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The effect of elephant rides and walks on the number of self directed behaviours in African Elephants (*Loxodonta africana*)

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1 List of abbreviations

Abbreviation	Definition
AERU	African Elephant Research Unit
FGM	Faecal Glucocorticoid Metabolites
FAWC	Farm Animal Welfare Council
HAB	Human-animal bond
HAI	Human-animal interaction
HAR	Human-animal relationship
KEP	Knysna Elephant Park
OIE	World Organisation for Animal Health
OOS	Out of Sight
SDBs	Self-directed Behaviours

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4 Introduction

One of the most discussed topics regarding to animal welfare nowadays are the elephant rides. First initiated in Asia now also a business in Africa. With increasing amount of tourism, the number of providers of elephant rides were increasing. Now with increasing amount of concerns of animal welfare and the change in the perspective of wildlife tourism the number of operators are decreasing. Especially in Asia elephant rides is a popular tourism activity. The methods of negative reinforcement in order break the will of the animal is well known and made public with the media. On the other hand, the training of the elephants with positive reinforcement is often rather unknown to the public. This leads to the often false distribution of information that in all elephants that are ridden their will and back was broken in order to make them ridable. Now with increase awareness and information tourist get more and more the choice to what they want to choose as experience in wildlife tourism also under the perspective of animal welfare.

The number of wild living elephants on the entire African continent is decreasing but in South Africa there is still a great amount left. With more and more land being inherited by man the space for free-roaming wild elephants is decreasing. The majority of the African elephants (*Loxodonta africana*) live in game reserves and parks. According to Rossman et al. (2017) there are currently 129 captive elephants in South Africa, an increase of approximately 30% in the last 10 year. Captive elephants spend a significant amount of time in close proximity to humans. The management of captive elephants can range from protected- to free contact. Methods were no physical barriers are between the elephants and their handlers (Rossman et al., 2017).

More than 4.000 years ago in the Indus Valley the capture and taming of elephants began and since then people have continued. In 326 BC 85 elephants have been used in the Battle of Hydaspes by the Emperor of India to face Alexander the Great and in 218 BC Hannibal went through Spain, France and across the Alps with 34 African elephants. In the eighteen hundreds the Belgian King Leopold II captured and trained African elephants.

In the Buddhist and Hindu religion elephants play an important role. Their image and character are a powerful metaphor Buddha referred too and the Hindu elephant god Ganesh is honored as the remover of obstacles.

Breeding elephants in captivity has never been fully successful so that in order to cover the increasing demand of captive elephants they still need to be captured from the wild. Historically this was so great that it led to the consequence that on the Indian subcontinent the elephant population has been locally depleted. Worldwide the estimated number of captive elephants is between 15.000 and 20.000 animals. The reason why elephants are kept in captivity changed over the years. Formerly captured elephants were used for working purposes and sent to war. With the industrial revolution and the introduction of machinery elephants were replaced so that nowadays captive elephants are mostly used for the entertainment of people (elephantvoices, 2019).

This study was done in collaboration with the African Elephant Research Unit (AERU) and the Knysna Elephant Park (KEP) in South Africa. At KEP elephant rides and walks are offered to tourist. After the elephant rides were stopped from the 1st of March 2018 with this study the aim was to gain scientific data about how this effects the elephants. By analysing self-directed behaviours as a measure of stress.

5 Literature review

5.1 Proboscidea – elephants (Family Elephantidae)

Elephants belong to the family Elephantidae. There are three species known in the world. The African savannah elephant (*Loxodonta africana*), the African forest elephant (*Loxodonta cyclotis*) and the Asian elephant (*Elephas maximus*) (Figure 1).

On the African continent two of these species are living. They are very different in appearance and culture. The size of an African savannah elephant is up to 4 meters tall and 9 meters long and they can weigh more than 5,500 kilograms. The African forest elephant is smaller. They can grow up to 2.5 m tall and weigh around 2,800 kg. The African elephant species are classified as threatened (Elephants for Africa, 2016).

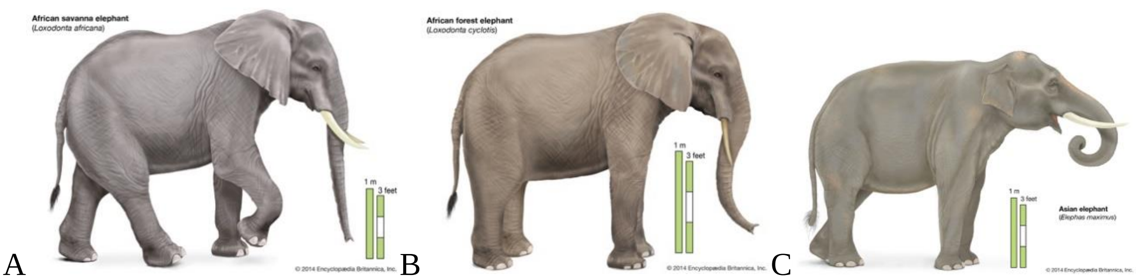

Figure 1: *A. Loxodonta africana, B. Loxodonta cyclotis, C. Elephas maximus (Encyclopaedia Britannica, Inc., 2014).*

Elephants are herbivores and have a daily food intake of 4-7% of their body weight. They can spend up to 16 hours eating every day. The reason for that lies in the fact that elephants can only digest about 40% of the amount they take in.

The trunk of an elephant is a modified nose made purely of muscles. The trunk is a fusion of the upper lip and the nose. The muscles of the trunk are radial and striated. Helical bands of muscles are wound spirally around the trunk allowing the elephant side-to-side twisting of the trunk and with that being able to manipulate foodstuff. The trunk is heavy and powerful but also very sensitive. Long sensory hairs are situated along the entire length of the trunk and is sensitive to touch. Especially near the tip. Here in the African elephant are the two “fingers”. With them the elephant can pick up individual berries or pull thorns from the feet. The two nostrils are separated the entire length of the trunk by a muscular septum which is mucous-lined. When used for drinking an adult elephant’s trunk can hold approximately 10–12 liters. After sucking up the water with the trunk it is squirted in the mouth of the elephant.

Elephants have very good smell and hearing. The eyesight is negligible. The ears of an African elephant are big. The pinnae are able to catch sound waves. The ear opening, which can be closed when the elephant submerges, is encircled by a ring of long sensory hairs which probably help keep dirt and insects out (Carnaby, 2018). Strong headshaking can be observed and is probably a way to clean out the ears from debris that is not hold back by the hairs. For the detection of smell the trunk is often lifted. Elephants often have long eyelashes which are suspected to help shade the eye and stop dirt getting in the eye. To move dust inside the corner of the eye a nictitating membrane moves sideways (from inside to outside) across the eye. Elephants have no tear production but secretions that are excreted from the harderian glands. These secretions can be mistaken as tears.

Elephants flap with their ears as a cooling mechanism and to get rid of insects. It is not always an expression of anger. As elephants have no sweat glands they can easily overheat in African climate. To cool down their body, they stand in the shade and covering themselves with mud. Another mechanism of cooling is via the ears, which are supplied with a venous network that is able to dilate during heat. The total surface area of both ears is about 20% of the entire body surface and the skin of the ears is relatively thin. The heat can derive through the blood flowing through the veins and capillaries. This is improved significantly by flapping with the ears. Cooling currents of air flowing over the veins is caused via this mechanism (Carnaby, 2008).

The life span of captive elephants is estimated with around 17 years for zoo-born females. In protected areas in Asia and Africa wild elephants can live more than twice as long. As reasons for a decreased lifespan in captive elephants' researches assume obesity and an increased amount of stress (Mott, 2008).

Of all terrestrial mammals' elephants have the largest brain (Hart et al., 2008) and they are known to have a great capacity of long-term social memory (Rossman et al., 2017).

The human-animal interactions (HAIs) is a concept of animal welfare for a long time. Relatively new are the two new concepts of human-animal relationship (HAR) and its subset, the human-animal bond (HAB) (Rossman, 2016). HABs benefit both parties involved and have been defined as "reciprocal and persisten" relationship (Hosey & Melfi, 2012; Russow, 2002).

In HAIs the temperament and personality play a role and also the individual extend is varying as to how much an animal wants to interact with humans (Rossman, 2016). In temperament traits relating to aggression, exploratory behavior and social integration elephants show great individual differences (Lee & Moss, 2012). These different temperaments can play a role in the determination of how an animal will interact with humans (Topál et al., 1998; Svartberg, 2002). Studies with chimpanzees showed that human personality traits can also have an effect on HAIs as their reaction to humans was based on the performance of the experimenter (Hebb, 1949).

The amount of information's on the relationship and interaction between humans and elephants is limited and mainly data about Asian elephants.

A study of Lehnhardt and Galloway (2008) is describing that the safety in training and handling elephants is greatly influenced by ability of HABs between the trainer and the elephant and possibly even more important than the formal training of how to handle an elephant.

The most reports of HABs have been in large mammals (Hosey & Melfi, 2012). In the development of bonds the physical contact is contemplated to being important. (Payne et al., 2015; Rossman et al. (2016) assume that human-animal bonds can provide a safer environment for the animal and human that are involved in the bond. An increase in affiliative behaviour between conspecifics because of positive interactions between animals and humans can be the benefits of HABs (Baker, 2004; Carrasco et al., 2009).

