

# Zoo Environments for People, Plants and Animals

Jon Coe



## Designing Enclosures and Landscape Planning for Indian Zoos

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Workshop for Indian Zoo Directors

Central Zoo Authority of India

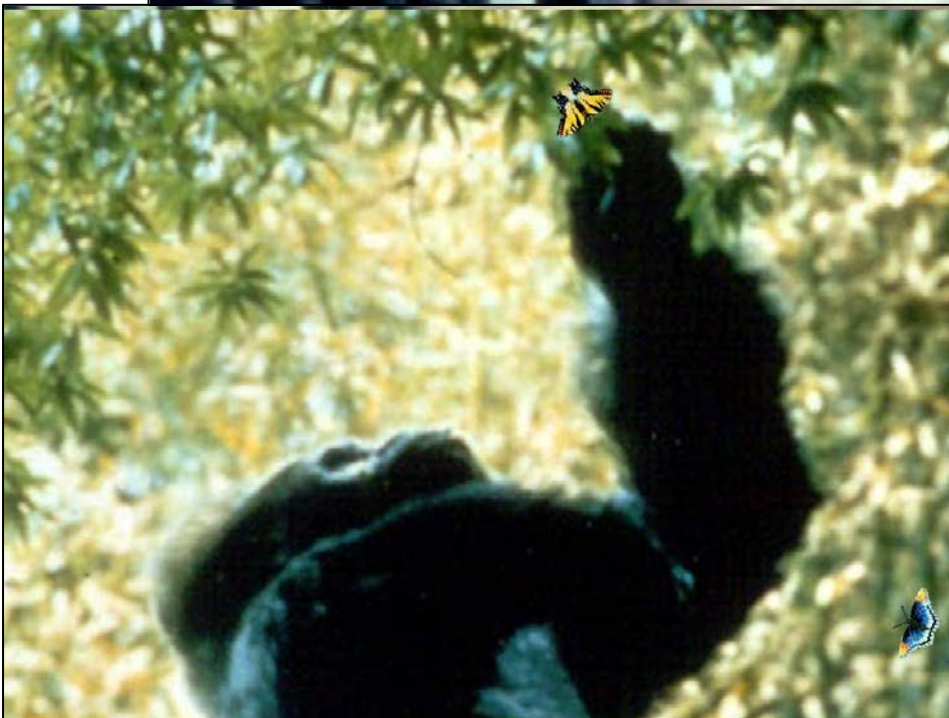
2 November – 5 November 2011

## Introduction

This paper is in the form of a modified PowerPoint slide presentation with descriptive captions and text.

We begin with subjects primarily of interest to people such as recreation, education, zoo design philosophies, immersion design techniques, cultural immersion, affiliative design and combining animal viewing with other types of visitor accommodations. Non-Traditional zoos such as day and night safari parks are also discussed.

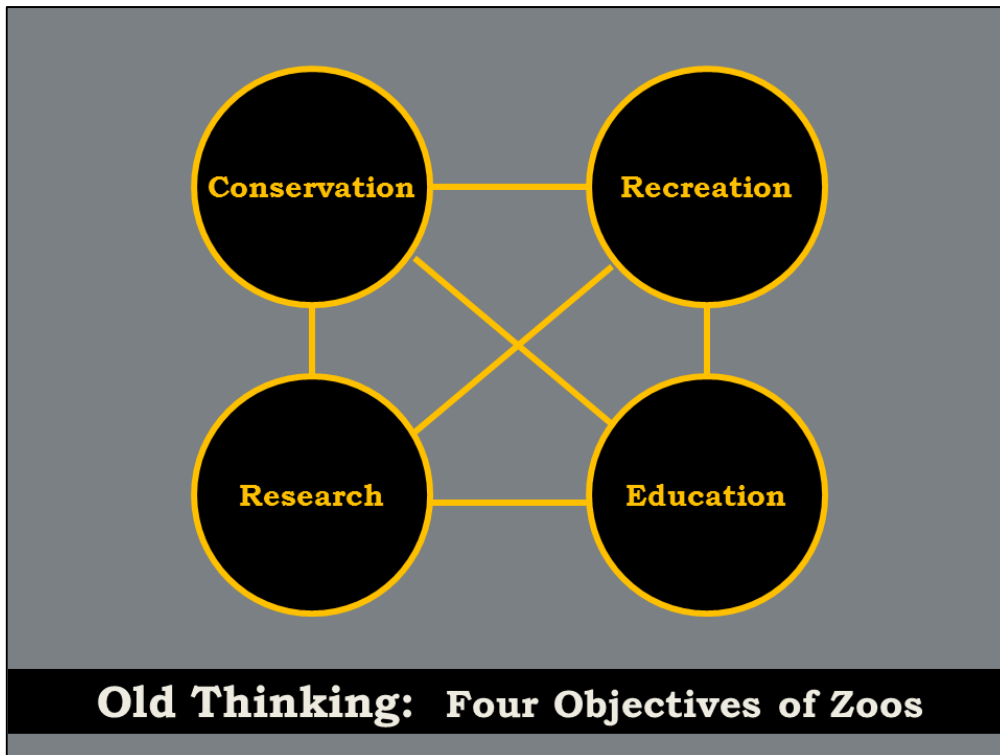
Next we present design subjects related to animal well-being such as ex-situ conservation, animal competence, control and choice, and environmental enrichment. Then work related issues of interest to zoo staff such as security and sustainability are discussed. We end with the need for a collaborative design process.



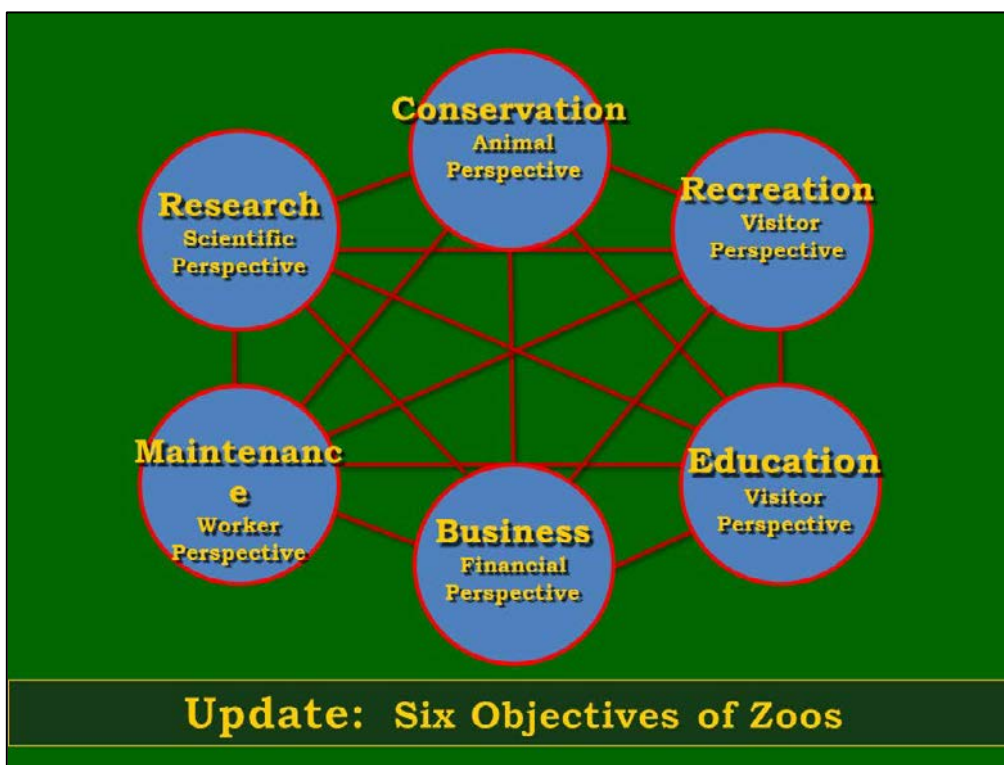
Zoo design has made tremendous advances in the last thirty-five years. Yet many of these innovations are unknown to the majority of zoos worldwide. Most new zoo facilities are designed by directors with little design knowledge assisted by architects and builders with little zoological knowledge. Neither zoologists nor architects are usually aware of major trends in zoos outside of their regions, thus most zoo designs are copies of older facilities which were themselves copies. Advancement has been slow.

Aware of these problems, the Central Zoo Authority of India (CZA) has wisely introduced training courses such as this “Designing Enclosures and Landscape Planning for Indian Zoos” for Indian Zoo Directors. Therefore the goal of this presentation is to share our experience of international trends in zoo design and to put these innovations in context so that the underlying rationales and interrelationships become clear and useful in the Indian context.

Architects and landscape architects with special zoo training and experience are rare and centred in North America, Australia and Singapore. Therefore it is up to Indian zoo directors to become informed about appropriate advances and to communicate this information to their own staff, architects, landscape architects and builders.



Advances in zoo design naturally follow advances in zoo practice. This old model of zoo objectives shown above, widely used by the American Zoo and Aquarium Association (AZA) left out some important modern zoo realities.



I have updated this diagram to include the business of managing a zoo and the needs of zoo staff. A successful zoo must balance its resources among all six areas. Success in each is essential to overall success.

All of these areas have design needs and overlaps. Integration is a key to success.

# Part One

## Recreation and Education

### The Visitor Experience *and* Learning

The first measure of a zoo's success should be the quality of the visitor experience. I believe the wildlife conservation role zoos are best suited to advance is creation of lasting bond with animals in visitors' minds. When people feel no passion for wildlife they take no action supporting wildlife conservation. Zoos can create and support this passion through development of memorable animal and habitat experiences which also support attendance and revenue generation.

While the terms 'recreation' and 'education' are usually considered as separate and even competing aims, good exhibit design serves and integrates them both.

## Zoo Design Philosophies

- **Modernism**
- **Landscape Immersion**
- **Cultural Immersion**

Zoos, like all human institutions, are subject to changing and often conflicting styles, themselves artefacts of differing philosophies. Rather than selecting a certain design style unconsciously or because it is temporarily in vogue, designers and administrators need to consider the underlying philosophy and the "message" (Coe 1987) it communicates to the viewer.

## Modernism

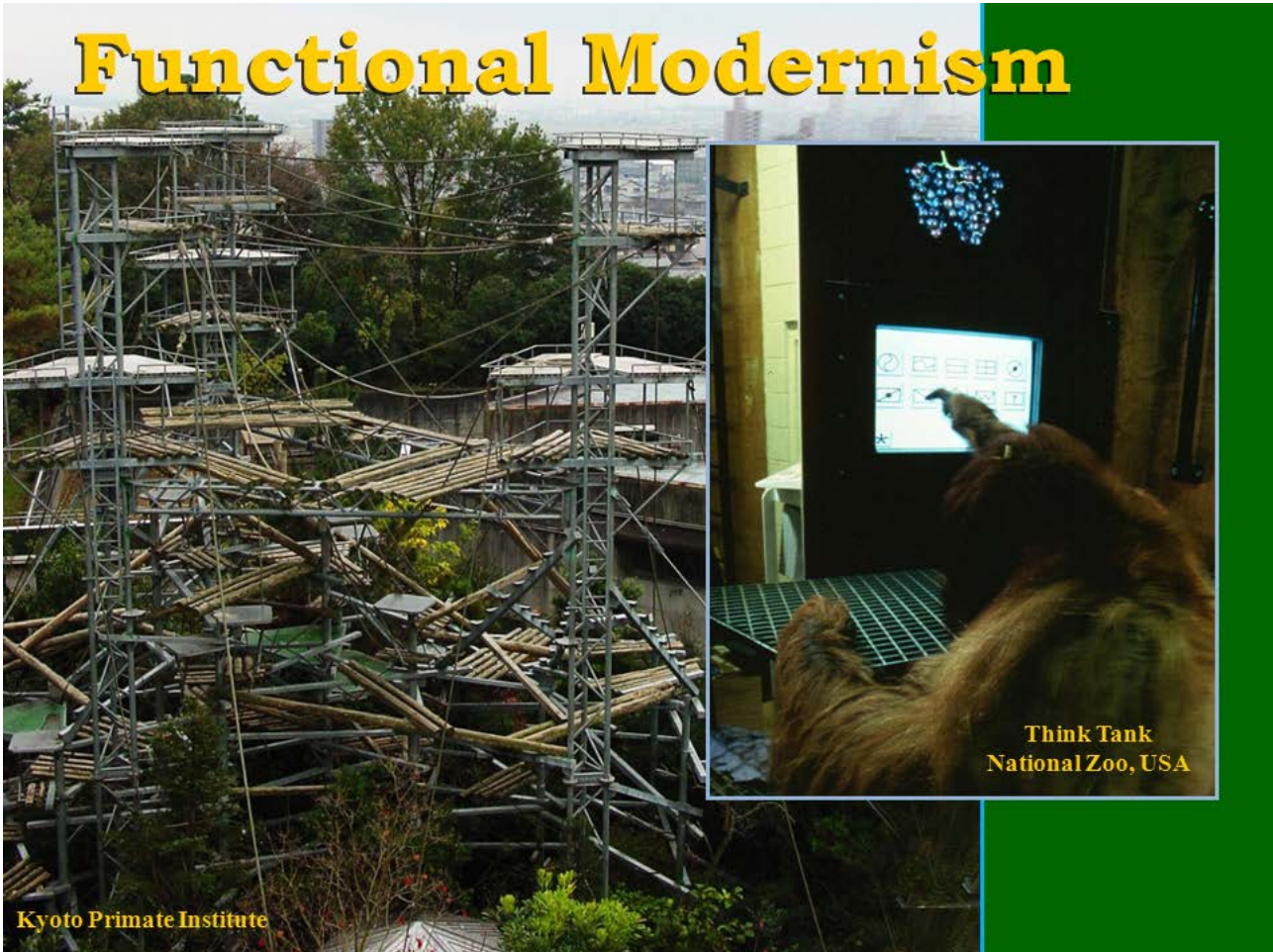
### *What's the Message?*

Modernism is a philosophical revolt against naturalism, realism and tradition in art, architecture, literature and so on.

In the zoo context modernism is a way of thinking that puts humans and their technology over nature. It is a "homocentric" or man-centred philosophy which believes that human science and technology can meet all challenges including meeting the needs of zoo animals. It also assumes we are wise and knowledgeable enough to know what all of the animals' needs are.



# Functional Modernism



## Functional Modernism

Functional modernism in zoos adapts human architectural forms and equipment to animal's functional needs. But in so doing may send the anthropocentric message that animals are no more than primitive or underdeveloped people or that animal needs can be met without also preserving wild nature.

Functional modernism is the common style for zoo 'back of house' and off-exhibit animal areas.

# Themed Modernism



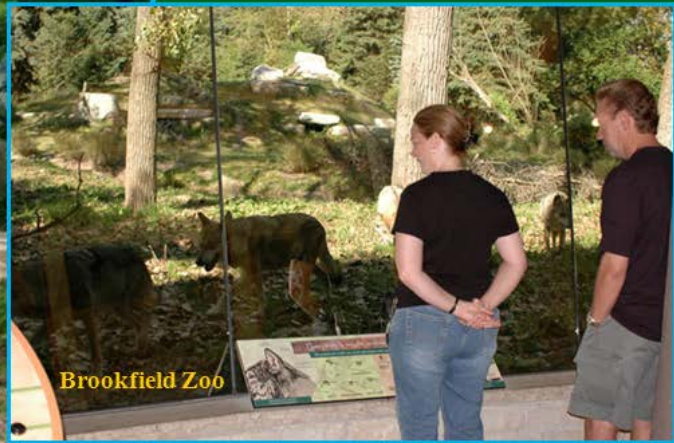
## Themed Modernism

The extensive use of modern technology communicates a modernist message even if this is not the designer's principle intent.

Themed modernism in zoos can be seen in exhibits like this orangutan enclosure at Los Angeles Zoo we designed that combines Thai thematic elements with a modern high-tech mesh enclosure.

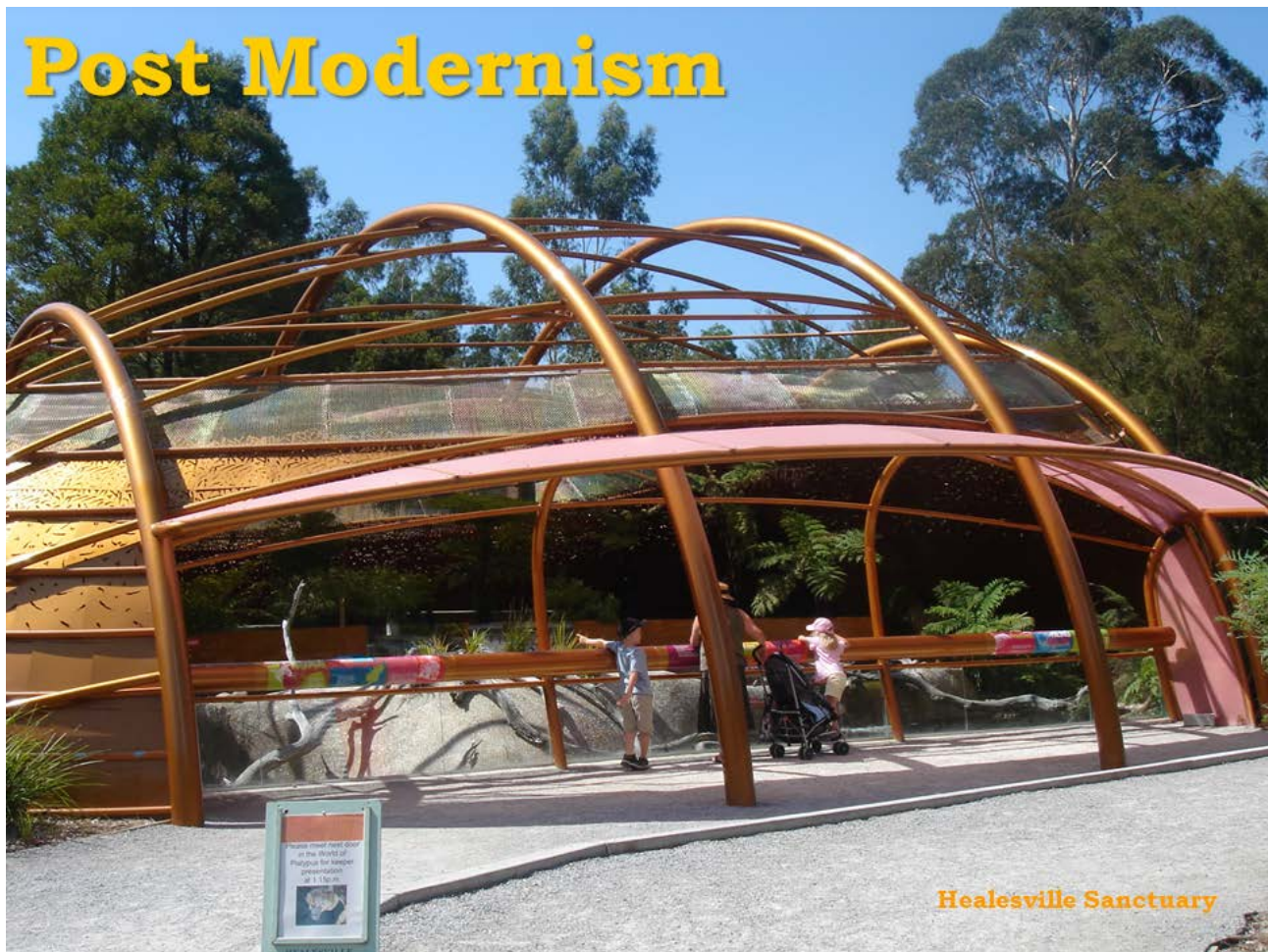


# Hidden Modernism



## Hidden Modernism

Hidden modernism, seen in our “Wolf Woods” exhibit at Brookfield Zoo in Chicago. The functional, modernist viewing building is submersed into the landscape and is buried with planting. The “one-way” glass allows visitors good views of the wolves while the visitors remain invisible to the animals.



## Post Modernism

Post modernism is a fairly recent variation on modernism adding elements of allegory and whimsy. In this example the platypus enclosure at Healesville Sanctuary in Australia the architecture symbolized an egg, the unique reproductive characteristic of platypus. In my opinion this architecture distracts badly from a more important message about protecting platypus and their natural habitat. In other words, it is a display of architecture rather than of animals.

## **Landscape Immersion**

### ***What's the Message?***

Landscape or habitat immersion is a highly naturalistic style of zoo design originated by Grant Jones, Dennis Paulson, David Hancocks and myself (Jones, Coe, Paulson 1976) wherein nature is the model and realism the goal. The idea is to develop zoo animal displays, including visitor areas, which surround and immerse both visitors and animals in detailed replicas of the exhibited animal's natural habitats. Features not found in natural habitats such as artificial barriers, support buildings and animal pens are hidden from view.

