

ENVIRONMENTAL ENRICHMENT

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INTRODUCTION

Over the past twenty years, the focus of zoos has expanded from merely accommodating an animal's physical needs to considering its psychological well-being. Psychological well-being can be defined as the ability to adapt, that is, to respond and adjust to changing situations (Laule and Desmond 1998). One important way to maintain psychological health is to provide an animal with environmental enrichment. There are many reasons why zoological institutions should be encouraged to develop environmental enrichment programs. Environmental enrichment plans encourage an environment in which zoo animals, such as orangutans, can perform species-typical behaviors. Environmental enrichment may help to reduce or eliminate undesirable behaviors and reduce behavioral stress which could lead to improved health, reproduction and longevity. Structured plans allow institutions the opportunity to conduct research. Formal data collection may help identify better ways to introduce variety in an animal's day. Enrichment plans provide zoological institutions the ability to build a stronger relationship with the local community. Public appreciation and understanding of animals and their natural behaviors helps to increase visitor attendance (Kreger et al. 1998). Enrichment plans should be incorporated into all caregivers daily animal husbandry routines.

United States Department of Agriculture (1991) regulations require zoos to develop enrichment programs. Subpart D of the Animal and Plant Health Inspection Service (APHIS) regulations discuss the specifications for nonhuman primates. Animal dealers, exhibitors and research facilities must develop, document, and follow an appropriate plan for environmental enhancement adequate to promote the psychological well-being of nonhuman primates. This plan must be made available to APHIS upon request. The physical environment in the animal's primary enclosures must be enriched by providing means of expressing non-injurious species-typical activities. Some forms of acceptable enrichment include increased cage complexities, providing objects to manipulate, providing varied food items, using foraging or task-oriented feeding methods, and providing interactions with caregivers. Institutions are also required to make considerations for primates needing special attention (infants, young juveniles, distressed individuals, singly housed nonhuman primates that are unable to see or hear nonhuman primates of their own or compatible species and great apes weighing over 110 lbs.). Special consideration needs to be given to geriatric animals that may require more extensive care as they age.

The Association of Zoos and Aquariums (AZA) is currently considering implementing rules that will require members to initiate environmental enrichment with every species they house (Young 2003). The AZA defines enrichment as:

“a process for improving or enhancing zoo animal environments and care within the context of their inhabitants' behavioral biology and natural history. It is a dynamic process in which changes to structures and husbandry practices are made with the goal of increasing behavioral choices available to animals and drawing out their species-appropriate behaviors and abilities, thus enhancing their welfare. As the term implies, enrichment involves the identification and addition to the zoo environment a specific stimulus that the occupant wants or needs but which was not previously present.”

Additionally, Shepherdson (1994) provided the following definition:

“Environmental enrichment is a concept which describes how the environments of captive animals can be changed for the benefit of the inhabitants. Behavioural opportunities that may arise or increase as a result of environmental enrichment can be appropriately described as behavioural enrichment.”

SOCIAL ENVIRONMENT

Many orangutans have thrived in social groups as opposed to being solitary as their wild counterparts are. Group composition will vary institutionally. The number of animals housed together depends on the individual animal personalities and enclosure space. Orangutan management may differ greatly from other great ape species due to a much different social system. Opportunities for social contact can provide valuable stimulation for compatible animals. Environmental enrichment may be achieved by further modifying the social environment of an animal. This environment consists of potential interactions with conspecifics, other species in multi species exhibits and members of the animal care staff. The addition of conspecifics creates opportunities for the expression of species-specific social behavior including courtship, mating, grooming and playing. Overall activity levels are likely to increase as well (Baer 1998). Poole (1987) suggests that play seems to occupy an important role in the life of captive juvenile, adolescent and subadult orangutans. In many social situations in captivity play can be observed across all age ranges. In cases in which animals must be isolated, social stimulation can come from visual, auditory or olfactory stimuli rather than the actual physical presence of another animal (Kreger et al. 1998). These animals pose a greater need for enrichment and attention from caregivers. Animals that may have a higher priority for enrichment are those in quarantine situations, animals that are separated from conspecifics for medical management, animals that are preparing for transfer to other institutions and groups that are changed for breeding purposes.

PHYSICAL ENVIRONMENT

Captive conditions provide animals with regular food, water and shelter. The physical environment encompasses temperature, humidity, illumination and sound exposure. When designing an exhibit for orangutans, its natural behavior should be considered. Arboreal locomotion can easily be encouraged by providing usable horizontal and vertical space, including nesting platforms and climbing structures. Installing ropes, firehose, vines, hanging branches, ladders, sway poles and mesh in enclosures will promote brachiation and activity. Orangutans can easily become overweight so promoting activity is desirable. Installing privacy barriers in an exhibit can reduce stress while giving the individual a break from its conspecifics and zoo visitors. Elevated platforms, horizontal aerial pathways and nesting materials should be provided, in addition to the climbing structures for accessibility, which increases activity levels (See Design Chapter, this volume). These objects and climbing structures can be the most stimulating option for the animals.

