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Fallstudie av träning av Röd Panda (Ailurus fulgens) för hantering

Sarah Aspenström-Oguguo

Uppsala 2018

Ethology and Animal Welfare – Bachelor's programme

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Abstract

Zoo animals are trained for a lot of different reasons including facilitating husbandry procedures, physical exercise and mental stimulation. Training has also been shown to reduce stereotypies in captive wild animals. Among other factors, two of the most important for zoo animal welfare are the Human-Animal Relationship (HAR) between animal and zookeepers, and an environment that allows behavioural choices. These factors are important for the animal´s perceived level of control of its environment. This study is divided into two parts. First, it aims to investigate trainings implications for the HAR, control and motivation. Second, it also includes a case study of training Red Panda (*Ailurus fulgens*) for weighing and transporting.

The method used in the study was literature search in databases. The case study aimed to evaluate a training plan for two Red Pandas and also to assess behavioural change throughout the training period.

The results show that training can have positive implications for both the HAR and for the perceived control. The training plan proved functional as a template but may have to be adjusted depending on the individual animal and trainer. The behavioural changes throughout the training period could possibly be due to enhanced HAR, increased control or motivation but which factor, if any of the three, had the most implication could not be concluded.

1. Introduction

1.1 Zoo Animal Training

There are several different reasons to train animals and different people may have different priorities and objectives. In zoo animal training, a common main objective to train is making management and medical procedures less stressful for the animals and easier and safer for the keepers (Westlund, 2013; Ward & Melfi, 2013; Melfi, 2013; Minier *et al.*, 2011). Training has for example been successful in reducing stress during husbandry procedures (Westlund, 2013) such as weighing animals (Miller & King, 2013), reduce aggression toward people (Minier *et al.* 2011), and to reduce abnormal behaviours and stress (Manciocco *et al.*, 2009; Carlstead, 2009). There are many definitions of training. The definition from English Oxford Living Dictionaries (2018) puts it simple "The action of teaching a person or animal a particular skill or type of behaviour." Ramirez (1999) choses instead to use a one word definition, namely "Teaching".

1.2 Is training natural?

Most zoos strive to keep their animals as natural as possible (Claxton, 2011). This is done by designing naturalistic enclosures and facilitating different enrichments that promote natural behaviour (Santymire, 2012.) It can be argued that training wild species is unnatural since the animal would not encounter such situations in the wild (Zeligs, 2014; Kawata, 2016). However, in captivity, we do not have the option not to train at all since the animals interact with keepers daily and every interaction can be considered training (Zeligs, 2014). Hence, we can only choose how to train, and make well thought out training plans. Animals learn through classical and operant conditioning, the very same mechanisms used for learning and survival in the wild (Zeligs, 2014). Whereby, training could be considered a natural learning process set in an unnatural environment.

Ramirez (1999), as a professional dolphin (Cetacea) trainer, states that a lot of the behaviours animals perform on cue are natural, or extensions of natural, behaviours like jumping or making noise. Furthermore, since we keep the animals in an unnatural

environment and they experience situations they would not encounter in the wild, we should train an animal to be able to cope with the environment it finds itself in, rather than restrict the training to behaviours it would perform in the wild (Zeligs, 2014). Therefore, even behaviours considered unnatural might be of importance for animal welfare.

1.3 Training in the wild

Life on Land and Life Below Water are two of the seventeen Global Goals set by the UN and the world leaders (United Nations, 2018). A part of both goals is biodiversity. This includes protection of endangered species (United Nations, 2018).

Renowned animal trainer Ken Ramirez helped to design a training project in Sierra Leone for the sake of conservation work with chimpanzees (*Pan troglodytes*) which led to an 80 % decrease in poaching (Lombardi, 2018). The animals were taught to start making a lot of noise when unfamiliar people were present, as to alert the rangers when poachers were in proximity, according to Lombardi (2018).

Training has also been used to prevent released condors (*Vultur gryphus*) from foraging in the city (Lombardi, 2018). This has, according to the author, led to a successful conservation program for condors.

