Caring for Wildlife - The World Zoo and Aquarium Animal Welfare Strategy
Chapter 3: Environmental Enrichment

Our commitment is to provide animals with opportunities for challenge and choice to promote positive welfare states

RECOMMENDATIONS

To realise our commitment to high animal welfare standards, the *World Zoo and Aquarium Animal Welfare Strategy* calls on member organisations to:

1. Build staff skills, internal culture and commitment to embed enrichment strategies and activities into the daily management of all animals in your care. Regularly review these strategies and activities and provide ongoing staff training in this area.
2. Introduce different enrichments that provide challenges, choices and comfort to animals to maximise their psychological health. Change them when appropriate and design them to stimulate a diversity of species-specific natural behaviours.
3. Use positive reinforcement as an enrichment and training tool.
4. Evaluate enrichment success and failures and share enrichment successes and failures with other zoos and aquariums to improve your own and other's enrichment knowledge and activities.
5. Incorporate environmental enrichment into exhibit design and upgrades.
6. Share enrichment stories with visitors to broaden understanding and education of animal biology and welfare.
7. Use specific, target-orientated enrichment designed to meet specific behavioural needs.

INTRODUCTION

Environmental enrichment, also known as behavioural enrichment, provides species-appropriate challenges, opportunities and stimulation. Environmental enrichment includes the regular provision of dynamic environments, cognitive challenges, social opportunities, positive interactions with humans and other means of engaging individual animals. The practice of enrichment has now been integrated as a basic principle of zoo and aquarium animal husbandry, which, to date, has been applied mainly to mammals and birds. Opportunities to apply enrichment to all species held by zoos and aquariums should be incorporated as knowledge grows.

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An enriched environment should promote a range of normal behaviours that animals find rewarding. It should also allow animals to respond in positive ways to potential stressors. Such responses potentially allow animals to avoid or reduce their exposure to such stressors. Thus, a well-enriched exhibit space provides opportunities for performing behaviours such as hiding, climbing or running, as appropriate for the species.

WHY IS ENRICHMENT IMPORTANT?

Animals with good mental health tend to be engaged in their environment. Thus, they rest peacefully, without an over-expression of vigilance; behave in a fashion that is not overly fearful with minimal and non-exaggerated startle responses; assimilate new information, demonstrated through learned tasks or modified behaviours; perform no abnormal behaviours; and have a diverse behavioural repertoire that includes regular exploration and investigation. With regard to their physical health, animals should be able to be physiologically relatively stable, grow and reproduce effectively and also be supplied with opportunities to have appropriate forms of exercise.

Environmental enrichment promotes animals' mental and physical health by enabling them to engage in behaviours that give rise to a range of positive experiences. Such rewarding behaviours may involve food, space, temperature, social partners, activities such as swimming or dust-bathing, information gathering and many others.

Neuropsychologists have known for decades that animals raised in enriched environments have higher cognitive capacity than those from un-enriched environments. As early as 1947, for example, it was demonstrated that rats kept as pets were more capable of performing problem-solving tests than laboratory-reared rats. Later work demonstrated differences in brain anatomy between animals raised in enriched and un-enriched environments, and, importantly, that even adult brains remained capable of beneficial reorganisation of neural processing in response to enrichment.

While basic science has determined many positive effects of environmental enrichment, practitioners in zoos and aquariums have also played a substantial role by their innovative application of the science to

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Citation: Mellor, D. J., Hunt, S. & Gusset, M. (eds) (2015) *Caring for Wildlife: The World Zoo and Aquarium Animal Welfare Strategy.* Gland: WAZA Executive Office, 87 pp.

