

# A Keeper's Guide to Evaluating Environmental Enrichment

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## Why evaluate enrichment?

Enrichment can be time consuming to provide therefore it is important for keepers to know that their limited time is not wasted on ineffective enrichment. However, most importantly, since enrichment is provided to enhance the animals' welfare it is vital to know whether it is working and indeed to be sure that it is not having the opposite effect and decreasing their welfare.

## What are the aims of your enrichment?

Enrichment can have many aims, mostly often related to the behaviour of the animals. Some are very general eg provide opportunities for a wider range of natural behaviour, some are more specific eg reduce the time spent performing a stereotypy (Box 1)

Sometimes it is relatively easy to measure whether these aims have been achieved and sometimes it is not without specialist equipment, lab tests, a very carefully planned experiment or a very long term study (ie years).

### **Box 1 Examples of enrichment aims**

- |  |                       |
|--|-----------------------|
| • Reduce time spent pacing             | Measurable            |
| • Increase diversity of behaviour      | Measurable            |
| • Increase use of enclosure space      | Measurable            |
| • Increase adaptability                | Not easily measurable |
| • Improve post-release survival        | Not easily measurable |
| • Increase physical fitness            | Not easily measurable |
| • Provide more stimulating environment | Not measurable        |

In order to assess whether your enrichment has done what you intended it to, you must be clear on the aim was and that aim must be measurable.

## What is measured?

Most enrichment evaluation is done by measuring the animals' behaviour with and without the enrichment. However other factors could be measured such as cortisol levels in faeces as a measure of stress, muscle weight or skeletal factors at post mortem, longevity or disease occurrence as a measure of health.

This guide focuses on evaluating enrichment by comparing the animals' behaviour with and without enrichment, since it is assumed that most keepers will not have the opportunity to use other possible measures.

Unless the enrichment is totally ignored it is almost inevitable that it will alter behaviour immediately after it has been provided. It is easy to see animals using an enrichment and think that it is successful, or conversely not using the enrichment and think that it is unsuccessful. However, this is not always the case. To be sure what the effect of the enrichment is behaviour over the whole day must be systematically observed on several days with and without enrichment.

## **How to measure behaviour**

### **Step 1 – Develop an Ethogram**

An ethogram is simply a list of all the behaviour types that will be observed and a description of each behaviour so that other observers would recognise the behaviour. Two ethograms for the same animal may differ depending on what needs to be measured. If the aim is to increase friendly social interactions then the ethogram may need to include several different types of social interaction whereas if it is to decrease a stereotypy than a general behaviour category 'social interaction' may be sufficient. Behaviour types that are not at all relevant to your enrichment aims can be grouped together in an 'other' category.

#### *States and Events*

Most ethograms will include two groups of behaviour: states and events. States are long duration behaviour types such as resting, walking, grooming. Events are very short duration behaviour types such as yawning, scratching, making a threat gesture.

It is important to decide which are states and which are events as they require different recording methods

### **Step 2 – Study schedule**

The schedule will depend on the time you have available and your normal routine. Although spending all day every day for a 2 weeks evaluating enrichment may be ideal in terms of study design most keepers will not be able to do this!

The most important aspect of design is to make every effort to ensure that all other conditions on enrichment and non-enrichment days are kept as similar as possible (Box 2)

If you cannot control some conditions e.g. visitor numbers then you should try to randomise them so some enrichment days are busy and some quiet and some non-

#### **Box 2 Controlling other factors**

If all your enrichment days are cold and wet and all your non-enrichment days are hot and sunny you any differences you find in behaviour could just be due to the weather not the enrichment.

