Can presentation of a favourite food decrease abnormal behaviours in Asiatic black bears (*Ursus thibetanus*)?

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Abstract

Ursidae species, like other large carnivore species, have commonly been observed displaying abnormal behaviour under human care. The 1.2 Asiatic black bears (*Ursus thibetanus*) at Night Safari (Singapore) have been observed head rolling and pacing. This study investigates if an environmental stimulus using only their preferred foods can lead to their optimal psychological and physiological well-being. A total of 64 trials were carried out for this study; their favourite food (ant eggs) were presented in three different categories of enrichment. The General Mixed Model Analysis revealed cognitive/occupational enrichment had a significant effect on investigatory behaviours, while the treatments themselves did not have a significant effect on their behaviour or enclosure use. Abnormal behaviours were at their lowest with cognitive/occupational and nutritional enrichments (7.7 % down to 3.6% and 4.6 % respectively). Foraging behaviours were at their highest and inactivity at its lowest with sensory enrichments (24.7 % up to 34 % and 62.6% down to 51.2 %).

Introduction

Asiatic black bears, also commonly known as the moon bear, has a white patch on their chest which most of the time resembles a V-shape. Being largely adapted to arboreal life, their upper body is more powerful than their hind legs, suited for climbing trees to feed or rest. Most of the Asiatic black bears do not hibernate within the Southeast Asian region, except those at the colder range (Japan, Korea). Insects, fruits and vegetation makes up the bulk of their diet. Being opportunists, they will hunt and eat small mammals from time to time.

Various forms of repetitive behaviours have been recorded in many large carnivore species under human care. Possible causal factors for such behaviours include incapacity of the animals to tackle presence of stress and fear in the environment, or the lack of stimulation. While some literature postulates such behaviours to be a manifestation of stress, others suggest them to be a form of coping mechanism for a negative welfare state (Mason, 2006). Regardless, fixations on repetitive behavioural patterns prevent animals from interacting with their environment in a species-typical fashion and limit their behavioural diversity, thereby adversely affecting their welfare. Ursidae species, like other large carnivore species, have commonly been observed displaying abnormal behaviour under human care.

The 1.2 Asiatic black bears (*Ursus thibetanus*) at Night Safari (Singapore) have been observed head rolling and pacing. As part of an effort to achieve desirable mental domain of positive welfare state for this animal, this study investigates if an environmental stimulus using only their preferred foods can lead to their optimal psychological and physiological well-being. With the limited space available in captivity, to stimulate and encourage natural behaviour is a challenge. Providing enrichment is a proven way to reduce abnormal behaviours by providing opportunities for the bears to perform natural behaviours. According

to ‘The Shape of Enrichment’, the five broad categories of classification are ‘social’, ‘cognitive/occupational’, ‘physical habitat’, ‘sensory’ and ‘nutrition/food’.

It is tempting to label the favourite food item as an ‘enrichment’ simply based on the interest and response showed by the animal. In reality, food-based enrichment is often short lived and does not necessarily have a carry-over effect throughout the day. Various enrichment types may affect each individual animal in a slightly different way; providing one enrichment category at a time may not be the most conducive to reduce abnormal behaviours.

Enrichment activities that are more complex and involve more than one category may be the way forward in minimising undesirable/abnormal behaviours in this species. Based on our preliminary observation data, the longest time our bears spent on a typical single-categorised enrichment is roughly about an hour. Favourite foods may be more beneficial if used as rewards for training as opposed to enrichment for bears.

The aim of our study was to reduce the abnormal behaviours displayed by our bears. We expected different food presentation styles to have different effect on their food engagement level. We also hypothesised that our bears are likely to spend less time displaying abnormal behaviours when cognitive/occupational enrichment is used, as compared to other enrichment categories. We also postulate that scatter feeding (treatment 10) in particular will have a desirable effect on decreasing the time they spend on stereotypic/abnormal behaviours.

