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ABSTRACT

Felids are displayed in zoos and parks all over the world but are often kept in unsuitable enclosures. Stereotypic behaviours are therefore commonly observed in large captive cats caused by a lack of a stimulating environment. To prevent this, keepers use different enrichments to encourage animals to express natural behaviours such as running, investigating and playing. Play behaviour has recently attained more attention and has been suggested to be an indicator of good welfare as well as possibly being the cause of it. This study aimed to investigate if play can be stimulated by presenting environmental enrichments, or "toys". In this study two litters of cheetah (*Acinonyx jubatus*) cubs of various ages that were presented with a Boomer ball. Behavioural data were collected during two weeks. The first week was used as a baseline and during the second week a Boomer ball were presented .The result show a small increase in object play, even though the cubs did not use the Boomer ball during the time of observation. The most commonly observed type of play was contact social play, but the litters spent the majority of the time resting. This might have been affected by the chosen time of day for the observations. The results of this study did not indicate the possibility of stimulating play in cheetah cubs, but it does not rule out the possibility of a better result during different circumstances. If play could be increased by presenting environmental enrichments and if the theory of play was confirmed to cause positive emotions, this could result in a practically manageable way to improve the welfare of captive animals. Future research might hand us the tools to measure emotions in animals and the effect of how animals feel, creating a major step forward in animal keeping.

INTRODUCTION

Members of the Felidae family are commonly displayed in zoos and parks all over the world, a life that often differs a lot from their natural environment. Cheetahs (*Acinonyx jubatus*) and other large felids in captivity spend the majority of their time inactive (Margualis *et al.,* 2003). When living in the wild, large cats spend a great amount of energy on locating, capturing, killing and consuming prey (Lindburg, 1988). In cheetahs, the chase itself includes a very intense but short sprint which can reach a speed of 104,4km per hour (Sharp, 1997; Shoemaker *et al.*, 1997). This particular hunting technique demands a large amount of energy during a very short amount of time, which leaves it to become a very important activity in the life of a wild cheetah (Law *et al.,* 1997).

Felids in captivity and stereotypic behaviour

Zoos and parks keep animals not only for recreation, but also to educate, for the sake of research and the purpose of conservation (Pitsko, 2003). Even though the keeping of animals have improved, the natural life of large felids is still hard to stimulate (Bashaw *et al.,* 2003). Studies have shown that the surroundings, such as enclosure design and the management, have a great visible effect on the captive animals´ ability to express behaviours (Lyon *et al.,* 1997).

It is common to observe different stereotypic behaviour among felids, generally caused by a lack of a stimulating environment (Lindburg, 1988). An inadequate management could also result in both physical and psychological stress in captive animals (Lindburg, 1988). This is initiated by the deprivation of active behaviours, as the previously mentioned behaviours concerning the hunt, excluding the consumption itself, according to Lindburg (1988). He also describes a situation where lack of stimulation, despite having four acres of land, resulted in cheetahs becoming virtually inactive in captivity. Among other large felids, it has been observed that an unsatisfactory environment could result in a display of stereotypic behaviours like pacing or other possible indicators of poor welfare (Lyons *et al.,* 1997).

Environmental enrichment

To manage stereotypic behaviours zoo personnel use environmental enrichment among other things to stimulate the animals both psychologically and physiologically (Skibiel *et al.,* 2007). Skibiel *et al.* (2007) suggests balls, ropes, spices and barrels, among others object to be used as enrichment for captive felids. These enrichments are used not only to encourage an increase in the animals' activity level but also to stimulate the felids to express a larger range of natural behaviour, such as running, investigating, chasing and playing (Bashaw *et al.,* 2003). Play behaviour have been discussed to possibly improve welfare (Held & Spinka, 2011).

Play behaviour

Schlosberg (1947) states that behaviour is normally categorized as playful if it appears to serve no purpose, all based on the interpretation of the observer. Defining play behaviour is not an easy task but it is obvious that play behaviour cannot be identified by one criterion (Beach, 1945). Beach (1945) defined play as a behaviour that is always pleasurable, more common among young individuals and serves no direct biological purpose other than for the sake of the behaviour itself (non-utilitarian). Play behaviour is also species specific and

is more frequent, more variable and occurs on a higher percentage in the lifespan of more "highly evolved" animals compared to others, according to Beach (1945).

Burghardt (2005) used similar criteria to help distinguish play from other behaviours. The following five criteria, according to Burghardt (2005), needed to be fulfilled for behaviours to be classified as play behaviour.

- Play behaviour is not fully functional when expressed, unaffected by its form or context.
- Play behaviours are autotelic (self-rewarding), voluntary, intentional, reinforcing and spontaneous.
- Play separates itself from other behaviours within the animal´s repertoire as it is considered "unserious" with the reason of being incomplete, exaggerated, precocious, awkward etc.
- Play is not stereotypic, but is normally repeatedly preformed in a similar form during parts of the ontogeny.
- Play is commonly initiated when the animal is "pleased" or "relaxed", with no other competing motivational systems, in example when the animal is satisfactorily fed, in good health and free from stress.

Citing Burghardt (2005: p.81): "*all five criteria must be met in at least one respect before the play label can be confidently attached to any specific instance of behaviour*". What play behaviour could look like does vary plenty between species but also within species (Beach, 1945; Burghardt, 2005). Play is also capable to fluctuate between countless different patterns of combinations that might change every time, something that is not often observed in other behaviours (Loizos, 1966).

Play has been observed at all different ages within many species (Beach, 1945). Even though the purpose of play is unclear, the behaviour of play needs to provide a positive effect on fitness as the cost of this behaviour otherwise would result in it disappearing though natural selection (Held & Spinka, 2011).

Held & Spinka conclude (2011), that play behaviour is motivated as long as it does not interfere with more urgently motivated behaviours with direct effects on the individual's fitness. In captivity, the conditions are different and natural stressors such as predation and food shortage are normally absent, leaving the large cats with loads of energy and spare time (Held & Spinka, 2011).

Play is often assumed to be a" luxury" behaviour, as it is normally expressed when all other needs are fulfilled (Held & Spinka, 2011). These behaviours have been observed most commonly in young individuals within different species (Fagen, 1974) and seems to be decreasing with age (Poirier & Smith, 1974; Baldwin & Baldwin, 1974). The definition of play behaviour varies as well as the theories of its causation. Thorpe (1966) describes play as a behaviour that can include patterns similar to innate behaviours but is performed for the sake of play itself.

