a sense of fun, excitement and attraction (Clayton et al., 2009).

Argument and Questions

There is a continuous conflict in zoo research between (1) preserving the welfare of animals and their need for sufficient space and materials in exhibits so that they can express their natural behavior (WAZA code of ethics), and (2) enhancing the experience of visitors who desire to see wild animals up close and who ultimately provide financial support for zoos. Animals have been historically displayed in cages, and some zoos such as the Giza Zoo still use caged displays. These cages are small and barren with no sanctuary or refuge for the animal. Although these enclosures offer a close view for visitors however, they do not provide a healthy, stimulating or pleasant life for the animals.

Naturalistic and immersion exhibits—the current state-of-the-art in zoo exhibit design—offer more for the well being of animals, as they provide an enriching natural behavior setting (Gibbons, 1994). Even though visitors may not get the chance to view animals up close, the landscape as a whole is more pleasing, especially with animals behaving as they would in their original habitat.

Landscape design processes provide the means to resolve such conflicts through careful design synthesis that can address animals' needs and enhancing visitor experience. This requires a dynamic and complex environment that includes visitors, animals and their surrounding environment. Understanding these physical and

psychological needs and translating that knowledge into a physical built environment is the role of the landscape architect (Polakowski, 1987).

This can be best accomplished through collaboration among multiple disciplines including landscape architects, architects, environmental social scientists, veterinarians, zoo curators, and horticulturists. The landscape architect should use his/her the expertise to develop design recommendations that will fulfill the requirements of all the stakeholders.

It cannot be denied however that revenue from ticket sales is the main financial support for zoos to achieve their conservational, educational and research mission. Zoos usually compete with other recreational institutions with respect to visitor revenue. Although zoos and aquariums have achieved the highest number of visitors of any recreational institution, including sports games (AAZPA, 1990), there is no sufficient information or evidence as to what drives visitors to choose a zoo visit.

Most of the data involving “visitor experience” originates from museum visitor research. Without this information, zoos cannot “help bridge the gap between the intention of exhibit designers and the actual impact upon the visitor” (Aveni, 1989). To the author’s knowledge, there has been no ex post facto research to evaluate the visitor experience, even though zoo marketing, fundraising, education and design departments could use the information for long-term management (Ebenhoh, 1992).

In an effort to attract visitors to the Giza Zoo as well as sponsor organizations, this thesis will address the following question: What are the design guidelines that could be used by the landscape architect to enhance the visitor experience for the Giza Zoo?

Goals of Research

Guidelines have been developed for zoo design, including legislated codes for animal welfare or the WAZA code of ethics, have focused primarily on animal welfare. The main goal of this research is to propose a set of design guidelines that encompass the visitor experience. The proposed guidelines will be used specifically for the purpose of the Giza Zoo revitalization and will be used to inform the redesign of two of the Giza Zoo exhibits. They will include the WAZA accreditation criteria expanded to include more detail and recommendations to enrich the visitor experience in the Giza Zoo. To create guidelines this thesis will:

1- Identify the history and current status of the Giza Zoo.

2- Evaluate the impact of animal exhibits on the visitor experience.

3- Define “visitor experience”.

Scope and Methodology

The scope of this research focuses on the impact of animal exhibit design on both animals and visitors. It illustrates how a well conceived animal exhibit design process can provide animals with a place where they can express their natural behavior and visitors with a rich wildlife experience. The research will not address issues such as pedestrian circulation, zoo entrances, parking, or overall theme of the zoo. It will rather examine specific aspects of the exhibit such as exhibit style, exhibit setting, exhibit furniture, vegetation, barriers, information panels and visitors’ viewing area.

The research will not take into account exhibits of animals that are not residents of the Giza Zoo. Aquatic life will not be included as well. The research will not involve the animal care provider point of view.

Conducting this research will involve three main strategies:

1- Interpretive historical research that involves the history of the Giza Zoo, animal welfare organizations, the development of zoos, development of exhibits, and the different visitor experiences specifically required in a zoo. The role of the landscape architect in the exhibit design process will also be discussed.

2- Case studies of animal exhibits from different zoos. The selection of these case studies is based on three criteria: a) they include exhibits of animals perceived by visitors as the most attractive animals in the zoo (pachyderms and predators); b) they include exhibits that encompass three different styles (naturalistic, memorial and immersion exhibits); and c) the selected animal exhibits (elephant and lion exhibits are the most deteriorated exhibits in the Giza Zoo) are presented as follows:

   Elephant exhibit, Zoo Atlanta (naturalistic exhibit).

   Elephant exhibit, San Diego Zoo (memorial exhibit).

   Elephant exhibit, Woodland Park Zoo (immersion exhibit).

   Lion exhibit, Zoo Atlanta (naturalistic exhibit).

   Lion exhibit, San Diego Zoo (memorial exhibit).

   Lion exhibit, Zoo Leipzig, Germany (immersion exhibit).

3- Personal observation of zoos and animal exhibits, especially Zoo Atlanta, San Diego Zoo, and Giza Zoo. Personal visits to other zoos and animal parks will

provide further insight. These include Zoo Berlin, Germany; Pittsburgh Zoo, USA; Africa Safari, Egypt; and Lion Village, Egypt.

Based on the previously mentioned methodologies and the knowledge gained throughout the course of the research, the thesis will propose and develop guidelines for the purpose of enhancing the visitor experience in the Giza Zoo. These guidelines will be used to redesign two of the zoo exhibits: the elephant and lion exhibit. These guidelines are guiding principles for zoo designers to consider during the design process and not a set of rules to be applied to every exhibit.

Thesis Structure

The thesis includes the following chapters:

In addition to a general history of animal keeping and zoos, chapter 2 includes a literature review of the Giza Zoo history and an analysis of its current conditions.

Chapter 3 presents a literature analysis of the accreditation criteria of different animal welfare organizations. Special focus is on the role of the landscape architect in zoo exhibit design.

Chapter 4 introduces the concept of “visitor experience”, proposes definitions for it, and the author proposes guidelines for the animal exhibit design process.

Chapter 5 includes case studies for two animal exhibits for the elephant and lion which are known from previous research to have a high percentage of visitor holding power, in addition to being among children’s top ten favorite animals. Following the case studies, an investigation of specific aspects of the previously proposed guidelines will be conducted.

Using the proposed guidelines, chapter 6 presents a design solution for the elephant and lion exhibits at the Giza Zoo and recommendations for future research.

2. Animal Keeping and Zoo History

2.1 Animal Keeping History

Animal keeping evolved along with civilization. It is as old as the *Egyptian* civilization. Beginning about 3000BC animals were kept for religious reasons (Loisel, 1976, p.I 9-17) and they were deeply involved in the ancient Egyptian civilization and culture. Ancient Egyptians considered many animals to be sacred, and they kept them either inside temples or nearby. Wall sculptures in Mereruka tomb (Figure 2.1) are one of the earliest illustrations of a known zoo (Bostock, 1993). Antelopes (oryx, addax and gazelle) were shown tied next to their mangers, and some were being fed by their attendants (Lauer, 1976).

Figure 2.1 Wall sculptures in Mereruka tomb. Jill Kamil photo.

The Ancient Egyptian civilization held animals in high regard. Some considered them sacred and worshipped them. Animals such as lions, crocodiles, baboons, etc. were pampered. These “god” animals received their food and were bathed and perfumed. Each region of the old Egyptian civilization selected an animal as its symbol and used these symbols in its drawings on tomb walls to document that era. The Sphinx that still stands in Giza beside the pyramids remains as a sign of appreciation of the ancient Egyptians towards animals. When the pharaohs built the pyramids, they believed that they needed the wisdom of a man and the courage and strength of a lion to protect such a great architecture, and so they built the Sphinx with the head of a human and the body of a lion (Figure 2.2).

Figure 2.2 The Great Sphinx of Giza on the left has the head of a human and the body of a lion. The Great Pyramid of Khafre is shown on the right. Mrs Logic photo.

In 2094-2047 BC in Sumer, *Mesopotamia* King Shulgi had a collection of lions that were held in cages and pits (Oppenheim, 1977, p.44-46). In other parts of the Middle East, Babylonian and Assyrian kings received animals as gifts and often purchased them for hunting or fighting purposes.

As in Egypt, animals were considered sacred in *Greece*. Lions, leopards, eagles and snakes were kept in temples (Loisel, 1912, p.I 59-60). *Roman*s treated animals differently. Animals were brutally displayed in the Colosseum and other circuses (Figure 2.3). In *Medieval Europe,* wild animals only existed as private property of kings and the elite (Loisel, 1912, p.I 162). Wild animals provided the wealthy class with exclusive leisure activities (Hawkes, 1973). At that time, wild animals were collected to demonstrate wealth and power.

Figure 2.3 Brutal display of animal hunting in the Colosseum. vRoma photo.

2.2 Zoological Garden History

The London Zoo (1828) was the first zoo to be designed. The intent of the zoo was to hold an animal collection for scientific studies. Zoo design can be divided into the

following three phases: zoos as jails, zoos as art galleries and Zoos as conservation and education facilities.

1- *Zoos as jails* (Mid 19th century - late 19th century)

In this early phase of zoo design, animals were kept in small cages, and zoos were like 'jails'. People viewed animals as beautiful pieces of art and not as living creatures—it was an era of Linneaus and Darwin. Classifying plants and animals was a major preoccupation of the scientific fields. Zoos that evolved at that time were built for the sake of science, but also acted as a place for socialization. Aside from the cages for animals, the overall architectural style of the buildings was of high aesthetic value (Figure 2.4).

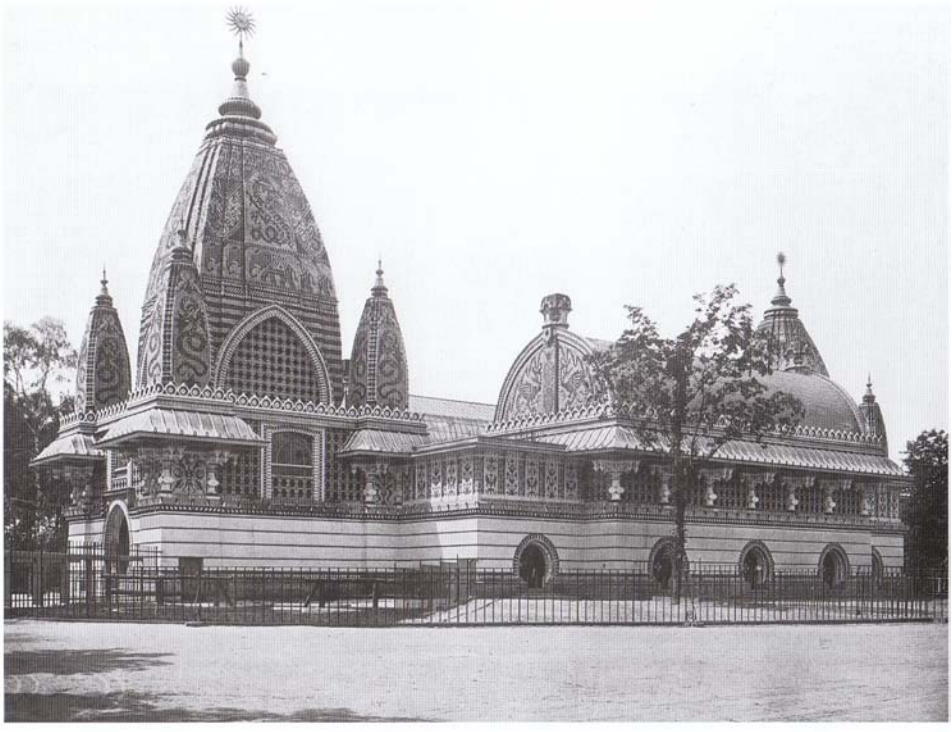


Figure 2.4 Berlin Zoo, 'Indian pagoda' for pachyderms' animals. The architecture of the building is very rich. A History for Zoological Gardens in the West (2004) Photo.

2- *Zoos as art galleries* (Early 20th century - mid 20th century)

During the transition from the Romantic Movement to the Modern Project, zoos were designed to be similar to art galleries. The Romantic Movement attempted to create a living landscape like famous paintings rather than recreating 'nature for moral sensitivities'. Exhibits were designed as paintings or sculptures (Figure 2.5). After Modernism took hold, 'form follows function' became the axiom driving zoo design. Exhibits were characterized by their simplicity. They were more like modern sculptures than habitats.

Figure 2.5 The polar bear exhibit that looks like a piece of sculpture. Go2.wordpress website photo.

3- *Zoos as conservation and education facilities* (Mid 20th century – present)

A significant change occurred in zoo design when in the 1970s Jones and Jones designed the Woodland Park Zoo (Figure 2.6). They decided to recreate the natural habitat in which animals would be naturally seen. With advances in healthcare and ecology, captive animals began to be treated for their physical and mental health while highlighting the importance of their natural environment.

Figure 2.6 Asian elephant naturalistic exhibit in Woodland Park. Zoolex website photo.

2.3 History of Giza Zoo

In the year 1869, while preparing for the Suez Canal inauguration, Khedive Ismail the ruler of Egypt decided to build a zoo. At this time Khedive Ismail brought experts from Europe to help him redesign the capital. New projects included paved

roads, street lighting, a botanical garden, the expansion of the Port of Alexandria and the Giza Zoo. His aim was to make Cairo “Paris of the East”. The Khedive expressed his reasoning with these words: “My country (Egypt) is no longer in Africa; we are now part of Europe” (The Muhammad Ali Dynasty Genealogy). The inauguration of the Suez Canal was a historic event with the presence of Empress Eugenie of France, the guest of honor at the opening ceremony. Although the plan was to open the Giza Zoo at the time of the Suez Canal inauguration in 1869, the zoo was officially open to the public in 1891 (Travel Egypt website) (Figures 2.7 & 2.8).

Figure 2.7 (left): Giza Zoo gate in 1911. Figure 2.8 (right): Giza Zoo gate in 2009. Giza Zoo website photo.

2.4 Development of Animal Exhibits

Although it might seem that the design of exhibits is mostly concerned with animals in captivity, the reality is that exhibits are the “natural voice” of a zoo or aquarium (Coe, 1996). Exhibits are considered one of the best ways to communicate the message of the zoo to the public. This opportunity is usually overlooked. Exhibits do not only provide ways to display animals, but also inform visitor attitudes towards animal

rights. In caged exhibits, animals are being shown as an object on display just like museums.

These exhibits are usually barren and unappealing while the buildings in which these animals are kept are usually well designed and historically significant. However animals are shown out of context, and there is nothing that resembles their natural habitat. These types of exhibits usually denote human power over nature (Fisher, 1967). They offer very little for their residents let alone their visitors. The message that these exhibits sends is that wild animals live in cages. The public cannot develop a sense of respect for animals or wildlife when they see animals behind bars (Sommer, 1972). They are either left with a sense of sadness towards these creatures or are under the impression that the confined animals are dangerous.

2.4.1 Naturalistic exhibit design

A new design trend called naturalistic exhibits gradually replaced cages. Naturalistic exhibit design attempts to imitate nature through artificial methods (Figure 2.9). The first barless zoo was in Hamburg, Germany. The zoo used new techniques such as hidden moats, naturalistic composition of vegetation and artificial concrete to create the illusion of the wild (Hangenbeck, 1909). Naturalistic exhibit design depends on imitating the natural landscape of animals in an attempt to make them live in the same environment as if they were in the wild. The enclosure context seems very safe, familiar and predictable (Coe, 1996).

Figure 2.9 The gorilla naturalistic exhibit at Zoo Atlanta shows visitors on the safe side of the exhibit. Jon Coe photo.

2.4.2 Immersive exhibit design

Currently there is a completely different animal enclosure context: the 'immersive' exhibit design, where visitors walk along narrow and rugged pathways through, over hanging trees and through densely planted wild landscapes in an attempt to "immerse" visitors in a simulation of the animal's natural environment (Figure 2.10). Visitors look across invisible barriers to see the animal, realizing that the animal dominates the enclosure. The immersed landscape not only attempts to recreate the appearance and sense of the animal's natural environment, but also to place the visitor in a similar context.

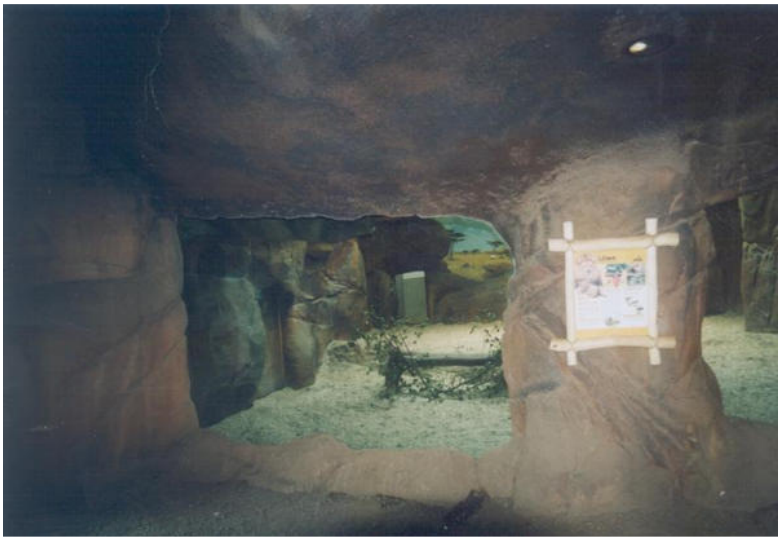


Figure 2.10 The spiny mice enclosure at Zoo Leipzig. The visitor viewing area is cave like increasing the immersive sense. Monika Fiby photo.

Nothing is allowed to spoil the sense of habitat immersion. All utilities, staff access and other buildings are hidden from the public to highlight the wilderness atmosphere. These enclosures provide a sense of excitement and adventure which also makes visitors feel unsafe and uncertain. Even though there is no sufficient data evaluating immersive exhibits, they are increasingly being built all around the United States. The immersive exhibits seem to be gaining public acceptance and also design awards.

As animal enclosures developed from cages to naturalistic and immersive exhibits, the designer of these exhibits is gradually changing from the architect who used to design buildings in which animals' cages were placed to the landscape architect who would be able to design either the naturalistic and immersive exhibits.

Both the naturalistic and immersive enclosures require a designer who is familiar with landscape design, as they both attempt to imitate the animal's natural habitat.

Some knowledge of ecology and awareness of biodiversity is necessary. Since planting these exhibits is what gives them their wild appearance, the designer should be well acquainted with native plant palettes and be able to choose them carefully; as using the wrong plant can give the wrong message.

Although choosing the right plant list is important, “the landscaping of a naturalistic exhibit does not begin and end with the simple selection of plants to represent a specific region of the world. There must be a thoughtful landscape design” (Jackson 1996). The landscape architect has to place these plants carefully so that they do not look artificial. They have to feel natural and complex.

2.5 Potentials of the Giza Zoo

The Giza Zoo is considered one of the rare green spots in the heavily populated city of Cairo. The zoo, which is almost 80 acres in area, is home to almost 6,000 animals representing 175 species (redOrbit, 2008). It is located across the River Nile adjacent to Cairo University. In addition to animals, a wide variety of rare imported plant species including cacti from different parts of the world have been collected and successfully grown. There is also a museum located inside the zoo that showcases many birds, reptiles, mammals and fish. The Giza Zoo holds the first California Sea Lion to be born in the Middle East, the heron, the African elephant, Asiatic elephant, black lemur, Nubian Iblex, Dorcas Gazelle, white rhinoceros, hippopotamus, fennec fox, American black bear, Asiatic black bear, Egyptian golden jackal among others (Giza Zoo website). Furthermore, the zoo is home to the endemic fauna collection.

The zoo landscape consists of five hills. The most popular one is the Citadel Hill, where a stream flows through caves and ends in a waterfall that flows to a lake with two

islands. These islands are connected by a suspension bridge (Figure 2.11) designed by Gustave Eiffel -- a French structural engineer who designed the Eiffel Tower in Paris and the armature for the Statue of Liberty. The lakes and hills give the zoo a very unique atmosphere. The hills screen the zoo from the high density city of Cairo from all directions. They offer an oasis with trees and water, isolating visitors from the harsh urban conditions and moving them into a magical setting (Figure 2.12).


Figure 2.11 (left): Gustave Eiffel suspension bridge. Figure 2.12 (right): Hills and variety of vegetation in the zoo. Giza Zoo website photo.

The original paths of the zoo were constructed of colored pebbles which were very carefully designed with different patterns all over the zoo (Figures 2.13 & 2.14).

Figure 2.13 (left): A bridge in the tea island. Figure 2.14 (right): Colored pebble patterns.

Although the zoo has been deteriorating for the past 20 years, visitors can still experience the aesthetic value of the hills and lakes, especially the 'Tea Island', one of the most popular places in the zoo (Figures 2.15 & 2.16). The island is in the middle of a lake surrounded by dense trees that screen it from the rest of the zoo. It is characterized by its highly decorative pathways and walls, and an ornamental bridge that takes the shape of a crown.


Figure 2.15 (left): Tea Island. Figure 2.16 (right): A crafted handrail in the Tea Island.

The Giza Zoo has a special place in the hearts of Egyptians because of its historic importance. In addition, establishing the Giza Zoo was associated with a very important event in Egypt's history -- the inauguration of the Suez Canal. This affection was clearly demonstrated when there were several rumors in 2009 that the Egyptian government was planning to allocate the zoo in one of Cairo's new satellite cities (Figure 2.17), and that the current zoo site would be developed into a residential high rise building complex.