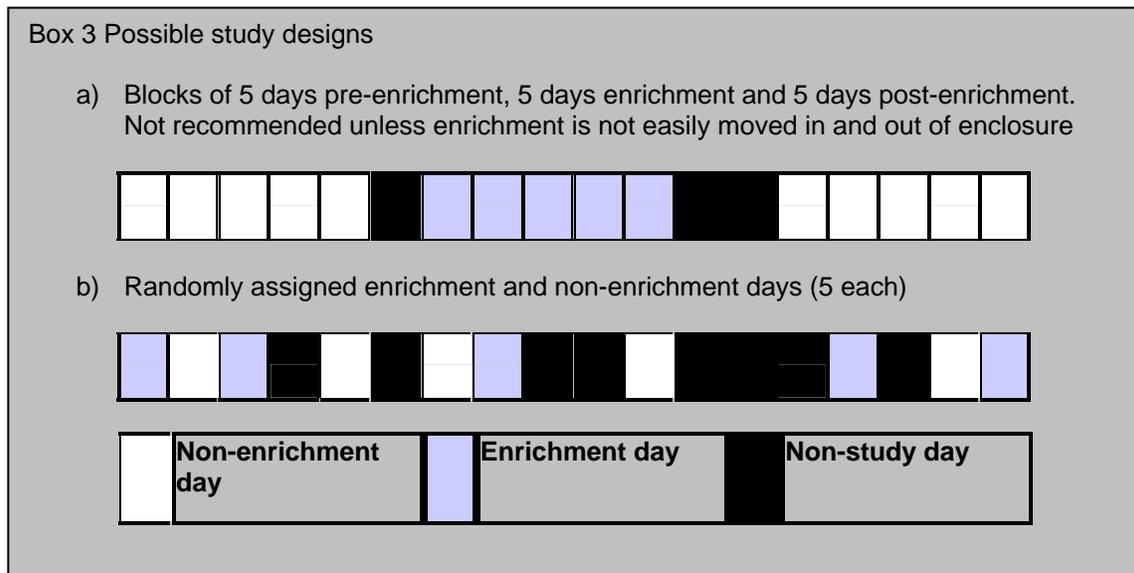
Similarly if all your enrichment observations are done in the morning and all your non-enrichment in the afternoon then differences could be just due to time of day

Similarly if all your enrichment observations are done on individual A and all your non-enrichment observations on individual B then differences could be just due to individual animal differences.

**You must keep all conditions as similar as possible so that the only difference between enrichment and non-enrichment days is the enrichment.**

enrichment days are busy and some quiet.

A randomised design (Box 3) is ideal as this allows you to be very flexible as to when you have study days, when you don't not have time to have a study day or when you have days off. It automatically randomised for factors such as weather and visitor numbers and allows statistical analysis by randomisation tests (the best tests for small numbers of animals). If a randomised design is not possible (e.g. because enrichment is too heavy to move in and out of enclosures every day) then a blocked design can be used but it is important to include a post-enrichment block.

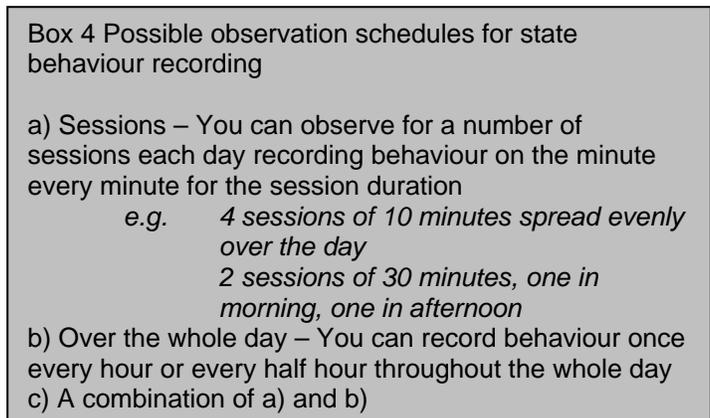


To be confident that any effects you see are caused by the enrichment you should really observe behaviour for a minimum of 5 days with and without enrichment. It is possible to have more than 1 person conducting the observations as long as you confirm that all observers recognise the same behaviour types.