When designing enclosure structures and enrichment devices, orangutan strength and ability to use tools should be considered. Appropriately implemented programs can contribute to better animal health by creating opportunities for the animal to exert some level of control over its environment. Whether the enrichment gives the animal the ability to avoid stressful external stimuli or the opportunity for displacement behavior, it allows the animal a means for stress reduction and helps to reduce the risk for any associated health problems (Baer 1998). Providing a combination of fixed objects (trees, ground substrate, climbing structures, etc.) and manipulable objects (ropes, browse, enrichment devices, etc.) is highly recommended. In a 1982 study by Susan F. Wilson it was shown that “the environmental complexity of an enclosure such as the inclusion of fixed, moveable and temporary objects, was more important to the orangutans, than the size of the enclosure, frequency of feedings or available surface area” (Cocks 2002). In a more recent study, Perkins (1992) confirmed Wilson’s findings.

Many zoological institutions are nonprofit organizations that are supported by local governments, visitor admissions, donations and grants. Many visitors are attracted to zoos for recreational purposes, and although it may not be the primary purpose of the institution, recreation is often the avenue of support for other zoo interests such as education, research and conservation (Hutchins and Fascione 1991). Enrichment is a means to facilitate animal visibility and thus contribute to an exhibit's recreational and educational potential. Different methods of feeding animals on exhibit can also be employed to make them more visible by drawing them toward more ideal viewing areas.

Enrichment strategies do have their constraints which differ from one institution to another. According to Mench (1998), the primary constraints on environmental enrichment strategies in zoological institutions are (1) resource availability which includes social companions and materials from a natural habitat, (2) animal health, (3) aesthetics and acceptability to visitors, (4) space, and (5) conservation mission. When providing for orangutans that can be sometimes destructive in nature, exhibit and enrichment device maintenance and replacement should be included in the annual budget. This adds to the expense of enrichment in terms of caregiver time involvement as well as the financial aspect.

HUSBANDRY ROUTINE

Enrichment should be considered a basic and necessary part of every orangutan caregiver's daily husbandry routine. One must never forget that good animal husbandry and animal welfare are totally dependent on good management of animal caregivers.

Making some changes in your basic husbandry routine can be easily accomplished while increasing the enrichment opportunities for the animals in your care. Studies have shown a marked increase in activity associated with the introduction of enrichment items. Variety is important and can be accomplished through changing the daily routine of cleaning, feeding and training schedules, or rotating which enclosure an animal has access to. When developing your husbandry routine for orangutans it should promote foraging, activity, and arboreal locomotion that mimics that of a wild type time budget while giving the animals the opportunity to have an element of control over their environment. Allowing an animal to have some control over part of their day is very important to their psychological well-being. Feeding behavior and ecology can be particularly important in formulating enrichment strategies for captive orangutans. Many studies have shown that captive animals prefer to work for their food, rather than to be fed ad libitum (Kreger et al. 1998). The more interesting, challenging and naturalistic ways that food can be provisioned, the more successful enrichment projects have been (Shepherdson 1992). It would suggest that a species with a high degree of neural complexity and advanced cognitive abilities, like the orangutan, have a greater need for environmental enrichment.

All orangutans should be provided with fresh nesting material on a daily basis. Nesting material promotes species-typical behavior while giving the animals a comfortable place to rest. In addition, nesting material provides an excellent opportunity to promote foraging behavior. Foraging for food items mixed in straw, timothy hay, shredded paper or wood wool (natural wood excelsior) will occupy most animals for hours. Encouraging a time budget closer to that of wild orangutans that spend a large part of their day foraging for food, can help to reduce or eliminate the performance of abnormal behavior. Enrichment opportunities can be diet related. An animal's regular diet can be presented in many ways. For example, an animal can be encouraged to climb and look for their food by distributing their regular diet through out the enclosure instead of placing it in a single pile in the enclosure. Novelty, presentation method, and timing can all add variety to any program. For example, Barbiers 1985 study at Woodland Park Zoo found that orangutans consumed more monkey chow when it was

presented in varied colors. For example, if you routinely feed your animals twice a day, try offering 5 or 6 daily meals of smaller quantity. Feeding enrichment can help to reduce the occurrence of abnormal behavior and improve the physical condition of the animals (Young 1997). Since orangutans can easily become obese, encouraging animals to obtain their food in an active manner can help to alleviate this problem. Regular food items can be chopped into smaller pieces or frozen into a large block of ice. If you have feeding devices such as puzzle feeders or juice feeders, make sure that group dynamics, such as dominance relationships, are taken into account. To make sure that one dominant individual does not have exclusive access to the food, provide several enrichment locations so that subordinate individuals may benefit as well.

YOUR ENRICHMENT PROGRAM

Developing your enrichment program should be performed with the involvement of all relevant staff members including director, curators, veterinarians, behavioral husbandry managers, scientists, nutritionists, horticulturists and caregiver staff. Many zoological institutions utilize docents and volunteers for their ability to help find donations of materials used as enrichment. Introducing environmental enrichment to an animal will indeed require time from the caregiver. No matter who is providing the enrichment, a key component to any enrichment program's success is the dedication of the caregiver staff and support of supervising personnel. It is most likely going to provide an element of variety to the person's day as well, beyond the routine cleaning and diet preparation that occurs each day. When providing environmental enrichment, one must consider that the following will be necessary including: researching the species for which the enrichment will be given, locating the materials to construct the enrichment, fabricating the enrichment, monitoring its use and recording the effect of enrichment (Young 2003).

Kreger et al. (1998) contends that in order to develop an environmental enrichment program that maximizes both animal welfare while recognizing all other important concerns, zoological institutions must consider at least the following factors:

- Intended goal or use (purpose) of the animal or group
- The physical environment in which the animals are maintained and the alternatives available, if any
- The social environment in which the animals are maintained and the alternatives available, if any
- The species-specific needs of the animals
- Individual variation in behavioral repertoires
- Economic concerns, including human and financial resources
- Guidelines concerning animal welfare, including minimum housing and care standards, when available or legally mandated.

