

Mixed Species Rotation Exhibits

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Abstract

Immersion exhibits have changed animal zoo exhibition using “nature” as the model for international best practice, yet even the most diverse zoo habitats don’t provide animals occupations and animals soon become habituated with resulting decrease in animal activity and visual interest for the public. Activity-based design merges immersion displays with behavioral management to increase novelty and species-typical activities. At the Louisville, Kentucky (USA) Islands Exhibits orangutan, tapir, babirusa, siamang and Sumatran tiger rotate through four habitat areas on a randomly determined schedule. Five years of behavioral observations show normal stress levels, increased activity and previously unseen natural behaviors.

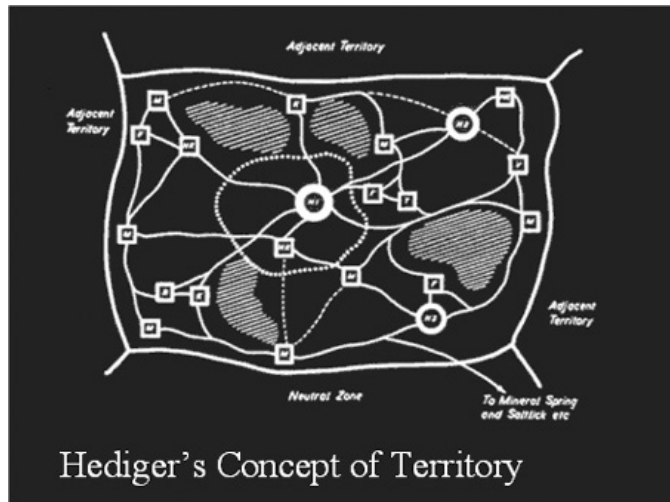
Introduction to Animal Rotation

How can we increase healthy animal activity and visitor interest while helping improve staff skills? Animal rotation displays can provide these benefits. I first introduced the concept of animal rotation displays in 1995 as one example of what my colleagues and I called Activity-Based Design and Management. (Coe, 1995, 1997) The central idea was to fully integrate the commonly disparate practices of husbandry, design, behavioral management and behavioral enrichment for the benefit of animals, staff and visitor alike. Readers interested in more background are referred to these papers. Since then a number of new animal rotation facilities have been built and operated and several more are being planned. It is time to devote a paper to the specific subject of animal rotation exhibits themselves.

DEFINITION AND DESCRIPTION

“Animal rotation” is an integrated management and facility design strategy which allows animals to move sequentially between two or more interconnected display and off-display areas for the purpose of increasing available space and behavioral opportunities for the animals. Resulting increases in appropriate animal behavior and activity should improve visitor interest and satisfaction. Forms of rotation include single individual, single species group, multi-species individuals and multi-species groups. In traditional zoo displays a given animal or group may live its entire life in a single display yard. In a rotation display the animal may spend mornings in one yard and afternoons in a second yard. While the animal is in the second

yard another animal or group inhabits the first yard. Think of this as a “time share” arrangement for zoo animals. When the animals are of different species occupying the same area at different times it can be thought of as a consecutive mixed-species display. Naturally, procedures to prevent spread of contagious disease would be similar to those used in conventional mixed-species facilities which animals share concurrently.



BEHAVIORAL BASIS FOR ROTATION DISPLAY

Professor H. Hediger (1950) described a typical territory of a wild animal as being made up of a variety of special use areas (dens and retreat areas, basking sites, marking stations, foraging areas) interconnected by regularly used pathways. This mosaic of use areas and trails overlaps similar patterns used by many other species and sometimes (either spatially or temporally) with others of the same species. The animal may need access to each of the special areas, but it does not need access to all areas at the same time. Other individuals or groups could be using its disused areas. This is the natural “time share” model for the rotation exhibit concept. No zoo is large enough to give each animal enough space and environmental complexity to approach a natural condition, but perhaps we can greatly increase both space and complexity for our animals by devising a managed “time share” concept to make the most of the space we do have.

IS THERE A NEED?