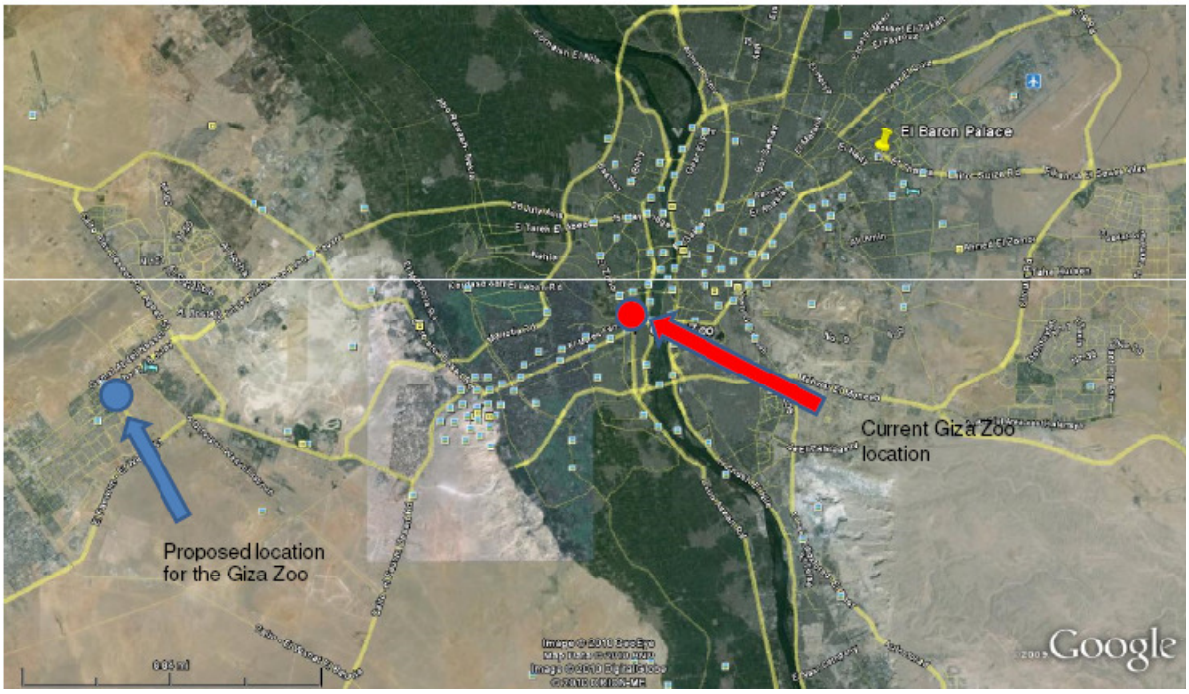


Figure 2.17 The arrow on the right shows the current Giza Zoo location in the heart of Cairo. The arrow on the left refers to the proposed allocation of the zoo by the government in one of the new satellite cities that surround Cairo. Aerial photo.

There was an outrage at all levels of society against the idea. To many people it would not only destroy an important part of Egypt's history, it would destroy priceless memories. This outrage was only contained when the Minister of Culture declared the zoo as an archaeological site. Officials at the Supreme Council of Antiquities declared that "two buildings in the zoo, the Japanese Kiosk and Citadel Hill, which houses monkeys, would be added to the list of Islamic and Coptic antiquities due to their unique architectural, archaeological and historical qualities" (Al-Shorfa, 2009).

After the upheaval, redevelopment of the zoo at its current location seems to be the most likely solution. The Giza Zoo is surrounded on all sides by a dense urban fabric making the expansion of the zoo an almost impossible task. This implies

development within the current 80-acre area, which will be a challenging task for the zoo. The current zoo exhibits are in the form of cages. In order to change those to naturalistic enclosures, more space is required. The landscape architect will have to develop alternative and creative solutions to change animals' cages to naturalistic exhibits in the same amount of space.

2.6 'Development' or 'Destruction' of the Giza zoo

Although there was an attempt in the years 2000-2002 to renovate the Giza Zoo, this renovation did not include the animal exhibits. The AD 2000 renovation focused on the open spaces in the zoo and included planting trees, adding water features, repaving pedestrian pathways and adding fences and outdoor furniture. This unplanned development of the zoo was referred to as a destruction of the historic garden rather than 'improving' its conditions (Stino and Elmasry, 2002). A report prepared by the design and planning team of Stino and Elmasry (2002) revealed that what was supposed to be 'improving' the Giza Zoo conditions was actually destroying its authenticity (Figures 2.18 & 2.19). According to the report, the failure of this attempt was due to several reasons:

- Absence of the concept of zoo development
- Absence of the zoo as a zoological garden
- Unawareness of the importance of conservation
- Depreciation of its historic importance

The AD 2000 zoo redevelopment was not conducted according to a master plan of the zoo, but was rather based on a set of individual decisions and disjoined efforts. It

is evident that the redevelopment of a zoo is not a simple task. Zoo design requires a team effort, with landscape architecture as the primary mediator and coordinator.

Figure 2.18 (left): The tree is fenced and surrounded with different colored forms. Figure 2.19 (right): A concrete bench and light post.

Today Egypt is undergoing another phase of renewal similar to that of the era of Khedive Ismail. The Egyptian Ministry of Tourism has announced its plan to increase the number of tourists from 12.3 million in 2007-2008 to 14 million tourists by 2011 (global post, 2009). A new museum is being built near the pyramids, the Alexandria library is rebuilt, Cairo's airport is renovated among many other projects. The redevelopment of the Giza Zoo would be an obvious addition to Egypt's new vision.

2.7 Giza Zoo Current Condition

The design of the eighteenth century zoo is still intact. Animals are kept in cages and are sometimes chained. Lions and tigers are displayed in six feet by ten feet cages (Figures 2.20 & 2.21). Each lion or tiger is displayed alone in a separate cell. The cage is barren. There is nothing else except the animal inside, and there is no furniture that

could enrich the natural behavior of these animals. There is no space for them to retreat away from the staring visitors and no partner in that solitary confinement.

Figure 2.20 (left): The elephant chained from its leg to the ground. Figure 2.21 (right): The lion in its very small cage.

Fences:

One of the most intrusive features of the Giza Zoo is the excessive use of fences. Everything in the zoo is fenced; animals, trees and even the children's playground (Figures 2.22 & 2.23). There is no distinction between dangerous animals and harmless ones. It is evident that exhibits were not designed for a specific species and their particular behavior. For example, the fence design of the camel exhibit could be easily mistaken for a lion or tiger exhibit. Both exhibits are surrounded by a double fence; one is almost eight feet tall on the animal's side and the other is three feet high on the visitors' side with a distance of almost two feet between both fences. The camel fence is the same height as the lion and tiger fence even though the camel cannot jump or climb an eight foot fence (Figures 2.24 & 2.25). There is no attempt to hide the

fences or make them less intrusive. They are painted green, and the gap between both fences is vegetated with grass or paving.


Figure 2.22 (left): A dying tree that has been fenced. Figure 2.23 (right): The children playground area is also fenced.


Figure 2.24 (left): The camel exhibit with a double fence. Figure 2.25 (right): The lion and tiger exhibit.

Information panels:

The black and white hand lettered information panels in the exhibits include the scientific name of the animals and their origin (Figures 2.26 & 2.27). There is no information about their eating habits, how they live in the wild, their social organization and whether they still live in the wild or are endangered. The information panels are set at such a high level that children cannot read them. They list the scientific name of the species in both Arabic and English languages but all the other information is written in Arabic.

Figure 2.26 (left): Information panel on one of the birds' cage. Figure 2.27 (right): The sign reads "please do not tease the animals".

Water bodies:

The water bodies that were constructed in the AD 2000 redevelopment are already leaking (Figures 2.28 & 2.29). The old water bodies of the zoo are still working but they do not recirculate and filter the water. These water bodies are very important for the zoo residents especially in the hot summer days of Egypt. The water features are

the only cooling facility that the animals have and are essential for their welfare. The concrete ponds are not attractive when they are empty.


Figures 2.28, 2.29 Waterless concrete ponds.

Vegetation:

Most of the exhibits, even the large outdoor ones such as the zebra exhibit, (Figure 2.30) are bare. The lack of vegetation makes the exhibits look even more miserable particularly since vegetation might lessen the feeling of imprisonment in some displays. On the other hand, the zoo as a whole does not lack vegetation. In fact, it is also considered a botanical garden. The large tree canopies that surround the pathways give the visitors a great sense of enclosure and protect them from the sun on hot summer days. The plant species however are not incorporated into the animal exhibits.

Figure 2.30 The zebra exhibit bare from vegetation.

Despite the current deteriorating situation, the Giza Zoo is still a very popular place for recreation, especially among low income families in Cairo. One of the main reasons for its popularity is the low admission fee—only one Egyptian pound (about 20 cents in U.S. currency). Another reason is that the zoo is one of the rare green spaces in Cairo. According to the Giza Zoo website, the number of visitors in 2007 was more than 3,398,000. On feast days, this number is four or five times a normal day's visiting rate. The high visitation levels are due to the central location of the zoo and easy access for Cairo's population (Figure 2.31). This of course makes the zoo a potential tool for educating visitors about animals and their rights and about conservation and its importance.

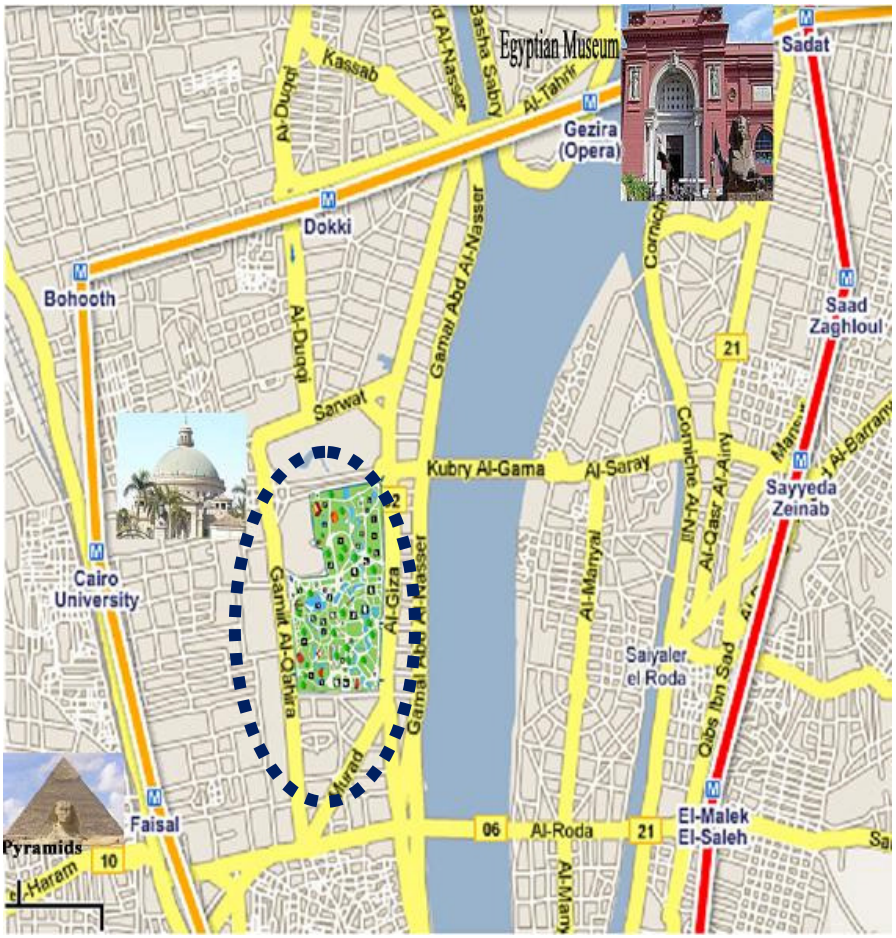


Figure 2.31 The Giza Zoo central location and the surrounding road network. Giza Zoo website photo.

2.8 Animals vs. people

It could be argued that from the visitors' point of view, displaying animals in cages completely protects the visitor and minimizes the distance between visitors and animals. On the other hand, animals in these cages are imprisoned. There is not enough room for them to express their natural behavior. Furthermore, the cages have no retreat areas in which animals could seek refuge when they are stressed by visitors.

Visitors could enjoy viewing animals in naturalistic exhibits which gives the illusion of seeing the animal in the wild (Bostock, 1993). According to the most current thinking about zoo design, animal exhibits should inform us of the nature of the animals' natural environment. Naturalistic exhibits are likely to stimulate our respect and admiration for the animals (Hutchins, Hancocks & Crockett, 1984). In some cases, visitors will not have the perfect view of animals and sometimes they will even be out of sight. This can be resolved using innovative design techniques.

In naturalistic enclosures, visitors will spend time to look for the animal if the animal is out of sight and they might take the opportunity to read the information panel while waiting for the animal to appear. In cage exhibits, visitors will not give it a second glance if the animal is not there. In this regard, the landscape architect should be able to provide both the healthiest environment for animals and an exciting visual experience for zoo visitors.

The revitalization of the Giza Zoo is a great opportunity to put the zoo back on the world map of great zoos. This opportunity should be used as a chance to improve both the animals' and visitors' environment. By looking at other world zoos and how they are designed, it is becoming clearer that the role of the landscape architect has been increasing and is gradually replacing the role of architects who used to be in charge of zoo design. Nowadays most zoos are designed with the landscape architect as the key actor in the design process. For the Giza Zoo to join the world organization of zoos, it has to comply with different sets of criteria that are required by animal welfare organizations. The next chapter will address animal welfare organizations and their accreditation criteria.

3. Animal welfare organizations

Animal captivity has increased world-wide. In addition to zoos and aquariums, circuses and even research facilities keep animals today. Because of the urgent need to organize and regulate ways by which animals are held in captivity, animal welfare organizations emerged to supplement traditional law enforcement. Animal welfare organizations offer support, education, information and expertise. They consider state, federal and international laws as minimum requirements and expect their members to surpass them. In this thesis, the World Association of Zoos and Aquariums (WAZA) and the Association of Zoos and Aquariums (AZA)—the most respected animal welfare organizations will be used to analyze animal welfare standards. In addition to looking closely at WAZA and AZA standards, the requirements of African Zoos and Aquaria (PAAZAB), which is concerned with animal institutions in Africa, will be analyzed.

3.1 World Association of Zoos and Aquariums

The World Association of Zoos and Aquariums (WAZA) is the unifying organization for the world zoo and aquarium community which acts as a catalyst for their joint conservation action (WAZA website). WAZA members are leading zoos, aquariums, associations and affiliate organizations from around the world that focus on a single goal: *conservation*. The WAZA code of ethics supports animal welfare, environmental education and conservation goals. AZA and PAAZAB are both association members of WAZA.

WAZA, like all other zoo organizations, focuses mainly on animal welfare inside and outside zoos. It aims to improve the welfare of animals in captivity by promoting the

need to improve attitudes toward the ecosystem including conserving the natural habitat. WAZA has high standards for zoo accreditation and membership. Only standards that relate to this thesis will be included and explained. The basic principles for all members of WAZA are:

- Conserving species should be the aim of all members.
- Promoting biodiversity.
- Providing assistance in maintaining global biodiversity through research and different environmental organizations.
- Endorsing research through publications and conferences.
- Sharing professional information with other members.
- Encouraging public education programs.
- Achieving all WAZA guidelines.

All members of WAZA should be in compliance with all local and international laws and require the highest standards in the following areas:

- Animal welfare: All members should exercise the highest standards of animal welfare.
- Use of zoo and aquarium animals: When wild animals are to be used in presentations, conservation must be the main message with focus on the natural behavior of animals.
- Exhibit standards: “All exhibits must be of such size and volume as to allow the animal to express its natural behaviors. Exhibits must contain sufficient material to allow behavioral enrichment and allow the animal to express natural behaviors. The animals should have areas to which they may retreat and

separate facilities should be available to allow separation of animals where necessary" (WAZA website).

- Acquisition of animals: Any animal acquisition must not have a harmless effect upon the wild population.
- Transfer of animals: All animals being transferred from an institution to another should be traveling with full records.

From the above WAZA standards, it is clear that in general they do not pertain to zoo visitors.

3.2 Association of Zoos & Aquariums

The Association of Zoos & Aquariums (AZA) is one of the WAZA's associate members. AZA has set very high standards for keeping animals in order to ensure their welfare. The AZA has specific guidelines concerning animal display to make sure that the way animals are displayed will induce respect for wildlife and nature. AZA standards are more detailed than WAZA's code of ethics. According to AZA, the way animals are displayed should focus on the following principles (AZA, 2008):

- Human and animal welfare and safety should never be compromised.
- The way the animal is presented should convey a conservational message.
- The individual animal on display should be cared for at all times, and its physical, behavioral and nutrition needs should be considered.

The accreditation standards for AZA focus mainly on: Animal Collection, Veterinary Care, Conservation, Education and Interpretation, Research, Governing Authority, Staff,

Support Organization, Finance, Physical Facilities, Safety/Security, Guest Services and Other Programs/Activities.

Although AZA accreditation standards are explained in detail in their manual, the regulations become vague and unidentified when they describe acceptable animal exhibits and visitor experience in zoos. The standards are very general and flexible, and do not provide a comprehensive account of how they can be applied practically and specifically. Below are some examples of AZA standards for animal exhibits.

In AZA's accreditation standard, under the *Animal Collection* section, it is stated that: "Animals should be displayed, whenever possible, in exhibits replicating their wild habitat and in numbers sufficient to meet their social and behavioral needs. Display of single specimens should be avoided unless biologically correct for the species involved"(AZA, 2008).

In their *Guest Services* section, AZA accreditation standards require accessibility for all visitors, basic facilities (restrooms, food facilities and drinking fountains), common conveniences like parking and gift shops, and the presentation of animals in a positive, 'professional and aesthetically pleasing environment' (AZA accreditation standards) .

In the *Physical Facilities* section under *Animal Enclosures*, AZA requires that all enclosures whether exhibits, holding areas, or hospital and isolation areas should be of sufficient dimensions and complexity to enhance the animals' physical, social, and

psychological well being, and that the exhibits must work on the enrichment of the animals' behavior.

All of the other AZA standards speak to the animals' well being, their health, medical care, how they should be held, in what environment, how to move animals from one place to another, and the ethics of taking animals from the wild.

These standards have little to say about zoo visitors. There are only a few criteria which imply what animal exhibit should look like and how important these exhibits are in giving visitors a positive message about animals and wildlife. This message that the visitors receive either consciously or unconsciously, affects the visitors' behavior after they leave the zoo. It could direct their attitude in a positive or negative manner regarding animals, wildlife and the whole ecosystem (Sommer, 1972).

A research study conducted by AZA shows that visitors to accredited zoos and aquariums play a role in conservation efforts (Flack et al., 2007). It also shows that visitors are convinced that zoos and aquariums have an important role in conservation, that visitors who go to zoos and aquariums show a higher level of knowledge about conservation and ecology and the study shows that visitors go to zoos and aquariums for different reasons and that those reasons are what drives the specific zoo experience.

3.3 African Zoos and Aquaria

African Zoos and Aquaria (PAAZAB) is an organization concerned solely with African zoos. PAAZAB is a regional organization and is also an associate member of WAZA. The mission of PAAZAB is "conservation through cooperation" (PAAZAB

website). Its mission is to help zoos improve their existing conditions by providing knowledge and expertise.

PAAZAB has the following guiding principles:

- Conserving community.
- Promoting high ethical standards for animal welfare.
- Researching as a mean of providing better opportunities.
- Setting priorities and development strategies.
- Promoting team morale.

PAAZAB does not have accreditation standards for zoos. It welcomes all zoos to join the organization, and promotes zoo development through the cooperation and assistance of its members.

3.4 Discussion and conclusions

Table 3.1 describes AZA & WAZA accreditation standards and shows what currently exists in the Giza Zoo per these standards and what does not. These standards are:

Animal records: There should be up-to-date records of the acquisition, disposition and health records for any zoo animal collection.

Veterinary care: Zoo animals must be checked regularly by veterinarians.

Conservation: Zoos should promote conservation as their primary goal.

Education and interpretation: The zoo should have educational programs targeting audiences such as school groups, teachers and families.

Research: Zoos should show commitment to scientific research, both basic and applied.

Governing authority: The governing authority must be supportive of the accreditation standards.

Staff: An adequate number of trained staff should be available.

Finance: Regardless of profit or nonprofit, institutions must ensure financial stability.

Physical facilities: Facilities should be available for animal enclosure, public areas, housekeeping and equipment.

Safety/security: Employees should be trained for safety measures in their working spaces and other safety procedures.

Guest services: Basic public amenities should be addressed.

Programs/Activities: The institution should have a strategic facilities master plan to guide its development.

Animal presentation: In using animals in shows, the zoo should be promoting conservation and biodiversity.

Table 3.1 summarizes AZA and WAZA standards and applies them to the Giza Zoo (to the best of the author's knowledge). While these standards deal mainly with animal welfare and zoos as research centers with educational opportunities, there are only a few criteria that are linked to visitors. Stronger visitor experience measures would help designers address all critical elements in zoo development. As shown in the table, there is very little in WAZA and AZA standards that consider visitor experience.

Table 3.1 shows AZA & WAZA accreditation criteria showing what exists in the Giza Zoo and what does not.

	AZA	**WAZA**	**Giza Zoo**
Animal Records	√	√	√
Veterinary care	√	√	√
Conservation	√	√	√
Education and Interpretation	√	√	—
Research	√	√	—
Governing Authority	√	—	√
Staff	√	√	—
Finance	√	√	—
Physical facilities	√	—	—
Safety/security	√	—	—
Guest services	√	—	√
Programs/Activities	√	—	—
Animal Presentation	—	√	—

The animal exhibit should address other issues such as authenticity and a good aesthetic setting for the visitor experience. A sustainable landscape design for the animal exhibit decreases the required maintenance. Landscape architects with their skills in ecology, botany, sustainability and human behavior in different spaces, are the

ideal candidate for such an undertaking. They are a key player in zoos and animal exhibit design, aided by a large interdisciplinary team.

Since the animal exhibit is the most important component of the zoo, the message that the public receives from exhibits is critical. As most of the Giza Zoo exhibit provides visitors with an imperfect message, the zoo should follow the standards of WAZA of which it aims to regain membership. Table 3.2 is an attempt to identify some of the WAZA and AZA criteria, if any, that could possibly affect visitor experience in the zoo.