An effective enrichment program should be perceived as a thoughtful and enduring process and not be comprised of random acts. The program should be proactive, not reactive and should be based upon the animals' biological, social and cognitive needs. Each enrichment initiative should have a measurable goal that allows each animal to have choice and control in their environment.

In the 2007 accreditation guidelines of the AZA, a member zoo's enrichment program should meet the following criteria:

“A formal written enrichment program is recommended which promotes species-appropriate behavioral opportunities for appropriate taxa. [AC-39]

Explanation: It is recommended that an enrichment program be based on current information in behavioral biology, and should include the following elements: goal setting, planning and approval process, implementation, documentation/record-keeping, evaluation, and subsequent program refinement.”

To meet this guideline, Disney’s Animal Kingdom® Theme Park has developed a framework to help structure the entire enrichment process and many institutions are adopting this model and modifying it to fit their needs. The S.P.I.D.E.R. framework is made up of six major components: **S**etting goals, **P**lanning, **I**mplementing, **D**ocumenting, **E**valuating and **R**e-adjusting (see Appendix A). By following this framework when developing an enrichment program, you can ensure that the physical and psychological needs are met for each animal by allowing them to:

- Perform highly motivated behaviors
- Respond to environmental conditions using evolutionary adaptations
- Develop and use cognitive abilities
- Effectively cope with challenges in the environment.

For an explanation on the S.P.I.D.E.R. framework and how to use this model to develop and sustain a successful program at your institution see

www.animalenrichment.org/introduction/whyframework.htm. To help decipher what particular enrichment program goals are, it is important to look at all aspects of natural history, individual history, exhibit and holding space, and any husbandry/management constraints. Following a list of goal setting questions can help to achieve a successful program (see Appendix B). For further assistance, the AZA offers the course “Managing Animal Enrichment and Training Programs,” which provides managers with a background in developing these programs at their institution. See www.aza.org for more details.

Disney’s Animal Kingdom® Theme Park recognizes that many components of the framework are not unique and that most likely they resemble things that other institutions have already implemented as part of their enrichment programs. This framework is thought to be successful when there is a commitment to follow through all the steps from beginning to end. The process must be dynamic to keep pace with our constantly increasing knowledge about orangutans and their needs and to support our dedication to enhance their care, husbandry management and ultimately their welfare.

ENVIRONMENTAL ENRICHMENT DEVICES

Environmental enrichment is a term which is used to employ heterogeneous methods of improving animal welfare that includes everything from social companionship to toys (Young 2003). Bloomsmith et al (1991) identified five major types of enrichment, each with subcategories:

- (1) Social
 - (1.1) Contact
 - (1.1.1) Conspecific (pair, group, temporary, permanent)
 - (1.1.2) Contraspesific (human, non-human)
 - (1.2) Non-contact
 - (1.2.1) (visual, auditory, co-operative device)
 - (1.2.2) (human, nonhuman)
- (2) Occupational
 - (2.1) Psychological (tasks or puzzles, control of environment)
 - (2.2) Exercise (mechanical devices, run)
- (3) Physical
 - (3.1) Enclosure

- (3.1.1) Size (alterations)
 - (3.1.2) Complexity (panels for apparatus)
 - (3.2) Accessories
 - (3.2.1) Internal
 - (3.2.1.1) Permanent (furniture, bars, swings)
 - (3.2.1.2) Temporary (toys, ropes, substrates)
 - (3.2.2) External (hanging objects, puzzles, mirrors)
- (4) Sensory
 - (4.1) Visual (tapes, television, images, windows, lighting)
 - (4.2) Auditory (music, recordings of vocalizations)
 - (4.3) Other stimuli (olfactory, tactile, taste)
- (5) Nutritional
 - (5.1) Delivery (frequency, schedule, presentation, processing time required)
 - (5.2) Type (novel, variety, browsing, treats)

The type of enrichment devices and opportunities provided varies greatly between institutions. Consideration should be given to naturalistic versus non-naturalistic enrichment. A combination may be used: naturalistic while the animals are in public view and non-naturalistic in the holding enclosures. The options available for animals that are off public view can actually be more diverse and cost effective because the emphasis can be purely about function rather than aesthetics, like puzzle boards, toys and other artificial devices. See Appendix C for a sample of orangutan environmental enrichment devices divided into the categories above.

Designing environmental enrichment devices can be a time consuming and complex process. It is important to evaluate if the time, energy and money put into the device design is cost-effective.

Many enrichment items can be obtained at very low cost or for free. A notice can be posted on staff bulletin boards, listing the items you need, i.e., phone books, blankets, old toys or plastic pools. A pre-determined drop-off location for donations can be established for staff, docents or volunteers. Working with local vendors or zoological society members can also be a source of free or low cost enrichment items, such as burlap bags from coffee bean distributors or carpet rolls from flooring companies. Sharing ideas on list servs such as redapekeepers@lists.aza.org and enrich@lists.aza.org can be an excellent means to increase variety at your institution. Caregivers should work with their managers to develop an appropriate enrichment rotation for their facility. Appendix D contains an example of a four week enrichment rotation.

