

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Proceedings of the 1st UK and Ireland Regional Environmental Enrichment Conference.

14th – 17th May 2006.

Paignton Zoo Environmental Park, UK.



Monday 15th May

- **The Development and Progression of the Primate Enrichment Timetables at Paignton Zoo.**
 - Tony Dobbs and Andy Fry- Paignton Zoo Environmental Park.
- **Environmental Enrichment: Friend or Foe.**
 - Andy Hartley- Zoological Society of London.
- **A Novel Approach to Feeding Enrichment for Tufted Capuchins.**
 - Lisa Berrill- Twycross Zoo.
- **We don't do enrichment! '(but we do good husbandry)'.**
 - Simon Marsh- Chester Zoo.
- **Enrichment, a Natural Evolution.**
 - Holly Farmer- Paignton Zoo Environmental Park.
- **Team work; supporting Environmental Enrichment at Paignton Zoo.**
 - Phil Knowling- Paignton Zoo Environmental Park.
- **An overview of how the Environmental Enrichment Forum has tried to stimulate the use of enrichment within the Zoological Society of London.**
 - Greta John- Zoological Society of London.

Tuesday 16th May

- **What makes an effective enrichment?**
 - Dr Vicky Melfi- Paignton Zoo Environmental Park.
- **Does the provisioning of carcasses compromise the health of zoo housed carnivores?**
 - Kathy Knight- Paignton Zoo Environmental Park.
- **Can environmental enrichment compensate for not providing carnivores with live prey?**
 - Lucy Manning- Paignton Zoo Environmental Park.
- **Comparing the effects of novelty versus independent movement in enrichment for large felids.**
 - Mark Kingston Jones- University of Stirling.
- **High Browse; improving giraffe enrichment at Dublin Zoo.**

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

- Helen Clarke- Dublin Zoo.
- **Creating an environment for Owston's palm civet.**
 - Owen Taylor- Newquay Zoo.
- **Environmental Enrichment effects on visitor stay time.**
 - Sanne Te Strote, Joanna Bishop- Paignton Zoo Environmental Park.
- **Enrichment for a Mixed Species Exhibit Housing Lowland Anoa (*Bubalus depressicornis*) and Sulawesi Crested Macaques (*Macaca nigra*).**
 - Helen Wade and Nicky Jago- Paignton Zoo Environmental Park.
- **Enrichment on a huge scale; programmes for the Asian Elephant.**
 - Andy Durham- Zoological Society of London.
- **Foraging enrichment; a mixed blessing for vicunga.**
 - Matthew Parker- University of Southampton.
- **Enriching the dragon.**
 - Dr Ian Stephen- Zoological Society of London.

Wednesday 17th May

- **How can we measure the effects of Environmental Enrichment? – Workshop and discussion.**
 - Amy Plowman- Paignton Zoo Environmental Park.
- **How can we measure if training is enriching?**
 - Dr Vicky Melfi- Paignton Zoo Environmental Park.
- **Keeper interaction and animal husbandry as a form of enrichment.**
 - Yianna Christopoulos- Paradise Wildlife Park.
- **Is Environmental Enrichment feasible in a small zoo?**
 - Tracey Moore- Shaldon Wildlife Trust.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

**The development and progression of the Primate Enrichment Timetables at
Paignton Zoo.**

Tony Dobbs and Andrew Fry, mammal keepers.
Paignton Zoo Environmental Park, Mammal Department, Totnes Road, Paignton, Devon,
TQ4 7EU.
Telephone: 01803 697500, Email: bigbonobo@hotmail.com, andrewcfry@yahoo.com

Abstract

Paignton Zoo is home to a large number and range of primates. All these primates are intelligent and require a lot of stimulation to be provided to them to avoid stereotypical or stress behaviours. This is done through the provision of enrichment devices. We have been providing this enrichment as part of a successful enrichment programme (EP) since June 2004. The timetables used as part of this EP have undergone a number of changes since we originally started the programmes; this talk aimed to discuss these changes and the reasons behind them.

The original EP was designed for trial on our Sulawesi crested macaques (Macaca nigra). All our enrichment devices were categorized into one of three groups; those based around food, those that stimulate the senses and those that are objects to be manipulated. Each day the keeper selected the enrichment to be used from one of the lists. Once used that device had been ticked off the list it was not used again during that month's enrichment cycle. The category of enrichment used rotated daily according to a timetable; food, scent, food, manipulative, food and so on. Each day using enrichment was followed by a refresh day; this means the device was reused, refilled or simply moved to a different location within the enclosure on the second day. Each month there would be two non-enrichment days to avoid the animals becoming habituated to the devices. The principle of the EP was to be easy to follow (as we had several people on the section) and quick (to avoid the possibility of us making excuses about time and skip days).

When we moved to the new Monkey Heights complex the decision was made to create timetables for four other groups, two groups of Abyssinian colobus (Colobus guereza kikuyuensis), a group of king colobus (Colobus polykomos) and a pair of Diana monkeys (Cercopithecus diana). This meant that we needed to make adjustments to the timetables. Due to the limited number of each type of device it was necessary to stagger the timetables so that while two of the groups were on food based enrichment the other three would be on a sensory based enrichment. The most recent change to the timetables was made when it was discovered that we had more devices than were needed for the monthly rotation of the timetable. As a result a number of devices, especially the more complex ones, were being avoided each month. Therefore, the decision was made to change from a monthly rotation to a two monthly rotation, thus ensuring that all devices were being used.

We feel that these enrichment programmes have been extremely successful. This has been highlighted by the fact that we have been able to continue the programme long term and allow it to evolve. This talk was an expansion of the poster presented by Lisa Doran at ICEE 2005, New York.

Introduction

Paignton Zoo is home to a large number and range of primates. All these primates are intelligent and require a lot of stimulation to encourage natural behaviours and avoid stereotypical or stress behaviours. This is enhanced through the provision of enrichment devices.

This report will discuss why an enrichment timetable is advantageous to staff and animals, describe how the timetable format was created and explain how the enrichment was broken down into categories. It will also discuss the progression of the timetables at Paignton Zoo to the position that we are currently in.

Why our enrichment timetables are advantageous.

There are three main reasons why an enrichment timetable was created for the primates at Paignton Zoo;

- To provide regular enrichment to the primates. A timetable ensures that enrichment is provided on a regular basis over a set period of time.
- To prevent repetition. With no records of previous enrichments being used it was difficult for keepers to know which enrichment items had been provided. This was made even harder on a larger staffed section with keepers who had different days off and holidays.
- To avoid “keeper laziness”. If a straight forward timetable is put in place and records are kept, this simplifies the process for keepers thus not taking up to much time making it possible to provide enrichment even on days with limited staff time. Enrichment can even be made up in advance, such as the day before.

How our enrichment timetables were created.

Up until June of 2004, most of our primates had received enrichment in one form or another but it had been noted by many of the keepers that some enclosures were not receiving enrichment on a regular basis and that certain enrichments were being repeated on a regular basis. This was a particular problem for our group of Sulawesi crested macaques (*Macaca nigra*) who were housed a distance from our monkey house where enrichment items were stored. Also as this group is large, destructive and very inquisitive, discussions began as to the best way to provide enrichment.

Our senior head keeper of mammals (Julian Chapman) was consulted and suggested a monthly timetable. In order for this to be established, it was necessary to divide our enrichment devices into one of three categories based on their primary roles (see figure 1);

- Food based devices- interesting ways to present food.
- Sensory based devices- to stimulate the senses, olfactory (smell), visual (sight) or auditory (sound).

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

- Manipulative based devices- to encourage play.

This categorising led to the first problem. It was soon discovered that some devices could be classified into more than one category. For example, a standard Kong could be classified as a sensory device due to its bright colour, or as a manipulative device due to its design as a toy. It was decided that the device would be classified according to its primary function, in the case of the Kong, as a manipulative device.

Another issue was that the categorizing of a device would change according to how the device was provided. Using the Kong as an example again; providing the Kong on its own is classed as a manipulative device (as above). However, if it is stuffed full of food or scented herbs it becomes a food based or a sensory based enrichment respectively. Therefore, it was agreed that a device could appear in more than one category in the timetable, on the assumption that the device was provided in a different manner in each category.

TYPE OF ENRICHMENT	WHEN USED AND COMMENTS
<u>FOOD BASED</u>	
LIVE FOOD FEEDER	
FORAGE POLE	
PUZZLE FORAGE POLE	
½ BASKET FEEDER	
WHOLE FEED ON ROOF	
ASTROTURF	
BAMBOO FEEDER	
SEEDED BARK	
FRUIT KEBABS	
PINATAS	
CAGE WITH WHOLE FOOD	
CAGE WITH PUZZLE BALL	
CAGE WITH SACKS	
CAGE WITH STRAW	
CAGE WITH KONG	
KONG	
<u>SENSORY BASED</u>	
SUN CATCHERS	
DRIPPING WATER	
HONEY WATER	
SCENTED WOODCHIPS	
SCENTED TOILET ROLLS	
SENSORY KONGS	

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

<u>MANIPULATION BASED</u>	
RATTLES IN A CAGE	
ICE BLOCKS	
HANGING SACKS	
BROWSE	
PAPER SACKS	
EGG BOXES OR TRAYS	
CARDBOARD BOXES	
CARPET TUBES	
GREG'S FINGER DEVICE	
BOUY	

Figure 1. The original list of devices in their categories.

Once all of the devices were categorised, it was possible to create the timetable (see figure 2).

	DATE	TYPE OF ENRICHMENT	WHAT WAS GIVEN AND COMMENTS
SATURDAY		FOOD	
SUNDAY		REFRESH	
MONDAY		SENSORY	
TUESDAY		REFRESH	
WEDNESDAY		FOOD	
THURSDAY		REFRESH	
FRIDAY		MANIPULATIVE	
SATURDAY		REFRESH	
SUNDAY		FOOD	
MONDAY		REFRESH	
TUESDAY		NO ENRICHMENT	
WEDNESDAY		SENSORY	
THURSDAY		REFRESH	
FRIDAY		FOOD	
SATURDAY		REFRESH	
SUNDAY		MANIPULATIVE	
MONDAY		REFRESH	
TUESDAY		FOOD	
WEDNESDAY		REFRESH	
THURSDAY		SENSORY	
FRIDAY		REFRESH	
SATURDAY		NO ENRICHMENT	

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

SUNDAY		FOOD	
MONDAY		REFRESH	
TUESDAY		MANIPULATIVE	
WEDNESDAY		REFRESH	
THURSDAY		FOOD	
FRIDAY		REFRESH	

Figure 2. The Original Timetable.

All enrichment days were repeated, on the second day the enrichment was either refreshed/refilled and/or repositioned to another part of the enclosure. This was only done for two days to avoid animals becoming too familiar with the device. Once the device had been used once in the month cycle, it was not used again until the following month.

There were two non-enrichment days included per month to avoid the animals becoming habituated to the presence of devices. We also discovered that these days appeared to enrich the animals themselves as they seemed to spend time actively looking for the devices even when there are none present.

Food-based enrichment appears twice as often within the timetable compared to the other categories. This was solely due to us having double the amount of food based enrichment devices available to us. (Note that all food used for enrichment is taken from the animals daily diet, this avoids over-feeding or variations from set diets).

The timetables were made easy to follow and fill out. A copy of the timetable (Figure 2) was printed out and stored in the keeper's food preparation area. Each day, the date and the type of enrichment used were recorded. The device list (Figure 1) would also be printed and the date was recorded next to the name of the device to avoid repetition. We were also able to record any additional comments on this sheet such as the scent used with sensory enrichments, or the success of a new device.

The progression of the primate enrichment timetable.

Due to the success with our macaque group the decision was made, when we moved to the new monkey height complex, to create timetables for four other groups, two groups of Abyssinian colobus (*Colobus guereza kikuyuensis*), a group of king colobus (*Colobus polykomos*) and a pair of Diana monkeys (*Cercopithecus diana*). This meant we needed to make adjustments to the timetables due to the fact that our limited number of each device meant all five groups could not have the same device at the same time..

This was simply done by staggering the timetables. Figure three shows the staggered timetable.

	DATE	TYPE OF ENRICHMENT	WHAT WAS GIVEN AND COMMENTS
SATURDAY		SENSORY	
SUNDAY		REFRESH	
MONDAY		FOOD	
TUESDAY		REFRESH	

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

WEDNESDAY		MANIPULATIVE	
THURSDAY		REFRESH	
FRIDAY		FOOD	
SATURDAY		REFRESH	
SUNDAY		NO ENRICHMENT	
MONDAY		SENSORY	
TUESDAY		REFRESH	
WEDNESDAY		FOOD	
THURSDAY		REFRESH	
FRIDAY		MANIPULATIVE	
SATURDAY		REFRESH	
SUNDAY		FOOD	
MONDAY		REFRESH	
TUESDAY		SENSORY	
WEDNESDAY		REFRESH	
THURSDAY		NO ENRICHMENT	
FRIDAY		FOOD	
SATURDAY		REFRESH	
SUNDAY		MANIPULATIVE	
MONDAY		REFRESH	
TUESDAY		FOOD	
WEDNESDAY		REFRESH	
THURSDAY		FOOD	
FRIDAY		REFRESH	

Figure 3. The Staggered Timetable.

Comparing the original and new timetables (Figure 2 and Figure 3) the difference is that the first two days of the timetable have been moved from the top of the timetable (see Figure 2) to the bottom of the timetable (see Figure 3). The original timetable was then used for three primate groups and the staggered timetable for the remaining two. This meant that while three of the groups were provided food based enrichment, the other two would be provided sensory based enrichment.

The device lists also had to be adapted according to the variations in enclosure design for each of the species. For example, one of our Abyssinian colobus groups has a mesh roofed enclosure, whereas all of the indoor enclosures at Monkey Heights have solid roofs and all the primates housed in the Monkey Heights complex have mesh training windows providing another potential enrichment method. Each enclosure therefore provides the opportunity to present enrichment devices in a different way.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

TYPE OF ENRICHMENT	DATE USED	TYPE OF ENRICHMENT	DATE USED
FOOD BASED		SENSORY BASED	
Forage Pole		Suncatchers / disco ball	
Puzzle Forage Pole		Honey water	
Astroturf		Scented water	
Bamboo Feeder		Scented Kongs	
Seeded Bark		Scented pine cones	
Kebabs		Scented woodchip/sawdust	
Box Kebabs		Scented toilet rolls/carpet tubes	
Carpet Tube Kebabs		Scented eggboxes	
Piñatas		Scented cardboard boxes	
½ Baskets		Scented shredded paper	
Cage with whole food		Scented straw (in a cage)	
Cage with puzzle ball		Herb paste	
Cage with sacks		Frozen herbs/herb ice cubes	
Cage with straw/shredded paper			
Cage with Kong		MANIPULATION BASED	
Cage with boxes/egg boxes		Rattles (in a cage)	
In training windows		Ice blocks	
Food in boxes/egg boxes		Paper sacks	
Food in sacks		Egg boxes/trays	
Food in toilet rolls/carpet tubes		Cardboard boxes	
Kongs		Carpet tubes	
Frozen food		Toilet rolls	
Stuffed pine cones		Buoys	
Blue barrels		Rubber balls/Kongs (empty)	
		Boomer balls	
		Greg's finger device	
		Pine cones	

Figure 4. The Extended List of Devices.

Most recently it was discovered that more devices were available than were needed for the monthly rotation of the timetable (see Figure 4). As a result a number of devices, especially the more complex ones or those that took a long time to set up, were being avoided each month. Therefore, the decision was made to change from a monthly rotation to a two monthly rotation thus ensuring that more devices were being used. The new two monthly timetable is shown in figure 5.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

TYPE OF ENRICHMENT	MONTH 1			MONTH 2		
		DATE	WHAT AS GIVEN		DATE	WHAT WAS GIVEN
FOOD	SAT			SAT		
REFRESH	SUN			SUN		
SENSORY	MON			MON		
REFRESH	TUES			TUES		
FOOD	WED			WED		
REFRESH	THUR			THUR		
MANIPULATIVE	FRI			FRI		
REFRESH	SAT			SAT		
FOOD	SUN			SUN		
REFRESH	MON			MON		
NOTHING	TUES			TUES		
SENSORY	WED			WED		
REFRESH	THUR			THUR		
FOOD	FRI			FRI		
REFRESH	SAT			SAT		
MANIPULATIVE	SUN			SUN		
REFRESH	MON			MON		
FOOD	TUES			TUES		
REFRESH	WED			WED		
SENSORY	THUR			THUR		
REFRESH	FRI			FRI		
NOTHING	SAT			SAT		
FOOD	SUN			SUN		
REFRESH	MON			MON		
MANIPULATIVE	TUES			TUES		

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

REFRESH	WED			WED		
FOOD	THUR			THUR		
REFRESH	FRI			FRI		

Figure Five. The new two monthly timetable.

Conclusion

There are plans to progress our timetable even further to incorporate more species such as spider monkeys due to join our collection shortly and expand to other animal groups; currently a timetable is being considered for our Rodrigues fruit bat (*Pteropus rodricensis*) colony. When we have created enough devices we will probably move to a three-month timetable system.

The primate enrichment timetables have been very successful and ensure a large selection of enrichment devices are used for a wide range of primate species. From starting with a one-month single group timetable, we have now evolved to a two month five group timetable.

Acknowledgements

- All the primate keepers, past and present, for their assistance in the creation and implementation of the timetables.
- Julian Chapman, for his assistance with the original concept.
- Paignton Zoo's science department, for their help in the production of both the talk and this report.
- And the monkeys, for their participation.

Environmental Enrichment – Friend or Foe?

Andy Hartley, Scientific Officer.

