

## Approved research statement of facts Protocol 970

NB: The submission of animal use statistics to MPI for this research project was made in error – because these animals were manipulated overseas (Tanzania), the manipulation and animal use were not regulated by the Animal Welfare Act 1999.

University of Waikato Approved Animal Ethics Protocol #970

Date of Approval: 01 Oct 2015 to 01 Oct 2018

**Project:** Scent Detection by African Pouched Rats in An Automated Operant Chamber

**Animals species:** African pouched rat

**Number to be used over entire project:** 10

**Impact Level:** B – low impact

**Type of Application:** Basic biological research

### Lay Summary of Overall Project

When a stimulus is presented, an organism has four possible responses; the stimulus can be present, and the organism detects it or does not. The stimulus may be absent, and the organism does not perceive it, or incorrectly perceives it as being present. Pouched rats are currently trained by the NGO APOPO to find landmines and tuberculosis. This project will investigate pouched rat's ability to discriminate between scents commonly used in the fragrance industry. Rats will keep their nose in a hole containing a target scent and are rewarded with pellets. Experimental protocol such as the number of rewards and complexity of scents will be manipulated.

### Background

Animals have been utilized for a variety of scent detection tasks. such as dogs trained to detect cancer (Elliker et al., 2014) and bees to identify landmines (Shaw et al., 2005). APOPO is a Belgian NGO that trains African pouched rats (*Cricetomys angorsei*) for humanitarian detection tasks. It began research in 1998, and since then has conducted a range of studies, focused on the detection of landmines (Poling, Weetjens, Cox, Beyene, & Sully, 2011 a) and tuberculosis (Poling et al., 2011 b).

The operant conditioning chamber was first developed by Skinner in the 1930's (Schacter, Gilbert & Wegner, 2011); it is a box in which an animal can be trained to emit a specific response under precise stimulus conditions. APOPO has refined the operant chamber so that these conditions, such as the delivery of food as a reinforcer, are largely controlled electronically. The automatic cage is superior to a manual cage as it removes the possibility of rats using the behaviour of the trainers to make their choices. When the trainer is aware of which samples are positive, they may inadvertently behave differently than when the sample is negative; the "clever Hans effect" (Miklosi, Polgardi, Topal & Csanyi, 1998).

How often a behaviour is reinforced significantly affects the speed and strength of the response. Intermittently reinforcing the desired behaviour, instead of every time it is exhibited, results in a response that is more resistant to extinguishing when opportunities for reinforcement are less numerous (Ferster & Skinner, 1957) and a high, steady response rate, ideal for learning new behaviours (Heffner, 2001).

### Description of Procedures

Rats are housed in pairs with water constantly available. On Monday-Friday the animals will receive their entire ration in-session, in the form of banana-flavoured Omnitreats™. On Friday evening each rat is provided with 275g of a variety of fresh foods such as tomato and corn. Slight food restriction is standard in behavioural experiments, so that animals are motivated to work; the rats at APOPO are normally maintained between 1075-1275g and are weighed and health checked once per week by a veterinarian. Weights may be adjusted outside these parameters based on the standard operating procedure requirements that the rats must not be fat but the bones must not be visible (see Section 1.2 of the Operational TB Detection Rat SOP v2.03).

When a rat is to participate in the experiment, it will be removed from the cage and taken to the research room. The rat will then be transferred to the automated line cage, a transparent box with IO circular holes in

the floor. At one end a magazine port delivers pellets. Each rat will be required to sniff each hole, pausing at the ones containing the target scent in order to earn a food reward. At the completion of the session, the rat will be returned to its home cage.

### **Addressing the three R's**

**Replacement:** Detection animals play an important part in humanitarian demining and tuberculosis detection, and for resource-poor countries alternative technologies are not a viable option.

**Reduction:** As few animals as possible will be used while ensuring adequate data. Rats will only be in the operant chamber for the duration of their session and will be in their home cages at all other times. The length of the experiment will not be extended unnecessarily.

**Refinement:** Both the home and operant cages are an adequate size and constructed of appropriate materials. The rats will be handled by staff who have been trained and internally accredited in APOPO's standard operating procedures. An outside exercise area and items in the home cage ensure adequate enrichment, and animals are habituated to humans from four weeks of age.