### Step 3 – Record the occurrence of each behaviour.

#### State behaviour

The most common way to record state behaviour is to note at predetermined specific points in time what behaviour the animal is doing eg on the hour every hour throughout the day. This is very effective for getting a good estimate of the proportion of time spent performing that behaviour and is called instantaneous sampling. Often the behaviour of all animals in the group can be recorded at the same time point (instantaneous scan sampling) and this allows data to be collected very quickly.



You can schedule time points or sessions depending on what your routine allows (Box 4)

### *Event behaviour*

Because event behaviour is very short instantaneous sampling will miss most events. If it is important for evaluating a particular enrichment aim to know what effect it has had on an event behaviour it is necessary to watch the animals for sessions (Option a) in Box 4) and to count the number of times the event is seen in throughout that session. It is not possible to use Option b) in Box 4 if event behaviour is important.

### *Individual recognition*

If you cannot identify individual animals and you cannot scan sample all animals at once you must have a method for ensuring that you sample a random selection of individuals with and without enrichment. This can be any random method (such as eeni meeni mini mo, or the third from the right) as long as it is not something that may bias the results (such as the one nearest the enrichment or the one that looks most active). If you are recording in sessions it may be best to use several different individuals each session e.g. if your session time is 15 minutes watch one randomly chosen individual for 5 minutes, then another for 5 minutes and then another for 5 minutes.

If unrecognisable individuals go out of sight it is usually impossible to say that the same individual comes back into sight. It may be sensible to switch to another randomly chosen individual at that point.

## **Step 4 – Analyse your results**

Ideally you should compare your data with and without enrichment using statistical tests. To do this you must use daily averages for the behaviour types of interest (Box 5).

Once you have the daily averages you can apply statistical tests to compare these with and without enrichment.

### **Box 5 Calculating daily averages**

#### *State behaviour if using sessions*

1. Calculate session scores for each state behaviour for each individual  
e.g. In a 30 minute session, the animal rested for 10 of the sample points, proportion of time resting =  $10/30 = 0.33$
2. Calculate the average of session scores for one day to get the daily score for each individual
3. Calculate the average daily score for all individuals

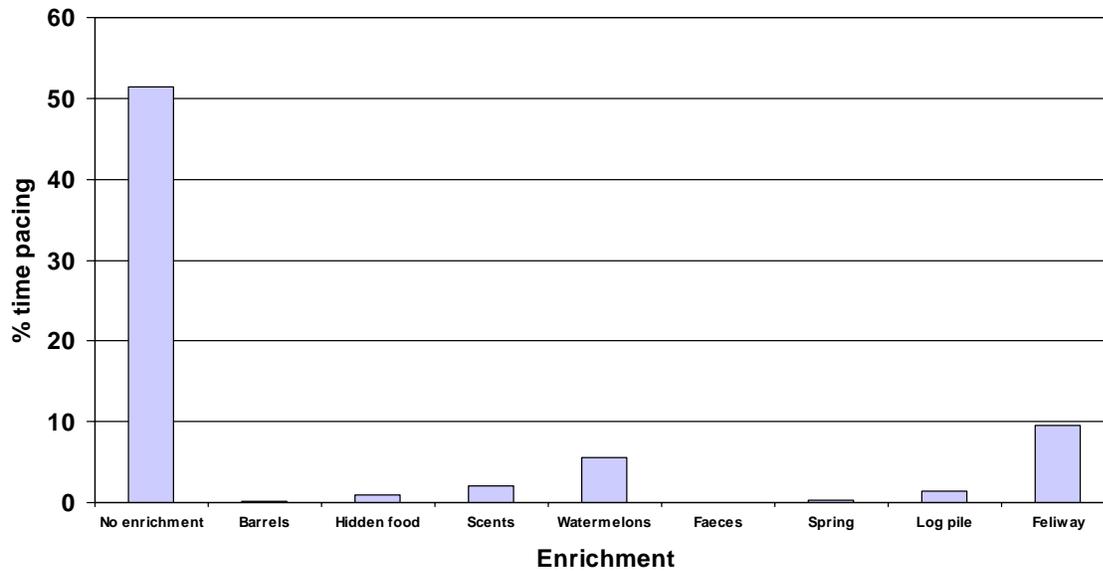
#### *State behaviour is not using sessions*