In this paper, we present a detailed analysis of the different types of food presentation against the duration of abnormal behaviours shown. To ensure consistency, we decided to use ant eggs throughout this study while we vary the style of its presentation. We had noticed our bears to respond particularly well to ants’ eggs during our preliminary observation period.

Materials and Methods

Animals and Housing

Observations were carried out on three Asiatic black bears (1.2) housed in Night Safari in Singapore. They are aged 7, 10 and 11 years old. The bears have been housed together since arriving from Panyu Xiangjiang Safari Park five years ago. They were given access to two sheltered dens and two yards with mixture of sand and grass substrate at all time. Both dens have a platform each, while the yards have two pools, three swings of different heights and types, four baskets for resting in, eight platforms of different heights, and logs for climbing. Morning headcount and husbandry are done in the period between 0930-1030hrs. Enrichment is given during this period. The bears get their lunch at 1330-1340hrs. No other observations go on after 1730hrs for this study.

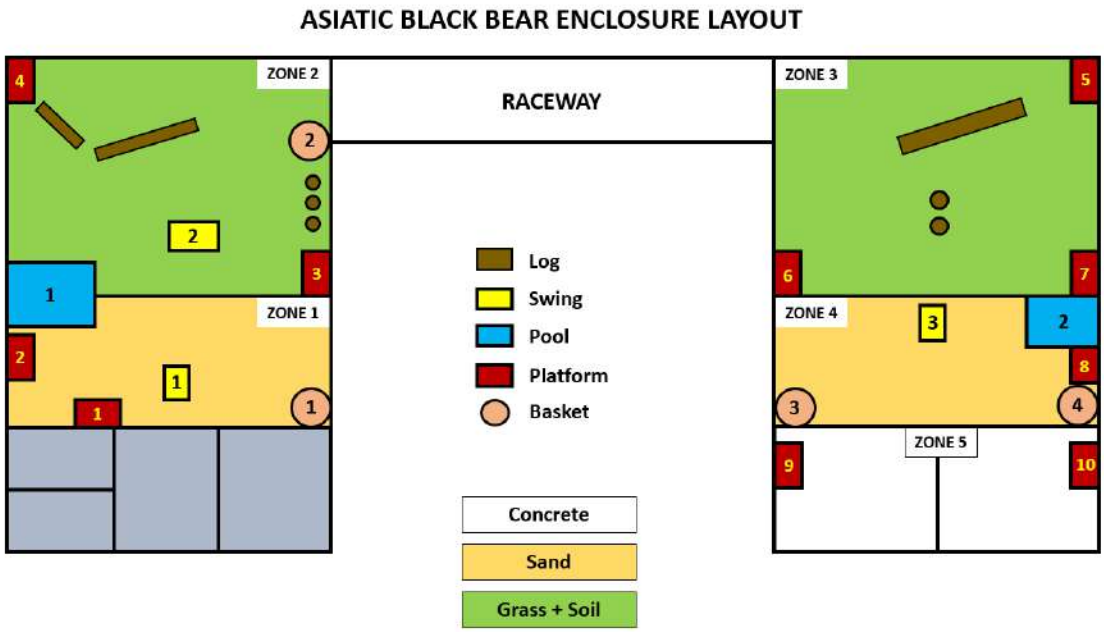

Figure 1. Asiatic black bear enclosure layout

Time (hrs)	Workflow	Remarks
0930 - 1030	Morning headcount + husbandry	Enrichment to be given during this period, if any (after husbandry)
1330 - 1340	Feed/lunch	
1845 - 1850	Release for operation	-
2345 - 2350	Confine	-

Data Collection

Preliminary behavioural data collection using continuous sampling method spanned over six months. Pacing and head circling behaviours were identified as the main abnormal behaviours displayed by our bears. Subsequent data collection was through interval sampling (by time blocks), where treatment types and trial days, as well as observation time blocks were randomly selected to reduce biasness.