SAFETY

Use of any enrichment device or item should be approved by curators, veterinary staff and nutritionist for each individual animal. There have been many documented cases of animal injury related to unsafe environmental enrichment devices, including many great apes that have drowned in deep water moats, ingestion of rope that resulted in fatality, strangulation by loose rope and zinc toxicosis from galvanized metal. The following list of questions from Young (2003) should be kept in mind (more details can be found in chapter 5 of this reference) when developing and implementing an environmental enrichment device (which includes ropes, chains, etc):

- Does the device have any sharp edges?
- Can the animal's digits, limbs or other appendages become trapped inside any part of the device?

- How likely is it that the animal could break the device? If the device could be broken, would it break into sharp fragments or would the constituent parts of the device pose a safety risk?
- Could the device be dismantled by the animal? If the device could be dismantled would any constituent parts pose a safety risk?
- Can the device or any part of it be swallowed?
- Is the device made of non-toxic material?
- Could the animal gnaw pieces off the device?
- Can the device be cleaned adequately or sterilized to prevent disease transmission?
- Can the animal become entangled in the device?
- Could the animal use the device as a weapon against cagemates, animal caregivers, or other people, e.g. the public in a zoo?
- Could the animal use the device to damage its enclosure? This is especially important in enclosures with glass windows. Orangutans in some zoos have learned that a sharp blow with a hard object to the corner of a bomb-proof window will shatter the glass.
- Could the animal use the device to facilitate escape from its enclosure?
- Can the animal see the object?
- Are devices using electronics properly earthed and insulated?
- Can the device be filled and maintained quickly?
- Does the installation of the device block any caregiver access to restrict view of the animals?
- Does use of the device require the caregiver to enter the enclosure?
- Is the device of the simplest design possible?

Once you have followed the safety guidelines, the finished device should be product tested before it is given to an animal. Some basic tests include the drop test, sharp edge and seams test and testing the strength of the seams and attachments. When using metal chains and connections, the use of stainless steel should be investigated. It is highly durable and will not rust or eventually become a hazard as galvanized metal would. Strong connections with glue such as Loctite® are recommended since an orangutan has no problem loosening screws or bolts that would take a human hours to tighten with tools.

BROWSE

The benefits of browse as a form of environmental enrichment have been well documented. Offering browse to orangutans regularly as part of your enrichment program provides nutritional supplements to their diet, stimulates natural behavior activities as well as helps to decrease unwanted or stereotypic behaviors. The provision of browse may contribute to reductions in the expression of coprophagia (more commonly observed in gorillas than orangutans) and regurgitation/reingestion (R & R) behavior (Maple and Perkins 1996). By offering more complex food items that may require increased processing time in order to consume, feeding time cannot help but be increased.

Before offering an animal any type of browse material, it is imperative that each plant species be researched for the poisonous potential of all aspects of the plant. Consult any general reference material on browse species you plan to offer and get veterinary approval prior to feeding it to an animal. For more information on toxic plant species you may consult this database:

www.library.uiuc.edu/vex/toxic.htm. Additional references regarding toxic plants may also be found at this website.

Animal Browse and Enrichment Surveys conducted at 36 zoological institutions around the world in 1998 and 2003 have yielded a large, comprehensive list of approved browse species that is mostly orangutan specific. This reference guide can be located in the Orangutan Husbandry Manual (See

Orangutan Browse List, this volume).

An ideal way to obtain browse for orangutans is to contact local councils or parks for donations of browse during routine pruning operations. You must be sure that any material received in donation is not sprayed with any toxins, such as pesticides, or has been subjected to high levels of pollution. When fresh cut browse is received and not fed immediately, it may be stored in containers with water or in cool rooms to maintain freshness. In areas where colder climates do not allow for year round growth outdoors, browse may be put in containers and frozen to prolong availability.

Many zoological institutions have created successful botanical gardens on their premises. For example, Melbourne Zoo has introduced some 800 plant species to their botanic collection, while the Cincinnati Zoo and Botanical Garden houses a living museum of over 3000 plant species from around the world. Cleveland Metroparks Zoo and the San Diego Zoo also feature extensive botanical collections as well.

Herb gardens have been grown at zoological institutions in North America, Europe and the Middle East with mixed reviews. While many gardens are planted directly in animal exhibits, some animals show interest in free browsing while others are disinterested. Apenheul Primate Park was the first institution to experiment with herb gardens about twenty years ago. Cousins (2006) reviewed the literature on the benefits of herbs and medicinal plants positioned in and around primate enclosures. While research indicates that wild animals have the innate ability to self-medicate by utilizing various medicinal plants, a note of caution is required as almost all medicinal plants are toxic, and if used excessively, can have adverse effects on an animal's health.

Providing browse to your orangutans is a simple means to form a connection between caregivers and visitors through education. Discussing the many benefits of browse with visitors is an easy way to help connect people with animals and nature. While many zoo guests recognize browse as a form of food, they may observe orangutans using browse in many different ways. Some animals use browse in affiliative play interactions between conspecifics, use browse to build a sleeping nest as they would do in the wild or as a tool to extract hard to reach or hidden food items.

NOVELTY

Novelty and variability is an important part of any enrichment program. Adding a variety of novel objects will reduce the rate of habituation and give an individual more choices. Studies show that enrichment programs that offer novel items result in a reduction in lethargy of orangutans (Wright 1995). Avoid boredom by rotating enrichment devices and food items (see Appendix D for an example of an enrichment rotation calendar). When many environmental enrichment devices are available, they can be utilized on a bi-weekly or monthly basis. Food items used with the devices can be changed regularly to encourage novelty.

