

Enrichment Gone Wrong!

Valerie J. Hare, Beth Rich, and Karen E. Worley

The Shape of Enrichment, Inc., San Diego, United States of America

Abstract

By definition, an enriched environment offers more potential for harm than a sterile environment. Yet, the behavioral, physical, and welfare benefits of providing an enriched environment are generally considered to outweigh the risks and, thankfully, enrichment efforts continue to increase worldwide. To further reduce risk, responsible caretakers make every reasonable effort to anticipate and prevent harm from occurring. Regrettably, harm, and even death, have occurred as the direct result of providing enrichment. But these events, and the details of the enrichment involved, are rarely made public, presumably to avoid negative press and professional embarrassment. Unfortunately, reluctance to share this information may contribute to additional harmful outcomes. Information, even anecdotal, about the hazards of enrichment can be invaluable to other animal-care professionals, as they design enrichment plans and devices for their animals. This paper consists of a collection of anonymous, anecdotal accounts of enrichment gone wrong presented in a safety-oriented context.

Introduction

An enriched enclosure is inherently more dangerous than a sterile enclosure. Toys, furniture, manipulanda, vegetation, feeding devices, “movable” perching, substrates, indeed, virtually all enrichment strategies offer a myriad of potential hazards. Yet, for our captive animals’ physical and psychological welfare, we are ethically (and sometimes legally) compelled to provide enriched enclosures. Hartley (2006) has compiled a useful review of the physical, behavioral, and psychological health issues that may be caused or exacerbated with enrichment.

This paper will focus primarily on the physical dangers known to have occurred as a direct result of an enrichment plan. The following three areas of safety concerns are discussed: (I) Animal and Cagemate; (II) Public and Staff; and (III) Escape and Keeper Access. All examples given are either from the authors’ personal experience or have been reported directly to the authors by individuals with first-hand knowledge of the incidents.

I. Animal and Cagemate Safety Concerns

The most obvious safety concern is for the animals themselves or their cagemate(s). Animal hazards include ingestion, entanglement, suffocation, entrapment of body parts, tooth damage or impaction, and so on. Depending on the animal involved, any of these may require anesthesia and/or surgery to correct. Regrettably, some have resulted in an animal’s death.

Body Part Entrapment – Holes

Example 1. Fishing Cat and PVC Tube

To increase the difficulty of catching live fish by providing them a refuge, a PVC tube was added to the pond in a fishing cat (*Felis viverrinus*) enclosure. The tube was large enough in diameter to readily allow the cat’s paws to move freely in and out of it. However, the diameter was also large enough to allow the cat to insert his head but small enough that he became stuck (Fig. 1). The cat panicked and, in his attempts to push the tube off his head, severely damaged his claws. Fortunately, he was anesthetized and the tube was successfully removed. Although this cat recovered, death due to drowning or hyperthermia was considered a realistic outcome of this entrapment.

Enrichment Gone Wrong!

Example 2. Elephant and Truck Tire

Many elephant yards have suspended truck tires for the elephants to manipulate. Although one zoo had such a tire in the enclosure for years, one elephant managed to get her rear foot caught in the tire interior. The elephant was clearly distressed as she tried to remove her foot. Although staff were aware of the problem immediately, they were unable to devise a plan to quickly extricate the elephant. Fortunately, the elephant was eventually able to free her foot.

Example 3. Maned Wolf and Feeder Ball

A three-year-old male maned wolf (*Chrysocyon brachyurus*) received his overnight diet in a feeder ball. He was discovered the following morning with his lower jaw stuck in the hole (Fig. 2). He was anesthetized and the ball was successfully removed; the wolf escaped with mild lacerations.

TIP — Hole Size

During initial and revising phases of design, be sure to consider hole sizes. Remember that holes must be either too large (so inserted body parts cannot become stuck, Fig. 3) or too small (to prevent insertion of body parts). Measurements taken during routine medical examinations can be helpful when determining appropriate sizes. If these measurements are not available, good approximations may be obtained from biofacts available in your zoo (Education Departments are a good source for these!). If, for example, you have access to a skull from the species you are interested in, you could measure its jaw size and add a few millimeters to accommodate the tissue on a living animal's jaw. Approximations can be also be made from measurements from a similar species.

Due to species, gender, and individual variations, hole size must be determined to be safe for each animal to receive this enrichment. It is important to remember that juveniles and other cagemates, whether the intended user of an enrichment item or not, will have access to most items placed in their enclosure. These individuals may vary greatly in size from the intended animal. The hole size must be safe for all individuals who may interact with the enrichment item.