Table 3.2 Summary of accreditation criteria that is related to visitor experience

	Exhibit Criteria	**AZA**	**WAZA**
Animal exhibit	Replicating wild life	√	√
	Avoid single specimens	√	
	Retreat area		√
	Enclosure size	√	√
	Complexity	√	√
	Provision for enrichment of animal behavior	√	√
Interpretive devices	Reflect current methods	√	
	Reflect overall process	√	

The matrix in the table illustrates WAZA and AZA standards for animal exhibits and interpretive devices, as these also play a major role in the success of an exhibit. Table 3.2 shows that even though WAZA and AZA have standards for animal exhibit, they are only concerned with animal welfare. There are no goals associated with visitors, their needs, expectations and experience in the zoo.

3.5 The Role of Landscape Architecture

The animal exhibit is one way to communicate with visitors. The message that these exhibits send can shape how people behave towards animals and wildlife in general. The exhibits have to address the public intellectually and emotionally, and this can be achieved through proper design. In essence, design is communication, where the landscape architect is viewed as communicating with both animals and visitors. The landscape architect communicates with animals through design by providing captive habitat that is similar to their natural habitat. The exhibit design aims to connect animals to their habitat fulfilling their social, physical, psychological and natural behavioral needs.

As mentioned earlier, naturalistic exhibits provide an answer for most of animals' needs, as nature is the perfect place for animals. The design intent to imitate the natural setting seems like the obvious solution. Landscape architects look towards nature as a solution to zoo problems, where nature is complex, unpredictable, and constantly changing. They start designing animal exhibits with great complexity, using different soil materials, rocks, vegetation, water, elevation changes and hiding places, thus creating spatial variation. This spatial variation stimulates complex animal behavioral patterns, which entices active and natural behavior. Caged animals on the other hand live in

sterile exhibits and are isolated from nature which results in animal boredom which can lead to behavioral problems.

At the same time, the landscape architect communicates with visitors through the design by addressing visitor needs. Landscape architects recognize that people go to zoos to see animals and therefore strive to design authentic animal exhibits which give zoo visitors “real” wildlife experience.

Landscape architects design zoo exhibits with great care to enhance the visitor experience of not only seeing the natural habitat (as in naturalistic exhibits) but also being part of it (as in immersive exhibits). Specific features are employed to allow for this immersive feeling. Barriers for example are hidden carefully so that there is no visual obstacle between animals and humans. The viewing area is also chosen with great care so that it looks like visitors are peeking on animals in their natural habitat. These features and others make visitors feel that they are actually in the wild rather than just watching it in artificial setting.

The experience in immersive exhibits becomes highly enhanced, where visitors find themselves walking on narrow rough trails, with tree branches hanging over them and surrounding them, the same way as if they were in the animal exhibit. Visitors no longer are spectators in this experience; they are rather active participants in the scene. Therefore they tend to become more attuned to nature through the illusion of being in the wild. Visitors realize that they share the same space with the animals, especially with features such as the elimination of physical or visual barriers between people and animals. This message enhances the visitors’ sense of conservation, not only towards animals but also towards natural habitat in general (Kellert, 1996).

The following chapters attempt to establish a set of visitor guidelines that need to be addressed in the design of animal exhibits. These design guidelines should meet the standards of WAZA and AZA regarding animal exhibits, and focus simultaneously on the enriching the visitor experience. The next chapter aims at defining ‘visitor experience’ to be able to establish the guidelines for Giza Zoo.

4. Visitor Experience

There has not been sufficient research concerning the evaluation of visitor experience in zoos or even the evaluation of animal exhibits (Ebenhoh, 1992). Most visitor experience research is primarily based on data from museums. Other research mainly deals with the holding power–a measure of time spent viewing an exhibit, and how zoo visitation increases public awareness concerning conservation efforts. The goal of this research is to focus on the visitor experience in zoos, but first the thesis will define what is meant by 'visitor experience'.

Since there is no exact definition of the visitor experience, it could be treated similarly to how animal exhibits are defined and evaluated in the literature. There is no clear definition of a good or effective exhibit. Currently, determining whether an exhibit is effective or not is based solely on factors of popularity or expertise (Shettel, 1968). Jones (1986) argues that an exhibit must be designed in a way that produces a specific measurable result. This implies that the zoo design team should set goals and objectives for the exhibit early on in the process, and that the exhibit should be evaluated as good or effective based on whether or not it meets those goals.

4.1 Defining 'Visitor experience'

As the zoo has to set its mission prior to designing the exhibit, it also has to set the kind of visitor experience it desires and establish guidelines for this experience. Since there are no visitor experience guidelines established by the Giza Zoo, this thesis will take the liberty to define those guidelines by means of literature review and analysis,

personal observation, and personal experience (particularly in the Giza Zoo). Visitor experience, as identified by the thesis, is an enriching experience that contains the following components: authenticity, aesthetics, recreation, education, and exploration. Following is a brief description of these components. The sequence is not priority based (Figure 4.1).

Figure 4.1 The five components of visitor experience (equally weighted).

Authenticity: is being true to the origin and current location of animals.

Zoos have historically displayed animals of different species from different regions, all on an equal basis without consideration of their original habitats. In naturalistic and immersive exhibit animals are displayed in groups or herds in naturalistic landscape settings, in a similar manner to their authentic or original environment. This way of displaying animals is important for visitors and their perception of the animal's natural habitat.

Zoos are viewed as an opportunity to show the public "the characteristics of original landscape zones all over the world" (Drecker, 1992). This could be accomplished through a design that is true to animals' needs by including elements in the exhibit such as proper exhibit size and shape, water features to play in, trees to climb, caves or burrows to hide in, and other necessary features in the exhibit.

Authenticity could also be established by using plants and settings that are true to the region of the animal's native environment. A zoo might be in a different regional climate than that of the animal's origin. "Vegetation is the most important tool for creating a feeling of being" in a certain region (Tanant & Nani, 2008). The use of plants that have the same leaf shape and size as the animal's natural habitat is important to reinforce the sense of the animal's natural landscape, but these plants should also be native to the zoo region or at least adaptive to the climate of that region. Using this approach, the designer is being "authentic" to both the animal's natural habitat and the zoo environment.

In addition to the plant species the exhibit setting as a whole should be authentic to the animal's natural environment. For example, a waterfall feature in a camel exhibit would be considered a fake, as the camel's natural habitat is the desert. However, providing dry climate vegetation (e.g. cacti) and constructing the animal exhibit floor with sand is considered authentic to the camel desert origin. Being authentic to the animal's natural environment would enrich their natural behavior. Being true to the zoo region would offer a sustainable landscape and minimize the need for heavy maintenance. In general, authenticity can be established by getting acquainted to the animal's natural habitat and sharing knowledge with team members , other experts and research groups.

Aesthetics: "The factors which contribute to creating an aesthetically pleasing experience are novelty, complexity, surprise, ambiguity and uncertainty" (Berlyne, 1971)

When zoos were first established, animals were hosted and displayed inside buildings as if they were objects in a museum. Zoos relied on buildings that conveyed an aesthetically pleasing image for visitors. Today naturalistic exhibits rely mainly on mimicking the natural landscape of the animal to provide visitors with a sense of beauty and belonging to another space, namely *nature*. Naturalistic exhibits allow for an aesthetically pleasing feeling as they tend to imitate nature.

Proper aesthetics can be achieved by using some natural elements such as plants, water, landform and rocks. These elements are more likely to provide a feel of complexity, surprise, ambiguity and uncertainty that contributes to proper aesthetics. This can be accomplished by using a suitable composition, variety, repetition and harmony between these elements (Kaplan et al 1998). However, the animal still remains

the master ‘piece of art’ in the exhibit (Bostockn, 1993). Some species for example are considered to have a perceived beauty in their own right such as reptiles because of their hypnotic motion and perception of danger, and pachyderms because of their unusual size and shape (Bitgood & Benefield, 1986a) (Figure 4.2).

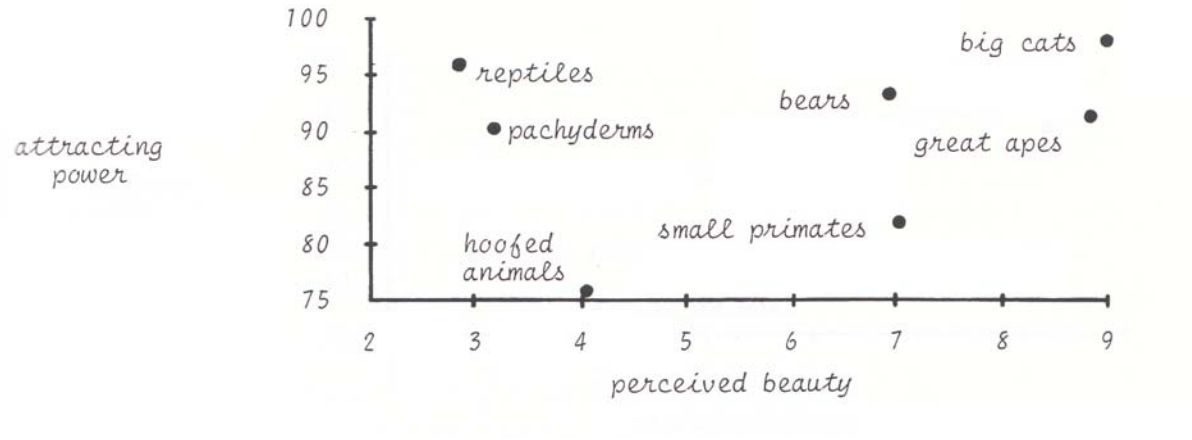


Figure 4.2 The relationship between the attracting power and the perceived beauty of an animal (beauty rated on a ten point scale by visitors). Bitgood & Benefield (1986a) graph.

Given that the animal is perceived as the main focal point of the exhibit, implies that exhibit design should make sure that visitors have the best possible view or visual access to the animal. It also implies that any single exhibit element should not supersede the holistic picture of the exhibit.

Recreation: defined as spending time in a naturalistic outdoor setting that allows for socialization.

Recreation is the foremost reason for visiting a zoo. A study done by Flak (2006) demonstrated that one of the main reasons for visiting zoos is plainly “a good day out”, where people enjoy themselves as part of a social group. An analysis done by Clayton,

Fraser and Saunders (2009) suggests that zoo animals facilitate “topical interaction among social groups”, as they explore the connection between human and animals. In addition, observing animals in groups and their interaction together promotes social interaction between viewers. It has also been recorded that the holding power of any exhibit increases when an infant animal is in the exhibit (Bitgood & Benefield, 1986a) (Figure 4.3).

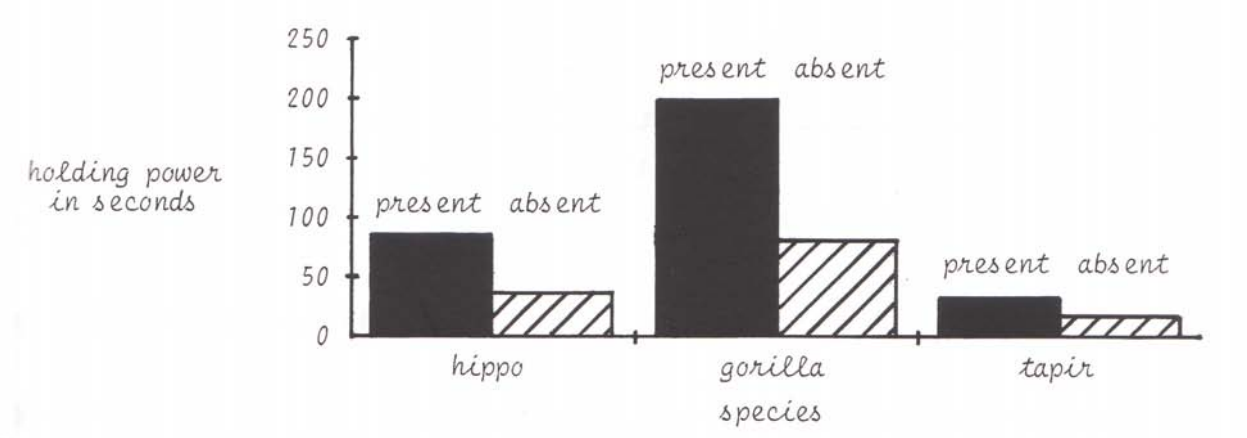


Figure 4.3 The holding power of exhibits in case of the presence of an infant and its absence. Bitgood *&* Benefield (1986a) graph.

Zoos are seen as a recreational destination for families. The zoo is where families have the opportunity to provide their children with information about animals, wildlife, plants, and the ecosystem (Morgan & Hodgkinson, 1999; Reade & Waran, 1996). Zoos also are a great opportunity to promote stewardship towards the Earth. “Families have been in the business of learning together for many years. Their behavior (in museums) reflects a complex, well-balanced interweaving of personal and cooperative agendas to learn” (Hilke, 1988). This example shows how the zoo can play an important part in promoting social interaction among groups and families.

People go to the zoo to amuse themselves and have a nice outdoor experience in a natural setting. According to Curtis (1968), “the enjoyment of the outdoor park setting is recreational by itself. A zoo is also a source of entertainment. Indeed the entertainment factor is perhaps one clue to the intrinsic popularity of zoos”. The presence of “popular animals” that interact with other animals or visitors provides visitors with an entertaining performance. “When there is no movement there is no fun” (Wolf & Barbra, 1981). Thus recreation occurs through the combination of a naturalistic landscape, active animals and an entertaining program offered by the zoo.

Zoos compete with other recreational institutions for visitor dollars. The primary difference between zoos and other recreational institutions however is the successful mixture and link between recreation and education (Polakowski, 1987).

Education: is gaining knowledge either consciously and unconsciously.

Zoos emphasize animal and habitat conservation as their main goal. This can only take place through public education. Education can occur in the zoo either consciously or unconsciously. Conscious education takes place when zoo personnel provide information about the animal’s eating habits, behavior, origin and other related information. Reading the information panels in front of the animal’s exhibit is also another component of conscious education.

Unconscious education takes place by observing the behavior of animals in their natural surroundings and exhibits that resemble their natural habitat. It can also be achieved through play. Assembling puzzles that resemble animals in their exhibit or

asking funny, but educational, questions are examples of innovative ideas that provide indirect educational goals.

Exploration: occurs when there is a mixture of complexity and mystery in a landscape.

Zoo visitors desire a different experience than their regular everyday experience. “Exploration can satisfy what may be a basic human need for new experience” (Carr, 1995). Even though there is no guarantee that a designed landscape will be explored, it should have the “right level of novelty and complexity to stimulate curiosity” in the landscape (Carr, 1995).

The exhibit setting itself should facilitate exploration. If people are eager to explore they will expand their horizons and find out what lies ahead. Kaplan (1998) believes that a world without opportunities for exploration is “a grim place indeed”. For a landscape to provide opportunities for exploration, two main factors are required: complexity and mystery.

Complexity is based on two dimensional scenes. It involves the perception of components in the scene, their quantity, the way they are grouped and their location. It also occurs by having many different visual components in the scene. The richness of the landscape or the variety of its components encourages exploration.

Mystery is the desire to explore a place if there is a promise that one can find out more. Incorporating mystery into an animal exhibit could be achieved by adding features such as curved pathways instead of straight lines, vegetation that partially obscures or blocks the view so that visitors cannot see the entire exhibit from one location. The physical environment is not the only place where exploration occurs. Exploration can be

facilitated by other factors such as providing options, wondering and imagining (Kaplan, Kaplan & Ryan, 1998).

Visitors can explore naturalistic exhibits as animals hide behind bushes and rocks, making viewers wonder what they are doing. Having a group of animals together in the same exhibit increases visitor interest and increases their holding power. While naturalistic exhibits keep visitors on the safe side of the exhibit, immersive exhibits place both visitors and animals in the same space. This further increases exploratory behavior and moves visitors from observer to a more active participant. It increases the illusion that they are really in the wild. These new types of exhibits have not been evaluated, but they are being built in zoos across the globe.

Visitor experience, a subjective feature, has now been defined. In the following section, the thesis uses affordance theory to translate the visitor experience into a built environment. The role of the landscape architect becomes essential in this case, in order to incorporate these components of the visitor experience into an animal exhibit.

4.2 Affordance theory

This research is based on the concept of affordance by James Gibson (1979). The concept of affordance has been used by designers as it shows the link between the built environment and human behavior. Gestalt psychology recognized that the meaning or value of an object is perceived immediately and that “each thing says what it is….. a fruit says ‘Eat me’; water says ‘Drink me’; thunder says ‘Fear me’; and a woman says ‘Love me’ “(Koffka, 1935). Psychologist James Gibson then introduced the concept of ‘affordance’. “The affordance of something does not change as the need of the observer

changes. The observer may or may not perceive or attend to the affordance, according to his needs……..The object offers what it does because it is what it is" (Gibson, 1979).

Affordance is objective and not subjective. The affordance of the environment is in a sense objective, real, and physical. On the other hand, meaning and values are considered subjective. This theory suggests that every object or built environment offers a certain human behavior. For example a seat offers a place for people to sit, and so it 'affords' a human behavior that will not be conceived unless a person took advantage of it. At the same time, this seat will continue to offer a place for people to sit, whether people decided to sit on it or not. It does not change; it is what it is. It depends mainly on people making 'behavior choices'.

According to Gibson, the presence of components or objects that afford certain activities or aesthetic interpretations minimize or maximize the zoo visitors' 'behavior' opportunities. This research puts forward the assumption that visitor experience will be enhanced by providing certain elements or objects that 'afford' changes in that experience. The proposed design guidelines in this research thus become clear and will be determined according to the required 'visitor experience' in the Giza Zoo animal exhibits. These guidelines will be validated through case studies in the following chapter.

It is important before developing the guidelines to explore precedent guidelines in the literature. There have been a few attempts to establish guidelines for exhibit design. Jones (1982) developed the following guidelines:

- Have a scenario for the exhibit that describes the place being recreated in terms of geography, geology, the bioregion and specific habitat.
- Immerse visitors in a natural landscape or a cultural setting.
- Hide features (barriers and service buildings) that distract the visitor from the illusion of actually being in the same setting as the animals.
- Let animals dominate the exhibit. Avoid designing the exhibit in a way that the public looks down on the animals.
- Make sure that the public cannot reveal the entire exhibit from any point.
- Show appropriate animal and plant species together to recreate the original habitat as much as possible.

Another attempt to develop exhibit guidelines by Gibbons (1994) is described below:

- Increase enclosure size
- Increase structural complexity
- Increase social complexity
- Increase natural habitat resemblance

Although these guidelines are very vague, they do show the major elements that could influence the success or effectiveness of an exhibit. Developing a naturalistic built environment is one element that is repeatedly mentioned across different guidelines. Although it may seem logical to explain why animal exhibits should mimic animals' natural environment, the thesis will discuss the rationale for naturalistic exhibits so that there is an acceptable level of concurrence on its importance.

4.3 Rationale for naturalistic exhibits

There are four main reasons for designing naturalistic exhibits (Gibbons, 1994):

1- Ethical treatment of animals:

Disciplines such as animal behavior, ecology, physiology, and veterinary medicine have revealed the link between biological and psychological requirements of animals (Curtis, 1985). Deficiencies in the physiological and behavioral attitudes of animals in captivity may affect the validity of scientific findings deduced from these cases (Weihe, 1988).

2- Breeding animals in captivity and maintaining them:

Wild animal population has been decreasing all over the world due to habitat destruction, poaching and illegal trade (Western and Pearl, 1989; Wilson, 1989). Caged exhibit zoos do not provide the natural and social behavior needed for husbandry and breeding. They also do not encourage animal natural behavior and may promote for abnormal behavior that can affect animal health and well-being (Hediger, 1969).

3- Scientific study of animal behavior:

Naturalistic environments enable researchers to identify physiological, morphological and cognitive mechanisms that stimulate animal behavior. They provide scientists with opportunities to study animal behavior which they cannot do in the wild (Hediger, 1969).

4- Education:

Naturalistic environments serve as a tool to educate the public about animals, wildlife, plants, the ecosystem, and the need to conserve not only animals but also their habitat (Gibbons, 1994).

After demonstrating the rationale for building naturalistic environments, it is worth noting that exhibit design should balance between the need for “complexity and observability” (Gibbons, 1994). For an exhibit to mimic nature and provide a challenging environment, various elements should be placed with care such as baffles, barriers, nest boxes, or branches. The exhibit layout should maximize visitors’ observability of the animals.

From the previous guidelines, it is clear that there are certain components in the animal exhibit that affect visitor experience. These components, when manipulated by the designer, could satisfy the requirements for a successful visitor experience. Zoolex, a leading website in zoo design, declared exhibit components as the following:

- Plants
- Features dedicated to animals
- Features dedicated to keepers
- Features dedicated to visitors
- Interpretation

As previously identified in the scope of this thesis, the thesis will not examine keepers’ needs. Through the detailed examination and reflection of the previous components (Table 3.2), the following are identified as the basic components that define the boundary of an exhibit:

- Exhibit style
- Exhibit setting
- Exhibit furniture
- Vegetation
- Information panels
- Barriers
- Visitor viewing area

4.4 Giza Zoo animal exhibit design guidelines

As discussed before, the targeted 'visitor experience' for the Giza Zoo focuses on authenticity, aesthetics, recreation, education and exploration. Design criteria for the zoo should fulfill both 'visitor experience' and the WAZA standards that focus on animal needs in order to come up with standards for the whole exhibit. For the exhibit to fulfill visitor and animal needs, the design criteria should have the following standards:

Authenticity:

Exhibit style: Naturalistic and immersion exhibits are the most commonly used exhibit styles in zoos that promote authenticity.

Exhibit setting: should be authentic in every possible detail to provide the visitor with the true story of the origin and natural habitat of the animals without distortion or exaggeration.

Exhibit furniture: should be authentic to the animal's natural environment, for example using dead trees that are native to the habitat, artificial rocks that are carved as natural rocks and habitat-specific water features.

Vegetation: by using native plants of the zoo's origin, but resemble the texture, shape, color and size of the animal natural habitat. Choose native plants of the zoo's region to allow for sustainability and authenticity.