Play behaviours can be categorized differently. When observing cheetah cubs in the wild, Caro (1995) chose to categorize different play behaviours into locomotor play, contact social play, object play and non-contact social play, while Burghardt (2005) categorized three main types of play behaviour: social, locomotor and object play.

Locomotor play is also called locomotor-rotation play as it often is displayed accompanied with the animal shaking its head or/and twisting its body, according to Burghardt (2005). He continues to say that this type of play, like leaping and running, often involves the animal moving in exaggerated movements in all directions, as well as frequently switching direction. This type of play often starts without any immediate reason or stimulus and is often one of the first play behaviours to be displayed ontogenetically in several species (Burghardt, 2005). Locomotor play could however be hard to distinguish when observed in solitary species, especially non-mammal species, according to Burghardt (2005).

Social play, including contact and non-contact social play (Caro, 1995), are defined as play with conspecific or other animal substituting conspecific, something observed in captivity (Burghardt, 2005). Burghardt (2005) points out, when stating such a relationship it is important to apply the five previous mentioned criteria on all individuals participating, to prove that all individuals involved experience the event as play. Many different behaviours can be defined as social play but some obvious examples are chasing, wrestling, nipping and pawing (Burghardt, 2005). The movements are, according to Burghardt (2005), often complex and sometimes almost graceful and seem to show similarities of adult behaviour patterns.

Object play, also referred to as sensorimotor play, is often displayed when an animal manipulate an object using teeth or paw by, for example, lifting, pushing or grasping it (Burghardt, 2005). This type of behaviour is not classed as object play, if the object is food or nesting material as it does not fulfil all five criteria of play behaviour (Burghardt, 2005). Object play in carnivores is often termed predatory play as it often incorporates behaviours simulating the different stages of the hunt (i.e. shaking, grabbing and stalking), according to Burghardt (2005). He also state that the repertoire in this type of play, in general, observes to have strong influences of the animals natural foraging movements. Object play is not only commonly seen in young animals but it is also repeatedly observed in species like sharks and many types of fish, that otherwise are not perceived as playful (Burghardt, 2005).

Play and Welfare

As previously mentioned, the possibility is discussed of play correlating with good welfare and possibly being the cause of it (Held & Spinka, 2011). If this is proven and play can be stimulated in captive felines, then it might result in improved welfare of animals worldwide.

Welfare, just as play, need to be defined in this study to avoid misconception. The term is very commonly used in scientific articles and is defined differently by different writers. For this thesis, welfare is seen as improved with an increased amount of positive emotions and healthy biological functions (Dawkins, 2008). Welfare will as well be seen as decreased with increased amount of negative emotions and health problems, among other biological malfunctions (Dawkins, 2008).

AIM OF STUDY

Based on this introduction this study will review the possibility of stimulating play and activity. The aim of the study is to observe if an environmental enrichment (Boomer ball) will stimulate play behaviour, as well as discuss if play behaviour can result in improved welfare of large felines in captivity. The study conducted evaluated the following questions:

- Does the presence of environmental enrichment (in this study a Boomer ball) increase the amount of play behaviour and activity level of cheetah cubs (*Acinonyx jubatus*) in captivity?

- Judging from the result of the experimental study, is it possible to improve the welfare of large cats in captivity through play?

MATERIAL AND METHODS

Subjects and husbandry

Subjects for this study were individuals chosen from two litters of cheetah (*Acinonyx jubatus*) cubs born at Borås Zoo in Sweden, where the study also was conducted. Litter 1 (L1) was born on the 5th of November 2012 consisting of 7 cubs (5.2) and litter 2 (L2) was born on the 24th of December 2012 consisting of 5 cubs (3.2). All cubs were kept with their mother throughout the study.

The mother of L1 was born 2008 at Borås Zoo and was a daughter of the mother of L2, from a previous litter. Mother of L2 was born 2004 at Westfälischer Zoologischer Garten in Münster, Germany. Mother of L1 has had no previous litters, while mother of L2 has had three previous litters, in 2008, 2010 and 2011. Both mothers were captive born and both litters have the same father.

The study was conducted in the cheetahs' home pen at Borås Zoo. L1 was moved from a building close by, where L1 previously had been housed, short before the study begun (3rd of April, 2013). The building was made of wood and was equipped with five windows. Both litters were kept in the same building, holding four boxes and each litter had access to two boxes though a passageway (figure 1). L1 was housed on a total area of 30sqm and L2 was housed on an area of 22,8sqm for both boxes. As the litters were housed with their mothers, it gave L1 an area of 3.75sqm/individual and L2 an area of 3.8sqm/individual. Ceiling height was in all boxes 2,40m. The flooring was made of concrete but each litter had one bed made of straw and a few small piles of cutter shavings.

L1 had access to three elevated ledges and L2 had access to two (figure 1). The mentioned area of the boxes excluded the area of the elevated ledges (EL). Each litter had access to a large wooden bobbin (roughly 30x20cm) placed on the floor, a short log (roughly 30cm) and a rope hanging from the ceiling by a metal chain during the entire study.

The litters had access to outdoor enclosures during daytime, between 9.30AM and approximately 16.30PM. During the study L1 had access to a larger display enclosure (6700sqm), while L2 had access to different smaller outdoor enclosures (72sqm, 64sqm, 240sqm, 300sqm and 500sqm) that was not for display. The outdoor enclosure L2 had access to differed during the weeks of observation. During the night the animals were kept in their boxes.

All cheetahs were under the care of the same keepers before and during the study. The keepers let the cheetahs out into the outdoor enclosure in the morning, circa 9.30-10.00. The cheetahs were fed through the fence each morning with small pieces of meat. The animals were fed again at the end of the day in their boxes, with different types of meat (normally beef but also horse, hen and rabbit). The boxes were cleaned every day as soon as the animals were let out into the outdoor enclosure.

Experimental condition

The experimental study was carried out during two weeks, in April/May 2013 at Borås Zoo in Borås, Sweden. Two individuals were selected arbitrarily at each observation from each litter, as the cubs were too similar to tell apart.

Six different observations were recorded during two weeks. Three observations took place during the first week and were used as a baseline. During the second week, three observations were recorded under the same condition but both litters have access to one Boomer ball each. The Boomer balls were left for the entire observation week. The Boomer balls had a diameter of 300mm, were made of hard plastic and sand coloured.