Case study 3.1:
Providing choices by linking exhibits

Philadelphia Zoo has developed a 10-year plan for construction of a campus-wide network of animal trails that link exhibits for species with similar containment requirements and locomotion capabilities. This plan builds on and combines the concepts of species rotation and single-species connection systems already in use elsewhere. The Philadelphia Zoo plan includes three broad categories of trails: one for smaller arboreal species, including monkeys, lemurs and smaller carnivores; one for apes, bears and big cats; and one for large terrestrial species. The intent of the plan is to provide opportunities for long-distance travel and cross-species rotational usage of the trails themselves and, where appropriate, each other's 'home' exhibits. As one measure of impact, the trails have been used voluntarily and extensively by most species that have been given access. The trails have allowed some behaviours that are constrained in most of the 'home' exhibits; for example, sustained running, retreat from alarming stimuli, transport of food before consumption and inter-individual dispersal. Other observations include gradual and self-controlled approaches to novel stimuli and vocalisations not heard in the 'home' exhibits.

- Philadelphia Zoo, PA, USA, Colobus monkey in a linked species habitat

specific enrichments. This has had a positive impact on animal welfare. Research based in zoos and aquariums demonstrates that enriched compared to un-enriched animals show a broader range of normal behaviours, express fewer abnormal behaviours and maintain more appropriate social interactions. Exposure to complex and enriched environments may also improve an animal's ability to cope more effectively with change and animals are likely to be more responsive to training, making the options for their care more inclusive. Indeed, there are numerous positive welfare outcomes for enriched animals.

PROVIDING 'CHALLENGES' AND 'CHOICES'

Experienced zoo and aquarium practitioners use 'challenges' to engage animals. These may include physical or cognitive challenges that require animals to perform some feat to acquire a reward or that require animals to solve a problem. A substantial literature on 'contra-freeloading' develops the case that many animals prefer to work to acquire food rewards than to simply have easy access to such rewards provided by animal keepers. To support animals working for rewards, Phoenix Zoo, for example, has implemented a zoo-wide contra-freeloading programme. Contra-freeloading should be used to provide challenges and choices that encourage positive states of welfare without inducing negative states, such as frustration.

Other problem-solving opportunities are likely to generate positive animal welfare outcomes. Animals in the wild face many different challenges and, although their behaviour in zoos or aquariums may not mirror that in their natural habitats, exhibiting a fundamental motivation to solve problems may still remain. Consequently, animal managers provide animals with puzzles to manipulate or other cognitive challenges. Of course, the animals should be capable of solving the problem or meeting the challenge presented to them, otherwise frustration may arise. Also note that good challenges may stimulate the animals' stress responses, so that physiological measures showing such responses under these circumstances would not necessarily be a matter for concern.

Providing animals with opportunities to exercise control over various activities—giving them 'choices'—is another fundamental feature of environmental enrichment. Choices can be presented in numerous forms; for example, related to social partners, individual enrichment items or locations for resting or feeding (*see case study 3.1*).

In essence, enrichment works by keeping animals' environments dynamically engaging. To assist with this, a predictive theory of environmental enrichment has been developed. The concept suggests that systematically varying a single feature of an animal's environment will help to determine the most effective

Case study 3.2:
Predictive theory of environmental enrichment

A pair of fennec foxes (*Vulpes zerda*) housed at Brookfield Zoo were almost completely inactive and did not use their large exhibit. To test the concept developed in the predictive theory of environmental enrichment, a simple feeding device was installed that allowed food to arrive into the exhibit at several different locations at predictable or unpredictable times. Thus, researchers could vary the arrival of food in both space and time. Importantly, they found that predictability and unpredictability combined was more effective at stimulating natural foraging behaviour and attentiveness to the environment than complete predictability or complete unpredictability. They also found that the increased activity and range of behaviour led to zoo visitors staying longer at the exhibit.

- Brookfield ZOO, IL, USA, Fennec fox

way that enrichment should be presented (*see case study 3.2*).

ENRICHMENT THROUGH FEEDING AND FEEDING TECHNIQUES

Varying how animals are fed is perhaps the most widely used enrichment technique. Among numerous feeding-related enrichments, the time of feeding can be varied, as can the number of feeds offered and the locations where it is offered. The ways in which animals must search for food can vary and the time and activities committed to acquiring food by manipulating the size of food items and by placing them in structures from which they must be extracted can also increase enrichment. Feeding and feeding techniques need to be appropriate to the species, taking into consideration dietary requirements, social dynamics and other behavioural needs such as foraging.

