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# Keepers' rating of emotions in captive big cats, and their use in determining responses to different types of enrichment

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ABSTRACT

Effective identification of emotional states in captive big cats by keepers is important for them to be able to reduce the risks of abnormal behavior by providing appropriate enrichment strategies. In an initial study, 29 emotional states in each of 4 cheetahs were rated daily by 5 keepers. Three emotional state domains were identified, apparently associated with "nervousness," "adventurousness," and "aggression." Keepers then rated each cheetah on these domains daily for a mean of 18 days. Consistent differences in scores between keepers and between cheetahs were identified, with "aggression" being the least variable domain. In a second study with 9 tigers and 9 keepers, 4 emotional state domains were similarly identified from keeper ratings, apparently related to "aggression," "fear," "vigilance," and "obedience." Keeper ratings of these domains before and after the tigers' period in night quarters were used, together with video-recorded behavior in the first and last 90 minutes in night quarters, to evaluate the effect of 3 enrichments, 2 olfactory, 1 physical (coffee essence, fish smears, and palm leaves) offered in the night enclosures. There were no overall differences in the emotional state domains of the tigers between the 3 enrichments, as assessed by the keepers, although the video-records of behavior showed that tigers that received fish smears paced less (37% of time ±3.1%) than those receiving coffee essence (48% of time, ±3.1%) or palm leaves (50 % of time, ±3.1%). It is concluded that keepers can consistently rate big cats' emotions, but it is uncertain whether their ratings are adequate to determine appropriate enrichment strategies for individual felids to minimize abnormal behaviors.



## Introduction

Felids are particularly prone to developing stereotypic behaviors in captivity, such as pacing, toe and tail sucking, head-twisting, excessive grooming, and fur plucking (Wooster, 1997; Carlstead et al., 1996). Cheetahs and tigers are particularly susceptible to these problems because of the difficulties in providing appropriate social groupings in captivity compared with other felids (Beekman et al., 1997 and Bauer et al., 2008). Females are solitary or accompanied only by dependent young, whereas males are either solitary or live in coalitions of only 2 or 3, often siblings plus a maximum of 1 conspecific (Beekman et al., 1997 and Bauer et al., 2008). Ovarian suppression may occur in female cheetahs that are housed in the same enclosure (Wielebnowski et al., 2002b), depending on behavioral compatibility and pair composition (Wielebnowski et al., 2002b). Stereotypic pacing and a decline in auto-grooming have also been observed in pair-housed females (Wielebnowski et al., 2002b).

Small and barren enclosures increase the risk of stress in captive felids (Wielebnowski et al., 2002a). Provision of a naturalistic 3-dimensional enclosure, preferably including tree trunks, facilitates natural climbing behavior, in addition to functioning as a nail-sharpening tool (Moreira et al., 2007). Felid enclosures should also contain elevated platforms and visual barriers to allow the animals to withdraw and hide in the exhibit (Moreira et al., 2007; Lyons et al., 1997). Providing grass that felids can chew is another natural behavior that can be promoted (Moreira et al., 2007). Inadequate enclosures have been reported to result in behavioral stress

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(Terio et al., 2004) and in cardiovascular disease, such as veno occlusion (Moore, 2004), glomerulosclerosis (Moore, 2004 and Terio et al., 2004), gastroenteritis, and reproductive failure (Wielebnowski et al., 2002a) in captive felids.

Keepers are responsible for introducing conditioning and social, physical, and feeding enrichment. Conditioning involves training exercises that encourage close animal-keeper interactions (Embury, 1993), facilitating greater control over the animals, flexibility in the husbandry regimes, and cognitive enrichment (Shepherdson, 1999). Enrichment may include olfactory stimuli with strong odors, such as anchovy paste, perfumes, blood, herb-scented vinegar, and herbivore dung (Powell, 1997 and Karr, 1998). Olfactory enrichment can encourage foraging behaviors (Skibiel et al., 2007) and increased activity, as has been found with the provision of scents such allspice, musk cologne, almond, peppermint, cinnamon, ginger, and zebra dung scents to captive African lions' enclosures (Powell, 1995; Wells and Egli, 2004).

Keeper observation of felid behavior and temperament can be used to address behavioral and reproductive disorders. Wielebnowski (1999) found that keeper/observer questionnaires and observations not only can provide a valid method for the assessment of a cheetah's behavior in captivity but also may assist in identifying and examining breeding and behavioral issues. Keepers rated female cheetahs and nonbreeders higher on the behavioral domain "tense-fearful" than males and breeders, respectively. It is hypothesized that tense-fearfulness is an adaptive trait from the wild because females must not only raise their cubs alone but protect them from other predators (Wielebnowski, 1999).

