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Short communication

Issues of choice and control in the behaviour of a pair of captive polar bears (*Ursus maritimus*)

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Abstract

Stereotyped behaviour occurs in a wide variety of captive animals including ursids. The provision of animal control over aspects of their environment by providing choices is a critical element for improving welfare. The behaviour of two sibling polar bears at a metropolitan zoo was examined to investigate the effect of providing access to their indoor, off-exhibit holding space. Both bears demonstrated behavioural changes when given the choice to access their indoor dens including decreased stereotyped behaviours and increased social play. These results, although based on just two bears, provide additional support for the assertion that choice and control are closely tied to issues of well-being for captive animals.

Keywords: Abnormal behaviour; Bears; Pacing; Stereotypy; Zoo animals

1. Introduction

Stereotypies are invariant and repetitive behaviours that seem to have no functional consequence (Mason, 1991). Carnivores, such as felid and ursid species seem especially susceptible to stereotyped behaviours (Forthman et al., 1992; Lyons et al., 1997; Clubb and Mason, 2003; Vickery and Mason, 2003; Montaudouin and Le Pape, 2005) despite the trend to larger and more naturalistic exhibits in modern zoological parks. A popular conception connects high rates of stereotypies to deficiencies of the physical environment. However, it remains unclear what these behaviours actually indicate in terms of measures of well-being and the animal's subjective experience (Mason, 1991; Liu et al., 2003). Nonetheless, changes in management and exhibit design have proved to be moderately successful in altering behaviour patterns if only in the short-term.

The Dutch verb "ijsberen" is roughly translated "to polar bear" and means restless pacing (Wechsler, 1991). In the wild, polar bears inhabit sea ice habitats and often migrate long distances (Mauritzen et al., 2003) but in captivity, polar bears are well-known for their stereotyped behaviour patterns such as pacing and head-swinging. Despite these behavioural tendencies and the fact that these animals are popular with zoo visitors, there are surprisingly few studies of captive polar bear behaviour in peer-reviewed journals and only a few described elsewhere (Shepherdson and Carlstead, 2001; Fulk, personal communication). Previous studies of captive polar bears have suggested that stereotyped behaviours were not necessarily preceded by high activity levels (Wechsler, 1991) and may decrease over time (Grittinger, 2004). Research on other bear species suggests a relationship between sterotypies and management techniques (Grandia et al., 2001; Montaudouin and Le Pape, 2005), time of day (Grandia et al., 2001), time of year (Carlstead and Seidensticker, 1991), frequency of social interactions (Fischbacher and Schmid, 1999), and size of home range in the wild (Clubb and Mason, 2003). Relatively little of this research has been conducted with polar bears and study of the causes and correlations of stereotyped behaviour in ursids in general, remains incomplete.

Many investigators have suggested that promoting animal control over aspects of their environment by providing choices is a critical element for improving welfare (Novak and Dewsen, 1989; Coe, 1995; Markowitz and Aday, 1998; Bloomsmith et al., 2003; Owen et al., 2005). In this context, the provision of "choice" is the means to which an end, environmental "control" is achieved (for further discussion, see Owen et al., 2005). While traditional zoo housing may have restricted the choices that captive animals have, recent advances in zoo research and design have provided a greater understanding of how animals use their captive environments and methods to increase the control they

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have in their exhibit spaces (Maple and Finlay, 1986; Ross and Lukas, 2006). Small, stimulus-poor zoo environments are associated with reduced well-being (Carlstead et al., 1991; Chang et al., 1999; Mallapur and Chellam, 2002), however providing animals the option of multiple areas and giving them the choice to enter and exit these areas at their discretion has been promoted as a promising form of enrichment (Young, 2003). For example, exhibits can be designed with a variety of microclimates to allow animals a choice of areas that suit their proximate temperature preferences. Other studies suggest that the benefit of providing exploratory opportunities for animals is enhanced by allowing the animals to explore when they choose (Mench, 1998) and recent data show that providing giant pandas free access to alternative locations can have a significant effect on behavioural and hormonal variables that may be related to well-being (Owen et al., 2005). Although none of these studies were conducted with polar bears specifically, there is reason to believe that the provision of these choices might also benefit this species in captivity.

In this study we investigate changes in the behaviour of two polar bears with a history of stereotypic behaviour living in a major metropolitan zoo. By comparing rates of behaviour between different environmental conditions we hope to provide objective evaluation of the provision of environmental choice and contribute to the advancement of captive bear well-being research.