During the time of observations the litters were kept in their boxes. The keepers normally enriched the environment with different objects (i.e. animal scents, skins, braches, logs, basket balls and fruit) but during the two weeks of observation the environment were kept the same, consisting of the previously mentioned objects.

The recording equipment used for the observations were a KGUARD Standalone DVR KG-SHA104 with belonging surveillance cameras.

Data Collection

Both litters were observed during the same days and same time. The observation was made using four small surveillance cameras, one installed in each box (figure 1). The cameras were angled to display as much of the boxes as possible, but each camera was not capable to cover each box properly. The behaviour of both litters were observed during one hour, between 08.30- 09.30AM during the 23rd, 25th, 27th, 29th of April and the 1st and 3rd of May. The first three days were used as a baseline. On the 28th of April, one Boomer ball was placed in the each of the enclosures.

The video recordings were observed by using the programme "PlayBack" on a PC (laptop). Behaviours were registered with focal animal instantaneous sampling and 30 seconds intervals. The ethogram (table 1) was set up while observing the cheetah cubs through previous recordings, as well as using play behaviours described in an earlier study on wild cheetah cubs (Caro, 1995). The play behaviours observed were also assessed accordingly to the previously mentioned five criteria of play behaviour (Burghardt, 2005).

The observations were compiled to be displayed as a time budget to compare for possible differences, based on the behaviours of the ethogram used during the observations (table

1). Behaviours are arranged into the four different categories of play: *locomotor*, *object*, *social contact* and *social non-contact play behaviour*, as well as three other categories: *passive non-play behaviour*, *active non-play behaviour* and *out of sight*. Registrations of *Out of sight* were made when partial or the entire focal animal could not be seen, which unabled an observation of behaviour. When returned to sight, the cubs were identified by size, walking pattern, the shape of the white tip of the tail and by counting other cubs in sight to reassure the right cub was observed.

Data Analysis

The results were analysed by comparing the baseline week and the experimental week with the Boomer ball for both litters. A comparison between the two litters and the type play being observed was also conducted. The time budget was establish by calculating the percentage distribution for each cub and using result to calculate the mean value in percentage for all behaviours during baseline and experimental week using the following formula, which is also explained below.

$$\bar{X} = \frac{(\sum \frac{amount\ of\ one\ behaviour}{all\ behaviours})}{3}$$

The amount of registered behaviour was divided by the amount of all the behaviours observed during that time of observation, giving a mean for that behaviour during that particular observation. The observations were divided in four time periods. The periods were separated between litters and baseline/experimental week, leaving three times of observations for each period. The sum of all three observation means for a specific behaviour were divided by three to get a general mean for that time period.

This concludes that the formula provided a mean of the percentage distribution for the tree observations made during each week that could be compared with observations in the other litter as well as the other week.

To reach the aim of the study more efficiently, several articles have been used to answer the questions asked as well as using the results of the study of observation. These will though not be mentioned until *Discussion.*

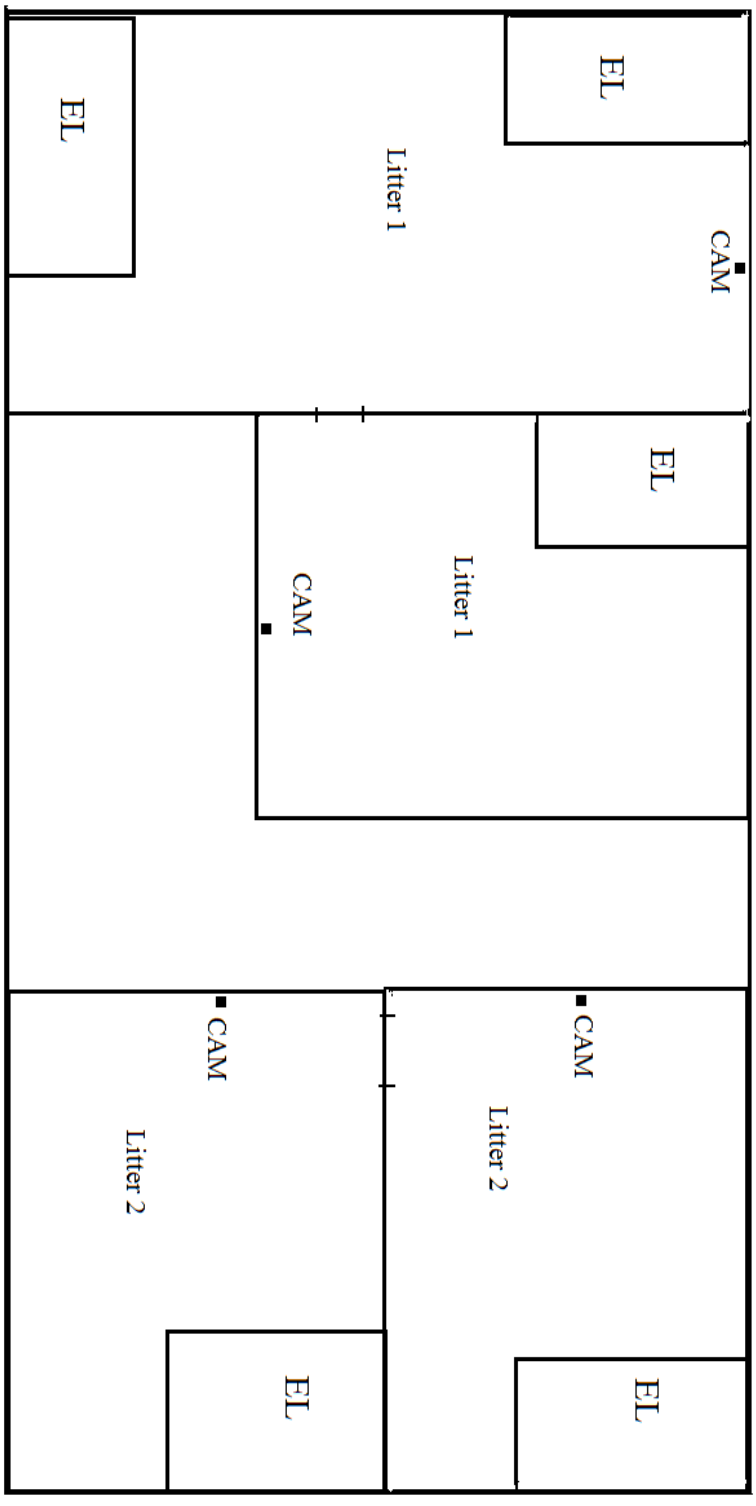

Figure 1 – Layout of building where study of the cheetah cubs where conducted. EL - elevated ledges, CAM - camera

Table 1 –An ethogram of a behavioural study on cheetah cubs, aimed at observing different play behaviours (modified after Caro, 1995).