Finally, each item should be checked before every presentation to ensure that holes have not become enlarged, split, or have sharpened edges, etc. (Fig. 4).

TIP — Materials

The maned wolf example (Ex. 3; Fig.2) above was not only a hole-size problem but also one of the material used. Soft, flexible rubber or plastic balls allow too much variability in size and shape to be safe in many situations. With a flexible ball, the hole size could change shape (with pressure) and allow the insertion of the lower jaw. Yet, once the pressure was removed, the hole size returned to normal and the jaw could not be extracted.

Hard, inflexible balls, such as a Boomer Balls®, do not allow a change in hole shape or size. It is difficult to tell from the photo, but the hole size may actually have been sufficiently small to prevent the wolf's jaw from being



Figure 1. An unsafe hole size for this fishing cat.



Figure 2. Flexible rubber feeder ball lodged on a maned wolf's lower jaw.



Figure 3. An example of a safe, large hole size for squirrel monkeys (*Saimiri sciureus*).

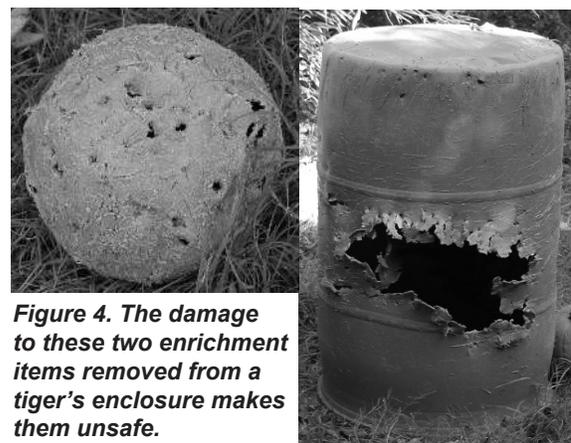


Figure 4. The damage to these two enrichment items removed from a tiger's enclosure makes them unsafe.

Valerie J. Hare, 2008

Valerie J. Hare, 2006

inserted. Had this feeder been made from a Boomer Ball® or similarly inflexible ball, this situation may have been prevented.

TIP — Overnight and Unsupervised Enrichment

The maned wolf example also raises the issue of unsupervision. Overnight is often identified as a key time for offering enrichment, especially for nocturnal species or animals that must be locked into small sterile night quarters for many hours. Yet, often no one is available to check on the animals throughout the night. Only items that have been deemed safe for an individual animal, based on sufficient observations of that animal’s interactions, be considered for use at night or whenever the animal is unsupervised. Potential concerns, such as hole size, should be identified and corrected before offering the device unsupervised.

Body Part Entrapment - Hanging Materials

Over the years, we have encountered numerous anecdotes of amputated body parts (fingers, hands, feet, limbs), damaged or extracted teeth, horns, and antlers, and strangulation resulting from ropes, strings, or chains used in enrichment strategies.

Example 1. Cockatoo and Rope

A round baleen enclosure with branches, a nest box, natural vegetation, parrot chew toys, and rope housed a pair of Moluccan cockatoos (*Cacatua moluccensis*). The birds used the rope for both climbing and chewing, causing it to become severely frayed after a few months. One morning, the male was found dead, dangling upside-down by one leg that was entangled in the frayed rope (Fig. 5).



Figure 5. This cockatoo lost its life due to frayed rope.

Example 2. Maned Wolf and Bungee Cord

A six-inch-diameter ball was hung on a bungee (elastic) cord at nose height for a maned wolf. When the wolf pounced on the ball with its forelegs, the elastic was stretched and the ball pulled toward the ground. When the wolf’s leg slipped off the ball, it became wrapped in the cord. Fortunately, the wolf remained calm and was able to extricate itself fairly quickly.



Figure 6. Dangling lengths of fire hose are too short and stiff to present significant entanglement risk to these Hamadrayas baboons (*Papio hamadryas*).

Example 3. African Lion and Garage Door Spring

A burlap bag stuffed with branches was hung on the end of a garage door spring and the spring was covered with fire hose. When the lion (*Panthera leo*) pulled on the burlap with his forelegs, he extended the garage door spring past the fire hose. He bit on the connection point where the burlap met the spring and his tooth became caught in the spring. When he realized he was stuck, he stopped moving and, thankfully, didn’t panic. The keepers reported “they could see the wheels turning” in his head as he was trying to figure out how to extricate himself. Luckily, he remained calm, pulled back on the burlap bag, and then removed his mouth from the spring.