Daily record keeping (documentation) is important to a successful enrichment program and the S.P.I.D.E.R. framework. It will be difficult to evaluate your enrichment program for any adjustments while ensuring variability without keeping records on the animals' acceptance.

CONCLUSION

Caring for an orangutan's psychological well-being is equally as important as caring for their daily physical needs. Orangutans need to be provided with daily environmental enrichment in order to prevent boredom and to promote species-typical behaviors. The 2007 AZA accreditation guidelines

states that a formal written enrichment program is recommended of each member zoo. The Orangutan Species Survival Plan© (SSP) encourages every institution that houses orangutans to develop their own enrichment program, combining exhibit design, social grouping, husbandry routine, available budget, individual animal needs and caregiver time. The animal should be allowed some means to determine their own daily schedule and be provided with some element of control over their environments.

There are many sources for nonhuman primate enrichment products, especially in the United States. Appendix E contains a partial listing of companies that manufacture products that would be appropriate for most orangutans. As always, an evaluation of the orangutan and their behavior should be conducted prior to obtaining new enrichment devices. While one individual may be gentle, another may be highly destructive in nature. Animals may change over time and so the enrichment that used to be safe may no longer be suitable. Continual evaluation is a necessary part of your enrichment program. Following your institution's approval process for new environmental enrichment and evaluation of all aspects of enrichment for safety are crucial as well.

The Orangutan SSP believes that environmental enrichment is a critical aspect of orangutan management. It is our responsibility as orangutan caregivers and managers to provide our animals with the best possible care and environmental enrichment is an excellent way to accomplish this.

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TRAINING COURSES, ORGANIZATIONS AND CONFERENCES

Training Courses

Active Environments Inc.

This commercial company runs fee-paying training courses in animal training and environmental enrichment but their expertise is primarily in animal training. Contact: Active Environments Inc., 7651 Santos Road, Lompoc, CA 93436, USA.

Active Environments Training and Enrichment Workshop: July 10-13, 2007.

“Managing Animal Enrichment and Training Programs”

See www.aza.org for details.

Organizations and Conferences

Conferences and workshops are a great place to share your ideas and thoughts about environmental enrichment. They are also a great place to ask questions of other professionals who care for orangutans. Conferences are also a means to make new contacts as well. While attending a conference can be costly, there are a number of professional organizations that provide financial assistance for their members who present papers at conferences.

International Conference on Environmental Enrichment (ICEE)

This conference is held in different locations around the world once every two years (on odd year numbers). The conference focuses on zoo animals with presentations ranging from zoo keepers to academic scientists. Details of the conference and information on conference proceedings are listed in the *Shape of Enrichment* website at www.enrichment.org.

Shape of Enrichment
1650 Minden Dr.
San Diego, CA 92111-7124
Fax: 619.279.4208

American Association of Zoo Keepers, Inc. (AAZK)

AAZK is a nonprofit (U.S. 501c3) volunteer organization made up of professional zoo keepers and other interested persons dedicated to professional animal care and conservation. The National Conference is hosted by a different institution yearly. For more information go to: www.aazk.org.

3601 SW 29th Street
Suite 133
Topeka, Kansas 66614-2054, USA

The Animal Behavior Management Alliance (ABMA)

The Animal Behavior Management Alliance, (ABMA) is a not-for-profit corporation with a membership comprised of animal care professionals and other individuals interested in enhancing animal care through training and enrichment. The ABMA is intended to be nurturing and informative, and was created to serve trainers, handlers, and keepers of animals, irrespective of species, with information and assistance in the behavior management of their charges. The ABMA Annual Conference is hosted by a different institution yearly. For more information go to: www.theabma.org.

Animal Behavior Society (ABS)

A professional society that represents academics interested in animal behavior and related subjects, such as animal welfare in the Americas. ABS co-publishes the journal *Animal Behaviour* with ASAB. The society organizes annual themed conferences and has funding available to support members who present papers at conferences and to support small research projects. For more information go to: www.animalbehavioursociety.com.

Association for the Study of Animal Behaviour (ASAB)

ASAB is a professional society much like ABS, interested in animal behavior and animal welfare in Europe and beyond. It has funds available to support members who present papers at conferences and small research projects, including grants for undergraduates. For more information go to: www.asab.org.uk.

Association of British Wild Animal Keepers (ABWAK)

This organization represents the interests of British zoo keepers. It publishes the magazine *Ratel* and other zoological documents such as *Enrichment Guidelines* and also organizes occasional meetings. For more information go to: www.abwak.org.uk.

Universities Federation for Animal Welfare (UFAW)

This is an organization that promotes animal welfare through scientific research. UFAW publishes the journal *Animal Welfare*. It has funding available for undergraduates and post-doctoral students in welfare-related subjects. UFAW holds occasional conferences. For more information go to: www.ufaw.org.uk.

Orangutan SSP© Husbandry Workshop

Chicago Zoological Society- Brookfield Zoo is pleased to host the first Orangutan SSP Husbandry Workshop October 16-18, 2007. This workshop will focus on the care and management of the orangutan in a zoological park setting. The workshop will bring together orangutan caregivers and managers, researchers and field biologists to share and disseminate the most current information on husbandry, conservation and emergent issues pertaining to captive and wild populations of orangutans. For more information, please contact the Orangutan SSP Husbandry Advisor, Carol Sodaro at carol.sodaro@czs.org.