	Behaviour	**Description**
Locomotor play	Jumping	Jumping up on object on a higher level
	Rushing	Short quick movement forward
	Bounding gait	Running slowly with stiff legs, lightly rocking back and forth
Object play	Patting	Using fore paw on object, giving it a slap or touch
	Kicking	Hit object with hind paw
	Biting	Closing jaw on an object
	Grasping	Holding on to object with fore- or hind paw
	Chasing	Running for or after an object or animal
	Carrying	Holding an object in mouth while moving
Contact social play	Patting	Using fore paw on other individual, giving a slap or touch
	Kicking	Hit other individual with hind paw
	Biting	Closing jaw on other individual
	Grasping	Holding on to individual with fore- or hind paw
Non-contact social play	Crouching	All paws on the ground, holding a stationary posture. Body held low or against the ground
	Stalking	Slow movement, approaching with body held in low position
	Chasing	Running with goal/aim of reaching an other animal
	Fleeing	Running away to avoid other animal or object
	Rearing	Both forepaws off the ground
Active non-play behaviours	Sniffing (Exploring)	Placing nose on or close to object
	Biting/Chewing/Eating	Manipulating object with teeth in a non-playful manner
	Socializing/Grooming	Interacting with other individual in a non-playful manner
	Sitting down	Bottom on the ground, body in upright position
	Walking/Slow run	Movement forward with at least two paws on the ground at the same time
	Rolling	Laying down on one side and rolling with back against ground until other side of body touches the ground
Passive non-play behaviour	Resting	Laying on one side with head resting, relaxed body language
Out of sight	Out of sight	Focal animal is out of sight with part or whole body resulting in that a behaviour cannot be noted

RESULTS

The time distribution is displayed in figures 2-5. Some of the behaviours are displayed at nil percentage, as the behaviour was not observed during the observations. Some behaviours presented the same way did get observed, but in a very low percentage. To clarify this, all behaviours are presented in table 2 with more precise numbers.

Table 2 - Precise time distribution of behaviours during both weeks and both litters (displayed in percentage.

Behaviour	Litter 1 (baseline)	Litter 1	Litter 2 (baseline)	Litter 2
Locomotor play	0.70%	0%	0%	0%
Object play	0.55%	1.80%	0.15%	2.20%
Contact social play	7.50%	10.25%	12.75%	9.75%
Non-contact social play	0.15%	0.40%	0.30%	0.15%
Passive non-play behaviour	51.85%	53.80%	55.40%	62.50%
Active non-play behaviour	27.80%	22.05%	24.65%	19.60%
Out of sight	11.45%	11.70%	6.75%	5.80%

Interactions with the Boomer ball were rarely observed. At only two occasions a focal animal interacted with the ball but neither was registered. In contrast to this, an increase in object play was observed in both litters when comparing baseline with the week with the Boomer ball (figure 2-5).

When including all categories of play behaviour, it is observed that L1 expressed more play behaviour during the week with the Boomer ball (figure 5). L2 did, in contrast to this, display less play behaviours (figure 4). The observations *contact social play* were most frequently consisting of wrestling, combining several *contact social play* behaviours as patting, kicking and biting. *Contact social play* was also undoubtedly the most displayed play behaviour during the study and was typically aimed at siblings, however both litters were observed displaying this behaviour towards their mother as well. L1 presented an increase of these play behaviours during observations with the Boomer ball present, while L2 presented the opposite.

Caused by camera angles, the focal animals were during a part of each study registered as *Out of sight*. Focal animals were observed to be out of sight a large amount of time, with a mean value for all observation of nine per cent.

Like this category, *passive non-play behaviour* consumed a large amount of time budget. Rest was the only behaviour categorized as a *passive non-play behaviour*, as it was the only one defined as inactive. Extensive periods of rest were displayed ordinarily during the beginning of each observation, but were also display extensively at one occasion at the end of the observation. Both litters presented an increase in this type of behaviour during the second week of observation (figure 4-5).

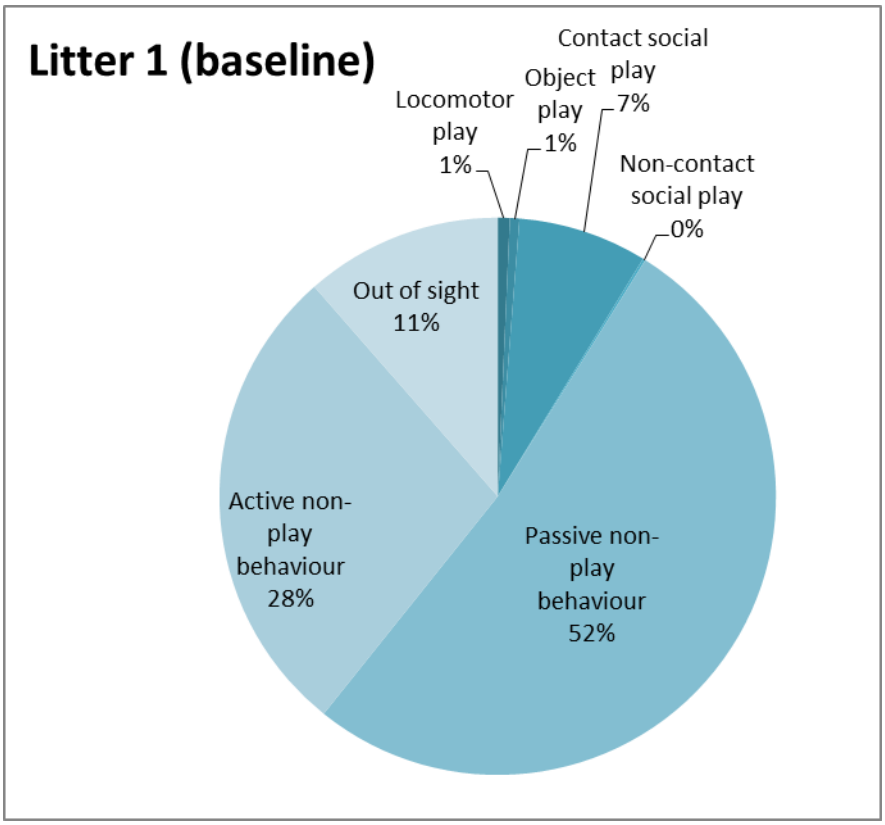

Figure 2 - Time budget for the baseline observations on litter 1.