The Zoological Society of London, Whipsnade Wild Animal Park, Dunstable,
Bedfordshire, LU6 2LF, United Kingdom.
Tel: 01582 872161, Email: andy.hartley@zsl.org

Abstract

The practice of environmental enrichment is always the source of discussion from a variety of angles, whether these focus on the need for..., type of..., assessment of... or mode of inclusion... they are but a few examples. There is surely no doubt however, that the implementation of enrichment protocols, in whatever format, is paramount to our collective responsibility to ensure the wellbeing of the stock we maintain in captivity.

Our individual responsibility however, is also critically important as it is “I” or “my team” that dictates when, how and which specific enrichment protocol is implemented on a given occasion. Youthful enthusiasm is very often the enrichment driving force within many zoological collections but we all have a duty to ensure the systems are suitably managed to safeguard against a variety of pitfalls, both of a primary category such as the risk of physical injury, or secondary, which may include the implications of changing the visitor impact of an exhibit.

Too much emphasis on the negative consequences would of course be counter-productive but when fed into the behavioural and physiological needs equation, they can take on a very positive spin in guiding and driving forward the enrichment programmes within our living collections.

Introduction

Environmental Enrichment in captive animalia, as a broad concept, is very much gaining in both application and discussion. I do not wish to try and clarify the definition and ethics other than to state that I personally view the concept as a means to either ensure we are providing an apt habitat, including all the usual management trimmings and/or using enrichment as a remedial tool to reduce what we consider to be unwelcome behaviours, whether these be stereotypic, anti-social etc in nature. Very often, the task of implementing enrichment is claimed by young and sometimes relatively inexperienced keeping staff, although this is of course not exclusive. Consequently, it is my intention to merely highlight a number of issues which are standard husbandry points but may well be inadvertently under-considered when implementing the enrichment protocols.

The array of species which we actively “enrich” is vast and all have their own peculiar key aspects. Attempting to prioritise the issues I raise is thus impossible but can be broadly categorised as either :-

- a) Primary – These would have a direct impact on animal welfare, or
- b) Secondary – For which there is an indirect impact via hindering the process of effective environmental enrichment programmes.

Primary Considerations

- 1) The masking of underlying causes of perceived problematic behaviour may be a consequence of a “successful” enrichment programme. If at all possible, the likely causes of distress should be addressed as well as the provision of enrichment to off-set the likelihood of the real problem remaining, albeit in a sub-visible and sub-clinical state.
- 2) Scatter feeds appear to be part and parcel of numerous enrichment programmes and although they are highly beneficial in terms of allowing the encouragement of foraging behaviour, extending true feeding times and assisting the development of social bonds etc, they may also lead to the compromise of the animals’ health if done without consideration. Obvious problems would include the intake of an imbalanced diet due to individuals selecting limited food types, this would of course be compounded should the exhibit be mixed or contain multiple individuals with a social hierarchy in place. The imbalances could lead to subtle influences such as breeding depression through to mineral overload of toxic proportions and lethal consequences.

Additional implications of feeding enrichment in general would also include the risk of over-feeding and subsequent weight gain, novel food items could have deleterious effects if introduced in large proportions and, for example, whole carcass feeding of carnivores should be very carefully considered to ensure no single component of the carcass could be problematic if routinely consumed (liver and feathers being rich sources of vitamin A and Cystine respectively, which can be harmful to a number of species groups if over consumed).

In order to reduce any nutritional compromise, all the items used within an enrichment programme should be a part of the scheduled daily diet and their intake monitored.

- 3) Social exclusion and/or increased tension with associated behavioural problems can be the unfortunate result of either insufficient opportunities to use the enrichment provided or even due to the inappropriate positioning of the enrichment devices.
- 4) The risk of physical injury can never be eliminated from any enclosure; however the risk can easily be significantly increased by the use of inappropriate materials/apparatus design.

For instance, the spinal injury as a consequence of the failure of structures supporting enrichment devices on which species are encouraged to hang or swing have occurred and primate’s fingers have been dislocated or detached when trapped in chains of incorrect size or use. These are but two examples and I am sure, each animal collection can offer other examples that have occurred within their own domain.

- 5) Behavioural restriction has been reported as a consequence of over provision of enrichment devices within an enclosure. This could be an easily introduced problem in bird aviaries where the opportunity to have free flight is impeded by the introduction of excess aviary furniture.
- 6) The accidental reinforcement of negative behaviour patterns could become an issue if the type and timing of enrichment introduction is such that the individual animal is able to interpret the introduction as a reward for showing certain behaviours. This has been reported to me in person as having occurred with both cat and primate species, but I would not expect this to be exclusive to these two taxonomic groups.
- 7) The use of puzzle feeders is of great benefit in terms of providing environmental enrichment. We must be mindful however of the need to ensure the feeders are cleanable and are cleaned on a regular basis to ensure there is no risk of pathogen build-up. On a similar basis, the use of cleaning agents also needs to be considered to safeguard against the accumulation of certain types of disinfectant etc, which may have an accumulative effect on the species involved. The effects of chemical build-up to either sub-clinical or pathologically toxic levels should also be borne in mind when choosing the materials to be used.
- 8) Inter-enclosure movement of materials (e.g. faeces, urine) to be used for enrichment purposes may warrant initial discussion with the institution's veterinary department as the potential risks of either pathogen or pharmaceutical transfer may be of increased importance depending on the species and individuals concerned.

Secondary Considerations

Although the issues below may not have a direct effect upon animal welfare, it could be argued they do impact the effectiveness of enrichment programmes.

- 9) The partitioning of staff may result from the delegation of enrichment protocols to certain individuals. This could lead to non-delegated staff members leaving the enrichment application to others and consequently a fragmented system would result.
- 10) Under the often met criteria of limited resources, the use of re-cycled materials may be a key part of an enrichment programme. The ingenuity of keepers, in certain circumstances could work against the grain of enclosure appearance expected by the higher zoo management. This issue could of course be resolved in-part by the use of appropriate signage explaining the conditions viewed by the visitors and also dialogue across the zoo management levels.
- 11) Employees are being increasingly protected by health and safety legislation, whether this be in relation to the use of power tools or through to safe working heights etc there is bound to be an influence on the array of environmental

enrichment that keepers are able to offer. Although these conditions may seem restrictive, they are not prohibitive and can be over-come via forward planning and having a considered enrichment protocol timetable in place rather than trying to work on an ad-hoc basis.

- 12) Time issues and true cost implications are often a major hindrance to effective enrichment. But as above, the use of a structured enrichment timetable for a given enclosure should assist the planning required for the implementation of the enrichment from a manpower perspective and also ensure the maximum effect is achieved from each enrichment by allowing a sufficient interval between uses etc. The timetable however, must be viewed as dynamic and be allowed to evolve to cater for the creativity of the keeping staff and enable new forms of enrichment to be incorporated.

Conclusion

The principles adopted by the implementation of environmental enrichment are not new and should in any case be very much a part of our animal management thinking and husbandry practices. Within the captive management protocol for any species, there is always a raft of welfare guided do's and don'ts. The provision of environmental enrichment is integral to this process and although some key issues are noted above, they all sit comfortably within these standard husbandry practices. My over-riding aim for this presentation was not only to ensure they are rightfully considered but also show to highlight that environmental enrichment to be correctly considered to be a part of animal husbandry and not an appendix to it.

Acknowledgements

My thanks go to those keepers at a number of institutions who were prepared, anonymously, to share with me the problems they had encountered in the name of environmental enrichment.

A Novel Approach to Feeding Enrichment for Tufted Capuchins *Cebus Apella*.

Lisa Berrill, New World Primate Keeper.
Twycross Zoo, Burton Road, Atherstone, CV9 3PX.
Tel: 01827 880250.

Abstract

Many post enrichment studies have indicated that many devices commonly used in zoos appear to have a limited 'shelf life', a value that can decrease over a set period of time. As a result, many novel devices are used until the individual appears to have 'lost interest', after which a new novel device may be introduced or as is more common the same device will be re-used, thus defeating the object of environmental enrichment. However with careful management, many novel enrichment devices can be reintroduced and used long after the longevity an 'average' enrichment device.

The purpose of this study was to determine the effects of novelty on environmental enrichment in captive primates by assessing the usage of feeding devices, all of which are of varying complexity. It does so by investigating the length of time taken for the usage of the device to decrease below 25% of the total usage observed during the first day of introduction. A successful reintroduction is one where the total usage of the device is almost equal to that observed during the first day of introduction, (over 75% of the total usage observed during the first day).

Preliminary findings indicated that novel enrichment devices, if done on a rotational system, can be reintroduced successfully and, as previously mentioned novelty can be maintained indefinitely.

Introduction

The purpose of this study was to determine the effects of novelty on environmental enrichment in captive primates, more specifically, tufted capuchins *Cebus apella*, by assessing the usage of feeding devices, all of which are of varying complexity. With their relatively large brains and facility for learning, capuchins are the obvious choice for enrichment studies, as their surroundings and diversity of social interactions affect much of their behaviour (Fragaszy 2004).

As outlined above, post-enrichment studies have indicated that many of the devices commonly used in zoos appear to have a limited 'shelf life'. Unfortunately, many novel devices are used until the individual appears to have 'lost interest', or as is more common the same device will be re-used, thus defeating the object of environmental enrichment. But what if there is a way in which you could reintroduce the same novel items without the items losing their overall 'value'. This study was designed to address this assumption by assessing the behavioural responses of capuchins to the introduction and subsequent reintroduction of objects over a set period of time.

Hypotheses

- The novel objects will promote higher durations and frequencies of manipulation of all objects.
- The capuchins will become habituated to the simpler forms of novel enrichment first such as the feeder poles, followed by the containers, and finally the seed dispenser.
- The novel objects will require 'resting' periods according to their level of complexity, for instance the more stimulating the device, the greater the interval period required to recapture novelty.

Method

The study first defined the novelty period by investigating the length of time taken for the usage of the device to decrease below 25% of the total usage observed during the first day of introduction. Once usage had declined, the device was then removed in order for the 'interval/resting' period to be defined. A successful reintroduction is one where the total usage of the device is almost equal to that observed during the first day of introduction. However, if an unsuccessful re-introduction occurred, another day was added onto the overall 'interval/resting' period until usage had increased above 75% of the total amount usage observed during the first day of introduction. (Please note that for the purpose of this study 'usage' was when an individual interacted directly with the device or was seen to be consuming food obtained from the device and was positioned within one metre of the same device).

Why Select this Method? Normally, the success of enrichment is measured when there are changes in the animal's behaviour and many studies have clearly shown that enrichment devices are generally found to cause a change in activity. As a result, it was considered appropriate to assume that these behaviours were affected as a direct result of using the device as the focus of the investigation was to determine how novelty affects usage and how long the interval or 'resting' period must be in order for successful reintroductions to occur.

Please note that all of the materials used for the purpose of this experiment were the result of previous studies undertaken at the zoo and/or enrichment devices that were already in use in many different sections around the zoo, for instance, hanging feeder poles are used for many of the higher primates, as well as being used for many Old World Monkeys (Mason, 1993). Fortunately these enrichment devices were easily adapted so that they could be used for the purpose of this investigation.

Subjects

The subjects are both currently housed in Primate House, at Twycross Zoo– World Primate Centre, Warwickshire. The subjects of the study were two unrelated tufted capuchins; one juvenile male, approximately 2 years and seven months, named 'chico' and the other a juvenile female, approximately 2 years of age, named 'petal'.

Materials

Hanging Feeder Poles

As you will note from Figure 1 (right), hanging feeder poles are a relatively simple forms of enrichment, as all food items used in the device are visible and are fairly easy to extract. Hanging feeder poles consist of an adequately sized log which then has several holes drilled into it (please note that all holes are drilled randomly), medium sized rope is then 'spliced' onto hooks that are attached to the top of the feeder, the rope is then spliced onto another hook that is attached to the ceiling. Once the hanging feeder is complete, a variety of foods can be placed into the holes, examples of which can include, banana, apple, grapes, pear, potato, tomato, baby food/rice, porridge, natural yoghurt, honey, cous cous, brown rice and many other items. The aim of this is simply to allow food items to be presented in a different manner.



Figure 1, Hanging Feeder Pole

Foraging tube

An example of a foraging tube, similar to the one used for the purpose of this study is shown in Figure 2 (right). Foraging tubes are an intermediate form of novel enrichment as the food items are 'hidden' from view, unlike the hanging feeder poles, and consist of an adequately sized plastic tube that can be sealed at both ends. Medium sized holes are then randomly drilled into the tube ensuring that two slightly larger holes are drilled into the 'top' of the tube so that small rope can be spliced onto the tube. As outlined above, the 'free' end of the rope is then spliced onto a permanent fixture within the enclosure such as a branch, or alternatively the tube can be attached to the ceiling. Once complete, food items such as nuts, seeds, mealworms, or alternately mashed foods like banana can be placed into the tube. The aim of this device is to force the animal to manipulate the tube with its fingers in order to gain access to the food items within.

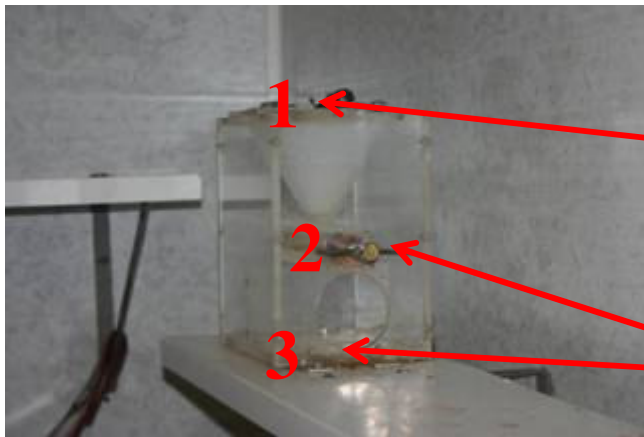


Figure 2, Foraging Tube

Seed/Lever Dispenser

Please note that this device was the created for the purpose of a previous study approximately 5 years ago. Since then, the device has been transferred between several enclosures and unfortunately, due to poor management, the dispenser was over used thus resulting in the animals showing little or no interest in the device. The lever/seed dispenser is shown in Figure 3, as shown below. As you will note from Figure 7 (below), seeds are placed into the funnel inside the device (1), the animal then needs to 'pull' on the lever (2) in order to dispense the seeds into the cavity below (3). The aim of this device is to ensure that the animal has to 'explore' the new device, and after several

attempts will eventually 'learn' that in order to gain the food reward the lever must be pulled. As a result, this device is considered the most complex device used in the study.

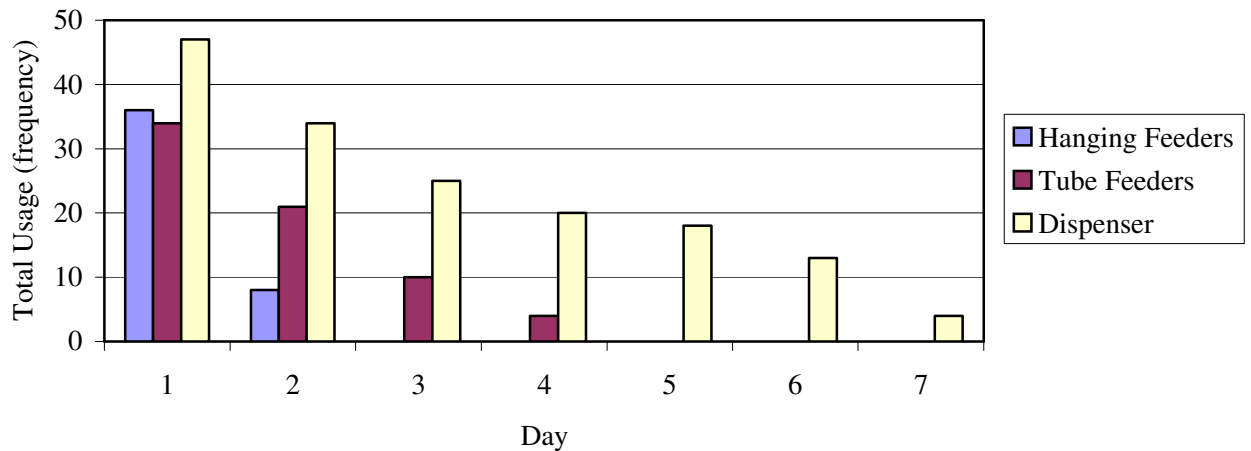


(1) Seeds are placed into the funnel.

(2) Once the lever is lightly pulled, seeds are dropped into the cavity below (3).

Figure 3, Seed/Lever Dispenser

Results

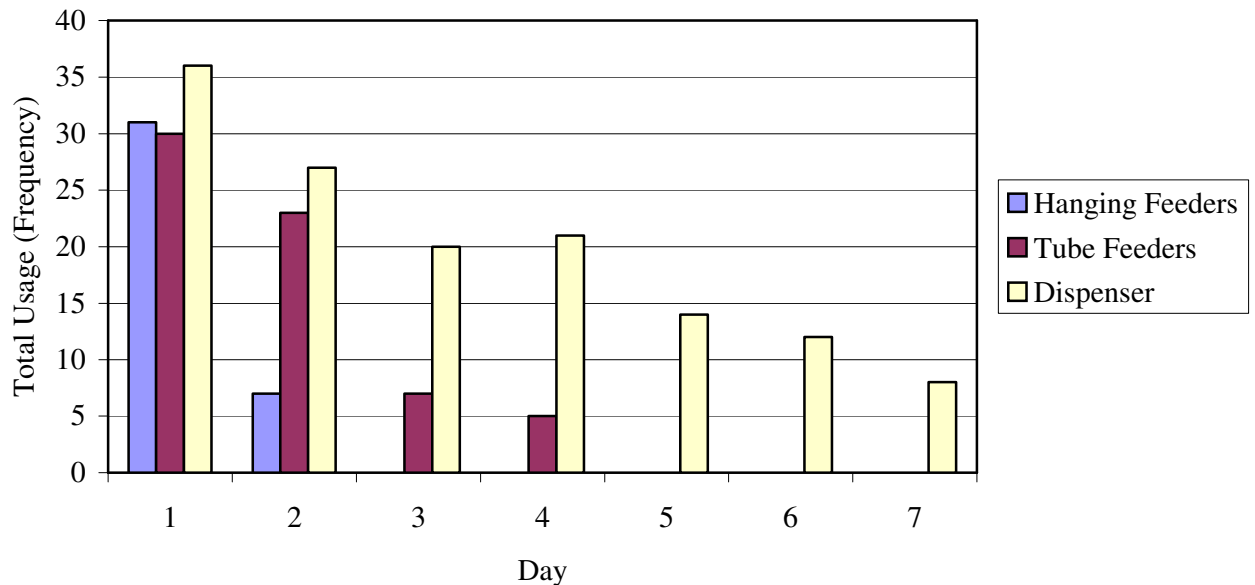


Graph 1. The total usage of all enrichment devices at first introduction only.

