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The effect of a randomised enrichment treatment schedule on the behaviour of cheetahs (*Acinonyx jubatus*)

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ABSTRACT

A range of types of enrichment have been shown to enhance activity levels, reduce stereotypical behaviours and increase levels of natural behaviour, subsequently improving the welfare of many species of captive animals. However, it is important to utilise effective forms of enrichment in a manner which will sustain their future use. The continuous use of particular types of enrichment in a regular, predictable, schedule may negatively impact upon the efficacy of the enrichment over a period of time. The objective of the present study is to introduce temporal feeding variation, spatial feeding variation and olfactory enrichment to cheetahs on a completely randomised schedule, in order to reduce levels of pacing and to increase active and exploratory behaviours. This study was carried out on ten cheetahs at Fota Wildlife Park, Ireland. Eight baseline days with no enrichment, eight days of no data collection and eight days for each of the three types of enrichment were assigned. Behaviour data were collected on baseline and enrichment days during either 09:00–13:00 h or 13:00–17:00 h, using instantaneous scan sampling with a 5 min interval. A Friedmann ANOVA was used to analyse behaviour data. Overall, a significant increase in exploratory and other behaviours was observed along with a significant decrease in pacing behaviour. Between 09:00 and 13:00 h, exploratory, other and inactive behaviour were significantly affected. Between 13:00 and 17:00 h, other, inactive and pacing behaviour were significantly affected. The lowest level of pacing behaviour was observed during the temporal feeding variation days and the highest level of exploratory behaviour was observed during olfactory enrichment days. Highlighting times of day when abnormal and inactive behaviours are prevalent will be beneficial in order to determine how and when enrichment should be provisioned. The use of a randomised schedule of enrichment also provides a greater degree of novelty and does not allow the animals to habituate to any single form of enrichment. The authors would recommend the use of temporal feeding variation, spatial feeding variation and olfactory enrichment, introduced to cheetahs on a random schedule.

1. Introduction

The current trend in zoological institutions worldwide is a move towards more enriched, more naturalistic enclosures (Young, 2003). This follows research documenting the positive behavioural and welfare effects of environmental enrichment for captive animals. Over the past two decades, a myriad of enrichment experiments have been carried out on a wide range of species from bank voles (*Clethrionomys glareolus*) (Cooper et al., 1996) to red foxes (*Vulpes vulpes*) (Kistler et al., 2009), large felids (Skibiel et al., 2007) and gorillas (*Gorilla gorilla*) (Wells et al., 2007). A GAP analysis by De Azevedo et al. (2007) reported that 744 articles related to environmental enrichment have been published between 1985 and 2004. These involved

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the use of a range of different types of enrichment including the simple addition of vegetation to an enclosure, the alteration of feeding regimes, the addition of novel objects or novel scents to enclosures. Many forms of enrichment have been shown to enhance activity levels, reduce stereotypical behaviours and increase levels of natural behaviour, subsequently improving the welfare of captive animals. Swaisgood and Shepherdson (2005) reported that 53% of the time, stereotypical behaviour was reduced significantly through the use of environmental enrichment. However, a finite number of effective forms of enrichment exist for each individual species. Therefore it is important to utilise effective forms of enrichment in a manner which will sustain their future use. Clubb and Mason (2007) highlighted the importance of increasing environmental variability and novelty for animals in captive environments, while Bassett and Buchanan-Smith (2007) also highlighted evidence suggesting that temporal unpredictability of feeding can enhance welfare of certain species in captivity. There is a possibility that the continuous use of particular types of enrichment in a regular, predictable schedule may negatively impact upon the efficacy of the enrichment over a period of time. Habituation has been previously defined as 'response decrement as a result of repeated stimulation' (Harris, 1943). Murphy et al. (2003) stated that habituation is specific to characteristics of the stimulus and that the response not only habituates to the exact stimulus but also to similar stimuli. This 'generalisation' (Tarou and Bashaw, 2007) can pose problems for zoo staff which incorporate similar types of enrichment in a predictable manner. Murphy et al. (2003) also highlighted that habituation to an enrichment that previously elicited a particular behavioural response can undergo spontaneous recovery if the enrichment is withheld for a period of time. This spontaneous recovery along with the phenomenon of 'dishabituation' (Tarou and Bashaw, 2007), whereby a new enrichment may cause the return of a response towards the older enrichment, combine to strengthen the claim that randomised enrichment schedules with a number of types of enrichment may effectively minimise habituation to each form of enrichment.