Landscape immersion grows from a bio-centric or life-centred philosophy. It suggests the more closely we recreate the landscape in which a species evolved the more likely we are to meet animal needs we may not even know exist.



## Immersion's Message

What would we feel if we saw male gorilla Will B in his old "modern" enclosure? What message would this experience communicate?



**What's the message?**

**Message:**

- ◆ **Animals as incompetent, dangerous and dependent**
- ◆ **Animals kept as objects**

Here is Willie B in his new enclosure at Zoo Atlanta. What message would experiencing a gorilla in this setting convey?



**What's the Message?**

**Message:**

- ◆ **Animals as competent, independent and to be respected and conserved.**
- ◆ **Animals as part of ecosystem**

Willie B at Zoo Atlanta



## *The beginnings of Immersion*

**1976**



The first immersion gorilla exhibit was opened at Woodland Park Zoo, Seattle, US in 1976.

Visitors enter the gorillas' forest before encountering the apes themselves.

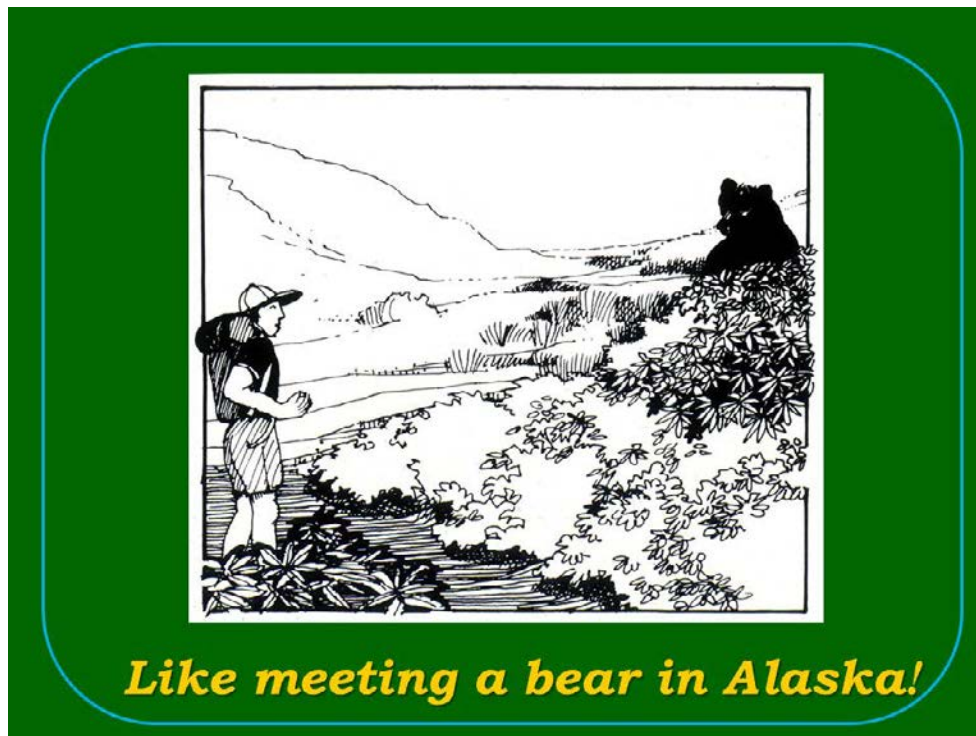
Inspired by the gorilla field research of Dr. George Schaller and with his strong encouragement, the first immersion exhibit for great apes “using nature as the model” changed the way gorilla displays were thought of. Before this time most gorillas were displayed on concrete.



**Children clearly understand the message: “Animals and landscape are inseparable.”**



Six year old school children visited the Seattle gorilla exhibit and the following day drew pictures from memory of what they remembered. The accuracy of their recollections was extraordinary. This proves that appearance does matter in communicating the message of apes in nature.



This illustration from “Design and Perception” (Coe 1985) demonstrates the types of emotions immersion exhibits are intended to convey.



## **Principles of Immersion Design**

This 1995 immersion display at Seattle’s Woodland Park demonstrates the realism principles of immersion design which follow.



# Applied Psychology



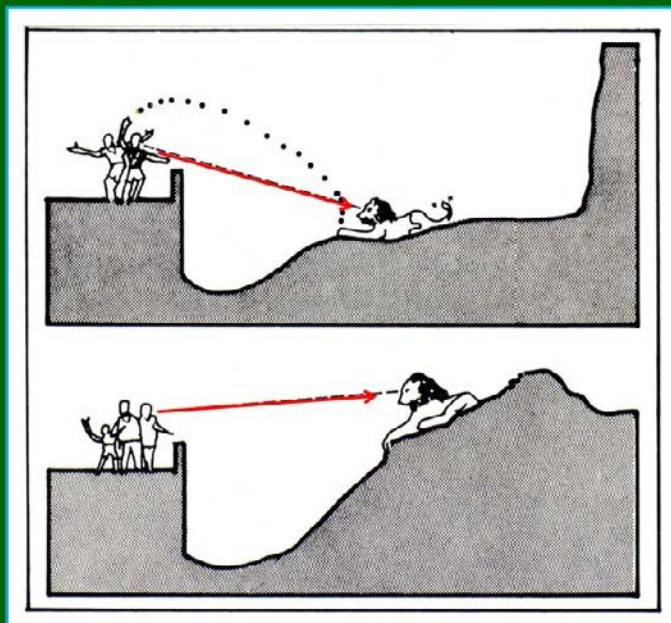
◆ People in a dominate position want to direct and control.

◆ People in a subordinate position are more likely to learn.

## Applied Psychology

If people in a subordinate position are more likely to learn, why not place zoo animals in an elevated position, forcing visitors to look up to them?

# Applied Psychology



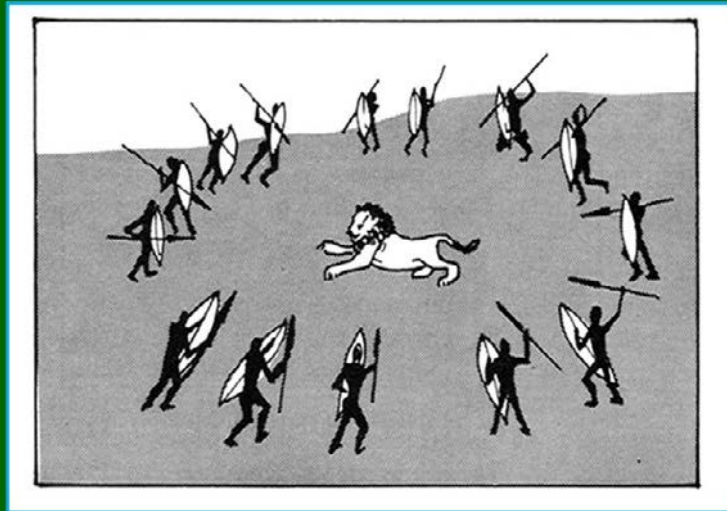
◆ People looking down on animals want to control them.

◆ People looking up to animals may respect them more.

Also, people tend to throw objects at animals below them, but not at animals above them in my experience. I believe that animals in higher position gain more respect from visitors.



## Applied Psychology

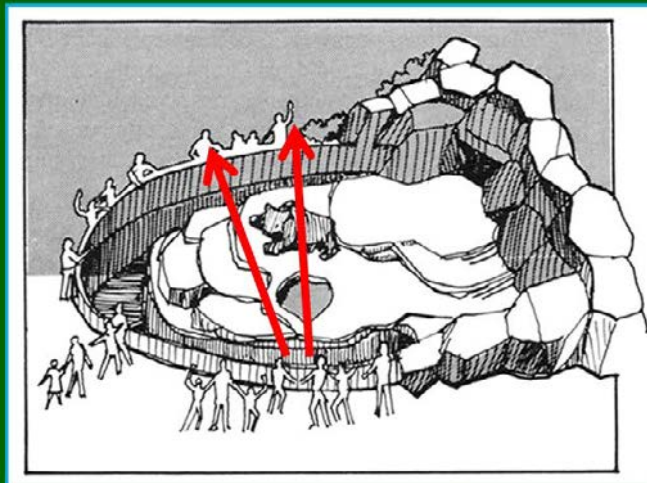


- ◆ **Hunters surrounding an animal is very stressful.**

### Applied Psychology

Humans are a dominating species and in large number numbers frighten most animal species.

## Applied Psychology



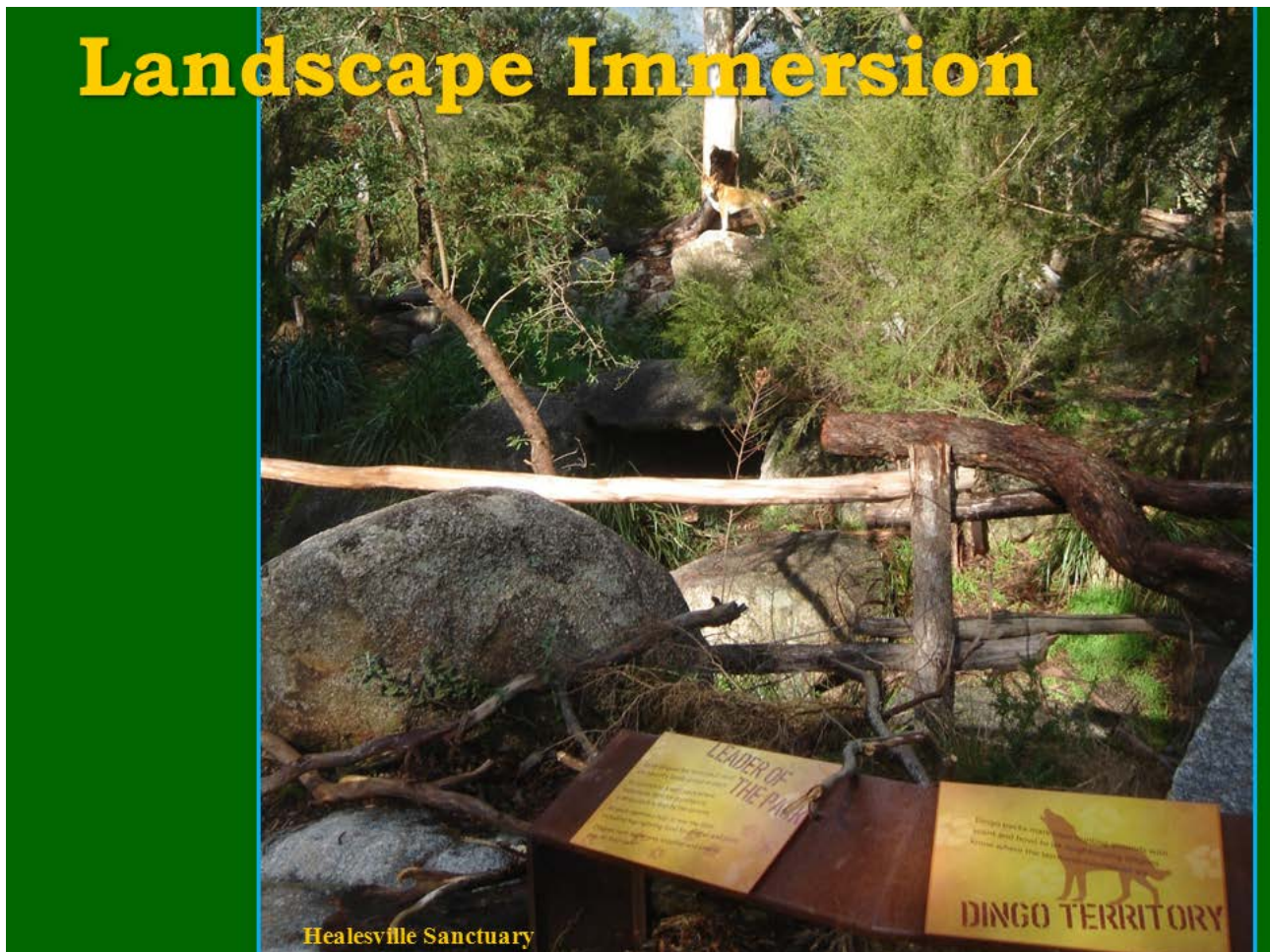
- ◆ **People surrounding a zoo animal is very stressful.**
- ◆ **Seeing other people (cross viewing) is distracting.**

Most wild animals are stressed when surrounded by humans. Also, humans are so attuned to other humans that the mere awareness of large crowds may seriously distract from the animal viewing experience, communicating the message of human dominance rather than respect.

# Landscape Immersion

## Views and Sight-Lines

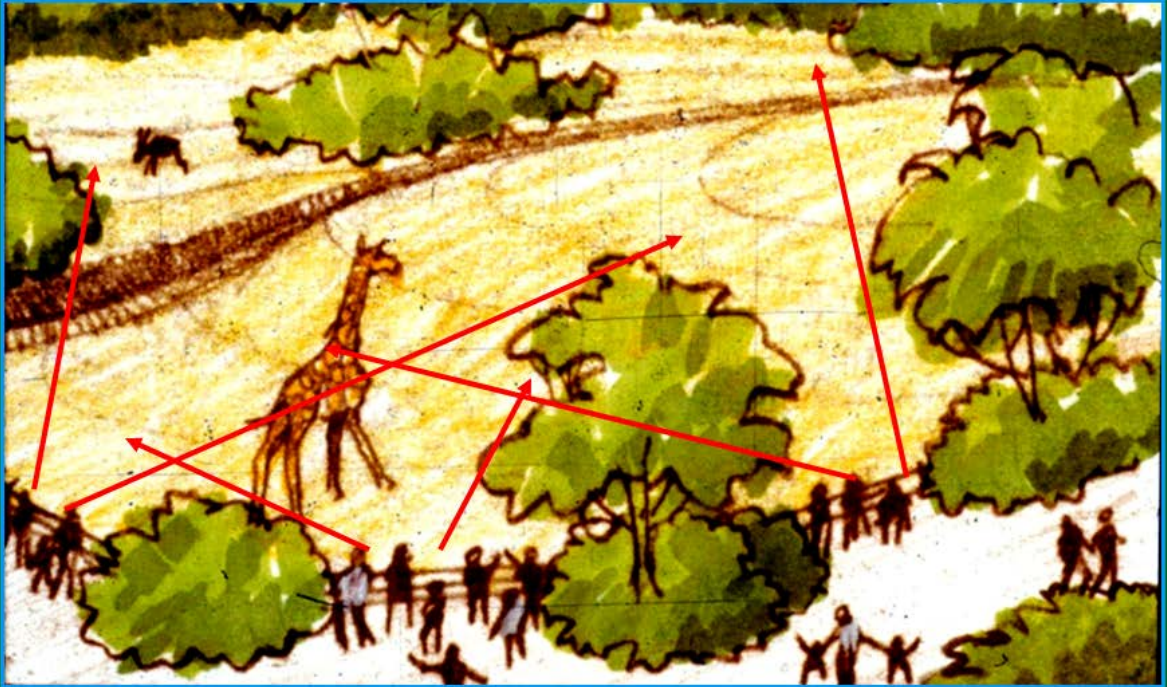
View and sightline concepts that make immersion design successful are covered in the following pages.



This dingo in a new display in Healesville Sanctuary in Australia positions itself well above visitors, facilitated by the intentional placement of boulders by exhibit designers. This is an excellent example of integrating sight-line design with animal behaviour and human psychology using immersion design. What is hidden is as important to delivering the message as what is revealed.



# Immersion Concepts

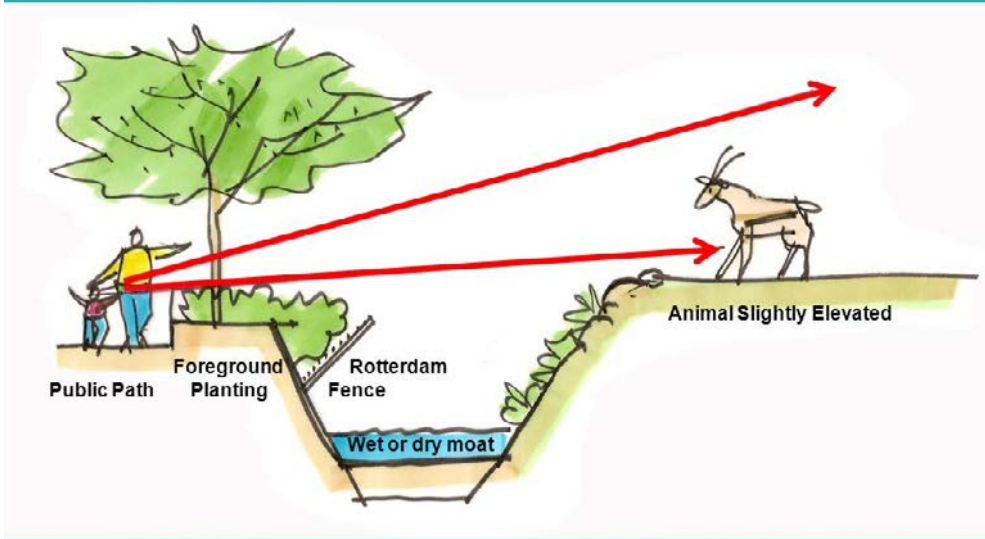


- ◆ **Break up viewers into small groups**
- ◆ **Avoid cross views.**

## Views and Sight-Lines

Large crowds of people dominate any scene and distract from a sense of “naturalness.” Separating viewers into small groups allows more personal experiences to take place.

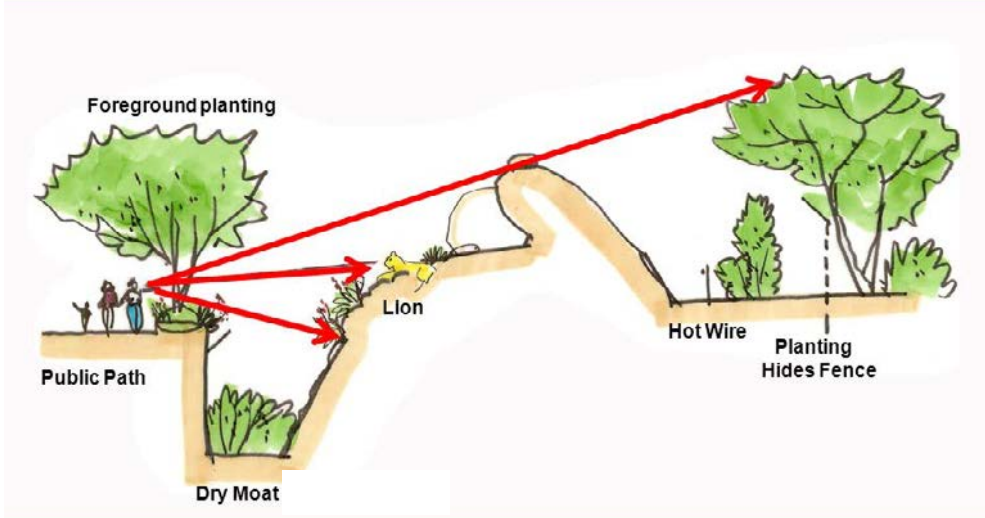
# Immersion Style



## Sight-Line Design and Hidden Barriers

Low planting hides this wet or dry moat. Planting must be maintained at the proper height without appearing unnatural or manicured.

# Immersion Style



## Sight-Line Design and Hidden Barriers

Earth and geologic features, together with planting can also hide fences.



## Immersion Concepts



- ◆ Don't allow entire exhibit to be seen.

## Immersion Concepts



- ◆ Allow the visitors to appear to move through the animal areas.

## Immersion Concepts



- ◆ Do allow the animals to move through the view.