2. Materials and methods

Study subjects were a male and female sibling polar bears housed at Lincoln Park Zoo (LPZ) in Chicago, Illinois. Both subjects were born at Seneca Park Zoo in November 1999 and moved to LPZ in February 2001. Both bears were reported to have performed some stereotypic behaviours at their previous institution, but no data are available on the extent or frequency of these behaviours. The LPZ polar bear facilities include a 311 m^2 outdoor exhibit with a 1 million litre freshwater pool adjacent to 105 m^2 of off-view indoor dens where the bears are housed at night. Visitor areas are elevated above the exhibit and surround approximately 180° of the perimeter in addition to an underwater viewing window.

Data were collected over a 12-week period between June 2001 and September 2001. During the first 6 weeks the bears were managed by moving them onto exhibit at approximately 09:00 h and not allowing them access to their indoor dens until they were moved inside for the night at approximately 16:30 h. During the second 6 weeks of the study, bears were given access to their indoor dens during the day. The bears could not be viewed by the public nor the observers when inside. Feeding, training and enrichment activities were consistent between the two phases and occurred in their outdoor exhibit only.

One hundred and sixty hours of behavioural data was collected by six observers having passed interobserver reliability tests at a minimum rate of 85% (mean score = 89.7%). An ethogram with 15 behaviours was reduced to 8 primary behavioural categories (see Table 1) to identify social, solitary and stereotyped actions. One-zero sampling was utilized with 30-s intervals in 15-min sessions. Prevalence of behaviour was calculated as the proportion of in-view scans in which a particular behaviour was noted. Although it does not result in true frequencies, this sampling method provided adequate estimates of behavioural rates and were used (1) because of ease of training a variety of observers and (2) to more easily quantify long-duration behaviours such as pacing. The number of visitors within 5 m of the viewing glass was estimated by the observer before the observation and assigned a score (0 = none, 1 = 1–9, 2 = 10–19, 3 = 20–29, 4 = more than 30). Ambient temperature was also recorded as an independent variable.

Table 1
Behavioural ethogram

Behaviour	Definition
Pace	Individual engages in a repetitive terrestrial locomotion over the same path. Must be part of a pattern of movement that has already completed at least two cycles. May or may not be accompanied by stereotyped head-tossing
Stereo	Individual engages in a repetitive movement of a body part (such as head or limb). The behaviour pattern must have been previously exhibited in the same ritualized manner previously in the session. Can be exhibited while on land or in the water. Example: head-tossing
Loco	Individual walks, runs or climbs at least two full steps along a terrestrial surface. Locomotion involves non-stereotyped movement only. Includes terrestrial locomotion within shallow water
Swim	Individual locomotes within the water. May include surface swimming or underwater swimming. Limbs may contact permanent surfaces, but weight is not supported. Includes the act of diving into water and gliding through the water after pushing off a solid surface
Intake	Individual consumes food items such as meals and enrichment. Includes manipulation of food for the purpose of eating, as well as chewing on food pieces. Also includes consumption of water from pool or from watering device
Object/env	Includes pulling, pushing, nosing, batting, mouthing, rubbing, shaking, holding or biting a movable object such as boomer balls and other enrichment items. Includes pawing or mouthing permanent surfaces such as ledges or rockwork
Staff	Individual shows directed gaze or actions towards keeper staff or towards a door or window opening in which keepers are usually present. May include hitting at the keeper door, staring up to at keeper on the roof area, or listening to keeper commands during training session. This attention must have duration of at least 3 s to be scored. Bear must be facing a doorway and within a body length of that doorway. Does not include staring at keepers when they are collecting data from the visitor area
Play	Individual shows obvious affiliative behaviour to a con-specific. May include rough-housing play, nuzzling, or chasing

All behaviours not listed here were included in a general "other" category before statistical analyses.

A summary of the ethogram is listed in Table 1, however the definition for pacing warrants further discussion. A number of factors make the objective characterization of "stereotyped pacing" difficult and the variety of definitions used in different studies can make comparisons difficult. Some studies utilize very broad definitions that remain open to interpretation such as the Fraser and Broom (1990) "repeated, relatively invariate sequence of movements." Other studies openly concede that "pacing could not be distinguished from walking" (Fischbacher