From Graph 1 it appears that the hanging feeders were only able to maintain interest for two days, with the tube feeder maintaining interest for four days. In comparison, the seed dispenser appeared to maintain novel for a much longer period of time, as interest appeared to be maintained for seven days.

Based on the information gained from the raw data, the total number of days required for an adequate 'resting' period were as follows; the hanging feeder took a total of 6 days before a successful reintroduction occurred, followed by the tube feeder which took a total of 16 days before a successful reintroduction occurred, finally the 'resting' period

for the seed/dispenser appeared to be the longest which took a total of 28 days before a successful reintroduction occurred.



Graph 2. Total usage of all devices (reintroduction only).

Once a successful reintroduction occurred it was important to note how long the devices managed to maintain interest. Graph 2, above, illustrates that the hanging feeders appeared to generate interest for two days, the tube feeders appeared to maintain interest for four days with the seed dispenser maintaining interest for the longest period of time, seven days in total. In comparison to Graph 1, it is important to note that all devices appeared to maintain interest for the same length of time. However, differences that were noted were largely the frequency of all interactions. Graph 2 shows that the frequency of interactions for all devices are somewhat lower in comparison to the results shown in Graph 1. For example, the first day the hanging feeder was introduced to the capuchins the frequency of interactions were recorded at 36, however the first day the hanging feeder was reintroduced to the capuchins, the frequency of interactions recorded were only 31. A lower value on the first day of reintroduction in comparison to the total usage value observed on first day of first introduction was noted for both feeder tubes and seed dispenser. This may be because the ideal usage value was only required to be above 75%, if this value was 95% then we would have removed the items for longer interval periods thus resulting in values that were much closer to the original values.

Discussion

One of the main findings is that each of the different novel enrichment devices appears to have varying 'life spans'. This finding may have been the result of varying levels of complexity and the amount of positive stimulation that the animal received when using the device. Originally, once a device 'lost' its novelty a new novel device was introduced or as is more common, the same device was be re-used thus defeating the object of environmental enrichment.

The results do appear to illustrate that the more complex devices maintained novelty for longer periods of time. This may be largely because of the amount of stimulation that the animal received from interacting with the device as predicted in the hypotheses and outlined above. In addition to this, it appears that the length of time required for novelty to be re-captured appears to relate to the amount of stimulation an individual may have received from the device. However, this finding is contrary to what should have occurred. When encountering the same or a similar device an individual will recall previous encounters with the same or a similar device and extract information gained from these previous encounters, thus reducing the amount of time taken in order to 'figure out' the device.

These contradictory results may have been the result of the ages of the subjects. Juveniles like these subjects have the luxury of a 'parental' figure, one who the juvenile may follow, observe and subsequently 'learn' certain behaviours from such as problem solving. However, these subjects only had each other to learn from and in comparison to an adult; both are considered very 'inexperienced'. As a result, it would be interesting to conduct this study on much older subjects or to have a much larger sample size with subjects of varying ages, the results of which may favour the more 'logical' assumption that information gained from previous experiences will be recalled upon when an individual encounters the same or a similar situation. In addition to this theory it is important to note that these subjects are considerably 'playful' and the results may just indicate their inquisitiveness and playfulness to the introduction of novel items. Again, as a result it would be interesting to conduct this study on older subjects or a group of subjects all of varying ages.

Conclusion

The aim of this study was to illustrate the positive effects of a 'resting' or interval period during enrichment provision. As a result it is strongly believed that with careful management many novel enrichment devices can be reintroduced and used long after the longevity of 'average' enrichment device would normally have expired. A regime can easily be designed which will allow each of the enrichment devices that any zoo may employ to be reintroduced thus ensuring that the benefits that are commonly associated with environmental enrichment continue indefinitely.

References

- Fragaszy, D. M. Visalberghi, E. & Fedigan, L. M. (2004). *The Complete Capuchin – The Biology of the Genus Cebus*. Cambridge University Press. Cambridge.
- Mason, A. (1993). Environmental Enrichment at Twycross Zoo, United Kingdom. *The Shape of Enrichment*. **2**: (3) 8 – 9.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

**“We don’t do enrichment!”
 (“But we DO good husbandry!”)**

Simon Marsh, Senior Keeper, Carnivores, Chester Zoo.
North of England Zoological Society, Caughall Road, Upton, Chester, CH2 1LH, UK.
Email: s.marsh@chesterzoo.org

Abstract

“Enrichment” isn’t a toy or something that takes too much time or money to carry out, but something the animals need to keep them healthy, both mentally and physically. It’s always around them or occasionally used in their diet or habitat. “Enrichment” isn’t something that is an added extra or a luxury, but part of the day-to-day care we give our animals. It may be a fairly new word, but the concept has been around in one form or another for years. After a few years working in zoos and using the words “environmental” or “behavioural” enrichment, and being involved with Chester Zoo’s Enrichment Group, I have come to the conclusion that whatever you want to call it, it comes down to basic animal husbandry and welfare. Good modern zoos have changed beyond recognition from the menagerie-style, with rows of small concrete cages, to large natural-looking enclosures with a design that suits the animals’ needs and takes into account their group structure, behaviours, and natural habitat. This change has come from public perception and a change in legislation but also because keepers and curators want to keep the animals in the best possible conditions and to have a healthy, breeding population. In this talk, I’ll give an overview of some of the animal husbandry or “enrichment” at Chester Zoo and the work that everyone, from Keepers and zoo/university researchers to managers have put in, to improve animal welfare and enclosure design. I will also discuss some of the obstacles and achievements that everyone has dealt with in the name of the word you either love or hate, “enrichment!”

Full proceedings to follow

Enrichment, a natural evolution.

Holly Farmer, Research Assistant.

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697514, Email: holly.farmer@paigntonzoo.org.uk

Abstract

Six years ago, Paignton Zoo created a specific group to coordinate the work both the animal and science departments carry out, developing and researching Environmental Enrichment. Today, our Environmental Enrichment Group involves members from departments throughout our zoo including education, marketing, science, veterinary and all animal sections. The group meets every six weeks to discuss progress, action points and request help in the sourcing and making of new devices, with meeting minutes written to organise and allocate tasks. The chairs of the group present workshops to both volunteers and groups organized by our education department. We also have a weekly team of volunteers who help to make our more complex and time consuming devices. The science, IT and keeping staff work together to write informational webpages for our website, including information on making enrichment and with the help of our marketing department, we have gained sponsorship from local charities and donations of many items and materials. Attendance at international conferences has been achieved, as well as publications and awards from Shape of Enrichment and UFAW. Our group works as a team to continue the development of our enrichment programmes and resources as well as expanding our knowledge through research.

The first project to study environmental enrichment at Paignton Zoo Environmental Park was carried out in 1997. In 1999, science and keeping staff attending the 4th International Conference in Environmental Enrichment (ICEE) in Edinburgh, presenting a number of posters on projects carried out and devices made for enrichment. These posters included enrichment for elephant, hamadryas baboons and olfactory enrichment for large felids. After the 5th ICEE in Sydney, Amy Plowman, head of the Science Department decided that there was a need to co-ordinate between the Science Department (who study enrichment) and the Mammal Department (who physically do enrichment), and to integrate enrichment into the keeper's daily routine. The aim was to formalise what enrichment and studies were being carried out and make it more inclusive. The Paignton Zoo Environmental Enrichment Group was formed in 2002 by the Senior Head Keeper, Mammals Julian Chapman and Research Associate Dr. Vicky Melfi of the Science Department to provide input from both departments. In 2005, due to work restrictions in the Science Department, Dr. Melfi handed over the reigns and I became co-chair of the group along with Julian.

Members of the EE group include staff from all departments of the zoo, including animal keepers, education, marketing and press, science, vets, volunteers and students. Each department contributes to the group in their own way. The education department are responsible for designing and providing interpretation about enrichment around the zoo and also provide information and presentations about enrichment to local schools. Our press officer is highly active in promoting our enrichment work with many devices and

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

projects being publicised in local newspapers and news programmes. Our veterinary staff use enrichment for animals in quarantine or recovering from operations and often require information from keepers about species-specific enrichment items and devices to use for injured animals. The volunteers and students help keepers to make the enrichment devices so we list all the items we would like made and they go ahead and make them.

So what do we as an EE Group do?

- We hold meetings every six weeks where we discuss jobs which have been completed, those we would like to be done and request materials which need to be sourced. At the end of the meeting, the minutes are written and distributed, assigning tasks and to inform absent staff members.
- Present workshops and 'walk and talks' to volunteers, students and local societies introducing the concept of environmental enrichment, how to design devices and a practical session which involves making piñatas.
- Design and write webpages for the Paignton Zoo website (www.paigntonzoo.org.uk) which are available for the public and animal keepers from other institutions to use as a resource. The pages include information on the goal of each device, which animals it can be used for, how to make it and enrichment which can be used for pets at home.
- We have succeeded in obtaining many materials and items which we can use to make enrichment devices purely from donations of local businesses and internet sources. These donations include newspaper for piñatas, old fire hose, surplus Christmas trees, pumpkins and hessian sacks.

Our achievements to date include attendance and presentations at the International Conference for Environmental Enrichment every year since 1999. Attendees include science staff, students and keepers which are paid for from our 'keeper for a day' programme. We have won awards from UFAW and BIAZA for a bird termite mound device in 1998, in 2003 were awarded the Significant Advances in Husbandry and Animal Welfare award for a habituation resistant enrichment programme for tigers and the Shape of Enrichment travel award in 2003. Enrichment studies conducted at the zoo have been published in journals such as *Animal Welfare*, *Applied Animal Behaviour Science* and as conference proceedings. We have also published articles in *Shape of Enrichment*.

It has taken time and hard work for the Paignton Zoo Environmental Enrichment Group to achieve all it has and it has taken self motivation, coordination and the team work of all the departments in the zoo to produce and maintain such a successful and evolving group.

References

McKay, S. and Pullen, P.K. Personality profiles of cheetahs (*Acinonyx jubatus*) in the UK and Ireland, in relation to environmental factors and performance variables. *Animal Welfare* (submitted).

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Melfi, V.A., Plowman, A.B., Knowles, L. and Roynon, J. Overcoming habituation in an enrichment programme for captive tigers. *Animal Welfare* (submitted).

Termite mound at Paignton Zoo, England. *Shape of Enrichment*. 7:13-14. 1998.

From junk to enrichment; uses for a camera film canister. *Shape of Enrichment* 14: 1-3. 2005.

Encouraging enclosure use for red river hogs using scatter feeding. *Shape of Enrichment* 15: 11-13. 2006.

From junk to enrichment 2; carpet tubes. *Shape of Enrichment*. (submitted).

Team work: supporting environmental enrichment at Paignton Zoo.

Phil Knowling, Press Officer.

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697500, Email: phil.knowling@paigntonzoo.org.uk

Abstract

Delivering Paignton Zoo's extensive programme of Environmental Enrichment is a team effort. Keepers, science staff and students create and test techniques and devices, whilst receiving support from several other departments within the zoo. The Marketing Department helps to source potential enrichment items from local businesses and from companies which support the zoo. These businesses can assist by making cash donations or by sending staff on team-building days to help with larger projects such as digging out pits in enclosures. The Press Officer makes use of the unusual stories that arise from enrichment - herb baskets for monkeys, rugby balls for gorillas, footballs for elephants – to publicise the zoo and our science and animal welfare work. Businesses get name checks in our zoo magazine, which reaches some 10,000 members.

There is a huge demand for enrichment items. Creativity, imagination and a little lateral thinking help to meet that demand. Over the years we have acquired second-hand railway sleepers, discarded carpet tubes, surplus Christmas trees and old fire hose from the local fire brigade. Enrichment doesn't have to cost much, if anything - contact local companies and suppliers and see what you can get for free. It's a great way to recycle and get businesses involved with your zoo. Enrichment is active and reactive – and so is the task of providing the materials needed to keep the work going.

We know that environmental enrichment is a team effort. It involves keepers, science staff and students, the maintenance crew, vet team and of course, the animals. You also need supportive curators and zoo directors.

There are other people who can help. Have you ever thought of including marketing people, local businesses or even the media? Why do this? Because it makes good sense. Enrichment requires stuff, and these people can help get it. Stuff can cost money, but these people can often get it for free.

At Paignton Zoo, marketing people help find enrichment items from local businesses, firms which support the zoo and companies with which the zoo does business. These items can be new products that are donated or surplus items that would otherwise be discarded or recycled. Companies are often intrigued by the idea of enrichment and are happy to help out of curiosity. For others the chance of a little publicity can persuade them.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Businesses can help in other ways. They can make cash donations to purchase specific enrichment items or send staff on team-building days to help with larger projects such as digging out pits in enclosures. The money made through team-building days goes into the enrichment fund.

The media can help, too. As Press Officer, I can make use of the unusual stories that come out of enrichment. It's important that local people and visitors understand what the zoo is doing. Enrichment is a great way of engaging their attention.

We use enrichment stories to publicise the zoo and our science and animal welfare work. We have put enrichment into newspapers and onto radio and TV. We also make use of our zoo magazine, which reaches over 10,000 members. Successful stories include herb baskets for monkeys, rugby balls for gorillas and footballs for elephants.

The rugby balls story is a good example. Keepers asked marketing to help eke out the limited enrichment budget by finding some free balls. We approached a local leisure centre and a sports shop and promised them the chance of publicity in return for the donation of balls.

A local freelance photographer was invited to cover the moment the balls were given to the gorillas; thanks to some excellent photographs the story went national, appearing in the *Daily Mail*, *Daily Express* and the *Daily Telegraph* and on television on the *Richard & Judy Show*. This helped raise the profile of Paignton Zoo and of enrichment work. As a result Mitre, who make rugby balls, got in touch and donated a further dozen balls.

A year on we did a similar story with different rugby balls – sometimes the media can have a pretty short memory!

Enrichment requires a lot of stuff. Creativity, imagination and a little lateral thinking help to meet the demand. In recent years we have acquired end-of-roll newspaper from the local daily paper – used to make piñatas - surplus Christmas trees from a garden centre and old fire hose from the local fire brigade.

Other zoo departments get involved, too. Our Education Department produces interpretation panels that explain to visitors about puzzle feeders and the sack on a spring in the tiger enclosure. We use our web site – www.paigntonzoo.org.uk – to advise on enrichment for domestic pets.

Zoo volunteers also support enrichment work, helping to make numerous items including papier mâché piñatas for the baboons. We hold regular meetings where keeping, science and marketing staff and volunteers get together to talk about enrichment. Keepers and scientists come up with the ideas, the marketing staff help to find the objects needed and the volunteers help to make them.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

To summarise, work with volunteers, marketing and other non-keeping staff to get free stuff for enrichment, attract cash donations or manpower, attract support, gain publicity for your zoo and for enrichment work, keep the cost down and recycle waste items.

Remember, you can never guarantee media coverage, so don't get carried away. But enrichment does make for the sort of quirky and intriguing stories that the media love. The businesses that help can benefit from the publicity and the publicity generated can itself bring more opportunities for networking and for acquiring enrichment items.

How do you get all these other people – who are just as busy as keeping and science staff - to join in? You hope, of course, that they have an inbuilt interest in enrichment, zoo science and animal welfare. Failing that, bribe them with doughnuts...

**An overview of how the Environmental Enrichment Forum has tried to stimulate
the use of enrichment within the Zoological Society of London.**

Greta John

Past details: The Zoological Society of London, Regents Park, London, NW1 4RY.

Present details: Utility Officer, Devil Facial Tumour Project, Department of Primary
Industries and Water, Animal Health Laboratory, 165 Westbury Road, Prospect TAS
7250, P O Box 46, Kings Meadows, TAS 7249.

Tel: 03 6336 5459, Email: Greta.John@dpiw.tas.gov.au

Abstract

There are a number of ways to motivate the implementation of Enrichment Programmes across any zoological collection, at ZSL we have an active Enrichment Forum with regular in-house meetings, but how often do we meet and is this enough? The provision of Environmental Enrichment is not just the domain of the keeper, who we involve and who we try to draw in from other departments is also critical. What we discuss, the challenges we face and how we deal with them should be very much a team effort. However, being realistic, in the true working day “enrichment”, rightly or wrongly, can often be placed on a list of priorities and thus the true value needs to be openly discussed and brought into a wider forum.

The Zoological Society of London is a large organisation and one way of spreading the word within the organisation is by the production of our periodic newsletter. This is available to read throughout ZSL, and is well received by keeping staff and office staff alike. The newsletter not only provides a source of inspiration via light coffee time reading, but also a means by which eager keeping staff can receive wider recognition for the effort they have contributed to the overall well-being of the stock in their charge.

The production of the newsletter is not without its challenges: wider sources of contribution, composition and meeting time schedules, to name but a few. However, when these challenges are met, the effort has, so far, been worthwhile.