Saint Louis Zoo is delighted to host the second Orangutan SSP Husbandry Workshop October 12-14, 2008. This workshop will focus on the care and management of the orangutan in a zoological park setting. For more information, please contact Terri Hunnicutt, Zoological Manager, Great Apes, Saint Louis Zoo at hunnicutt@stlzoo.org.

APPENDIX A

Source: <http://www.animalenrichment.org/introduction/enrichmentframework.htm>

ENRICHMENT FRAMEWORK

Setting Goals

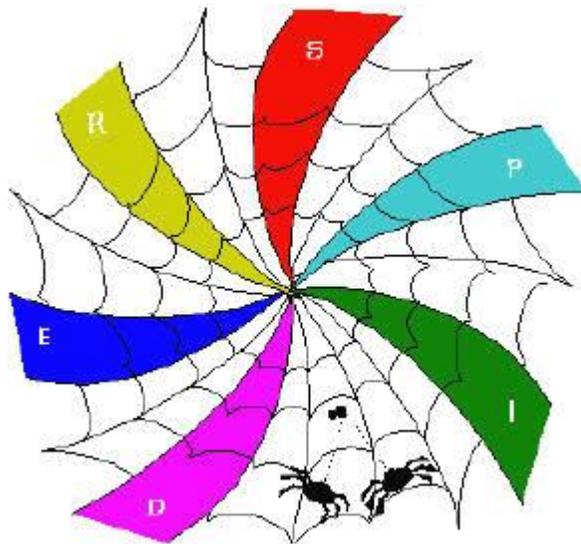
The goals of enrichment are to provide opportunities for the expression of species-appropriate behaviors, provide the animals with choices and control, decrease/eliminate abnormal behaviors, and provide the best guest experience. We use a series of questions to gather information on the natural history, individual history, and the current exhibits for each species. This information is used to identify specific behavioral goals, and to create specific enrichment ideas that promote these behavioral goals.

Re-adjusting

Based on the evaluation of trends in the data, the goals and plan can be re-adjusted and the process started over again.

Evaluating

Staff routinely discuss any information collected and look for trends and patterns in that information. Staff should assess whether the enrichment initiatives are meeting their behavioral goals, and should assess whether they have enough information to be able to answer any questions they have about the way the animals interact with the enrichment.



Planning

Given a list of potential enrichment initiatives, next steps include:

- Completing the approval process;
- Building/acquiring enrichment items.

Implementing

Roles and responsibilities

- Who will do what by when?

Documenting

Keepers document animal's response to enrichment daily, collecting information that can be used to answer specific questions concerning whether the enrichment achieved its goal.

Key points for Enrichment Documentation:

- Asking specific questions about the way the animals interact with enrichment.
- Collecting information in a consistent and valid manner.

APPENDIX B

Source: <http://www.animalenrichment.org/goal%20settings/SCQuestions.htm>

DISNEY'S ANIMAL KINGDOM® THEME PARK

GOAL SETTING QUESTIONS

Natural History: Use good library references to obtain this information.

1. What is this species' wild habitat (e.g., desert, tropical rainforest, cover, moisture, concealment/camouflage options, temperature ranges, barriers from conspecifics)? (If specific information on a particular species is unknown, provide information on closely related species/genus/family.)
2. How does the animal in the wild behave in response to changes in temperature and weather? What temperature/humidity range does it experience in the wild?
3. What are some self-maintenance/comfort behaviors (e.g., preening, grooming, bathing, dust-bathing, wallowing, sunning, panting)? Is there a seasonal molt/shed?
4. When is it most active (diurnal, nocturnal, crepuscular)? Why (e.g., predator avoidance)? Does the activity pattern change seasonally?
5. Does the species in the wild inhabit primarily arboreal, terrestrial or aquatic environments or does it switch between them at times?
6. What are the main threats to the animal in the wild? What is it likely to be afraid of (e.g., conspecifics, humans)? What different types of predators does it have to look out for in the wild? Are there any anti-predator behaviors (e.g., broken-wing display)? Where and how does the animal seek refuge in the wild from fearful situations (e.g., loud noises like thunder)? What does fearful behaviors look like?
7. What are its primary sensory modalities (e.g., sight, smell, sound) for communicating with conspecifics, detecting predators and for finding food, mates, or other social partners?
8. What is the social structure of this species (e.g., solitary, dyads, "harem," colonial, leks, polyandry)? What is the average/typical group size?
9. What is the average distance between social group members and from neighboring conspecifics?
10. Describe the primary social behaviors of this species (e.g., aggression, courtship, affiliative, play).

APPENDIX B

Source: <http://www.animalenrichment.org/goal%20settings/SCQuestions.htm>

11. Does the social structure change seasonally or throughout the animal's life (e.g., juvenile versus adult, bachelor groups)?
12. Does this species defend territories? Does it maintain a home range? What is the size of the home range/territory? Does this species migrate seasonally?
13. How does the animal advertise its home range or territory (e.g., scent marking, song)? How does the animal attract a mate (e.g., displays, scent marks)? Who displays?
14. Where does the animal raise young (nest location/type, den)? What materials does it use to build nests/prepare dens? Are both sexes involved in rearing young? Are the young precocial or altricial? How are the young fed?
15. How does the animal locomote through its habitat?
16. What is the animal's diet type (e.g., omnivore, carnivore, herbivore, nectivore) in the wild? Does diet change seasonally? By age?
17. What does the animal feed on in the wild? What variety of food does it need to eat? What behaviors does it use to locate and procure the different types of food it needs? Does it use tools to obtain food? Store/cache food?
18. Where does the animal sleep or rest? Does that change seasonally?