Figure 7. Small-diameter PVC encases a garage door spring to prevent a tiger’s claws, lips, etc. from becoming trapped in the spring. The PVC is twice the length of the spring so that even if fully extended, the spring is entirely inside the PVC (Hare and Jarand, 1998).

TIP — Hanging Materials

The length, stiffness, and thickness of the hanging material, mounting method, object weight, and positioning relative to exhibit surfaces should all be considered when hanging objects. With care, many potential dangers can be avoided.

Enrichment Gone Wrong!

Whenever possible, use lengths short enough to prevent the material from wrapping around the animal or its body parts (Fig. 6). Materials that are excessively thick and/or stiff (e.g. marine rope, fire hose), relative to the animal, are less likely to become wrapped around any part of the animal.

Encase springs, chains, or other dangerous materials in PVC or fire hose (Fig. 7). Note that in Figure 7, the tiger is prevented from direct contact with the spring but does have access to the chain. Ideally, the chain would be replaced by another material or encased in fire hose.

Be sure that the method of attachment does not allow opportunities for entrapment. For example, when tying rope or wire be sure you do not leave a “loop” that can be accessed by the animal. Also, be sure the ends remaining do not themselves create an opportunity for entrapment — either trim or secure them.

Judicious weighting and positioning of hanging objects can allow the safe presentation of otherwise unsafe enrichment items. Animals are unlikely to become entangled in rope that is used to hang objects that are too heavy for the animal to lift. Ropes that are positioned in such a way that the animal cannot access them other than from on the hanging object are also unlikely to become wrapped around the animal as their own body weight will prevent slack. Conversely, objects that are hung near elevated features of the enclosure are especially dangerous. In this situation, the animal can access the rope from an elevated position, creating slack, which can then become wrapped around a limb. Worse, if the animal falls from the elevated position, it can be left dangling, with no possible means of escape.

Finally, check the hanging materials in the enclosure often. Simple steps, such as trimming frayed edges off of ropes or replacing slipped cable ties, can literally make the difference between life and death!

Items Lodged in Mouth

Animals often use their teeth, tongue, lips, etc. to explore various aspects of their environment. These items can become lodged in the mouth or teeth, resulting in oral sores, loss of appetite, inability to eat, and even suffocation.

Example 1. Giraffe and Rubber Ball

A target made of a squash ball glued on a stick was used for training a young female Rothschilds giraffe (*Giraffa camelopardalis*). One day, the ball fell off the stick and, rather than re-gluing the ball, the staff replaced the ball and continued with the training session. Using her tongue, the giraffe pulled the ball off the stick and into her mouth, where it became wedged between her cheek and caudal molars (Fig. 8). In an effort to avoid anesthesia, staff massaged the giraffe’s cheek over the course of several days. Finally, just when surgery appeared inevitable, the ball was massaged out of the mouth.

The veterinarian who submitted this anecdote added the following comment. “I have found that there is a particular size of food item (i.e. squash-ball size) that tends to become wedged between the buccal mucosa and the molars of giraffes, presumably because of the way they pull the item into the mouth with the tongue — I have subsequently fed a piece of apple of a similar size to a giraffe during a transport, and watched (in horror) as she started throwing her head around in an attempt to dislodge the apple from the space. Fortunately, apple pieces quickly break up into apple mush and the situation resolved itself.”

Example 2. Carnivores and Burlap

Many large carnivores are given burlap (a.k.a. hessian) in a variety of ways. A lion (*Panthera leo*) in one zoo required anesthesia to remove burlap fibers that had become caught between its teeth (Fig. 9).

TIP — Items Lodged in Mouth

Assume that animals will attempt to swallow all or part of any enrichment item you introduce. Individual preferences should be



Figure 8. The squash-ball target.



Figure 9. Lions shredding burlap.

Valerie J. Hare, 2003

considered — it seems there are some animals that will eat anything, while others will not place non-food items in their mouths.

Offer items that are securely fastened (to prevent their disassembly into smaller pieces) and are too large, or too small, to become lodged in the teeth or mouth.

Whenever possible, use materials that, if they do become lodged in an animal's mouth, will be easier to dislodge (e.g. ice, small natural fibers) or cause minimal damage.