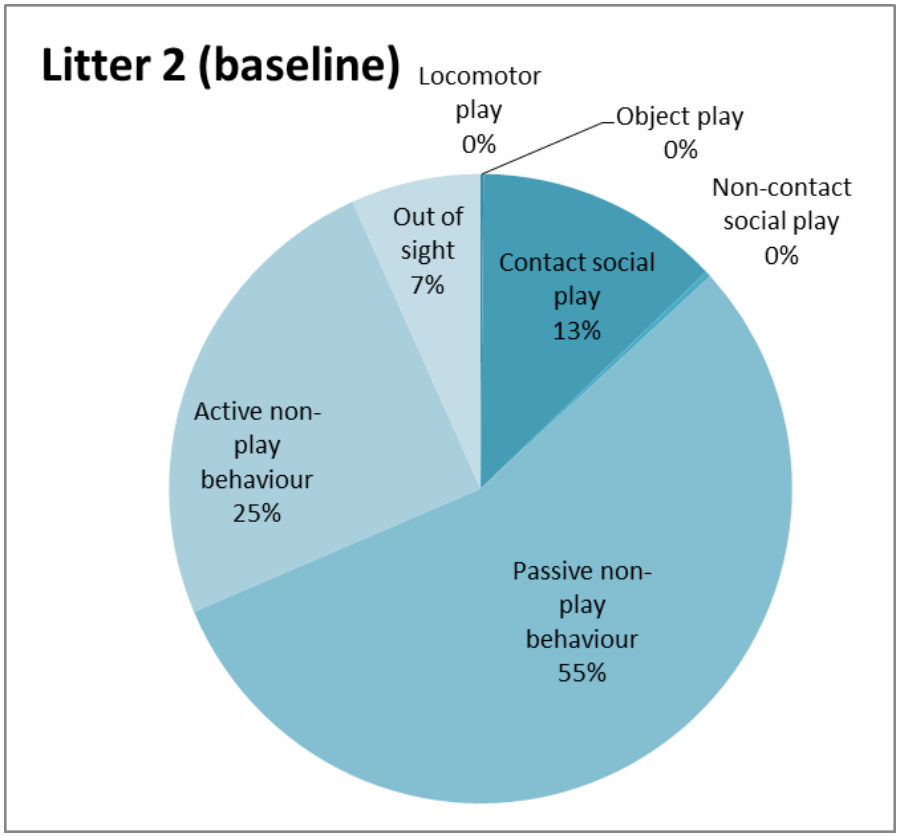

Figure 3 - Time budget for the baseline observations on litter 2.

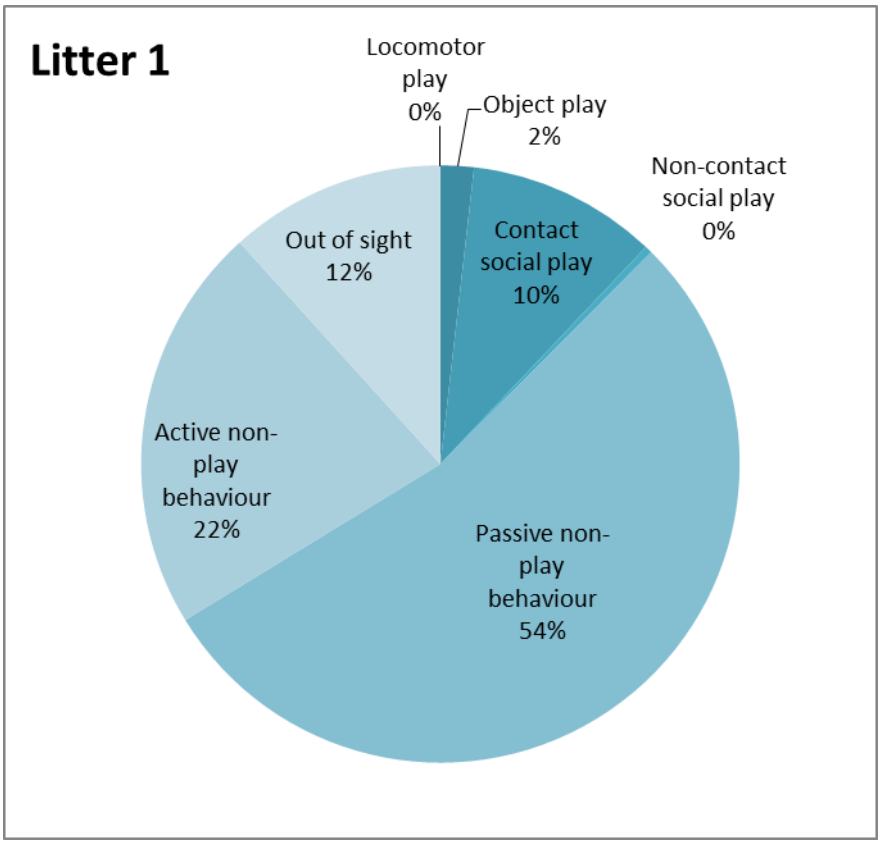

Figure 4 - Time budget for all observations during the experimental week on litter 1.