1.4 Training techniques

There are different techniques used in animal training. Training techniques are usually divided into four terms (Table 1) (Zeligs, 2014). In the current study, only Positive Reinforcement Training (PRT) was used. When the animal perform a desired behaviour, the trainer rewards the animal with something the animal wants (Coleman & Maier, 2010; Zeligs 2014), usually something food related. The animal is usually trained to associate the reward with another stimulus, called a bridge signal, such as a whistle or a clicker, through classical conditioning (Zeligs, 2014). The bridge signal is then used the moment the desired behaviour is performed to communicate to the animal that it was performing correctly and to let it know that a reward is to be expected (Zeligs, 2014).

Table 1. The different training techniques.

Positive Reinforcement - Adding something the animal wants when the correct behaviour is performed.	Negative Reinforcement - Removal of a negative stimuli. I.e. applying an aversive stimuli that is released when the correct behaviour is performed.
Positive Punishment - Adding an aversive stimuli after a performed unwanted behaviour in the aim of extinguishing it.	Negative Punishment - the removal of a wanted stimuli as a response to unwanted behaviour.

1.5 Enrichment

Training has the potential of being enriching for zoo animals (Westlund, 20XX; Claxton, 2011; Melfi, 2013). Environmental enrichments are different techniques used to positively alter animal behaviour (Rochlitz, 2005). Different techniques have been categorized by Claxton (2011) as improvement of enclosure design, food-related enrichment, novel objects, social enrichment and sensory stimuli.

The success of an enrichment is, according to Claxton (2011), an increase in desirable behaviours and a decrease in unwanted behaviours, such as stereotypies. Animals can develop stereotypic behaviour when they cannot cope with the environment, i.e. they lack control and cannot perform strongly motivated behaviours (Jensen, 2009).

A number of studies indicate that training can be enriching for the animals in several aspects (Westlund, 2013; Melfi, 2013; Ward & Melfi, 2013). First of all, it gives the animal mental stimulation through the opportunity to learn (Westlund, 2013; Melfi, 2013). Training may also facilitate use of conventional enrichment by teaching the animal how to approach it and manipulate it (Westlund, 2013), thus complementing conventional enrichment. There are good reasons to assume that training cannot, and should not, replace conventional enrichment techniques but rather be a complement (Westlund, 2013; Melfi. 2013). Sambrook and Buchanan-Smith (1997) conclude that successful enrichments have one thing in common and that is to give the animal control.

1.6 Human-Animal Relationship

A zoo housed animal experiences a lot of encounters with people on a daily basis. Both the zookeepers, that are consistent for long periods of time, and the visitors who change from day to day, even from minute to minute. Each encounter with a zookeeper or visitor allows for some sort of inter-species contact and could be considered an interaction (Hosey, 2007). If these Human-Animal Interactions (HAI) (Melfi, 2013) are perceived as aversive, neutral or desirable by the animal can be considered to have a great impact of the animal´s welfare (Claxton *et al.*, 2011). Of special importance is the animal's perception of the daily HAI with the zookeepers since these occur every day (Claxton, 2011). Through this daily interaction, a Human-Animal Relationship (HAR) is formed. Hinde (1976) describes the concept as:

"*A HAR can be defined to exist if a number of repeated interactions between the same animals and humans occur, eventually allowing each party to make predictions about the others behaviour"* (Hinde, 1976)

From Hinde´s definition, we can see that a HAR between the animal and the zookeepers will inevitably form from these daily interactions. Through these interactions, the animal learns what to expect from the zookeepers during encounters. A HAR can be considered negative if the animal is showing avoidance and is fearful to humans, neutral if the animal is showing low levels of fear but still avoids being close to humans, and positive if the animal shows some confidence in humans (Claxton, 2011).

A good HAR between animal and zookeeper can possibly be generalized to other humans and make the animal's perception of visitors more positive (Claxton, 2011; Minier *et al.*, 2011). Vice versa, if the daily interactions with keepers are associated with fear, this may generalize to visitors as well, according to Claxton (2011). The general perception of people is of importance for the animal's welfare. There is also the possibility that the animal can discriminate enough between keepers and people in general and have a good HAR with keepers without it altering the perception of unfamiliar humans such as visitors (Hosey, 2007).