My experience is that animals gradually become habituated to even behaviorally complex naturalistic displays and since most of their needs are met by zoo staff, they spend many hours inactively. Visitors complain about animals “not doing anything”. More progressive zoos introduce programs for behavioral enrichment. This is nearly always a good idea, but if it is applied remedially, perhaps active management concepts such as animal rotation would provide behavioral stimuli not previously considered. For example, at the Louisville Zoo display mentioned in the Abstract, the male tapir actively scent-marks over the scent of the tiger which had previously occupied the area. I suggest animal rotation and behavioral enrichment as complimentary forms of activity-based animal management, not as alternative strategies.

The more we do to encourage animal interest and combat boredom, the better off the animals will be.

HOW DO ROTATION EXHIBITS AFFECT THE GUEST EXPERIENCE?

Visitors to the Louisville Zoos' Island rotation exhibit display are encouraged to see which animals they may encounter while visiting a series of animal viewing structures connected by a streamside trail. Identification graphics are provided for each species at each overlook which guests may compare to the species on display. Is that a tiger or a tapir? Not knowing which animal will be seen next adds excitement and anticipation, as it would during a walk in a national park or the natural bush.

MODERN ANIMAL MANAGEMENT TOOLS MAKE ROTATION POSSIBLE

The growing application of operant conditioning training, popularly known as positive reinforcement or 'clicker' training has many benefits. (Luale and Desmond 1990) The ability to have an animal transfer through gates and chutes dependably at any time and in various sequences is essential to the operation of rotation exhibits. However the ability to create conditions in which the animal always enjoys the new rewards and opportunities the transfer brings encourages rapid compliance. In these circumstances, the transfer itself is anticipated and is enriching to the animal.

WHAT IS THE IMPACT ON STAFF?

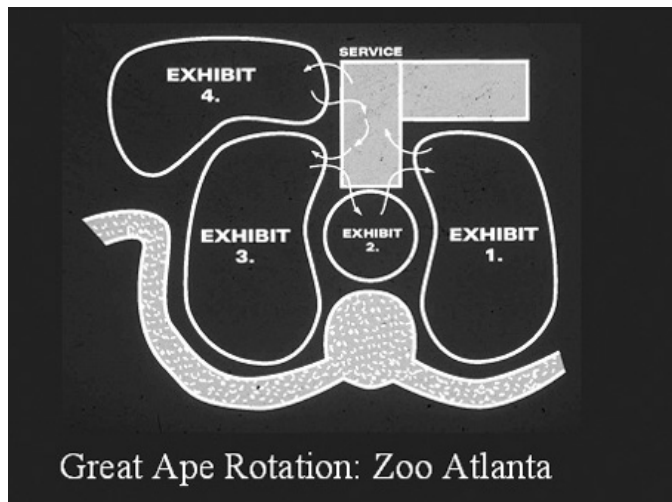
Rotation exhibits will generally require both more staff and better trained staff to operate at optimum levels. A good knowledge of operant conditioning training theory and practice is essential for most of the staff operating the facility. They should also be familiar with the latest developments in behavioral enrichment. American zoos and theme parks which make the most of rotation techniques, such as Disney's Animal Kingdom and the Louisville Zoo also emphasize staff training and professional advancement. In the case of the Louisville Zoo, Jane Herndon (1998) reported keepers meet every morning to decide upon the timing and sequence of the multi-species rotation, with a different keeper setting the schedule each day to encourage randomness and novelty for the animals. In this situation upper management gave keeper-level staff a good deal of responsibility, which encourages initiative and professional development.

WHAT ARE THE COST IMPLICATIONS?

In every exhibit containment barriers are sized to contain the most powerful or agile animal. In rotation exhibits barriers must be sized for the most demanding species in the rotation. At the Louisville Zoo, the most demanding species were orangutans and tigers, which have similar containment requirements. Once these needs are met smaller species such as babirusa and siamang are also accommodated. However, because the cost of each of the enclosures in the rotation sequence is largely determined by barrier costs, the project would be more expensive than building independent displays of similar size for the same list of species. The cost of additional gates and return chutes must also be considered. If rotation displays are more expensive to build and require better trained staff to operate, why are they recommended? This type of exhibition and management is not suggested for

every zoological institution. However for facilities looking to improve the well-being and activity of their animals as well as the motivation and professional development of staff, this may be an approach worth considering. Louisville Zoo Acting Director John Walczak (1995) believed guest satisfaction improved with increased animal activity as well as with the greater complexity and interest of the guest experience. Improving visitor satisfaction led to increased return visitation and earned revenue, which helped to offset the higher facility and operational costs if their rotation exhibits.