Enrichment for felids which have reduced levels of pacing and increased levels of active behaviour has tended to focus on feeding (Jenny and Schmid, 2002; Shepherdson et al., 1993; McPhee, 2002). Other non-food related enrichment for felids which have contributed to improved welfare and behavioural diversity include the introduction of novel objects such as bones (Skibiel et al., 2007) as well as olfactory enrichment using novel scents (Wells and Egli, 2004; Powell, 1995; Ellis and Wells, 2010). Cheetahs have previously been described as 'near average pacers' in a study on a range of felids in captivity (Lyons et al., 1997). Enrichment experiments on cheetahs are relatively rare in the literature. Skibiel et al. (2007) noted that cheetahs showed an increase in active behaviours when provisioned with bones and frozen fish. In an experiment designed to non-invasively collect hair samples from cheetahs, Balme et al. (2005) observed that cheetahs investigated 21 of 24 perfume and cologne scents presented to them, therefore highlighting the possibility of utilising a range of olfactory enrichments for cheetahs. Quirke and O'Riordan (2011) recently carried out enrichment experiments on cheetahs (*Acinonyx jubatus*) utilising temporal feeding variation, spatial feeding variation and olfactory enrichment, introduced to the cheetahs sequentially, in order to assess the influence of these enrichments on their behaviour. The objective of the present study is to introduce the same three enrichment treatments to cheetahs, on a completely randomised schedule, in order to determine their effect on cheetah behaviour. The aim is to decrease levels of pacing, increase active and exploratory behaviours and, to highlight the benefits of provisioning captive animals with enrichment at particular times of day. The main hypothesis for this research is that pacing will decrease, with active and exploratory behaviours both increasing. The second aim is to compare the random schedule from the current study to the sequential schedule used by Quirke and O'Riordan (2011) in terms of the difference in behaviours from baseline to enrichment phases of each schedule. Thirdly, levels of habituation to the enrichment in the random schedule are investigated. The goal is also to provide zoological institutions with information on the efficacy of randomised enrichment schedules for cheetahs in captivity and to also stimulate debate on how enrichment will develop as a husbandry practice in the future.

2. Methods

2.1. Study site and animals

This research was carried out at Fota Wildlife Park (51.8992°N, 8.2982°W), Carrigtwohill, Co. Cork, Ireland, for 40 days between March 2010 and May 2010. This study was carried out on ten cheetahs maintained in five enclosures at the Park. The five enclosures ranged in size from 420 m^2 to 3500 m^2 and contained grass, tall trees, numerous small shrubs and bushes as well as wooden sheds for shelter. The ten cheetahs consisted of a solitary male, a coalition of two males, a group consisting of a mother and four old cubs, and two solitary females. The cheetahs were aged between 1 and 11 years. The cheetahs were usually fed at a regular time (around 16:00 h) once daily, six days a week on whole dead rabbits or chickens.

2.2. Procedure

Three different types of enrichment, namely, temporal feeding variation, spatial feeding variation and olfactory enrichment using fresh oryx (*Oryx dammah*) faeces were introduced to the cheetahs on a completely randomised schedule. Out of the 40 days of this experiment, random number tables were utilised to assign eight baseline days with no enrichment and eight days for each of the three types of enrichment. There were also eight days when no data were collected. Each day when data were collected was divided into two 4 h periods, namely period 1, 09:00–13:00 h and period 2, 13:00–17:00 h. These time periods were chosen on the basis that the enrichments introduced had the possibility to alter the temporal dynamics of the entire activity budget of the cheetahs. Therefore, collecting data over 4 h daily increased the likelihood of detecting these changes. Random number tables were used