Architects and Enrichment

How Can Zoo Architects Build-In Animal Enrichment Opportunities …And How Can Enrichment Specialists Help?

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Abstract

Most environmental enrichment activities for zoo animals are remedial, compensating for inappropriate of inadequate animal housing and management practices. But with design of both animal exhibitry and support areas based upon behavioural objectives, enrichment work and opportunities can be greatly enhanced. While excellent examples of built-in enrichment exist, collaboration among zoo managers, architects and behaviourists, working with enrichment specialists, must be greatly increased, especially in developing economies around the world.

Key words: Environmental enrichment, zoo exhibit design, animal rotation, behavioural competence

Photo: CLRdesign, Inc

Prologue

It's 1965.

I'm a twenty-four year old landscape architecture student in the Harvard Graduate School of Design. We are visiting Franklin Park Zoo with drawing pads and conté crayons drawing animals for an art class. I venture into the old Elephant house. The atmosphere is filled with the screaming of elephants. Their fear odour, like vinegar, saturates the air. Three chained elephants are fighting, yet their stout fetters keep them from injuring each other. Their keeper is leaning against a wall, arms crossed helplessly.

I ask him, ***"Why are they fighting?"*** *and* He answers, ***"Because they're chained."***

I asked, ***"Why are they chained?"*** *and* The keeper answers, ***"Because they fight."***

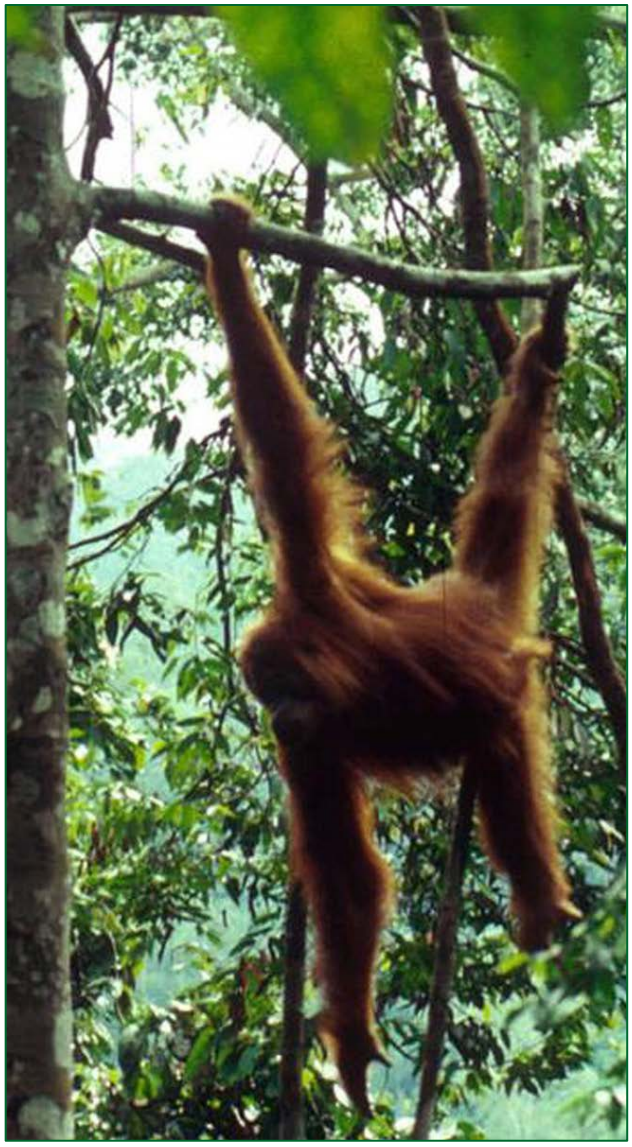
I've been looking for a thesis project and now I've found it. In June 1966 I submitted my Master's Thesis "*Artificial Environments for Captive Animals*" and set out to change zoos through behaviour-based design

Introduction

This paper covers two related subjects.

1) **Why do most animal facilities in zoos require substantial remedial work by environmental enrichment specialist?** By 'remedial enrichment' I mean work undertaken to remedy serious shortcomings in basic facility design and management rather than 'supplementary enrichment' which adds to the benefits already built-in to well-designed animal facilities.

2) What are important 'big picture' ideas and trends enrichment specialists need to be aware of if they are to contribute to the design of built-in animal *enrichment features in zoos?*



Enrichment in Nature at Bahorok Orangutan Sanctuary and Built-In Enrichment at Northern Trail Exhibit at Woodland Park Zoo.

1) Why Aren't More Enrichment Features Built Into Zoo Facilities?

For the last fifty years in North America, and more recently in Australia, New Zealand and Singapore, an increasing number of zoo facilities have been designed by zoo design specialists (often known as 'zoo architects' although many are landscape architects or have other design training). Many of these specialists have some understanding of animal behaviour as it relates to design, either through special training or acquired experience. In many cases they work closely with knowledgeable zoo staff in developing project objectives including environmental enrichment. However I believe the majority of zoo projects internationally continue to be done by generalist architects and this is especially true in Europe, India and East Asia. Thus it remains up to zoo staff to provide the concern, knowledge and leadership required to insure behaviour-based design of zoo facilities.