5.2 Animal welfare

The World Organisation for animal Health (OIE) included in the Terrestrial Animal Health Code that Animal Welfare "means how an animal is coping with the condition in which it lives. As animal is in good state of welfare if (indicated by the scientific evidence) it is healthy, comfortable, well nourished safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear, and distress …". (OIE, 2008)

Also, a major impact on animal welfare had the Five Freedoms (Table 1). They were last altered in 1993/1994 and focused essentially on the space made available to the animals. In 2012, the Farm Animal Welfare Council (FAWC) stated on its website that the Five Freedoms "define ideal states rather than standards for acceptable welfare" … and together with the aligned Provisions … "form a logical and comprehensive framework for analysis of welfare within any system together with the steps and compromises necessary to safeguard and improve welfare within the proper constraints of an effective livestock industry" (Mellor, 2016).

Table 1: *"The Five Freedoms and Five Provisions for promoting farm animal welfare" (Mellor, 2016).*

Freedoms	Provisions
1. Freedom from thirst, hunger and malnutrition	By providing ready access to fresh water and a diet to maintain full health and vigour
2. Freedom from discomfort and exposure	By providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury, and disease	By prevention or rapid diagnosis and treatment
4. Freedom from fear and distress	By ensuring conditions and treatment which avoid mental suffering
5. Freedom to express normal behaviour	By providing sufficient space, proper facilities and company of the animal's own kind

5.3 Stress

Stress is a word which was originally used in physics to describe the interaction between a force and the resistance to counter it. In 1936 Dr János Selye, who is also known as the "father of stress research", was the first to introduce the term to referring to "the body's nonspecific response to any demand placed on it, pleasant or not". Stress is measured by stressors which could be originate in outside forces or agents acting on the body. "As a general adaptation syndrome" Selye describes three phases of stress reaction. In animals and humans stress can result from an intensive experience e.g. too much work and can have a great influence on the behaviour. The consequence of stress can be anxiety. The responses to stress vary and depend on the animal or human. It can be influenced by many factors, such as healthy immune system, healthy nutrition and lifestyle (Cunningham, 2000).

Another way how to describe stress is by using the Yerkes-Dodson Law (Figure 2). The psychologists Robert Yerkes and John Dodson described the empirical relationship between arousal and performance.

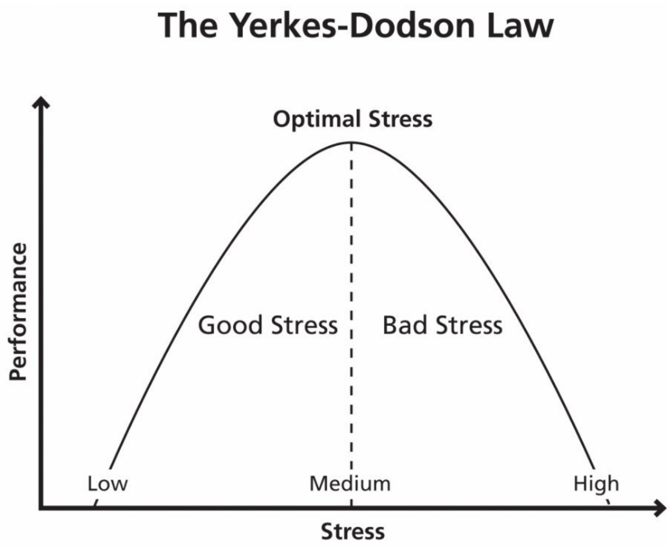

Figure 2: *The Yerkes-Dodson Law (Corbett, 2015).*

It describes the empirical relationship between stress and performance and states that with optimal stress the performance is the highest. When the stress is too low or too high the performance would decrease.

5.4 Signs of stress

In animals the signs of stress can be analysed by observing stereotypic- and self-directed behaviours. Also, the presence of humans can influence the stress levels in animals and is described with the "Visitor Effect". To improve welfare, it is important to identify and limit potential stressors.

Stereotypic behaviours are abnormal, repetitive behaviours as a result of a manifestation of stress. They are commonly seen in captive animals and humans with some mental disorders, such as autism (Lewis M., Kim SJ., 2009). The movements are ritualised being performed in the same way and same position over a longer period of time. They can come from situations were captivity prevents normal behaviour or can be a mechanism of self-enrichment. They can be a warning signal of potential suffering (Mason & Latham, 2004) and are reported to be able to be reduced by environmental enrichment (Swaisgood & Shepherdson, 2005). Examples for stereotypic behaviour are weaving or swaying.

A study of elephants in British Zoos in 2008 showed that sterotypic behaviours during daytime are displayed in more than half of the animals. In a 24-hour period some elephants even show stereotypic behaviour for up to 60% of the time (Harris et al., 2008). Another study that was performed in 2016 in 39 North American zoos found that in 89 elephants, that were involved in the studies, after feeding stereotypic behaviour was the most often performed behaviour (Greco et al., 2016).

Not only in captive animals seen but also in the wild are „Self-Directed Behaviours“. SDBs are non-invasive identifiers of situations that increase stress levels. They are behaviors that an animal performs on itself without a social partner (AERU, 2019). It can happen as a result of a mild inner conflict, tension, nervousness or indecisiveness that instead of deciding the energy is directed to the animal’s own body. The cause of SDBs are not always clear. They can be behaviours that have normally a hygienic function, such as self-grooming or scratching (Higham et al., 2009). These SDBs as well as body shaking and yawing in non-human primates have been proposed to be associated with anxiety and a subset of stress (Maestipieri et al., 1992). SDBs are seen as a coping mechanism in some species to reduce physiological response to stress (Schino et al., 1996).

The „Visitor Effect“ can be described as physiological or behavioural changes as a result of human presence, depending on the species, the type of visitors and the number of other factors (Hosey, 2000; 2008). It is built up from several components such as human-animal interactions (Hosey, 2008) and visitor intensity (Larson et al., 2014; Maia et al., 2012; Quadras et al., 2014; Selling & Ha, 2005). Finding out the extend of the visitor effect on (semi-) captive animals is important and necessary for several reasons e.g. animal welfare (Hosey, 2000). The visitor effect can have effect on the results of any behavioural studies that are done and need to be taken in account to ensure accurate interpretation of the results (Hosey, 2000).The presence of tourist can be a source of stress, enriching or can have no impact at all (Hosey, 2000; Hosey & Melfi, 2015).

There has been a great amount of research done highlighting out the negative impact of visitors on captive animals (Hosey, 2013; Lambeth et al., 2000; Wormell et al., 1996).

For example, when high numbers of visitors were present orang-utan adults were covering their heads with paper bags and their infants clinged to them. (Birke, 2002).

5.5 The Knysna Elephant Park

Located in Plettenberg Bay the Knysna Elephant Park (KEP) is home to 10 semi-captive African elephants (*Loxodonta africana*). In 2009 the African Elephant Research Unit (AERU) was established in the Park. AERU is a nonprofit trust dedicated to study and evaluate the behaviour of semi-captive elephants and their husbandry with a special eye on animal welfare.

The Park offers several „experiences“ for tourists, such as daily tours, elephant walks and until the 28th of February 2018 also elephant rides. In elephants SDBs have not yet been validated as a measure of anxiety. Though AERU has an ongoing project to investigate them. Previous Research from AERU has found that SDBs are most likely performed when the elephants are walking, standing and performing hygienic behaviours (Jim, 2015; Hauff, 2016). To measure SDBs AERU uses an „AERU Ethogram“ (updated in 2015). It was developed to observe the behaviour in captive Elephants and was used to define and observe SDBs. Predominantly performed SDBs are trunk movements. By separating different SDB movements performances of „trunk to body“ (Figure 3) behaviours are significantly increased during walks and „trunk to mouth“ (Figure 4) behaviours are significantly increased in rides (Hauff, 2016). A further category of SDBs were the „trunk to trunk“ bahviours (Figure 5). The „trunk to mouth“ behaviour Hauff talks of is build up by two SDBs. The „trunk to mouth“ movement and the „trunk suck“ movement. AERU researchers believe that the „trunk suck“ movement is performed to cope with stressful stimuli and can be compared to an infant using a pacifier. For the „trunk to mouth“ they believe that next to the functional purpose is a self-directed behaviour which could indicate anxiety and uncertainty.

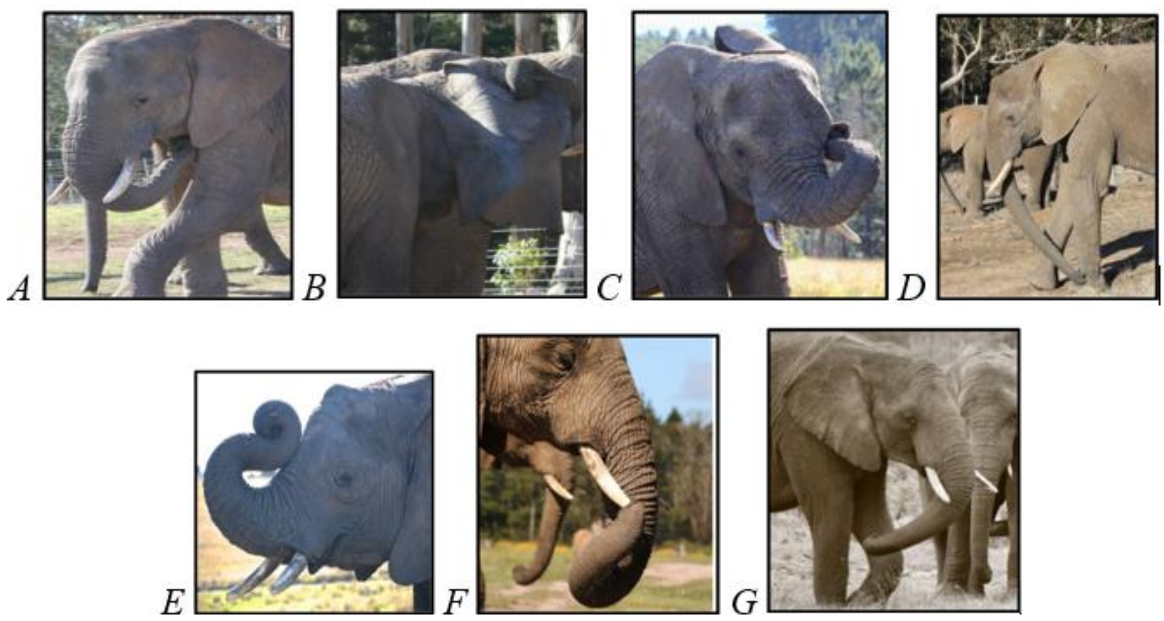

Figure 3: *Trunk to body behaviours: A. Trunk-to-body, B. Trunk-to-ear, C. Trunk-to-eye, D. Trunk-to-foot, E. Trunk-to-head, F. Trunk-tusk, G. Trunk-to-leg (no picture for Trunk-to-temporal gland).*