How and who the newsletter has benefited ZSL animals and staff.

The Enrichment Forum decided that we needed to do more within the zoo to encourage the use of environmental and behavioural enrichment for the animals at ZSL's two sites: London Zoo and Whipsnade Wild Animal Park. We recognised that it was being done but still could be done more regularly, and more keepers could get involved.

It was decided that a newsletter would be a good way to reach everyone within the zoo. This meant that we wanted to include all staff not just keeping staff. We thought it was not only important to keep non-keeping staff up to date with what our animals were

doing; but that it would be a good opportunity to encourage others to come up with ideas and possible funding or accessibility to equipment that could be used for enrichment.

Getting started

This needed to be put into action and that is where I came in. The forum needed a volunteer editor for the newsletter which would cover both representative sites. I did this gladly as I saw it as a good opportunity to take enrichment that one step further within the society. I felt really strongly about animal care and wanted to share this passion. So I had to figure out who it was going to reach and how it was going to be distributed.

I was keen to showcase those keepers that genuinely believed in enrichment and made an ongoing effort to improve the standards of captive animal's lives. This was not only a good form of recognition for keepers but also a good way of encouraging up and coming keepers to follow this route of animal care.

When it came to distribution initially I distributed a copy to each animal section and placed a copy on the ZSL server which theoretically was available to all staff. This was coupled with an email sent to all staff with a short cut to the file on the server. For the next copy I felt that it would be better to send it with a short cut instead of printing off copies as I was conscious of wasting paper and thought that this would be well received. I found that this did not work as keepers generally are too busy outside and don't have much access to computers in fact on some sections they didn't have any access. So I had to ask Team Leaders to print copies off to be placed in their mess rooms, for easy reading during break times. This turned out to be not as successful as I hoped either.

Having the newsletter on a server worked well, as people could reference previous issues as and when they needed; but as for current issues I found that keepers who were genuinely interested benefited a lot from the articles and were enthused to write regularly for the column, I am sceptical though as to whether it encouraged those keepers who do not agree with the term "Environmental Enrichment". Office staff read it eagerly; and were keen to offer ideas. The ZSL press office used many articles for the Societies quarterly magazine "Lifewatch".

Putting the newsletter on the server was the most complicated part of all, as the size of each file was always too big and needed downsizing due to the amount of pictures supporting the articles. I tried many ways of presenting it as I didn't want to have too many pages as it was meant for light reading. I found that if I formatted it in two columns on each page, it seemed to be easier to follow and nicely presented. I gave it a name "The Benefits of Environmental Enrichment at ZSL". I aimed at circulating it every quarter, which ultimately did happen.

Challenges and looking for articles

I found that after a few issues it became harder to source articles. I found that eventually it was only a handful of people actually submitting articles so it became an ongoing battle to get different keepers to write for the newsletter. I don't think that this was entirely due to lack of interest, I think it may have been due to the fact that a keepers work load is

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

pretty full anyway and getting a chance to do something that is not section work is hard enough in itself. There are many keepers out there with fantastic ideas and a lot of enthusiasm it was just a matter of encouraging them to write for the newsletter.

Each newsletter did take up a lot of personal time and I found it a challenge just to format it and present it properly. It was all worthwhile, as I found a lot of people did get something out of it; I believe the animals did benefit too.

Fund raising

We hoped that by showing what we do to improve standards of animal care that we may encourage different means of fund raising. These issues could be of use to the fund raising department. The newsletter has also been a good instrument for the enrichment forum to ask for an “Enrichment Budget” to be setup for both ZSL sites.

Even though the newsletter is still in its infancy overall it has definitely been worthwhile and is evolving as time progresses. It still has room for improvement and could have a lot more input from staff. It has encouraged keepers and given keepers something to talk about and think about. Most of all it is bringing attention to the animals who deserve the best care we can give them.

Acknowledgments

Andy Hartley, Scientific Officer, The Zoological Society of London, Whipsnade Wild Animal Park, Dunstable, Bedfordshire, LU6 2LF, 01582 872171, andy.hartley@zsl.org
Adrian Walls, Deputy Team Leader of Birds, The Zoological Society of London, London Zoo, Regents Park, NW1 4RY, 0207 449 6413, adrian.walls@zsl.org

What makes an effective enrichment?

Dr. Vicky Melfi, Research Associate

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697514, Email: vicky.melfi@paigntonzoo.org.uk

Abstract

Environmental enrichment is an integral part of zoo animal husbandry; however how do we decide what enrichments will be effective? Are 'natural' enrichment items such as whole prey and browse more effective than 'un-natural' items such as Kongs and plastic barrels. This talk will discuss which aspects are required to ensure that enrichment items continue to meet their desired goals.

Leading on from this talk, the following presentations are a selection from a symposium presented at the 7th International Conference on Environmental Enrichment, New York 2005, entitled 'To Carcass or Not'. The information provided within this symposium fueled an informed debate about whether or not we should use carcasses as part of carnivore management.

The use of carcasses in zoos worldwide is variable, yet it may be one of the most effective natural enrichments we can provide for zoo housed carnivores. Some of the main issues which arise year in, year out when discussing the use of carcasses were explored by the contributors to the session. Results from a survey comparing the health of carnivores which have and have not been fed carcasses was reviewed and anatomical and behavioural adaptations carnivores have developed to hunt and process food was explored.

Now that environmental enrichment has become an integral part of all animal husbandry there is increasing pressure to create, provide and monitor modifications to the animals' environment. Research conducted over the last 40 or so years, has outlined that the goals of many enrichments are to reduce stereotypies and increase behavioural diversity, enclosure use and general activity levels. The benefits of effective environmental enrichment programmes are far-reaching and go beyond positive changes in the animals' behaviour, but include the improved physical and mental fitness.

So why is it that sometimes we make modifications to an animals' environment and frankly nothing happens? At other times any changes in behaviour seem short lived, or don't work when a second time. Is it that the enrichment isn't working? No. Modifications to the environmental can only considered enriching if they attain your pre-determined goals/aims. If these goals/aims are not attained, it simply means that those modifications to the environment were not enriching.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Sometimes there are quite obvious reasons why environmental modifications fail to be enriching. It maybe that only one animal seems to benefit, as it monopolises the enrichment. Similarly, in mixed species exhibits, one species may again monopolise enrichments or destroy them.

So what can be done to try and ensure that the environmental modifications you make will indeed be enriching, and thus attain your enrichment goals and aims? There are a series of considerations which if incorporate into environmental modifications or general housing and husbandry will improve the likelihood that the lives of your animals will be enriched. These will be detailed and supported with data collated from a series of studies undertaken at Paignton Zoo Environmental Park.

First of all it is necessary to provide you animals' with opportunities to perform species typical behaviours. This can be done by providing an appropriate social group and basic enclosure design. By being aware of seasonal changes, both in your animals and their environment, which will affect their motivation to perform different behaviours. For example, animals which hibernate or females prior to parturition will require specialist conditions and will actively seek these out in their environment.

Animals may also use elements of their environment to mitigate social pressures. For example, at Paignton Zoo we hold a large group of baboons which are restricted in close proximity to one another for a couple of hours during cleaning. These conditions lead to many of the familiar consequences of crowding; levels of self-directed displacement behaviours increased, relative to when they had access to larger outside areas, as did levels of aggression. Self-directed displacement behaviours, such as yawning and body shake, have been shown to reflect stress and anxiety in other primate species. To alleviate the effects of crowding a deep litter substrate of bark was provided (Figure 1).

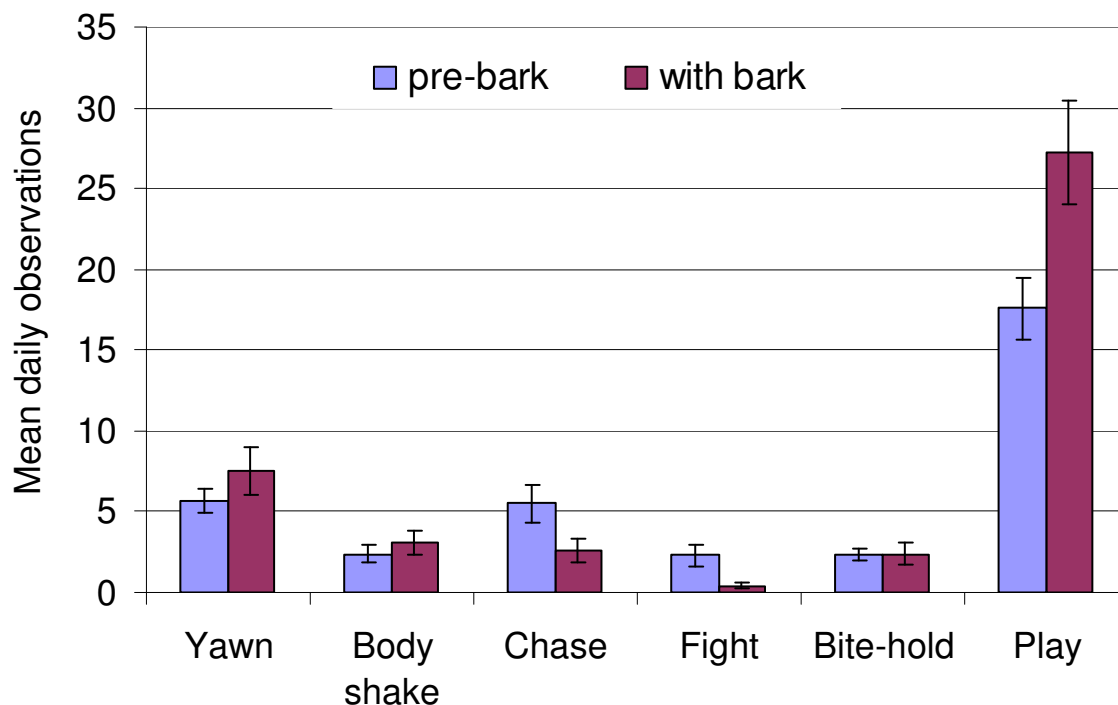


Figure 1: Mean (\pm SE) daily observations of behaviours expressed by baboons at Paignton Zoo, with and without a deep litter substrate of bark.

The provision of bark, as a deep litter substrate, led to a reduction in chasing and fighting, and an increase in play behaviour. These results suggested that bark provided the baboons, in close proximity to one another, with the opportunity to express alternative behaviours to aggression. Instead, the baboons were observed to play. Anxiety was not entirely alleviated however, as the levels of self-directed displacement behaviours increased.

It is also necessary to provide a contingent link between the environmental modification you make and the behaviour which you hope will be stimulated in your target animal. When a tiger feels hungry, it will be motivated to go in search of food and go hunting; termed appetitive behaviour. If the tiger is lucky or particularly skilled, it will eventually capture and consume prey; termed consumptory behaviour. These two behaviours, the appetitive and the consumptory, are linked. The tiger was internally motivated to hunt and is rewarded for its efforts by eating. Maintaining the link between these 2 behaviours in zoos is sometimes difficult and it has been suggested that behavioural problems results when only the appetitive behaviour is performed and not rewarded with a consumptory behaviour. For example, your zoo housed tiger is highly motivated to feed and forages, looking around it's enclosure, however as it is a Thursday and a starve day, there is no chance of it finding food and thus rewarding it foraging efforts. Careful planning can restore the link between these behaviours. Scatter feeding provides an extremely simple and yet effective method of rewarding a diverse array of animals, i.e. tapir and red river hog (Figure 2 and 3) which forage around their enclosures.

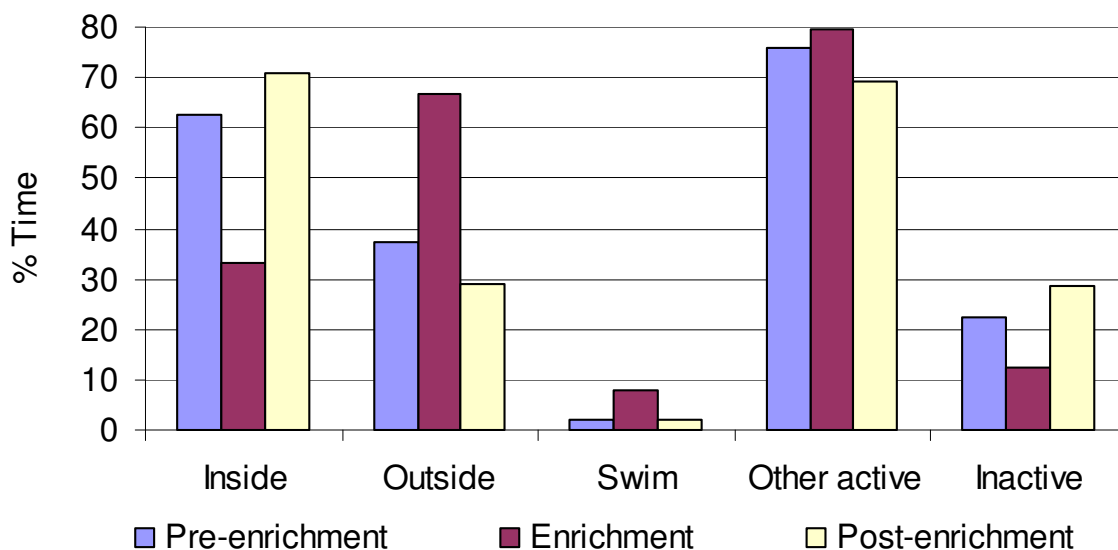


Figure 2: Percentage time spent, by tapirs, using enclosure areas and expressing behaviours before, with and after scatter feeding.

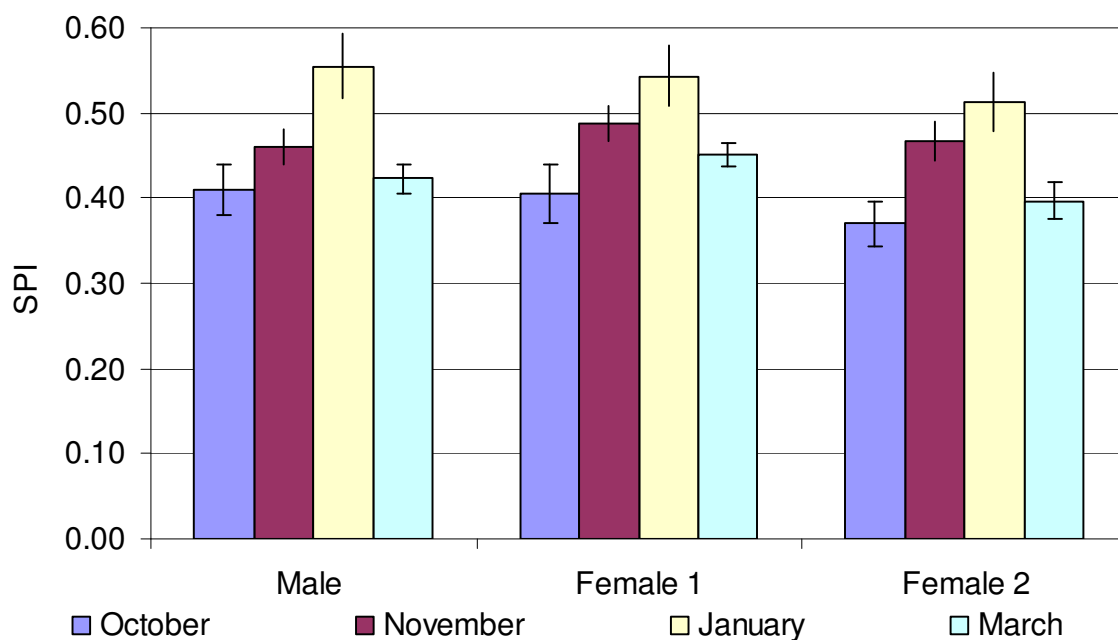


Figure 3: Mean (+/- SE) spread of participation index calculated for red river hogs when they were initially given access to a new enclosure (October), after they ate a lot of the enclosure (November and January) and then once scatter feeding was initiated (March).

Scatter feeding the tapirs at Paignton Zoo led to an increase in enclosure use and activity. This pattern was also seen in the red river hogs, whose use of the enclosure decreased over time, as illustrated by an increase in SPI. However enclosure use increased once the red river hogs were given scatter feeds (Farmer *et al.*, 2006).

Another key aim to a successful enrichment programme is to reduce habituation. When enrichments are repeated, or left in enclosures for periods of time animals soon find them less interesting. This means that they will no longer be effective or able to attain your enrichment goals/aims. So how do we prevent habituation? Habituation is reduced, by limiting the time animals have access to enrichments, so don't leave them in enclosure for prolonged time periods. Also, try to amass lots of different enrichments, so that you can leave long gaps between the use of an enrichment. A study at Paignton Zoo highlighted that it wasn't the number of times a tiger received an enrichment which effected how well it could reduce their level of stereotypes, but the length of time since they last saw it (Figure 4; Plowman and Knowles, 2003). In this study, we estimated that if enrichments were not repeated within a 3 week interval, they would retain their effectiveness at reducing stereotypes (Figure 5).