Barriers: need not to stand out; use natural materials when necessary. If barriers are too large and noticeable visitors will get the message that there is a significant difference between animal space and visitors' space.

Visitor viewing area: will appear as authentic in naturalistic exhibits if there is an attempt to make them resemble the animal's natural origin or cultural background.

Aesthetics:

Exhibit style: the naturalistic exhibit style allows for a sense of aesthetically pleasing experience because of its complexity, variety and harmony.

Exhibit setting: nothing in the exhibit setting should distract visitors from the animal. However, the background scene should be well detailed so that the scene looks aesthetically pleasing.

Exhibit furniture: using natural material in the exhibit creates more unity within a naturalistic exhibit rather than using prefabricated furniture made with unnatural materials (e.g. plastic, concrete or steel*)*.

Vegetation: composition and complexity of vegetation is very important in both naturalistic and immersive exhibits.

Information panels: should be inviting for visitors to read. The design of these panels should be attractive, colorful, with a variety of images, less text, big fonts and easy language.

Recreation:

Exhibit style: the naturalistic and immersive style is inherently recreational, while the caged exhibit zoo style offers very little space for recreation.

Exhibit setting: using the naturalistic or immersive setting is inherently recreational. It provides visitors with a relaxing and enjoying experience. Water is one of the most important features in an exhibit that allows for normal animal behavior.

Exhibit furniture: having furniture inside the exhibit that enriches animal behavior. It is important to allow visitors to watch animals in motion and perform their normal activities. Examples include the presence of dead trees, ropes, hammocks, tree houses, and nets.

Information panels: could incorporate questions that trigger social interaction by trying to find the right answer about the origin or natural habitat of the animals. Interactive panels such as games and puzzles provide additional educational recreation opportunites at the exhibit and at home.

Visitor viewing area: should contain enough space to allow people to socialize or stand together to watch the animals.

Education:

Exhibit setting: is significant for unconscious education. When the exhibit is authentic, the public gets the right information about the animal's natural habitat.

Exhibit furniture: increases animal activity, which in turn leads to an increase in holding power. This provides for more educational opportunities.

Vegetation: the use of different plant species educates visitors about the wide variety of plants in different regions. Educational objectives can be achieved unconsciously by just watching the plants and enjoying their appearance or consciously if the plants are labeled with their names and species.

Information panels: attractive graphics for signage and information panels increase the probability of visitors reading it (conscious education). Placing panels on a height appropriate for young children increases the possibility of children reading or asking their parents what the pictures mean, and thus adults would participate as well in the educational process.

Barriers: minimizing the visual presence of barriers helps visitors understand that we all live in the same space and that our actions affect the animal's natural habitat. This also increases the sense of conservation and stewardship towards Earth.

Visitor viewing area: The placement of the visitor viewing area affects one of the important messages of the zoo, which is respecting the animal. According to Jones (1982), if the zoo desires that visitors respect the animals, the design itself should respect the animals first. Placing the animal exhibit at a lower level than the visitor

viewing area should be avoided so that visitors will not look down on the animal. Whenever possible, animals should be placed at a higher level than the visitors' area.

Exploration:

Exhibit style: while the naturalistic exhibit style allows for visual exploration, immersive exhibits allow for both physical and visual exploration.

Exhibit setting: should be carefully designed so that the exhibit is not revealed at once for the public. Having cages or concealed places is more inviting for exploration.

Vegetation: the arrangement, variety and composition of plants all play an important role in giving the visitors the impression that there is more that the eye can see hidden behind these plants.

Information panels: could promote visual exploration by providing the visitors with interesting stories about animals and their life or by asking interesting questions.

Barriers: integrated barriers increase the visitors' sense of exploration, as they feel that they are exploring the animal world with no restrictions. Ideas for using innovative barriers that allow for public exploration can be incorporated, such as having a tunnel that runs through the exhibit so that the visitors feel and find themselves looking within the exhibit rather than from the safe side. Glass barriers are considered minimal barriers as they are visually do not obstruct visual exploration.

Visitor viewing area: allows for a high sense of exploration only in case of immersive exhibits.

The WAZA criteria: most of the WAZA animal exhibit criteria have been covered in the previous guidelines except for the following:

- The exhibit size has to be adequate for the animal size and needs. Small exhibits provide more opportunities for people viewing the animal, while in large ones, the animals are more likely to hide from curious visitors. This also affects visitor experience. Research has shown that the larger the animal the greater the holding power of the exhibit. Greater holding power could be accomplished for smaller animals by scaling down the exhibit setting and furniture (smaller plants, waterfalls, etc.) (Bitgood et al., 1986a; Ptterson et al., 1988). The exhibit space should be big enough for the animals, but not too big so that animals are visually lost.
- Naturalistic exhibits are recommended by WAZA. This type of exhibit provides opportunities for both animals and viewers.

Based on the identified guidelines for the visitor experience required for Giza Zoo visitors, the thesis will next examine these guidelines and validate them through case studies.

5. Case Studies

5.1 The rationale for selection of case studies

According to a research study conducted by Morris and Morris (1966), the top ten animals favored among children were the chimpanzee, monkey, horse, bushbaby, panda, bear, elephant, lion, dog and giraffe. The findings of another survey conducted by Kellert (1989) showed that the elephant is the most liked wild animal. In a study done to measure the holding power of different animals (Bitgood & Benefield, 1986a), it was found that inactive animals still received a long holding power. Pachyderms (such as the elephant, hippopotamus, and rhinoceros) came first in holding power, followed by predators (such as tigers, lions, and hawks) and primates (such as great apes, gibbons, Old World monkeys, and New World monkeys) (Figure 5.1). In addition to holding power and popularity the thesis considered choosing animals in the Giza Zoo with the most deleterious exhibits.

This chapter will examine the guidelines previously set by the author for determining the 'visitor experience' in the Giza Zoo through case studies of animal exhibits. Since all of the zoos in the case studies are members of either the WAZA or AZA organizations, they are assumed to comply with their criteria. The case studies are:

- Elephant exhibit, Zoo Atlanta.
- Elephant exhibit, San Diego Zoo.

— Elephant exhibit, Woodland Park Zoo, Seattle.

— Lion exhibit, Zoo Atlanta.

— Lion exhibit, San Diego Zoo.

— Lion exhibit, Zoo Leipzig.

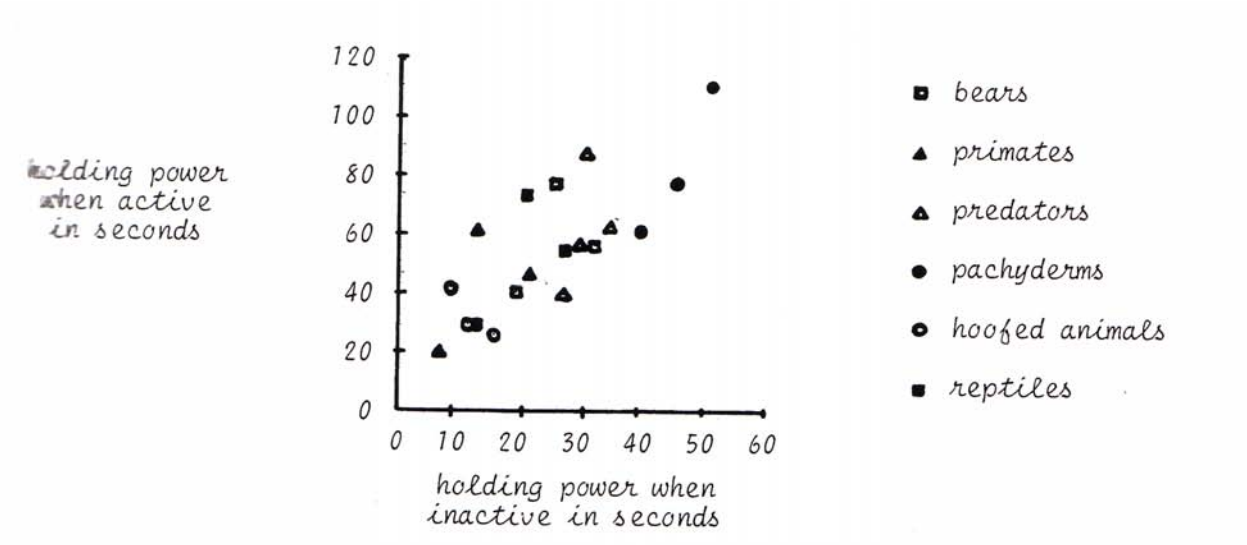


Figure 5.1 Scatter diagram of the holding power of various types of animals in active and inactive states. Bitgood & Benefield (1986) graph.

5.2 Elephant exhibits

5.2.1 Elephant exhibit, Zoo Atlanta

After being listed as one of the ten worst zoos in the United States in the mid-80's, Zoo Atlanta is now considered a world-class institution (Zoo Atlanta website). In 1989, the elephant exhibit located in the rainforest area was opened. The entrance to the rainforest area is through a gateway which announces to the visitors that they are entering the savannah forest. The exhibit is naturalistic in style. It is divided into outdoor and indoor exhibits. The spacious landscape of the outdoor exhibit includes a pond for

the elephants to play in, bathe and refresh in hot summer days, and provides a significant view for visitors (Figure 5.2). Artificial rocks in the exhibit form a cave which the elephants could retreat to in order to hide from the curious eyes of the public when they desire. The indoor exhibit is where the elephants are brought inside for feeding and as a resort from the outdoor climate. This indoor area is dark with an unpleasant odor.

Figure 5.2 Elephant exhibit layout. Zoolex website photo.

Authenticity:

Exhibit style: The naturalistic style promotes for authenticity.

Exhibit setting: The exhibit is designed to resemble the natural environment of the animals. The pond is designed to look natural, which adds to the aesthetic feel of the exhibit. The exhibit ground is covered with a type of red sand. The inner wall of the exhibit is lined with artificial rocks.

Exhibit furniture*:* The furniture setting is authentic to the animal's natural habitat. Elements of furniture include dead trees laid at the exhibit floor, artificial rocks, and a high tree that provides elephants with food as they would do in the wild.

Vegetation*:* Plants are chosen carefully to resemble African vegetation. Tall grass, wild flowers, and thorny plants emphasize the naturalistic feel of the savanna forest.

Barrier: Barriers are minimized. They are made out of wood with strings that are stretched horizontally across the barrier, making them feel natural.

Aesthetics:

Exhibit style: The style is naturalistic, allowing for a good aesthetic experience.

Exhibit setting: The exhibit is characterized by its complexity and harmony. This is provided through elements like the pond, artificial rocks that line the exhibit interior, the plant island and the vegetation at the perimeter, all of which contribute to a good aesthetic scene.

Exhibit furniture: Using natural materials like dead trees and other elements adds to the beauty of the exhibit.

Vegetation: A good aesthetic experience is seen in vegetation through the complex composition of plants at the perimeter of the exhibit, dense vegetation in the small island, and the variety of plant species.

Information panels: Using elements of graphic design and colored images makes information panels look appealing.

Recreation:

Exhibit style: The naturalistic style of the elephant exhibit is inherently recreational.

Exhibit setting*:* The exhibit setting is naturalistic. The presence of the pond provides animals with the opportunity to bathe and play with water and splash it, enriching the animal behavior and giving the visitors the opportunity to watch the elephants practicing their everyday life activities (Figure 5.3).

Exhibit furniture: Dead trees in the exhibit allow elephants to move them from one place to another, thus providing the visitors with a feeling of the natural behavior of the elephant and its motion within the environment.

Information panel*:* Panels have questions that enable social interaction in order to find answers, either within or among groups in front of the exhibit.

Visitor viewing area*:* The viewing area is big enough to allow a group of people to observe the elephants together.

Figure 5.3 Elephants having fun in their natural pond. Zoolex website photo.

Education:

Exhibit setting*:* The setting highlights the animal's natural environment as the savannah forest which the visitors learn unconsciously throughout their visit.

Exhibit furniture: The presence of furniture elements in the exhibit such as dead trees allows the public to observe the elephants in action while learning about their natural behavior.

Vegetation: Using tall grass, wild flowers, and thorny plants is a way to educate the public about the different plant species that are found in the African savannah forest (unconscious education).

Information panels: Colorful information panels, full of illustrations with minimum text, encourage visitors to read — especially young children. Information panels are hung on barrier handrails at a height of three to four feet within the reach of young children (conscious education).

Barriers: Although barriers are minimal, they still visually separate the visitors and elephants.

Visitor viewing area*:* This area is set higher than the elephant exhibit, making humans feel superior and giving the public the wrong message with respect to the relation between humans and animals (Figure 5.4). Part of the educational message of the zoo however is enhanced by the presence of zoo personnel at scheduled times to talk to visitors about the animals and their behavior.

Figure 5.4 Minimum vegetation within reach of the elephant and in front of the barrier, while vegetation is dense around the exhibit perimeter

.

Exploration:

Exhibit style*:* The exhibit is naturalistic, providing visitors with visual exploration.

Exhibit setting: Elements such as caves, water and dense vegetation all give the exhibit a sense of mystery and complexity which stimulate visual exploration.

Vegetation*:* Dense vegetation at the perimeter of the exhibit implies that there is more than the eye can see, thus providing visitors with a sense of mystery.

Information panels: Panels incorporate questions about the elephants, thus allowing for exploration.

Barriers: Even though barriers are at a minimum they still exist, thus reducing the sense of visual exploration.

Visitor viewing area*:* Not applicable.

The elephant exhibit at Zoo Atlanta provides a good visitor experience with respect to authenticity, aesthetic and recreation. Regarding education, one of its visitor viewing areas is at a higher level than the elephant giving people a sense of human superiority. The exhibit did not offer a unique visitor experience to increase the sense of exploration for visitors. None of the visitor viewing areas are considered to be innovative design technique (Table 5.1).

5.2.2 Elephant exhibit, San Diego Zoo

Rather than organizing the animals according to their geographic origin, the San Diego Zoo chose to incorporate animals according to an abstract idea of the endangered animals in California. The exhibit encompasses animals from different species and different origins in a new exhibit called the 'Elephant Odyssey', which opened in 2009 (Figure 5.5) (Elephant Odyssey website).

Figure 5.5 A memorial plaque that displays endangered and extinct animals.

Authenticity:

Exhibit style: The elephant exhibit is designed in a new way that is rarely seen in zoos. The naturalistic design of the exhibit is kept to a minimum. The exhibit style does not allow for authenticity. There is no sense of the elephants' origin or their current location. It might be referred to as the "memorial style".

Exhibit setting: The elephant exhibit is very simple. The water feature consists of a big pool. There is no place for the elephants to hide. The large open space makes the elephants stand out in the exhibit, but offers no connection to their origin or existing habitat.

Exhibit furniture: The exhibit is rich with innovative furniture elements. One of the innovative elements is a stainless steel tree construction (Figure 5.7). Although interesting, there is no sense of authenticity. There are other regular furniture elements like dead trees and rocks placed in separate areas. These natural elements give the exhibit some sense of authenticity, but it is minimal. The steel tree-like construction stands out as an unrelated element.

Vegetation: Vegetation is at a minimum in the exhibit. Yet the species used are native to the zoo region.

Information panels: Not applicable.

Barriers: Barriers are minimized, but there is no attempt to make them authentic. Barriers are not integrated in the landscape. They are made of steel and are reinforced

with electric fences. The barriers are not hidden from view, which make them less authentic.

Visitor viewing area: It is comfortable and has a modern look, but is not authentic.

Aesthetics:

Exhibit style: While the exhibit style is not the regular naturalistic style and since the vegetation has not grown in, it is hard to decide whether the new style will be as aesthetically pleasing as the naturalistic one.

Exhibit setting: The setting is very simple and almost barren. There is no water feature. There are also no hidden landscape features for elephants to escape to.

Exhibit furniture: Dead trees in the exhibit provide the exhibit with perceived beauty, while the steel tree construction does not.

Vegetation: The sparsely planted ground plane is not aesthetically pleasing. It is very simple with no clear composition. The exhibit is new and plants might not be fully grown yet. The exhibit opened May 2009 and was visited by the author in December 2009.

Information panels: Panels and memorial plaques contain more text than images. There are no bright colors to attract children and adults. The graphic design used in these panels is relatively simple (Figure 5.6).

Figure 5.6 The memorial plaque has lots of text. It raises an interesting question to attract visitors' attention to read the panel.

Recreation:

Exhibit style: As the exhibit style is not of a typical naturalistic style, it cannot be assumed that it is recreational.

Exhibit setting: There is minimum exhibit setting, making it less recreational.

Exhibit furniture: The steel tree construction offers the elephants many opportunities for action (Figure 5.7). Food is placed at the "trunk" of the tree. The elephant has to keep pushing the gate down and pulling the food from the top. This construction not only supplies food but also provides shade and entertainment and enriches elephant behavior.

Information panels*:* Panels have questions, initiating conversation between groups.

Visitor viewing area*:* The viewing area is big enough to allow for socialization and viewing the animals.

Figure 5.7 View from visitor area showing the elephant exhibit with minimum vegetation and the steel tree construction with some dead trees on the ground

Education:

Exhibit style: The memorial exhibit style of the elephant is uniquely educational in the way it alerts people to the destruction of habitat and species extinction. The public may be more aware of the importance of conservation.

Exhibit setting: The barren exhibit setting is very important for unconscious education, as visitors realize that the elephant natural habitat is being destroyed and that these elephants are at the risk of extinction.

Exhibit furniture: The steel tree construction is designed to enrich elephant behavior. The possible complexity of interaction with the steel construction exhibits the elephant's intelligence and educates the public. Naturalistic furniture elements such as dead trees and rocks allow for natural elephant behavior.

Information panels: Panels are designed in the form of memorial plaques. That might work well with the main idea of the 'Elephant Odyssey' exhibit that revolves around the idea of the extinction of the mammoth, a relative of the elephant, in California. It serves a slightly different educational purpose. The panel height makes it harder for young children to read.

Visitor viewing area*:* The viewing area conveys the message of emptiness and barren life as does the exhibit. The elephants are placed a little higher than the visitors.

Exploration:

Exhibit style: The memorial exhibit style does not allow for much exploration.

Exhibit setting*:* The open, barren and sterile setting allows for almost no exploration. Visitors can visually access everything and there is no mystery or complexity.

Vegetation*:* Vegetation is at its very minimum with no complex composition or variety of plants. Visitors can see the whole exhibit at one glance. Nothing can hide behind the vegetation.

Information panels: Panels encourage intellectual or cognitive exploration using exciting questions about the elephants.

Barriers: Barriers are steel barriers with electric fences all around the exhibit with no attempt to hide them. This does not provide any opportunities for exploration for visitors.

Visitor viewing area: Not applicable.

The elephant exhibit at San Diego Zoo has accomplished a very strong educational experience for its visitors with the daring design that did not attempt to hide or disguise the exhibit features. This however was at the expense of the other visitor experience components, as the exhibit offered very little in terms of exploration or authenticity.

5.2.3 Asian Elephant Park, Woodland Park Zoo, Seattle

In 1976 Jones and Jones, a well known landscape architecture firm specialzing in zoo design, was hired to produce a long range comprehensive plan for Woodland Park Zoo. The long-range plan established an ecological approach for all the exhibits (Elephant Care and Conservation). In 1989 when the Asian Elephant Forest exhibit opened, it was considered very innovative. It is located in the Zoo Tropical Asia exhibit zone. The exhibit contains the “Trail of Vines”, a temple-like barn, a logging camp, and a rustic gate that resembles elephant gates in Ayuthaya, Thailand—all reinforcing the Thai cultural landscape (Figure 5.8).

Figure 5.8 A rustic elephant gate resembling a similar gate in Thailand. Zoolex website photo.

Authenticiy:

Exhibit style: This exhibit is immersed in Thailand's cultural landscape, allowing for a very authentic landscape.

Exhibit setting: The setting is completely authentic to the elephant origin in Asia. The exhibit includes a pond, barn, and logging camp. These all allow for a very authentic visitor experience.

Exhibit furniture: Furniture is authentic to the Thai culture and environment. Elements such as dead trees, logs, saddles, tack and bells enforce the strong relationship between elephants and the people of Thailand.

Vegetation*:* The exhibit contains over 300 species from the Thai region, providing the exhibit with an authentic Asian forest feeling.

Barriers: Barriers are kept to a minimum. Natural materials such as wood and rope nets are used.

Visitor viewing area: The immersion exhibit that reflects Thai culture is very authentic to the elephant's Asian origin. Visitors feel that they are actually walking in the Asian forest.

Aesthetics:

Exhibit style: The immersion exhibit style of the Thai culture is an aesthetically pleasing experience.

Exhibit setting: The design of the Asian forest increases the aesthetic design of the exhibit.

Exhibit furniture: This is enhanced by using natural materials that originated from Thai culture like dead trees, logs, saddles, tack and bells.

Vegetaion: dense vegetation with a wide variety of plants in a complex arrangement.

Information panels: Not enough information.

Recreation:

Exhibit style: The immersion in Thai culture is recreational by itself, as visitors experience a new culture.

Exhibit setting: The immersion setting offers a unique experience for visitors in the Asian forest. The pond is deep enough to cover the elephant allowing for normal activity. The log camp and barn gives the elephants different opportunities to express their natural behavior (Figure 5.9).

Exhibit furniture: Using saddles, tack, bells and logs enriches animal behavior.

Information panels: The use of auditory and tactile equipment allows for social interaction and discussion within groups.

Visitor viewing area: The viewing area is designed as a culturally-themed environment with enough space for social groups to interact.

Figure 5.9 The elephant pond is deep enough to cover the elephant's whole body with water. Zoolex website photo.

Education:

Exhibit setting: The culturally-themed exhibit is a great educational opportunity to learn about the Asian forest and Thai culture.

Exhibit furniture: Furniture initiates elephant natural behavior, resulting in public education about elephants and their behavior.

Vegetation: Plantings introduce the public to the vegetation found in that part of the world.

Information panels: Different learning aids are provided using different tools such as auditory, tactile, and written means that describe the elephants' role in Thai culture.