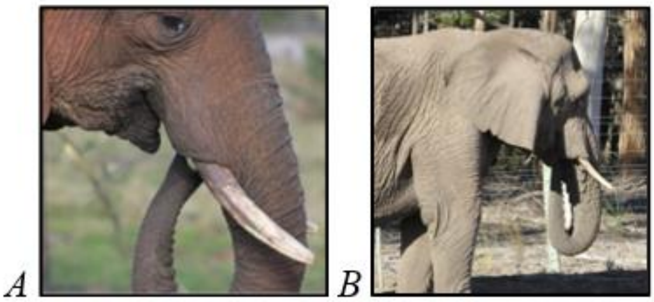

Figure 4: *Trunk to mouth behaviours: A. Trunk-to-mouth, B: Trunk-suck.*

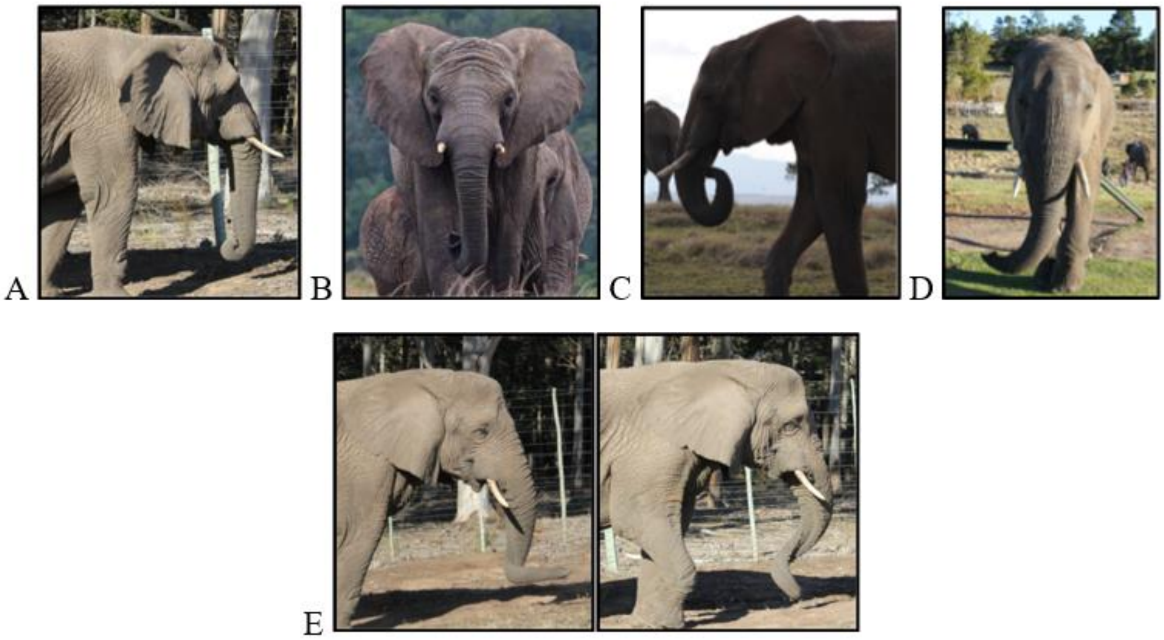

Figure 5: *Trunk to trunk behaviours: A. Trunk-curl, B. Trunk-outcurl, C. Trunk-to-trunk, D. Trunk-swing, E. Trunk-twist.*

At KEP during elephant rides a guide and up to two tourists used to sit on the back of the animal. No saddle or chair was used. Just a blanket for the comfort of the elephant and riders. The duration of the rides varied between 25-40 minutes and lead around variable tracks through the Park (Figure 6). During elephant walks a guide and up to two tourists walk beside the animal. The duration and the track can be varying as it used to be in rides.

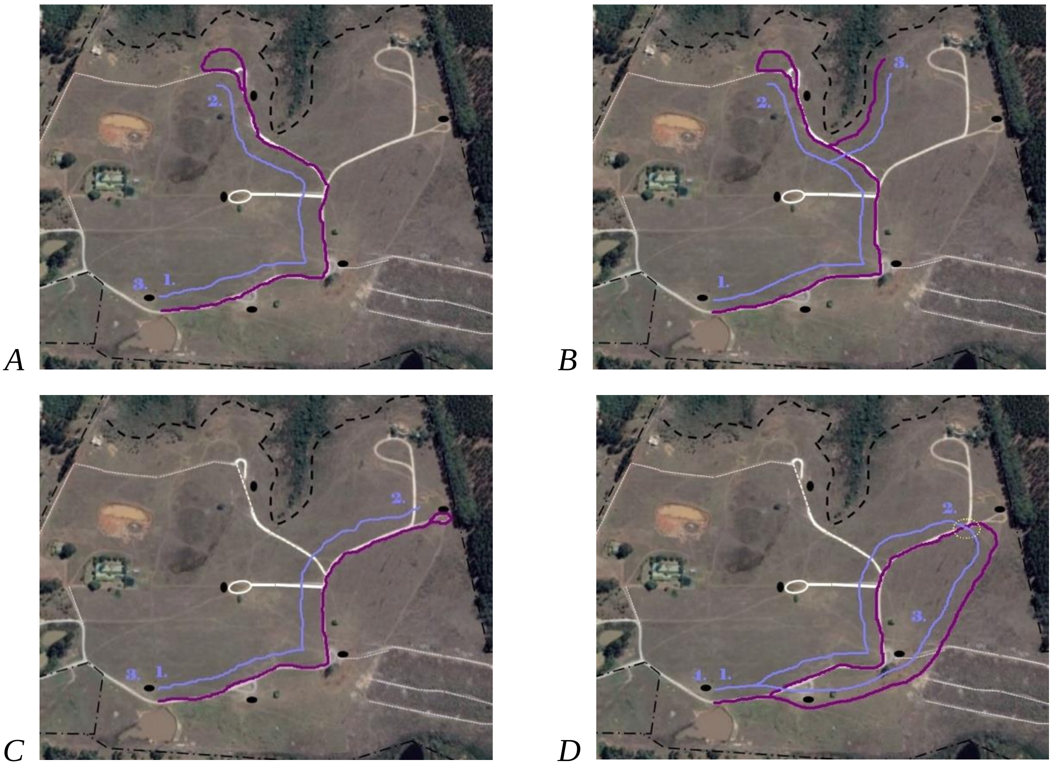

Figure 6: *Walking/Riding routes. A: Old Boma, B: picnic route; C: viewpoint route; D: Clockwise/ anticlockwise route (1: start, 2: turn, 3: end; D:3,4: both possible ending points); purple line: route walked by the elephants, blue line: route walked by the researcher (Padfield. 2018. personal communication).*

During the time of the rides and walks the elephants have no control over the proximity to tourists. Kohlhass et al. (2011) concluded that situations of extended periods of time that lack self-control and involve bearing weight might be stressful due to the uncontrollable element of stress.

When an animal is stressed it stimulates the secretion of hormones such as cortisol and glucocorticoid (Club & Mason, 2002).

Previous research has found out that African elephants have higher FGM (faecal glucocorticoid metabolites) levels after human interaction, which included elephant back safaris (Millspaugh et al., 2007; Zander 2014). These elephants were probably trained with negative reinforcement methods based on fear which are predominantly used to train Asian elephants. This involves breaking the will of the animal which is often seen in (social-) media. Here stress is most likely the result to a command.

The elephants at KEP are trained using positive reinforcement techniques and they are used to being exposed to humans and the close proximity and contact from a very early age on. Doing elephant rides does not involve breaking the will of the animal to make it ridable.

A project conducted from Evans (2017) analyzed „Salivary Cortisol levels and Self-Directed Behaviours in African Elephants (*Loxodonta africana*)“. It showed no simple or obvious relationship between salivary cortisol concentration and SDB rate per minute. Furthermore Evans writes that there where two peaks in SDB rate during the day were apparent, during the times of rides and walks in both the morning and afternoon, a similar response in cortisol concentration was not found. She assumes that it can be a result of the short duration of walks and rides.

These results show that there is no link yet been found between SDBs and stress hormones and that further studies are needed to figure out what self-directed behaviours do mean and how we can interpret them.

5.6 Aims of the study

As the Knysna Elephant Park stopped the elephant rides from the 1st of March 2018 more detailed studies comparing SDBs in rides and walks could be done. With this study the aim is to 1) proof that the number of SDBs performed is significantly higher in elephant rides compared to elephant walks. As the studies from Jim (2015) show an increased amount of SDBs during rides it can lead to the conclusion that the amount of SDBs should decrease with the stop of the rides. A possible decrease of SDBs can show that the elephants enjoy not needing to do rides anymore.