This study has been published as follows:

Ellis, H. M., Watkins, E. E., Cox, C., Sargisson, R. J., & Edwards, T. L. (2019). Trialing a semi-automated line cage for scent detection by African pouched rats. *Behavior Analysis: Research and Practice*, 19(2), 150-163.

# Approved research statement of facts Protocol 1049

University of Waikato Approved Animal Ethics Protocol #1049

Date of Approval: 18 Jun 2018 to 30 Nov 2018

**Project:** Examining the effects of novel environmental enrichment items on the behaviour of spider monkeys

**Animals species:** Black-handed spider monkey

**Number to be used over entire project:** 4

**Impact Level:** A – no impact

**Type of Application:** Basic biological research

## Lay Summary of Overall Project

Captive animals in zoos are often provided with environmental enrichment. Enrichment can take many forms, and is designed to encourage species-typical behaviours (e.g., investigating things, locomotion), increase animals' behavioural repertoires (e.g., natural foraging behaviours) and to reduce unwanted or abnormal behaviours (e.g., pacing). Hamilton Zoo has a pre-existing programme of providing enrichment to their spider monkeys. This project aims to assess if there are any differences in the spider monkeys' behaviours in response to novel enrichment items. This study could provide some objective information on which forms of enrichment result in more or less behavioural responses in these animals, and the types of responses provoked, thus informing Hamilton Zoo's existing enrichment schedule in a manner that maximises the welfare of these animals.

## Background

Environmental enrichment is used with many species, but it is employed frequently with captive animals, such as those housed in zoos. Enrichment is generally used to encourage normal (species-typical) behaviours in animals, to increase animals' behavioural repertoires to encourage positive use of their environments, and to reduce unwanted behaviours (e.g. .. stereotypical behaviours; Wells, 2009). The overall goal of enrichment is to improve animal welfare.

Alejandra et al. (2014) used an environmental enrichment program on a group of seven captive spider monkeys and examined the impacts of the enrichment. The authors found that when provided with both physical and dietary enrichment, such as a foraging panel and bottles with seeds and fruit hung from the ceiling, the monkeys frequently showed decreased hostility, stereotypic behaviour, and coprophilia, while also showing more explorative and play behaviour as compared to when they received no enrichment.

In another study by Costa, Sousa, & Llorente (2018), enrichment was provided to individuals of three different non-human primate species (white-handed gibbons, mono monkeys, and brown lemurs). The authors found positive results. When enrichment using food from their diets such as pieces of bamboo filled with food paste and a wire box filled with fruits, was provided to these animals, the expression of natural behaviours increased while abnormal behaviours decreased.

At Hamilton Zoo there are four spider monkeys located in the rainforest section, who will be the focus of this research. These animals are routinely provided with a range of environmental enrichment items, e.g., ice blocks, pine cones with smears, whole food items (from their main daily diets), and foraging trays. However, Hamilton Zoo staff would like to explore using novel items to see if the presentation of new enrichment opportunities alters the spider monkeys' behaviour, so that they spend more time displaying natural behaviours such as foraging and potentially more time being engaged with puzzle-based enrichment items.

Given the results from other research (such as that described above), showing increased levels of natural behaviours, more explorative and play behaviour, and a decrease in undesirable behaviours following

enrichment, it is reasonable to anticipate similar changes in behaviour with the Hamilton Zoo spider monkeys. For this reason, this study could improve the welfare of the spider monkeys at the Hamilton Zoo while mitigating the impact of stereotypic behaviours. This study could also potentially benefit other primate species at Hamilton Zoo if the Zoo staff consider that other species would benefit from more enrichment opportunities.

## **Description of Procedures**

### **Subjects**

The subjects of this study will be the four spider monkeys that currently reside within the rainforest section at Hamilton Zoo. There will be no change of any animals' normal routines in terms of feeding, cleaning, and any other husbandry procedures. Preliminary observations and training will take place during Hamilton Zoo opening hours, in the spider monkeys' normal enclosures. The spider monkeys are accustomed to humans observing them, so the observations carried out in this study will not be unusual for the animals.