Barriers: Barriers are minimal. With the immersion exhibit, there is the illusion that both visitors and animals share the same place.

Visitor viewing area: Positioning visitors in the same setting as the elephants educates the public about the Asian forest and Thai culture. It shows the role played by elephants in the development of logging. It also inspires people to respect elephants and view them as partners in daily life.

Exploration:

Exhibit style: The immersive exhibit allows for both physical and visual exploration.

Exhibit setting: The exhibit cannot be seen as a whole from one place. There is always something hidden that can be revealed when viewed from another point.

Vegetation: The wide variety of vegetation and its complex arrangement implies that there is more than the eye can see.

Information panels: Panels that contain questions and auditory explanations of the exhibit initiate cognitive exploration.

Barriers: Visitor exploration opportunities increase in cases where there are no barriers.

Visitor viewing area*:* The immersion exhibit places visitors in the context of Thai culture.

The immersive elephant exhibit in Woodland Park enriches the visitor experience in terms of authenticity, aesthetics, recreation and exploration. It also offers educational opportunities (Table 5.1).

5.3 Lion Exhibits

5.3.1 Masai Mara's Lion Exhibit, Zoo Atlanta

Masai Mara's Lion exhibit completed in 1989 is part of the phase three development of Zoo Atlanta's 1986 master plan. The lion exhibit is located in the African savannah forest. Visitors enter the African forest through a rustic gate that introduces the visitors to a new region. The presence of two completely different visitor viewing areas adds to the exhibit. One of the viewing areas overlooks the highly vegetated area of the exhibit with a large rock in the middle for the lion to lie on. This view is surrounded with plants and artificial rocks. The second viewing area is a cave-like area with a glass barrier in front of the pond. Immersion occurs when visitors stand inside a cave in the dark watching the lion play in the water through a large window.

Authenticity:

Exhibit style: The immersive naturalistic style of the exhibit is an attempt by the designer to make it authentic to the lion's African origin.

Exhibit setting: The setting is authentic to the African savannah, including artificial rocks in different parts of the exhibit, a pond that looks natural, and a large rock outcropping in the center that is placed on a higher elevation.

Exhibit furniture: The exhibit furniture depends on natural materials such as dead trees and rocks, adding to the authenticity to the exhibit.

Vegetation: Vegetation is authentic to both the African savannah forest in its look, leaf shape and composition and to the Atlanta Zoo by using native plants. For example,

mimosa (Albizia julibrissin)—native to Japan and the Middle East, and thorny and thornless honeylocust (Gleditsia tricanthos) were used to imitate the acacia.

Barriers: Barriers are minimal and are constructed of wood and rope.

Visitor viewing area: This area is designed to mimic the African forest. The viewing area placed in front of the pond is designed as a cave. Visitors feel they are standing in a dark cave looking at the lion playing in the water.

Aesthetics:

Exhibit style: The exhibit style is naturalistic, providing visitors with a high level of complexity and mystery, and which makes the exhibit look aesthetically pleasing.

Exhibit setting: Setting is well detailed. The large rock placed in the center of an open landscape increases the focus on the lion as the master piece of the exhibit.

Exhibit furniture: The use of natural materials inside the exhibit is aesthetically pleasing.

Vegetation: The complexity, density and variety of plants is aesthetically pleasing.

Information panels: Panels incorporate attractive graphics, colorful pictures and minimal text (Figure 5.10).

Recreation:

Exhibit style: The immersive naturalistic style is inherently recreational.

Exhibit setting: Different features are included in the exhibit, such as the pond and the different rock outcrops and places for the lion to hide. The complexity of the design enriches animals' behavior, increases the lion's motion and offers different activities.

Exhibit furniture: Furniture includes elements such as dead trees and rocks, increase the lion activity and gives visitors the chance to see the lion's natural behavior.

Information panels: Panels incorporate questions about the lion and its origin. This engages people in social activities.

Visitor viewing area: The area is large enough to accommodate a group of people. The cave-like viewing area also feels intimate.

Figure 5.10 Information panels in the lion exhibit are hung on the handrail, making it available to children. The panel is colorful and has minimum text.

Education:

Exhibit setting: The natural setting educates children about the African savannah forest, the lion's natural habitat.

Exhibit furniture: The furniture elements increase animal activity, allowing the public to watch the lion's natural behavior.

Vegetation: Vegetation is a very important tool to inform the public about the multitude of plants and their different shapes and colors.

Information panels: Panels have graphics that are attractive for visitors and young children to read. They are hung at an appropriate height and are placed on top of handrails, making them accessible to all visitors (Figure 5.10).

Barriers: The glass barrier in the cave-like viewing area makes visitors feel that they are standing in front of the lion. This increases their awareness that humans and animals share the same space. Other barriers in the exhibit include regular wooden post barriers.

Visitor viewing area: There are two visitor viewing areas. The first shows the large rock that is placed higher than the viewer area. The cave-like area in front of the pond is however at the same level as the animal.

Exploration:

Exhibit style: The immersive style of the African savannah encourages visual and physical exploration.

Exhibit setting: The naturalistic exhibit style allows for visual exploration. The entire exhibit is not revealed from one viewing area. The complexity of the exhibit implies that there is more than the eye can see.1

Vegetation: Vegetation is dense and contains a complex composition and arrangement. Hiding parts of the exhibit adds a sense of mystery.

Information panels: Panels incorporate questions about the lion and its natural habitat, thus initiating visual exploration.

Barriers: The exhibit has two kinds of barriers: a regular barrier made of wood and rope that allows for visual exploration. The second barrier is a glass barrier in front of the pond. The feel of this invisible barrier increases the visitor's sense of exploration.

Visitor viewing area: The cave-like viewing area allows visitors to feel immersed with the lion in the same landscape. The darkness of the cave adds a sense of realism to the scene.

The Zoo Atlanta lion exhibit contains high level of authenticity, aesthetics, education, recreation and exploration. The cave-like viewing area offers visitors an exploration experience by means of a glass window peering into the exhibit (Table 5.2).

5.3.2 Lion exhibit, San Diego Zoo

The lion exhibit is a part of the Elephant Odyssey exhibit. As mentioned in section 4.2.2, the exhibit tells the story of extinct or endangered animals that used to live in California. The message of the lion exhibit is to highlight the danger of extinction these animals face of a threatened environment.

Authenticity:

Exhibit style: The exhibit is in the naturalistic memorial style, which is rarely used in zoos.

Exhibit setting: The setting is not very authentic to the lion's natural habitat. The exhibit is rocky with minimum vegetation. The waterfall gives the exhibit a glimpse of authenticity.

Exhibit furniture: Not applicable.

Vegetation: Vegetation is minimal, providing a very small sense of authenticity.

Information panels: Not applicable.

Barriers: Barriers are very clear, especially the net that separates visitors and animals (Figure 5.11).

Visitor viewing area: The viewing area has the same theme as the exhibit. It is simple and almost sterile with no sense of authenticity.

Aesthetics:

Exhibit style: The new naturalistic memorial style offers very little in terms of aesthetics, as the exhibit is very sterile and vegetation is at its minimum.

Exhibit setting: The exhibit is simple. It is only composed of different rock arrangements that form a cave used as a hiding space. The water feature is the only element that adds to the exhibit complexity. Because of the exhibit's simplicity the focus is on the lion.

Exhibit furniture: Not applicable.

Vegetation: Vegetation is simple with no complexity or variety. Plants arrangement is monotonous.

Information panels: Graphics are not interesting or attractive. Panels are overloaded with text and are not colorful.

Figure 5.11 The lion exhibit with lots of rocks and minimum vegetation. The net barrier makes people aware of the difference between animal space and human space. Panoramio website photo.

Recreation:

Exhibit style: Since the lion exhibit style is not the regular naturalistic style. It cannot be assumed to be recreational.

Exhibit setting: The exhibit is designed with rocks at different elevations, giving lions the opportunity to choose the place they prefer. Water features increase the lion's natural behavior.

Exhibit furniture: Not applicable.

Information panels: Panels contain brief questions, encouraging social conversation both within and among groups of people.

Visitor viewing area: The viewing area is large enough to accommodate a group of people.

Education:

Exhibit style: Using the memorial exhibit emphasizes the threat of extinction of the lions if humans do not act quickly. This type of exhibit has a very strong educational impact.

Exhibit setting: Although it is not the usual naturalistic setting, the exhibit still delivers an important message.

Exhibit furniture: Not applicable.

Vegetation: Minimum vegetation is a metaphor of loss of habitat.

Information panels: Panels convey the same message as the exhibit—educating the public about the lion's natural environment. They are not colorful but are available to young children.

Barriers: Net barriers are very visual. They conflict with the exhibit message that involves human acts being responsible for affecting the lion habitat. These visual barriers put humans on one side and animals on the other.

Visitor viewing area: The viewing area is at the same level of the exhibit ground. Rocks at different elevations allow lions to choose higher locations for sitting or lying down. This enforces the message of the zoo to respect them.

Exploration:

Exhibit style: The unusual naturalistic style allows for no exploration, whether physical or visual.

Exhibit setting: The setting is very simple and open, offering no complexity or mystery.

Exhibit furniture: Not applicable.

Vegetation: There is no density or variety of vegetation.

Barrier: Net barriers visually obstruct exploration.

Visitor viewing area: Not applicable.

San Diego Zoo lion exhibit is part of the elephant odyssey exhibit. The exhibit provides the visitor with a high educational experience, while the authenticity, aesthetics and exploration components are not fully addressed.

5.3.3 Maskasi Simba Lion Exhibit, Zoo Leipzig

Since 1999, Zoo Leipzig has been building what it calls the Zoo of the Future. The master plan when complete will offer exhibits from around the globe. Continents are given different colors that are used all over the exhibit. The lion exhibit, completed in 2001, is a part of the Continent Africa. Lion savannah “Maskasi Simba” is designed to resemble the African savannah forest.

Authenticity:

Exhibit style: This is an immersion exhibit that resembles the African savannah forest. It is very authentic to the origin of the African lion.

Exhibit setting: The exhibit is very authentic as it contains water features, rocks for the lion to lie on, densely vegetated and outcropping areas that all resemble the savannah forest.

Exhibit furniture: Dead trees and rocks enrich the authentic feel of the exhibit.

Vegetation: Vegetation is dense, with a wide variety of trees, long grass and bamboo grass. The plants used in the exhibit are native to the Leipzig region, but are visually similar to the vegetation in the African savannah forest.

Barriers: are authentic made of wood and bamboo. They are minimized (Figure 5.12).

Visitor viewing area: The immersion exhibit is authentic with the presence of a water fall, a cave for visitors to view the lion from and the dense vegetation.

Figure 5.12 The lion exhibit with dense vegetation, cave for the lion to retreat and a pond. The barrier is made of natural materials. Zoolex website photo.

Aesthetics:

Exhibit style: The exhibit is an immersion exhibit. The naturalistic style is highly complex but harmonious.

Exhibit setting: Although the exhibit setting is very complex and rich in texture, the center of the exhibit is open. Large rocks for the lions to sit on allow visitors to view the animals more easily (Figure 5.13).

Exhibit furniture: The use of rocks, dead trees and ropes (to hang food on) add to its authenticity.

Vegetation: The variety and complexity of the plant composition makes the exhibit aesthetically pleasing.

Information panels: Panels are colorful but the text is too dense.

Figure 5.13 The lion exhibit resembles the savannah forest. A wide open space with large rocks is placed at the center of the exhibit. Zoolex website photo.

Recreation:

Exhibit style: The immersion style makes it recreational for visitors, as they feel they have entered a savannah forest.

Exhibit setting: The exhibit features such as the waterfall, pond, cave, and dense trees increase lion activity, providing visitors with the opportunity to watch the lion behaving naturally.

Exhibit furniture: Elements such as dead trees, rocks and ropes offer the lion opportunities to perform different activities, thus enriching their natural behavior.

Information panel: Panels are colorful and incorporate questions to trigger social conversation. There are also interactive games that illustrate which animal species profit from the lion's prey.

Visitor viewing area: The viewing area has enough space for people to socialize. The immersive setting is recreational (Figure 5.14).

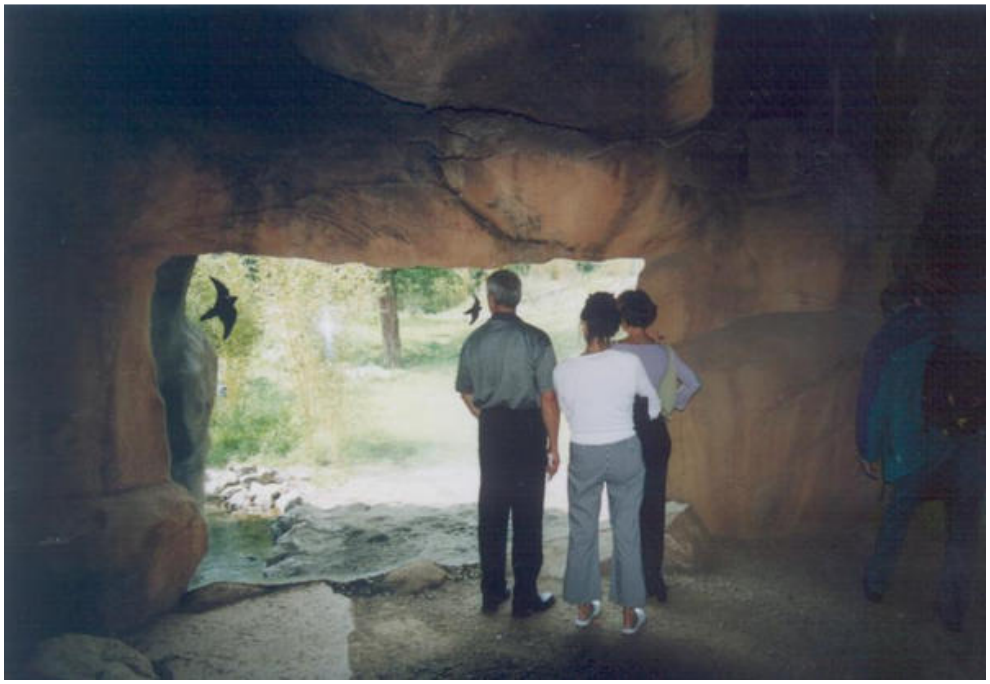


Figure 5.14 Visitors peek to see the lion through the glass barrier. Zoolex website photo.

Education:

Exhibit setting: The immersion setting helps to educate visitors about the origin of the Angola lions and their natural habitat.

Exhibit furniture: Furniture allows animals to behave naturally, and consequently visitors learn more about the lions and their behavior.

Vegetation: The variety of plant species — many of them close to the visitor areas — provides a good educational opportunity.

Information panels: Panels have an attractive graphical design and use colorful pictures, but the text dominates the panels. They are placed at an appropriate height for young children to read. These panels include questions that play an important educational role (Figure 5.15).

Barriers: Barriers are minimal. There are two viewing areas. The first area has three types of barriers: a pond, followed by a dry moat and a four feet barrier constructed of natural material. The other viewing area is a cave that has a glass barrier, making visitors feel immersed in the lion space.

Visitor viewing area: The lion is placed higher or at the same level with visitors.

Figure 5.15 An information panel in yellow, indicating the African continent. The graphic is attractive although there is more text than pictures. Zoolex website photo.

Exploration:

Exhibit style: The immersive exhibit allows for visual and physical exploration.

Exhibit setting: The exhibit is not totally revealed from one spot. The exhibit includes hiding places and concealed parts that invite people to explore.

Vegetation: The complex composition and variety of plant species gives the illusion that there is more to the exhibit than what is revealed.

Information panels: Panels include questions about the lion. The exhibit also includes an interactive game that shows which animal species benefit from the lion's prey. This game initiates visitors' curiosity about animals, allowing for cognitive exploration.

Barriers: The cave-like viewing area has an integrated barrier. The feeling of being inside a dark cage looking through glass makes visitors feel that they are inside the forest with the lions. A second viewing area offers less exploration.

Visitor viewing area: The immersive exhibit encourages exploration.

Zoo Leipzig with its immersive exhibit style offers a "good" visitor experience with respect to the guidelines set for the Giza Zoo. The lion exhibit accomplishes the five components of the Giza Zoo guidelines effectively.

5.4 Discussion and Conclusions

The Atlanta Zoo is typical of zoos across the United States. It can be considered a suitable match for the required visitor experience of the Giza Zoo. The zoo seems to provide visitors with a variety of experiences ranging from authenticity to recreation.

Although the zoo has a strong conservation goal and focus, it does not compromise other visitor experiences. The cave-like visitor viewing area in the lion exhibit is considered a new experience. Hidden in the dark cave visitors can see lions playing in the pond. The cave immerses visitors in the lion's world, making them feel part of that environment. Although other zoo exhibits have interactive games, they are not installed in either the elephant or lion exhibit. Zoo Atlanta has good visitor experience ratings for the elephant exhibit (Table 5.1).

When the 'Elephant Odyssey' exhibit was designed for the San Diego Zoo, the zoo used a new design style identified in this thesis as the 'memorial exhibit'. The idea of this exhibit is to include animals from different species based on the abstract idea of endangered animals in California (Figure 5.16). The zoo has been increasing public awareness concerning the dangers of animal extinction as one of the goals of the new exhibit.

Features of the Elephant Odyssey exhibit are abstract compared to the dense vegetation, water features and artificial rocks used in most exhibits. Using creative ideas to enrich animal behavior without disguising them such as the use of natural material is one of the exhibit's unique features. The steel tree construction enriches the elephant's natural behavior. It acts as a multi-purpose artifact for shade, food and entertainment. The design of this artifact is well conceived. It can be viewed as a metaphor that stands for the human development that is endangering the elephant and its natural habitat.

The San Diego Zoo compromised other factors of visitor experience — particularly authenticity — to achieve its goal. On the other hand, it could be argued that

the exhibit is being authentic to the elephant's current status. As stated previously, the exhibit is evaluated according to the goal that has been set prior to its design, and if it achieved that goal then the exhibit could be evaluated as a good or effective exhibit. It might be fair to say from the viewpoint of the thesis that the 'Elephant Odyssey' exhibit has achieved its mission despite the fact that it has lost other valuable components is debatable. This is an area of further research.

Figure 5.16 At the entrance plaza of the 'Elephant Odyssey' exhibit lies the remains of an extinct giant short faced bear.

Regarding the Woodland Park Zoo and Zoo Leipzig, both of these zoos use the immersive exhibit. The Woodland Park exhibit mimics the African savannah, while Zoo Leipzig immerses visitors in the Thai culture as a whole. Both exhibits offer a unique visitor experience. The choice of the immersion exhibit can be considered appropriate for all the desired visitor experience components. It performs best as an educational tool

that informs the public about the origin of the animals and how human actions affect them. Authenticity allows for a very rich visitor experience, as if they are on a journey to another part of the world. The experience of exploration and recreation is achieved throughout the whole immersion atmosphere. Zoo Leipzig has the best visitor experience ratings for the lion exhibit (Table 5.2). The Woodland Park Zoo elephant exhibit is also a candidate for the best visitor experience ratings, but due to the lack of data on information panels it could not achieve that point (Table 5.1).

The following tables (Tables 5.1 & 5.2) present a summary of the findings for the case studies. For convenient display purposes, the design guidelines are simplified for the visual comparison between the three different exhibits. In the tables, a check mark means that the exhibit has established that feature. A dash mark means that a feature is not found in the exhibit. When there has not been sufficient data as in the 'information panels' for the Woodland Park Zoo, it is stated as 'not enough information'.

There are cases where guidelines are only partially fulfilled. For example, most of the zoo exhibits have at least two visitor viewing areas. If one of these areas had a specific feature, the whole exhibit is assigned as acquiring that feature in the comparison table, since visitor experience is formed collectively through all viewing areas. The lion exhibit in Zoo Atlanta for instance has one of the viewing areas designed as an immersive exhibit. In that case, the whole exhibit will have a check mark for offering physical exploration in the visitor viewing area. On the other hand, if the animal is at any point at an elevation lower than the visitor viewing area, that affects the educational message of the exhibit, therefore the whole exhibit will have a dash mark, as the feature does not exist exclusively.

Table 5.1 Elephant exhibit summary for the three zoos

Visitor Experience	Components	Exhibit Features	Zoo Atlanta	San Diego Zoo	Woodland Park Zoo
Authenticity	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Authentic to animal natural env.	√	—	√
	Exhibit furniture	Natural material	√	—	√
	Vegetation	Native to animal/zoo origin	√	√	√
	Barriers	Min. & made of natural material	√	—	√
	Visitor viewing area	Immersive exhibit only	√	—	√
Aesthetic	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Detailed background	√	—	√
	Exhibit furniture	Natural material	√	√	√
	Vegetation	Complexity & variety	√	—	√
	Information panel	Colorful	√	—	not enough info.
		Lots of pictures	√	√	not enough info.
		Minimum text	√	—	not enough info.
Recreation	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Naturalistic exhibit	√	√	√
	Exhibit furniture	Provoke animals natural behavior	√	√	√
	Information panel	Questions	√	√	not enough info.
		Interactive games	—	—	√
	Visitor viewing area	Enough gathering place	√	√	√
Education	Exhibit style	Authentic to animal origin/culture	√	√	√
	Exhibit setting	Provoke animals behavior	√	√	√
	Exhibit furniture	Stimulate animals behavior	√	√	√
	Vegetation	Variety of species	√	√	√
	Information panel	Colorful	√	—	not enough info.
		Appropriate height	√	—	not enough info.
	Barrier	Minimized	√	√	√
	Visitor viewing area	Place animal at higher or same level of visitors area	√	√	√
Exploration	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Enclosure not revealed at once	√	—	√
	Vegetation	Variety/composition	√	—	√
	Information panel	Questions	√	√	not enough info.
		Interactive games	—	—	√
	Barrier	Demolished barrier	—	—	—
	Visitor viewing area	Immersive exhibit	√	—	√

Table 5.2 Lion exhibit summary for the three zoos

Visitor Experien	Components	Exhibit Features	Zoo Atlanta	San Diego Zoo	Zoo Leipzig
Authenticity	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Authentic to animal natural env.	√	—	√
	Exhibit furniture	Natural material	√	—	√
	Vegetation	Native to animal/zoo origin	√	√	√
	Barriers	Min. & made of natural material	√	—	√
	Visitor viewing area	Immersive exhibit only	√	—	√
Aesthetic	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Detailed background	√	—	√
	Exhibit furniture	Natural material	√	—	√
	Vegetation	Complexity & variety	√	—	√
	Information panel	Colorful	√	—	√
		Lots of pictures	√	√	√
		Minimum text	√	—	—
Recreation	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Naturalistic exhibit	√	√	√
	Exhibit furniture	Provoke animals natural behavior	√	—	√
	Information panel	Questions	√	√	√
		Interactive games	—	—	√
	Visitor viewing area	Enough gathering place	√	√	√
Education	Exhibit style	Authentic to animal origin/culture	√	√	√
	Exhibit setting	Provoke animals behavior	√	√	√
	Exhibit furniture	Stimulate animals behavior	√	—	√
	Vegetation	Variety of species	√	—	√
	Information panel	Colorful	√	—	√
		Appropriate height	√	√	√
	Barrier	Minimized	√	√	√
	Visitor viewing area	Place animal at higher or same level of visitors area	—	√	√
Exploration	Exhibit style	Naturalistic/immersive exhibit	√	√	√
	Exhibit setting	Enclosure not revealed at once	√	—	√
	Vegetation	Variety/composition	√	—	√
	Information panel	Questions	√	√	√
		Interactive games	—	—	√
	Barrier	Demolished barrier	√	—	√
	Visitor viewing area	Immersive exhibit	√	—	√

After analyzing the exhibits to test the guidelines that have been proposed for the Giza Zoo, it is clear that certain features in an exhibit promote several visitor experience aspects. For example, choosing an immersive exhibit style would afford for authentic, aesthetic, recreational, educational, and exploration experience.