Many basic principles of behaviour-based zoo design and management were published by H. Hediger over sixty years ago (Hediger 1950) and this has developed into a modest but useful literature. Yet today my observation is that most animal facilities still require remedial programs from environmental enrichment workers. Why is this? I believe it is because:

a) Most zoo enclosures were built before the importance of enrichment features was appreciated. This is especially true in developing nations.
b) Most animal facilities are designed to insure staff convenience rather than animal well-being.
c) Many published zoo standards are based upon minimum rather than ideal conditions for animals and also fail to take into consideration individual variations in animal needs.
d) Primary decision makers are unaware of important animal behavioural requirements or are not up-to-date on enrichment and related trends.
e) In Asia and South America it is common for zoo directors to be appointed by government authorities with little or no zoo experience.
f) European city officials, ignorant of animal needs, often pick architects through open design competitions favouring style setters rather than selecting for specific zoo knowledge or experience.
g) Enrichment and behavioural specialists often have relatively low ranking positions in zoo decision making.

What Are Some Solutions To These Problems?

Enrichment specialists should:

a) **Look beyond day-to-day remedial work and develop a real appreciation of emerging trends, 'big ideas' and what may be possible.**

b) **Contribute to architectural design briefs and review plans.**

c) **Earn a place at the 'head table' where important decisions, such as selection of architects, are made.**

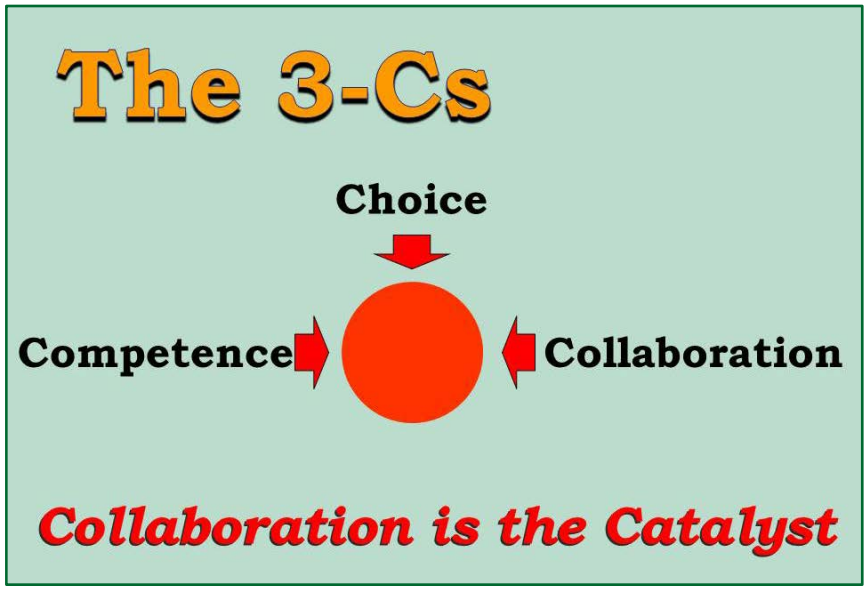
d) **Encourage the zoo specialist education of architects designing zoos.**

2) What Are Important Trends and 'Big Ideas' in Enrichment?

Let's talk about the 3–Cs: Competence, Collaboration and Choice.

Behavioural competence

Zoo, aquarium, and sanctuary animals normally have the same innate behaviours as their wild ancestors, but may be lacking the "learned competence" to facilitate their natural instincts and physiological systems. Keepers, trainers and "enrichers" (there doesn't seem to be a short, convenient term for what you do) can champion and teach behavioural competence.



Choice

Providing animals with relevant opportunities and choices reduces stress and improves well-being and self-sufficiency (see Young 2003 p. 38 for a discussion on this) provided the animals are able to make these choices and exploit these opportunities.

Collaboration

Collaboration is an important strategy for helping improve animals' learned competence and ability to access enrichment choices. Collaboration between caregivers and animals includes training and conditioning, encouraging animals to become active partners in their own care. (Laule 1997) Collaboration between and among people (keepers, trainers, enrichers, evaluators, managers, designers and others) is essential to visualize, fund, implement, evaluate and sustain enrichment programs. (Coe 1992) Therefore *collaboration* is the catalyst mediating and optimizing the benefits of *competence* and *choice*.