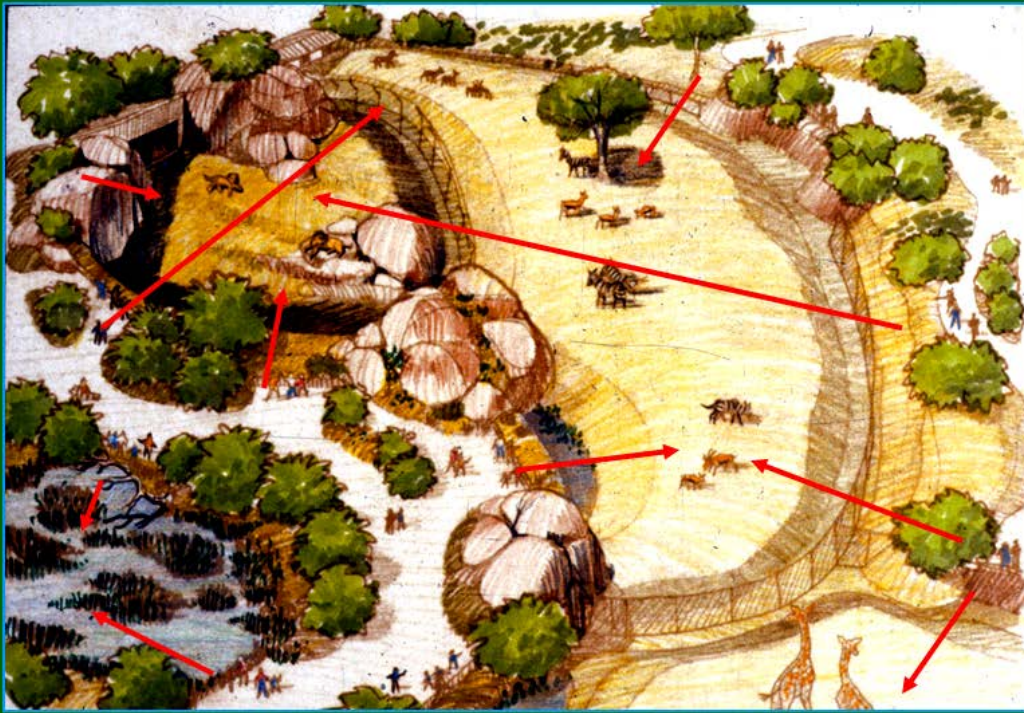
## Views and Sight-Lines

Exhibit viewing shouldn't be a static experience. This series of diagrams shows the concept of choreography, moving visitors through the landscape exposing them to a succession of well integrated views with viewing areas carefully designed.

Note that the entire animal exhibit cannot be seen from any one place, giving the impression it may be limitless.



# Immersion Concepts

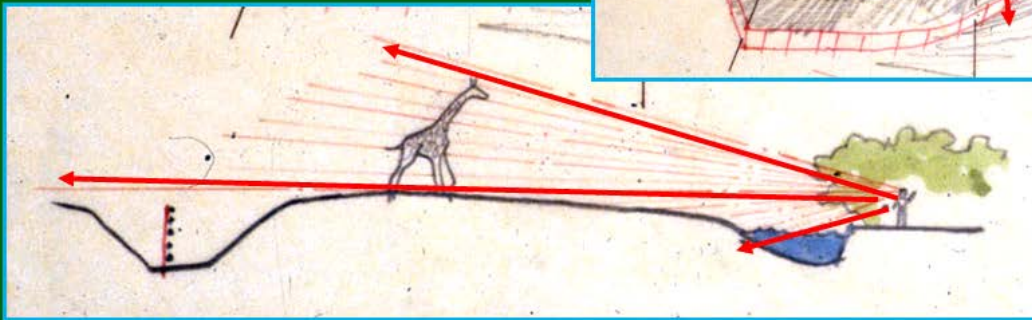
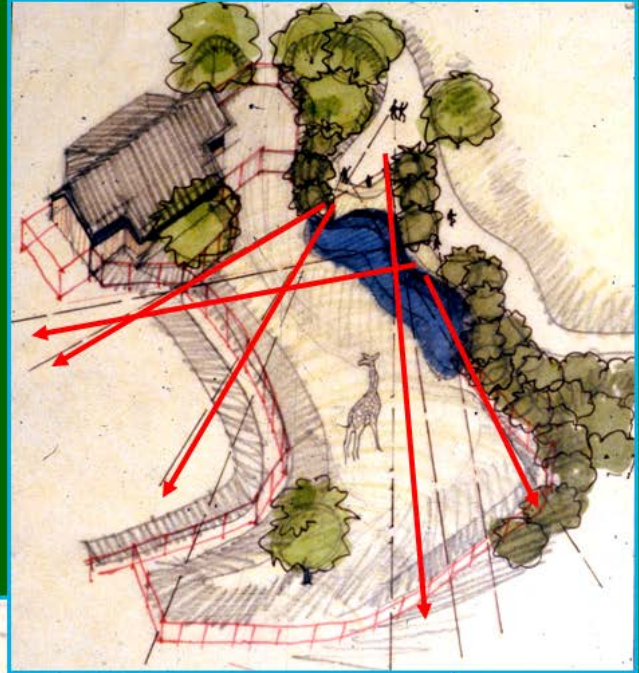


◆ **Plan using these concepts.**

By combining the previous design techniques into a carefully planned sequence of views the zoo experience resembles a foot safari in Africa.

# Immersion Concepts

## Sight Line Design



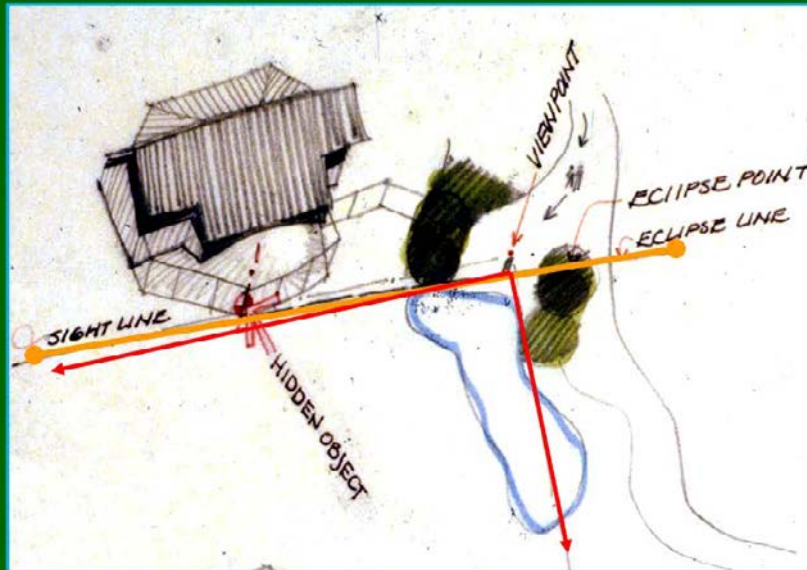
### Sight-Line Design

Sight-line design is the thoughtful control of lines of sight or vision to create the desired zoo visitor experience. While this method has long been used by theatrical designers and cinematographers, it is also useful in zoo design.

Designers use land forms and planting to carefully limit what is to be seen (simulated nature) and what is to be hidden (service buildings and barriers.) Sight-lines need to be considered both horizontally (plan view) and vertically (cross section) when designing them. But in fact, sight-lines are part of a three-dimensional landscape experienced through motion and over time.



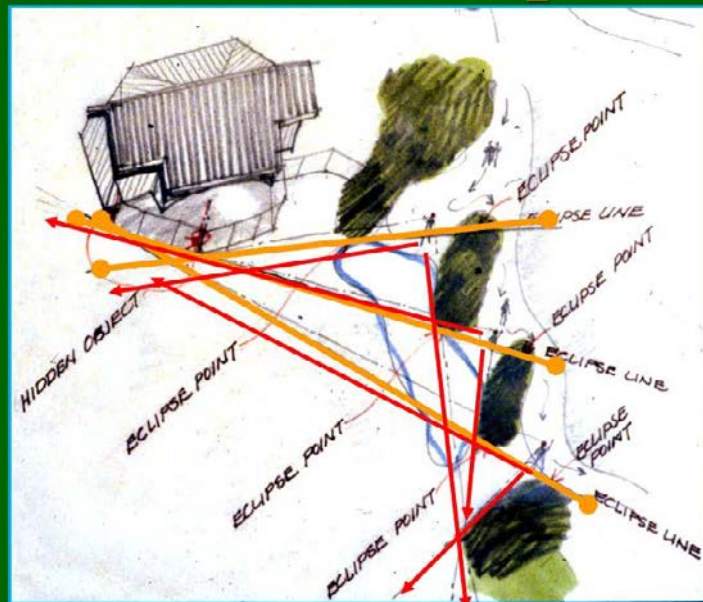
# Immersion Concepts



**Sight-Line Design**

View from first overlook with services areas hidden by plantings. Even though natural elements like plantings are used to screen unwanted views, sight-lines can be carefully controlled.

# Immersion Concepts

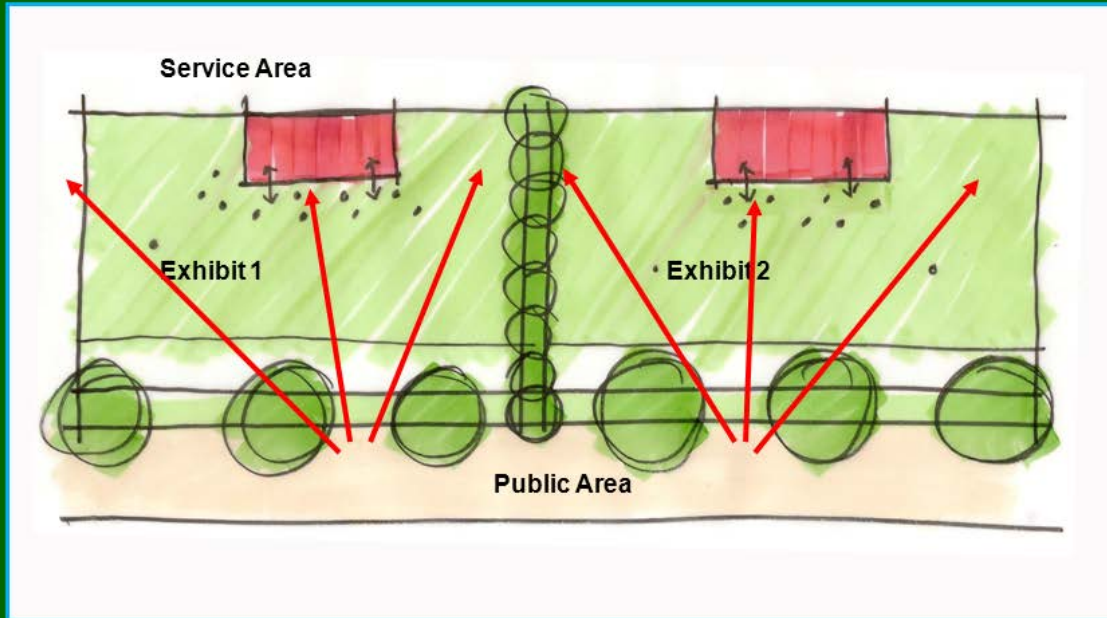


**Sight-Line Design**

Views from second and third overlooks showing service building remains hidden even as the visitor moves along the display.

# Immersion Concepts

## Traditional Style

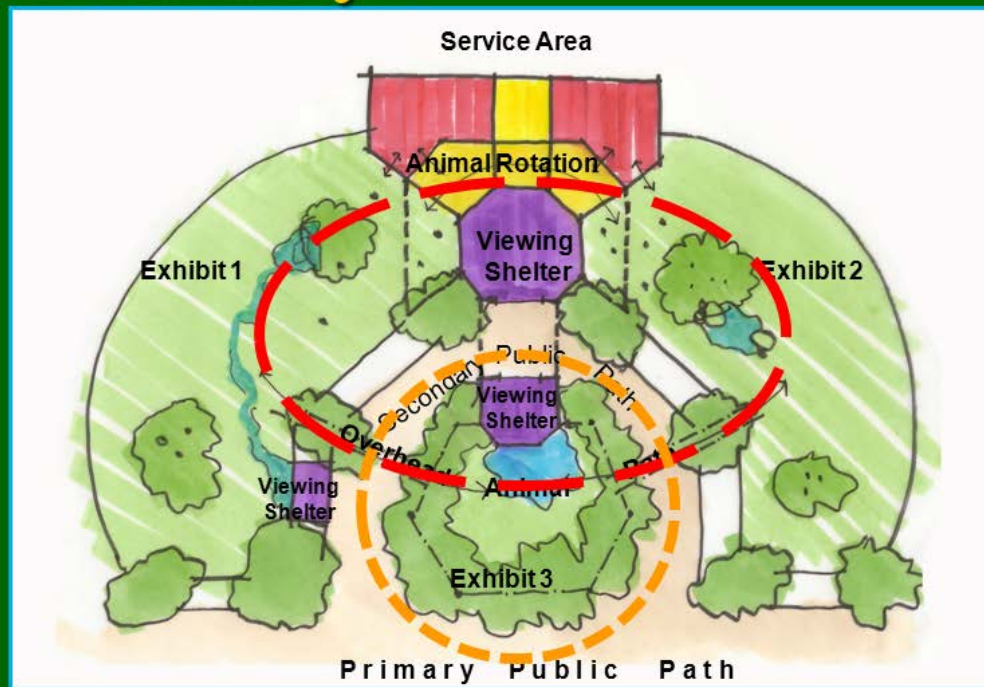


## Sight-Line Design

In this example of traditional non-immersive zoo exhibit layout, the visitor is kept outside the scene. Animals are often attracted to their shelters and distant from the public. The overall effect appears more agricultural than naturalistic.

# Immersion Concepts

## Immersion Style



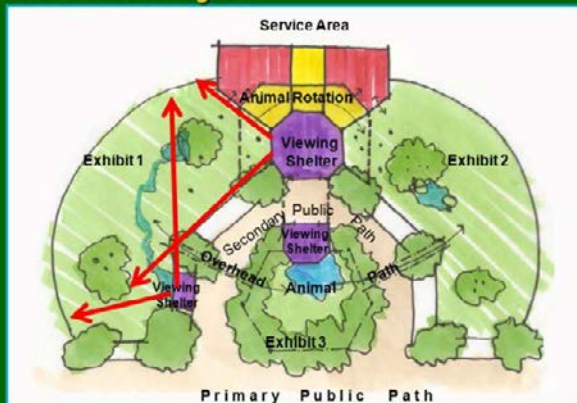
## Sight-Line Design

Put the visitor into the scene using sight-line design.

In this immersion-style exhibit the animal areas are wrapped around the viewers (yellow dashed line), who are on the “inside” surrounded by animals and are immersed in their simulated habitat. Arboreal animals may loop over public areas (red dashed line).



## Immersion Concepts Immersion Style

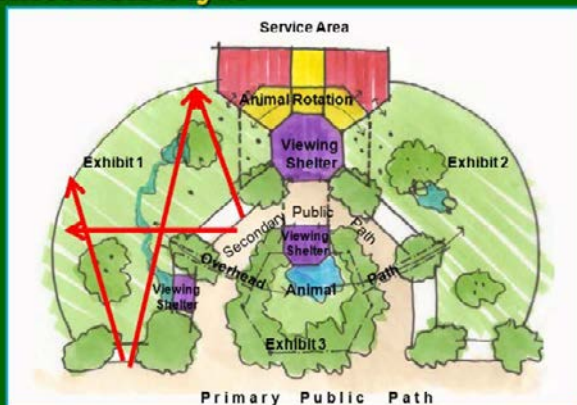


Sight-Line Design

Put the visitor into the scene using sight-line design:

Hidden viewing shelters (purple areas) allow visitors to see nearby animals through glass while minimizing reflections. The larger viewing shelter allows views of animals in indoor displays and close-up views of animals near or in their night quarters.

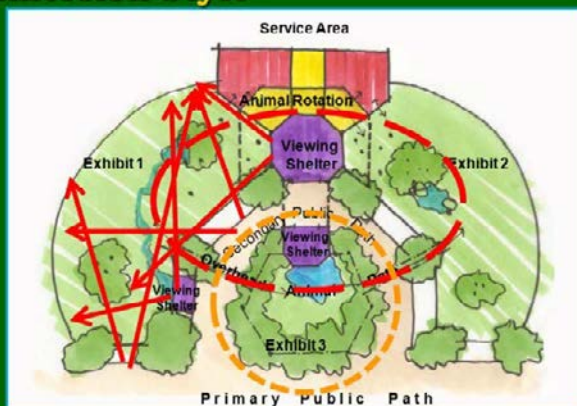
## Immersion Concepts Immersion Style



Sight-Line Design

Views over hidden moats can be large or small using sight-line design and "borrowed" (adjacent) landscapes as backgrounds. This can give a feeling of spaciousness.

## Immersion Concepts Immersion Style



Sight-Line Design

Even though each viewing area only reveals a small portion of the site, the combined effect is like a walk through nature. Animals not visible from one area will become visible from another overlook.

# Landscape Immersion

## Barriers

Barriers not only create a physical separation between people and animals, but, if not properly hidden, also create an emotional barrier as well.



This is the first animal exhibit visitors see upon entering Singapore Zoo and sets the message of “animals in nature.” Hidden barriers, carefully designed sight-lines and a wraparound animal area demonstrate the effectiveness of well-executed immersion design.

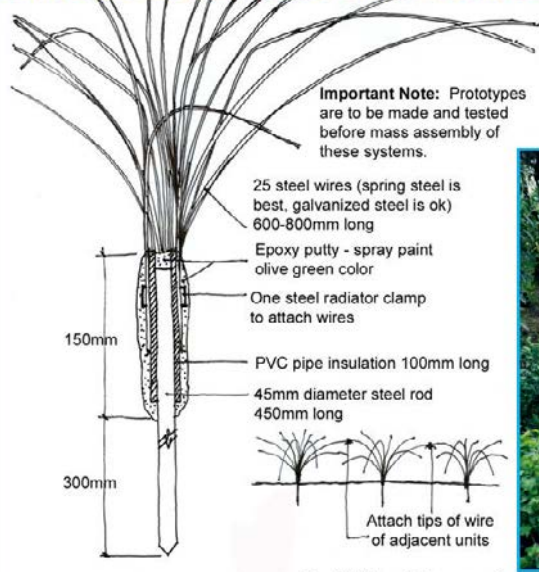




Barriers are affectively hidden at the Singapore Zoo lion exhibit.



# Hidden Barriers



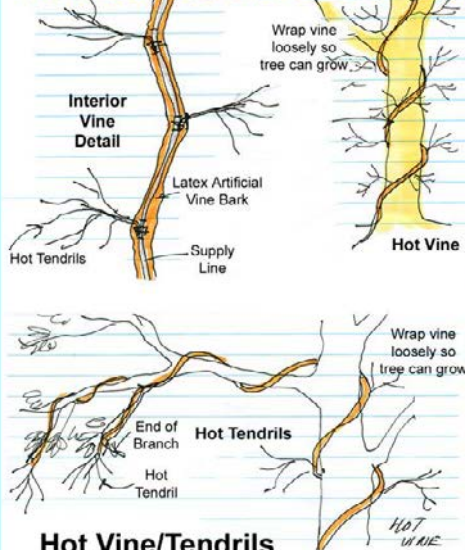
Hot Grass

Hot Wire Concepts  
Jon Coe Design, P/L 11 June 2007

## Secondary Barriers



# Hidden Barriers



Hot Vine/Tendrils for Tree Protection

Hot Wire Concepts  
Jon Coe Design, P/L 11 June 2007

**Important Note:** Prototypes are to be made and tested before mass assembly of these systems.



Electrified wires are useful barriers to protect plantings or keep animals back from primary barriers like fencing, walls and moats. "Hot wires" as they are called, are easy to disguise as grass, roots, twigs or tendrils. Hot wires should only be used where animals have sufficient space within the hot wires.