With the stop of the elephant rides KEP introduces a possible third elephant walk per day which is happening an hour before the evening walk. The data on elephant walks collected will 2) be analysed how the increase of walks effects the number of SDBs performed in the elephants. A possible increase in SDBs can be related to the increased amount of activities an elephant has to do over the day and can lead to the assumption that the elephants does not agree being in close control over an increased amount of time.

6 Materials and Methods

6.1 Research animals and Location

The study was done in collaboration with the African Elephant Research Unit (AERU) at Knysna Elephant Park.

The matriarchal herd of ten African elephants (*Loxodonta africana*) is build up by eight females and two young males (Table 2).

In this research five of the elephants which were initially also used for the elephant rides were involved. The matriarch of the herd Sally, two young females, Keisha and Thato, and two young males Shungu and Mashudu.

Table 2: *Short history about each elephant involved in the study.*

	Keisha	**Mashudu**	**Sally**	**Shungu**	**Thato**
Birth	December 2003	July 2007	October 1989	January 2007	February 2008
Origin	mother died and new mother didn't accept	from a hunting farm in the North West Province	saved from culling in Kruger National Park	born in park	from a hunting farm in the North West Province
in KEP since	January 2004	May 2008	October 1994	since birth	May 2008

The other five elephants were not used in this study because they were not used for elephant rides. Three of the elephants, Shanti, Amari and Madiwa, just arrived in May 2017 to the park and are still being integrated into the herd. The other two elephants not used, Nandi and Thandi, are mother and daughter. When Nandi arrived at the park in 2002, she was pregnant and therefore not trained on rides. Thandi later refused being ridden and was not used.

6.2 Field research

The onsite research was carried out from the 4th of June to the 13th of August 2018.
Data from the months February to May were observed by AERU staff and contributed to the project. The Knysna Elephant Park offers several „experiences“ for tourists visiting the Park. Until the 28th of February 2018 elephant rides and walks were a part of this. Since the 1st of March 2018 elephant rides were stopped and only elephant walks are offered to tourists.
The rides and walks until March took place twice a day in the morning and in the evening. After the 1st of March 2018, up to three elephant walks can take place. In the morning starting at 07.30 am and in the afternoon starting at 03.30 pm and/or in the evening starting at 04.30 pm. The duration of each walk can vary between 25 and about 40 minutes leading on a variable track around the park (Figure 6).
Which elephant was used for a walk was decided by the guides working with the elephants. Also, there were tourist depending changes in the number of persons in the field and walks/ days without bookings for walks. When there were no tourist bookings for a ride or walk there was no recording happening. Due to lack of bookings there were also further changes in the amount of walks an elephant did per day.
During the elephant rides a guide was sitting together with a tourist on the back of the elephant. During the walk the tourist stands together with a guide besides the elephant.
During the time of the walk or ride the observer walked about 10 -15 meters parallel to the elephant that had been observed at that time. The SDBs were recorded via voice memo on a phone. The recorded data was then transcribed later.
The recording and with that the elephant ride or walk started when the guide and elephant received their tourist. First thing that will be recorded is the date, the time, the name of the observer, the observed elephants name and the number of tourists in the field and the number of tourists with the observed elephant. After that every SDB performed by the focal elephant was recorded.
When the elephant was not visible (entire trunk) or it could not be clearly said what was performed "OOS" (Out of Sight) was used. The time an elephant was OOS was excluded from the statistical analysis for this study. Also, in potentially unsafe situations or when it was necessary to look where to step. When the elephant was in sight again dictate "in sight". Invalid recording can happen due to long time OOS (over half of the time), walker changing the elephant permanently or when an unsafe situation made it necessary for the observer to

return to the supervisor (guide) at the back of the ride. Also, when there was no tourist with the focal elephant the recording was invalid.

The end of the walk was when the elephant dropped off its tourist.

When there was an afternoon or evening ride or walk recorded it was also taken into consideration how many rides or walks that elephant had done that day already.

Therefore further data, such as KEP sales records and photos from the onsite photographer were used.

During February, the month of rides, there was data to three morning and three evening rides from each elephant collected. In March and April together there was data collected from two morning, two afternoon and two evening walks collected from each elephant. In May data from 9 morning walks, 5 afternoon and 7 evening walks were recorded. In June there was data for 8 morning, 8 afternoon and 6 evening walks recorded (24 in total), in July for a total of 27 morning, 26 afternoon, 27 evening walks (80 in total) were recorded and in August for 2 morning data was collected. In total there were 30 rides and 157 walks recorded from each elephant.

To increase the amount of ride data previous research data using the same observation method from 2015 (Jim, 2015) and 2016 (Hauff, 2016) were used. With their data a total of 109 rides were recorded and used for statistical analysis.

6.3 SDB measuring

The SDBs are measured using the AERU Ethogram (updated in 2015). Here are General behaviors and SDBs listed and described. Before recording the SDBs during a walk every observer was trained on SDBs in the field and was tested in an on-site reliability test. To pass the test it was needed to reach a minimum of 80% concordance with a trained researcher.

Important is that movements can also be related to commands by the guide working with the elephant. These behaviours are not recorded as SDBs.

6.4 Statistical analysis

The collected SDBs were then added up to a total sum during one experience. Due to differences in the duration of each ride or walk the data war standardised (behaviours/min). This was made excluding the time the elephant was OOS. In order to compare the data to previous research results three more categories from that were used. “Trunk to mouth”, “Trunk to body” and “Trunk to trunk”. Also, here the data was standardised to make the results comparable.

For statistical analysis the software program “R” was used. Welch’s unequal variances t-test was used to compare elephant rides and walks with $P < 0.05$ being considered as significant. ANOVA with post-hoc Tukey HSD test was done to analysis the differences between the three elephant walks.

7 Results

To analyse how the SDBs develop after rides where stopped at the 1st of March 2018 mean values of the total SDBs/min of each elephant in rides and walks were compared individually and as group of 5 (Figure 7). To analyse if the mean values reflected a significant change "Welch's unequal variances t-test" with all elephants as a group and each elephant individually were done. When testing the five elephants as a group no significant differences were found. However, the mean values of each elephant individually showed differences (Table 3). These showed that Keisha had significantly lower average SDBs/min in elephant walks and Shungu in comparison showed significant higher SDBs/min in elephant walks. In case of Thato we can observe a tendency to lower SDBs/min in elephant rides but they were not significant. Mashudu and Sally did not show any significant changes in the amount of SDBs/min in elephant rides and walks.

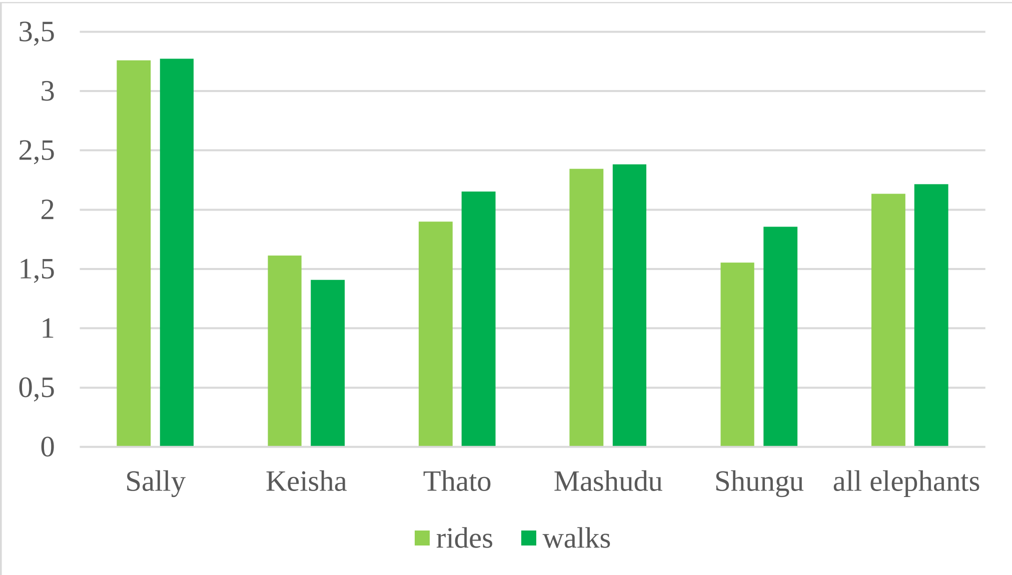

Figure 7: *Comparison of the mean values of elephant rides and walks.*

Table 3: *Results of „Welch's unequal variances t-test" on number of SDBs/min.*

SBDs/min	**Keisha**		**Mashudu**		**Sally**		**Shungu**		**Thato**	
	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk
mean	1.97	1.41	2.36	2.38	3.33	3.27	1.17	1.86	1.59	2.15
t	2.73		-0.06		0.22		-2.40		-1.70	
df	30.41		43.16		51.11		48.43		44.82	
p	0.01		0.96		0.83		0.02		0.10	

Also it was analysed how the mean values in the categories A: “trunk to mouth SDBs/min”, B: “trunk to body SDBs/min” and C: “trunk to trunk SDBs/min” showed an effect in each elephant (Figure 8). To analyse if the results were significantly different in elephant rides and walks “Welch’s unequal variances t-test” was used. In category “A” Keisha and Sally showed significantly lower trunk to mouth SDBs/min in elephant walks. Mashudu, Shungu and Thato did not show any significant changes (Table 4).

Table 4: *Results of „Welch’s unequal variances t-test“ on „trunk to mouth“ SDBs/min.*

trunk to mouth SBDs/min	**Keisha**		**Mashudu**		**Sally**		**Shungu**		**Thato**	
	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk
mean	0.18	0.11	0.25	0.31	0.53	0.33	0.32	0.35	0.34	0.41
t	2.26		-0.71		2.76		-0.32		-0.67	
df	35.42		50.48		56.87		47.58		49.99	
p	0.03		0.48		0.01		0.75		0.51	

In the category “B” Sally and Thato showed significantly lower trunk to body SDBs/min in elephant rides. Keisha showed a tendency to lower trunk to body SDBs/min in elephant walks and Shungu a tendency to lower trunk to body SDBs/min in elephant rides but both results were not significant. Mashudu also here showed no significant differences (Table 5).