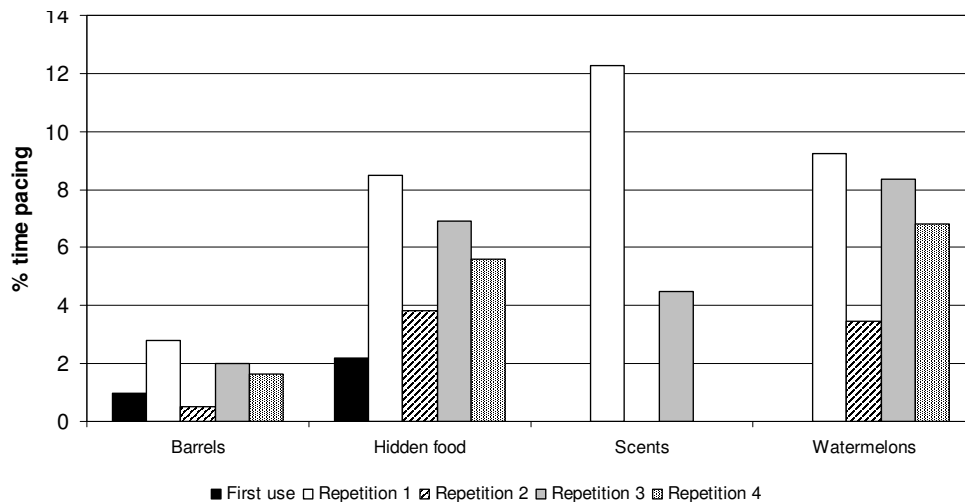


Figure 4: Percentage time spent pacing by tigers at Paignton Zoo, after the presentation of different enrichments.

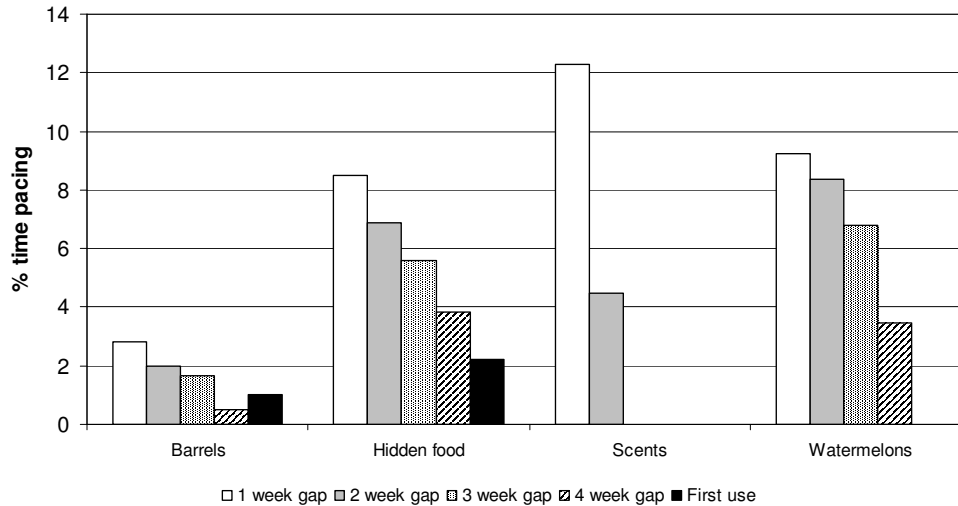


Figure 5: Percentage time spent pacing by tigers at Paignton Zoo, after the provision of different environments which were separated by different lengths of time (1, 2, 3 and 4 weeks).

In the zoo community we are lucky to work with a huge diversity of animals. We need to consider and tailor accordingly this diversity when creating and providing enrichment. We are also familiar with the concept of species specific needs; that the motivations, behaviour, abilities and much more will vary across species. What also needs to be borne in mind is the variation within a species, namely individual differences. Individuals will vary in their age and thus agility and habitat us, there prior experience and thus problem solving ability and much more. Some individuals just differ in the preferences for enrichment devices. Sulawesi crested black macaques at Paignton Zoo were given four different feeding devices, which varied in their level of complexity; a being the simplest to extract from and d requiring the greatest dexterity to gain access to food. There were clear preferences amongst the macaques for different devices; Gum preferred the more difficult devices (c and d), while Mistletoe preferred the simpler device (b) (Figure 6).

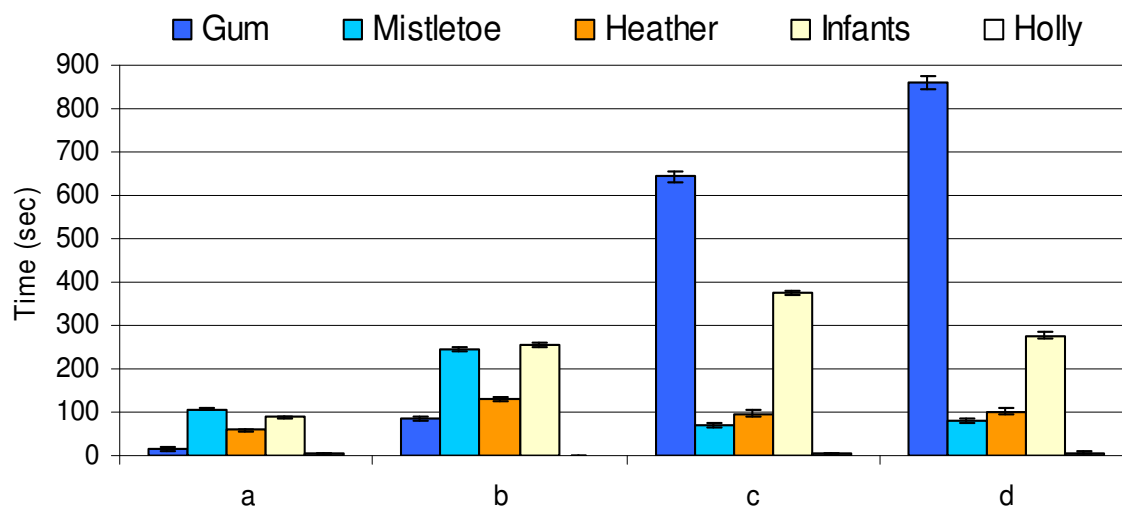


Figure 6: Mean (+/- SE) percentage time spent, by the macaques at Paignton Zoo, using different feeding devices.

A quick and easy way to ensure that an enrichment will be effective is to stimulate a highly motivated behaviour. We all know that animals are highly motivated by food and indeed many animals have evolved to spend long periods of time, locating, processing and consuming food. As such, a key goal/aim of much enrichment is to increase activity which can be accomplished by prolonging feeding and foraging behaviour. With so much enrichment being based around food, there are many examples of how to prolong feeding and foraging behaviour. One such example can be illustrated by the method we use at Paignton Zoo to feed our elephants. Straw, hay and even vegetables are presented to our two elephants in large wire racks. The elephants have to use their trunks to manipulate the food out through the wire, which takes skill and dexterity and also prolongs the time they spend feeding and foraging. This method of food presentation keeps them feeding and foraging for over 12 hrs a day (up to 60% of a 24hr day).

So in summary, increasing the efficacy of your enrichment programme can be achieved by sticking to these top tips:

- Provide the opportunity for highly motivated behaviours to be expressed;
- Provide a contingent link between appetitive and consumptory behaviours;
- Create an interesting and dynamic environment
- Reduce habituation;
- Tailor EE programmes to suit your species, enclosure and available resources;
- Prolong feeding and foraging!!

Does The Provision Of Carcasses Compromise The Health Of Zoo Housed Carnivores?

Kathy Knight, Postgraduate Researcher.

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697514, Email: kathy.knight@paigntonzoo.org.uk

Abstract

The provisioning of captive carnivores with carcasses is a topic of much debate within the zoo community. The argument stems from a number of proposed benefits and risks associated with its use; the main benefits appear to be behavioural, and carcass feeding has been shown to be an effective environmental enrichment method, however some zoos are still reluctant to feed carcasses and the main objections to its use are generally related to health risks.

Past research into the provision of carcasses has focused on its use as an enrichment tool for large felids, either to alleviate feeding related stereotypies or promote natural foraging and feeding behaviours. There is a paucity of data on other carnivores. The

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

aims of this study were to investigate feeding regimes for a wide range of carnivore taxa, we wished to; establish what feeding regimes are being implemented world wide; investigate any associations between feeding regime and health and on the basis of our findings make husbandry recommendations for the species involved in the study.

It was found that feeding method could not predict the occurrence of health problems and therefore it was concluded that carcass feeding did not increase health risks compared to a commercial diet. There were some sourcing and preparation methods of carcasses/meat that could predict health indices and it is suggested that these are more important than the actual feeding method when formulating a diet for captive carnivores. Increased non-food enrichment was found to decrease the risk of disease occurrence therefore it is suggested that institutions implement more enrichment for the carnivore species involved in the study. Recommendations for husbandry and further research concerning the provision of carcasses for non-felid carnivore species are discussed.

Full proceedings to follow

Can environmental enrichment compensate for not providing carnivores with live prey?

Lucy Manning, Carnivore keeper.

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.
Tel: 01803 697500, Email: mammals@paigntonzoo.org.uk

In many cases in zoos it is not suitable to feed carnivores with carcasses or live prey for various reasons. For example these food items may not be available, the zoo may deem them unsuitable or it may be illegal; 'feeding live vertebrate prey should be avoided save exceptional circumstances, and then only under veterinary advice' (Defra, 2000).

Carnivores are highly motivated to display a variety of food/hunting related behaviours, despite that fact not all zoos provide live prey or carcasses. This means that successful alternatives to live prey and carcasses need to be found. A long history of providing (and studying the impact of) Environmental Enrichment to carnivores exists in zoos. The aims of these enrichments have included the promotion of activity, reduction of stereotypes and the provision of opportunities where carnivores can express a diversity of hunting/food related behaviours.

The aim of this paper is to break down the hunting/food-related behaviours displayed by carnivores, and match these with enrichments that have previously been shown to be successful. Using this information, we aim to evaluate whether the alternatives to carcass feeding can really provide carnivores with the opportunities to express a diversity of hunting/food related behaviours.

Full proceedings to follow

Comparing the effects of novelty versus independent movement in enrichment for large felids.

Kingston Jones, M. and Lee, P.C.

Mark Kingston Jones, C/o Dr Phyllis C. Lee, Department of Psychology, University of
Stirling, Stirling, FK9 4LA, Scotland.

Tel: 07740 193 065, Email: mark@lionrover.co.uk

Abstract

*Novelty has long been considered an important aspect of enrichment items used with large carnivores. We suggest that devices with independent movement incorporated into their design may not require continuous novelty in order to promote natural behaviours and maintain interest. A modified horseball, dubbed the Wubbleball, was built to provide independent movement in an enrichment object that captive carnivores could choose to interact with. This moving device was directly compared to simple novel object ball enrichment. The study was conducted with a pride of (4M:12F) African lions (*Panthera leo*) housed at Blair Drummond Safari Park, Scotland. During device presentations, significant increases were found in the rates of watching and pawing the ball, and in the frequency with which the ball was stolen in the Wubbleball compared to unmodified ball conditions. A significant difference was also found in the rate of inter-individual*

aggression over the ball which was highest in the initial novel ball presentations and in the hide Wubble conditions.

These findings suggest that the introduction of independent movement adds an extra attribute of novelty to enrichment items which then become more attractive by comparison to simple novel presentations. Further research is needed to determine whether habituation is associated with independently moving devices, since these may be unpredictable and dynamic with the consequence of sustaining attention and arousal, as was suggested by the increase in stealing and aggression over the ball in hide Wubble conditions.

Introduction

Background

Historically, providing captive carnivores with opportunities to express natural behaviour has been complicated by the obvious ethical issues inherent in provisioning live prey species. This has made the feeding of captive carnivores one of the greatest animal welfare challenges faced by zoos today (Ings *et al*, 1997). In seeking to solve this challenge Mellen, Hayes and Sheperdson (1998) state that techniques applied to carnivore enrichment must be original and continually adapted, due to carnivore species' capacity for relatively rapid habituation, in order to maintain positive results. One solution to creating such innovative and adaptable enrichment items would be to employ technology to create enrichment items which could have this dynamic capability built in, through the use of independent and unpredictable movement. These independently moving devices might then potentially be used to provide more long-lived functional alternatives to live prey with inherent benefits to both physical and mental welfare.

This development may seem unnecessary however, particularly relative to the costs of developing such devices, as simple enrichment has been shown to successfully reduce abnormal behaviour and increase the expression of more positive behaviour patterns (e.g. Plowman and Knowles, 2001). Mellen (1998) states for example that novel objects, even if not associated with food, encourage captive cats to exhibit natural hunting behaviour. While these observations might suggest that independent movement is not necessary for facilitating predatory behaviour, the emphasis is placed on the novelty aspect of the object, which Lindburg (1998) argues is key to maintaining successful enrichment. There is obviously a limit to the number of novel objects that can be introduced into the captive environment and rapid habituation must be avoided in order for long-term enrichment programmes to be a sustained success (Plowman and Knowles, 2001). It is possible that devices which have independent movement incorporated into their design may not require this continuous novelty aspect in order to promote predatory behaviour and continued interest and interaction from captive carnivores.

Aim

The aim of this research was to assess the effect on interaction and interest of independent movement in an enrichment item by comparison with the effect of novel object enrichment only. We hypothesised that independently moving enrichment would prove to be a more powerful stimulus in promoting interactions and interest than simple

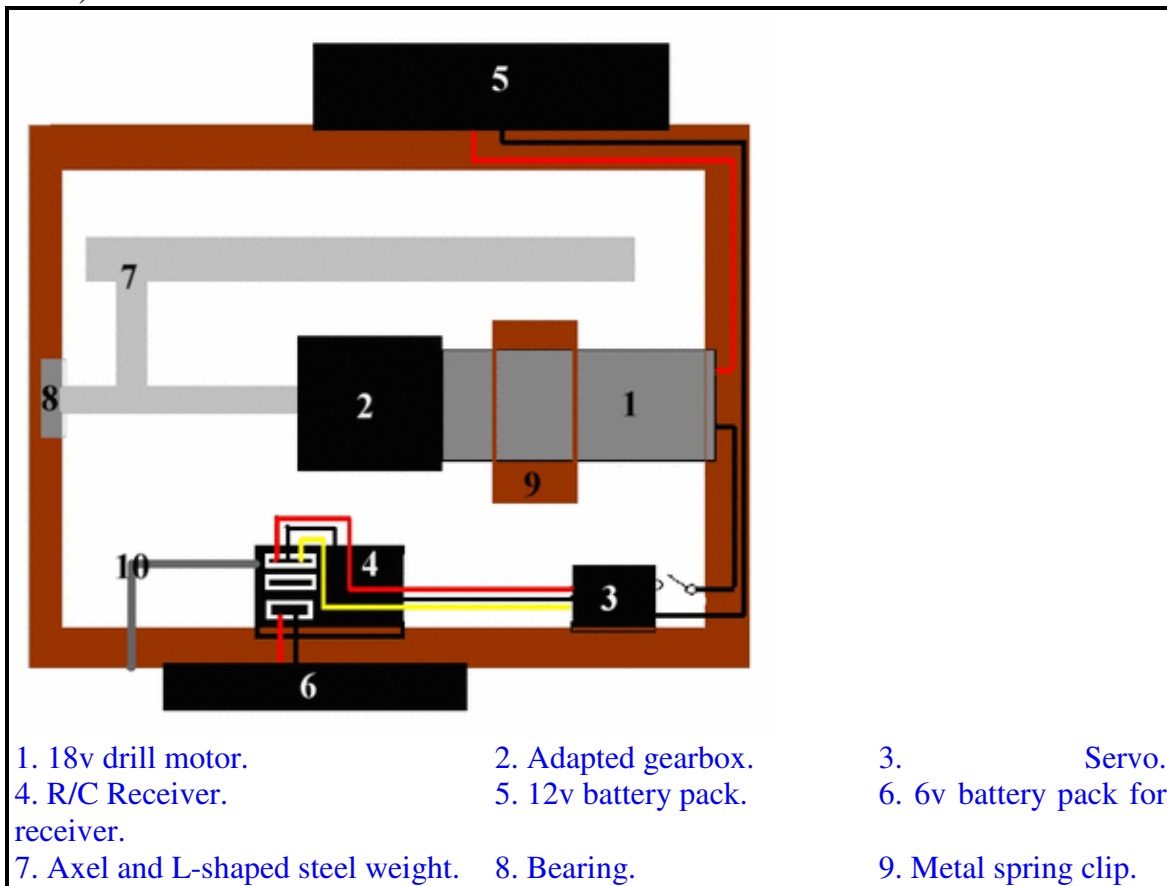
novel enrichment. In addition, this new enrichment device, dubbed the Wubbleball, represents a possible tool for improving captive carnivore welfare.

Methods

Apparatus

The enrichment device was constructed from a Talisker Bay Snak-A-Ball, available from larger pet stores, used for feeding enrichment for horses. A wooden box was shaped to fit tightly inside this ball so that it could be easily slotted in and out and would not move around once the ball was sealed. Inside the box (see Figure 1) was a geared motor (1 and 2) originally from an 18v hammer drill; this was used with the original switches and wires attached to a 12v battery pack (5) and a single servo (3), wired to the receiver (4). The motor was held in place by a metal spring clip (9). The switch was adapted so that it was either on or off rather than providing a variable speed, so that the motor could be operated via a remote control from within the lion enclosure at any time. The axel (7) was made from an adapted screwdriver shaft and an L-shaped steel weight was welded to it. This was shaped to fit into the end of the gearbox (2) and slotted through a bearing (8) in the wall of the box at the other end. The remote-controlled moving device was dubbed the Wubbleball and when operated the ball would shake and wobble slightly within a small area.

Figure 1. Diagram of the internal mechanisms used to power the Wubbleball (not to scale).



10. Aerial.

Experimental design and procedure:

Observational data were collected on 16 African lions (4M:12F) by 1/0 focal object sampling (Martin and Bateson, 1993) during eight two-hour device presentations. Four conditions were used; in the first condition the ball was modified to bring it to the 3kg weight of the Wubbleball. In the second the weighted ball was wrapped in cow hide. The third and fourth conditions repeated the first two but the Wubble mechanism was operational inside the ball. During Wubbleball conditions, the device was triggered upon its initial presentation within the enclosure and then subsequently every 15 minutes for one minute periods. This time frame was determined from a pilot presentation, which indicated that this was the average duration before interaction with the ball by individuals began to slow and stop.