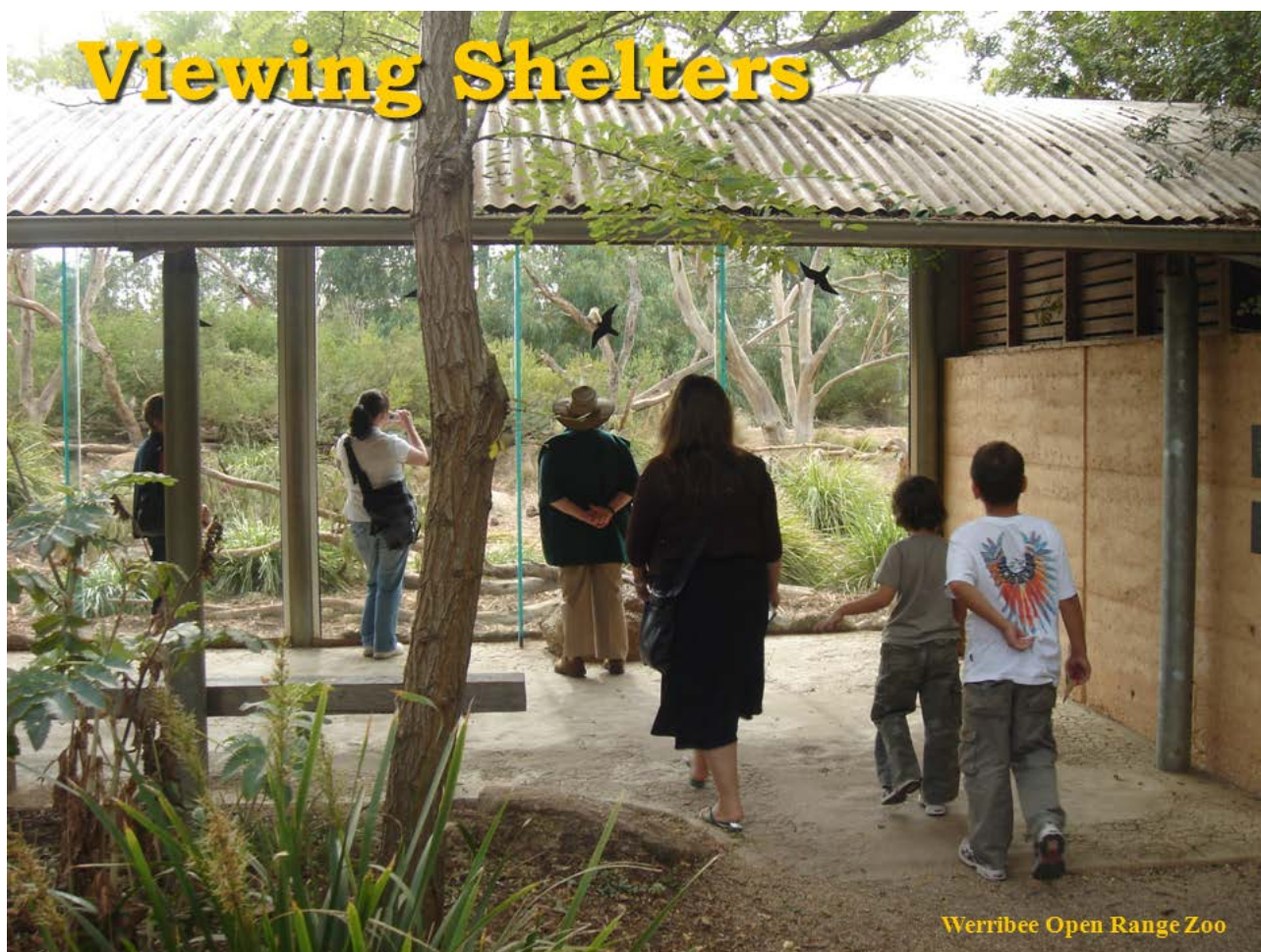
# Landscape Immersion

## Viewing Shelters

The most precise way to control views is to place the viewer in a confined space looking through a controlled opening, rather like a traditional museum diorama, but with views into a living landscape. While most zoo viewing shelters are designed as small themed buildings such as hunting hides or native huts, they may also resemble geological formation or vine-covered bowers.

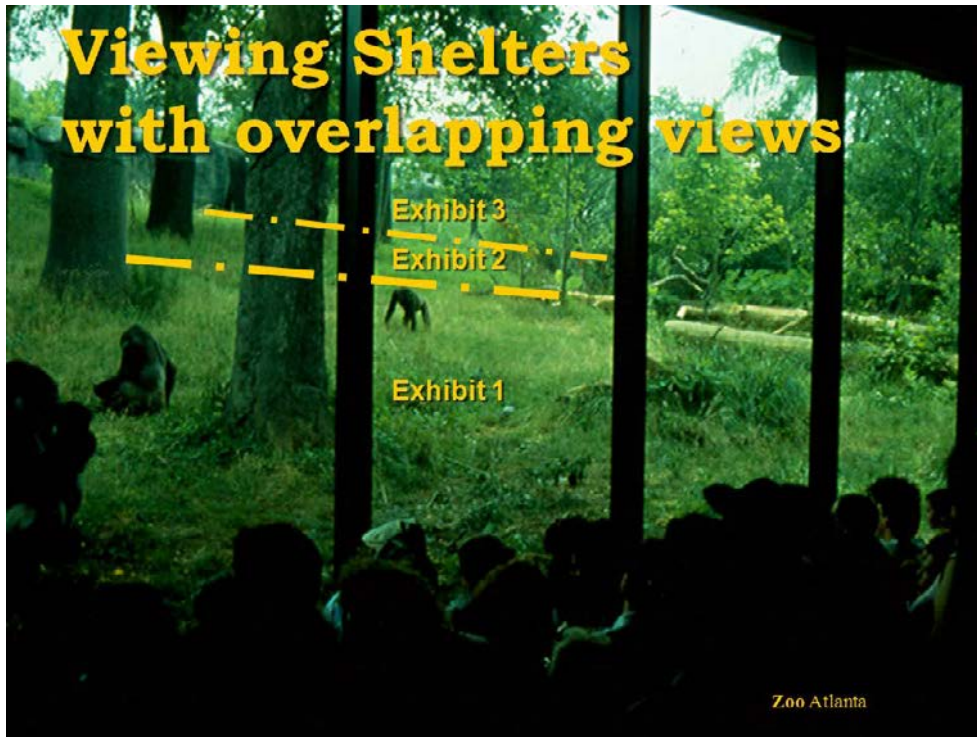
Viewing shelters also provide shelters for zoo visitors and protection for educational displays. Control of reflections on glass surfaces and of the acoustic environment is important.

While such features provide intimate views for some, other more open viewing areas must be used to accommodate larger crowds.



This simple viewing shelter at Werrabee Open Range Zoo in Australia provides both close-up viewing and shelter for visitors. It also hides the adjacent animal night quarters.



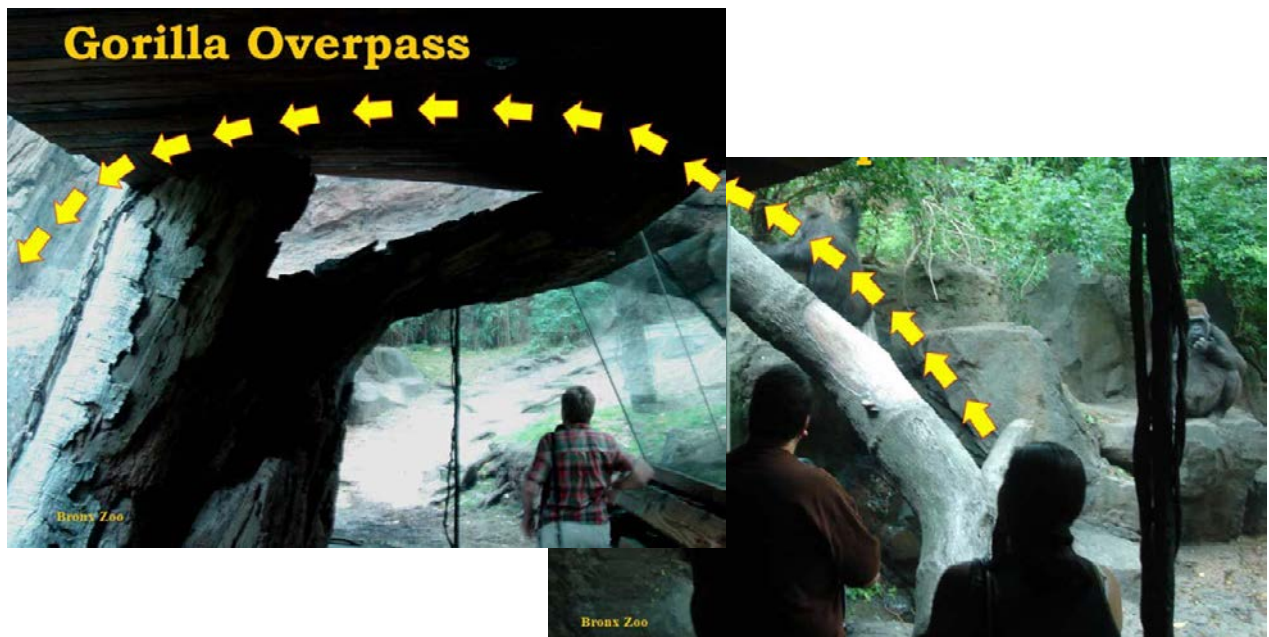


I designed this theatre style viewing area at Zoo Atlanta in the U.S. to present three separate gorilla exhibit areas in a single view.



The indoor viewing room at the Congo exhibit at the Bronx Zoo, U.S., is also a mini-museum.



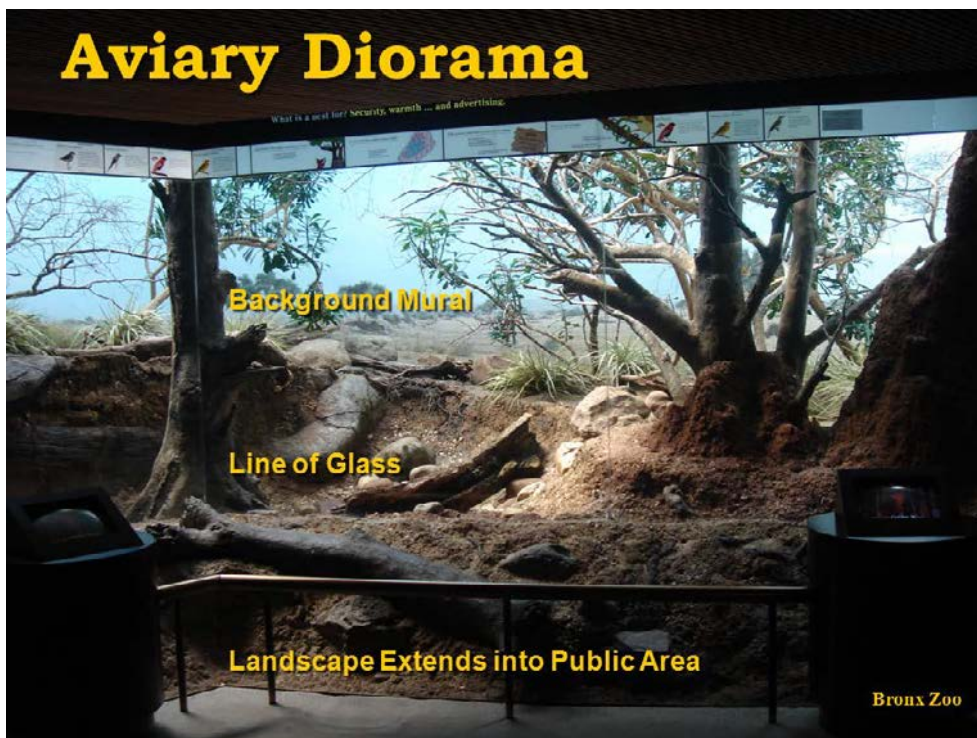


Another indoor viewing area at the Congo exhibit is circular. Visitors are surrounded by a large gorilla family. Gorillas even pass directly over an extension of this long gallery.





This elevated platform in a large aviary at Singapore’s Jurong Bird Park provides visitors a view into the tree tops and the birds perching there. The handrails and perching vines are simulated using modern materials and are carefully placed to bring birds and visitors close together.



This excellent traditional diorama at the Bronx Zoo, U.S. was renovated with landscape features extending past the glass and into the public hallway. This makes it more immersive.



We designed this wrap around penguin diorama for Riverbanks Zoo in the U.S. It features a wave making machine and the waves stimulate the penguins' activity levels.



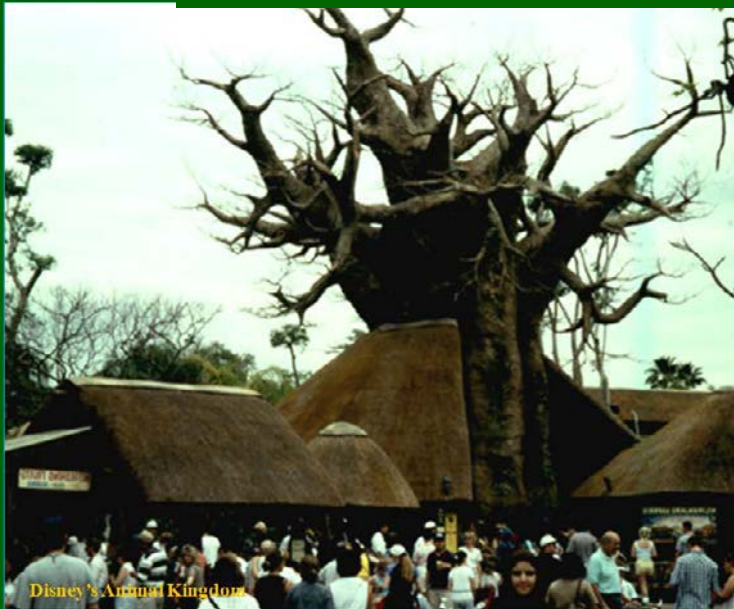
## Cultural Immersion

While landscape immersion surrounds the zoo visitor with a simulated natural or wilderness landscape, cultural immersion surrounds the visitor with a simulated cultural landscape. This could resemble anything from rice paddies to elephant logging camps or African villages. Cultural immersion can also represent modern culture such as a scientific camp, in-situ animal sanctuaries or undersea observatories.

### Cultural Immersion



### Cultur



The first example from Jacksonville Zoo, U.S., takes visitors inside a ruined and overgrown Central American pyramid. The second example is a village train station built against a simulated African baobab tree at Disney's Animal Kingdom, Orlando, U.S.

# Cultural Immersion



Zoo Atlanta



Bronx Zoo

Cultural immersion communicates stories about human and wildlife interactions. The tent in the first photo at Zoo Atlanta, U.S., simulates a research camp in a gorilla forest. The second photo at the Bronx Zoo, U.S., shows a village near an African wildlife reserve.



# What's the Message?



## **Cultural Immersion:**

- ◆ **Experience of seeing animals in vernacular, cultural setting**
- ◆ **Message of interdependence of animals of people and human domination**
- ◆ **Naturalistic and vernacular enrichment**

### Cultural Immersion's Message

Both cultural immersion and landscape immersion are intended to communicate a message – to tell a story. Zoo designers should first decide upon the message and story and then design the immersive landscape that best supports this message.



## What's the Message?



### **In Situ Sanctuary Story:**

- ◆ **Experience of visiting animal sanctuary**
- ◆ **Could combine animal dependence (reserve animals) and interdependence (collaboration with wildlife)**
- ◆ **Either naturalistic or artificial enrichment**

**In-Situ Message:** For example it is useless to attempt to convey the message of an orangutan or elephant living in the native forest if the animal will destroy the simulated native forest. It would be better to select a message about how in-situ sanctuaries help save wildlife because an in situ structure can be recreated more successfully in a zoo setting with destructive animals.

## What's the Message



### **Ex Situ Behind-the-Scenes Story:**

- ◆ **Experience of back-of-house tour or conservation and breeding centre**
- ◆ **Preparing animal for reintroduction**
- ◆ **Either naturalistic or artificial enrichment**

**Ex-Situ Message:** A number of zoos now provide special “:behind-the-scenes” or “back-of-house” tours for visitors. In these cases zoo service areas must be safe and clean, but also represent the zoo’s humane concern for animal well-being to the public. Are night quarters as attractive and enriching to the animals as public displays are?



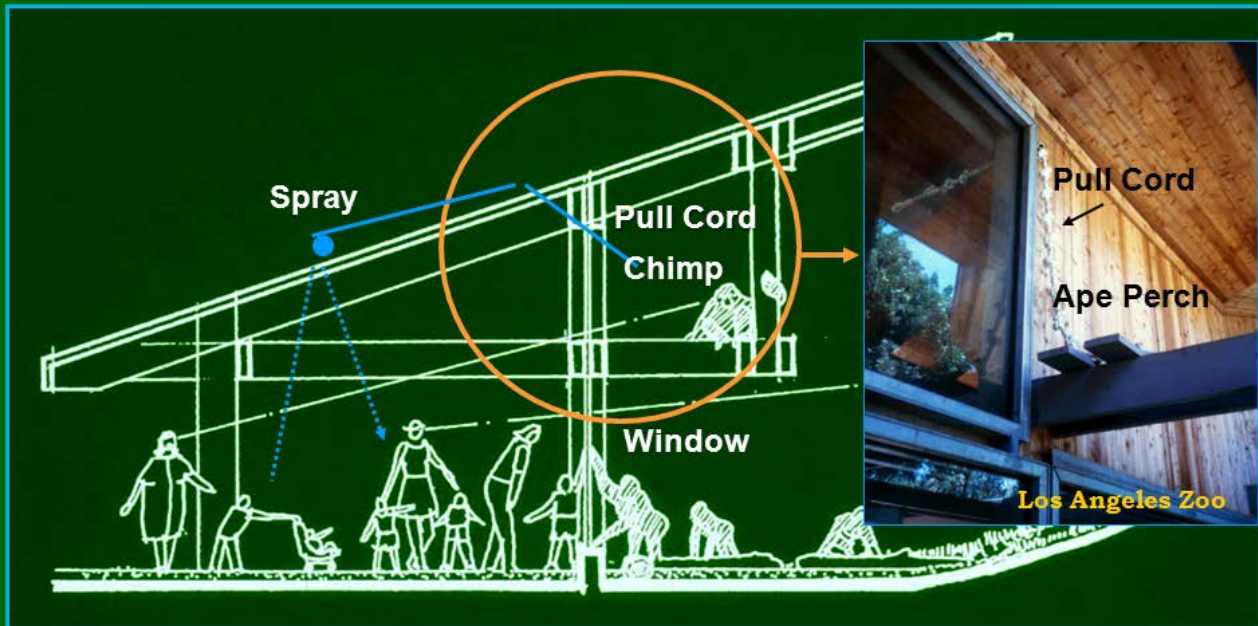
## Affiliative Design

### Definition

All social species have both friendly or affiliative natures and hostile or aggressive natures. The natural or social environment may determine which behaviours are expressed. Therefore we should try to create the types of environments which encourage positive affiliative behaviour.



# Collaboration with Visitors



**Chimpanzees share a simulated camp converted to a sanctuary with zoo visitors.**

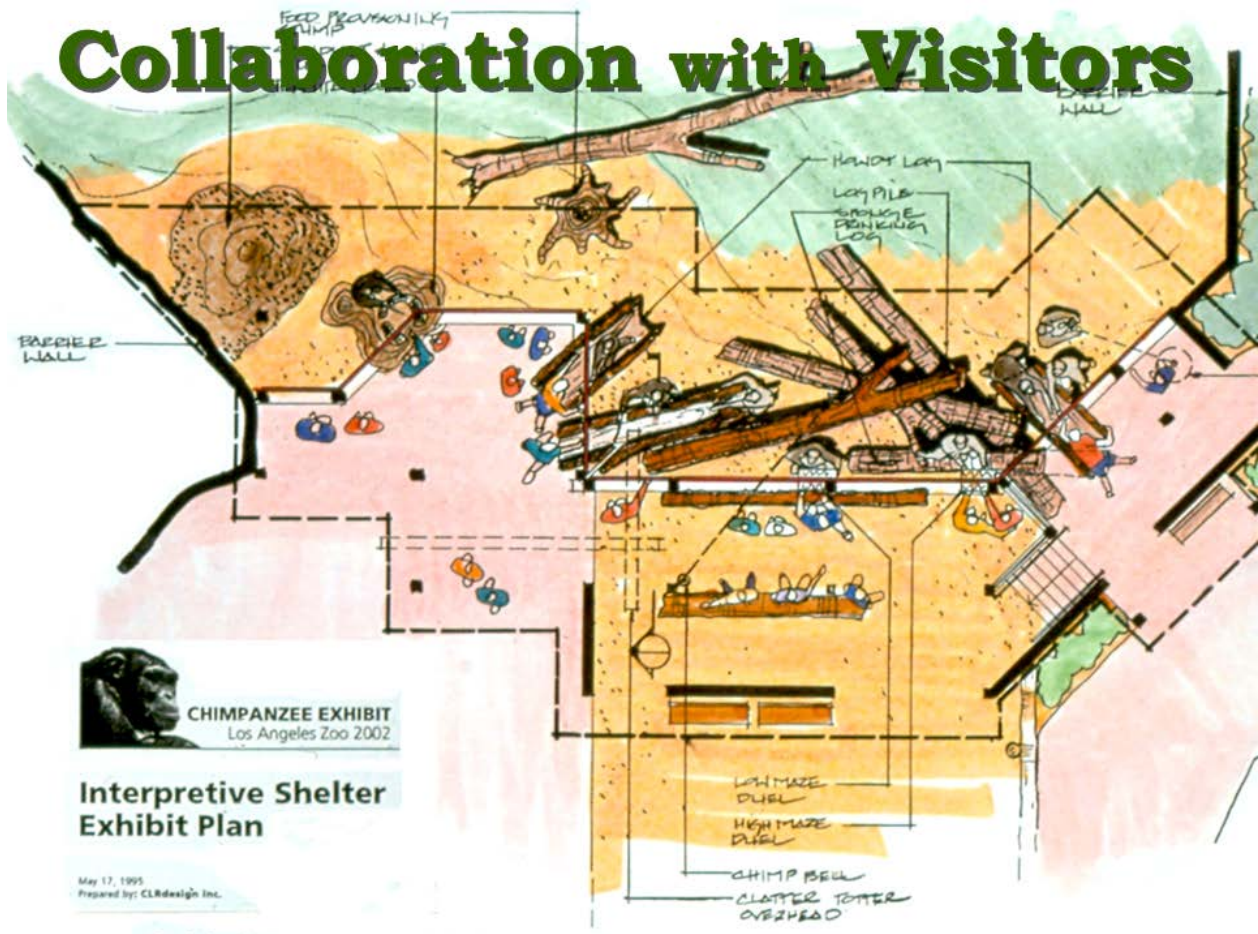
**Chimp can pull cord to give the public a “shower”.**

## Collaboration with Visitors

I designed this simulated abandoned logging camp at the Los Angeles Zoo, U.S., to place chimpanzees and people under the same roof, but allow a chimp to activate a mist spray to give visitors a brief shower. Both chimpanzees and visitors enjoy this game, but it also gives the apes some control over the people.