Table 5: *Results of „Welch’s unequal variances t-test“ on „trunk to body SDBs/min“.*

trunk to body SBDs/min	**Keisha**		**Mashudu**		**Sally**		**Shungu**		**Thato**	
	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk
mean	0.38	0.25	0.98	0.95	0.42	0.62	0.48	0.80	0.36	0.64
t	1.73		0.10		-2.21		-1.86		-2.08	
df	27.15		40.57		57.54		46.77		49.94	
p	0.09		0.92		0.03		0.07		0.04	

In the third category „C“ Shungu showed significant lower trunk to trunk SDBs/min in elephant rides. Keisha showed a tendency to lower trunk to trunk SDBs/min in elephant walks but the difference was not significant. Mashudu, Sally and Thato did not show any significant differences in elephant rides and -walks (Table 6).

Table 6: *Results of „Welch's unequal variances t-test" on „trunk to trunk SDBs/min".*

trunk to trunk SBDs/min	Keisha		Mashudu		Sally		Shungu		Thato	
	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk	Ride	Walk
mean	1.40	1.05	1.55	1.40	2.31	2.25	0.36	0.69	0.82	1.07
t	1.90		0.59		0.28		-3.52		-1.36	
df	29.05		40.37		39.63		46.24		49.80	
p	0.07		0.56		0.78		0.001		0.18	

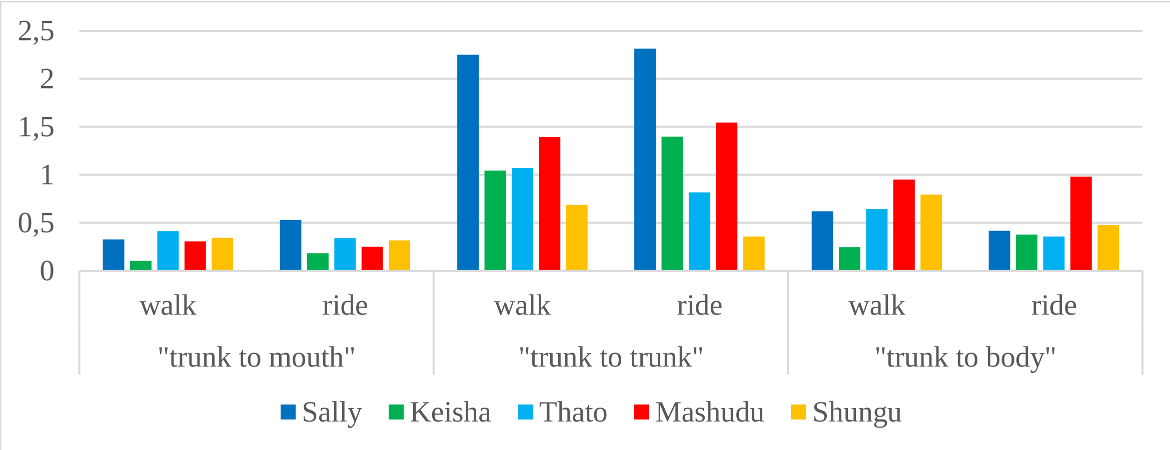

Figure 8: *Comparison of the mean values of elephant walks and rides mean values categorised in "trunk to mouth", "trunk to trunk" and "trunk to body".*

With the stop of elephant rides the amount of elephant walks was increased from possible two to possible three walks per day. This study is also used to analyse if a difference because of this can be observed in the amount of SDBs/min performed. Therefore the mean values of the total SDBs/min in the AM, PM1 and PM2 walks were compared (Figure 9). It can be seen that all elephants show the same pattern. The highest SDB rate is performed in the early afternoon walk (PM1) which is the additional, newly introduced walk. Also in all five elephants it can be seen that the lowest rate of SDBs/min is performed in the morning walk (AM). To test the mean values for significance and to see if there was a difference in the three groups ANOVA was used and to further analyse where the difference is a post hoc Tukey test was used. When all five elephants are compared as group it can be said that there is a significant difference between the first and second walk of the day. Analysing all five elephants individually only Keisha showed a significant increase in SDBs from the morning walk (AM) to the first afternoon walk (PM1) (Table 7).

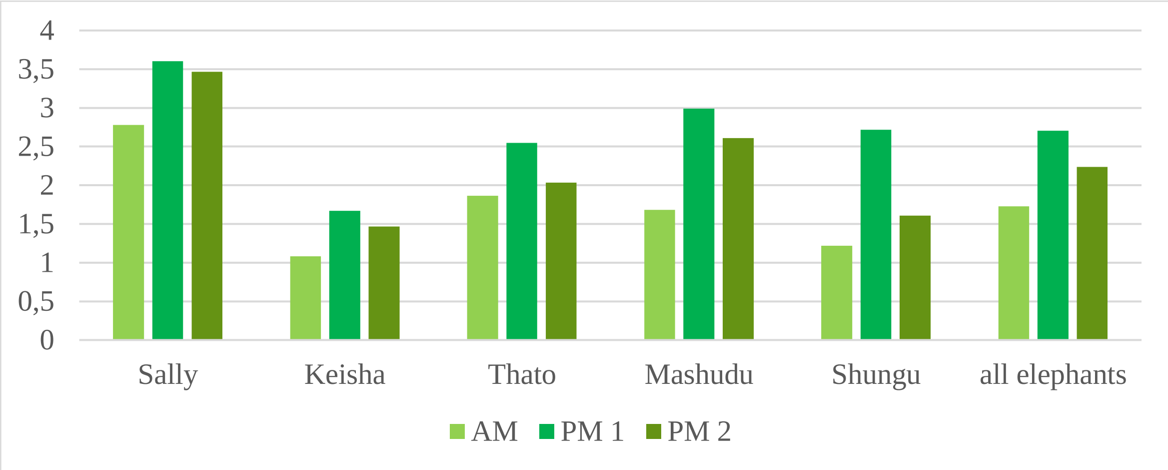

Figure 9: *Mean value of SDBs/min in AM, PM1 and PM2 elephant walk.*

Table 7: *One-way ANOVA and Post-hoc Tukey HSD test analysis in SDBs/min. The different letters mark the significant differences ("a", "b", "ab").*

SBDs/min	All elephants	Keisha	Mashudu	Sally	Shungu	Thato
first	1.95±1.12 a	1.18±0.46 a	1.70±0.82	3.11±1.00	1.59±1.04	1.98±1.11
second	2.57±1.35 b	1.74±0.47 b	2.96±1.72	3.46±1.16	2.31±1.20	2.46±1.45
third	2.41±1.65 ab	1.31±0.50 ab	3.03±2.46	3.40±1.08	1.05±0.31	2.29±1.79
ANOVA	Df=2,16 F=3.92 p=0.02	Df=2,27 F=4.41 p=0.02	Df=2,29 F=2.88 p=0.07	Df=2,31 F=0.42 p=0.66	Df=2,29 F=2.50 p=0.10	Df=2,29 F=0.44 p=0.65
Post-hoc Tukey HSD test	1^{st} vs 2^{nd} t=2.70 p=0.02	1^{st} vs 2^{nd} t=2.93 p=0.02	1^{st} vs 2^{nd} t=2.15 p=0.1			

Also, here it was analysed how the mean values in the categories A: "trunk to mouth SDBs /min", B: "trunk to body SDBs/min" and C: "trunk to trunk SDBs/min" showed an effect in each elephant.

In category A the results of the ANOVA test showed a significant difference in trunk to mouth SDBs/min. The Post-hoc Tukey HSD test then showed that there is a significant increase from the morning (AM) to the first afternoon (PM1) walk. When analysing each elephant individually we can see that only Mashudu shows a tendency to an increased amount of SDBs/min from the AM walk to the PM1 walk but the result was not significant (Table 8).

Table 8: *One-way ANOVA and Post-hoc Tukey HSD test analysis in "trunk mouth" SDBs/min. The different letters mark the significant differences ("a", "b", "ab").*

trunk to mouth SBDs/min	**All elephants**	**Keisha**	**Mashudu**	**Sally**	**Shungu**	**Thato**
first	0.23±0.26 a	0.10±0.13	0.17±0.16	0.30±0.25	0.26±0.20	0.30±0.38
second	0.41±0.46 b	0.10±0.06	0.48±0.49	0.39±0.41	0.49±0.41	0.61±0.69
third	0.27±0.26 ab	0.13±0.11	0.30±0.21	0.30±0.29	0.09±0.05	0.49±0.39
ANOVA	Df=2,13 F=4.63 p=0.01	Df=2,27 F=0.14 p=0.87	Df=2,29 F=2.92 p=0.07	Df=2,31 F=0.33 p=0.72	Df=2,29 F=3.27 p=0.05	Df=2,29 F=1.26 p=0.3
Post-hoc Tukey HSD test	1^{st} vs 2^{nd} t= 2.997 p=0.01		1^{st} vs 2^{nd} t=2.42 p=0.055			

In category B the results of the ANOVA test also showed a significant difference in trunk to body SDBs/min. The Post-hoc Tukey HSD test then showed that there is a significant increase from the AM to the PM1 walk. When analysing each elephant, we can see that only Mashudu shows not a significant difference but a tendency to an increased amount of trunk to body SDBs/min from the PM1 walk to the PM2 walk (Table 9).