The reproductive success of exotic felids is improved when keepers spend more time interacting with them (Mellen, 1991). A keeper's relationship with their cat or cats plays an important role in promoting good husbandry (Mellen, 1991; Wielebnowski, 1999), but care must be taken to ensure that the interactions are positive, as negative interactions potentially cause unwanted stress for the animal (Wielebnowski et al., 2002a). Maintaining a species' natural social conditions is especially important when attempting to create self-sustaining ex situ populations of a threatened species, such as the cheetah (Wielebnowski et al., 2002b). Males and females need to be kept separate from one another for the majority of the year, as in the wild; otherwise, they lose interest in breeding and behave like littermates (Louwman and Louwman, 2005).

Most zoos place captive felids on display during the day and isolate them in off-limit dens at night. Stereotypic behavior is common during the day (e.g., 07.00-18.00 h) (Mohapatra et al., 2014), particularly if space is restricted (Sajjid et al., 2011) and tigers can see each other (Miller et al., 2008). The night dens are usually much smaller than the display enclosures, although the animals may have to spend up to two-thirds (16 hours) of their time inside them. Little is known about behavior in these dens, although in 1 study tigers spent most of their time resting, with only 1 of 3 exhibiting stereotypic pacing (Zahnow, 2002).

Tigers can pace whether they are housed in social groups or individually (De Rouck et al., 2005), depending on feeding strategy and their ability to cope with captivity, including camouflaging themselves to another tiger in a neighboring cage (Miller et al, 2008). Excessive grooming, another potential problem, can lead to flattened occipital protuberances in tigers compared with their wild counterparts (Duckler, 1998). Pacing can be reduced by provision of feeding enrichment, such as frozen fish and spices (Skibiel et al., 2007). An individual felid's personality will determine how they interact with the enrichment being offered (Wielebnowski, 1999).

Planning an enrichment program requires keepers to decide which behaviors and activity patterns that they want to change, generally by enhancing natural behaviors used in the wild to reduce stereotypic behaviors (Mellen and MacPhee, 2001). Ideally, the program should be tailored to individual felids, depending on their personality and emotional state. In domestic felids, personality traits are identifiable and stable after 4 months of age (Lowe and Bradshaw, 2001), and emotional states, which varies over time, can similarly be identified (Phillips and Peck, 2007).

Measurement of personality has been done using rating adjectives or categories, for example, "aggressiveness" in relation to the individual animal. Historically rating an animal's personality traits has been considered subjective, although it does allow for assessment to be made over a relatively long period (Gosling, 2001). Assessing emotional state often makes use of behavioral tests, such as assessing the animal's response when it is exposed to in novel object (Gosling, 2001, Gosling and Vazire, 2002). Both methods have some value and may be seen as complementary (Gosling 2001).

Razal et al. (2016) advocate a combined approach of keeper ratings and behavior coding for the determination of personality in cheetahs. Domestic cat personalities can be separated into 3 groups: first, "confident, sociable" (Feaver et al., 1986) cats, trusting and bold (McCune, 1995) cats; second, "shy, nervous, and timid" cats (Feaver et al., 1986); and third, cats with an "aggressive or active personality" (Feaver et al., 1986). The time spent in contact with the new object may indicate inquisitiveness in the animal (Gosling and Vazire, 2002; McCune, 1995).

The personality of the keepers also affects their interactions with captive tigers (Phillips and Peck, 2007), for example, keepers with a self-reported "angry" personality pay less attention to their tigers. There have been few attempts to determine personalities of captive felids, but Baker and Pullen (2013) have identified "dominance," "general sociability," and "sociability to keepers" dimensions in cheetahs' personality, using behavior observations. Recently, Razal et al. (2016) identified "insecurity," "aggressiveness," "interactive behavior," "activity," and "unsociability" in cheetahs from a combination of keeper ratings and behavior recording.

For the purpose of our research, keepers were used to identify emotional domains in captive felids, and the stability of these domains was investigated. Tigers' behavioral and emotional responses to different enrichment strategies were then investigated.

## Materials and methods

This study was conducted at Australia Zoo, Queensland, Australia, using 2 species of big cat: cheetahs (*Acinonyx jubatus*) and tigers (*Panthera tigris*). Ethical approval was obtained from the University of Queensland Ethics committee.

For the purposes of this study, we consider an emotion to be an intense mental state which occurs instinctively, as opposed to through conscious effort, and consisting of 3 components: subjective, physiological, and behavior change (Houghton Mifflin Company 2007; Oxford University Press 2007). An emotional domain (ED) describes a group of behavior descriptors which as a whole form an emotional state.

### *Animals and their keepers*

The first study used 2 female and 2 male cheetahs, aged, respectively, 3 years, 10 months, 4 years, and 4 years. They were managed by 6 keepers, 5 females and 1 male, with a mean age of 28.2 years (standard deviation [SD] 0.60), who had a mean of 2.2 (SD 0.15) years of experience with cheetahs at Australia Zoo.

The second study used 3 Bengal tigers, all 2 years of age, and 6 Sumatran tigers, 3 aged 4 years and 3 aged 1 year. The tigers were looked after by 7 male and 2 female keepers, who had a mean of 3.28 (SD 1.68) years of experience with tigers.