The key to designing such affiliative interactions is to understand both human and animal behaviour and to develop a game or other interaction both humans and animals enjoy while present the message of species being naturally competent and not dependent on humans. Both humans and animals should be seen as winners and beneficiaries of the affiliative interactions.

# Collaboration with Visitors



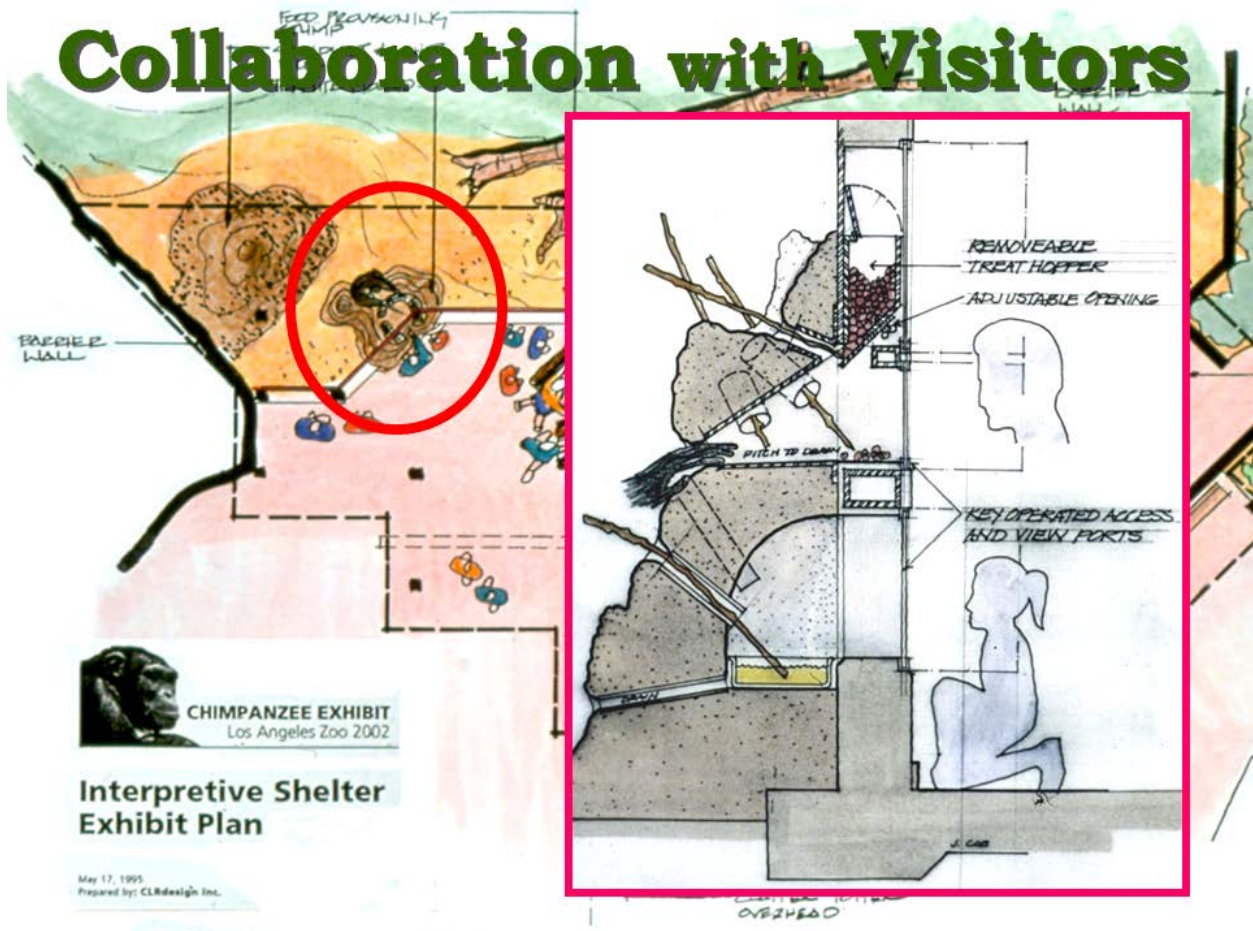
The people and apes are separated by a zigzag glass wall which de-emphasizes the separation.

Sometimes chimpanzees nearly surround the people and sometimes the roles are reversed. Artificial termite mounds and hollow logs appear to penetrate the glass wall allowing both apes and zoo visitors access to their side of these enrichment features.

Close up views of some features from this exhibit appear in the next slides.



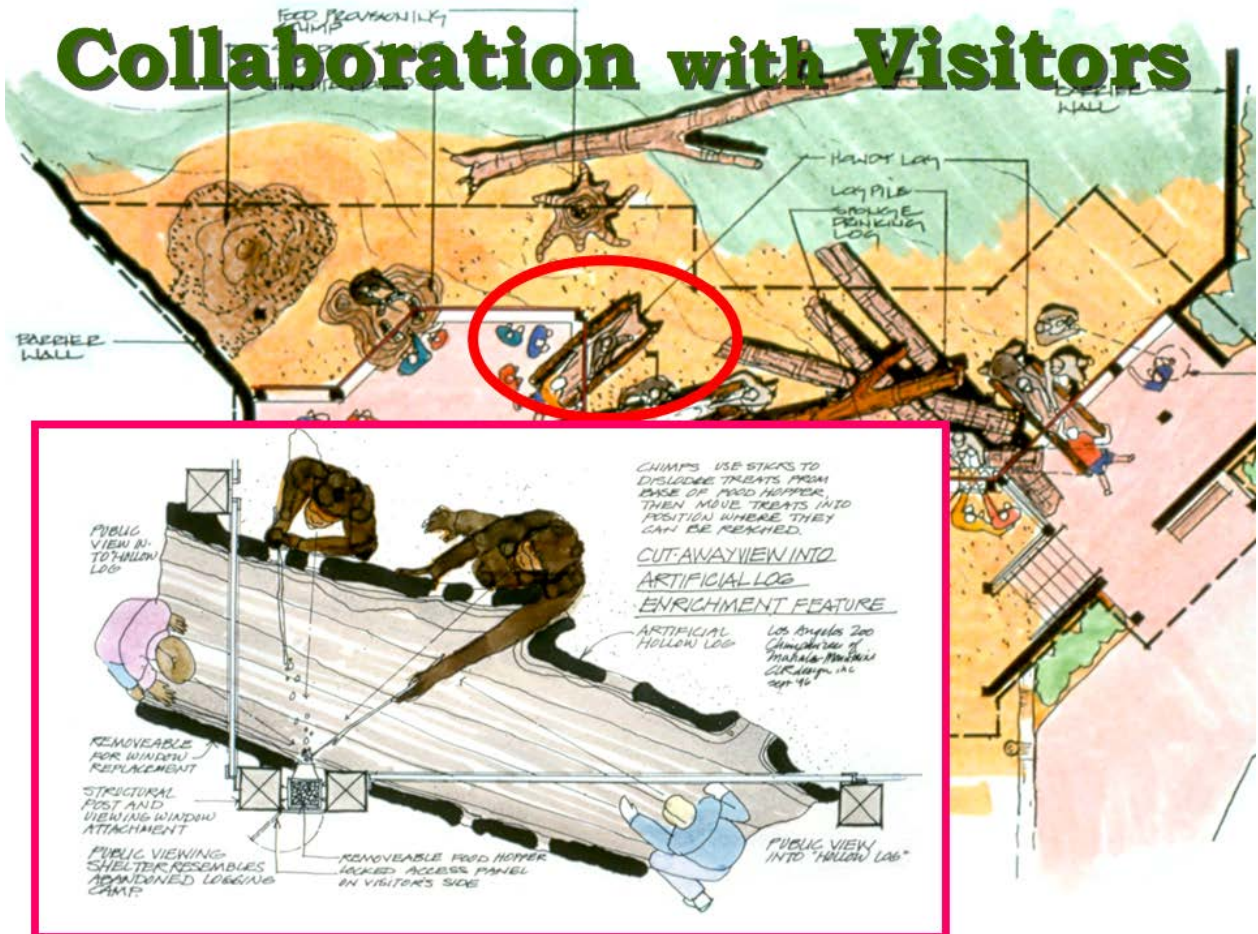
# Collaboration with Visitors



Chimpanzees can use sticks to probe for food items placed inside the artificial termite mound. Visitors get an inside view while the chimps work.

The enrichment items (food treats in this case) can be replenished by zoo staff from the visitor area. It also would be possible for supervised visitors to replenish the animal food. (Uncontrolled feeding by the public cannot be allowed.) Feeding animals is a very popular affiliative behaviour and in this case the apes also have to earn the food by displaying their natural dexterity. This activity can be seen as collaborative, with both species benefiting.

# Collaboration with Visitors



The chimps can also probe for treats in an artificial hollow log, while visitors can look in from the two ends.



# Howdy Opportunities

In the old American West friends use the greeting “howdy.” This term has come to be used for features which are intended to informally introduce animals (or animals and people) to each other.



Some of the logs extend beyond the glass on both sides. Young chimps can climb into one side while children enter the other. They can meet nose to nose at the glass partition in the middle and say “howdy.” The howdy crate is a simulated animal shipping crate serving the same purpose.



Here is another example of a “howdy Log” at the Corrumbin Wildlife Sanctuary, Australia, where children can climb in to meet a wombat.



## Public Feeding Wild Birds



## Affiliative Design Feeding

Corumbin Sanctuary in Australia trained wild, free-ranging lorikeets to drink nectar from small cups held by visitors. This technique has been widely copied in the U.S. in lorikeet aviaries.



## Free-Flight Theatre

Many excellent zoos feature free-flight demonstrations of birds of prey and other species.

The birds are well trained and managed and the “shows” focus upon the unique abilities and adaptations of the birds. While the presentations are often light and humorous, the birds are presented respectfully and each show ends with a conservation message. These types of high capacity venues are excellent for zoos attracting large crowds.

Regrettably, some zoos feature demeaning anthropomorphic presentations such as orangutan prize fighting or animals on tricycles or motorbikes. Such demeaning, disrespectful and misleading shows should not be allowed. But such negative examples should not prejudice zoos against presenting high quality, respectful presentations of natural animal behaviour using no-coercive training procedures.

## Keeper Talks

Many zoos feature talks by keepers or trained presenters using tamed live animals. These may occur outside exhibits, in mini-theatres at special functions or even in outreach programs given at local schools. The key, as in the bird shows, is that the animals are well looked after and the presentations are respectful to the animals and scientifically accurate and informative.



## Safari Parks

Open range zoos and safari parks are not new but are becoming major attractions, especially in Asia.

Recent innovations include night safaris such as Singapore Night Safari and Al Ain Wildlife Park (in the UAE). The relatively new Bali Safari and Marine Park in Indonesia (one of my projects) combines a resort and housing in African themed bungalows with open range exhibits simulating an African safari.

Night safaris are only practical within the tropics where day and night hours are about equal resulting in predictable hours of park opening. Most visitors enjoy the cooler evening hours and exhibits seem to take on an aura of mystery. Features that need to be hidden such as service areas and barriers can simply be left unlit in the darkness. Singapore night safari only operates at night, while other safari parks operate both day and night.



## Themed Transport

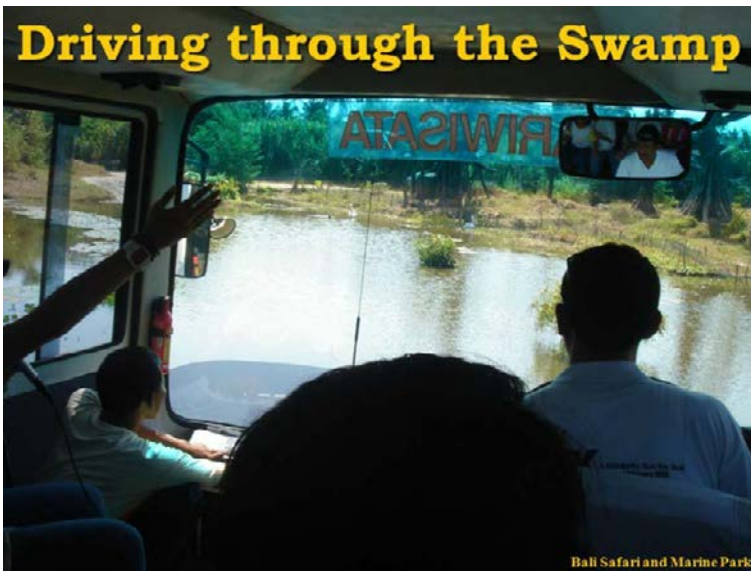
While many safari parks allow visitors to drive private autos through dangerous animal enclosures, the better facilities minimize security issues by providing themed tour vehicles. However, public response to such themed transport varies according to culture. Westerners tend to like the “adventure” character while Asians tend to prefer more modern and comfortable transport.





## Drive-Thru Exhibits

The safari road simulates rough back country road conditions for theatrical effect. In this illustration from Bali Safari the road appears to be flooded.



The Bali Safari road even transverses a hippo pool





## Drive-Thru Exhibits

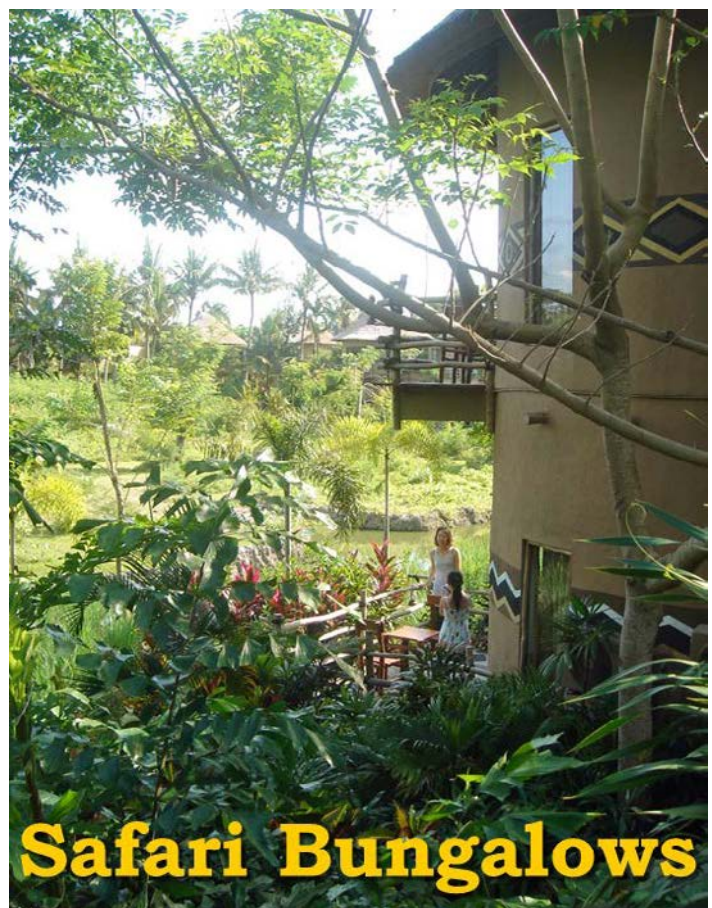
At Bali Safari the architecture of the holding building follows traditional cultural lines. In this case the drive-through display appears to be an abandoned Sumatran farm and palm oil plantation taken over by tigers.





## Overnight Accommodation

Overnight visitors to Bali Safari stay in themed bungalows overlooking typical East African animals such as rhino, zebra, antelope and giraffe.







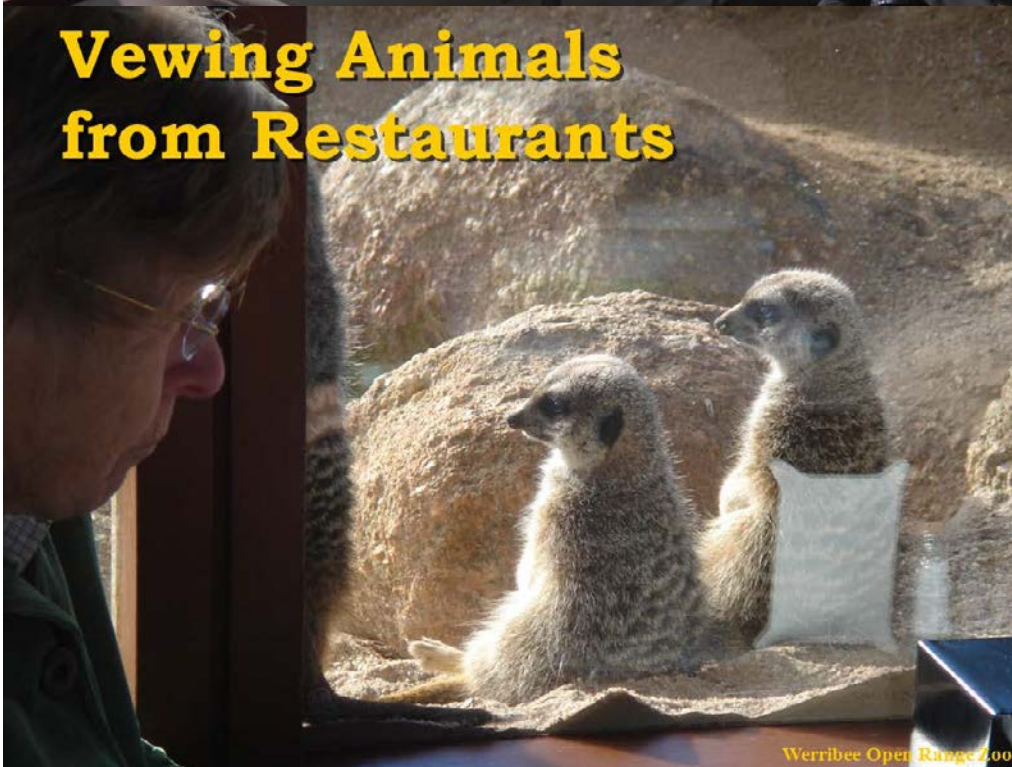
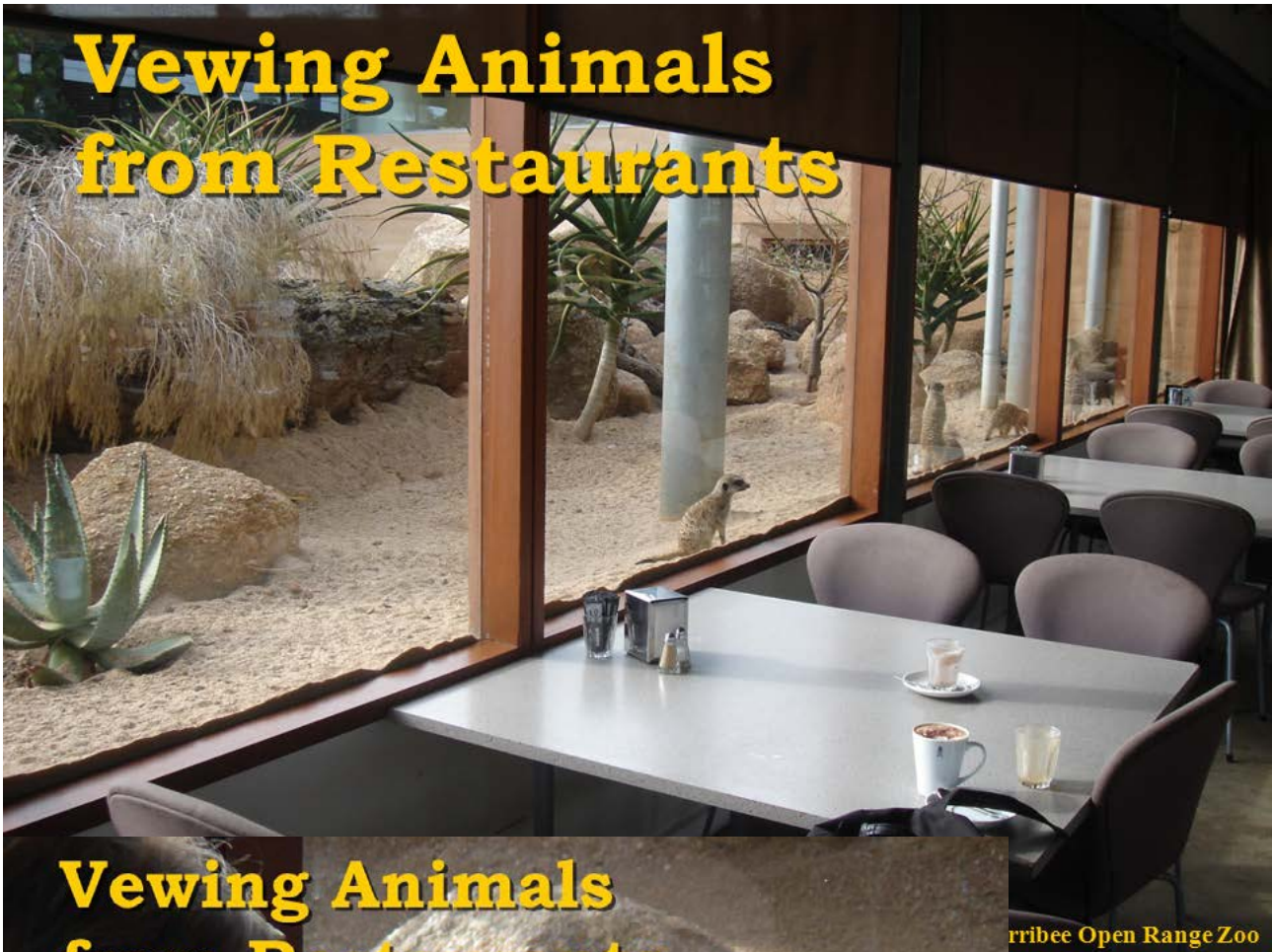
## Dining Experience

Combine animal viewing with restaurants.