Each condition consisted of two ball presentations in sequence. A minimum of two days and a maximum of five days occurred between each ball presentation. Presentations began at 11am, by which time the lions had usually finished their morning meal. Ball presentations commenced when the keeper's jeep dropped the ball within sight of the lions, with the first data being recorded at the first 30-second interval. All individuals in proximity with the device (within one body length) were identified and behavioural interactions with the ball and others were recorded every 30sec. These data were grouped into possessor bouts, by identity of the main ball possessor, for the purposes of analysis.

Results

There was a significant difference in the frequency of ball possession bouts ended by either being left or stolen between independently moving and unmodified ball enrichment presentations ($X^2(1) = 5.46, p = 0.020$). There was a decrease in the frequency of the ball being left and an increase in the frequency that the ball was stolen in independently moving versus unmodified ball conditions.

Exploring this result across ball conditions (Figure 2), there was a significant difference between the frequency of leave and steal in the hide ball condition (binomial exact: $p = 0.038$) and a marked trend towards significance in the hide Wubble condition (binomial exact: $p = 0.058$).

Figure 2. Frequency of individual possession bouts which ended by animals leaving the ball or having it stolen by a conspecific.

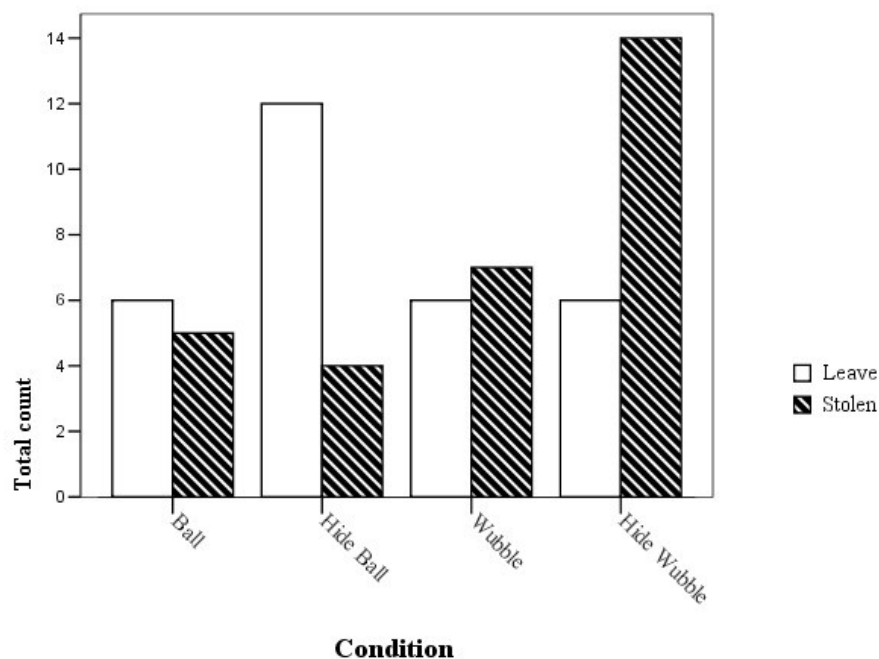
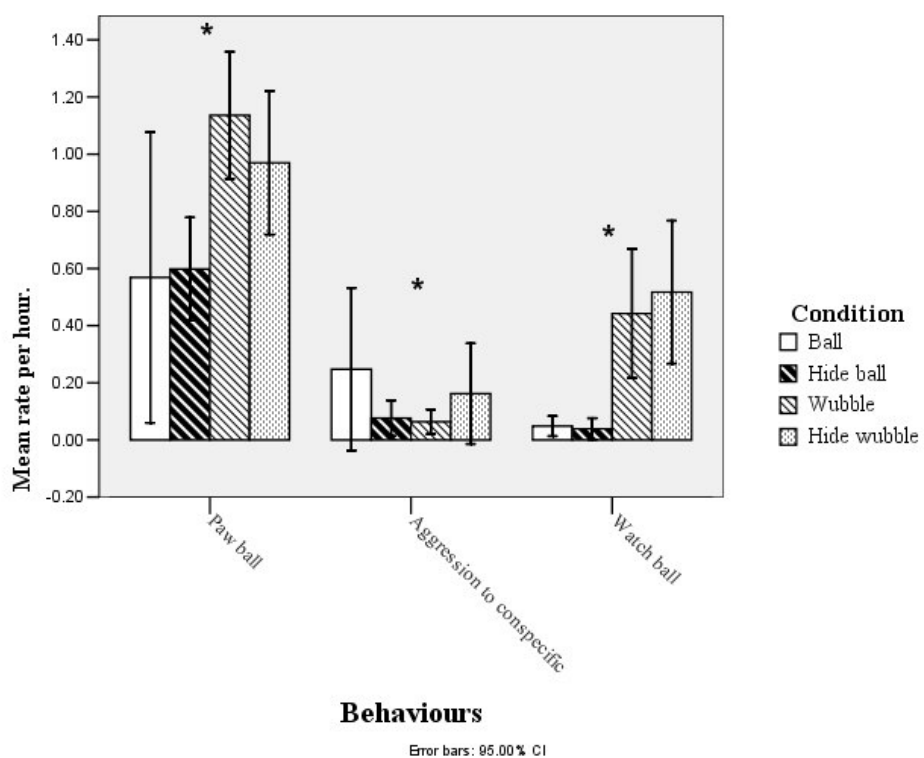


Figure 3. Mean (+95%CI) rate per hour of behavioural events showing attention to the ball across the four conditions.



Behaviour that indicates attention paid towards the balls across the four device conditions is displayed in Figure 3. The rate of pawing behaviour was significantly different among the four device conditions (ANOVA: $F_{3,41} = 3.71$, $p = 0.019$) with the Wubble conditions evoking more pawing in all comparisons (Post hoc all $p < 0.03$, Table 1).

Table 1. Scheffé post hoc comparisons of Wubble effects on pawing behaviour.

Conditions	<i>p</i>
Ball < Hide ball	NS
Ball < Wubble	0.002
Ball < Hide Wubble	0.022
Hide ball < Wubble	0.002
Hide ball < Hide Wubble	0.032
Wubble > Hide Wubble	NS

For aggression and watching ball, non-parametric tests were used to compare between the device conditions. There were significant differences across device conditions in the number of 30-second point samples where aggression over the ball occurred (Kruskal-Wallis $\chi^2(3) = 9.05$, $p = 0.029$) and in the number of 30-second point samples spent watching the ball ($\chi^2(3) = 21.50$, $p < 0.001$). No significant differences in the rates of aggression between the ball and Wubble conditions and the hide ball and hide Wubble conditions were found in post-hoc comparisons (using Mann-Whitney U tests). Significant increases were found in the post hoc analysis of the rate of watching behaviour between the ball and Wubble conditions (M-W: $z = -2.33$, $p = 0.020$) and between the hide ball and hide Wubble conditions (M-W: $z = -3.62$, $p < 0.001$).

Discussion

The movements of the Wubbleball was minimal in terms of area covered and only occurred every 15 minutes; yet during ball presentations a significant increase was found in the frequency of the ball being stolen by conspecifics rather than being abandoned during independently moving enrichment, compared to ball alone enrichment. Exploring this result further, in the initial ball presentations the frequency of leave and steal were very similar. In the hide ball condition, most likely due to habituation effects, the frequency of leaving the ball increases significantly. Upon the introduction of independent movement however, a novelty effect reappears with a return to similar total levels of possession as during the initial presentation. The introduction of this new variable – movement - increased the frequency of stealing relative to leaves, suggesting that the Wubbleball was more attractive than novel but non-moving enrichment. This reverse in relative frequency of possession loss appears to strengthen in the final hide Wubble condition and the frequency of stealing shows a marked increase. Taken together, these results support the hypothesis that independent movement is a more powerful stimulus than novelty and may be more resistant to habituation effects.

During device presentations with movement, significant increases were also found in the rates of pawing and watching the ball. This again suggests that an independently moving

enrichment item is a more powerful source of interest than is simple novel object enrichment. A significant difference was also found in the rate of inter-individual aggression over the ball which was highest in the ball and in the hide Wubble conditions. While aggression diminished between the ball and hide ball conditions, suggesting habituation in the absence of movement, the level of aggression increased between Wubble and hide Wubble conditions. While any increase in aggression might be viewed as negative for welfare, this kind of squabbling over an enrichment object may be beneficial, reaffirming temporary pride social structures and limiting overall overt aggression.

More work is obviously needed to examine the effects of long term exposure of independently moving enrichment items in order to support the premise that there is minimal habituation with movement. Plowman and Knowles (2001) found that habituation occurred the fastest for some enrichment items that were the most successful (or interesting) during their first presentation. That behaviour such as pawing and watching continued to remain high from Wubble to hide Wubble conditions suggests that this is not the case for this moving enrichment item.

One limitation to these findings is that during the hide conditions there was a wide variability in the amount of time that the hide remained fixed to the ball, which increased from one minute during the first presentation to 78.5 minutes in the last presentation, most likely due to an increase in human proficiency in attaching the hide to the ball. Despite fresh hide leaving an olfactory residue on the balls, its loss apparently reduced the ball's attractiveness. In hide ball presentations, the possession bouts ended by leaving the ball at the point when the hide separated from the ball. This change in interest does appear to support the suggestion by Mellen and Shepherdson (1997) that animal skins are of more interest to felids than plastic objects. The fact that possession bouts did not end upon the removal of the hide in the Wubbleball presentations might be viewed as further evidence for the relative 'attractiveness' of movement over simple novel object enrichment.

In the development of functional substitutes for live prey, these results suggest that the Wubbleball may be an important tool in promoting continued interest and interaction. A new version of the device would need to be built to allow a greater range of movement, to increase unpredictability and potentially further resist habituation effects. An alternative to the horseball might be required in order to reduce the cost of such devices since the addition of the Wubble mechanism increased the damage sustained. The ball needed to be replaced more regularly in order to prevent the lions breaking into the centre of the ball and gaining access to the internal mechanical components. These difficulties could be overcome by creating a purpose-built Wubbleball (see www.lionrover.co.uk for more suggestions), which could be used in enclosures that are restricted by space and terrain, such as those used to house semi-terrestrial felids, which could not otherwise accommodate more complex moving enrichment.

Conclusions

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

1. The introduction of even minimal independent movement appears to promote increased and sustained interest compared to simple novel object enrichment.
2. Although further work is required, these preliminary results suggest independently moving enrichment may prove to be less susceptible to habituation effects
3. The Wubbleball appears to be a successful form of enrichment which may be best implemented in the enclosures of semi-terrestrial felids.

Acknowledgements

A huge thanks to Howard Jones for the time and effort he put into building the Wubbleball. Thanks also to Jean McKinley for suggesting the development of this device in the first place. Many thanks also to all at Blair Drummond Safari Park and to the park for its financial support. Also to Joe Cleland for advice on the design and internal mechanisms for the ball and Peter Vidgeon for advice on R/C equipment. To Hannah Buchanan-Smith and Alex Farrand for help and advice and Phil Stone and Sam Wallace for their editing and photographic skills.

References

Ings, R., Waran, N. K. and Young, R. J. 1997. Attitude of Zoo Visitors to the Idea of Feeding Live Prey to Zoo Animals. *Zoo Biology* **16**: 343-347.

Lindburg, D.G. 1998. *Enrichment of captive mammals through provisioning*. In: Second Nature: Environmental enrichment for captive animals. Shepherdson D.J., Mellen, J.D. and Hutchins, M. (Eds.). Washington and London: Smithsonian Institution Press. pp262-275.

Martin, P. and Bateson, P. 1993. *Measuring Behaviour: An Introductory Guide*. UK, Cambridge: Cambridge University Press.

Mellen, J. 1998. *Optimal environments for captive felids*. In: Husbandry manual for small felids. Mellen, J. and Wildt, D. (eds.). Lake Buena Vista, FL: Disney's Animal Kingdom. pp51-56. (Available on Felid TAG web site: <http://www.felidtag.org>)

Mellen, J.D., Hayes M.P. and Shepherdson D.J. 1998. *Captive environments for small felids*. In: Second Nature: Environmental enrichment for captive animals. Shepherdson D.J., Mellen, J.D. and Hutchins, M. (Eds.) Washington and London: Smithsonian Institution Press. pp184-201.

Mellen, J. and Shepherdson, D.J. 1997. Environmental enrichment for felids: An integrated approach. *International Zoo Yearbook* **35**: 191-197.

Plowman, A.B. and Knowles, L. 2003. *Overcoming habituation in an enrichment programme for tigers*. In: Hare, V.J., Worley, K.E. and Hammond, B. (eds.) Proceedings of the 5th International Conference on Environmental Enrichment. Taronga Zoo, Sydney, Australia. Shape of Enrichment Ltd, San Diego. pp 263-267.

High Browse; improved giraffe enrichment at Dublin Zoo.

Helen Clarke, Team leader African Plains.
Dublin Zoo, Phoenix Park, Dublin, Ireland.
Tel: 35314748936, Email: helen.clarke@dublinzoo.ie

The study aimed to reduce the performance of stereotypic behaviours and increase use of our large exhibit in giraffe held at Dublin Zoo. 12 feeding stations were spread around the giraffe enclosure allowing browse and other feedstuffs to be provided at a height of 6metres above the ground with ease for keepers. The results will be discussed in detail.

Full proceedings to follow

Creating an environment for Owston's civet.

Owen Taylor, Small mammals keeper.
Newquay Zoo, Trenance Gardens, Newquay, TR7 2L7.
Tel: 01637 873342.

Abstract

In 1995, two very young Owston's palm civets were seized from the wildlife trade and brought to Cuc Phuong National Park. This group was joined the following year by three more individuals to form the basis of the Owston's Civet Conservation Programme which is now entering its 11th year. Achievements of the programme include; breeding the animals ex situ, national Ranger training, monitoring wildlife trade, producing resources for schools, raising local awareness of the threats to small carnivores, and establishing an international breeding programme for Owston's civet.

In 2002, the assistant director of Newquay Zoo travelled to Vietnam to work with the project coordinator to produce extensive husbandry guidelines, which have been published by BIAZA. These guidelines have now been used to establish a population of Owston's civets within Europe. The civet's have only ever successfully breed at the National Park in Cuc Phuong. At Newquay Zoo, we wanted to replicate the conditions as closely as possible following the husbandry guidelines. In November 2004, the first three pairs of civets arrived in the UK as part of an international loan agreement. After undergoing six months in quarantine, Newquay received one of the pairs.

At Newquay Zoo, the outdoor enclosure for the civets was landscaped to replicate environmental conditions in Vietnam. We wanted to follow as closely as possible the

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

varied enrichment regime used at Cuc Phuong, as clearly described in the husbandry guidelines. The enrichments provided include, a 'twiggy stick', worm foragers, fruit bombs, scent trails, log piles, and scatter feeds. The civets have been seen to use all enrichments extensively.

Providing a high standard of husbandry and following well written guidelines has rewarded us with the first birth of twin Owston's civet out side of Vietnam. International cooperation between Newquay Zoo and the Vietnamese forest protection department has made this possible.

Full proceedings to follow

Environmental Enrichment effects on visitor stay time.

Sanne Te Strote^{1,2} and Joanna Bishop^{1,3}, Undergraduate researchers.

¹Paignton Zoo Environmental Park, ²Van Hall Larenstein Institute and ³Plymouth University. c/o Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697514, Email: Vicky.melfi@paigntonzoo.org.uk

Abstract

The visitor effect model suggests that the presence of zoo visitors can affect the behaviour of the zoo animals (Hosey, 2000). Investigations into the visitor effect support this model (Jones and Wehnelt 2003; Keane and Marples 2003). It is also interesting to note that zoo animals influence the behaviour of the zoo visitors (Altman 1998, Bitgood et al. 1988, Margulis et al. 2003 and Mitchell et al. 1992). Indeed zoo visitors are more interested in active animals (Melfi et al., 2004) and have also been reported to be disappointed to see sleeping animals, remarking that "when there is no movement there is no fun" (Wolf and Tymitz, 1981).

Since environmental enrichment has been shown to increase animal activity (Renner and Lussier, 2002; Wells and Egli, 2004; Shepherdson et al. 1993), and increased animal activity results in increased visitor attention and interest, it is reasonable to suggest that the presentation of environmental enrichment will result in an increase in visitor attention and stay time at the exhibit.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Data were collected at Paignton Zoo Environmental Park, recording the behaviour of meerkats, tigers and their respective visitors. This paper will present these data and discuss the following hypotheses:

1) The tigers/meerkats will perform significantly more active behaviours when enrichment is provided compared to when it is absent (Renner and Lussier, 2002, Wells and Egli, 2004, and Shepherdson et al. 1993).

2) Visitor stay time at the exhibit will be longer when:

a) the tigers/meerkats are using the EE (Altman 1998, Bitgood et al. 1988, Margulis et al. 2003, Melfi et al. 2004, Shepherdson 1991, and Wolf and Timitz).

b) the EE is present in the enclosure compared to when no EE is present (Davey et al, 2005).

Full proceedings to follow

Enrichment for a Mixed Species Exhibit Housing Lowland Anoa (*Bubalus depressicornis*) and Sulawesi Crested Macaques (*Macaca nigra*).

Helen Wade and Nicky Jago, mammal keepers.