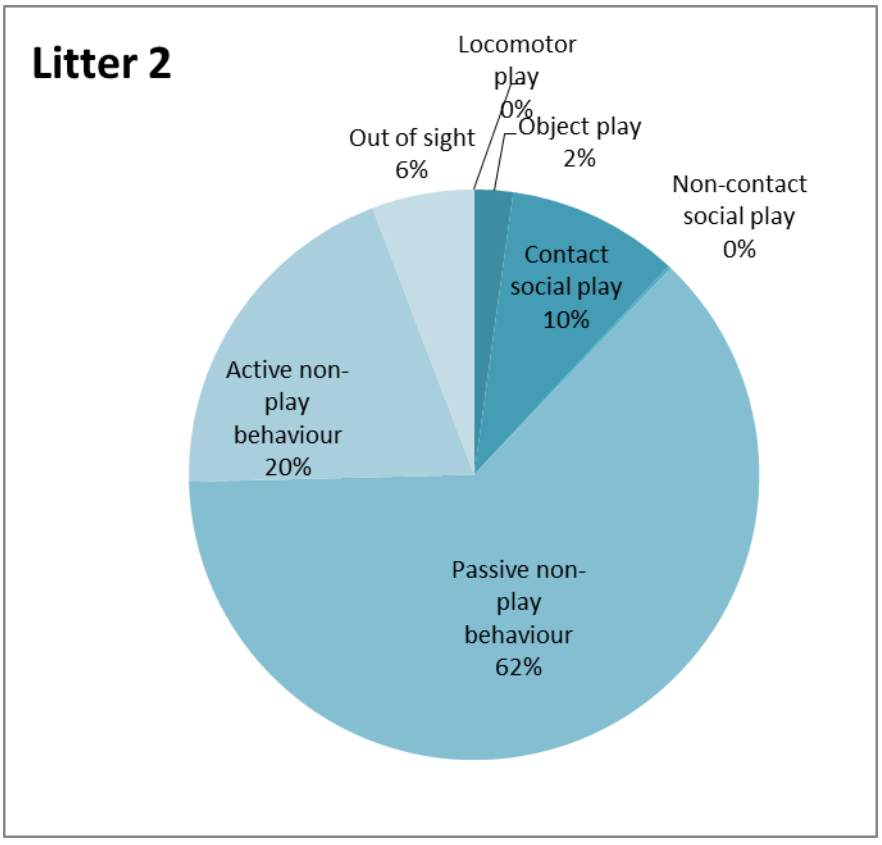

Figure 5 - Time budget for all observations during the experimental week on litter 2.

DISCUSSION

During the observations, the litters spent the majority of time resting. Cheetahs, in a study comparing several felids, showed the highest percentage of inactive behaviours (Skibiel *et al.*, 2007). Quirke & Riordan (2011) also observed cheetahs in captivity spending a large amount of time inactive, reaching 44.7 per cent during the baseline study. Interesting enough, Quirke & Riordan (2011) did observe an increase in inactivity during four out of six of their phases of observations, showing similarities to the study conducted for this thesis. Concluding that cheetahs being largely inactive as a possible indicator of poor welfare seems hard considering the fact of both their natural life as well as the amount spent during enrichment. It is probably more important here to consider what other behaviour that are being displayed and how they change with environmental improvements.

Quirke & Rioidan (2011) observed cheetahs pacing more than ten per cent during baseline observations, which seemed to decrease when their environment was enriched. Skibiel *et al.* (2007) observed stereotypic behaviours in other species of captive felids but none in the cheetahs observed. This might have been affected by the fact of only two specimens of the species being included.

Subjects and husbandry

The boxes, where the cubs were observed, had some enrichment during all observations other than the Boomer ball during the experimental week. Even though the environment was constant during the study, it still might have affected the results. The presence of other object might have lessened the effect of the Boomer ball. To improve the study´s scientificity all loose objects should have been removed, like in the study by Skibiel *et al* (2007). The issue with this is the effect it might have on the animals, as a change in the environment might cause stress (Morgan & Tromborg, 2007) which might have had an effect of the amount of play expressed (Held & Spinka, 2011).

Continuing on the matter of stress, it is also worth discussing the fact of L1 being moved less than a month before the study was conducted. A move could cause a large amount of stress for many reasons (Morgan & Tromborg, 2007). According to the keepers, when L1 were moved into the building, the mothers started responding to the call of each other's cubs. Something that was perceived as a confusing experience for the mothers, according to the keepers. The sound of a con-specific might cause stress to the individual (Morgan & Tromborg, 2007).

During the observation a construction site were building a few hundred meters from the enclosures and housing, involving regular loud bangs and loud warning signals that started two weeks before the study begun, on the 10th of April. Even though the keepers, in this matter, did not notice any effect on the cheetahs it might have caused them stress. Strong stimuli and other changes in the environment might affect the animals even though they are not showing any clear external signals (Morgan & Tromborg, 2007). A possibility of the animals habituating to the noise is possible considering the timespan between the study and the beginning of the construction, although either one cannot be ruled out as data for that kind of conclusion were not collected.

As the study was conducted on young individuals the amount of displayed play behaviour almost certainly would differ if the same study would be carried out on adult cheetahs. Cubs are more likely to display play behaviours compared to adult cheetahs, as it has been observed that the frequency of play seem to decline with age (Fagen, 1974). An interesting remark in this matter is that even though age seems to have an effect, it is observed, as previously mentioned, that individuals in captivity have a tendency to play more compared to the same species living in the wild (Greene *et al.,* 2011).

Even though this study did not display any result showing a difference in play behaviour depending on age, it has been observed in wild cheetah cubs that the type of play do change with age (Caro, 1995). Compared with Caro´s (1995) observations of play in wild cheetah cubs, the results do consent with a clear dominance of contact play behaviour in cheetah cubs. Contact social play is most displayed of all behaviours observed by Caro (1995), until the age of 10 months when exploratory behaviour became more common. Object play were the least observed (Caro, 1995) which might explain the lack of interest in the Boomer ball.

The difference between the results comparing the two litters is comparable with the results in Caro´s (1995) study, showing a change in type and amount of play depending on age. Before the age of two months cubs normally have very little activity and have not yet developed motor skills, leaving them resting for most part of the day (Caro, 1995).

Even though there were no differences a different ages, in this study, it might have had a positive effect in the distribution of boxes, as the larger cubs were housed with a larger area with an extra elevated ledge. Considering these conditions the larger cubs were not more restricted from moving around because of their size.

Previously it has been observed that male individuals seem to play more than females (Poirier & Smith, 1974), especially play involving wrestling (Burghardt, 2005). This study cannot confirm or deny this as I did not discriminate between the individuals in each litter. Using the data collected it is only possible to mention the possibility that the amount of expressed play behaviour varies between individuals as well as between litters, in this particular study. Burghardt (2005) mentions that play might differ between individuals as a result of genetic variation. In the matter of this study this might have had little effect as the litters had very similar genetics as both litters were breed using the same male, as well as the mothers were related mother-daughter.