The dining room of the Tsavo Lion Restaurant is surrounded on two sides by the lion exhibit at Bali Safari and Marine Park.

There is even a lion visible behind the restaurant's bar. It is also visible from the public toilets.





## Dining Experience

Werribee Open Range Zoo in Australia displays popular meerkats at the table level just outside its restaurant. Because the animals are never fed by visitors and can't smell food through the glass they pay little attention to diners.

These are very popular dining venues and enhance the simulated safari experience.



## Part Two

# Conservation and Animal Well-Being

The second measure of a zoo's success (some would say the first) is the health and well-being of the animals and their long-term conservation and fitness. We begin this section with the concept of animal competence. See Coe 2009 for more information on animal competence and environmental enrichment.



## Competence

Wild animals which survive in the wild are competent animals by my definition. They have physical (genetic) competence and learned competence, having learned social and other essential survival skills from a parent and peer group.

Much effort is expended in ex situ zoo breeding and genetic management programs to maintain genetic competence. But what effort is expended in maintaining behavioural competence? Are we actively encouraging development of independent competence, or do we encourage learned dependence and incompetence?



# Competence

## Genetic

- ◆ Long-term breeding programs
- ◆ Insurance populations
- ◆ Rescue and re-introduction
- ◆ Animal health and well-being

## Behavioural

- ◆ Environmental enrichment
- ◆ Behavioural conditioning
- ◆ Animal choices and self-sufficiency
- ◆ Animal mental health

Above are ways to consider animal competence. Do our facilities and management programs encourage behavioural and learned competence?



## Environmental Choice

Most animal managers maintain their collections more like domestic livestock than like wildlife. In the wild animals do everything for themselves, sometimes showing great initiative and resourcefulness. In zoos everything is done for them conditioning animals to depend upon care staff for everything. This may make things easier for keepers, but is it best for the long-term health of the animals and the species?

Behavioural science has proven that animals (and people) with the most control over their environments have the least stress. Chronic stress is proven to impact health and well-being

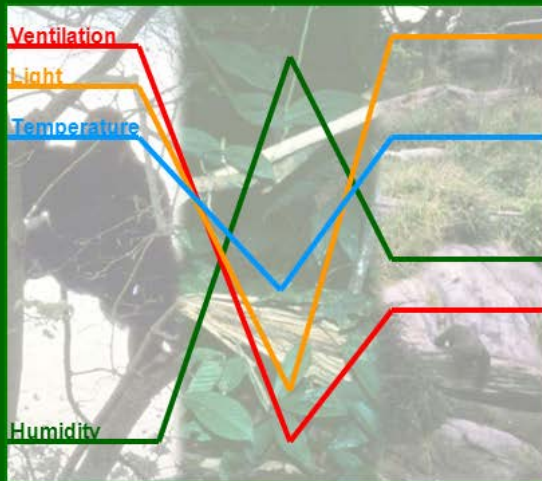
Freedom means having choices and the competence to exercise these choices.

The following pages will demonstrate features to give zoo animals more behavioural choices, which should lead to greater learned and natural competence. But all of these innovations require collaboration between animals and their keepers as well as collaboration among zoo staff.



# Environmental Enrichment: Choice

## Interactive Enrichment Features



**Rainforest  
Environmental  
Gradients** (hypothetical)



**Conventional Primate  
Holding Micro-Climate  
Gradients** (hypothetical)

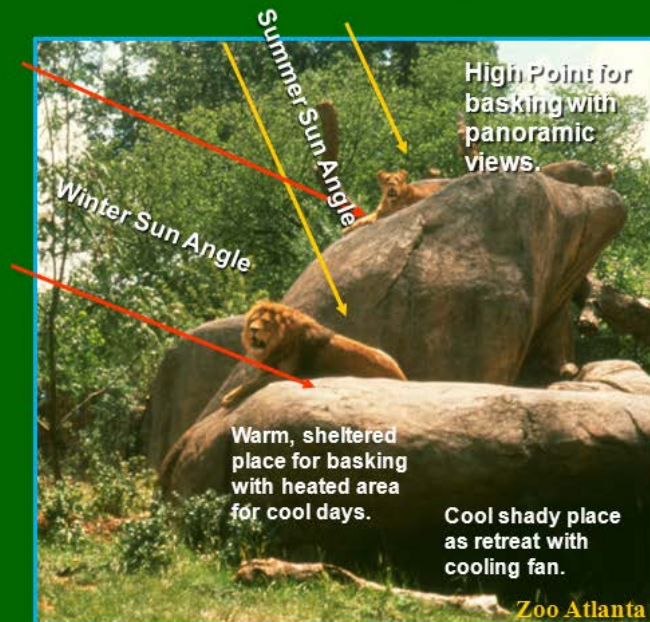
## Environmental Choice

- ◆ Lighting
- ◆ Heating and cooling
- ◆ Ventilation
- ◆ Create gradients and choices

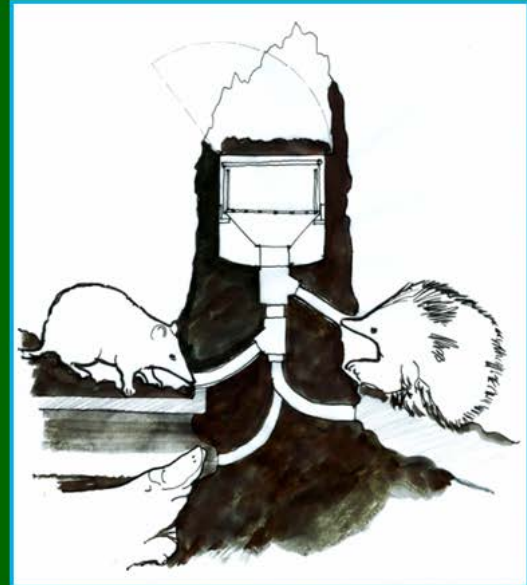
### Environmental Choice

The rainforest provides a complex matrix of environmental and ambient gradients. Tree tops and other exposed areas are often warm and provide good basking during cool times. The forest floor tends to be damp and humid. Apes move through these gradients of light, humidity, ventilation and temperature to meet their comfort needs. Indoor animal holding areas usually have uniform conditions of light, humidity, ventilation and temperature. These are usually based upon management needs of keepers rather than upon ambient needs of zoo animals. This is more often the case in cool climates with indoor housing than in tropical zones. Barren outdoor exhibits also lack the variety of conditions needed to allow for choice.

# Built in Features of Enduring Interest to Animals



**Lion Rocks**



**Artificial Termite Mound**

## Built-In Enrichment Features

Environmental enrichment programs are usually considered to be remedial, making up for the inadequacies of housing and management. But why not build-in enriching opportunities from the beginning?

In the left illustration for Zoo Atlanta in the U.S. artificial geological formations were designed as passive solar collectors, carefully angled to trap winter sun and provide cool summer shade for the lions. In addition heating coils are built into the structure. These preferred animal positions are placed to provide ideal animal views for visitors.

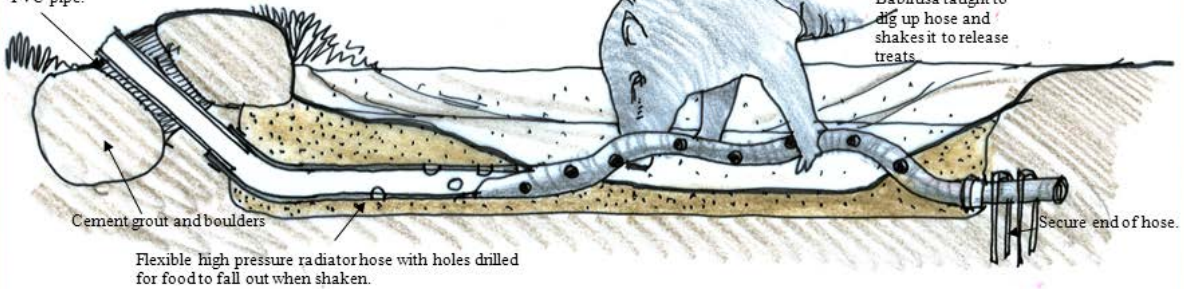
The second illustration shows an artificial dead stump in which food items like mealy bugs are provisioned as a random, natural food source.



# Moving Enrichment Features

## Babirusa Root Feeder

Pour nuts, meal worms etc. into PVC pipe.



Will the Babirusa use it?



How well does it liked?  
Enough to cuddle with when sleeping!

Prototype at Houston Zoo



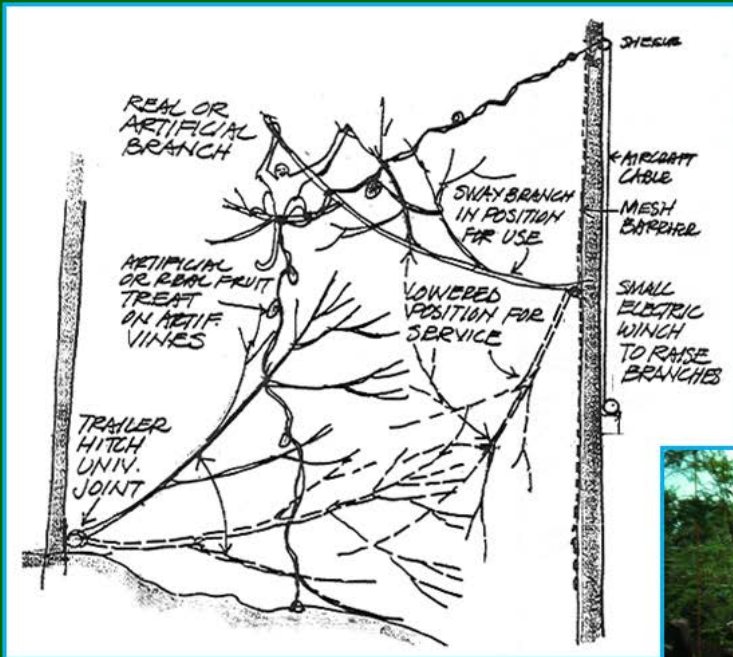
## Moving Enrichment Features

The previous built-in enrichment features were fixed in place. However, features which more and interact with animals are even more stimulating.

### Root Feeder

In this example tested at Houston Zoo in the U.S. perforated flexible tube is used as an artificial root. When the babirusa digs it out and shakes it, food treats are dislodged through perforations, encouraging natural forage behaviour.

# Moving Enrichment Features



Testing Artificial Tree Limb



Denver Zoo

## Sway Branch Concept

## Moving Enrichment Features

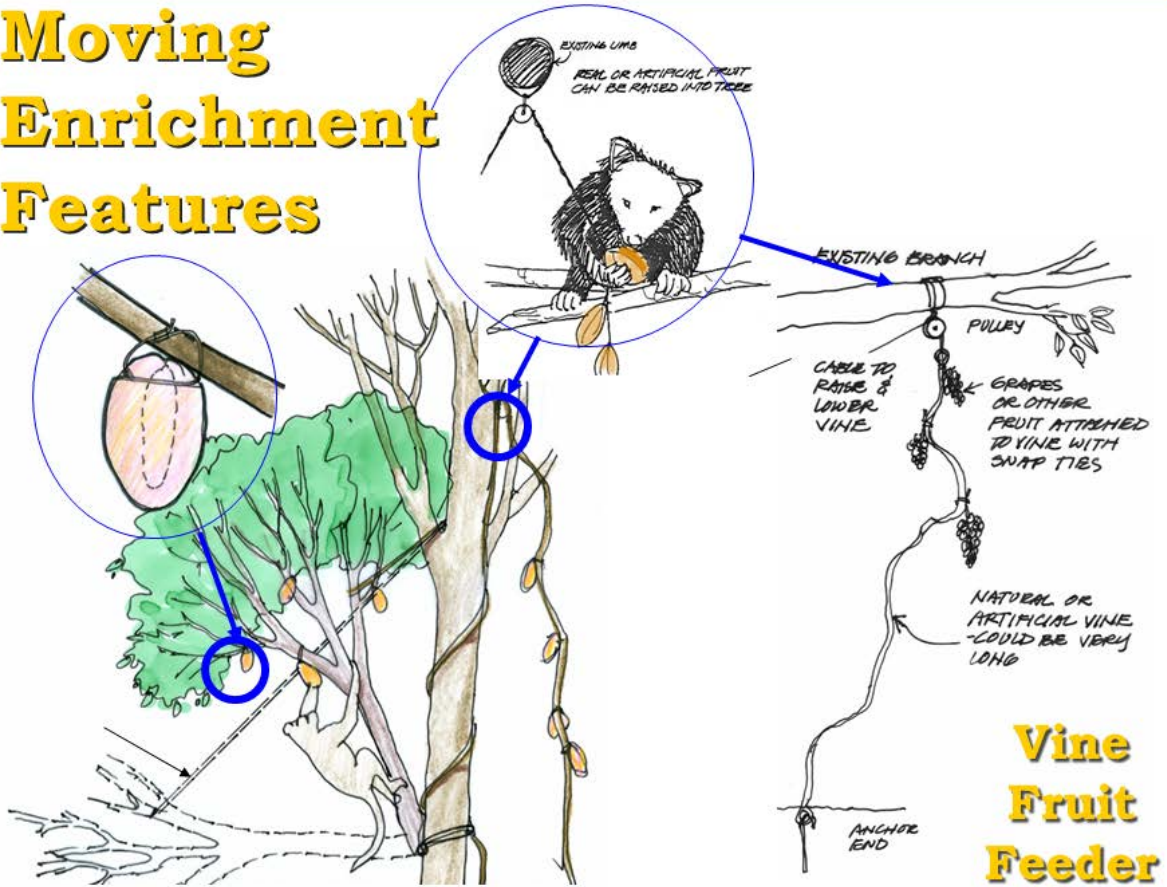
### Sway Branches

“Sway branches” are attached at the base with a flexible anchorage system and supported by a flexible cable disguised as a vine. When animals climb along the branch it sways like a natural tree branch. This helps animals to develop strength and balance and provides play opportunities.

These sway branches can also be lowered on small winches for provisioning. There is no need for staff to climb trees for enrichment provisioning.



# Moving Enrichment Features

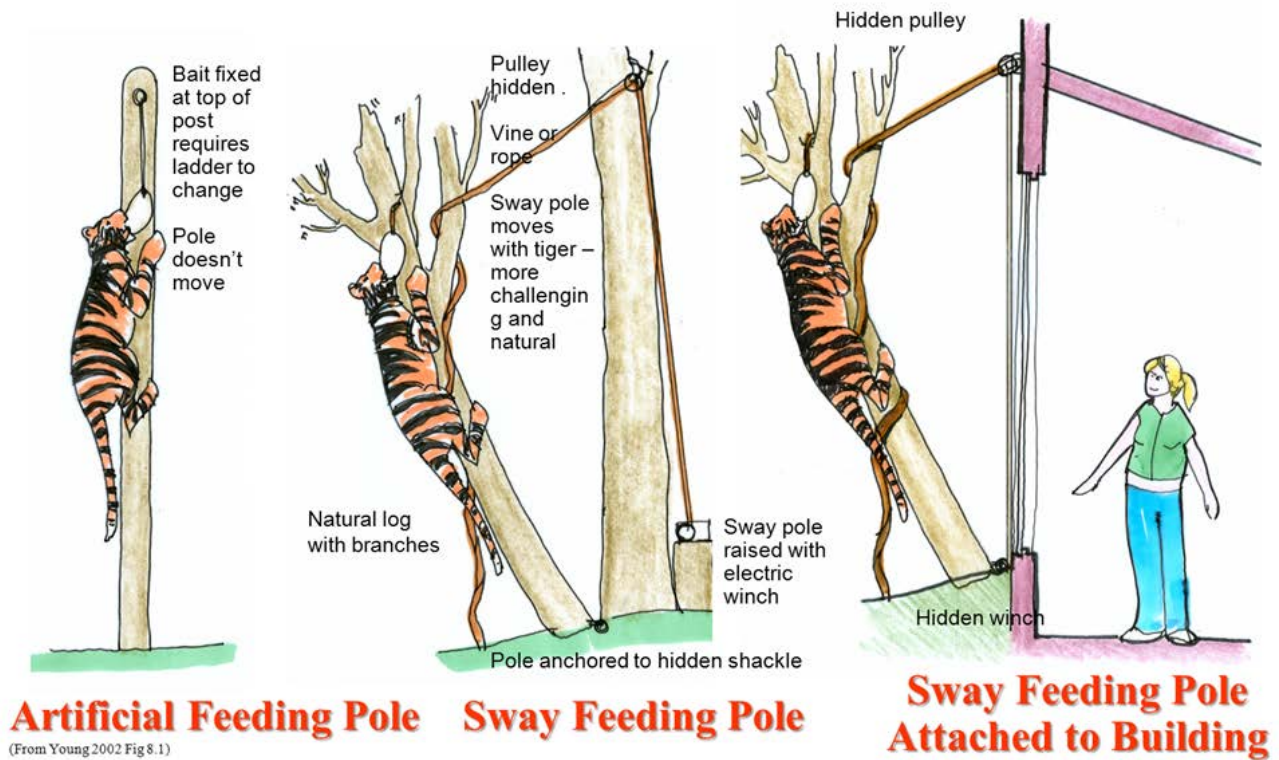


## Moving Enrichment Features

### Vines

Natural or artificial vines can also be raised or lowered on small winches to easily and safely place provisions in trees, encourage foraging and climbing behaviours.