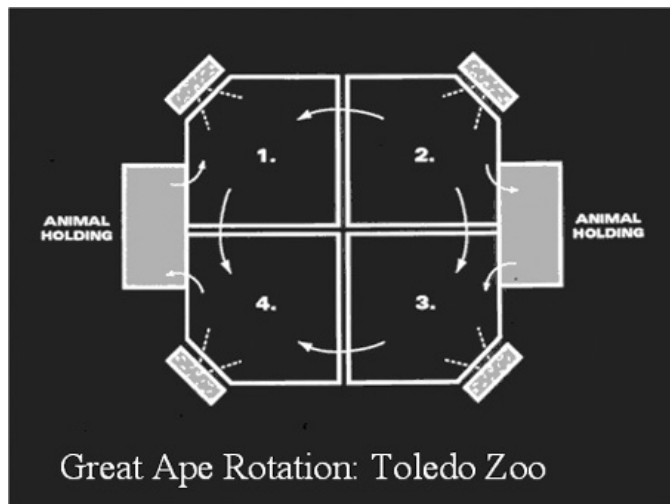
Rotation Exhibit Case Studies



CASE STUDY 1: Zoo Atlanta *Gorilla Exhibit*

This complex of four interconnected western lowland gorilla displays opened in Atlanta, Georgia, USA in 1988 with fourteen gorillas in four family troops. As originally envisioned by Director Terry Maple and myself (Coe and Maple, 1985), each troop would rotate through the four displays spending a day in each. Thus the combined areas would represent each troop's home range, a much larger area than would be available if each troop stayed in a single area. Dr. Maple, a noted expert in great apes, did not think the gorillas would find alternating outdoor habitats stressful, since they all spent their indoor off-display time in close proximity.

In the interest of simplifying the environment during animal introductions, the rotation feature was not used for several years after the exhibit opened. Then seven years later behavioral researcher Kristen Lukas rotated two gorilla troops with increasing frequency until they exchanged display yards on a daily basis. Lukas recorded increased gorilla activity levels and fuller use of available areas. (Lukas, 1995) When this research was completed, staff went back to conventional (non-rotational) use of the displays and ape activity levels dropped to former levels.



CASE STUDY 2: Toledo Zoo *Great Ape Rotation*

In the early 1990's the Toledo Zoo, Ohio, USA, increased the size and complexity of the areas available for their gorillas, chimpanzees and orangutans. Four outdoor and one indoor display are interconnected with transfer chutes. (Petiniot, 1995) Keepers clean and hide treats in one yard, then move in, say, the gorillas. They continue this process around the circle, spot cleaning, hiding treats and rotating apes throughout the day until each group had visited at least four areas, finding fresh treats and perhaps signs of previous occupants each time. At the end of the day each ape has had access to about four times more space than it would have in conventional separate displays.



CASE STUDY 3: Louisville Zoo *Islands Exhibit*

Opened in 1995 at the Louisville Zoo in Kentucky, USA, this is the project described in the Abstract to this paper. To my knowledge this is the first zoo rotation display to include predator and prey species. The species displayed include orangutan, siamang, Asian tapir, babirusa and Sumatran tiger. The complex includes three naturalistic yet highly varied outdoor displays and one indoor behaviorally enriched day room, as well as a variety of off-display areas. These are interconnected with a complex system of chutes and gates, allowing animals to bypass each display when needed. Keeper access paths