Experimental design

Choosing a suitable time of observation was a challenge but the selected time for observations was based on previous observations by Caro (1995) of cheetah cubs playing in the wild, as well as some previous observations using data from the CCTV surveillance. By watching for a minute during every half an hour, from two weeks of data recorded every morning between 8.00AM and 10.00AM is was presumed that activity level were correlated with daylight, the presence of the keepers and gaining access to the outdoor enclosure. The decision were also based on that cheetahs are diurnal (Shoemaker et al, 1997) and Caro (1995) observed that cubs were active playing in the morning, right when they woke up and the mother was still resting. The real timespan of play for these cubs in captivity might not be as restricted as for the wild cubs in Caro´s (1995) study as they might be affected more by temperature and hunger than the captive cubs.

In the matter of discussing the time of observation, one of the observations was shortened by mistake during the baseline week. About ten minutes less was therefore observed during one observation. Other than losing minutes of data it might have affected the result in a negative manner as the minutes lost were in the end of the observation, which was normally when the cubs were more active.

The chosen time of observation did show a fair amount of play behaviours. The problem lay in the fact that the cheetahs were not active during the same time each morning, causing large parts of the beginning of some observations to be registered as inactive (figures 2-5). This effect on the result was caused by the fact that the study was adapted to the routines of the cheetahs and the keepers to minimize the stress correlated with environmental changes (Morgan & Tromborg, 2007). If the management routines would have been more adapted by keeping the cubs in their boxes for a longer time in the morning, it might have decreased the amount of inactive behaviours observed. In this study I choose not to adapt the routines to avoid the chance of causing stress, in a future study it might improve the result if an adaption were made if it is properly thought though.

The angle of the cameras also turned out to cause problems as the observations lost an average of nine per cent of observation time caused by cubs being recorded as *out of sight* (figures 2-5). This factor could have been excluded if other camera equipment had been used or if all four cameras had been used on one litter at a time. Using all four cameras would have resulted in only one litter being recorded at the time, which would have doubled the time of the observation period and the cubs would not be recorded at the same time. The high percentage did, without doubt, have an effect on the result as it resulted in losing an average of nine per cent of data.

There is also the possibility of the focal animal getting switched when being out of sight as the cubs was very much similar to one another, even though the observer used all possibilities of identifying the cubs during the observation.

It is also worth to discuss the effect of expectation. Every morning the cheetahs were let out into the large outside enclosure, at approximately the same time. This might create expectations which might result in the cubs being more active (Latham & Mason, 2010) and in that matter playing more. Naturally wild cubs play more actively in the morning (Caro, 1995), which makes this hard to interpret. There was a difference between the two litters in paying attention to, being close to and checking the passageway into the outdoor enclosure. L1 seemed to show more attention than L2 during all observations. This was noted but not registered within the observations, as it was not relevant to the research questions. Theories worth mentioning of possible causes for this active behaviour is previous experiences, age and/or affected by the behaviour of the mother.

In addition to the subjects being cubs, they differed in ages. Though being born almost two months apart, both litters displayed similar amount and type of play, as well as having a similar distribution of behaviours during time of observation. The only clear difference noted was the pace of play behaviours and how fast they switched between them. L1, which was the older litter, had a much higher pace of activity which made them more difficult to observe compared to L2. As the behaviours changed quickly, a 30 second interval became inadequate to register behaviours as several behaviours were displayed during a shorter interval. To improve the data collection, a 15 second interval could have been used which would have registered more behaviours that were displayed during the time of observation. Play behaviours like locomotor play and non-contact social play

appeared to be displayed during shorter moments, which might have been more frequently registered using a 15 second interval.

Another way to improve the data collection would have been to observe more cubs in each litter during the time of observation. A higher number of cubs were planned to be observed but the quality of the observations were chosen to be prioritized instead of the quantity caused by lack of time.

Play and welfare

Play is for many humans normally correlated with sound of laughter, which has been observed and documented in other animals as well (Powell, 2000). Play behaviour is experienced, among humans, as fun and results in positive feelings and emotions (Burgdorf & Panksepp, 2006). As previously mentioned, Held & Spinka (2011) holds argument about play behaviour being not only the result of good welfare but also having the ability to cause it. If this is the case then play behaviour could make a major difference if encouraged in captive animals. Even though the results of this study did not show any strong indications that play behaviours can be encouraged by a Boomer ball, it is still possible to investigate if play can be stimulated in other ways. A similar study conducted might give a better result, while using different objects, technics or species.

Continuing on the matter of play, it is discussed that play behaviour can give immediate benefits, in a form that is believed to be positive emotions (Burgdorf & Panksepp, 2006), as well as delayed benefits and/or long term benefits, like improved physical fitness or social skills (Held & Spinka, 2011). Feelings in animals are though hard to prove, as the animal cannot describe in words how it feels. Body language might be one way of interpreting emotions but more research is needed in this field to gain better understanding of the emotional aspect in animals. Held & Spinka (2011) states, that by understanding how animals experience emotions, a possibility is given to improve animal welfare in many different ways. More research within the subject of play might lead in the right direction. Studies that might answer questions like; how do different animals express feeling, or how do different types of play affect emotions?

A problem within the subject of play in captive animals involves the fact of play not being displayed if other behaviours are more strongly motivated, like hunger or fear (Held & Spinka, 2011). In captive environments animals experience stress and fear in situations that often are out of their control, which have a negative effect on the amount of play behaviour displayed (Held & Spinka, 2011). If the management does not fulfil the “basic needs” of the animal, it might not be able to have the possibility to display play behaviour. Something that might in that matter result in the animal not gaining anything from the advantages it might be correlating with. The “basic needs” is referred to acts keeping the individual content with physical aspects by proving food, water and other essential means of survival.

Captive animals that do get their “basic needs” fulfilled still might display stereotypic behaviours as management might not count the possibility to express strongly motivated behaviours as a need that should be met. In contrast to this play behaviour does appear to be more commonly displayed in captive animals compared to the same species living in the wild (Kleiman *et al.*, 2010). The fact that play behaviour is more commonly displayed in captive animals might also relate to the absence of hunger and other natural stressors like

predators (Caro, 1995; Held & Spinka, 2011), and play is sometimes therefore considered to be a welfare indicator.

Play is, as previously mentioned, a behaviour that is displayed in a variety of forms and differs in appearance from species to species (Beach, 1945). In the matter of this it is important to remember that all species have different needs of displaying behaviours. Different enrichments and toy objects may encourage different behaviours which makes it an advantaged to use several types of enrichments to offer variation (Skibiel et al., 2007). The novelty effect of objects seems to have a larger effect in shorter studies (Kulik & Kulik, 1991) like this one. Something you need to be aware of this to avoid misrepresented results.