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697500, Email: mammals@paigntonzoo.org.uk

Abstract

*Paignton Zoo recently transferred 0.1 lowland anoa (*Bubalus depressicornis*), into a mixed species exhibit with 4.5 Sulawesi crested macaques (*Macaca nigra*). Prior to this move, enrichment items were offered and used by the anoa on a regular basis. However, the change in enclosure design and the presence of the macaques made the provision of enrichment for this animal more challenging, the major limitation being the highly inquisitive (and destructive) nature of the macaques. This recent lack of enrichment and constant attention from the macaques were thought to be contributing to the apparent decrease in the anoa's activity levels. In this study a number of enrichment items and devices were tested to assess suitability for both these species. The main objective of the study was to increase enclosure use and behavioural diversity by the anoa. The results show that while enclosure use was unaffected by the addition of the enrichment, behavioural diversity was increased. The resulting series of enrichment objects, which have been shown to be suitable for both anoa and macaques, are currently being incorporated into an enrichment schedule for this exhibit. We propose that a similar schedule could be developed for other mixed exhibit situations.*

Introduction

At Paignton Zoo a single female lowland anoa (*Bubalus depressicornis*) was recently transferred into mixed species exhibit with 4.6 Sulawesi crested macaques (*Macaca nigra*). Following this move, provision of enrichment for the anoa became difficult, primarily due to the presence of the macaques, which have a tendency to monopolise (and often destroy!) any enrichment provided. Keeping staff noticed an apparent decrease in the activity levels of the anoa, and it was thought that the recent lack of enrichment and constant attention from the macaques could be contributing factors.

Aims

This study aimed to create and test a number of enrichment items and devices suitable for both species in this mixed exhibit. The main objective was to increase enclosure use by the anoa and increase her behavioural diversity, using enrichment to stimulate behaviours such as foraging, head-butting and body-rubbing.

The end result of the study is a series of recommended enrichment objects suitable for both species. At Paignton Zoo these items are currently being incorporated into an enrichment schedule.

Method

Subjects and Location

The subjects were a female lowland anoa and 4.6 Sulawesi crested macaques. These animals co-exist in the same geographical region in the wild, and have recently been housed together in the new 'Monkey Heights' exhibit at Paignton Zoo (figure 1).



Figure 1 – The anoa and macaque exhibit at Paignton Zoo

The anoa and macaques are mixed together daily from 8am until 5pm, after which the macaques' access is limited to their show den and the anoa has sole access to the paddock overnight. This study was conducted during winter months when the anoa has access only to the sandy area at the bottom end of the paddock, in order to protect the grass. The anoa house is located adjacent to this sand area, and the macaques have access to the

- Hanging baskets with picked grass (figure 3). Two hanging half-baskets were connected together using metal clips, and suspended from sections of chain to produce the spherical hanging baskets. 5 of these baskets were produced. Picked

grass was stuffed into the baskets for the anoa, and cabbage was used for the macaques. They were suspended from various points in the enclosure.



Figure 3 – Hanging basket with picked grass

- Growing grass trays (figure 4). Plastic troughs (1.75m x 0.5m) were filled with a layer of stones (to add weight for stability) and compost, and planted with grass seeds and herbs. These were allowed to grow, and then were secured by short sections of chain to posts in the enclosure. Three of these troughs were planted and used in rotation, in order to give each one time to grow, in between uses.



Figure 4 – Growing grass tray

- Hanging barrels with dry feed (figure 5). To create these devices, 20-30 small holes (diameter 1.5cm) were drilled into the bases of 5 plastic barrels. The barrel lids were secured by cable ties and short sections of chain were attached to the barrel handles, in order to suspend them from perching. The barrels were filled with grazer pellet for the anoa and mixed dry feed for the macaques.



Figure 5 – Hanging barrel

3. Manipulative

- Broom heads (figure 6). 3 broom heads were connected vertically to perching and mesh in the enclosure using cable ties.



Figure 6 – Broom head

Experimental Design

An enrichment schedule was created for the study (see figure 7). Each type of enrichment was tested both inside the anoa house and outside in the paddock (in areas where both anoa and macaques had roughly equal access throughout the day). Where possible, we also set up the items in the macaque-only area of the paddock, in order to provide adequate enrichment for the large group of macaques, and attempt to prevent the macaques from monopolising the anoa enrichment. To ensure the results of the observations would be significant we repeated each enrichment type on five days inside the anoa house and five days outside in the paddock, with ten control days (of no enrichment) interspersed. This totalled 60 days of observations.

The enrichment schedule:

Date	Day of Study	Location	Enrichment type
7/2/06	1	Inside	Hanging Barrels
8/2/06	2	Inside	Broom Heads
9/2/06	3	Inside	Hanging Baskets
10/2/06	4	Inside	Scent Trails
11/2/06	5	Inside	Lawns
12/2/06	6		Control Day
13/2/06	7	Outside	Hanging Barrels
14/2/06	8	Outside	Broom Heads
15/2/06	9	Outside	Hanging Baskets
16/2/06	10	Outside	Scent Trails
17/2/06	11	Outside	Lawns
18/2/06	12		Control Day

Figure 7 – First 12 days of the enrichment schedule designed for the study

Behavioural ethograms were constructed prior to observations in order to standardize the observations, which were taken by three different people.

The enrichment was set up in the enclosure at 8.00am each morning, and observations of location and behaviour of each animal in the paddock were recorded for a minimum of ten minutes immediately after the enrichment was introduced. These initial observations were continued until the enrichment had been out of use for two minutes. Instantaneous scan sampling was carried out every hour on the hour for the rest of the day.

The data was recorded on spreadsheets. More detailed behavioural observations were recorded for the anoa than for the macaques as she was the main focus of the study.

Photographs and video footage were taken, and notes were also made to help assess the effectiveness of each type of enrichment.

Data Analysis

To quantify the enclosure use by the anoa, spread of participation index (SPI) analysis was carried out for each different type of enrichment (Plowman, 2003). This is commonly used in zoos to describe how well the available space is used by a captive animal. It is an established method, which allows for designated zones of unequal size.

$$SPI = \frac{\sum |f_o - f_e|}{2 (N - f_{emin})}$$

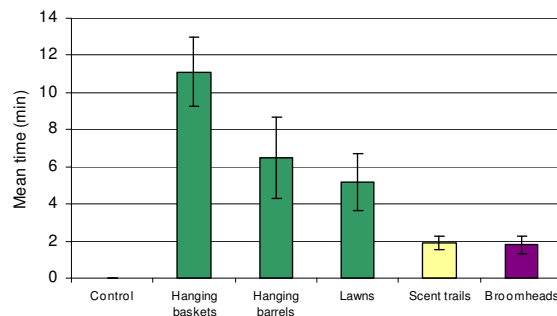
Where f_o is the observed frequency of observations in a zone, f_e is the expected frequency of observations in a zone (based on zone size assuming the whole enclosure is used evenly), and N is the total number of observations in all zones.

Behavioural diversity was assessed using the Shannon-Weaver Index (Fowler *et al.*, 1998), which is defined as:

$$H = - \sum p_i \ln p_i$$

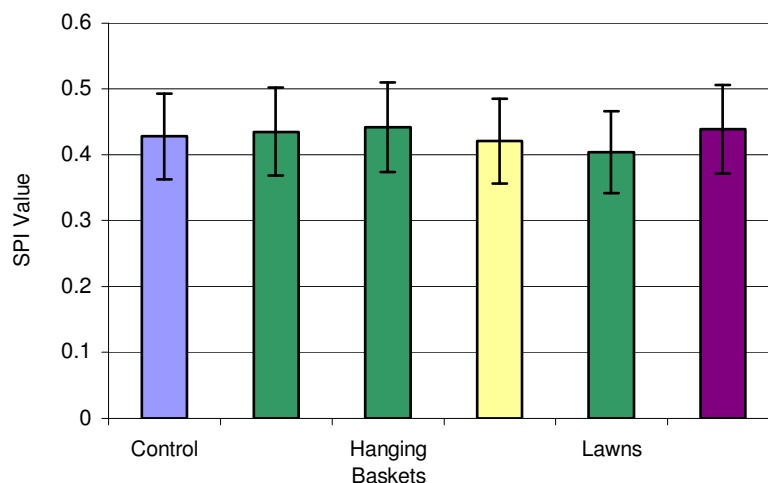
Where p_i is the proportion of observations for one sample.

Results



Graph 1 – Average time spent by the anoa using the enrichment, immediately after it was provided.

Graph 1 shows that the enrichment techniques tested greatly varied in effectiveness, with the food-related devices used for longer periods by the anoa. All enrichment types were utilised by both macaques and anoa. Unfortunately towards the end of the study one of the grass troughs was destroyed by the macaques, however all the other items used remained undamaged.

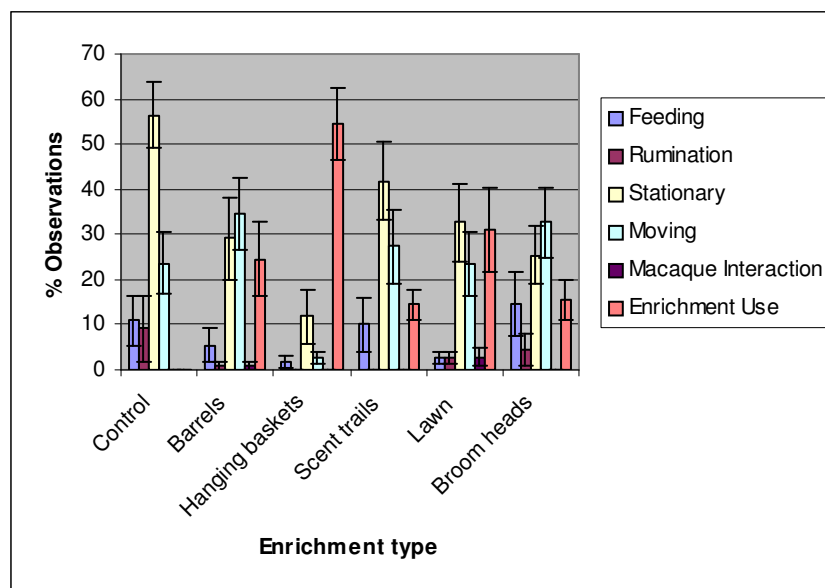


Graph 2 – Graph comparing enclosure use throughout the day for each enrichment type, as indicated by SPI analysis.

- Enclosure Use

The SPI index varies between 0 (maximum enclosure use with all zones being used equally) and 1 (minimum enclosure use with only one zone used). SPI analysis of the data (graph 2) shows that enclosure use did not increase or decrease on days when enrichment was offered in comparison to control days.

- Behavioural Diversity



Graph 3 – Activity budget of anoa showing behaviours immediately after enrichment was provided.

The activity budget above (graph 3) shows that time spent stationary by the anoa decreased, and time spent moving was increased on the days when enrichment was offered (hanging baskets being the only exception). Time spent interacting with the macaques also decreased on days when enrichment was offered.



Graph 4 – Graph showing behavioural diversity of the anoa, as indicated by the Shannon-Weaver index.

The histogram showing the Shannon-Weaver Diversity Index (graph 4) shows that there is an increase in the behavioural diversity of the anoa on the days when enrichment was provided, as opposed to control days.

Discussion

Summary of results

The results of this study have shown that:

- Scent trails, broom heads, hanging baskets and hanging barrels are all suitable methods of enrichment for a mixed species exhibit, with anoa and Sulawesi crested macaques. They are used by both species, and with the exception of the lawn troughs) are not destructible by macaques!
- Food-based enrichment types proved most successful.
- Enclosure use – SPI analysis indicates that the enrichment provided in the study did not significantly increase enclosure use by the anoa. This result could be due to a number of limitations within the study (see limitations section of discussion).
- Behavioural diversity – when enrichment was provided in the exhibit, the anoa spent less time stationary, more time moving and less time interacting with the macaques. Behavioural diversity also increased with enrichment.

Limitations of the study

The data could have been affected by various limitations:

- Some of the enrichment types offered (e.g. scent trails) appeared to lose their novelty value rapidly after introduction to the enclosure, therefore were not always used beyond the initial ten minutes.
- Some food-based enrichment types were limited by the volume of food they contained, which therefore restricted the length of time they were used for.

- Some of the enrichment was presented in areas of the enclosure that the anoa would normally use. This was because it was necessary to secure the enrichment to perching posts which were unfortunately situated in areas the anoa already frequented.

- It was not possible to regularly observe the anoa's behaviour in the absence of the macaques due to husbandry constraints. Although it is not apparent in the data the macaques were frequently observed monopolising the enrichment, which appeared to deter the anoa from using the item.

- Anoa's are crepuscular or nocturnal in the wild so her natural activity patterns may not be compatible with the times we provided the enrichment. It may be more appropriate to provide enrichment at other times of day, or even overnight.

Future developments

The troughs finally proved too flimsy to withstand investigation from the macaques. A more sturdy plastic or wooden trough may have been more appropriate, but we are also looking into the possibility of growing grass turf strips on water (hydro culture).

At present an enrichment schedule is currently being created for this group of animals based on the results of this study. This schedule includes other enrichment methods which have been found to be successful in the past (including scatter feeding and cardboard food boxes) and also includes techniques have yet to be tested (such as boomer balls and kongs). As part of this schedule enrichment will be offered at different times of the day to take into consideration her crepuscular or nocturnal behaviour.

Behaviours observed throughout the study seemed to suggest that the anoa may be experiencing stress (indicated by tail-flagging and head-rolling) (Mason, 1993), particularly during interaction with the macaques. Based on our observations a further study is now being planned to investigate these interactions between the anoa and macaques. This study will also investigate a possible correlation between the aggression shown by the dominant male macaque and the anoa's oestrus cycle.

Successes

The enrichment ideas we developed were successful and used by both species, and our study resulted in increased behavioural diversity and activity levels in the anoa.

In addition to increasing quality of life for the animals involved in this study, this project has provided a valuable opportunity for keeping staff to spend more time observing these animals than normal routine would allow. This project has highlighted the real need for careful long-term observation of mixed species exhibits, and has also shown the value of the provision of enrichment in these circumstances. Although it can be a struggle for keeping staff to find the time to carry out regular observations such as those in this study, this project has demonstrated that it is possible, and very constructive.

References

Burton JA, Hedges S & Mustari H. (2005). The taxonomic status, distribution and conservation of the lowland anoa *Bubalus depressicornis* and the mountain anoa *Bubalus quarlesi*. Mammal rev 35: 25-50.

Fowler, J, Cohen, L & Jarvis, P. (1998). Practical Statistics for Field Biology. 2nd Ed. John Wiley and Sons, Chichester.

Mason, G J. (1993). Forms of stereotypical behaviour. In: Lawrence AB, Rushen JB, editors. Stereotypic Animal Behaviour – Fundamentals and Applications to Welfare. CAB International, Wallingford. P86-91.

Plowman, A. (2003). A note on a modification of the spread of participation index allowing for unequal zones. Applied Animal Behaviour Science 83: 331-336.

http://www.ultimateungulate.com/Artiodactyla/Bubalua_depressicornis.html, Accessed 02/05/06

Acknowledgements

Nina Topping, Holly Farmer, Vicky Melfi, Julian Chapman, Lisa Doran, Tony Dobbs, Andy Fry, Gillian Davies, Louise McKenna, Bryan Raynes, Davinia Hollingworth and Neil Bemment.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

**Enrichment on a Huge Scale
Programmes for the Asian Elephant**

Andrew Durham, Elephant keeper.
The Zoological Society of London, Whipsnade Wild Animal Park, Dunstable,
Bedfordshire, LU6 2LF, United Kingdom.
Tel: 01582 872171.

Abstract

*Environmental Enrichment is an on-going process for the keepers of seven Asian Elephants, *Elephas maximus*, at Whipsnade Wild Animal Park. The aim of the enrichment is to provide the elephants with as many biologically and ecologically relevant stimuli as possible.*

The enrichment aim of the keepers is to provide sufficient stimuli to ensure there is both the opportunity for the elephants to behave in a naturalistic way and also provide the distraction necessary to reduce abnormal behaviours such as raised levels of stereotyping. Not only are natural methods of enrichment used but also “non-natural” means are able to provide the necessary distraction if used in a positive way. The Whipsnade keepers provide four different enrichment modes – feed and foraging, social, enclosure furnishings and the use of “toys”. Only by using a combination of all four types have the keepers successfully reduced the incidence of stereotypic behaviours and improved the welfare of the animals in their care.

Full proceedings to follow

Foraging enrichment; a mixed blessing for vicugna.

Matthew Parker, Postgraduate Researcher.
Department of Psychology, University of Southampton, Highfield, Southampton,
Hants, SO17 1BJ.
Tel: 23805 95078.

Abstract

Increasing foraging behaviour and promoting substrate choice as methods for reducing stereotypy in captive animals are widely practised and generally accepted as effective. In the present study we examined the efficacy of offering a foraging patch and substrate choice in an attempt to reduce motor stereotypy in two captive vicugna (F1 and F2). Browse was added to the vicugna's enclosure as an additional forage substrate and keepers also split the vicugna's normal feed; half being delivered outside of the sleeping enclosure and half inside, to offer a split patch choice. The study employed an ABACA design; A= baseline, B= browse, C= split feed conditions.

Results showed a significant effect for condition, $p = 0.017$, T-tests revealing a significant condition effect in F1 between the Browse and Baseline one, $p < 0.05$ with the frequency of stereotypy during the Browse condition being higher. In F1 a higher frequency of stereotypy was observed during the Browse condition, compared to Baseline two, this was approaching significance, $p = 0.06$.

T-tests revealed several significant inter-condition differences in F2. The frequency of stereotypy during the Browse condition was significantly higher than during Baseline one, $p < 0.05$, Baseline two, $p < 0.01$ and the Split Feed condition, $p < 0.05$. The frequency of stereotypy was also significantly higher in the Baseline three condition than in the Split Feed condition, $p = 0.05$.

In the wild, vicugna are the only camelids who sleep and eat in separate areas. However, the subjects used for the present study were fed in their sleeping enclosure. The decrease in stereotypy during the split-feed condition may be indicative of the relative reinforcer value of stereotypy, compared to simulated wild-type foraging opportunities. The reason the browse increased stereotypy may be because it represented a supernormal stimulus.