Any other considerations?

Individual History: Review information in ARKS and related studbooks.

1. Does this animal have any medical problems (e.g., arthritic, obese, diabetic, missing digits, wing damage, pinioned)?
2. Does this animal have any behavioral problems (e.g., fearful/aggressive to humans, stereotypy, feather plucking)?

Any other considerations (e.g., exhibit at previous institution, hand-raised)?

Current Exhibit: Review information in related husbandry manuals.

1. What is the size of the animal's enclosure (exhibit and holding area)? What are the containment barriers (e.g., chain link, moat)?

APPENDIX B

Source: <http://www.animalenrichment.org/goal%20settings/SCQuestions.htm>

2. Can the animal use all components of its exhibit? Can it hide? For example, how many places could this animal be out of view of its cagemate?
3. How functional is the current exhibit? Does the exhibit facilitate/allow the animal to exhibit natural behaviors? How does the animal interact with exhibit elements?
4. Where and how is the animal's food (normal diet, enrichment, browse) provided? Does the animal have a preference for one feeding site over another?
5. Does the physical environment contain elements of novelty (e.g., weather changes, can furniture be changes easily)?
6. What are the animal's opportunities to feed/forage, breed, socialize in species-appropriate ways? Do/can/should animal interact with other species in exhibit?
7. Can the animal exhibit normal patterns of behavior? Are components of the physical environment available for this to occur?
8. Can the animal make choices about where and how it spends its time? Does the animal have control over acquisition of food? Access to hiding places? Protection from the elements?
9. Are there any hazards in this enclosure?

Any other considerations?

APPENDIX C

Social

Contact	Non-Contact
pair or group housing positive reinforcement training	co-operative device Direct sight and sound Use of mirrors, television/video, recordings view and hear others

Occupational

Psychological	Exercise
puzzle feeder, busy box, crib toy computer based research on cognition tasks, positive reinforcement training, painting or coloring	sway poles, vines, cargo nets, climbing structures, aerial pathways, ladders, elevated platforms hanging feeders substrates that promote foraging and nest building

Physical

Enclosure	Accessories
rotate between holding space and exhibit firehose structures, including hammocks and swings flooded floor, indoor/outdoor Ability to interchange items- having multiple locations for connections of structures, feeders, sleeping sites	Internal <i>Permanent:</i> cage furniture, platforms, swings, sway poles, shelves, cage front mesh <i>Temporary:</i> sheets, blanket, burlap, clothes cardboard boxes, paper bags, phone books, newspaper durable toys toilet paper, butcher paper plastic containers spoons, boomer balls bubbles, tires, barrels, paper mache External hanging objects, puzzles, mirrors, objects to manipulate, painting, juicers, forage tubes

Sensory

Visual	Auditory
DVD/VHS, television, images, windows, lighting	music, recordings of vocalizations, nature sounds
Olfactory	Tactile
spices, scents, herbs, perfume ads	other animals, painting, coloring drawing, food extraction
Taste	
novel food items, cooked, steamed, frozen foods	

Nutritional

Delivery	Type
multiple small feedings, variable schedule hidden foods, whole vs. finely chopped foods, food painted on walls, in log feeders or frozen into ice treats	novel foods, seasonal availability, special treats, browse, insects

APPENDIX D

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A.M. FOOD	Wood shavings FP: rice	Juicers Browse	Bark chip FP: alphabet pasta	Dry crystal light Browse	Jell-O boards & balls	Large ice treats Browse	Bed-o-cob FP: dry mix
EXHIBIT	Wood shavings FP: rice	Crickets Browse	Bark chip FP: alphabet pasta	Dry crystal light Browse	Alfalfa	Large ice treat Browse	Forage balls: spices & dry mix
P.M. NON FOOD	Clothes & blankets	Bird paper Bubbles- Bubble King	TV Super Beds: 1 bale wood wool	PVC pieces	Spoons	Scents & heat lamp	Water
P.M. FOOD	Popcorn mealworms	Crickets Puzzle feeders	Small ice treats	Yogurt: 1cup per group	Alfalfa & paper mache	Bark chip FP: Raisin Bran	All- U-Can Drink Crystal light
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A.M. FOOD	Wood wool & popcorn	Dry Jell-O Browse	Bark chip FP: puffed rice	Juicers Browse	Jell-O boards & balls	Large ice treat Browse	Bark chip FP: cracked corn & sunflower seeds
EXHIBIT	Wood wool & mealworms	Dry Jell-O Browse	Bark chip FP: puffed rice	Water shower Browse	Alfalfa	Large ice treat Browse	Applesauce on branches
P.M. NON FOOD	Water Nuts and bolts toy	TV	Switch movable objects	Shredded paper	Tires Nature music	Mulch in tubs	Clothes & blankets
P.M. FOOD	Cooked rice & mealworms	crickets	Yogurt 1 cup per group	Honey forage tubes	Small ice treats Puzzle feeders	Wood shavings FP: enrich bits	Applesauce 1 can per group
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A.M. FOOD	Wood shavings FP: dry mix & mealworms	Dry crystal light Browse	FP BOC seeds 1C. per group	Jell-O boards and balls Browse	Large ice treats	Juicers Browse	Bark chip FP: puffed rice
EXHIBIT	Wood shavings FP: dry mix & mealworms	Juicers Browse	scatter 1 cup seeds paper mache	Spices on exhibit Browse	Large ice treat Log feeder	Warm water shower Browse	Bark chip FP: puffed rice
P.M. NON FOOD	News paper	Clothes & blankets	PVC pieces	Bird Paper	TV Bubbles- Bubble King	Water & bird mister	Crib toys Bimples
P.M. FOOD	Popcorn with spices	Alfalfa	Raisin phone books	Crickets Puzzle feeders	hard shelled nuts	Frozen yogurt cubes	Small ice treats
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A.M. FOOD	Wood shavings FP: elbow pasta	Juicers Browse	Bed-o-cob FP: dry mix	Jell-O in small PVC pieces	Large ice treats Browse	Yogurt on cage front	Bark chip FP: puffed rice
EXHIBIT	Wood shavings FP: elbow pasta	Crickets Browse	Scatter dry mix	Alfalfa	Large ice treats Browse	Yogurt on branches	Bark chip FP: puffed rice
P.M. NON FOOD	Switch movable items	Burlap Nature music	Boxes & spices	Nuts and bolts toys	Scents or fresh herbs	Water	Heat lamp and space heaters
P.M. FOOD	Popcorn Worms	Cricks	Raisin paste in forage tubes	Alfalfa	Paper mache	Dry crystal light in socks & Puzzle feeders	Small ice treats