Let me expand on the 3–Cs…

Encouraging Competent Independence

Animals should be allowed to mature into relative independence by caregivers just as good parents are pleased to watch their offspring mature into fully functional, independent adults. Incompetence also can be learned. When animals are taught over-dependence, lose or never develop their natural initiative, they may develop learned helplessness. (Young 2003 p. 38)

A dependent relationship is formed when animals associate critical needs (food, safety, shelter, companionship and leadership with the care giver. Of course this dominant relationship is convenient for zoo keepers, but is it best for zoo animals? If means were found for the animal to find and process its own food, satisfy microclimate and social needs and appropriate stimulation without apparent (to the animal) association with caregivers or in a kind of collaborative rather than dependent relationship, wouldn't animals benefit?

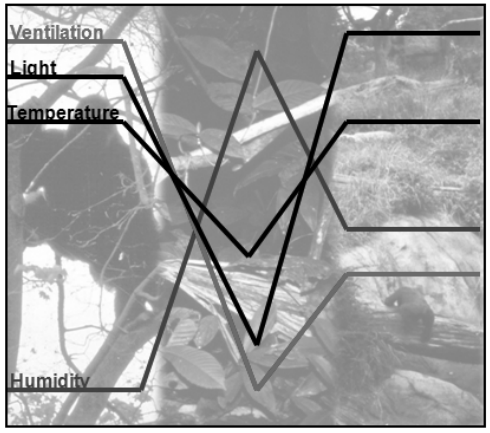
Encouraging Choice with Built-in Enrichment Features[1]

All of us (humans and other species) move through gradients of choice and opportunity, selecting that which benefits, avoiding that which is uncomfortable or threatening. These choices may be ambient, dietary, physical (both permanent and transitory) or social, to name but a few subjects in this varied universe of possibilities.

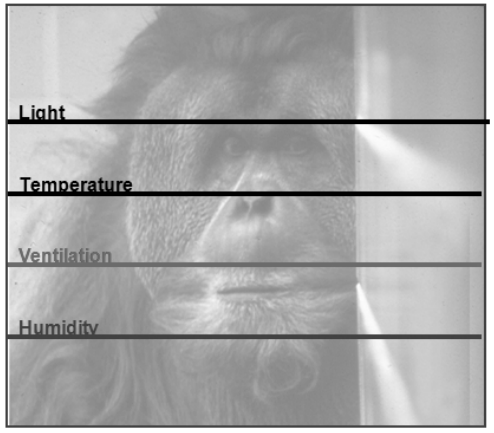
"Animals should not be isolated in sterile environments; rather they should be exposed, as much as possible, to the full range of environmental variability that they would find in their natural environment. Light cycles should follow those in the wild, and animals should be exposed to the extremes of temperature and humidity found in the will." (Snowdon 1989)

1, See a selection of built-in enrichment features at http://www.joncoedesign.com/pub/PDFs/NaturalisticEnrichment2006.pdf

Built-In Ambient Choices: Nature is full of choices in microclimate, light levels, colours, sounds, tastes and other sensory stimuli arranged in constantly changing gradients; high to low, bright to dim, warm to cool, hard to soft and so on. In nature, if an animal is too cool and wet for example, it will move to a warmer, dryer local; if too exposed, it will seek shelter. Yet many captive facilities provide few such gradients with levels of light, air and water temperatures, ventilation, elevation and hard surfaces mandated by accreditation standards.



Rainforest Environmental Gradients (hypothetical)



Conventional Primate Holding Micro-Climate Gradients (hypothetical)

Environmental Choices

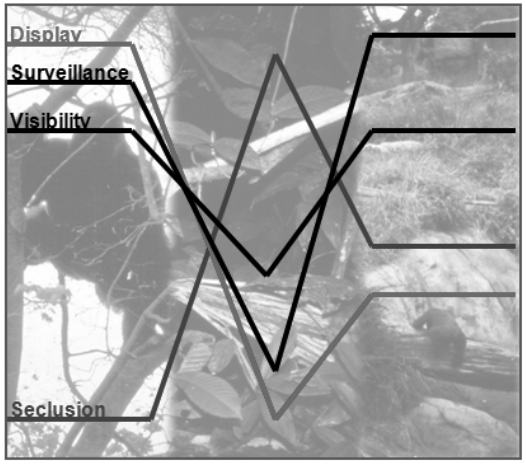
- Lighting
- Heating and cooling
- Ventilation
- Create gradients and choices

Firstly, animal facilities must be designed to provide ambient gradients from which an animal can choose by moving to the location where the combination of ambient factors best suits its needs.

Secondly, animals can be trained to control many of the ambient features of their enclosures. They can activate lights, fans, heaters, colour or sound systems, showers or feeders. (Coe 1995, 1998) Research shows that providing animals with even modest control over their environment reduces stress (Young 2003 p. 38) and seems (anecdotally) to be enjoyed by the animals. (Peachey 2009)

Thirdly, animals may be given some control over ambient features of adjacent visitor areas, expanding their sense of choice and control. For a while Los Angeles Zoo allowed chimpanzees to ring a bell and activate a mist spray in an adjacent public viewing area as enrichment for both the apes and the public.

Built-in Behavioural Choices: In nature social animals also move through social gradients. They chose varying degrees of interaction with or isolation from their own species or nearby species depending upon their needs and interests. Yet captive animals are often provided very little choice in their social environment.