We provided their favourite food (ant eggs) in three different categories of enrichment, each containing four treatments: sensory (cold, frozen or warm ant eggs or only the scent), cognitive/occupational (two different puzzle feeders either accessible or buried) and nutritional (ant eggs on leaves, scattered, in small or big clumps).

Table 1. Enrichment Categories & Treatments

Category	Treatment No.	Description
Control	0	No treatment (control)
Cognitive/Occupational	1	Ant Eggs in Puzzle Feeders Type 1 (placed)
	2	Ant Eggs in Puzzle Feeders Type 1 (buried)
	3	Ant Eggs in Puzzle Feeders Type 2 (placed)
	4	Ant Eggs in Puzzle Feeders Type 2 (buried)

Sensory	5	Frozen Ant Eggs
	6	Warmed Ant Eggs
	7	Ant Eggs in Ice Block
	8	Ant Eggs' Scent only
Nutritional	9	Ant Eggs on a Leaf
	10	Scatter Feed Ant Eggs
	11	Ant Eggs Presented in Small Clumps
	12	Ant Eggs Presented in Big Clumps

A total of 64 trials were carried out for this study, with three hours of data collection per day separated into counterbalanced blocks. Four sets of time blocks have been allocated, namely 0930-1115hrs, 1115-1200hrs or 1300-1400hrs, 1400-1545hrs, and 1545-1730hrs. The duration of each observation is 20 minutes and there is no specific timing, as long as the 20 minutes is within the allocated time block.

For each treatment, we collected data on their behaviour and enclosure use/Spread of Participation Index (SPI). For SPI, we divided their enclosure into five key zones as depicted in Figure 1. Zones 1 and 4 have white sand as their substrate, while zones 2 and 3 are grass turf and zone 5 is their dens (concrete).

Table 2. Ethogram

Category	Behaviour	Description
Normal stance and locomotion	Rest	Sitting or lying with body motionless for at least 30 sec.
	Stand	Stand Bi-pedal or quadrupedal stationary stance.
	Locomote	Move from one location to another at floor level by walking or running.
	Forage	Attempt to obtain food or provision by active searching
	Climb	Stand or locomote above floor level with no body weight supported by the cage floor.
Normal behaviours	Feed	Ingestion of edible material.
	Drink	Consumption of water.
	Eliminate	Defecation and urination.
	Manipulate	Any non-stereotyped manipulation (e.g., lick, bite, grasp, chew, scratch) directed at structures, food materials, items or permanent apparatus.
	Sniff	Sniff ground, object, floor or object attentively for a period of more than 5 sec.
	Groom (self)	Cleaning of fur or skin of by licking.
	Social Interaction	Investigating or making contact with conspecific or keeper (to elaborate in remarks). Grooming of conspecific to include here
	Water bath	Water bath stepped up onto or sat upon.
Stereotypic behaviours	Standard pace	Locomotion (straight) in a fixed pattern/path for more than four repetitions.
	Head circle	Head rotated in a circular fashion.
Others	Others	Other behaviours not specified in the ethogram.

	Out of sight	Observer is unable to see animal.

Results

Our General Mixed Model Analysis revealed that the category of enrichment only had a significant effect on investigatory behaviours; cognitive/occupational enrichment tripled investigatory behaviours (Figure 2). Abnormal behaviours (head circle and pacing) were at their lowest with cognitive/occupational and nutritional enrichments (7.7 % down to 3.6% and 4.6 % respectively). Foraging behaviours were at their highest and inactivity at its lowest with sensory enrichments (24.7 % up to 34 % and 62.6% down to 51.2 %).