The flexibility of the item should be appropriate as well. Flexible items may appear to be of an appropriate size but could become a hazard as the animal manipulates the item, changing its shape or size. As long as their original form is safe, hard, inflexible materials that will not change in size or shape are likely to remain safe. However, there is a risk of pieces becoming lodged if they are broken.

Ingestion

Ingestion is one of the greatest areas of concern for most enrichment items today. For whatever reason, many animals ingest non-food items, causing serious health concerns, including irritation and blockage of the digestive tract.

Example 1. Fishing Cat and Cotton Cloth

Rabbit meat in a cotton cloth bag was hung from the top of a five-year-old male fishing cat's enclosure. Seven days later, he was reported as not eating and vomiting and small bits of cloth were found in his stool. The cause was found to be a large piece of the cotton bag obstructing the GI tract at the pylorus. Surgery was required to remove the obstruction and save the cat's life (Fig. 10).

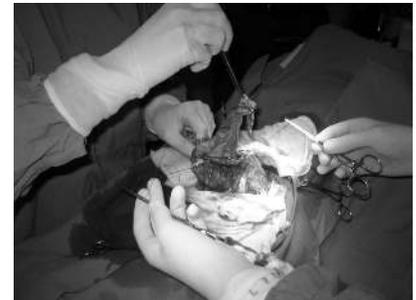


Figure 10. Removing the cloth swallowed by a fishing cat.

Example 2. River Otter and Cardboard Sonotubes

Sonotubes are cardboard tubes of varying lengths and diameters that are used as forms for poured concrete pillars. The authors have used these tubes for a variety of animals with no problem.

One anecdote submitted described the result of offering sonotubes with fish to Asian small-clawed river otters (*Aonyx cinerea*). One otter looked as if he couldn't open his mouth to eat. Once anesthetized, staff realized that the otter's mouth was "glued shut" with cardboard from the sonotube. This material was first loosened with warm water and then removed with dental tools. This otter made a full recovery.

Example 3. Brown Bear and Paper

An adult male brown bear (*Ursus arctos*) had been given paper bags containing lean meat over the course of many years. Recently, however, a wad of paper from this enrichment became trapped in his teeth and "glued" his mouth closed. While under anesthesia, staff required engineering clamps to pry the bear's jaw open to remove the paper. The bear recovered fully.

TIP — Ingestion

Assume that animals will attempt to ingest non-food enrichment items. As noted before, some individuals seem prone to ingest items, while others rarely do. Such noted traits are not infallible predictors but should certainly be considered when designing enrichment strategies.

Whenever possible, use those materials least likely to cause blockage (a.k.a. those most likely to pass through the digestive tract naturally), thus causing little or no harm. For example, when sewing sacks, use short strands (e.g. cut strand after every one or two stitches) of natural fibers rather than long or artificial fibers.

Mix food and ingestible non-food items with great care. From examples the authors have encountered over the years, the most important consideration appears to be the type of food offered. Cloth or burlap sacks, cardboard tubes and boxes, and paper wrappings are all common feeding devices that most animals appear uninterested in ingesting, as long as the food used does not stick to or become absorbed in the non-food

Enrichment Gone Wrong!

packaging. So, for example, kibble, nuts, seeds, insects, and dried fruit may not encourage the animal to ingest the packaging. But honey, peanut butter, jam, fresh fruit, and meat probably will.

Notes — Sonotubes

The person who submitted the sonotube anecdote added the following information. “I spoke with the manufacturer ... [and learned that] Sono Tubes are made out of recycled cardboard, plus a small amount of an adhesive product (I was told it is the same adhesive as is used in Elmer’s glue). Additionally, on the interior of the tube there is a very thin plastic liner/laminate that is heat-sealed to the cardboard.”

The manufacturer’s website (www.sonotube.com) does not mention what type of glue, if any, is used in the production of sonotubes. However, they do advertise a glue-free product, VoidForm[®], that may be a safer alternative. At the time of publication, we have not heard from anyone who has tried this product.

Beyond the Enclosure

Example. Orangutan and Light Bulbs

A pair (1.1) of hybrid orangutans (*Pongo X*) were given an 18-inch-long piece of 2-inch PVC pipe filled with food and stuffed with paper on each end. After the paper was removed and the food extracted, the male used the piece of PVC as a tool. He climbed to the top of the exhibit, poked the PVC through the top of the enclosure mesh, and broke all the light fixtures above the exhibit. When the keepers discovered the glass shards both animals were shifted into their off-exhibit areas and staff removed the broken glass and replaced the light bulbs.