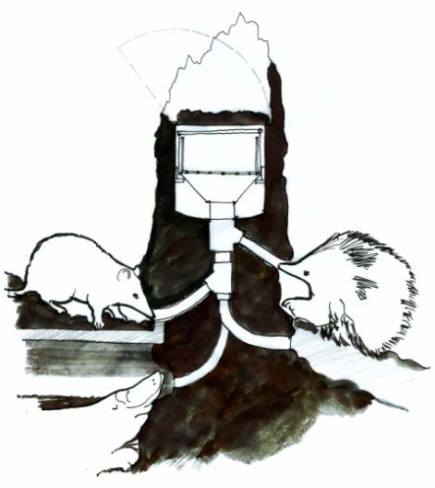


Rainforest Behaviour Opportunity Gradients (hypothetical)

Conventional Holding Behaviour Opportunity Gradients (hypothetical)

Behavioural Choices

- Display
- Visibility
- Surveillance
- Seclusion

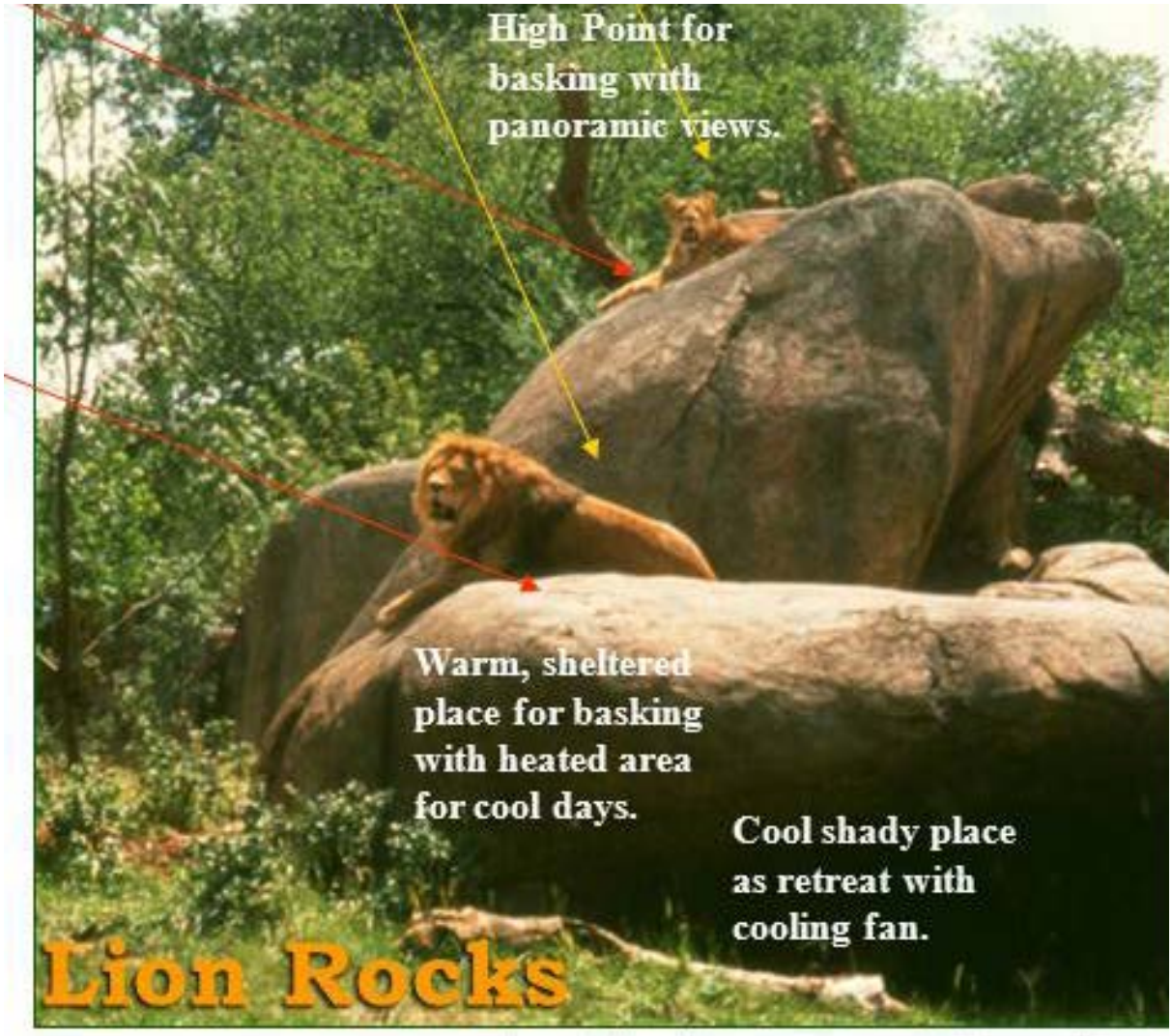


Artificial Termite Mound Feeder with hopper for refill

Build-in Features of Lasting Enrichment Value like basking and overlook positions, pools, shelters and food delivery systems. They merit permanent status because they are resistant to habituation and will be used constantly.