As previously mentioned, Skibiel *et al*. (2007) states that providing captive felids with different enrichments could affect both the activity level and reducing the amount of displayed stereotypical behaviours, in a manner that might improve the welfare of the individual. Even though this is a relatively updated reference it is important to be aware that the result might not be able to be applied to a large scale as the study only involved 14 individuals and the novelty effect were not discussed. Awareness of the effect of the number of individuals observed applies just as well to the study presented in this thesis. A similar study on 12 cheetahs showed a decrease in stereotypic pacing and an increase in locomotor and explorative behaviours when enriched with feeding variation and olfactory enrichments (Quirke & Riordan, 2011). This also being a recently published article makes it relevant but the number of individuals used as well as lack of detailed background of the observed cheetahs causes me to keep a critical approach.

Skibiel *et al*. (2007) mention that any increases of activity level and decreased stereotypic behaviour that occur during enrichments might not be sustained if the enrichment gets removed or the practise stop. It has even been indicated that individuals that have had enrichments removed can increase the amount of displayed stereotypic behaviour (Latham & Mason, 2010). Even though this might be the case, it has also been observed that at least the behavioural patterns of felids become effected by the presence of enrichments (Skibiel *et al.*, 2007), which might indicate that environmental enrichment have a psychological effect on animals even in the cases where it is not frequently in use. The options of use might be enough, which also might create a sense of control in an environment that normally only provide a small amount of control for the captive individual.

Play might be displayed for atypical reasons as well, according to Wood-Gush & Vestergaard (1991), that hypothesize that play behaviour can be expressed when fear and exploration is in equilibrium. This is an interesting statement that brings thought to mind about play-acting as a sort of “displacement behaviour” when the individual cannot decide between staying or fleeing. It has also been observed that individuals suffering from sensory dysfunction and brain trauma, resulting in a disruption of the neurological mechanisms, show an increase of play behaviour (Held & Spinka, 2011). This is not, however, likely to indicate an improvement of welfare, according to Held & Spinka (2011).

Play, as previously mentioned, is defined as behaviours that do not serve an immediate purpose (Burghardt, 2005). Even if this is the case, it still causes the animal to become active. This activation has both a psychological and physical effect on the body, training it physically which could result in improved fitness (Brown *et al.*, 2003). It is within this matter that possibilities to increase activity with a self-rewarding behaviour, which not only increases the prospects of improving the physical fitness in captive animals but might also

to improve their mental abilities through play that may result in an improved emotional experiences for the animal.

Conclusion

Even though the study did not indicate that play behaviour can be stimulated, it is not impossible that the presence of other objects during different circumstances will present a different result. Another possible conclusion from this study might just be that balls are not a got enrichment for cheetah cubs. In the matter of trying to increase play behaviour in captive animals is affected by many factors, like management, enclosure design, choice of enrichment and the subject´s age. If future research proves successful within proving the emotional aspects of animals and play it might create possibilities to improve welfare within many species by stimulating play behaviours. At the moment, this might be seen as a bit of a challenge but if successful the result might be very rewarding.

POPULÄRVETENSKAPLIG SAMMANFATTNING

Lek är ett beteende som inte bara skapar aktivitet, utan det diskuteras även om lek har möjligheter till att skapa positiva känslor hos djur. Lek är dock ett relativt nytt område inom forskningen, vilket innebär att mycket fortfarande inte är förstått ännu. Exempelvis tros lek inte bara vara ett tecken på god välfärd utan man tror även att lek kan vara länkade till positiva känslor vilket kan resultera i en god välfärd hos djur. Beteendet är vanligt hos unga individer och verkar minska i förekomst desto äldre djuret blir. Djur i fångenskap verkar dock ha en större tendens till att leka, vilket tros sig grunda i att de har god tillgång på föda och inte behöver oroa sig för predatorer. För att ett beteende ska klassas som lek måste det uppfylla vissa kriterier. Lekbeteenden är bland annat självbelönande, frivilliga, medvetna och spontana. De uppfattas som oseriösa då de liknar andra beteenden men utförs på ett överdrivet , löjligt och ofullständigt sätt. Det verkar även som lek endast utförs när djuren verkar ”tillfredställda”, nöjda eller avslappnade, alltså när djuret inte är motiverat att utföra något annat beteende som att äta, dricka eller fly.

Stora kattdjur, som till exempel lejon, gepard, leopard och tiger, hålls idag av många djurparker över hela världen. Dessa djur spenderar stora delar av sin tid vilandes i brist på annat att göra. Hos många djur kan detta leda till frustration vilket kan uttryckas i stereotypa eller andra onaturliga beteenden som kan tyda på mental ohälsa hos djuren.

Många av djurparkerna arbetar med att minska eller förebygga att dessa beteenden förekommer genom exempelvis olika berikningar, som föremål, varierande utfodringssätt eller olika utformingar av hägnen. Dessa metoder används för att stimulera djuren till aktivitet på olika sätt samt skapa mentala och/eller fysiska utmaningar för djuren. Hos stora kattdjur kan allt från kryddor, avföring, tunnor och bollar användas i olika former, allt för att stimulera djuren till att uttrycka mer naturliga beteenden, som exempelvis jaga, klättra eller leka.

Är det då möjligt att motivera lek hos djur och därigenom skapa bättre välfärd? Två gepardkullar i olika åldrar observerades under två veckor, då djuren under andra veckan fick miljön berikad med en stor hård platsboll. Detta för att se om djuren lekte mer när de hade tillgång till en boll. Observationerna visade inte på att gepardungarna generellt lekte mer under andra veckan. Under andra veckan visades dock en ökning av lek med objekt. Det visade sig dock inte vara med bollen utan andra saker i närheten. Gepardungarna i studien lekte som mest med varandra, då de exempelvis brottades med en eller flera kullkamrater.

En slutsats från denna studie kan vara att lek inte kan stimuleras hos gepardungar med hjälp av en boll. Skulle en liknande studie göras på en annan art eller med annat föremål som berikning skulle det kunna ge helt andra resultat om samma fråga ställdes. För att ge resultat som verkligen tyder på bättrad välfärd måste det utföras mer forskning kring djurs känslor och hur de uppfattar olika situationer.

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