Table 9: *One-way ANOVA and Post-hoc Tukey HSD test analysis in "trunk to body" SDBs/min. The different letters mark the significant differences ("a", "b", "ab").*

trunk to body SBDs/min	All elephants	Keisha	Mashudu	Sally	Shungu	Thato
first	0.51±0.47 a	0.24±0.15	0.49±0.49	0.63±0.40	0.70±0.65	0.48±0.43
second	0.80±0.73 b	0.28±0.18	1.20±1.07	0.68±0.52	0.98±0.69	0.77±0.54
third	0.79±1.12 ab	0.19±0.17	1.74±2.02	0.51±0.35	0.41±0.03	1.14±1.14
ANOVA	Df=2,16 F= 3.47 p=0.03	Df=2,27 F=0.57 p=0.57	Df=2,29 F=3.2 p=0.06	Df=2,31 F=0.33 p=0.72	Df=2,29 F=1.28 p=0.29	Df=2,29 F=2.46 p=0.10
Post-hoc Tukey HSD test	1^{st} vs 2^{nd} t= 2.42 p=0.04		1^{st} vs 3^{rd} t=2.30 p=0.07			

In category C the results of the ANOVA test only showed no significant differences in trunk to trunk SDBs/min in all five elephants as a group. When analysing each elephant individually we can see that only Keisha shows a tendency a significant difference in trunk to trunk SDBs/min in the ANOVA test and the then used Post-hoc Tukey HSD test showed a significantly increased amount of SDBs/min from the AM walk to the PM1 walk (Table 10).

Table 10: *"ANOVA" and "Post-hoc Tukey HSD test" analysis in "trunk to trunk" SDBs/min. The different letters mark the significant differences ("a", "b", "ab").*

trunk to trunk SBDs/min	All elephants	Keisha	Mashudu	Sally	Shungu	Thato
first	1.19±0.80	0.83±0.30 a	1.10±0.56	2.10±0.57	0.62±0.30	1.17±1.00
second	1.43±0.82	1.35±0.44 b	1.76±0.98	2.34±0.69	0.80±0.40	1.05±0.45
third	1.40±0.99	0.99±0.44 ab	1.41±1.15	2.48±0.65	0.53±0.32	0.66±0.31
ANOVA	Df=2,16 F=1.50 p=0.23	Df=2,27 F=5.91 p=0.01	Df=2,29 F=2.12 p=0.14	Df=2,31 F=1.06 p= 0.36	Df=2,29 F=1.28 p=0.30	Df=2,29 F=0.65 p=0.53
Post-hoc Tukey HSD test		1st vs 2nd t=3.42 p=0.01				

Furthermore, it was analysed how the amount of previously done walks made a difference in SDBs/min performed. When analysing all five elephants as group with ANOVA it can be see a significant increase in SDBs/min (Figure 10). Post-hoc Tukey HSD test then showed that the there was a significant increase in the amount of one walk performed before. Analysing each elephant individually we can see the same significant increase in SDBs/min in Keisha. Mashudu shows a tendency of significantly increased amount of SDBs/min between the first and second walk of a day (Table 11).

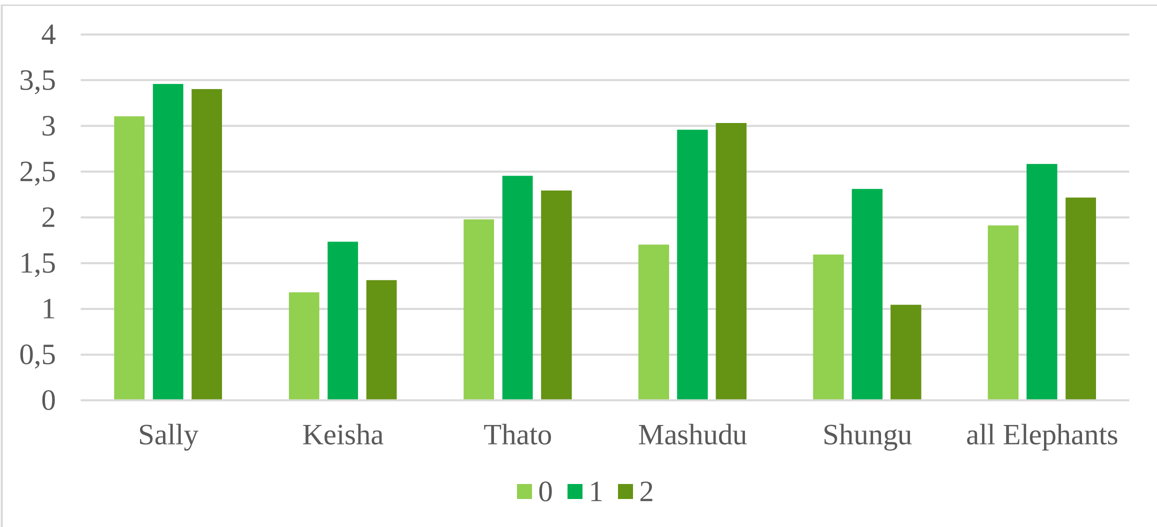

Figure 10: *Mean values of 0, 1 or 2 elephant walks prior.*

Table 11: *Effect of the number of elephant walks/ day in SDBs/min, the different letters mark the significant differences ("a", "b", "ab").*

SBDs/min	All elephants	Keisha	Mashudu	Sally	Shungu	Thato
first	1.95±1.12 a	1.18±0.46 a	1.70±0.82	3.11±1.00	1.59±1.04	1.98±1.11
second	2.57±1.35 b	1.74±0.47 b	2.96±1.72	3.46±1.16	2.31±1.20	2.46±1.45
third	2.41±1.65 ab	1.31±0.50 ab	3.03±2.46	3.40±1.08	1.05±0.31	2.29±1.79
ANOVA	Df=2,16 F=3.92 p=0.02	Df=2,27 F=4.41 p=0.02	Df=2,29 F=2.86 p=0.07	Df=2,31 F=0.42 p=0.66	Df=2,29 F=2.50 p=0.10	Df=2,29 F=0.44 p=0.65
Post-hoc Tukey HSD test	1^{st} vs 2^{nd} t=2.71 p=0.02	1^{st} vs 2^{nd} t=2.92 p=0.02	1^{st} vs 2^{nd} t=2.15 p=0.10			

Then it was analysed how the mean values in the categories A: "trunk to mouth/min", B: "trunk to body/min" and C: "trunk to trunk/min" showed an effect in each elephant.
In category „A“ it can be seen a significant increase in the amount of trunk to mouth SDBs/min with one previous walk on a day. Analysing each individual elephant it can only in Mashudu not a significant increase but a tendency can be seen (Table 12).

Table 12: *Effect of the number of elephant walks/ day in "Trunk to mouth" SDBs/min, the different letters mark the significant differences ("a", "b", "ab").*

trunk to mouth SBDs/min	All elephants	Keisha	Mashudu	Sally	Shungu	Thato
first	0.23±0.26 a	0.10±0.13	0.17±0.16	0.30±0.25	0.26±0.20	0.30±0.38
second	0.41±0.46 b	0.10±0.06	0.48±0.49	0.39±0.41	0.49±0.41	0.61±0.69
third	0.27±0.26 ab	0.13±0.11	0.30±0.21	0.30±0.29	0.09±0.05	0.49±0.39
ANOVA	Df=2,157 F=4.63 p=0.01	Df=2,27 F=0.14 p=0.87	Df=2,29 F=2.92 p=0.07	Df=2,31 F=0.33 p=0.72	Df=2,29 F=3.27 p=0.05	Df=2,29 F=1.26 p=0.30
Post-hoc Tukey HSD test	1^{st} vs 2^{nd} t= 2.997 p=0.009		1^{st} vs 2^{nd} t=2.42 p=0.055			

In category „B“ when all elephants are analysed as a group it can also be observed that there was a significant increase in the amount of trunk to body SDBs/min when there was one walk prior. When analysing each individual elephant Mashudu shows not a significant increase but a tendency in the amount of trunk to body SDBs/min between the first and third walk during the day (Table 13).

Table 13: *Effect of the number of elephant walks/ day in "Trunk to body" SDBs/min, the different letters mark the significant differences ("a", "b", "ab").*

trunk to body SBDs/min	**All elephants**	**Keisha**	**Mashudu**	**Sally**	**Shungu**	**Thato**
first	0.51±0.47 a	0.24±0.15	0.49±0.49	0.63±0.40	0.70±0.65	0.48±0.43
second	0.80±0.73 b	0.28±0.18	1.20±1.07	0.68±0.52	0.98±0.69	0.77±0.54
third	0.79±1.12 ab	0.19±0.17	1.74±2.02	0.51±0.35	0.41±0.03	1.14±1.14
ANOVA	Df=2,157 F= 3.48 p=0.03	Df=2,27 F=0.57 p=0.57	Df=2,29 F=3.2 p=0.06	Df=2,31 F=0.33 p=0.72	Df=2,29 F=1.28 p=0.29	Df=2,29 F=2.46 p=0.10
Post-hoc Tukey HSD test	1st vs 2nd t= 2.42 p=0.04		1st vs 3rd t=2.30 p=0.07			

In the category „C“ there was no significant difference in trunk to trunk SDBs/min when analysing all five elephants as a group. When analysing each elephant individually it can be seen that Keisha shows a significant increase in trunk to trunk SDBs/min performed from the first to the second walk on a day (Table 14).