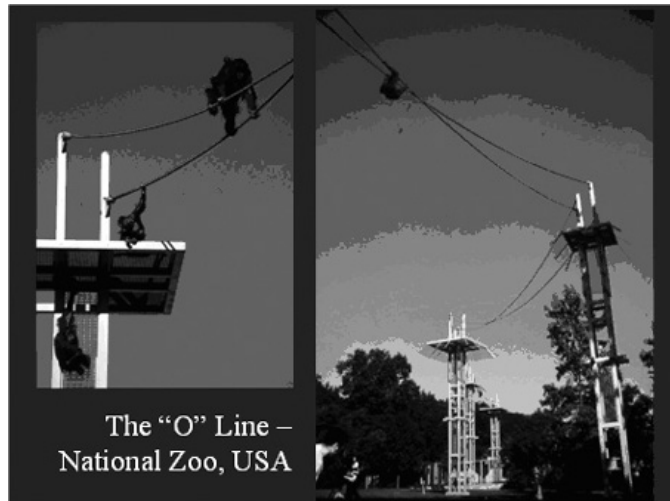
parallel all animal chutes, giving keeper/trainers continuous access to animals being trained and transferred. (Also see: Taylor, 1995 and Walczak, 1995)

A five year long behavioral analysis by White et al (In Press.) contains the following statement: "Moving animals among the exhibits affected activity levels and/or space utilization in all animals in the activity-based management system... The results support the conclusion that exposure to varying exhibits produces variation in the behavior of the animals and elicits natural behaviors that would be unlikely to occur in a traditional exhibit. Activity-based management provides unique opportunities for the behavioral enrichment of captive animals." A parallel unpublished study by the zoo evaluated five years of urine cortisol analysis of the animals, demonstrating they maintained optimal stress levels.



CASE STUDY 4: Louisville Zoo *Gorilla Forest*

The success of the Island Exhibit led to the development of the winner of the 2003 American Zoo and Aquarium Association Exhibit Award, the Gorilla Forest at the zoo in Louisville, Kentucky, USA. This exhibit provides eleven gorillas two large naturalistic outdoor yards and three behaviorally enriched indoor group rooms, as well as many off-display areas. All of these are interconnected with chutes and arranged to allow apes to travel in circuits. During fair weather the gorillas are given free access to their choice of areas, indoor or outdoor. The apes appear to especially enjoy the "gorillas in the round" concept, where they can circle a central public viewing gallery by rotating themselves through the three group rooms.



CASE STUDY 5: National Zoo *Think Tank*

Opened in 1997 by the National Zoological Park in Washington, DC, USA, the innovative Think Tank project utilized an approximately 800meter long overhead line (the "O" line) as a movement corridor for the zoo's orangutans to travel between their home in the established Great Ape House and the new Think Tank research and display area. A mature male is kept at each area and the female orangutans have ad lib daytime access to the "O" line to visit the male of their choice. By all accounts this highly visible form of rotation has been a great success with both the orangutans and the visiting public. (Broda-Bahm, 1997)



CASE STUDY 6: California Science Center *Asian Rainforest*

The California Science Center in Los Angeles, CA, USA is now completing design of its most ambitious project, 'The World of Ecology.' The Asian Rainforest area of this project will contain the most innovative rotation exhibits developed to date. Visitors will enter a large central walk-through aviary about 18m high containing a pair of large fig trees. Surrounding the aviary on three sides are aviary-like enclosures, habitats for the following rotating species: rhinoceros hornbill, Bhraminy kite, babirusa, small-clawed otters, fishing cat, binturong, and siamang. The habitats contain pools with food fish dispensers and underwater viewing as well as viewing at terrestrial and

arboreal levels. Each species has access to each habitat. It is anticipated, given the height, size and complexity of the rotation exhibits, various combinations of species can be conditioned to be compatible as mixed-species rotation groups. However, the composition of these groups could be changed during the day. For example, the combination of babirusa-otter-hornbill could be modified by transferring out the hornbill and adding siamang for the arboreal/aerial component when the hornbills are nesting. Additional animals, if individually compatible through training and habituation, such as binturong, could be moved on or off exhibit as needed to ensure each animal receives abundant exercise and stimulation.