Build-in Animal Access Choices are also important. Sometimes an animal needs access to a high vantage point to reduce stress or needs to escape from overly aggressive individuals. This need is especially important in mixed-species exhibits.

Passive examples include creeps and escape zones accessible to some by virtue of their size or agility, but excluding others. Active examples could include automatic "smart doors" programmed to respond to certain individuals (reading microchip identification implants[2]) and not to other animals.

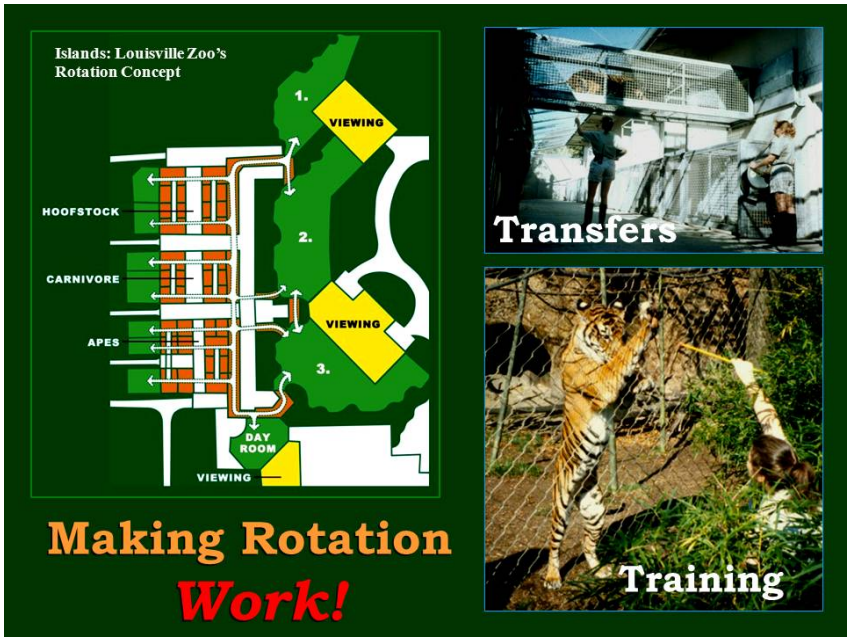


[2] In rural Australia animal shape recognition software activates gates to control access to water on some ranches. Perhaps a system could be developed for zoo and aquarium animals to activate doors.

Build-in Facilities Encouraging Physical Fitness and Competence: Maintaining optimum levels of physical fitness for captive animals may be one of, if not the greatest challenge to maintain physical competence. Young (2003 p. 127) states: *"At the very basic level, an animal's environment should challenge the animal's body to maintain its physical strength."* He goes on to remind us that many species need motivation and encouragement to exercise even when appropriate space and facilities are provided. Some specialists believe that lack of physical fitness is one underlying reason for general lack of breeding success in captive elephant programs in North America and Europe. (Lee and Moss 2009) To help combat this problem I helped the Taronga Zoo in Sydney, Australia design a simulated river meander 60 meters long by 3 wide and 3 deep to provide low impact aquatic aerobic fitness training for their elephants.[3] I have observed three young elephants vigorously using this pool for extended periods.

Build-in Access for Replacement of features subject habituation, which are nevertheless essential and must be changed or exchanged frequently.

Built-in Rotation Opportunities have been developed at zoos like Louisville Zoo and Pt. Defiance Park Zoo and Aquarium in the United States. (Coe 2004, Walczak 1995) and tested at Zoo Atlanta (Lukas 1995). Animal rotation exhibits may be thought of as consecutive (as compared to concurrent) mixed species habitats. They are interlinked enclosures (numbering from two to over a dozen) in which animals or groups of animals (even compatible mixed-species groups) rotate through a series of enclosures in a "time-sharing" arrangement.