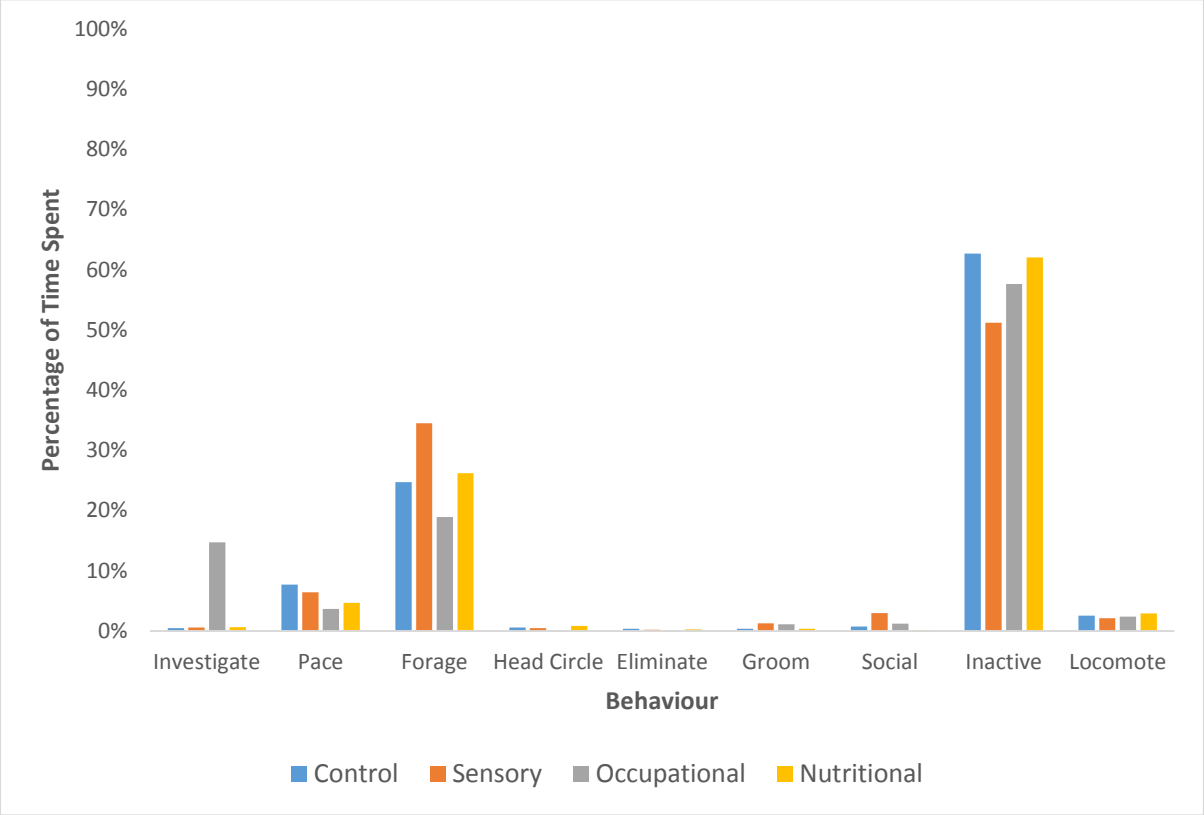

Figure 2. Activity budget of all bears per different category of enrichment with investigation being significantly higher with occupational enrichment.

While there was some significant effect on investigatory when we consider the enrichment categories holistically, the (individual) treatments do not appear to have a significant impact on the inactivity, investigatory, foraging or abnormal behaviours of the bears independently (Figure 3).