Summary of Additional New Rotation Exhibits

The Melbourne Zoo opened its highly successful new elephant exhibit in 2003. Elephants can rotate across public paths into two separate enclosures. Two more enclosures are to be added in the future.

Point Defiance Park Zoo and Aquarium, Tacoma, USA, is presently building a major Asian forest exhibit. Rotating species will include tiger, tapir, otter, gibbon, langour, porcupines and binturong.

Conclusion

An activity-based design and management system such as animal rotation can bring extraordinary opportunities for increasing appropriate and natural animal activities and interactions with the environment, other species and with conspecifics. These activities should not only increase animal physical fitness and overall well-being, but would be exciting for zoo visitors and staff alike to observe. These benefits, of course, come at a price. Such facilities are more expensive both to build and to operate. The risk of human error and of animal injury increases with the complexity and opportunities for animal activities and staff development. For those willing to consider the risks always associated with new ideas and opportunities, the challenge of rotation exhibits may provide opportunities for zoo keeping at an unprecedented level.

Credits

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Photo of "O" Line at National Zoological Park courtesy of NZP, Smithsonian Institution.

Design of Ford African Rainforest and Zoo Atlanta by Coe Lee Robinson Roesch, Inc., Jon Coe, principle (retired).

Design of Toledo Zoo Great Ape Exhibits, Louisville Zoo Islands and Gorilla Forest exhibits and California Science Center rotation exhibits by CLRdesign, inc., Jon Coe, principal (retired).

Design concept for Think Tank, National Zoological Park by Dr. Ben Beck and the NZP staff.

References

- Boda-Bahm, C. 1997. "Think Tank Evolution and Revolution" in *Museum News*, pp. 44-48.
- Coe, J. C. and Maple, T.L. 1985. "Approaching Eden: A Behavioral Approach to Great Ape Exhibits" in *Proceedings*, American Association of Zoological Parks and Aquariums, Wheeling, WV, pp. 117-128.
- Coe, J.C. 1995. "Zoo Animal Rotation: New Opportunities from Home Range to Habitat Theatre" in *Proceedings*, American Zoo and Aquariums Association, Wheeling, WV.
- Coe, J. C. 1997. "Entertaining Zoo Visitors and Zoo Animals: An Integrated Approach" in *Proceedings* American Zoo and Aquarium Association, Bethesda, MD.
- Hediger, H. 1950. *Wild Animals in Captivity*, Butterworth, London, p. 14.

- Herndon, J., 1998. "The Islands Exhibit: Multi-Species, Multi-Solutions through Training" in *Proceedings Addendum*, American Association of Zoo Keepers, pp. 22-29.
- Laule, G.E. and Desmond, T.J., 1990. "Use of Positive Behavioral Techniques in Primates for Husbandry and Handling" in *Proceedings*, American Association of Zoo Veterinarians, pp. 269-273.
- Lukas, K., 1995. "Rotating Gorilla Troops through Multiple Exhibits at Zoo Atlanta's Ford African Rainforest: A Behavioral Evaluation" in *Proceedings*, American Zoo and Aquarium Association, Wheeling, WV, pp. 352-354.
- Petiniot, C., 1995. "Great Ape Rotation at the Toledo Zoo: A Keeper's Perspective" in *Regional Conference Proceedings*, American Zoo and Aquarium Association, Bethesda, MD.
- Taylor, S., 1995. "Rotating Multi-Species Groups and Pushing Exhibit Frontiers at the Louisville Zoo's Proposed Islands Exhibit Complex" in *Regional Conference Proceedings*, American Zoo and Aquarium Association, Bethesda, MD, pp. 159-160.
- Walczak, J., 1995. "Multi-Species Rotation: A New Concept for Animal Display and Management at Louisville Zoo's New Islands Exhibit" in *Regional Conference Proceedings*, American Zoo and Aquarium Association, Bethesda, MD, pp. 543-544.
- White, B.C., Houser, L.A., Taylor, S. and Elliott, J.L.L., *In Press*. "Activity-Based Exhibition of Five Mammalian Species: Evaluation of Behavioral Changes" in *Journal of Zoo Biology*, New York, NY.