In operant conditioning, positive reinforcement involves providing a favourable outcome, event or reward after a desired behaviour has occurred, which makes it more likely that the behaviour will occur again in the future. While obtaining food rewards may be one outcome associated with variations in food provision, in many cases there are other outcomes such as stimulating animals to search and determine information about their environment.

It is important to consider how the environment will remain dynamically engaging when designing exhibits, such that it continues to enrich the lives of animals living within (*see Chapter 4*). Exhibits can be designed with novel and enrichment feeding tools in mind, such as feeding poles for big cats. It is essential that animals be engaged by components of the environment that they can come to understand and over which they can exert some control. Ease of placement of enrichment objects that include food is also important, so that enrichment becomes an easy-to-accomplish component of daily animal care.

USE OF LIVE FOOD FOR ENRICHMENT—WELFARE CONCERNS?

To date, there are few studies on the enrichment effects of feeding live animals to predators. Two studies found that feeding live fish to cats both reduced abnormal behaviour and resulted in a more diverse behavioural repertoire. However, each of these studies also used an alternate treatment that achieved positive behavioural outcomes—either food was hidden in numerous locations throughout the exhibit or animals were given large bones to gnaw. The goal of any enrichment strategy involving live feeding must be carefully considered. It is important that the goal of the enrichment is properly evaluated, alongside its potential negative welfare impacts on the prey. Consideration of whole-of-life care must be given to all animals in our care, including those used in live feeding.

Although there are varied approaches globally on live-feeding practices, zoos and aquariums should, where relevant, investigate non-live feeding options to promote positive animal welfare outcomes. Consideration may be given to using animal ethics and welfare committees with external memberships to assist with reaching decisions on these matters.

MEASURING THE EFFECTIVENESS OF ENRICHMENT

It is important to measure the effectiveness of environmental enrichment. This is to ensure that

resources are being used effectively and that the enrichment being used does indeed procure animal welfare benefits. In addition, enrichment assessment helps to build cooperation and improvement within the zoo and aquarium community. Sharing successes and failures benefits the entire zoo and aquarium community. This can be done at a regional level or more widely through shared website resources.

A key issue in assessing the effectiveness of enrichment is comparing the behavioural outcomes against expectations. Disney's Animal Kingdom developed the 'SPIDER' framework for planning and evaluating enrichment schemes. This is a useful tool that guides staff to *Set goals, Plan* an approach to enrichment, *Implement* the enrichment, *Document* outcomes, *Evaluate* those outcomes in comparison to the set goals, and *Re-adjust* implementation if necessary.

VISITORS AND ENRICHMENT

Although visitors' expectations may not have a direct impact on animal welfare, they have the potential to increase zoo and aquarium commitment to environmental enrichment. As visitors' expectations have risen sharply, many now anticipate that zoos and aquariums will actively work to keep animals healthy and engaged. Thus, it may be beneficial to tell visitors about enrichment activities and how they make important contributions to animal welfare. Many zoos and aquariums have website pages that provide information about enrichment and showcase their enrichment work.

Some zoos and aquariums also celebrate 'enrichment days' where visitors are provided with opportunities to help make enrichment items and learn about their relevance. Although many animal managers feel that unnatural, yet effective, enrichment items detract from visitor experience, a limited number of studies on the subject provide no clear evidence that viewing these items reduces visitors' opinion of the exhibit. Moreover, visitors appear to appreciate knowing that animals are provided with enrichment. When animals are active and engaged, as they tend to be with enrichment, visitors tend to observe them longer and the opportunity to learn from the exhibit increases.

CONCLUSION

Environmental enrichment is a proven approach to maintaining animals' physical and mental health in zoos and aquariums. Enrichment can take many forms, but the overall goal is to provide a dynamically engaging environment that provides challenges for animals. These challenges should be within the scope of the animals' capabilities and animals should succeed in overcoming them more often than not.

The primary difficulties associated with enrichment are maintaining dynamic environments for animals within the confines of the animal-care staff working hours. It is important to remember that animal welfare is not the expression of only a few moments in an animal's day but of the cumulative experiences an animal has over time. Environmental enrichment programmes should always consider an individual animal's needs and changing requirements over time.