1. Calculate the daily score directly for each individual  
e.g. If you scored every half hour between 08:00 and 17:00 you would have 19 data points in total if 6 of those were resting the score for resting is  $6/19=0.32$
2. Calculate the average daily score for all individuals

#### *Event behaviour*

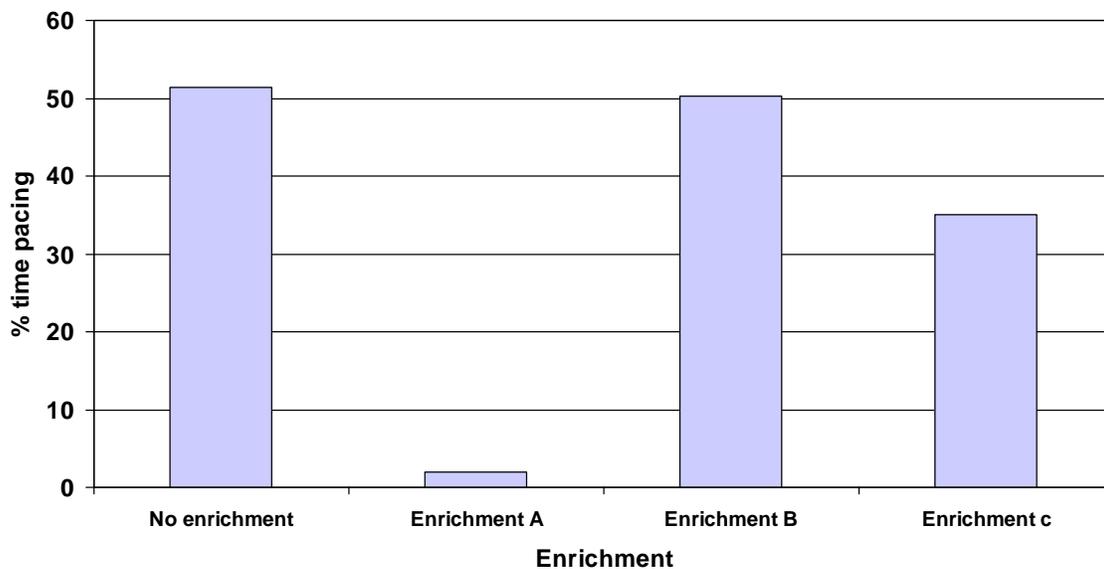
1. Calculate frequency of each event behaviour in each session for each individual  
e.g. Yawning was seen 8 times in a 30 minute session – Frequency = 4 per hour
2. Calculate the session average for each day for each individual
3. Calculate the daily average for all individuals

If you have no clue about statistics you can often make sensible biological decisions by looking at a graph of your results. Plot the overall average (average of the daily averages) values of the key behaviour types with and without enrichments as the example below.



This is the average time spent pacing by a pair of Sumatran tigers with no enrichment and with several types of enrichment. Even without statistics we can see that all the enrichments made a substantial and real difference to the tigers.

Sometimes the difference is not so clear (as below)



In this fictional example enrichment A is clearly effective, enrichment B is clearly not, but what about enrichment C? It is better than nothing but was it worth the cost in terms of money, time and effort. The decision about whether to use it again may depend on whether other more effective enrichments are available and how frequently these can be used before they become ineffective.

## **Useful Sources of Information**

BIAZA Research Guidelines – available from [www.biaza.org.uk](http://www.biaza.org.uk)

*Volumes on behavioural observations and statistics are particularly useful but other volumes may also be helpful.*

R.J. Young (2003). Environmental Enrichment for Captive Animals. Blackwell Publishing

*The final chapter is on design of experiments to evaluate enrichment – I disagree with some of this though!*

Martin & Bateson Measuring behaviour

*Excellent beginner's guide on how to observe and record behaviour*