Tip — Beyond the Enclosure

Remembering that items may change in size and shape due to the animals’ interactions and wear, offer untethered items of a size and/or shape that does not allow them to create dangerous situations. Untethered items should not be able to fit through the enclosure bars or mesh. Or, if they can be extended beyond the enclosure, be sure that they cannot be used to reach loose or unsafe objects with which to harm themselves (e.g. electric wires, bulbs, insulation, hoses, etc.) or staff and visitors (i.e. any loose item that can be tossed or pushed away from the enclosure). Items that could fit through the enclosure barriers should be tethered. See Tip — Expulsion of Items below (p. 42, Public and Staff Safety) for more details.

Aggression and/or Distress

Example. Orangutan and Piñatas

Piñatas were given to two groups (one Sumatran and one Bornean) of orangutans (*Pongo pygmaeus*) for the first time. One of the Bornean orangutans readily destroyed the piñatas as expected. However, the reaction was quite different with the Sumatran orangutan group of 3 adults and 2 juveniles.

“When we put them in, all hell broke loose! They were absolutely terrified! We have never seen them in such a state before. They were rasping and bellowing and going for each other in sheer panic.”

The staff were unable to remove the items, since the orangutans could only exit the yard by passing the piñatas on the ground. It was at least 2 hours before the staff were able to coax the orangutans out of the yard and remove the piñatas.

TIP — Aggression and/or Distress

To reduce the possibility of aggression or distress, it is important to consider the individual’s personality and history as well as the social system in the group. For example, an animal that has responded with distress to a wild snake entering its enclosure may be more likely to become distressed if its food is offered in a sausage casing. The individual’s past experience with this and other enrichment items should also be considered. The staff and volunteers’ experience with these individuals is the best source of this type information.

The determination of how many items to supply concurrently is often directly correlated to the strength of the group’s hierarchy. With a weak or undecided hierarchy, the addition of feeders or coveted items can lead

to varying levels of aggression or distress. In these cases, it is often best to offer far more items than should be “needed” to ensure all (or at least the more dominant) animals have access to one.

With a strong hierarchy, though, this “flooding” with enrichment items may not be necessary — or even desired, as the dominant individual will access whatever s/he wishes while the others wait their turn. In these cases, it can be especially interesting to offer feeders that are designed or placed so that the individual who manipulates the feeder may not be the one who obtains the reward.

Regardless of our best attempts at predicting our animals’ reactions to enrichment strategies, there is always a risk of increasing aggression, distress, or other dangerous behaviors. Thus, prior to offering the enrichment item, there should be a plan in place for the most efficient and low-stress method of shifting the animals and/or removing the item. This is especially important for previously untested enrichment strategies.

Disease-causing, Toxic, and Irritating Materials and Foodstuffs

Example 1. Tigers and Deer Hide

Three Amur tiger siblings (*Panthera tigris altaica*) had been given hanging deer hides as food enrichment about once a month since they were a year old. Staff were concerned that the hides might cause mild stomach discomfort but no symptoms were reported resulting from this enrichment.

On their second birthday, the tigers were given deer hides as birthday gifts for a publicly announced viewing. Unfortunately, this was the second such presentation in 8 days. After eating its birthday present, one tiger was found to be vomiting and have a loss of appetite. Impaction was suspected and exploratory surgery was conducted.

Fortunately, the tiger was not impacted but was suffering from acute gastritis — an irritation caused by the deer hide hairs — which was successfully treated. Whole deer hides are no longer presented, however the veterinarian has approved the use of small pieces or strips.

Example 2. Carnivores and Cayenne Pepper

Scents are often used for enrichment in carnivores. Exposure to even small doses of some scents can have a detrimental effect. Mucous membrane irritants, such as cayenne pepper, can cause irritation of the gums and eyes. Although these symptoms should resolve themselves with no long-lasting effects, they can be misleading to veterinarians unaware of the recent scent presentation.

Example 3. Bears and Salmon Poisoning Disease

Zoo polar bears (*Ursus maritimus*) have reportedly died due to salmon poisoning disease. This disease is contracted from eating contaminated live, raw, or incompletely frozen salmonid fish and is reported to be fatal in 90% of untreated dogs.