1.7 Control

Sambrook and Buchanan-Smith (1997) concluded that successful enrichments have one thing in common and that is to give the animal control. If the animal perceives that it is in control of its environment, it can reduce stress (Veissier and Boissy, 2007; Weiss, 1968 i Westlund).

Daily routines may also play an important part for the animal welfare, as to Hindes definition of HAR. Claxton states that in this aspect, a good HAR can promote control since the animal can predict a positive outcome of the interaction. Yin Yong *et al.* (2017) showed that mice (*Mus musculus*) exposed to uncontrollable electric shocks developed depressive-

like symptoms. This shows that even if the outcome of a stimulus is strongly aversive, to be able to predict it creates less stress. Lack of control can also lead to Learnt Helplessness, i.e. the animal learns that escape attempts are futile and hence, does not try to escape even when given the opportunity (Yin Yong *et al.*, 2017). In zoo animals, we should of course aim for a HAR as positive as possible and create positive associations to the zookeepers. Training involves choices for the animal and allows the animal to control a positive outcome through behavioural change, according to Westlund (2013).

1.8 Motivation

The animal being motivated is essential when it comes to training (Zeligs, 2014; Ramirez, 1999; Westlund, 2013). Through the PRT we give the animal an extrinsic motivator to perform a behaviour, i.e. to receive treats. Training with Negative Reinforcement, Positive Punishment and Negative Punishment can also be considered to be extrinsic motivators - either to avoid a stimulus, to avoid a consequence or to keep wanted stimulus. When training with food as a primary reinforcer, Westlund (2014) argues that it is the foraging motivation and the SEEKING system in the brain that is activated. SEEKING is an emotional system in the brain driven by dopamine that induces foraging behaviour and anticipation (Panksepp, 2004)

In ethology, the behaviours of animals are considered to be derived from external and internal motivation that aims to keep physiological parameters to keep the animal in homeostasis (Toates, 1986). Natural behaviours from extrinsic motivation serve clear survival or evolutionary functions (Baldassarre, 2014). Behaviour occurring without a clear evolutionary function, and seemingly is performed for fun, is called Intrinsic Motivation (IM) (Baldassarre *et al.*, 2014). However, the word intrinsic can also be used to describe the internal motivation that derives from physiological needs (Loberg, 2005) such as dust bathing in hens (*Gallus gallus)* (Colson *et al.*, 2007) and motivation for movement in cows (*Bos taurus*) (Loberg, 2005). In this report, Intrinsic Motivation is defined as behaviour without a clear evolutionary function that seems to be carried out "for its own sake" (Baldassarre *et al*., 2014).

A lot of activities seem to be carried out "for their own sake" (Berlyne, 1966). A behaviour rewarded by an external stimulus, such as food, is more likely to be performed again compared to a non-rewarded behaviour (Anderson *et al*., 2016). An intrinsically motivated behaviour is in itself rewarding enough and simply by performing the behaviour, it is more likely to occur again (Anderson *et al*., 2016). Playing is a clear example of that, according to Baldassarre *et al.*, (2014). Although, it has been discussed if play actually serves an evolutionary function (Bekoff & Byers, 1998) but that is beyond the scope of this report.

In humans, setting goals and learning new forms of competences without a clear evolutionary motive is considered to be due to IM (Baldassarre *et al*., 2014). Salge & Polanski (2013) describe the phenomenon in humans as an internal measurement of a behaviour that we want to optimize. Performing and improving these behaviours give rise to complex interactions with the environment, according to the authors. .

In animal research, IM was first used to explain why rhesus monkeys (*Macaca mulatta*) would engage in solving puzzles for long time without extrinsic motivation, such as positive reinforcement (Harlow, 1950; Baldassare *et al.*, 2014). In humans, this was extended to setting one's own goals (Ryan & Deci, 2000 i baldassarre). Behavioural needs, such as a need for movement can be in marine mammals (Ramirez, 1999), performed during a training session could possibly be of intrinsic value to the animal.