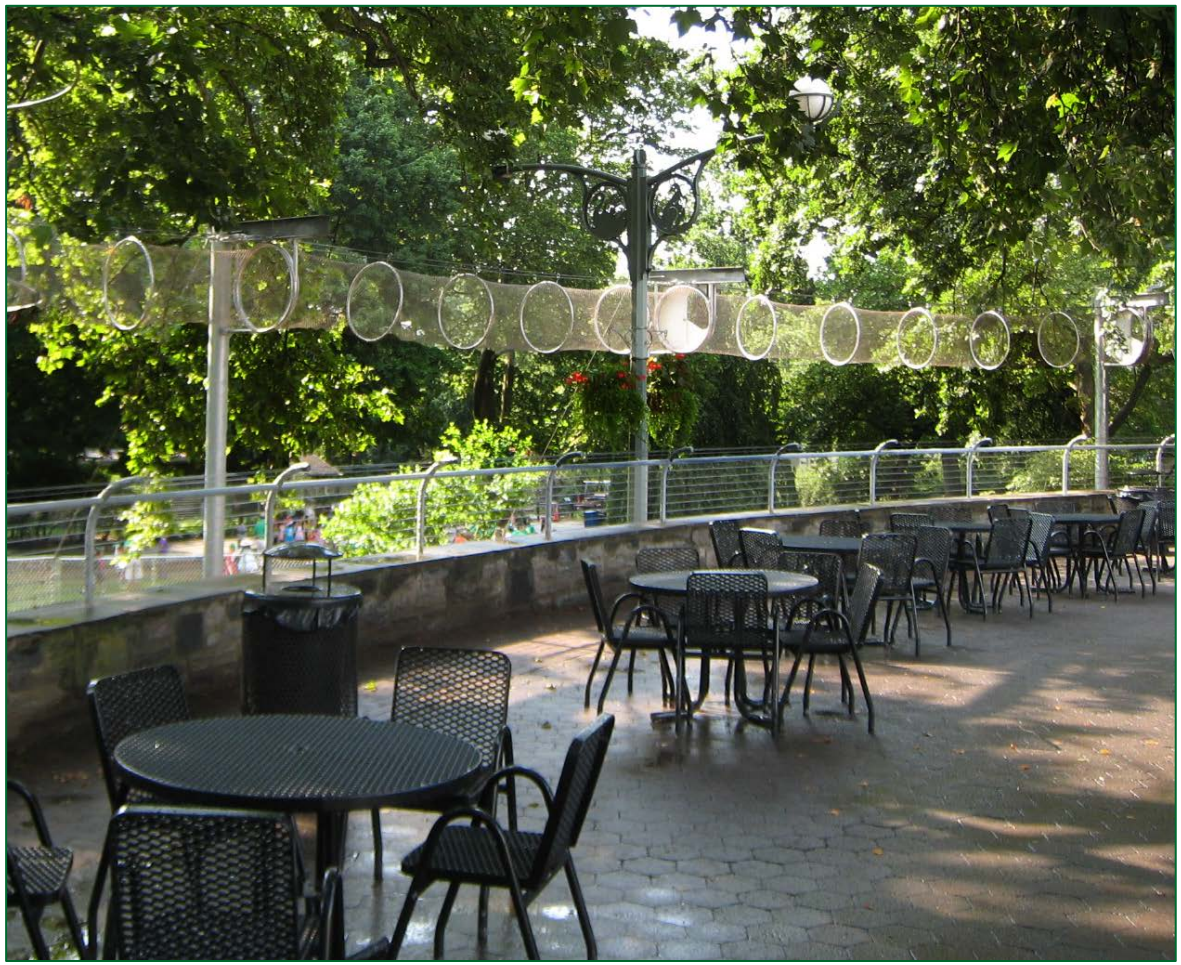
At Louisville Zoo (Herndon 1998) orangutan, siamang, babirusa, tapir and Sumatran tiger rotate

[3] See "Environmental Enrichment for Asian Elephants" for a video of elephants suing these features. Link from home page of joncoedesing.com.

through four display areas on a randomized basis in order to provide the animals with greatly expanded (collective) areas and opportunities. Long-term behavioural observations by (White et. al. 2003) show this rotation system is enriching, but activity levels are reduced by habituation over the years.

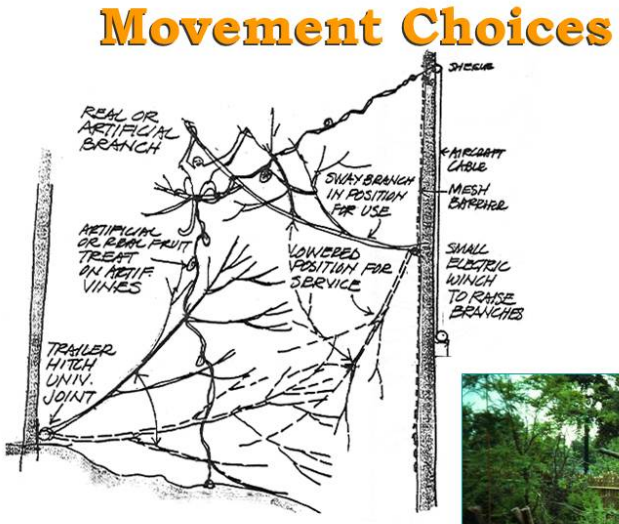
Philadelphia Zoo has just opened a nearly 200 meter long arboreal raceway loop for as many as ten species of small to medium sized primates now living in their Rare Mammal House (Baker 2011). A new 'back of house' ridged raceway system inter-connects all of the existing indoor animal enclosures. This connects to a raceway loop of flexible mesh and a series of lay-by nodes where animals can rest or explore areas of mesh enclosed trees. When fully operational, each group of primates (or even multiple groups) can 'take a walk' through the loop system as a form of enrichment as well as to improve physical fitness in a moving arboreal environment. Needless to say this activity will be of great interest to the viewing public.