One zoo reported the occurrence of this disease in two sun bears (*Helarctos malayanus*). Fortunately, they were diagnosed early and with lengthy treatment, both made a full recovery.

TIP — Disease-causing, Toxic, and Irritating Materials and Foodstuffs

Transference of disease-causing materials among animals is a major concern for enrichment items. Of course, disinfection between offerings can reduce this risk. For a PVC feeder tube, this can be as simple as washing the item with the same disinfectant used for the cage floors (remember to rinse well!).

For transferring excrement or body parts, sterilization can be a bit more problematic. Elephant dung is apparently relatively clean of disease-causing agents and most veterinarians are willing to approve its use as enrichment for other species. Carnivore dung is less commonly approved.

Reptile skin sloughs, bird feathers, and carcasses (or parts thereof) are potentially invaluable enrichment items. However, many veterinarians will approve their use only if the items are sterilized with gas, autoclaved, or frozen, prior to their presentation as enrichment.

The authors’ intention for this section is to familiarize the reader with common health hazards associated with various enrichment practices. Veterinary staff should be consulted to ensure the development of effective and safe sanitation procedures.

Enrichment Gone Wrong!

Notes — PVC (Polyvinyl Chloride) and ABS (Acrylonitrile-Butadiene-Styrene Copolymer)

Over the years, the authors have worked with PVC to create enrichment items (usually feeders) for a wide variety of taxa. And, to our knowledge, PVC is quite safe as long as the items are carefully constructed and examined for wear prior to each use.

There has been much discussion about the pros and cons of PVC and ABS. ABS looks like black PVC and is often used because it is (a) less expensive and (b) not as unsightly in the enclosures. Both PVC and ABS contain toxic materials. However, we have heard that ABS leaches toxic materials into water, while PVC does not.

Checking the Material Safety Data Sheets (MSDS) for these products sheds little light on this subject. Both state that the materials are “not soluble in water” (Cook, 2005 and Anonymous, 2002). The PVC MSDS does not mention aquatic solubility (Anonymous, 2002), while the ABS MSDS states that “Aquatic toxicity: Toxicity is expected to be low based on insolubility of polymer in water” (Cook, 2005). Yet, in San Diego, California, ABS pipes may not be legally used to bring water into residential buildings; they are used to remove waste water. More investigation into these materials is needed.

As for the “look” in the enclosure, Holfinger and Fleuchaus (1998) shared their technique for burning PVC to cause it to look like wood. During the burning process, the toxic materials are released into the air, so we recommend conducting the burning out of doors and wearing breathing protection while burning. However, it is our understanding that once burned, the remaining toxic materials are still bonded in the PVC and do not represent a danger to the animals. If the burns are too deep, they can compromise the strength of the material and allow damage to occur more readily. You can also use a heat gun to “burn” PVC, which may be safer and easier to control.

II. Public and Staff Safety

The safety of our visiting public and staff is of utmost importance in most institutions and their safety must be considered when devising enrichment plans. The most likely public hazard resulting from enrichment is items being expelled from the enclosure and into the visitor areas. Two examples are presented.

Example 1. Fur Seal and Ice Blocks

Large fur seals (*Arctocephalus pusillus* and *A. tropicalis*) were given an ice block with a fish frozen inside. To provide a handle for the seals, toys were embedded within the blocks so that a portion of the toy extruded from the ice. Using this handle, one seal flung the ice block out of its pool and over the protective fence, striking a child’s head. Fortunately, the child sustained only minor injuries.

Example 2. Gorilla and Ice Blocks

An adult female gorilla (*Gorilla gorilla gorilla*) would throw ice blocks at the visitors when she felt threatened by the public.

Example 3. Brown Bear and Truck Tire

A singly housed, adult male brown bear (*Ursus arctos gyas*) was given a truck tire as a toy. Prior to this his only toy had been a beer keg tethered in his pool. He readily manipulated the tire and explored its different properties. Then, without any warning or hesitation, he flung the huge tire, Frisbee-like, out of the grotto enclosure and towards the crowd of visitors! Fortunately, no one was hurt as the tire sailed over the crowd and onto the open road behind them.

TIP — Expulsion of Items

The expulsion of items from meshed enclosures is readily prevented by offering items that are unable to fit through the mesh. Remember that through wear and tear, breakage, etc., items may not remain their original size and shape indefinitely.

The most common method to ensure that enrichment items remain in the grotto or “open” enclosures is to tether them to a permanent fixture. The safety hazards associated with tethering are similar to those with hanging objects (see Tip — Hanging Materials).