When the guidelines for the Giza Zoo were established for this thesis, there was no attempt to prioritize the aspects of the visitor experience (Figure 4.3). After reviewing the case studies it is clear that prioritizing the components of visitor experience is as important as their establishment in the first place. It is also obvious that the zoo could easily focus on a major component at the expense of other aspects in an attempt to make a design that stands out for the zoo's mission (e.g. San Diego Zoo 'Elephant Odyssey' exhibit). One of the important findings is that designers have to make compromises when designing in the real world. The important decision or question is when to compromise and when to stick to constants that cannot be compromised. Setting priorities will help determine what should be compromised. Based on this assessment, the visitor experience that is required for the Giza Zoo is as follows:

Priorities for visitor experience in Giza Zoo:

1- Education: As mentioned earlier, conservation is the goal of most zoos. It has also been identified as one of the goals of Giza Zoo, which is to be achieved through educating visitors. This goal should not be compromised at any expense.
2- Authenticity: This characteristic seems to add for visitors experience, especially in recreational and aesthetic dimensions. It also aids the education process. According to Giza Zoo goals for visitor experience, authenticity is a major feature

that cannot be compromised at any level. This is due to the historically and culturally rich significance to all Egyptians (a history that goes back to 3000 B.C).

3- Exploration: Although authenticity offers opportunities for exploration, keeping exploration in mind as a source of inspiration during the design process is also important.

4- Recreation: Some of the recreational goals can be achieved through education, authenticity, exploration and other zoo features (e.g. open theater, kids' playground, carousal, petting zone, restaurants, etc.). Recreation thus should not be the main focus of zoo exhibit designers.

5- Aesthetics: Although aesthetics is a major concern of the landscape architect, it could be partially achieved through maximizing authenticity. This can be deduced from the San Diego exhibits (Tables 5.1 & 5.2). In both the lion and elephant exhibits, when authenticity was not sufficiently addressed, it was harder to achieve proper level of aesthetics. This aspect of the visitor experience will thus be addressed as part of the authentic experience in the redesign process (Figure 5.17).

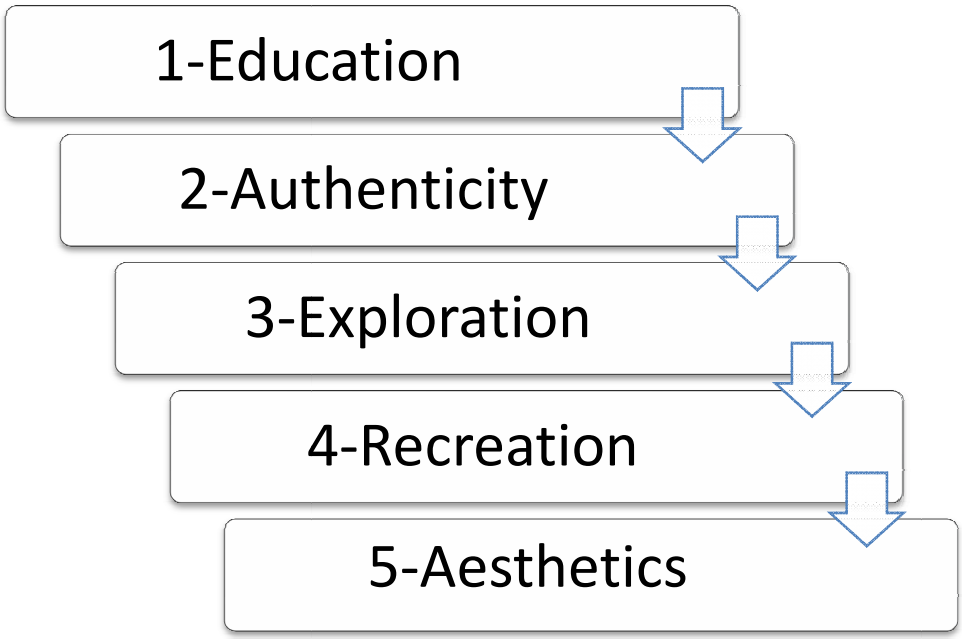


Figure 5.17 Prioritizing the components of visitor experience for the Giza Zoo.

The guidelines did not take into consideration that the visitor viewing area consists of multiple areas, each providing a different experience. This is an issue for further research, where each area could be examined separately in more detail in order to have a better understanding of the visitor experience. The following chapter will propose how the developed guidelines will be used to redesign two exhibits at the Giza Zoo: the elephant exhibit and the lion exhibit.

6. Re-designing the Giza Zoo and Future Recommendations

The aim of this chapter is to propose a design for the elephant and lion exhibits in the Giza Zoo using the guidelines that have been identified in the previous chapter. The design is specifically for the outdoor exhibit. These guidelines are defined hierarchically as follows (Figure 5.17):

1. Education
2. Authenticity
3. Exploration
4. Recreation
5. Aesthetics

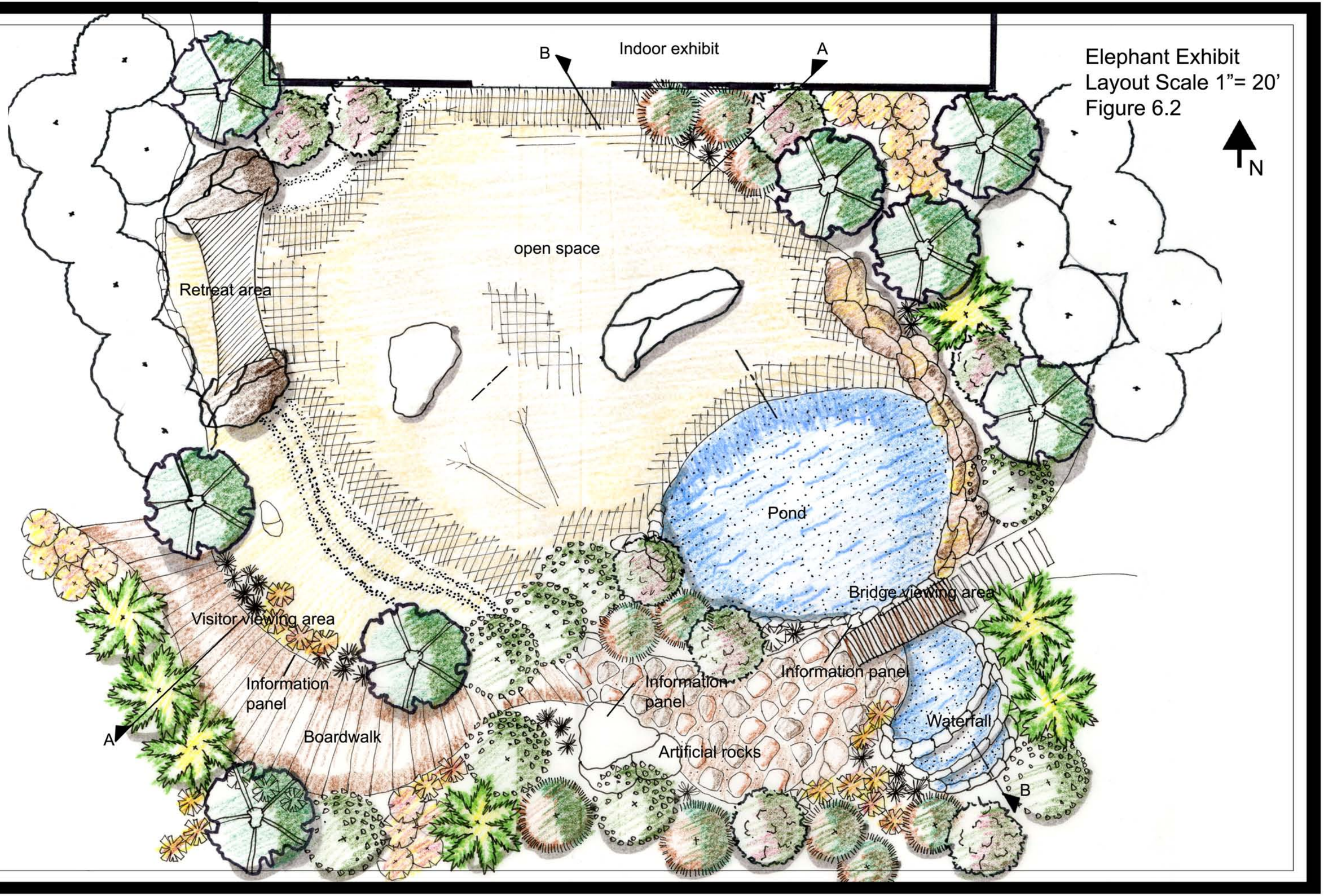
Figure 6.1 shows the map of the Giza Zoo and the current location of the elephant and lion exhibit.

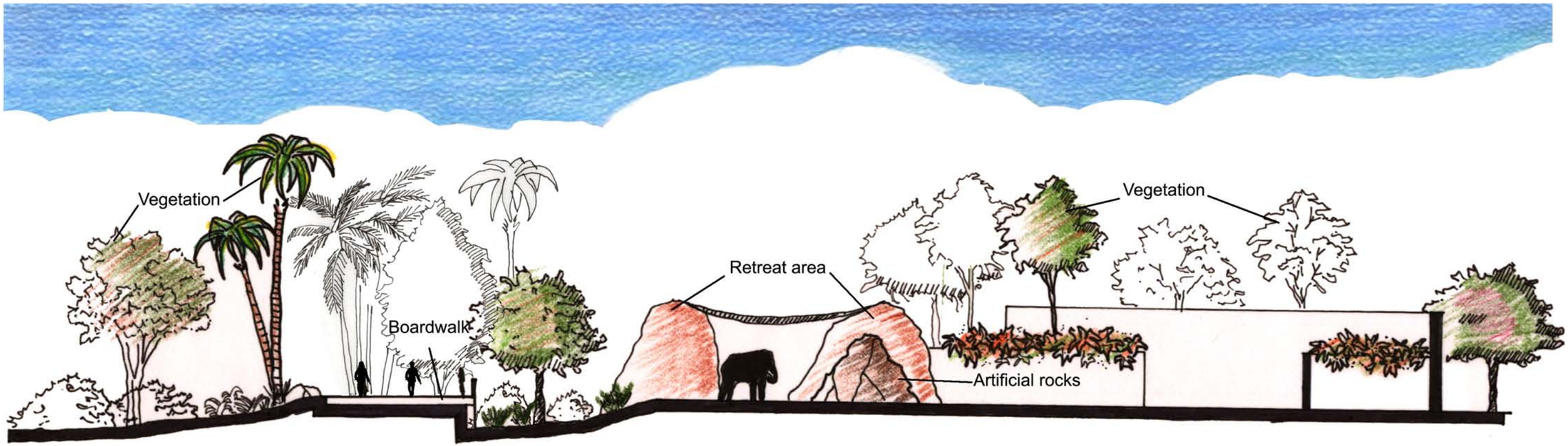
6.1 The elephant exhibit in the Giza Zoo

The current elephant exhibit in the Giza Zoo comprises two main areas: one with an area of almost 445 square feet and the other with an area of almost 1,411 square feet (Figure 6.1). The total of both areas is 1,856 square feet. The proposed elephant exhibit is designed to resemble the African savannah forest (Figure 6.2). The average proposed area for the new exhibit is 22,124 square feet, which is based on the elephant exhibit at Zoo Atlanta.

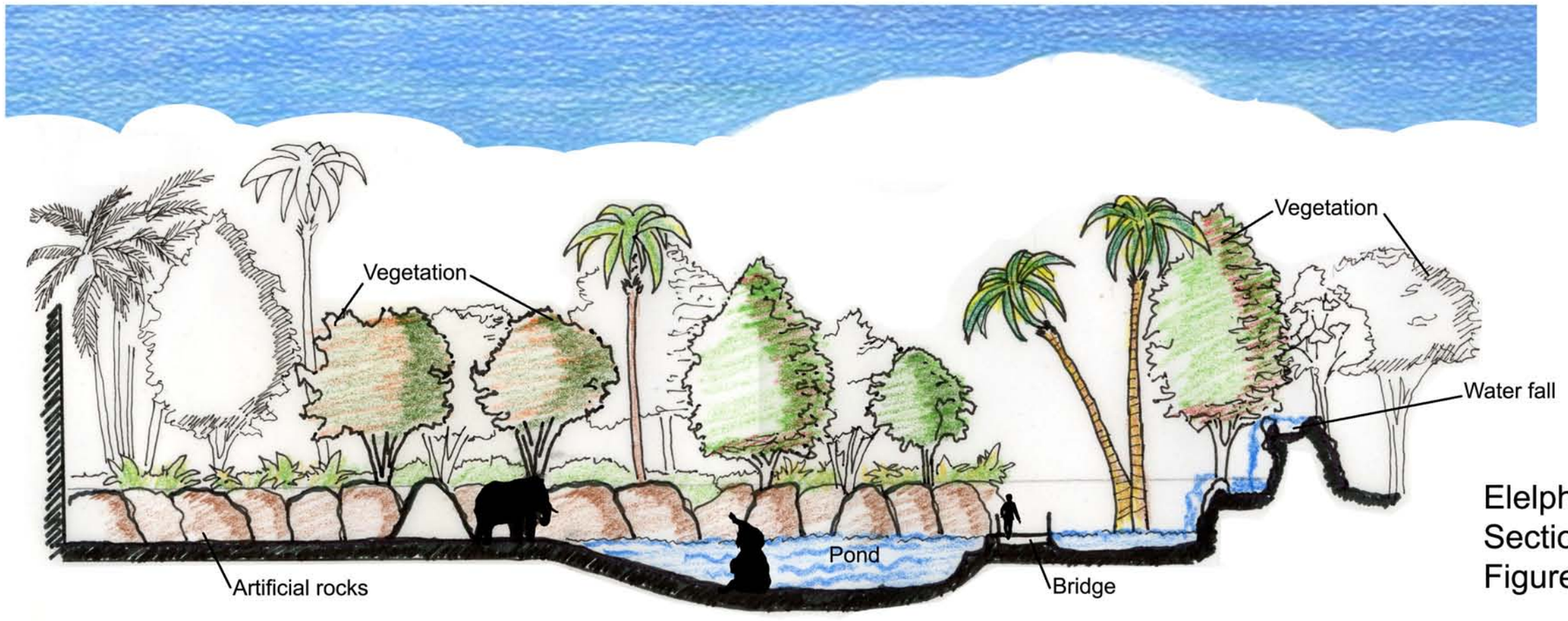
Giza Zoo Visitor Map
Map not to Scale
Figure 6.1

Elephant Exhibit
Layout Scale 1"= 20'
Figure 6.2





SECTION A-A



SECTION B-B

N

Elelphant Exhibit
Section Scale 1"= 20'
Figure 6.3

This enlarged area could be acquired by adding some other areas to the elephant exhibit. More space could be provided by removing unnecessary activities like the bumper cars area (Figure 6.4). Additionally, a 3D cinema theater could be relocated to provide enough space for the animal exhibits (Figure 6.5). The style of the proposed exhibit will be an immersive exhibit designed to educate visitors about the origin of the elephant and also to provide an authentic experience. Authenticity is augmented by the illusion of actually being in a savannah forest and at the same time being true to the zoo's native region as part of North Africa.

Figure 6.4 (left): The bumper cars area could be removed. Figure 6.5 (right): The 3D cinema theater could be relocated.

A cave-like grove at the side provides a retreat opportunity for the elephant. This grove enables the elephant to move out of the sight of visitors and provides shade and privacy (Figure 6.6).

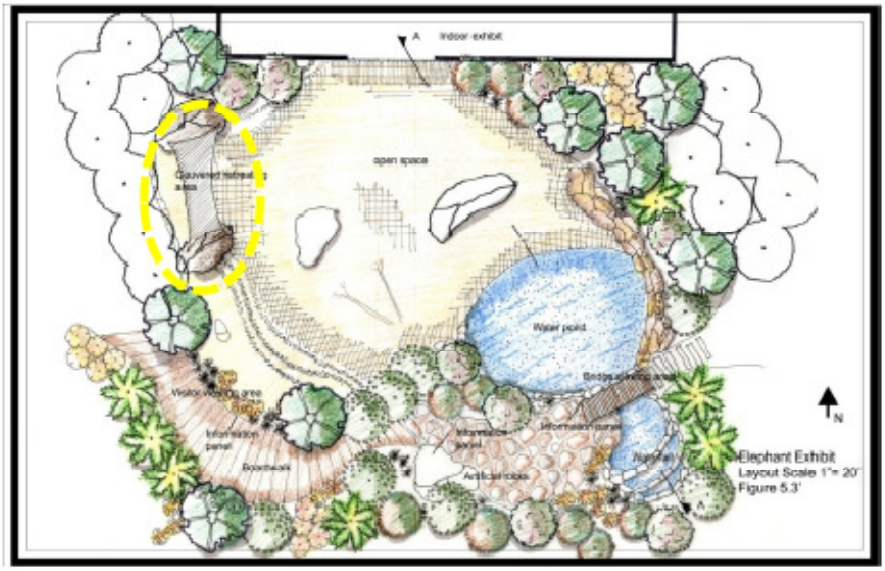


Figure 6.6 An elephant retreat area to hide from eyes of curious visitors (not to scale)

A pond deep enough for the elephant is placed inside the exhibit to cool the elephant in hot dry summer days (Figure 6.7). This pond can also be used as an entertainment feature for the elephants, thus increasing and encouraging their natural behavior. It also acts as a good bathing opportunity, allowing the visitors to watch ‘behind-the-scene’ experiences while care providers give the elephants their bath.

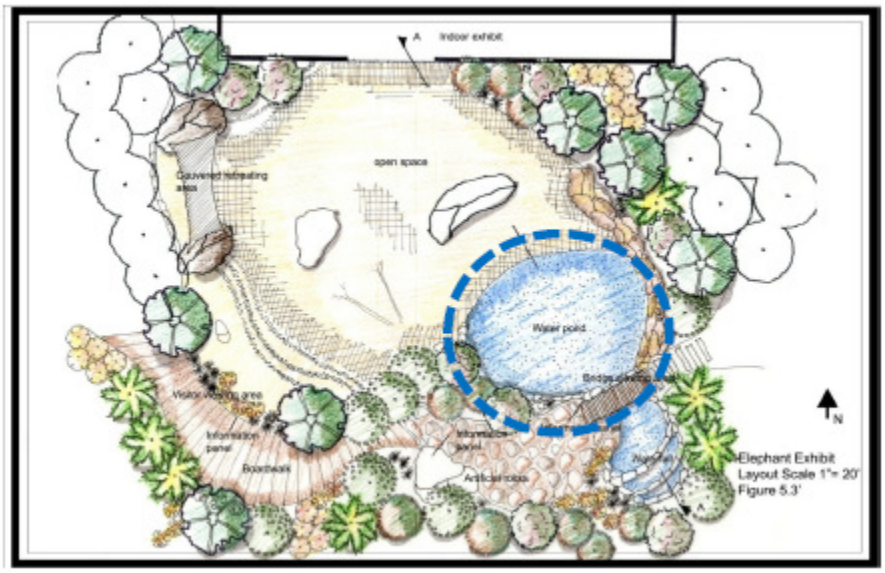


Figure 6.7 Elephant pond (not to scale).

Several dead trees are placed in the exhibit to define different spaces in the exhibit and allow the elephants to move from one space to another. A ball hanging from the top of a rock in the middle of the exhibit encourages elephant activity (Figure 6.8).