Rotation exhibits combine varied physical features with access choices. While at present access choices are made by keepers, ways are being considered to allow animals choice of rotation sequence and timing.



Philadelphia Zoo's Small Animal Exercise Loop

Built-in Feeding Choices: Animals directly dependent on caregiver's schedules and routines for feeding are apt to become dependent. However, independent choice is encouraged by food or treat dispensing devices which operate randomly or are animal activated. Most enrichers are familiar with simple meal worm or cricket dispensers made from perforated PVC pipe or freezer containers. Julia Hoy (2009a) and her colleagues designed an electronic treat dispenser activated by the animals' microchip identification implant. Woodland Park Zoo has arrangements for food fish to "escape" randomly from holding tanks into otter and brown bear pools. These systems encourage both physical fitness and feeding competence, although some jurisdictions do not allow live feedings.



Sway Branch Concept


Denver Zoo

Interactive Climbing Features: Climbing features that tilt and sway naturalistically and tugging or pulling toys that rebound because of elastic attachments somehow seem more lifelike and responsive to animals. The former may also encourage fitness for arboreal animals while the latter would seem to benefit carnivores and species where male rut combat is important.

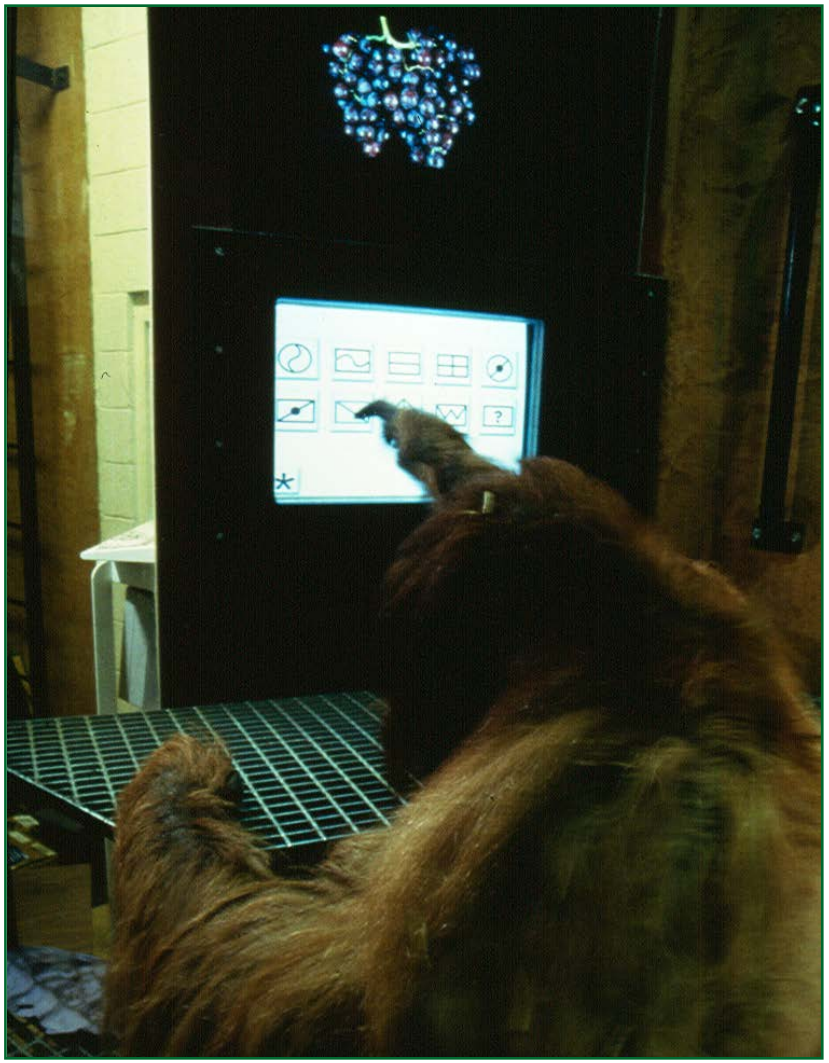
Self-Activated Features for Aquatic Animals: Aquatic environments need complex aquatic gradients of temperature, velocity and perhaps other characteristics like salinity and oxygen content for animals to move through to meet their needs. Some of these features can be interactive as well. I've observed penguins playing in mechanically generated waves and high velocity underwater jets (tigers enjoy these as well).

It is useful to try to "see" the world as animals do when seeking enrichment opportunities. For example, would aquatic animals like platypus and some fish which sense subtle electromagnetic fields be enriched by encountering or manipulating simple devices producing minute amounts of such emissions?

What's the Message?