When freezing rope (or chain, etc.), in ice blocks for tethering be sure to loop or coil the rope in the water. This will give the ice a better purchase on the rope and ensure the tether remains anchored in the ice block longer. The easiest way to accomplish this is to use smaller ice cubes to hold the rope in place during freezing.

Other methods can be employed even in these open enclosures. Items can be designed to be either too large or too heavy for the animal to expel. A good example is the feeder ball (Gilbert and Hare, 1994) developed for Asian elephants (*Elephas maximus*). To prevent the elephants from tossing them out of the enclosure, the balls were made too large for them to wrap their trunks around (Fig. 11).



Valerie J. Hare, 1994

Figure 11. To prevent the elephants from throwing the feeder ball out of the enclosure, it was designed to be too large for the elephant's trunk to wrap around.

III. Animal Escape and Keeper Access

Unfortunately, animals have been known to use enrichment items to either escape or block doorways, preventing shifting or keeper access. Obviously, both situations are safety concerns for the animals, staff, and public.

One method of escape is to use enrichment items as a bridge over, or to fill, moats, allowing the animal to simply walk out of the enclosure. Among others, we have received reports of great apes and bears escaping this way. Logs, browse (e.g. bamboo), and trees seem to be the most common materials.

Also, powerful animals such as chimpanzees (*Pan troglodytes*), siamang gibbons (*Hylobates syndactylus*), and orangutans (*Pongo pygmaeus*) have all been reported to use enrichment items to crack and/or break the glass partitions of their enclosures, allowing escape or near-escape situations.

Example. Bonobo and Branch

Bonobos (*Pan paniscus*) ripped a branch off an aging climbing structure, propped it up against the side of their moated exhibit, climbed up the log, and exited the exhibit. To the great relief of keepers and veterinarians, all of the animals who escaped voluntarily returned to the enclosure. They were then secured in their night quarters while the section of climbing structure was removed.

TIP — Animal Escape and Keeper Access

When planning enrichment strategies, consider all manners in which these items could be used to block doorways or escape the enclosure. Permanent anchoring or tethering are common solutions.

For example, an Asian elephant feeder ball (Fig. 11) was later given to an African bull elephant (*Loxodonta africana*). The bull's enclosure contained areas where the ball could be used as a stepping stone, allowing him to walk out of the enclosure. So, the ball was modified for tethering and was chained to a concrete pad in the enclosure.

Another solution is to provide logs, trees, etc. that are either too small/short to be used as a bridge or too weak to support the animal's weight.

But the most important preventative strategy is to frequently evaluate the various aspects of the enclosure and enrichment items. What was once considered safe may no longer be safe, as the item has changed over time or there are different individuals in the enclosure. For example, one author recently saw a lovely, naturalistic brown bear enclosure that had been planted some years ago with appropriate saplings for shade and visual barriers. Over the years, the trees had grown and one — due to its strong trunk, overhanging branches, and location near the moat — now also provides a convenient escape route!

Enrichment Gone Wrong!

IV. Unanticipated Responses

While not safety issues, per se, the following anecdotes are invaluable for those of us trying to anticipate potential interactions with new enrichment strategies.

Sometimes Enrichment Doesn't "Work"

Example. Macaw and Climbing Structure

Blue-and-gold macaws (*Ara ararauna*) were presented with a bamboo, A-shaped, climbing frame. The bamboo had previously been in an enclosure with red pandas. Palm fronds were woven around portions of the frame and large pieces of fruit were skewered on the rungs. Although it was presented in various parts of the enclosure, none of the macaws were seen using it. The conclusion was that they were either uninterested or fearful.

TIP — Enrichment that Doesn't "Work"

If your enrichment strategy doesn't work, it is time to reassess.

Whenever possible, it helps to videotape the animals' response to new enrichment to help with assessment and redesign. Keeping in mind the established goals for these enrichment items and your best guesses as to what aspects failed to interest the animals, reconsider materials, design, and presentation.

For example, a Boomer Ball® was hung on a chain for tigers (*Panthera tigris*) to provide the opportunity to simulate a "kill." After assessing the original presentation (via videotape), all agreed that the goal wasn't met and the tiger's interest would fade quickly. So, the item was redesigned as a stuffed burlap sack hanging on a garage-door spring (Hare and Jarand, 1998). This design met (and exceeded) all expectations.