Table 14: *Effect of the number of elephant walks/ day in "Trunk to trunk" SDBs/min, the different letters mark the significant differences ("a", "b", "ab").*

trunk to trunk SBDs/min	All elephants	Keisha	Mashudu	Sally	Shungu	Thato
first	1.19±0.80	0.83±0.30 a	1.10±0.56	2.10±0.57	0.62±0.30	1.17±1.00
second	1.43±0.82	1.35±0.44 b	1.76±0.98	2.34±0.69	0.80±0.40	1.05±0.45
third	1.40±0.99	0.99±0.44 ab	1.41±1.15	2.48±0.65	0.53±0.32	0.66±0.31
ANOVA	Df=2,16 F=1.50 p=0.23	Df=2,27 F=5.91 p=0.01	Df=2,29 F=2.12 p=0.14	Df=2,31 F=1.06 p= 0.36	Df=2,29 F=1.28 p=0.30	Df=2,29 F=0.65 p=0.53
Post-hoc Tukey HSD test		1^{st} vs 2^{nd} t=3.42 p=0.01				

8 Discussion

By using the opportunity of the stopping of the elephant rides at the Knysna Elephant Park AERU gained information about the effect of elephant rides and walks and how the stopping of the elephant rides changed the amount of self-directed behaviours of five elephants of the matriarchal herd in the park.

Due to current lack of validated knowledge about the means of SDBs and how much they reflect stress and anxiety in elephants this study cannot give a profund answere on the effect on the welfare of the animals but can be compared with past studies and literature to get an idea what the changing of the number of SDBs performed could mean in the elephants.

8.1 Proofing that the amount of SDBs performed are significantly higher in elephant rides compared to elephant walks

As the studies of Jim (2015) showed an increased amount of SDBs during elephant rides it was expected to see a significant decrease in the SDBs once the elephant rides were stopped. Analysing the five elephants as a group this effect cannot be seen. The amount of SDBs performed during elephant rides and walks did not change significantly after the 1st of March 2018.

When each elephant was analysed individually it was observed that only one elephant, Keisha, showed a significant decrease in the number of SDBs performed during the elephant walks and in comparison Shungu showed a significant increase in SDBs/min in elephant walks. During the elephant walks and rides Sally, the matriarch of herd, used to walk in the back behind all the other elephants. Since June she was moved in the middle and is now walking in front of Keisha. Shungu is first line, Thato second and Sally third. In the hierarchy of the herd Shungu and Keisha are on the bottom. Sally as the matriarch now walking in front of Keisha could give her the safety that she can see what the matriarch is doing. Shungu was always first in line and now not walking at the other end but closer to Sally could be more stressed and therefore showing a significant increase in the rate of SDBs. Thato could also be related to this. She is ranked higher in the herd but walking now directly in front of the matriarch of the herd can also explain why she shows not significantly increased SDBs/min but an increased tendency.

The number to „trunk to mouth“ SDBs significantly decreased during elephant walks in the two elephants Sally and Keisha. This is the expected behavioural change in accordance to the studies of Hauff (2016) that when stopping the elephant rides the amount of „trunk to mouth“ SDBs should decrease during elephant walks.

8.2 Measuring the effect the increased number of elephant walks per day has in the elephant by analysing amount of SDBs performed

With the stop of the elephant rides at the Knysna Elephant Park there was one additional walk in the afternoon introduced. This additional walk takes place an hour earlier (referred to as PM1) than the original afternoon walk (PM2). When comparing the amount of SDBs/min in the morning (AM), afternoon (PM1) and evening (PM 2) walk it can be seen that all elephants analysed as group showed significantly increased amount of SDBs/min in the afternoon walk compared to the morning walk. It can also be seen that all elephants individually show the highest amount of SDBs/min in the PM1 walk. This could be explained with the reduced time the elephants have to free roam and graze during the day by an hour. In the wild elephants can spend up to 16 hours a day grazing. Also during the time of the elephant rides and walks the elephants have no control over how close the tourists are to them. As Kohlhass et al. (2011) concluded that situations of extended periods of time that lack self-control might be stressful due to the uncontrollable element of stress.

Furthermore it can be seen that all elephants show the lowest rate of SDBs/min in the morning walk. This can also be explained with the fact that the elephants spend the night without the proximity of humans and therefore could have a lower stress level in the morning.

The amount of SDBs/min decrease from PM1 to PM2. This could lead to the suspicion that it is also the change of routine that is a potential stressor for the elephants.

When the SDBs were analysed, in the already named categories, for all five elephants as a group it can also be seen that there is a significant increase in SDBs comparing AM and PM1 walk in trunk to body SDBs and trunk to mouth SDBs. Trunk to trunk SDBs are not showing any significant changes.

Shino et al. (1996) describe that SDBs are a coping mechanism in some species to reduce physiological response to stress. When analysing the SDBs in the categories „trunk to body“, „trunk to mouth“ and „trunk to trunk“ there is visible that the category „trunk to trunk“ is never a strong indicator for any change.

In addition a further decrease in the amount of SDBs over time can be seen after the first of May 2018. The first of May is the start of winter season and with that a change in the daily rhythm of the elephants. In summer season the elephant guides start at 06.30 am their work with the elephants in summer season they start at 07.00 am their work. In the evening in winter season the elephants finish their day 30 min earlier then in the summer season. This could be an indicator that in the winter season the elephants enjoy having another extra hour in their night enclosure to feed and spend time not under close control of a guide.

Concluding it can be said that it is less the elephant ride itself being a problem for the animal but the additional number of walks that is causing an increase in SDBs. With the significantly increased number of SDBs during the additional afternoon walk the assumption can be made that the change in the routine of an animal and the decreased amount of time spending on food intake and free roaming can lead to a decreased comfortability.

Under this aspect of suspecting the change of routine being the cause of an increased number of SDBs further studies could be implemented to get an idea about how the SDBs develop over a longer period of time.

9 Abstract

Elephant rides are one of the most often discussed topics under the aspect of animal welfare. As the “Knysna Elephant Park” (KEP) South Africa stopped elephant rides on the 28th of February 2018 the “African Elephant Research Unit” took the chance to analyze the effect of elephant rides and -walks on the animals. Therefore “Self-Directed Behaviours” (SDBs) have been recorded during elephant rides and -walks. SDBs are non-invasive identifiers of increased stress levels that an animal performs on itself without a partner.

The Knysna Elephant Park offered the experience of elephant rides twice daily. And after they stopped them, they offered only elephant walks but with that an increased amount to three per day. The aim of the studies was it to proof that the amount of “Self-Directed Behaviours” during elephant rides are significantly higher than in elephant walks and also to measure the effect the increased number of walks per day has on the elephant.

A total of 109 rides and 105 walks have been recorded for this study over a period of 7 months in 2018 and using elephant ride data from previous studies in 2015 and 2016. Analyzing the data of the entire group revealed that there are major differences in the amount of SDBs in each individual animal during the rides and walks. When analyzing the significance of recorded SDBs per each elephant it can be seen that Keisha is showing significantly lower SDBs during walks, Shungu and Thato have higher SDBs during elephant walks, Mashudu showing no significant difference and Sally showing significantly higher Body SDBs and lower Mouth SDBs in elephant walks.

Comparing the amount of SDBs during the 3 different walks per day it revealed that the additional walk that was introduced on the 1st of March 2018 showed the highest amount of SDBs in all elephants. The same results can be seen when we analyzed if it makes a difference if the elephant did one or two walks prior. Results show that also here the highest amount of SDBs can be seen with one walk prior.

Concluding we can say that it less the elephant ride itself being a problem for the animal but the additional number of walks that is causing an increase in SDBs.

10 Összefoglaló

Az elefántlovaglás az állatvédők által leggyakrabbak vitatott témák egyike. Mikor 2018. február 28-án a dél-afrikai Knysna Elefánt Park (KEP) megszüntette a turisták számára kínált elefántlovaglásokat az Afrikai Elefánt Kutató Egység (African Elephant Research Unit, AERU) megragadta az alkalmat, hogy megvizsgálja, hogyan hatnak az elefántlovaglások és -séták az állatokra. Ennek érdekében az elefántok önmagukra irányuló viselkedéselemeinek (Self-Directed Behaviours, SDB) mennyiségét vizsgálták az elefántlovaglások és -séták során. Ezek olyan viselkedésformák, melyeket az állat egyedül végez, önmagára irányítva, és nem-invazív indikátorai a stresszes állapotnak.

A lehetőség megszüntetéséig a Park napi kettő lovaglást szervezett, onnantól pedig már csak elefánt sétákat, viszont már napi három alkalommal.

Jelen munka célja annak vizsgálata, hogy az SDB-k mennyiségét hogyan befolyásolja az, hogy az állat lovagláson vagy sétán vesz részt, illetve az, hogy napi kettő helyett három foglalkozást tartanak.

2018-ban a hét hónapos vizsgálat alatt összesen 109 lovaglás és 105 séta adatait gyűjtötték össze, emellett a 2015-ben és 2016-ban zajló vizsgálatok lovaglásainak adatait is bevontuk a kutatásba.

A rögzített adatok elemzése megmutatta, hogy minden állat eltérően reagált a lovaglásokra és a sétákra. Keisha szignifikánsan kevesebb SDB-t produkált a séták során mint a lovaglások alatt. Shungu és Thato a lovaglások alatt mutatott kevesebbet, míg Sally a testre irányuló SDB-kből szignifikánsan többet, míg a szájra irányuló SDB-k közül szignifikánsan kevesebbet végzett a séták során. Mashudunál nem találtunk különbséget az SDB-k mennyiségében.

A napi három séta összehasonlítása során azt találtuk, hogy a 2018. március 1-jén bevezetett koradélutáni séta alatt végezték az állatok a legtöbb SDB-t. Mivel nem minden délutáni sétát előzte meg reggeli séta, külön is vizsgáltuk annak hatását, hogy hány sétán vett részt aznap az állat a vizsgált séta előtt. Ez az összehasonlítás is azt mutatta, hogy az állatok napi második sétájuk során végezték a legtöbb SDB-t.