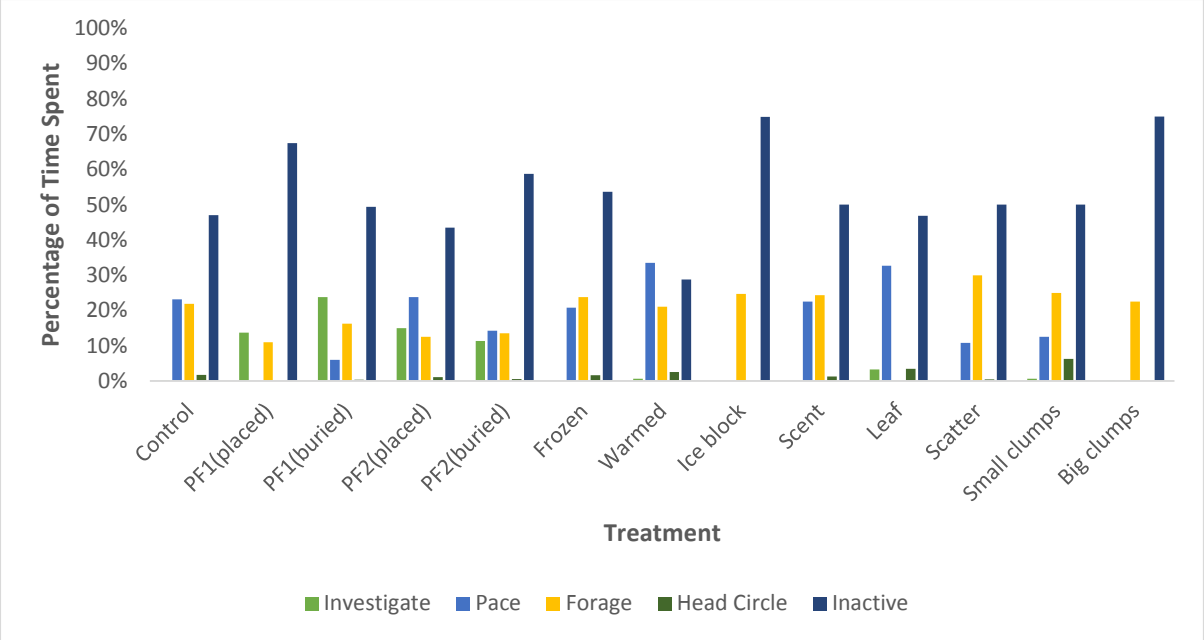

Figure 3. Time budget for selected behaviour categories per treatment

Enclosure use was highly uneven (averages for each category ranged from 0.85 to 0.88 where 1.0 is using only one zone and 0 using all zones equally) and was not affected by the different enrichments (Figure 4).