### **Equipment**

The new enrichment items used were a bamboo Kerplunk, Bamboo Box and a Dispenser. The current most popular/least popular enrichment used was Jam Smear (strawberry jam) / Scent (cinnamon). The final decision on the types of enrichment items used was made in conjunction with Hamilton Zoo staff. Four copies of each new enrichment item were made so that one would be available for each individual rainforest spider monkey. For the current enrichment, four roughly spread out spots on the ground (Scents) and four vertical beams (Jam Smear) within the enclosure were used.

Any food used in conjunction with the enrichment items were deducted from the spider monkeys' daily diet (just like the ones already used by Hamilton Zoo staff). Both the amount and type of food used, if any, was approved by Hamilton Zoo staff. Food used in the new enrichment items was enrichment treat food such as peanuts, grapes and porridge. The Kerplunk contained four red grapes halved (eight halves) per copy. The Dispenser contained four individual peanuts (de-shelled) per copy and each copy of the Bamboo Box contained half a cup of cooked porridge (two cooked cups total).

### **Procedure**

All observations were done during normal Zoo opening hours. All observations were carried out from the elevated visitor viewing area located alongside the rainforest spider monkey enclosure.

Informal observations were conducted first, to determine the spider monkeys' normal activity patterns. This informed the selection of optimal time of day to carry out the formal behavioural observations. An ethogram of spider monkeys' behaviour was constructed based on existing literature and these informal observations.

Formal observations were carried out. This involved conducting preliminary observations to collect baseline data on the animals' behaviour. These preliminary observations were carried out for one or two hours (exact time period to be determined following the informal observations), twice a day, for five days, over one to two weeks (exact length of time depends on time restrictions and Zoo staff schedules). The behaviour measurement methods were based on those done by Costa et al, (2018). The observations in this current study were carried out using scan and instantaneous sampling.

Three novel enrichment items were introduced over the course of five days and their placement (in the enclosure or attached to the walls of the enclosure) was repeated for the following fifteen observation days. When the spider monkeys were not receiving the enrichment items, they received their usual enrichment items on those days. In total, the four spider monkeys had access to each of the new enrichment items a total four times (three times per five day period, for twenty days). Either the novel or current enrichment items (see below) were placed in the enclosure just prior to the behaviour recordings starting. If placement of enrichment inside of the enclosure was required, it was done while under keeper supervision. The placement of enrichment items both inside the enclosure and attached to the enclosure walls was not unusual for the spider monkeys and occurs on a regular basis.

To allow comparison of the spider monkeys' behaviour with the current enrichment items vs. the new novel enrichment items, one of the most popular (jam smears) and one of the least popular (scents) current enrichment items (as designated by the spider monkeys' keeper) was selected to present to the spider monkeys during this study. These continued to be given to the spider monkeys on days when the novel items were not given. One enrichment item was used (individually) per day. In the animals' normal enrichment routine, the enrichment items selected each day were randomized, so Zoo staff considered that there was little chance of this study causing disruption to the animals' routines.

There was no change of any animals' normal routines in terms of feeding, cleaning, and any other husbandry procedures. Preliminary observations and training took place during Hamilton Zoo opening hours, in the spider monkeys' normal enclosures. The spider monkeys are accustomed to humans observing them, so the observations carried out in this study was not unusual for the animals.

### **Addressing the three R's**

**Replacement:** Because this study aims to investigate the impact of novel enrichment items on spider monkey behaviour and welfare at Hamilton Zoo, observations of live animals is necessary and cannot be avoided.

**Reduction:** This study will collect information on the spider monkeys already present at Hamilton Zoo, as they engage in their normal daily routines. No additional animals will be sought, and no major changes to their routines in terms of feeding, etc., will be requested.

**Refinement:** The proposed observations are non-invasive and are expected to have no impact on the spider monkeys, as they will be conducted from pre-existing public/staff viewing areas. The animals will be accustomed to being observed by people from these locations. Hamilton Zoo already engages in an environmental enrichment programme with these animals, so this should cause no stress or disruption to the animals. All enrichment items used will be approved by trained staff at Hamilton Zoo. As this project aims to assess the impact of novel enrichment items on these animals' behaviour, and as enrichment is considered to have positive welfare implications, this project is expected to have enriching effects on these animals.