# Moving Enrichment Features



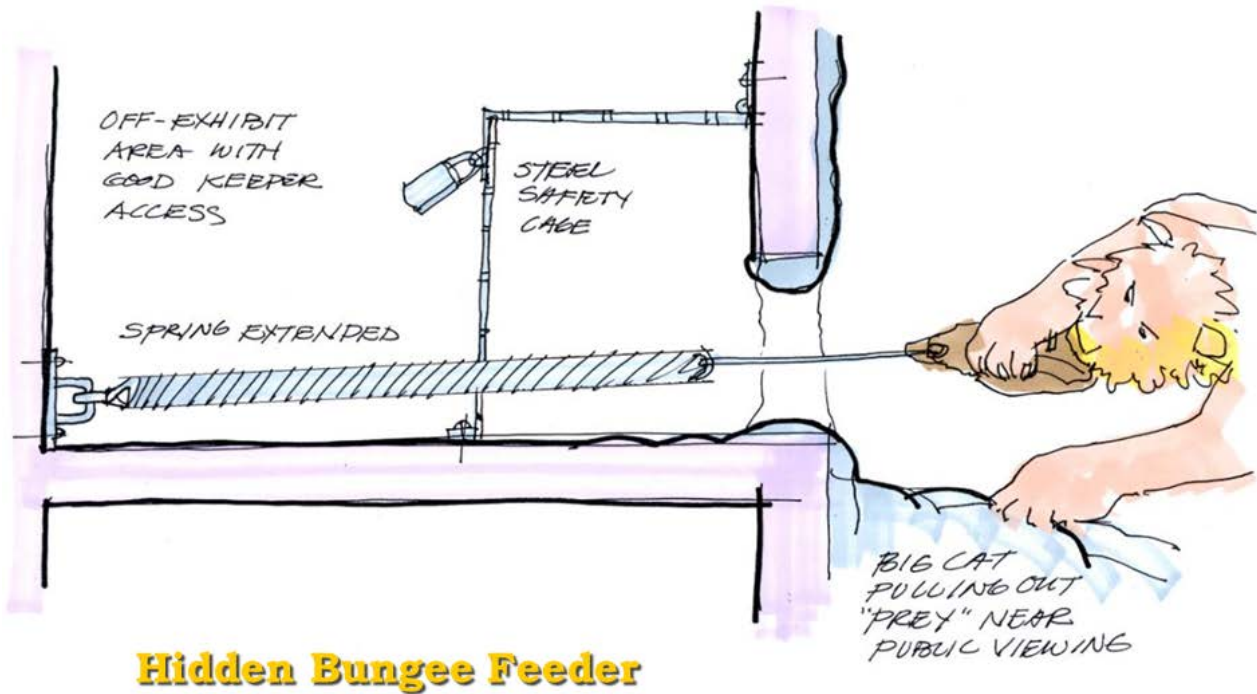
## Moving Enrichment Features

### Feeding Poles

Feeding poles with food or scent bags suspended by a flexible “bungee cord” are becoming more common. However this idea can be improved by making the entire dead tree sway as the tiger climbs it.



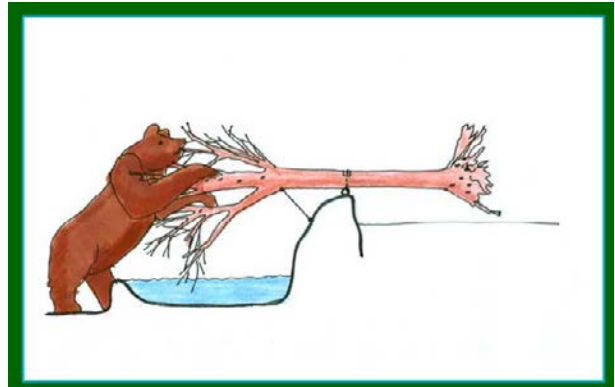
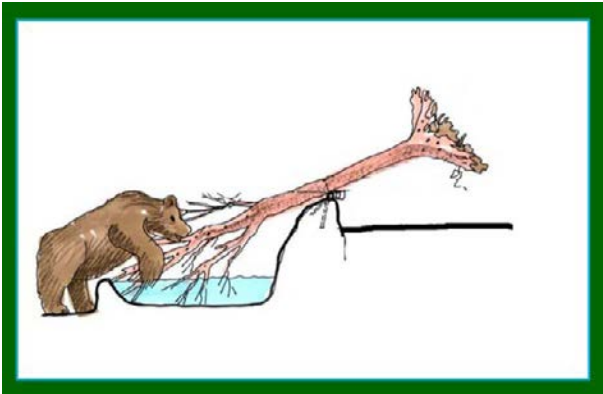
# Moving Enrichment Features



## Moving Enrichment Features

### Hidden Bungee Feeder

Feeding or scent bags attached to flexible cords can also be built in to walls or grottos. Because these features “snap back” when released by the animal, a cascade of prey stalking and capture behaviours often follow.



## Moving Enrichment Features

1. BEAR (OR OTHER ANIMAL) REACHES UP, PUSHES BRANCH DOWN TO FORAGE
2. WHEN BEAR RELEASES BRANCH IT RETURNS TO ORIGINAL POSITION (INTERACTIVE).
3. IF BEARS GRAB BOTH ENDS IT REALLY GETS INTERESTING!

ARC OF MOTION

HOLES IN ROOTS PROVISIONED WITH TREATS

POSITION SO THAT BALANCE POINT FAVORS ROOT END (ROOT END HEAVIER)

EYE BOLT FROM LOG AND EYE BOLT IN MOCK ROCK ATTACHED WITH PADLOCK OR STRONGER DEVICE

MOCK ROCK LEDGE

EXISTING POOL

HOLES IN BRANCHES PROVISIONED WITH TREATS OR ATTACH BRUISE BRANCHES

Drill holes through branches and stuff with peanut butter, etc

Shackle log to gunite

Log floats and bobs in pool

Motion of bobbing log attracts animals

### Balancing Treat Logs

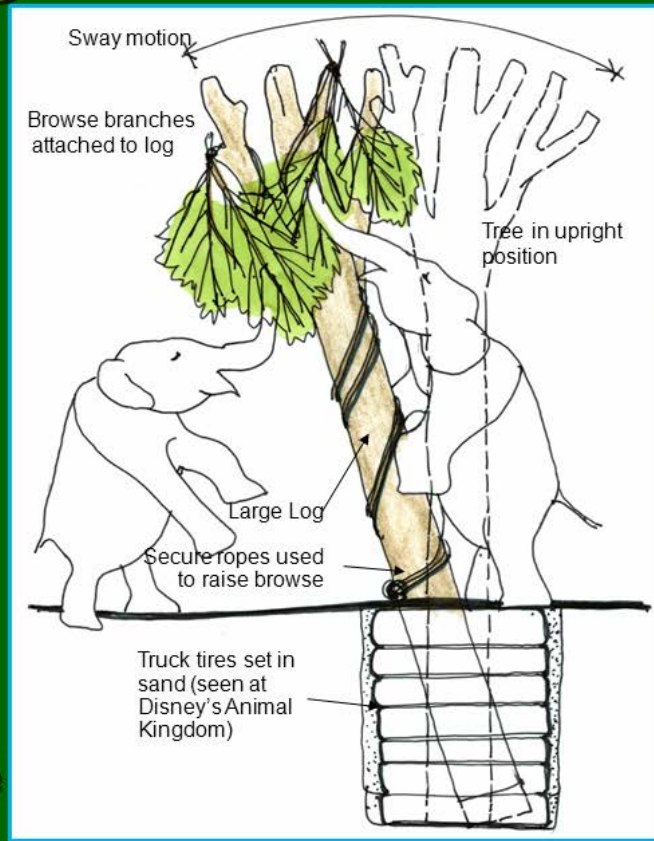
## Moving Enrichment Features

### Balancing Treat Logs

Balancing treat logs are popular with bears and big cats. Holes can be drilled into them to be filled with food treats or scents can be applied to increase or renew animal interest.



# Moving Enrichment Features



## Elephant Push Tree

### Moving Enrichment Features

#### Push Tree

Powerful animals need powerful exercise, such as pushing against a push tree or log to access browse.



## Moving Enrichment Features

### Self-Activated Shower

The Columbus Zoo in the U.S. installed a shower the elephants could activate. The first night the elephants used the shower forty-five times! They were using it to dampen and soften their hay before eating it.





## **Integrated Environmental Enrichment**

Even when animal display areas are properly enriched night quarters, where some animals spend the majority of their time, may be quite impoverished in terms of possible activities.

The great ape winter quarters at the Denver Zoo in the U.S. provides high windows for viewing and basking and climbing and rest areas at many levels.



**Let's think hard...what are things we do for the animals that they could do better for themselves?**

## **What Can Animals Do For Themselves?**

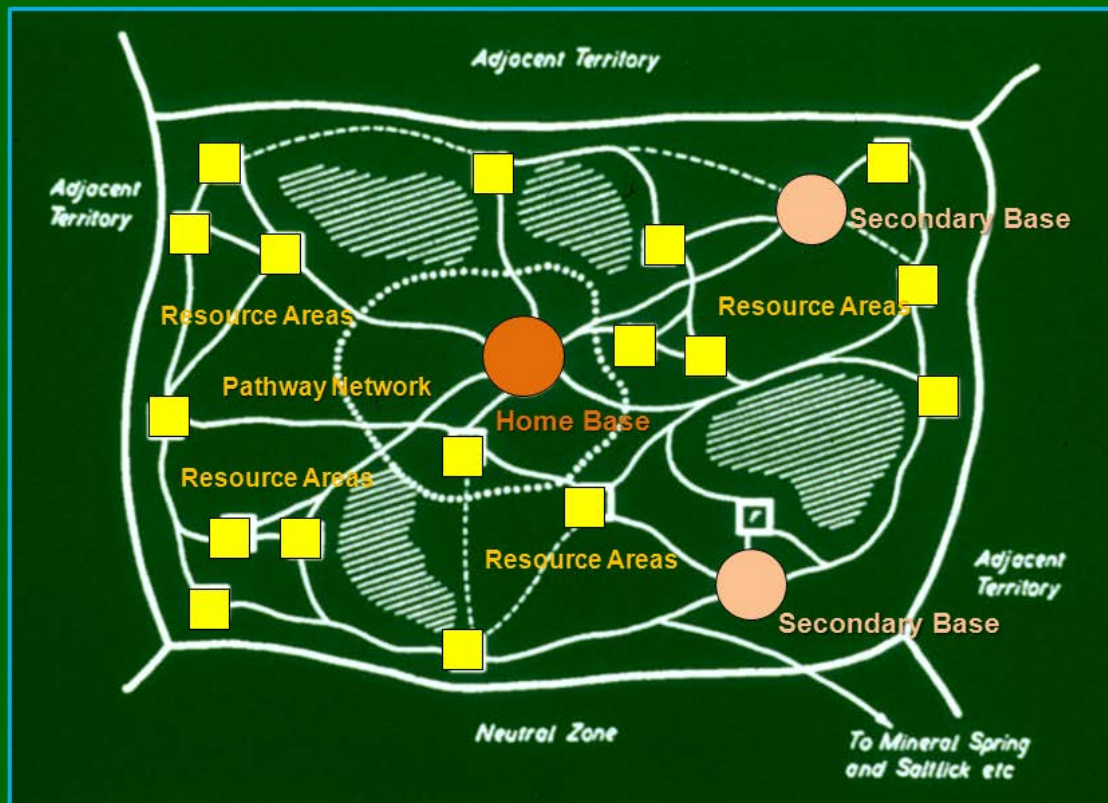
Environmental and behavioural enrichment programs encompass not only what we can do to improve the lives of animals in our care. It is also dedicated to provide more things animals can do for themselves, as they would in the wild.



## **Animal Rotation**

In typical zoos animals may spend their entire lives in the same limited space. But what if some animals could regularly exchange places? Then they could have twice as much space. And if four enclosures were linked so each animal had periodic access to each enclosure each animal or group could have four times more space.

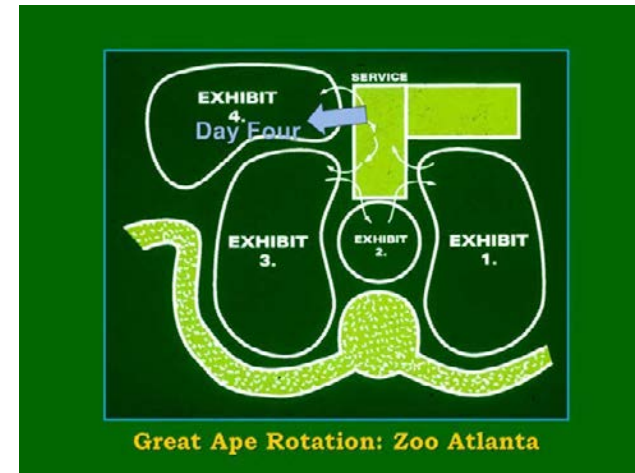
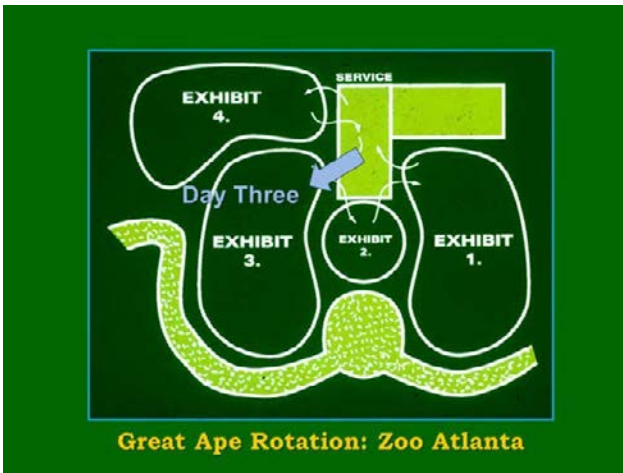
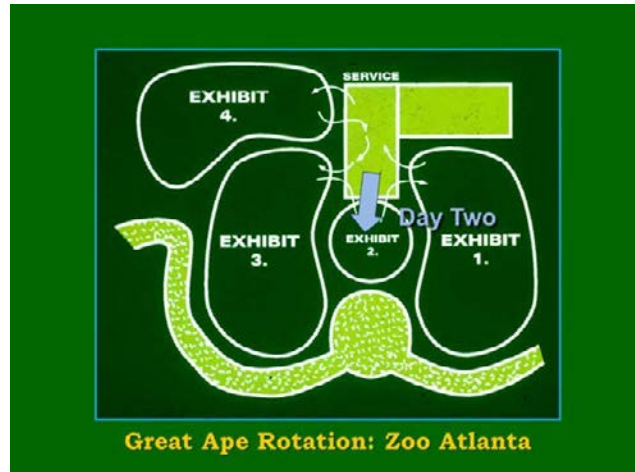
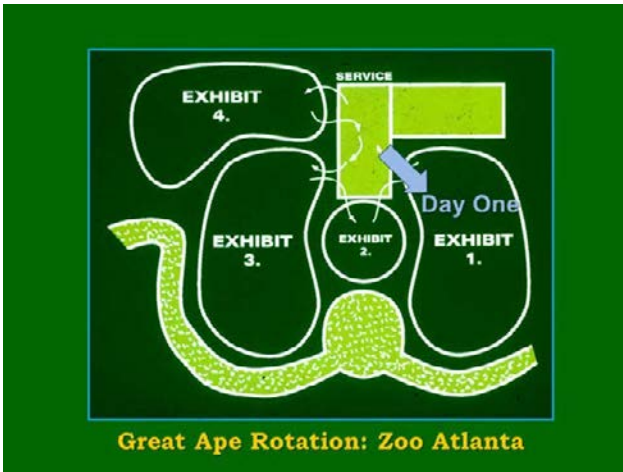
Rotation exhibits are like mixed-species displays because all animals in the rotation must be free of diseases and barriers must be adequate to the most robust animals in the rotation. See Coe 2004 for more information.



## Hediger's Concept of Territory

Animals, like people, need a variety of special use areas as this diagram shows. But when one animal is using a certain area another animal may be using other areas just as occurs in nature. This can be seen as a time sharing concept.





## Zoo Animal Rotation

The four gorilla enclosures at Zoo Atlanta in the U.S. were designed so that four gorilla family groups could be rotated through all four areas. While partial use of this concept was successful during a research trial the full rotation was never used.



## Multi-Species Rotation

The Louisville Zoo in the U.S. rotates five species: orangutan, siamang, tapir, babirusa and Sumatran tigers through three outdoor displays and an indoor exercise room. While areas are suitable for each species, each area is unique. This provides the animals with a range of behavioural opportunities.



**Islands: Louisville Zoo's Rotation Concept**

1. VIEWING

2. VIEWING

3. VIEWING

HOOFSTOCK

CARNIVORE

APES

DAY ROOM

VIEWING

**Transfers**

**Training**

**Making Rotation Work!**

## Making Rotation Work

Positive reinforcement animal training is essential to successful rotation exhibits.

The goal of the Louisville animal rotation was to offer novel experiences for the animals. Therefore the order, sequence and duration of the rotation varied daily.

These images show the complexity of this multi-species raceway system.



## Sanctuary Rotation

The Center for Great Apes in Florida, U.S, has developed 1.6 kilometres of elevated raceways interconnecting multiple enclosures. This allows the apes substantial areas to roam.





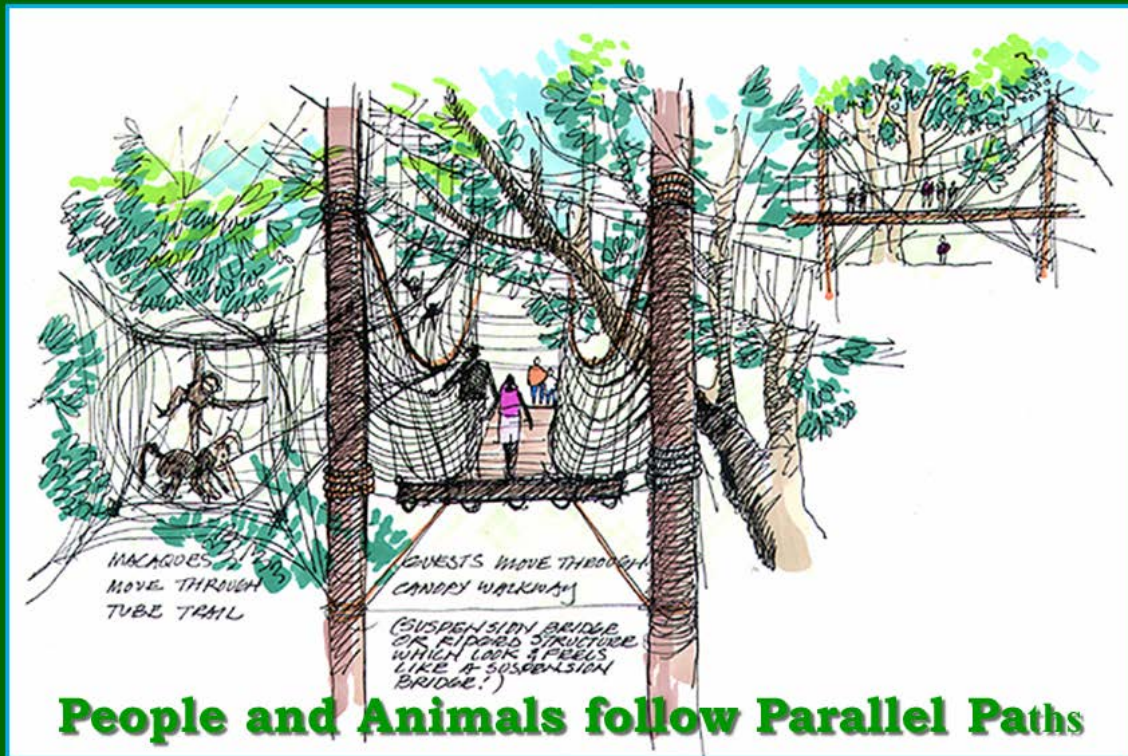
## Zoo Rotation

Philadelphia Zoo in the U.S. recently opened their “Tree Top Trail.” This long loop of elevated raceways is used for small to medium-sized primates.

The transparent mesh moves with the animals much as tree branches would. These mesh tunnels interconnect a series of mesh play enclosures built in large trees. The primates now have access to a much larger area. This feature greatly extends the existing relatively small primate enclosures. It would also be suitable for some smaller carnivores.