*Example of a 4 week enrichment rotation
(FP= forage pile)*

APPENDIX E

Companies that manufacture and/or supply nonhuman enrichment products:

Absolute Primate Enrichment Systems (A.P.E.S.)

241 N. Dobson
Burleson, Texas 76028, USA
Phone: 817.228.2283
Fax: 817.426.4815
Email: lwood@absoluteprimate.com
Internet: <http://www.absoluteprimate.com>

Description: Supplier of a wide range of enrichment products including balls, feeders, chew toys, tug rings and perches. Company also custom makes products to fit individual environments.

Aspen Pet Products, Inc.

4735 Florence Street
Denver, Colorado 80238, USA
Phone: 303.375.1001
Fax: 303.375.7592
Internet: <http://www.aspenpet.com>

Description: Creates unique products such as Bimples, a BOODA Bones® product.

Aussie Dog Products

P.O. Box 308
Ferntree Gully Victoria 3156, AUSTRALIA
Phone: +61 3 9752 3336
Fax: +61 3 9758 3020
Email: aussiedog@aussiedog.com.au
Internet: <http://www.aussiedog.com.au>

Description: Manufacturer of purpose-built, safe, durable toys and products for all animals, especially dogs, horses and a growing range of zoo animals including nonhuman primates.

Bio-Serv

One 8th Street, Suite 1
Frenchtown, New Jersey 08825, USA
Phone: 908.996.2155 OR 1.800.996.9908
Fax: 908.996.4123
Email: sales@bio-serv.com (sales); vetserv@bio-serv.com (veterinary assistance);
techserv@bio-serv.com (technical assistance)
Internet: <http://www.bio-serv.com>

Description: Produces and distributes food treats, foraging and grooming boards, challenger balls, toys and mirrors.

APPENDIX E

Chauvet®

3000 N. 29th Court
Hollywood, Florida 33020, USA
Phone: 954.929.1115 OR 1.800.762.1084
Fax: 954.929.5560 OR 1.800.544.4898
Internet: www.chauvetlighting.com

Description: Chauvet is a manufacturer and distributor of innovative products including bubble machines, fog machines and snow machines. Creator of the B-550 Bubble King™ (as mentioned in the sample environmental enrichment rotation).

Lomir Primate Enrichment Technologies

99 E. Main Street
Malone, New York 12953, USA
OR
95 Hout Notre-Dame-de-I'lle-Perrot
Quebec, Canada J7V 7M4, CANADA
Phone: 518.483.7697 OR 1.877.425.3604 (USA) OR 514.425.3604 (CANADA)
Fax: 518.483.8195 (USA) OR 518.425.3605 (CANADA)
Email: info@lomir.com
Internet: <http://www.lomir.com/pet>

Description: Producers of unique primate enrichment devices made of durable opaque polypropylene. Devices are designed to increase foraging time. See P.E.T. ® devices page.

MyTrainingStore.com

215 Daffodil Road
Southern Pines, North Carolina 28387, USA
Phone: 910.246.6263
Fax: 910.692.8799
Email: info@mytrainingstore.com
Internet: <http://www.mytrainingstore.com>

Description: Suppliers of training supplies such as clickers, whistles and lanyards, and distributor of Active Minds Enrichment Gear (AMEG). The toys are durable enough for all types of animals and come in unique colors and shapes. They can customize each shape according to your needs.

Otto Environmental, LLC

6914 N. 124th Street
Milwaukee, Wisconsin 53224, USA
Phone: 414.358.1001
Fax: 414.358.9035
Email: jeff@ottoenvironmental.com
Internet: <http://www.ottoenvironmental.com>

APPENDIX E

Description: Supplier and manufacturer of enrichment products, foraging devices and other equipment. The company works closely with zoo facilities.

Sanctuary Supplies

Phone: 877.886.1992

Email: kathy@sanctuarysupplies.com

Internet: <http://www.sanctuarysupplies.com>

Description: Supplier of hard to find supplies needed by animal sanctuaries, zoos, rescues and shelters. Products include enrichment devices, cleaning items and housing supplies for all animal species.