Enrichment specialists, like all zoo staff, are obligated to support their institution's public educational goals as well as their own. Appearances have consequences in term of educational message. (Coe 1996) Firstly, the zoo must be clear about the education messages intended for each exhibit. If the "message" (cognitive and affective) is based upon highly naturalistic exhibit presentations such as "landscape or habitat immersion" (Coe 1985), enrichers should be familiar and sympathetic to this educational philosophy and introduce only objects or animal activities that support the extended overall visitor experience message. In these cases compatible "naturalistic" enrichment features should be used on public view (Young 2003 p. 61) which can easily be accomplished without diminishing enrichment levels as described in Coe 2006

On the other hand, in off-exhibit areas and exhibits that already look artificial or where the exhibit message is about ex situ animal display and management, in other words most traditional zoos, enrichment features that appear "natural" are suitable, but not essential. For example, the US National Zoo elected to design its Think Tank exhibit around the education message of cognation. (Boda-Bahm 1997) Presenting an orangutan operating a computer to communicate with staff and visitors supports the educational and enrichment goals of the exhibit.



Think Tank, National Zoo

Postmodern Animals

We must not assume that only behaviours and activities found in wild animals are appropriate in zoos, aquariums and sanctuaries. Many opportunistic species have a genetic disposition to learn and adapt to new situations, including exploiting humans. (Low 2003 p. 8)

The US National Zoo's Think Tank encourages orangutans to use large computers to communicate with staff and visitors using symbolic language. (Boda-Bahm 1997) As long as twenty-seven years ago, Hal Markowitz taught a mandrill to play use a simple computer to tic-tac-toe with visitors. (Markowitz 1982) Critics of the day condemned such artificial enrichment features as "unnatural" and unnecessary. (Hutchens, Hancocks and Crockett 1984) Today I would respond, who are we to judge what animals should prefer? Why not let the animals decide for themselves? While not "natural" to these species, the primates clearly seemed to find these high-tech pursuits enriching.

Kyoto Primate Institute

Chimpanzees seem to thrive in fifteen metre high multistorey "triple towers" at the Primate Research Institute of Kyoto University. (Ueno 2009) If the animals seem to actively engage themselves in such environments and measurably benefit (R. Young 2003 pp. 34-35) then they should be provided with opportunities to choose either "naturalistic" or "engineered" enrichment while supporting the intended educational message. And this must be done in ways that also benefit the viewing public, again as a collaborative strategy

Collaboration with Animals

Animals have been exploiting and collaborating with people for a long time. Wild dolphins collaborate with fisherman in Brazil (Pryor 1994) and fraternise with tourists in Australia and the Caribbean. Wild king parrots trained me to feed them on rainy days. I'm sure zoo keepers have many stories of games their animals initiate with them or with zoo visitors. Yet zoo keeping, including environmental enrichment, is usually thought of as something "we" do for "them". What if this idea evolved into "What can we do with them?" and finally into "What can they do for themselves?" Can we change our relationship with zoo animals from dependence to interdependence?

Reciprocal Enrichment

Mutual, reciprocal enrichment between zoo animals and zoo visitors is at the heart of the best zoo experiences and I believe is fundamental to establishing bonds between visitors and the animal kingdom. Reciprocal enrichment opportunities can be built into exhibits.

Howdy Box Concept

Collaboration with Designers

"Enriched habitats result from an enriching design process. An individual designer, no matter how well informed, cannot match the collective knowledge and creative capacity of a diversified and motivated group. Exhibit design should involve specialists in ethology, research, training, enrichment, and education, as well as designers and caregivers. Good exhibits are educational and are rich in research opportunities. Animal and staff training help them reach their full potential. Close collaboration can build lasting relationships and mutual respect, insuring the optimal management and modification of the project over time."

"Observation and evaluation make design a continuous self-correcting process. As a result, behavioural enrichment evolves from remediation to facilitation in the creation of artificial habitats that have diversity and choice…" (Coe 1992)

The entire constructed facility, all display and service areas available to or supporting animals, should be thought of and designed as enriched environments. A fan designed by an engineer may be as enriching as a toy provided by a volunteer. Creative enrichment opportunities need to be discovered early in the design process. Therefore enrichment specialists deserve a "place at the table," a fully collaborative role with designers and managers in the design of new and renovated facilities. However, in order to prepare for this essential role, enrichers also need to think beyond their traditional roles and recognise enrichment opportunities in non-traditional places.

It is also important that all participating in the design process recognise the value of creating safe and enriching habitats and activities for zoo staff and visitors as well as animals.

What Is Next?

Firstly, animal enrichment specialists should continue along the successful paths being illustrated at this conference, expanding the benefits of enrichment to other taxa like aquatic animals, pets and livestock, organizing enrichment activities into long-term programs and networking with each other and allied professions.

Secondly, enrichment workers need to interact more with other staff, managers and designers in the design of new and renovated facilities so that both more built-in enrichment features and better access for changeable features are provided. You need to look more broadly at all aspects of the built and management environment for enrichment opportunities. Expand the concept of behavioural and environmental enrichment to include enriching the lives of caregivers and visitors.

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