Full proceedings to follow

Enriching the dragon

Ian Stephen and George Sunter, Reptile keepers.
Zoological Society of London, NW1 4RY, London, England.
Tel: Email: ian.stephen@zsl.org

Abstract

Reptile and enrichment: two words that seldom occur in the same sentence.

For such a behaviourally complex group of animals it is disappointing that when maintained in captivity many are regularly housed in a simple box, with newspaper as a substrate and maybe no more cage decoration than a plastic hide box and a water bowl.

Of course it doesn't have to be this way.

Komodo dragons are large predators/scavengers, the largest lizards in the world, and are found on just a few small islands in the Lesser Sundas, Indonesia. They have complex life histories, well defined social structures, follow visual and olfactory cues in search of potential mates and prey and live in a diverse and highly seasonal habitat. At ZSL we try to provide our Komodo dragons with a similarly enriched life. Scent trails, unique smells and novel objects are used to encourage foraging and exploratory behaviour. Food provided to the dragons is not only very diverse, but also presented in a variety of manners and in varied, but controlled quantities. Keeper interaction and operant conditioning is considered vital both for dragon stimulation and day to day management.

The dedicated housing for the dragons is designed to provide Indonesian temperature, humidity and rainfall patterns. 'Hot-spots' encourage basking behaviour, and behaviourally-stimulating ultra-violet light is provided both artificially by specialist spot-lamps and naturally via sunlight passing through a specialised UV-penetrable plastic roof. Enclosure design allows control over intraspecific social interaction, breeding behaviour, nocturnal nesting activity, and access to the six separate parts of the facility. Cage furnishings and various substrates are changed regularly, thus further stimulating the dragon's olfactory and visual senses.

Komodo dragons in captivity are prone to lethargy and obesity. ZSL's policies of environmental and behavioural enrichment, keeper interaction and operant training, and strict dietary control have so far prevented either of these problems and resulted in fit, healthy, reproductive dragons.

Full proceedings to follow

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

**How can we measure the effects of Environmental Enrichment? Workshop
and discussion.**

Dr Amy Plowman, Head of Science Department.
Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.
Tel: 01803 697514, Email: amy.plowman@paigntonzoo.org.uk

Abstract

There is no doubt that Environmental Enrichment is an integral part of zoo animal husbandry. However, how do we tell if enrichments are working in the way we want them to or even if they are working at all? This workshop will cover some of the basics of studying animal behaviour and evaluating enrichment effects, such as writing an ethogram, taking behavioural observations, evaluating what the goals of a particular enrichment may be and to how to assess if these goals are being met. The workshop will include many practical aspects of zoo research and hopes to provide basic knowledge so that zoo staff can reliably evaluate enrichment.

Full proceedings to follow

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

How can we measure if training is enriching?

Dr. Vicky Melfi, Research Associate.

Paignton Zoo Environmental Park, Totnes Road, Paignton, Devon, TQ4 7EU.

Tel: 01803 697514, Email: Vicky.melfi@paigntonzoo.org.uk

Abstract

The debate about whether zoo animals should be trained continues and increasingly some of the benefits of training are being recognised; including aiding the administration of medicine, facilitating husbandry and veterinary. Among these associated benefits is the perception that training is enriching to the animals being trained or can serve as part of the enrichment programme. However the literature (research) available to support this claim is anecdotal at best, and at worst an assumption.

Efforts made to establish if training is enriching, are hindered by semantics; what exactly do we mean by enriching? This presentation will suggest four different mechanisms by which training could be considered to be enriching: i) Training has the same effects as 'conventional' environmental enrichment (CEE), ii) Training is stimulating, iii) Training provides a dynamic change to the animals' day, or iv) Training facilitates the use of CEE. By identifying these mechanisms we are able to start disentangling what is meant, when it is said the training is enriching, and there start investigating whether this is true. Without the results from these studies, judgement should be reserved!

Full proceedings to follow

Keeper interaction and animal husbandry as a form of enrichment.

Yianna Christopoulos, keeper.

Paradise Wildlife Park, White Stubbs Lane, Broxbourne, Hertfordshire, EN10 7QA.
Tel: 01992470490.

Abstract

In the wild, the animals have to search for food, shelter, con-specifics, avoid predators and defend territories. One problem with placing animals in captivity is the fact the typical development of their authentic being is arrested at all levels (Animal Protection Institute 2000). The object of this study is asses how anticipation of feeding routines effect animal behaviour in captive camels. This was achieved by comparing the frequency of undesirable, desirable and appropriate behaviour in camels when feeding routines were carried out on and off schedule. The effects of introduced feeding enrichment were also measured. The original strict feeding routine showed a higher frequency of undesirable behaviours. A promotion of desired and appropriate behaviour was seen with the alterations to the feeding routine showing a reduction in undesirable behaviour in the three subjects studied, showing a change in the camel's behaviour after a change in a strict routine feeding schedule.

Introduction

Wild animals in captivity in the care of humans are often kept under conditions that generally prevent them from exhibiting their natural behaviour. All over the world thousands of zoo animals are kept in undesired environments with little stimulation. As a wildlife park we at Paradise Wildlife Park feel our most successful form of enrichment is the interaction we have with our animals. Interaction with our animals allows the animal to choose to whether to participate or not. This is also useful in gaining the animal's trust and allows the keeper close, visual observations of that animal.

It is of great importance to us to keep our animals steady and stress free, mostly due to the size of our enclosures and the contact with the visitors.

Routine husbandry acts connected with providing food and managing animals are all associated with this. Animals quickly learn to perform certain behaviours in response to even the subtlest cues in their environment. The distant sound of rattling food buckets or the jingling of keys bouncing on a keeper's hip may stimulate an animal to wait anxiously at a door in anticipation of its afternoon meal. In the wild, many animals feed constantly during their walking hours. An elephant can spend up to 20 hours a day searching for food, and a camel can walk up to 29 miles a day in search for food (Moges Dereje et,al 2005) In captivity zoo animals are fed once or twice daily. Artificial captive environment can generate intrinsic animal welfare problems such as abnormal behaviours, self mutilation, feeding disorders, and stereotypical behaviour (pacing, neck twisting or rocking) Carlstead, (1986) suggests feeding routines in captive animals in particular may be expected to have a major influence on behaviour, as it is the most important imposed event in captive animals.

Us as keepers should realize their power to influence animal behaviour and take responsibility for their participation in creating both desired and undesired behaviours of their animals.

Many of the behaviours we consider undesirable in our animals are the result of interactions where keepers have inadvertently reinforced the animals with positive or negative reinforcement. It is beneficial that animal keepers develop a working knowledge of operant conditioning training techniques to gain a clear understanding of how their actions influence behaviour.

Stereotypic pacing is a behavioural problem that has generated a variety of enrichment programs. It is important to understand that animals often view enrichment activity as a form of positive reinforcement. If enrichment is presented in conjunction with a particular act it may increase the likelihood that the act will occur again. Sometimes our noble attempts to eliminate undesirable behaviours actually act to increase them. Basheria our Bactrian camel has a problem with pacing, in a figure of eight. We have managed to reduce this greatly with spontaneous keeper interaction, random feeding, and a novel enrichment item being the feed cage consisted of a ball shaped frame (two flower hanging baskets tied together to form a ball) filled with chopped up fruit and vegetable. The object of this device is that the ball is hung from a height and would need to be manipulated and moved in order for the food to be dispensed, thus providing stimulation.

It was predicted that anticipation of feeding resulted in an increase in stress-related behaviours and a decrease in both activity and affiliative behaviours, it was also predicted that this behaviour would be exacerbated by delays in the feeding schedule.

From the observational study it was shown that the animals spent more time actively feeding through out the day as they would in the wild than previously. The feeding devices made it harder for the animals to access the food providing mental stimulation. The animal's often left the devices and returned shortly after throughout the day, thus providing continuous enrichment. By introducing variable feeding times, the animals showed reduced stereotyped pacing that they used to show before the regular feeding time, and were more active and varied in their behaviour.

As feeding was delayed an increase in vocalising, increased pacing and aggression was seen in the studied subjects. The most common behaviours seen at time of feeding were pacing of fence boundary and standing looking into the distance, which may be associated with looking out for the keeper.

The appropriate behaviours recorded in the observation stage were split into three categories.

1 = **Desirable** behaviour, 2 = **Undesirable behaviour** and 3 = **Appropriate** behaviour.

Category 1 desirable species specific behaviour definitions include:

Feeding behaviour

Feeding : ingesting food or water.

Foraging, grazing, searching for food on the floor with occasional lifting of substrate to rummage underneath.

Social behaviours

Allogrooming: one individual grooms another. This may be mutual, reciprocated or unidirectional.

Affiliative: huddling, make play face towards or play with another. play with another.

Category 2 undesirable behaviour definitions include

Aggressive behaviour

Fighting: aggressive interactions between individuals or groups, usually accompanied by loud vocalisations. Visual and vocal threats, chases, lunges, bites teeth chattering. Characterised by open mouth threats.

Vocalise

Any vocalization audible to observer.

Destructive

Biting, pulling apart enclosures or furnishings

Locomotion

Walking in a stereotype fashion, pacing.

Category 3 appropriate behaviour include:

Inactive alert

Remaining in one location without engaging in any other activity, eyes looking around at surroundings or others.

Solitary Behaviour

Sitting or laying down, resting, but not carrying out any other activity such as foraging.

Urination, and defecation.

Self- grooming, auto-grooming: grooming own body.

Locomotion

Walking: quadrupedal movement in a desired direction.

Running :as above, but faster.

From the data collected the statistics were analysed descriptively on the spss programme. Through descriptive statistics the frequency's of which the three categorised behaviours occurred were compared in the three situations. This made it possible for any increase or reductions in desired or un-desired behaviours to be displayed.

Throughout the study as the observer, a lot of time was spent with the camels. This allowed the observer to become very familiar with the personalities and traits. A noticeable difference was seen in all the of the Camels temperaments as the study went on. In the early stages of the study Bashieria was a temperamental camel that often put everyone in their place, including the keeper by using her size to pin them up against the railings. Towards the end of the study Bashieria became very affectionate and seemed to enjoy the company and attention of the other camels and the keepers even when food was not involved. By comparing data collected in phase 1 of the study from which data was collected from the routine feeding schedule, with the data collected in the final enrichment introduced enrichment phase the frequencies in behaviour are as follows:

Basheira showed desirable behaviour 15.4% which was increased to 21.5% in the final stages of the study. A reduction from 55.4% to 24.6% was seen in undesired behaviour. A change from 29.2 % to 53.8% was seen in appropriate behaviour. Which resulted in a total increase of appropriate and desired behaviour from 44% to 75.3%

It cannot be determined for sure that this was due to the change of the routine and enrichment but it can be considered as a result due to the extra stimulation provided for the camels may have an impact in behaviours which may be the result of boredom and frustration which would have been reduced by the appropriate enrichment.

The feeding ball offered the camels the opportunity of using time and energy to obtain food items. This resulted in behavioural changes consistent with improved welfare, the feeder resulted in increased feeding related behaviours and more activity, also a reduction in abnormal behaviour such as the pacing. No adverse effects were observed. These changes resulted in activity budgets being closer to that of the wild. This design of ball feeder was simple and cheap to construct, required little additional personnel effort and resulted in significant, positive changes in behaviour the three camels and also proved successful with other species. It was, therefore, an effective environmental enrichment tool.

Many of our animals are halter trained, being able to move the animal stress free from its enclosure provide many opportunities for the animal to experience new and stimulating surroundings.

I'm not suggesting that this is the best form of enrichment, quite the opposite. I'm sure, many of us would love to see our animals in as close to their natural habitats as possible, exhibiting their natural behaviours but unfortunately in most zoos today this is not the case, and it is therefore essential that we provide our animals with as close to stress free environment. Animal care routines are essential to an animal's physical well being, but the effects of husbandry routines on the animal's physiological well being are not often considered. Questions have been thrown on the subject that what defines enrichment from animal husbandry? I feel as we are gaining more and more insight into animal behaviour enrichment is becoming an essential focus in our husbandry, and is being carried out by us daily, sometimes with out us even noticing.

Acknowledgements

I would like to say thank you to all the staff and directors of Paradise Wildlife Park for their help and support throughout the study.

References

Corri waitt, Hannah M. Buchanan-Smith (2001) *What time is feeding? How delays and anticipation of feeding schedules affect stump-tailed Macaque behaviour*. Applied Animal Behaviour. 75-85.

Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Moges Dereje a, Peter Ud'en b. (2005) *The browsing camel Behaviour, plant preference and quality of forage selected*. Animal Feed Science and Technology

Animal Protection Institute (2000, April). Serving a life sentence: orcas and dolphins in captivity. Retrieved August 19, 2004, from
<http://www.api4animals.org/doc.asp?ID=300&print=y>

Is Environmental Enrichment feasible in a small zoo?

Tracey Moore, Director.

Shaldon Wildlife Trust, Ness Drive, Shaldon Devon TQ14 0HP.

Tel: 01626 872234, Email: tracey@shaldonwildlifetrust.org.uk

Abstract

At Shaldon we believe that enrichment is beneficial to the well-being of our animals, however, as the smallest member of BIAZA and EAZA we obviously need to be very careful how our budget is spent. Therefore any enrichment must be of little cost (ideally free of charge) and with only 2 full-time staff it needs to be easy to set up and maintain or alter. Bamboo is not only used as browse for our gentle lemurs but the remaining cane is then filled with banana for our porcupines. Food is often presented in empty boxes for the capuchins and porcupines which requires the animal to initially open them for food but they then spend time destroying the box. The local woods provide logs for our meerkats and porcupines to explore, flowers, browse and brambles for lemurs, capuchins and gundis, gum feeders for marmosets and new perching for tamarins, macaws, ocelots etc. Empty plastic bottles, hanging baskets, frozen fruit-filled ice blocks and snake skins are all used at no cost. Items such as swinging platforms and nut puzzle feeders make use of offcuts of mesh and wood etc. Donated items such as rope allow us to make hammocks for capuchins and lemurs. Even small changes like freezing, hiding or scattering food and offering whole fruits provide enrichment opportunities as does offering leaves, small branches etc to encourage nesting behaviours. Mixed exhibits allow us to make the most of our small size but also provide social enrichment. In summary ideas such as these mean that even the smallest zoo has numerous opportunities to provide enrichment for its animals.

There follows some examples of enrichment used at Shaldon:

Bamboo

We have 2 Alaotran gentle lemurs at Shaldon which are given daily supplies of bamboo and willow, collected from local gardens and also grown at the Trust. The bamboo not only provides browse for the lemurs but the remaining stems are used as enrichment for our African brush-tailed porcupines by pushing nuts and seeds or banana down the hollow centre, an idea taken from Baltimore zoo. The animals lick the food on the edge then gnaw the bamboo to get the contents within.

Empty plastic bottles

These are filled with nuts, seeds, grapes and small pieces of fruit for the capuchins who have to shake the bottle or use their fingers to remove the contents. Insects can be used for tamarins and also for ground dwellers such as meerkats/mongoose. These are easy to construct although not aesthetically pleasing.



Proceedings of the 1st Regional Environmental Enrichment Conference 2006, Paignton
Zoo Environmental Park, UK.

Boxes

Food is often presented in empty boxes. African brush-tailed porcupines will work at a box to get to the food inside. They are also very popular with our capuchins who also open the box initially for food then spend an afternoon destroying the box. Ripping apart old telephone directories is also popular.

Woodland

The surrounding woodland provides logs for our meerkats and porcupines to gnaw and dig, and stumps to dress the enclosures. Feedstuffs are available such as flowers (particularly daisies and dandelions), brambles for our gundis and browse such as willow and hawthorn for our lemurs and capuchins. The wood has been used for gum feeders for our pygmy marmosets (see right - a pole with holes drilled through then gum inserted) and perching for various enclosures and pine cones can be filled with nuts and raisins for callitrichids.

Surplus wood and offcuts of mesh are used for items such as nut feeders for macaws and prevost squirrel (see right - simply 1x1 mesh filled with hard-shelled nuts and sealed with c-rings). Swinging platforms have also been made from the stumps.

Something used very successfully at Shaldon are banana poles for our ruffed lemurs. They are not as easy to construct (a wooden pole with holes drilled through with sections of plastic drainpipe slid over the top to cover the holes) but once made (see right) they are easy to maintain and clean and are a very good attraction for the public.



A chick pole, similar in design to the gum feeder and banana pole is used for our ocelots as are buried, upturned, terracotta plant pots on the floor of the enclosure with chicks or mice inserted. Bristle doormats are scratched and help them clean their claws.

Hanging baskets and plastic trays, filled with straw and covered in mesh provide “lucky dip” feeders. Frozen fruit-filled ice blocks and snake skins are used at little cost.



Hammocks are very popular with the lemurs, made with hessian sacks, eyehooks, clips and chains which make them easy to remove. Cargo netting is used for the same purpose for the capuchins.

Even small changes like freezing, hiding or scattering food (roof feeding for our capuchins) or offering whole fruits can provide enrichment opportunities. Offering leaves and small branches can encourage nesting behaviour.

To make the most of our size we have always had mixed exhibits at Shaldon and have had many different combinations over the years. Some current mixed exhibits include meerkats and African brush-tailed porcupines (pictured right), kookaburras and acouchis, golden-headed lion tamarins and potoroos, and pygmy marmosets and mouse-deer. Not only does this make optimum use of space but provides social enrichment also.

In summary ideas such as these, no matter how simple and basic, show that even the smallest zoos have numerous opportunities to provide enrichment for their animals.



References

Bartos, C. (1998) Enrichment ideas for African crested porcupines *The Shape of Enrichment* Vol 7: No2 <http://www.enrichment.org/articles/72porcupine.pdf>