Finally, a reminder that although an animal may "ignore" an enrichment item, the animal is surely aware of its presence. There are any number of stimuli in an animal's environment that they do not appear to respond to. But it is important to remember that ignoring a stimuli is a choice! If the presence of the enrichment item achieves your goal (i.e. tiger pacing was reduced by the presence of watermelons; Melfi, 2007), even if it is ignored, it is still effective enrichment. In addition, the authors have both observed and heard numerous anecdotes that new enrichment items that have been ignored for several presentations often eventually elicit vigorous or strong interactions.

And Sometimes It "Works" Too Well!

Example. African Lions and Sensory Enrichment Items

To enrich 1.4 African lions (*Panthera leo*), burlap (a.k.a. hessian) was hung from two trees in the enclosure. One was a sack containing leaves suspended on bungee cord and the other a hanging strip, approximately 2.5 meters long and 1 meter wide (Fig. 12). Scents, brushes, and piles of branches, dirt, and camel wool were also placed in the enclosure.

The lions were intrigued by these novel items and slowly began to bite and pull on them. In fact, these items held their interest throughout the day — so much so that it they would not enter their night quarters until late the following day!

TIP — Enrichment that "Works" Too Well

Again, the key to success is to assess the design, materials, and presentation of the enrichment items. Encouraging animals to "forget" how to shift or lose interest in food is rarely, if ever, a target goal for enrichment!

An obvious solution to this problem is to remove such enticing items from their enrichment plans. However, we interpret their high interest as an indicator of their "need" for such diversions and interactions. Thus, we recommend offering these, and other enrichment strategies, more frequently!



Figure 12. Lion using the hanging burlap.

Valerie J. Hare, 2003

Conclusion

Environmental enrichment is now widely recognized as a necessity, not a luxury, for captive animals. Yet, an enriched environment is inherently more dangerous than a sterile environment. Therefore, we must make every reasonable effort to mitigate or eliminate potential hazards of the strategies in our enrichment plans.

The following steps may be helpful when considering enrichment safety issues:

- Create a standard checklist of potential safety hazards for ready reference;
- Thoroughly envision any and all ways your individual might interact with the item (consider individual personalities and histories as well as taxonomic information);
- Seek input on potential safety hazards from others (e.g. animal caretakers, educators, horticulture and construction staff, volunteers);
- Prior to offering enrichment items, create a staff response plan to use in the event of a problem;
- Observe each animal's interactions with new enrichment;
- Revise the enrichment items based on the animals' interactions; and
- Share your safety information!

The purpose of this paper is to raise awareness of enrichment safety hazards, so as to prevent future injuries. Our purpose is not to discourage enrichment efforts but to encourage safe enrichment practices! It is the authors' opinion that the more institutions and individuals are willing to make this information public, the more potential hazards can be avoided!

There are a number of journals, websites, and listserves that can help distribute this information. *The Shape of Enrichment* publication is one. And, coming soon, The Shape of Enrichment website (www.enrichment.org) will be maintaining an anonymous safety page. Please contribute your experiences!

Acknowledgments

Most of the examples in this paper were given in response to a worldwide request for safety-related anecdotes. Some were also presented in detail at the 1st Australasian REEC in November 2006. Our sincerest thanks go out to all of you who contributed. We understand that it is not easy for any of us to share our failures, even anonymously, and we appreciate those of you who recognize that your cooperation may prevent future disasters!

References

- Anonymous. 2002. *PVC and CPVC Materials Safety Data Sheet*. Solus Industrial Innovations, LLC.
- Cook, Steven. 2005. *Materials Safety Data Sheet, ABS*. City Plastics: Brompton, Australia.
- Gilbert, Jane and Hare, Valerie J. 1994. Elephant feeder balls. *The Shape of Enrichment*, 3(4):3-5.
- Hare, Valerie J. and Jarand, Paul. 1998. Artificial prey that fights back (and other tales of tiger enrichment). *The Shape of Enrichment*, 7(3):1-4.
- Hartley, Andy. 2006. Environmental Enrichment – Friend or Foe? *Proceedings of the 1st Regional Environmental Enrichment Conference 2006*. Paignton Zoo Environmental Park:UK.
- Holfinger, Margit and Fleuchaus, Dawn. 1998. Originator of burnt PVC idea found! *The Shape of Enrichment*, 7(1):12.
- Melfi, Vicky. 2007. Personal Communication.