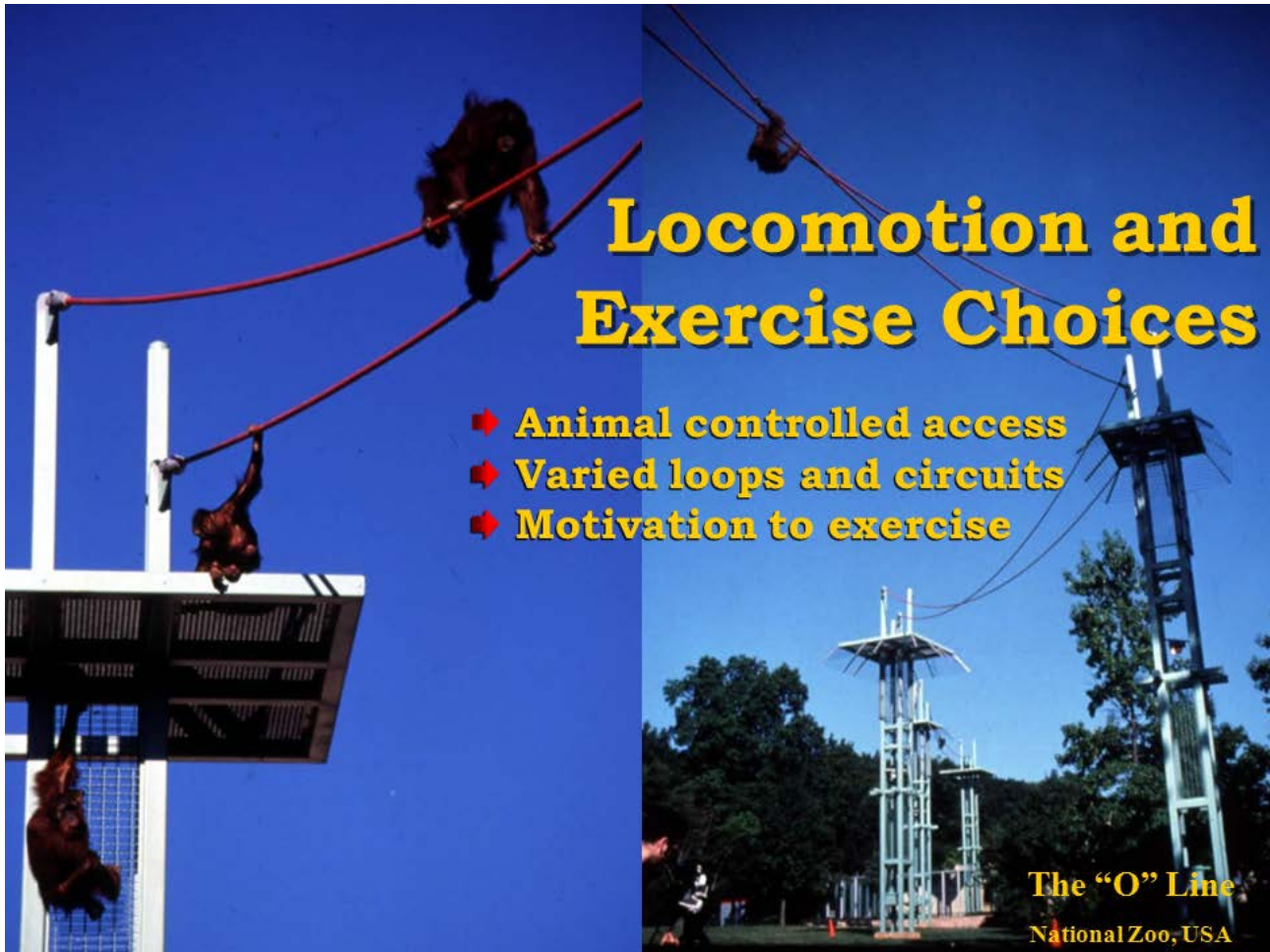
# Visionary Rotation Exhibit



## Future Zoo Rotation

Perhaps in the future elevated paths for apes and people will pass through tree canopies near each other.





## Zoo Rotation

### National Zoo "O" Line

The U.S. National Zoo developed this overhead line structure allowing female orangutans to consort with males at opposite ends of the central promenade.





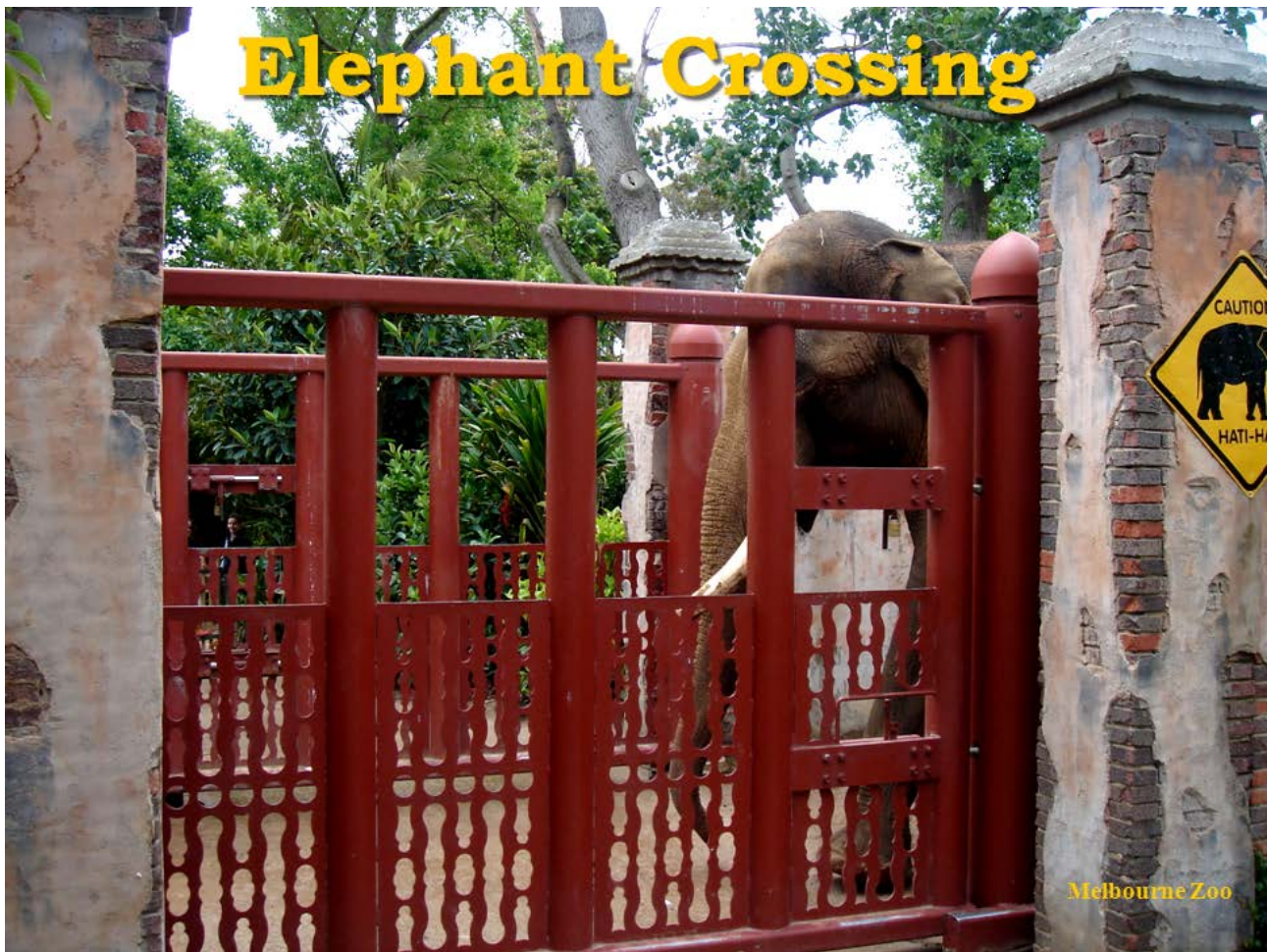
## Zoo Rotation

### Free-Ranging Orangutans

Singapore Zoo allows young orangutans to spend days in trees above the public. Hot wires around the tree trunks keep the orangs from climbing down. Keeper is present at all times.

In the afternoon zoo staff take the young orangutans into secure night quarters.





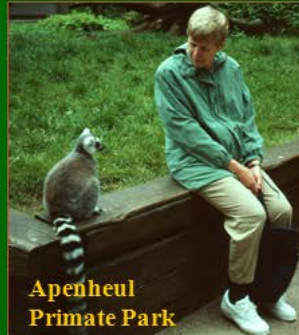
## Elephant Rotation

Elephants can rotate among three enclosures at the Melbourne Zoo in Australia. One of these is usually occupied by the bull elephant. This photo shows the point where the elephant trail crosses the public path. As soon as the elephants pass the gate swings back to open the public path and close the elephant trail.

# Positive Training



Santuário do Carasas, Brazil



Apenheul  
Primate Park



© Louisville Zoo

## Positive Training

Animal taming and training are ancient traditions. The use of positive reinforcement training is proving very useful for both public presentations and husbandry practices. Both animals and trainers enjoy the training session and once animals have learned a management practice like passing through gates on command, training reduces the time needed for animal management. (Read more on positive training by researching Karen Pryor.)



## Part 3

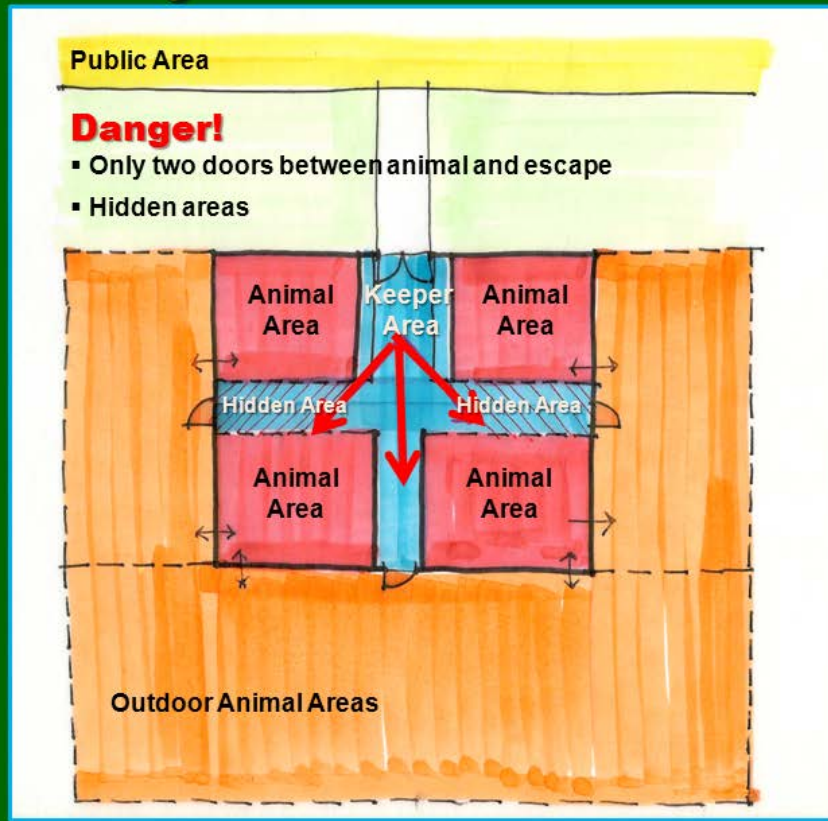
# Operations

The third measure of a zoo is the quality of professional and labour staff and the effectiveness and safety of facilities designed for their use.

Good design also improves animal management procedures and keeper safety.

The fourth and fifth measures of zoo success, excellence in business and research, also benefit from good design, but are beyond the scope of this presentation.

# Security

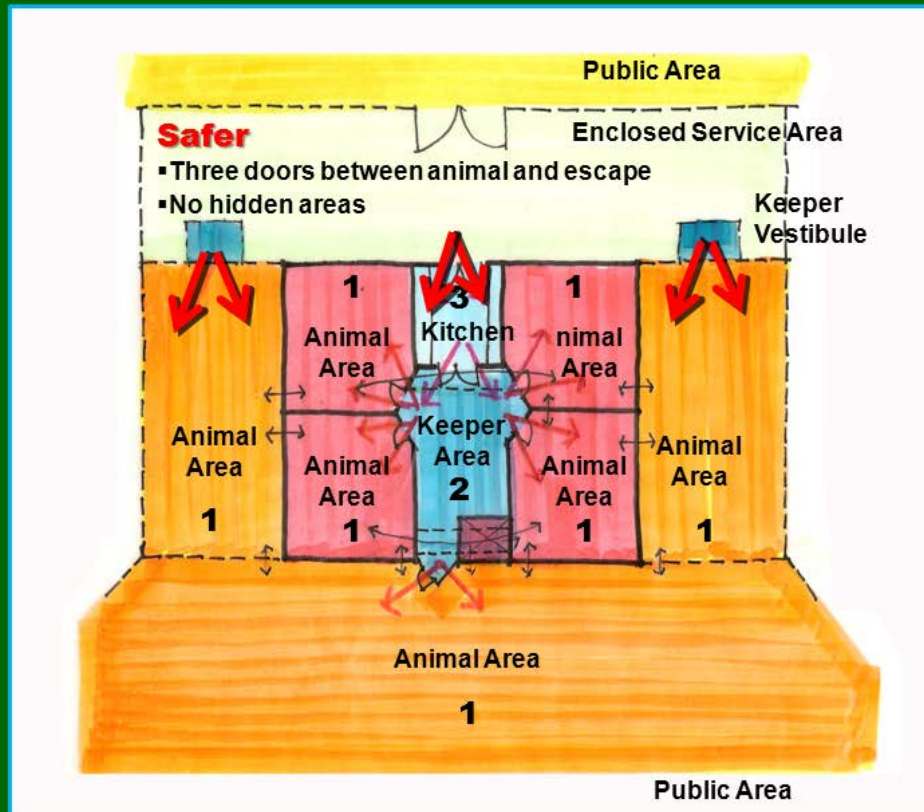


## Security

This diagram shows an unsafe off-exhibit animal facility. Any animal that escapes into the keeper corridor could remain hidden and attack staff from blind areas. Also, there are no safety vestibules into outdoor animal enclosures.



# Security



## Security

The plan above and on the following page is much safer for zoo staff.

1. The service yard is separated from public areas and only qualified staff and approved deliveries may enter. This is called **tertiary security zone**.
2. The indoor food preparation area or kitchen is also a tertiary security zone.
3. The blue areas on the plan (numbered 2) are **secondary security zones**. These are areas in contact with animals and only qualified staff and supervised guests may enter. Note that tertiary security areas must have clear views into secondary areas so staff can confirm these are safe to enter.
4. Animal holding areas and display areas are **primary security zones**. Off-exhibit animal holding areas must be entirely visible from secondary security zones.
5. Large, well landscaped outdoor yards will not be entirely visible to staff. Therefore it is essential staff account for all animals in holding areas before entering display areas for potentially dangerous species.





# Blood Draw Sleeves



Animal is trained to hold paw in sleeve to receive injection or blood draw



## Veterinary Procedures

Animals such as apes and giant pandas are trained to insert their paws into a pipe and hold them there while veterinarians draw blood samples or give injections. This is a stress-free way to provide excellent care to diabetic animals for example. Animals are also trained to present themselves for pap smears or pregnancy screening. This example combines caging design with animal training and veterinary practice to facilitate zoo operations.



# Green Design

## Green Design

As popular front-line conservation institutions, zoos must present and demonstrate their commitment to conserving and recycling natural resources and to use sustainable energy sources. In fact a strong case can be made that zoos should also represent a strong moral ethic embracing issues like fair trade and gender equality as well as humane care and management of animals. This ethic requires a “triple bottom line” accounting where financial, social and environmental costs and benefits are balanced.



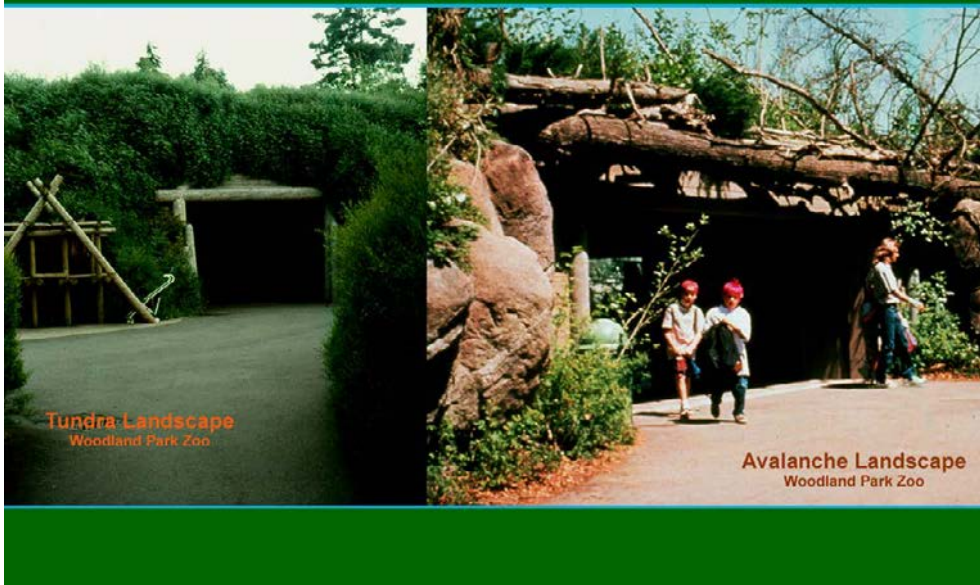
## Green Roof for Zoo Entry Building



### Green Roof

Adelaide Zoo in Australia recently opened their new green-roofed entry building as a forward-looking statement of commitment to sustainable operations.

## Deep Green Design



### Deep Green Design

These two building we designed at Woodland Park Zoo in the U.S. are not only immersed but also submerged in landscapes characteristic of the Alaskan biomes they represent. This type of green development not only communicates a thematic message, but also has practical functions in saving energy, slowing runoff, fixing atmospheric carbon and producing oxygen.

# Deep Green Design



## Deep Green Design

The Wolf Woods viewing pavilion at Brookfield Zoo in the U.S. is entirely buried in plantings, yet provides excellent views of Mexican wolves.

Another example of sustainable design is the hippopotamus exhibit at Werribee Open Range Zoo in Australia which uses reed beds to purify hippo waste water. See Coe 2007 further discussion on this subject.





## **Sustainable Engineering Systems**

Melbourne Zoo in Australia developed a state-of-the-art water treatment plant which is also a public display emphasizing their commitment to excellent environmental citizenship.

# Integrating Zoo Design *and* Management

*“21<sup>st</sup> century zoo design cannot function  
without 21<sup>st</sup> century zoo management.” J. Coe*

Zoo design and management systems must be compatible and mutually supporting. Conservative management traditions will best support tried and familiar facility design styles. More progressive management will assume some risk for perceived improvements to visitor experience and animal well-being embraced by more recent zoo design trends.

I sometimes tell clients they may choose between these four options for levels of innovation, depending upon their willingness to assume risk:

1. Business as Usual – low risk, low benefit. An example is a traditional moated exhibit.
2. Best Practice – a twenty year old idea that has become widely accepted. Example is the landscape immersion display (a thirty year old idea.)
3. Cutting Edge – An exciting new idea which has been used successfully in a few zoos. An example would be exhibits using animal rotation.
4. Next Generation – Exciting new ideas that have not yet been tested. These are high risk and if successful may have high gain or at least high prestige for innovations. An example would be smart phone operated zoo graphics.

While this zoo design conference is not the place to discuss alternative zoo management systems, please be aware of the necessary relationship between management style and exhibit suitability. (Coe 1998)



# Collaboration



## Summary

### Collaboration

Good exhibit planning and design can add greatly to visitor experience, animal well-being and keeper safety and convenience. But good design is a highly collaborative and integrative process requiring an interdisciplinary approach.

# Summary

1. What is best for the animals ?
  - Develops competence
  - A great place to live
2. What is best for the visitors?
  - Fun and exciting
  - What's the message?
3. What is best for the business?
  - Short term
  - Long term
4. What is best for zoo staff?
  - Safe
  - Rewarding
5. What is best for research?
  - Original
  - Useful

## Summary

Good design and planning must benefit all elements of the zoos operation. Above is a summary check list to assist in prioritizing and integrating needs and benefits for zoo design and development projects.





## References

- Coe, Jon. C., 1982. "Bringing It All Together: Integration of Context, Content and Message In Zoo Exhibit Design" in *AAZPA 1982 Annual Conference Proceedings*, American Association of Zoological Parks and Aquariums, Wheeling, WV, pp. 268-274.
- Coe, Jon C., 1985. "Design and Perception: Making the Zoo Experience Real" in *Zoo Biology*, vol. 4 no. 2, pp. 197-208.
- Coe, Jon C., Beattie, Ted, 1998. "Twenty-First Century Management Systems For Twenty-First Century Zoo Exhibits" in *1998 AZA Convention Proceedings*, American Zoo and Aquarium Association, Bethesda, MD.
- Coe, Jon C., 2004. "Mixed Species Rotation Exhibits", *2004 ARAZPA Conference Proceedings*, Australasian Regional Association of Zoos and Aquaria (now ZAA), Auckland, NZ.
- Coe, Jon C., 2005. "Plan Ahead: A Short Overveiw of the Planning Process", Published 2006 <http://www.joncoedesign.com>.
- Coe, Jon, 2007. "Deep Green Design for Zoos and Aquariums" *EAZA News*, European Association of Zoos and Aquaria, vol. 57, pp. 16-17
- Coe, Jon, 2009. "Collaborative Enrichment" 9th International Conference on Environmental Enrichment, published in *Shape of Enrichment* [http://www.enrichment.org/miniwebfile.php?Region=Publications&NotFlag=1&File=icee\\_proceedings.html](http://www.enrichment.org/miniwebfile.php?Region=Publications&NotFlag=1&File=icee_proceedings.html)
- Jones, G. R., Coe, J. C., and Paulson, D. R. 1976. *Woodland Park Zoo: Long-Range Plan, Development Guidelines and Exhibit Scenarios*, Jones & Jones for Seattle Department of Parks and Recreation. Reissued: Coe, J.C. 2004. *Woodland Park Zoo Long-Range Physical Development Plan*. CLRdesign. Available from Woodland Park Zoo.