Összefoglalva kijelenthetjük, hogy önmagukban a lovaglások nem jelentenek nagyobb stresszt az állatoknak mint a séták, viszont a bevezetett extra séta negatívan hatott rájuk.

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And last but not least thank you to all the guides who kept us safe in the field at all times.

12 Reference List

Baker KC., 2004: Benefits of positive human interaction for socially-housed chimpanzees. *Anim Welf.* 13(2). pp. 239–45.

Barton Cunningham J., 2002: The stress Management Sourcebook: Everything You Need to Know. 2nd ed. pp 8-9.

Birke L., 2002: Effects of browse, human visitors, and noise on the behaviour of captive orang utants. *Animal Welfare,* 11. pp. 189–202.

Carnaby T., 2017: Beat about the Bush. Mammals. *Proboscides – elephants (Family elephantidae*). pp. 239-273.

Carrasco L., Colell M., Calvo M., Abelló MT., Velasco M., Posada S., 2009: Benefits of training/playing therapy in a group of captive lowland gorillas (*Gorilla gorilla gorilla). Anim*., 18. pp. 9–19.

Clubb R., Mason G., 2002: A review of the welfare of zoo elephants in Europe. Horsham, UK: RSPCA.

Corbett M., 2015: From law to folklore: Work stress and the Yerkes-Dodson Law. *Journal of Managerial Psychology.* 30. pp. 741-752.

Elephants for Africa. Elephant facts. *General facts.* URL: https://www.elephantsforafrica.org/elephant-facts/. Accessed: 20 October 2019.

Elephantvoices. Tradition, use & abuse. 2019. URL: https://www.elephantvoices.org/elephants-in-captivity-7/traditions-use-a-abuse.html. Accessed: 12 October 2019.

Evans M. 2017: Salivary Cortisol Levels and Self-Directed Behaviours in African Elephants (*Loxodonta africana*). Unpublished master‘s thesis. University of Exeter.

Greco, B.J., Meehan, C.H., Hogan, J.H., Leighty, K.A., Mellen, J., Mason, G.H., Mench J.A, 2016: The Days and Nights of Zoo Elephants: Using Epidemiology to Better Understand Stereotypic Behavior of African Elephants (*Loxodonta africana*) and Asian Elephants (*Elephas maximus*) in North American Zoos.

Hart B.L., Hart L.A., Pinter-Wollman N., 2008: Large brains and cognition: where do elephants fit in? *Neurosci. Biobehav*. Rev. 32. pp. 86–98.

Harris M., Sherwin C., Harris S., 2008: The welfare, housing and husbandry of elephants in UK zoos.

Hauff L. 2016: Proximate correlates of captive African elephant (*Loxodonta africana*) self-directed behaviours during tourist interactions. Unpublished master's thesis. University of Exeter.

Hebb, DO., 1949: Temperament in chimpanzees: I. Method of analysis. *J Comp Physiol Psychol*. 42(3). pp.192–206.

Higham, J. P., MacLarnon, A. M., Heistermann, M., Ross, C., Semple, S., 2009: Rates of self-directed behaviour and faecal glucocorticoid levels are not. *Stress,* 12 (6). pp, 526-532.

Hosey, G., 2000: Zoo animals and their human audiences: what is the visitor effect? *Animal Welfare,* 9. pp. 343-357.

Hosey, G., 2008: A preliminary model of the human-animal relationships in the zoo. *Applied Animal Behaviour.* 109. pp. 105–127.

Hosey, G., 2013: Hediger revisited: how do zoo animals see us? *Journal of American Animal Welfare Science,* 16. pp. 338–359.

Hosey G, Melfi V., 2012: Human-animal bonds between zoo professionals and the animals in their care. *Zoo Biol*. 31. pp. 13–26.

Hosey, G., & Melfi, V., 2015: Are we ignoring neutral and negative human-animal relationships? *Zoo Biology*, 34. pp. 1-8.

Jim H.-L. 2015: Is self-directed behaviour in African elephants (*Loxodonta africana*) related to levels of tourist interactions? Unpublished master's thesis. University of Exeter.

Koolhaas, J. M., Bartolomucci, A., Buwalda, B. D., De Boer, S. F., Flügge, G., Korte, S. M., 2011: Stress revisited: a critical evaluation of the stress concept. *Neuroscience & Biobehavioral Reviews*, 35 (5). pp. 1291-1301.

Lambeth, S. P., Perlman, J. E., Schapiro, S. J., 2000: Positive reinforcement training paired with videotape exposure decreased training time investment for a complicated task in female chimpanzees. *American Journal of Primatology*, 5. pp. 79–80.

Larson, M. J., Sherwen, S. L., Rault, J. L., 2014: Number of nearby visitors and noise level affect in captive koalas. *Applied Animal Behaviour Science*, 154. pp. 76–82.

Lee PC, Moss CJ., 2014: Wild female African elephants (*Loxodonta africana*) exhibit personality traits of leadership and social integration. *J Comp Psychol*, 126(3). pp. 224–32.

Lehnhardt J, Galloway M., 2008: Carrots and sticks, people and elephants: rank, domination, and training. In: Wemmer CM, Christen CA, (eds). Elephants and Ethics: Toward a Morality of Coexistence. Baltimore, MD: Johns Hopkins University Press. pp. 167–82.

Lewis M, Kim SJ., 2009: The pathophysiology of restricted repetitive behavior.*J Neurodev Disord*., 1(2). pp. 114–132.

Maestripieri, D., Schino, G., Aureli, F., Troisi, A., 1992: A modest proposal: displacement activities as an indicator of emotions in primates. *Animal Behaviour*, 44. pp. 967-979.

Maia, C. M., Volpato, G. L., Santos, E. F., 2012: A case study: the effect of visitors on two captive pumas with respect to the time of day. *Journal of Applied Animal Welfare Science*, 15(3). pp. 222–235.

Mason, G. J., Latham, N. R., 2004: Can't stop, won't stop: is stereotypy a reliable animal welfare indicator? *Animal Welfare*, 13. pp. 57–69.

Mellor DJ., 2016: Updating Animal Welfare Thinking: Moving beyond the "Five Freedoms" towards "A Life Worth Living". *Animals (Basel).;*6(3):21.

Millspaugh, J. J., Burke, T., Dyk, G. V., Slotow, R., Washburn, B. E., Woods, R. J., 2007: Stress Response of Working African Elephants to Transportation and Safari Adventures. *Journal of Wildlife Management*, 71 (4). pp. 1257-1260.

Mott, M., 2008: Wild Elephants Live Longer Than Their Zoo Counterparts. URL: https://www.nationalgeographic.com/news/2008/12/wild-elephants-live-longer-than-their-zoo-counterparts/. Accessed: 20 October 2019.

OIE: A new definition for the Terrestrial Animal Health Code: „animal welfare“. URL: https://www.oie.int/doc/ged/D5517.PDF. Accessed: 20 October 2019.

Payne E, Boot M, Starling M, Henshall C, McLean A, Bennett P, et al., 2015: Evidence of horsemanship and dogmanship and their application in veterinary contexts. *Vet J*, 204. pp. 247–54.

Quadras, S., Goulart, V. D. L., Passos, L., Vecci, M. A. M., Young, R. J., 2014: Zoo visitor effect on mammal behaviour: does noise matter? *Applied Animal Behaviour Science*, 156. pp. 78–84.

Rossman, Z.T., Padfield, C., Young, D., Hart, L.A., 2017: Elephant-Initiated Interactions with Humans: Individual Differences and Specific Preferences in Captive African Elephants (*Loxodonta africana*). *Front. Vet. Sci.,* 4:60

Russow LM., 2002: Ethical implications of the human-animal bond in the laboratory. *ILAR J,* 43(1). pp. 33–7.

Schino, G., Perretta, G., Taglioni, A. M., Monaco, V., Troisi, A., 1996: Primate displacement activities as an ethopharmacological model of anxiety. *Anxiety*, 2(4). pp. 186-191.

Shoshani J.: Elephant. URL: https://www.britannica.com/animal/elephant-mammal. Accessed 19 October 2019.

Svartberg K., 2002: Shyness-boldness predicts performance in working dogs. *Appl Anim Behav Sci,* 79. pp. 157–74.

Swaisgood, R. R., Shepherdson, D. J., 2005: Scientific approaches to enrichment and stereotypies in zoo animals: what's been done and where should we go next? *Zoo Biology,* 24. pp. 499-518.

Topál J, Miklósi A, Csányi V, Dóka A., 1998: Attachment behavior in dogs (*Canis familiaris*): a new application of Ainsworth's (1969) strange situation test. *J Comp Psychol* ,112(3). pp. 219–29.

Wittemyer G., Douglas-Hamilton I., Getz W.M., 2005: The socioecology of elephants: analysis of the processes creating multitiered social structures. *Anim. Behav.,* 69. pp. 1357–1371.

Zander, S., 2014: Behaviour of African Elephants (*Loxodonta africana*) before and after translocation. Unpublished master's thesis, University of Potsdam.

Amendment:

There were two mistakes in the abstract (page 30) made.

In the following sentence the second, and fourth word need to be replaced with „it“ and „said“. In between the third and the fourth word the word „be“ needs to be added.

“Concluding we can say that it less the elephant ride itself being a problem for the animal but the additional number of walks that is causing an increase in SDBs.”

The second correction is the total amount of elephant rides and walks. It needs to be “30” and not “15” rides and “157” not “105” walks.

A total of 109 rides and 105 walks have been recorded for this study over a period of 7 months in 2018 and using elephant ride data from previous studies in 2015 and 2016.