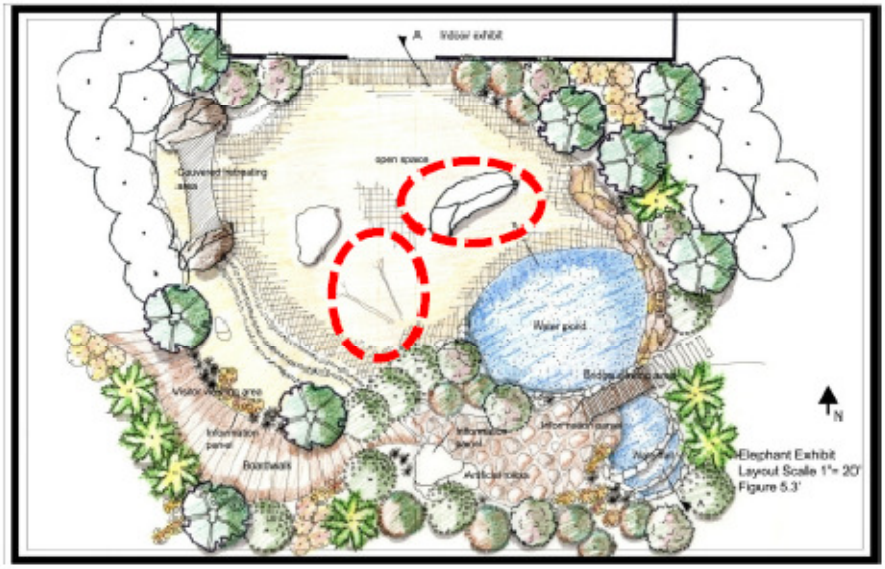


Figure 6.8 Elephant enclosure furniture, artificial rocks and dead trees (not to scale).

In the proposed design, the internal exhibit is almost bare of vegetation to prevent it from being ruined by the elephants (see section 5.1.1). Vegetation is densely planted at the perimeter of the exhibit (Figure 6.9). A wide variety of plants is used and arranged in harmony, including tall grass, wide leafed and thorny plant species in order to communicate a sense of danger and prevent the public from crossing over to the animal space.

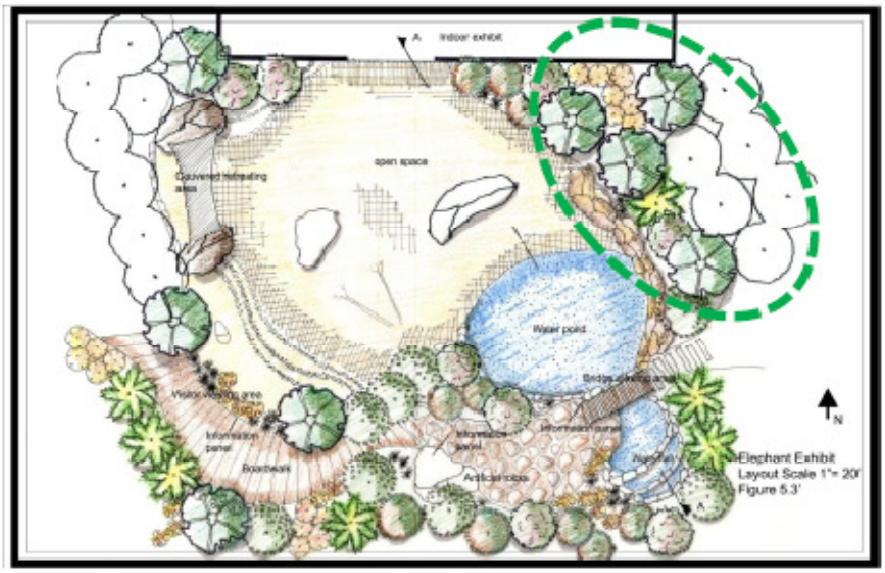


Figure 6.9 Dense vegetation on the elephant enclosure perimeter (not to scale).

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Figure 6.10 (left): The current elephant exhibit. Figure 6.11 (right): The proposed elephant exhibit.

There are two visitor viewing areas in the proposed exhibit. The first viewing area is along the bridge over the pond (Figure 6.12). From the viewing area, visitors can see the pond which immerses them in the same space with the elephant. The barrier is modified in this case to act as a handrail for the bridge, providing the illusion that there is no barrier between the human and animal.

The second visitor viewing area is across a moat that overlooks the open space area. The barrier is designed in the form of artificial rock that acts as a handrail. The artificial rock also acts as a hanging space for information panels. At no point in both viewing areas is the elephant viewed from a higher elevation. In the first viewing area (the bridge view), both the elephant and the visitors are at the same level. In the second viewing area (the moat view), the elephant is placed at a higher level.

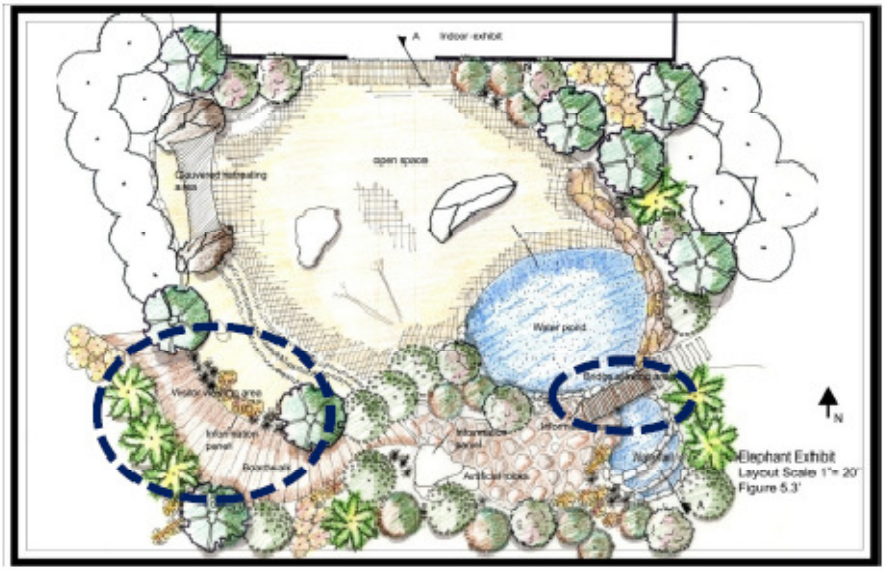


Figure 6.12 Elephant exhibit: two visitor viewing area (not to scale*).*

Similar to the elephant exhibit, the visitor viewing area is designed to look and feel like the African savannah (Figure 6.13). Several dead trees are placed on the visitors' side for seating. Rocks are also placed in the visitor viewing area and could also be used for seating. For safety reasons, the rocks are only two feet high, and are considered safe if children decided to climb them. A waterfall feature is added near the bridge to increase the feeling of immersion in the African savannah.

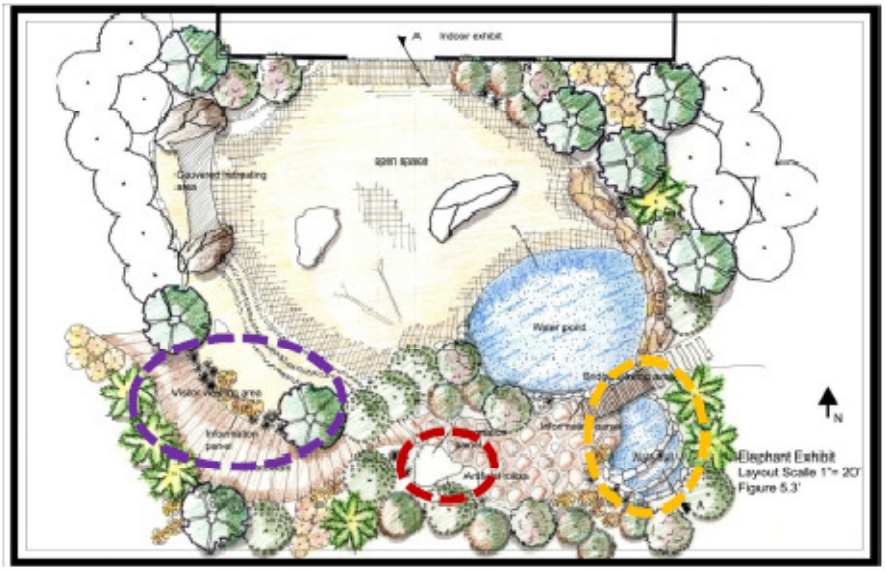


Figure 6.13 Elements in the visitor viewing area that augment the sense of immersion: *from right to left*: waterfall, artificial rocks and board walk (not to scale).

The feeling of immersion in the visitor viewing area is augmented by manipulating the visitors' sense of touch, hearing, smell, and vision. The sense of touch is manipulated by means of using natural materials throughout visitors' paths, including plants, rocks, dead trees and water. Hearing is manipulated by means of the continuous sound of waterfalls and elephants' voices. The sense of smell is manipulated by means of plants that have different scents. Even the elephant smell, whether good or bad, adds to the immersive feelings.

Vision is manipulated throughout the overall design to mimic the elephant's natural habitat by using elements such as water features, rocks, dead trees, dense vegetation and caves. In addition, the exhibit is not fully revealed from any one visitor viewing area, which allows visitors to feel that there is more to the exhibit than what is seen. This allows for a greater sense of mystery and exploration. Each of the two

viewing areas in this regard offers a unique experience. Below is an evaluation of the proposed elephant exhibit according to the established visitor experience guidelines.

1- Education:

Exhibit setting: Visitors learn about the animal's natural habitat unconsciously through their visit to the African savannah forest exhibit setting.

Exhibit furniture: The presence of furniture elements in the enclosure such as dead trees, rocks and a place such as a cave to hide food allows the public to observe the elephants as they move dead trees, rub their body against the rocks and search for food – a good way to learn about the elephant and its natural behavior.

Vegetation: Using tall grass, wild flowers, and thorny plants is a way to educate the public about the different plant species that are found in the African savannah forest. Adding non intrusive labels to the plants in the visitors' area allows for conscious learning.

Information panels: Using colorful information panels full of illustrations and minimal text will encourage visitors to read, especially young children. Information panels are hung on the artificial rock barrier handrails at a height of three to four feet, making them available to young children (conscious education). A puzzle game is also included to stimulate and increase visitor interaction.

Barriers: Barriers are almost invisible and are integrated into the landscape design. In one viewing area, barriers act as bridge handrails, and in the other they take the form of

artificial rocks. Therefore they enhance the feeling that visitors and elephants share the same environment.

Visitor viewing area: This area is placed at the same level as the elephant enclosure, creating an appropriate respectful relationship. Zoo personnel could be assigned to talk to visitors about the elephants and offer solutions or suggestions on how the public could help to keep the elephant's natural environment safer.

***2-* Authenticity:**

Exhibit style: The immersive style of the savannah forest allows for authenticity.

Exhibit setting: The exhibit is designed to resemble the natural environment of the elephant. The pond is designed to look natural, which adds to the aesthetic experience. The exhibit ground plane is covered with red sand. The inner wall of the exhibit is lined with artificial rocks varying in color from ochre to red, mimicking the native environment.

Exhibit furniture: Furniture selection and placement is authentic to the animal's natural habitat. Elements include dead trees laid on the exhibit floor, artificial rocks, and a high rock where food is placed on so that the elephant has to make some effort to reach its meal as it would do in the wild.

Vegetation: Plants are chosen carefully to resemble the African savannah vegetation. Tall grass, wild flowers, and thorny plants emphasize the naturalistic feel of the savannah forest.

Barriers: Barriers are conceived with vegetation. They are made of artificial rocks and wood to minimize their visual appearance.

3- Exploration:

Exhibit style: The exhibit is immersive, providing visitors with opportunities for mental and physical exploration.

Exhibit setting: Elements such as caves, ponds and dense vegetation all give the exhibit a sense of mystery and complexity which stimulate mental exploration.

Vegetation: Dense vegetation at the perimeter of the exhibit implies that there is more than the eye can see, thus providing visitors with a sense of mystery.

Information panels: Panels incorporate questions about the elephants, thus allowing for exploration.

Barriers: The integrated barriers increase the sense of mental or visual exploration.

Visitor viewing area: The immersive exhibit offers a sense of exploration with the presence of the waterfalls, dead trees, rocks, and the board walk trail, thus increasing the visitors' sense of being surrounded by a forest.

4- Recreation:

Exhibit style: The immersive style of the elephant enclosure is inherently recreational.

Exhibit setting: The exhibit setting is naturalistic. The presence of the pond provides animals with the opportunity to bathe and play with water and splash it, thus enriching animal behavior and giving the visitors the opportunity to watch the elephants practicing their everyday life activities.

Exhibit furniture: Dead trees in the exhibit allow elephants to move them from one place to another. Visitors can observe the natural behavior of the elephant in a savannah-like setting.

Information panels: Panels incorporate questions and puzzle games that enable social interaction in order to find answers. Rocks placed in the visitors' side contain carved interpretive information. This allows the public using these rocks as seats to read the panels.

Visitor viewing area: The viewing area is big enough to allow a group of people to observe the elephants together. Additionally, there are seating opportunities on the dead trees and rocks.

5- Aesthetics:

Exhibit style: The style is immersive, allowing for a good aesthetic experience.

Exhibit setting: The enclosure is characterized by its complexity and harmony. This is provided through elements such as the pond, artificial rocks that line the exhibit interior, the waterfall and the bridge that overlooks the exhibit, all of which contribute to a good aesthetic scene.

Exhibit furniture: Using natural materials like dead trees and other elements adds to the beauty of the exhibit.

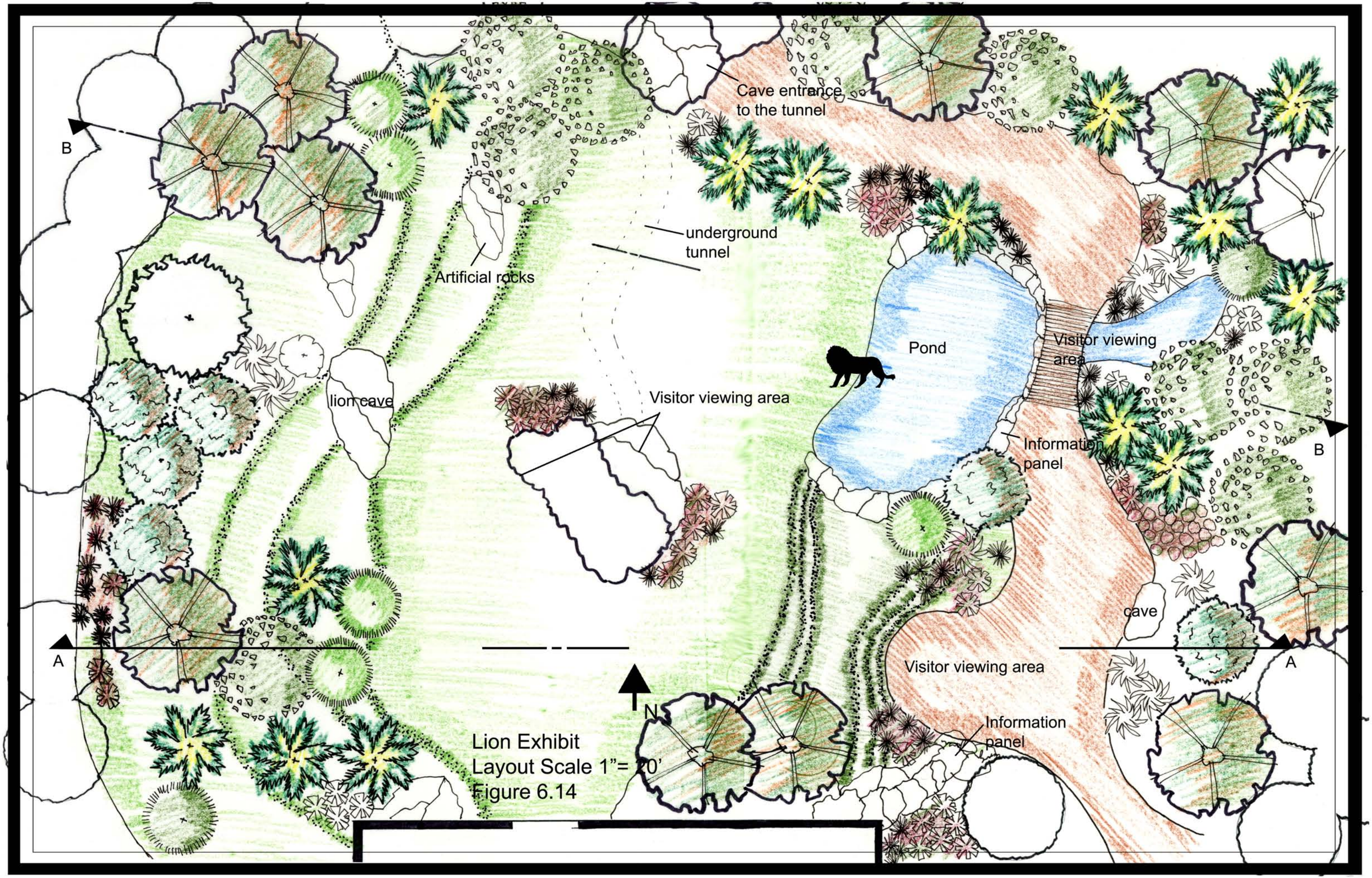
Vegetation: The complexity of vegetation and the variety of plant species arranged in harmony allow for a good aesthetic experience.

Information panels: Good graphic design and colored images make information panels appealing to visitors. The engraved rocks in the visitors' area with interpretive information provide a new aesthetic experience for the visitors.

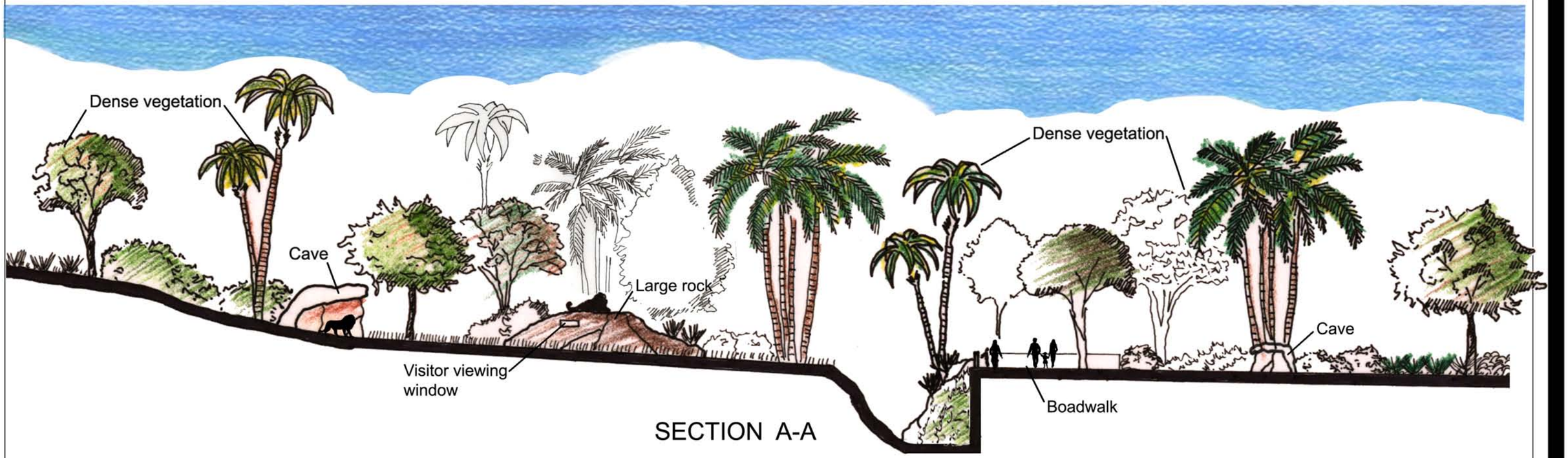
The following matrix (Table 6.1) is a summary of the guidelines for the elephant exhibit and how they apply to the proposed Giza Zoo exhibit.

Table 6.1 A summary of the elephant exhibit visitor experience guidelines, as seen in the proposed Giza Zoo exhibit

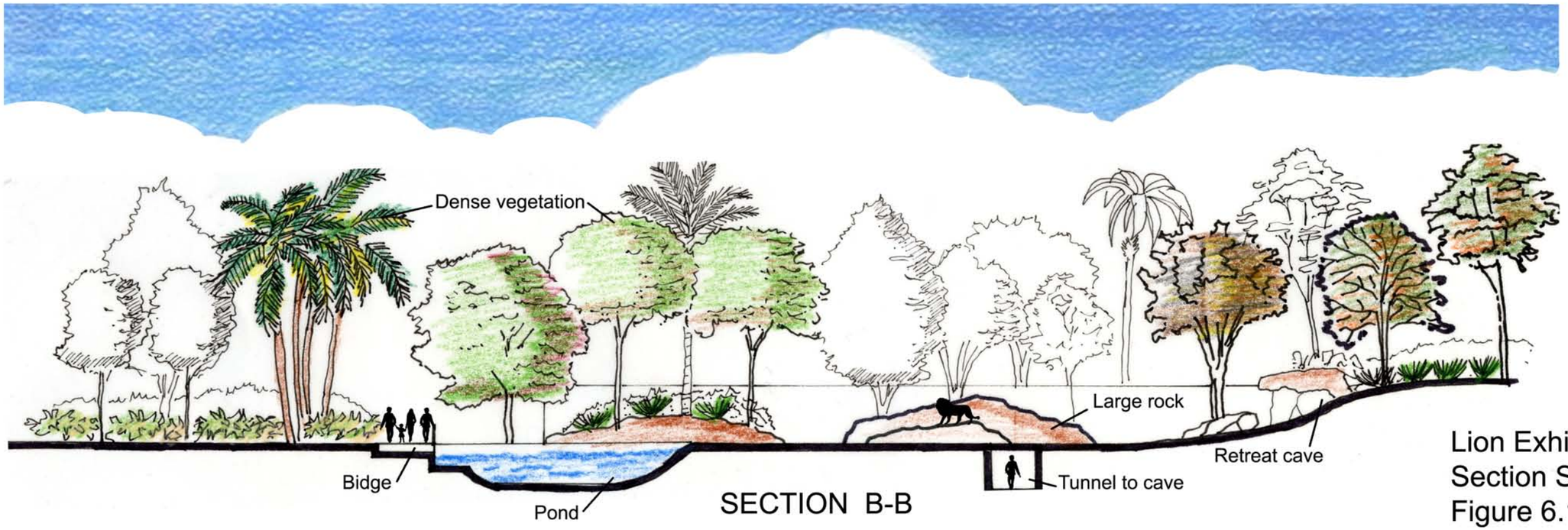
Visitor Experience	Components	Exhibit Features	Zoo Atlanta	San Diego Zoo	Woodland Park Zoo	Giza Zoo
Education	Exhibit style	Authentic to animal origin/culture	√	√	√	√
	Exhibit setting	Provoke animals behavior	√	√	√	√
	Exhibit furniture	Stimulate animals behavior	√	√	√	√
	Vegetation	Variety of species	√	√	√	√
	Information panel	Colorful	√	—	not enough info.	√
		Appropriate height	√	—	not enough info.	√
	Barrier	Minimized	√	√	√	√
	Visitor viewing area	Place animal at higher or same level of visitors area	√	√	√	√
Authenticity	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Authentic to animal natural env.	√	—	√	√
	Exhibit furniture	Natural material	√	—	√	√
	Vegetation	Native to animal/zoo origin	√	√	√	√
	Barriers	Min. & made of natural material	√	—	√	√
	Visitor viewing area	Immersive exhibit only	√	—	√	√
Exploration	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Enclosure not revealed at once	√	—	√	√
	Vegetation	Variety/composition	√	—	√	√
	Information panel	Questions	√	√	not enough info.	√
		Interactive games	—	—	√	√
	Barrier	Demolished barrier	—	—	—	√
	Visitor viewing area	Immersive exhibit	√	—	√	√
Recreation	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Naturalistic exhibit	√	√	√	√
	Exhibit furniture	Provoke animals natural behavior	√	√	√	√
	Information panel	Questions	√	√	not enough info.	√
		Interactive games	—	—	√	√
	Visitor viewing area	Enough gathering place	√	√	√	√
Aesthetic	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Detailed background	√	—	√	√
	Exhibit furniture	Natural material	√	√	√	√
	Vegetation	Complexity & variety	√	—	√	√
	Information panel	Colorful	√	—	not enough info.	√
		Lots of pictures	√	√	not enough info.	√
		Minimum text	√	—	not enough info.	√



Lion Exhibit
Layout Scale 1"= 20'
Figure 6.14



SECTION A-A



SECTION B-B

N

Lion Exhibit
Section Scale 1"= 20'
Figure 6.15

6.2 The lion exhibit in the Giza Zoo

The lion exhibit in the Giza Zoo is a cage-like exhibit that offers nothing for the lion to express its natural behavior. The current area of the lion exhibit is 662 square feet. The proposed area for the new exhibit is 35,779 square feet, which is based on the lion exhibit at Zoo Atlanta. Providing a naturalistic exhibit will give the lion opportunities to display its natural behavior.