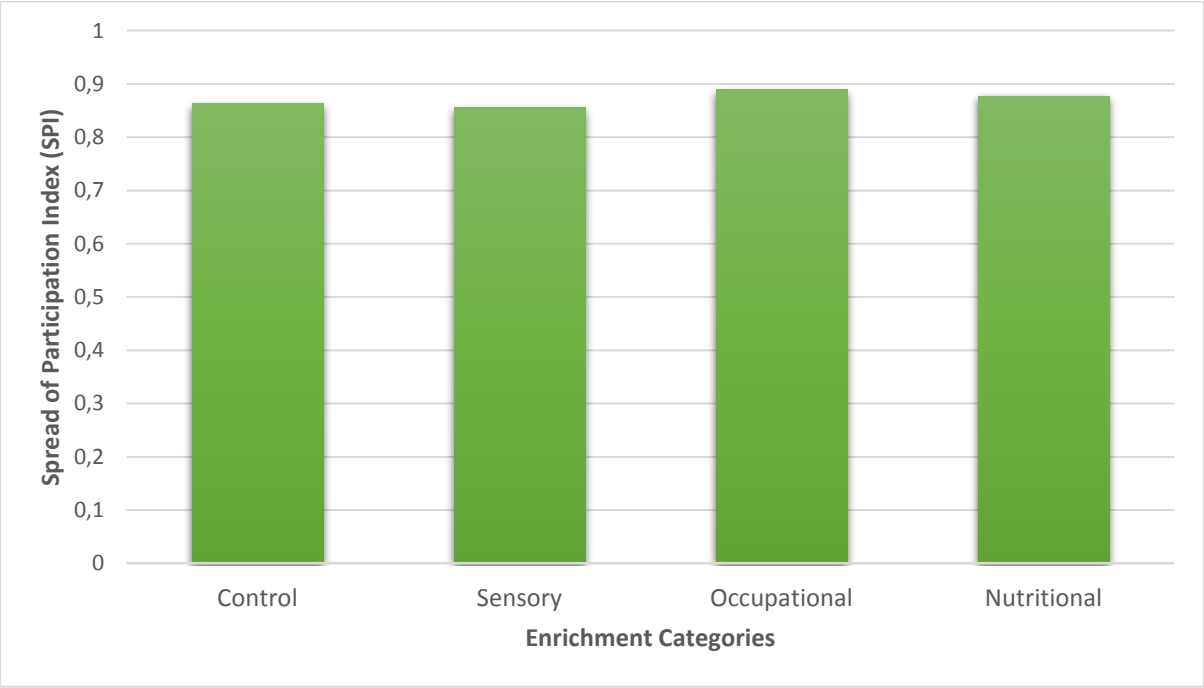

Figure 4. SPI for all bears per enrichment category

Discussion

There are a couple of possible reasons why there were no significant reductions in abnormal behaviours. Firstly, the enrichments used in this study may not be complex or challenging enough for the bears. Being fast learners, a situation only has to present itself once and get resolved before they know what to do when similar situation arise again.

Secondly, the sampling method used for this study has been interval sampling by time blocks, and the time frame for observation was set to between 0900 and 1730. In this way, certain routine behaviours or habits of the bears (e.g. afternoon nap/rest which often take place in the afternoon period, during 1400 – 1730 hrs) may have caused the data to be slightly skewed in terms of their 'inactivity'. Future studies may accommodate for this using continuous sampling method for a wider time frame.

Thirdly, the amount of ant eggs used in each treatment (except treatment #8) is an average of 1 kg, which amounts to roughly 333 g per bear. On the one hand, while presence of it in any form of cognitive/occupational category device will serve to motivate them to solve the puzzle to get to it, on the other hand, they may also end up consuming it at a faster pace (as compared to other food rewards) in order to prevent their conspecifics from taking their share. The bears are able to finish this amount in the blink of an eye, especially when it has already been established in the preliminary observation phase to be one of their favourite food. The results might have been different if a larger amount of ant eggs was provided (Forthman et al, 1992). Actual forage time may also be further reduced granted all three bears sharing the same enclosure – effectively lesser time is required to cover the entire area in the enclosure.

Although there is no significant reduction of abnormal behaviours overall under the five categories, enrichments under the cognitive category shows some promising results compared to the other categories and there is potential in focusing on this category to achieve our aim in reducing the abnormal behaviours. This category proved to be more engaging as compared to other categories as the bears have to spend time and (some) cognitive effort to solve the puzzle, which keeps them occupied for a longer period of time.

In this study, under the cognitive category, bamboo was used. While it is essentially a natural and safe material for the bears, it is also prone to destruction considering the strength of our bears. By using a durable heavy-duty food-grade polyethylene material to recreate a device of similar design, there is a possibility where the bears will be kept engaged longer.

The existing design can also be further enhanced to increase its complexity and make it more challenging for the bears. More forms of simulation can also be incorporated into the device thereby ensuring the device has enough component to account for it falling under two or more categories (e.g. cognitive and physical) to sustain their interest. An example could be planting a 3-metre-long bamboo into the ground, with a few holes and food only at the top portion. This way, the bears will have to think of ways to get the reward, possibly by climbing on the bamboo itself or digging the entire bamboo out from the ground before retrieving the food. There is an additional step/challenge here compared to before when it is under only one category. In this study, a single, relatively straightforward enrichment was given during each trial day. Providing the bears with different types of cognitive-based enrichment and giving them at more frequent and perhaps varied time slots may be an option for consideration in future.

Conclusion

Different forms of presentation style do affect the abnormal behaviour to a certain extend. Our findings suggest that the best method to reduce abnormal behaviour in our animals is to keep them engaged mentally. Allowing them to exhibit their natural behaviour (e.g. foraging) in a limited space in captivity is not enough to keep them occupied. A combination of different enrichment categories

could be the key to create a significant drop in abnormal behaviour. Future studies should work to identify the factors that causes abnormal behaviours. This will enable us to understand more and be able to find the solutions to tackle the problem directly.

Reference

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