A cave embedded in the hill acts as the lion retreat area (Figures 6.15 & 6.16). This spot is designed for the lion to be able to hide from the eyes of curious visitors. The cave is big enough to hold two to three lions. It is placed so that the lion can still view most of the exhibit from it. It is also placed at a higher elevation level than the visitor viewing area.

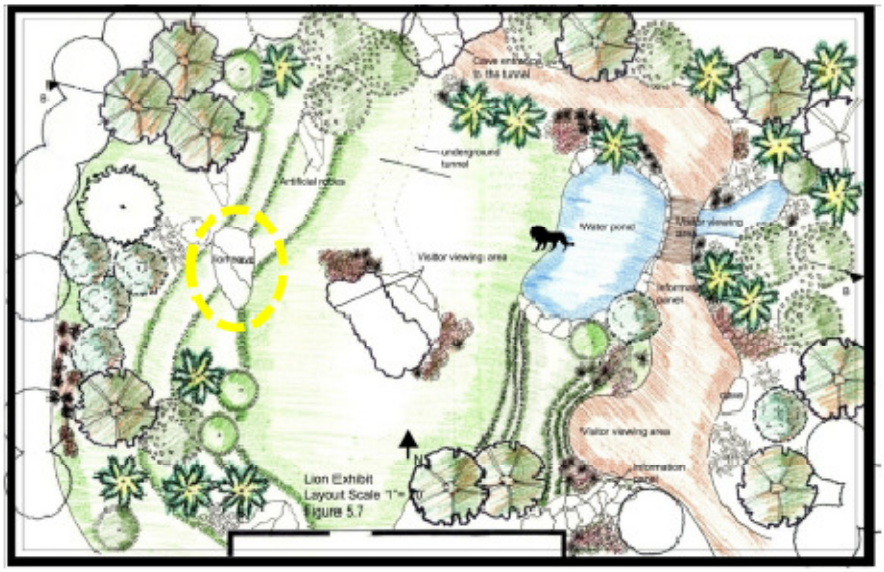


Figure 6.16 The lion exhibit retreat area (not to scale).

A pond is designed to look natural and provide the visitors with a viewing area across the bridge (Figure 6.17). The pond extends from the lion enclosure to the visitor viewing area, providing the illusion that both the lion and visitors share the same space. This is inspired from the lion exhibit at Zoo Atlanta (Section 5.3.1) where the visitor viewing area is across the lion pond with only a glass barrier between the visitors and the lion. The proposed design for the lion enclosure in the Giza Zoo offers similar scenery and takes advantage of the pond by moving it further to the visitor side.

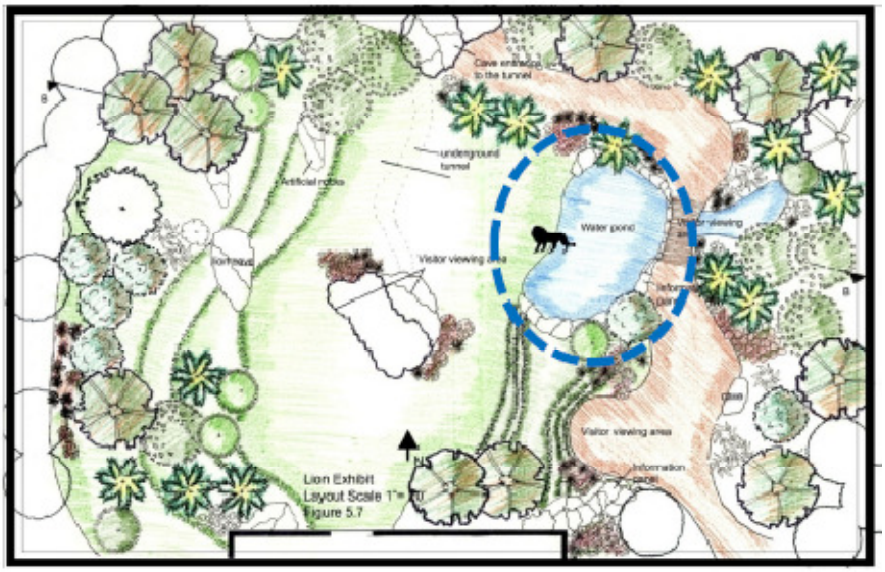


Figure 6.17 A pond that acts as a recreational tool as well as a barrier (not to scale).

Vegetation is dense inside the exhibit and at the perimeter (Figure 6.18). A wide variety of plant species are used and arranged in complex configurations. An open space area is placed in the middle of the exhibit with a big rock in the center for the lions to lie on (Sections 5.3.1, 5.3.2 & 5.3.3). The rock is almost nine feet tall and allows the lion to sit on and watch the exhibit from a high point. There are also other different levels at the perimeter of the exhibit that allow the lion to sit at a higher elevation, view

the exhibit and at the same time enjoy the shade of nearby trees (Figure 6.15). Different levels at the edge of the exhibit create an embedded cave that acts as a private retreat and hiding place for the lion. A water pond is placed in the exhibit for the lion to swim in and cool down.

Figure 6.18 Dense vegetation from different species (not to scale).

Figure 6.19 (left): Current visitor viewing area. Figure 6.20 (right): The underground tunnel visitor viewing area in the proposed lion exhibit design.

There are three visitor viewing areas and each area offers a different experience. The first visitor viewing area is across the moat. This area overlooks the open space, the rock in the middle and the different elevated land forms at the edge (Figures 6.15 & 6.21). The second viewing area is located at a bridge that crosses over a pond. Visitors can view the pond and part of the open space from that location. The barrier at this viewing point is integrated in the landscape, as it acts as a handrail for the bridge, thus making the visitors feel that there is no barrier between them and the animal.

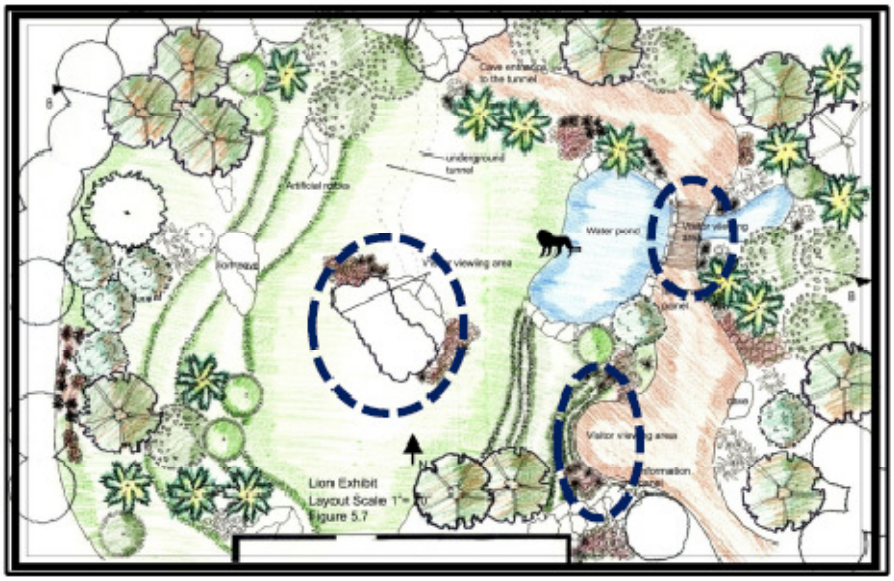


Figure 6.21 Lion exhibit visitor viewing areas (not to scale).

The third viewing area is quite different from the two previous areas. It takes the form of an underground tunnel that takes visitors through a cave until they reach the rock in the middle of the exhibit. The tunnel width varies to increase the visitor's sense of exploration. Information panels are hung all along the walls of the tunnel. At the end of the tunnel, visitors find themselves under the lion's rock. Small openings in the rock allow visitors to see the lion exhibit from three different locations.

The cave under the lion exhibit is a unique visitor experience that promotes visitor exploration. Inside the cave, there are a number of interactive elements including a video demonstration shows the lion in the wild, interactive games, and information panels that are hung along the walls of the cave. The cave design is inspired from the Zoo Leipzig cave-like visitor viewing area (Section 5.3.3). In the proposed design of the lion exhibit in the Giza Zoo however, the design increases the sense of visitor exploration by incorporating a subterranean cave and offers a unique exploration experience. Below is an evaluation of the proposed lion exhibit according to the established visitor experience guidelines.

1- Education:

Exhibit setting: The immersive setting educates children about the African savannah forest and the lion's natural habitat.

Exhibit furniture: The furniture elements increase animal activity, allowing the public to watch the lion's natural behavior.

Vegetation: Vegetation is a very important tool to inform the public about the variety of plants and their different shapes and colors.

Information panels: Panels have graphics that are attractive for visitors and young children to read. They are hung at an appropriate height, and are placed on the artificial rock beside the exhibit in addition to the cave underneath the lion exhibit. Video monitors also show the lion in its natural habitat.

Barriers: The cave viewing area makes visitors feel that they are actually standing in a cave hiding from the lion and peeking through the small openings to watch the lion in the exhibit. This increases their awareness that humans and animals share the same space.

Visitor viewing area: There are three visitor viewing areas all of these viewing area places the animal at a higher elevation level than the visitors.

***2-* Authenticity:**

Exhibit style: The immersive naturalistic style of the exhibit makes the exhibit authentic to the lion's African origin.

Exhibit setting: The setting is authentic to the African savannah, including artificial rocks in different parts of the exhibit, a pond that looks natural, and a large rock. The rock outcrops at the center of the exhibit and perimeter provide different levels for the lion to overlook the entire exhibit.

Exhibit furniture: The exhibit furniture relies on natural materials such as dead trees and rocks, adding to the authenticity of the enclosure.

Vegetation: Vegetation is authentic to both the African savannah forest and the Giza Zoo which is part of Africa.

Barriers: Barriers are minimal. They are made of wood at the moat and the bridge viewing area. In the third viewing area, the underground barriers take the form of small openings in an artificial rock, which allows visual access.

Visitor viewing area: This area is an extension of the exhibit design of the African forest. The viewing area located at the bridge across the pond gives visitors the illusion of being in the forest and crossing over a pond. At the visitor side is a cave hidden in the dense vegetation that resembles that of the lion exhibit so that kids could play in it and imitate the lion and retreat in it. The height and size of the cave is such that adults can also use it. The cave area beneath the lion exhibit allows the public to watch the lion from inside the exhibit.

3- Exploration:

Exhibit style: The immersive style of the African savannah encourages mental and physical exploration.

Exhibit setting: The naturalistic exhibit style allows for visual exploration. The exhibit is not revealed in its entirety from one viewing area.

Vegetation: Vegetation is dense, with complex composition and arrangement. Hiding parts of the enclosure adds a sense of mystery.

Information panels: Panels incorporate questions about the lion and its natural habitat, thus initiating mental exploration. The interactive games installed in the cave underneath the exhibit increase the visitors' sense of exploration.

Barriers: The exhibit has three kinds of barriers. The first barrier is a regular barrier made of wood and rope that allows for visual exploration. The second barrier is a wooden barrier in front of the pond. The third takes the form of small grooves in the

artificial rock placed inside the exhibit. This barrier increases the visitors' sense of exploration.

Visitor viewing area: The viewing area is generally rich with exploration opportunities for visitors, including the bridge that crosses over the pond, the cave that resembles the lion's cave, the tunnel that moves visitors from outside the exhibit to the inside, and finally the cave inside the exhibit that offers an interior viewing spot.

4- Recreation:

Exhibit style: The immersive naturalistic style is inherently recreational.

Exhibit setting: Different features are included in the enclosure, such as the pond and the different levels and hiding places for the lion. The complexity of the design enriches the animal's behavior, thus increasing the lion's motion and offering different activities.

Exhibit furniture: Furniture includes elements such as dead trees and rocks, thus increasing the lion's potential activity and giving visitors the chance to see its natural behavior.

Information panels: Panels incorporate questions about the lion and its origin. This engages people in social activities. The screens and interactive games provided in the underground cave also allow for social interaction.

Visitor viewing area: The area is large enough to accommodate a group of people. The underground cave viewing area also feels intimate and is large enough for one or two groups of people.

5- Aesthetics:

Exhibit style: The exhibit style is naturalistic, providing visitors with a high level of complexity and mystery, and making the enclosure look aesthetically pleasing.

Exhibit setting: The setting is well detailed. The large rock placed in the center of the open landscape increases the focus on the lion as the master piece of the exhibit.

Exhibit furniture: The use of natural materials inside the enclosure strengthens its prospect to be aesthetically pleasing.

Vegetation: The complexity, density and variety endorse a good aesthetic feeling.

Information panels: Panels incorporate attractive graphics, colorful pictures and minimum text.

The following matrix (Table 6.2) is a summary of the guidelines for the lion exhibit and how they apply to the proposed Giza Zoo exhibit.

Table 6.2 A summary of the lion exhibit visitor experience guidelines, as seen in the proposed Giza Zoo exhibit

Visitor Experience	Components	Exhibit Features	Zoo Atlanta	San Diego Zoo	Zoo Leipzig	Giza Zoo
Education	Exhibit style	Authentic to animal origin/culture	√	√	√	√
	Exhibit setting	Provoke animals behavior	√	√	√	√
	Exhibit furniture	Stimulate animals behavior	√	—	√	√
	Vegetation	Variety of species	√	—	√	√
	Information panel	Colorful	√	—	√	√
		Appropriate height	√	√	√	√
	Barrier	Minimized	√	√	√	√
	Visitor viewing area	Place animal at higher or same level of visitors area	—	√	√	√
Authenticity	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Authentic to animal natural env.	√	—	√	√
	Exhibit furniture	Natural material	√	—	√	√
	Vegetation	Native to animal/zoo origin	√	√	√	√
	Barriers	Min. & made of natural material	√	—	√	√
	Visitor viewing area	Immersive exhibit only	√	—	√	√
Exploration	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Enclosure not revealed at once	√	—	√	√
	Vegetation	Variety/composition	√	—	√	√
	Information panel	Questions	√	√	√	√
		Interactive games	—	—	√	√
	Barrier	Demolished barrier	√	—	√	√
	Visitor viewing area	Immersive exhibit	√	—	√	√
Recreation	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Naturalistic exhibit	√	√	√	√
	Exhibit furniture	Provoke animals natural behavior	√	—	√	√
	Information panel	Questions	√	√	√	√
		Interactive games	—	—	√	√
	Visitor viewing area	Enough gathering place	√	√	√	√
Aesthetic	Exhibit style	Naturalistic/immersive exhibit	√	√	√	√
	Exhibit setting	Detailed background	√	—	√	√
	Exhibit furniture	Natural material	√	—	√	√
	Vegetation	Complexity & variety	√	—	√	√
	Information panel	Colorful	√	—	√	√
		Lots of pictures	√	√	√	√
		Minimum text	√	—	—	√

6.3 Conclusion

Redesigning the elephant and lion exhibits as described in the guidelines will require additional space. As mentioned before, the Giza Zoo cannot expand outside its

current boundaries. The additional area required for the redesign could be accomplished by decreasing the number of species that the zoo holds to improve animal conditions, instead of keeping a large number of species in deteriorating conditions.

The exhibit design strives to satisfy the criteria of the proposed design guidelines. The most difficult criteria to adress were the barriers and visitor viewing areas. There is “a strong wish among many zoo designers for a completely invisible barrier” (Hancocks, 1971). At the same time, the guidelines established the need for invisible or integrated barriers, while simultaneously offering sufficient safety for the public. The design solution called for wooden barriers and artificially shaped barriers. While the barriers are still visible, their configuration was less obtrusive to the viewer. In addition to the integrated barriers, the design calls for an electric fence to surround the entire lion exhibit. Although it is not very appealing, its visual presence will offer the public a sense of security and safety and a greater reassurance that wild animals cannot cross over to their side.

Providing visitors with observation areas that do not visually intersect with other visitors’ sightlines was also a challenge. To enhance visual authenticity, the design created two visitor viewing areas for the elephant and three for the lion (one of which is an underground viewing area). Each exhibit offers several viewing areas, each with a different experience for the visitors. Hiding the building (indoor enclosure) from the visitors’ sight was also a hard task, as the building was not completely hidden and was partially visible to the public. Vegetation is strategically placed beside the building to hide it but was still visible, thus distorting the image of the African savannah forest.

The biggest design challenge was the lack of data concerning the animal exhibits, including the appropriate exhibit size for each animal. For example, the only dimension found for the elephant was its height. Lacking was information related to elephant width (resembling shoulder to shoulder in humans) which could be used to size pathways, circulation and retreat areas accurately.

The exercise did prove that designing an animal exhibit is not an easy task. It requires the collaboration of many disciplines. The exhibit design should be flexible enough to allow for future modifications in order to enrich animal behavior at its different life stages. Sharing design knowledge is essential in zoo design. Extensive research should be conducted to provide designers with sufficient data to design animal exhibits. Copying features from other zoo exhibits without being aware of unique characteristics, their special circumstances and the discrepancies among the abilities of individual animals could cause many problems.

For example, at Woodland Park, a gorilla barrier was designed with the same dimension that was used in other exhibits successfully. After a short time, a gorilla escaped via the moat. The difference between Woodland Park and other zoos was the presence of shrubs and trees that the gorilla used to climb to the other side (Hancocks, 1996). Another example is the hot wires that were placed in the exhibit as barriers. Some animals were intelligent enough to learn how to short-circuit these wires by using sticks or, in case of the elephant, by using its tusks to lift them.

Landscape architects should be aware that they are designing for smart developing creatures with individual learning capabilities. Gathering information about

individual species is important to insure their full capabilities are considered in the design solution, rather than focusing on standard data about the species. Respecting animals in the pre-design process is essential for the success of the final design.

6.4 Recommendations for future research

This research focused on the elephant and lion exhibits. Further research could expand to include other animal exhibits through a similar process to determine appropriate design guidelines. Identifying the appropriate visitor experience that each zoo desires for its visitors is important. Knowing and understanding these guidelines sets a datum line for measuring the success of the zoo for fulfilling its mission.

This research has focused on the importance of authenticity in animal enclosure design, specifically by being authentic to the animals' native habitat. If all zoos offered elephant exhibits as parts of the African savannah, there will be nothing that distinguishes an elephant exhibit in Atlanta and another in Egypt except for interpreting cultural differences between the two. This can be achieved not only by using native plant materials but also by introducing features from the zoo's regional culture in order to give it its unique taste and experience.

Currently, the profession of landscape architecture has produced very little information concerning zoo design and visitor experience. On the other hand, there is extensive research on how animals react and interact in different exhibits. Landscape architects should work on filling the gaps in both zoo design and visitor experience. If they continue to ignore this field, other professionals will step in to fill those gaps especially since zoological design is a growing industry across the United States.

Another major issue is the lack of sharing of knowledge among designers from different disciplines. Very rarely do landscape design firms or zoos offer any information or guidelines concerning exhibit design, vegetation, or even the design process. Many of the unknowns related to zoo design would be eliminated if people shared their experiences and expertise.

It seems that aquariums have developed in the past years at a much faster pace than zoos. This could be due to the innovative use of technology related to display methods. For example, some methods use tunnel paths underneath the aquarium that give the visitors the illusion of being inside the aquarium. Glass floors make visitors tip toe so as not to step on the fish. This all happened as a result of a new technology in manufacturing glass. Perhaps zoos need a new technology that would move zoos to a new era such as new barrier technique.

Finally, landscape architects should develop their own standard reference for zoo design. This standard reference would be very helpful and could identify specific problems and issues related to different project types, such as roof gardens, public parks, playgrounds, parking areas, and recreational parks, and will illustrate how design guidelines can be proposed for each case from the landscape designer's perspective.

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