1.9 Case Study

In the current study, two Red Pandas (*Ailurus fulgens*) were trained for husbandry procedures at Nordens Ark, Hunnebostrand, Sweden. The Red Panda (*Ailurus fulgens*) is distributed across the Himalayan region, extended across Bhutan, Nepal, India, Myanmar and China (Wei *et al.*, 2011). The species is listed as endangered in the IUCN Red List and it is threatened by anthropogenic activities, mainly habitat destruction (Dorji *et al*., 2012) and livestock grazing (Sharma *et al*., 2017). In 2011, it was estimated that less than 2500 adult individuals remained in the wild (Wei *et al.*, 2011). The numbers are declining and they are exposed to fragmentation and habitat loss, according to Wei *et al*. (2011).

In the current study, two Red Pandas were trained to step up on a scale and to go into a transportation cage by the use of PRT.

2. Aim and Questions

The aims of the literature part of the study were to investigate how certain aspects of the animal´s perceived control of its environment can be affected through training. First, the study aims to investigate training´s implications for control and the HAR. Second, it also aims to investigate if training in itself can be of intrinsic motivation for the animal.

- *What implication does training have for the HAR?*
- *Can training enhance the animal´s perceived level of control?*
- *Can training be intrinsically motivating for animals?*

In the case study, the aim was to create, follow up, and evaluate a training plan for weighing and transporting Red Pandas and to measure different behaviours occurring before and during training.

- *Were the developed training plans functional?*
- *Do behaviours change throughout the training plans and if so, could it be interpreted as an enhanced HAR, increased control and/or enhanced motivation to train?*

3. Materials and Method

The case study was completed over a total of 15 days, Monday to Friday for 3 consecutive weeks at Nordens Ark Zoo in Västra Götalands Län, Sweden.

3.1. Animals

The animals taking part in the study were two Red Pandas (*Ailurus fulgens*), Hulken, a male born at Opel Zoo in Germany in 2012, and Svea, a female born 2013 at Nordens Ark. Both pandas had previously been trained. They were already familiar with target and clicker and had been trained to go up on a scale.

3.2. Enclosure

The Red Pandas were kept in two adjacent enclosures that were connected with an opening in the fence, so the pandas could move freely between each other´s enclosures. Hulken´s enclosure was 270 m^2 and Svea´s was 320 m^2. Both enclosures consisted of several trees, branches and small houses.

3.3. Management and training schedule

The usual husbandry routine for the pandas took place in the morning unless there was a showing of the animals planned during the day. Routines included cleaning the enclosure, putting up bamboo branches in the enclosure, putting panda cakes (frozen pieces of a mixture with bamboo) in two bowls, changing the water and filling up pellets.

During the training weeks, the trainer did all the husbandry routines, unless there was a guided tour with a school that was supposed to do the cleaning. The aim of this was to spend as much times as possible with the animals and to be a part of their daily routine and desensitize them to the trainer´s presence, hence enhancing the HAR. The animals were fed panda cake and bamboo in the morning after the first training session, which took place between 7:30-9:00 in the morning. They had pellets *ad libitum* and got new bamboo branches every day. The training sessions in the afternoon took place between 15:00-16:30. The training sessions were conducted at two platforms, 60 x 80 m^2, ca. 1,5 meter above the ground, one in each enclosure, specially built for scale- and transport cage training. Both pandas were already familiar with the platform and the scale training. Each session lasted no longer than 5 min, starting from the moment the panda arrived at the training platform. All studies were conducted by the same trainer who had previous experience in clicker- and target training. The trainer wore the same sweater as the zookeepers, black pants and usually a green vest.

3.4. Training Tools

In all training, a Trixie Dog Activity Target Stick with an integrated clicker was used. The length was adjustable up to 65 cm. The target at the end of the stick was a 1,3 cm in diameter, black ball. The first scale used was 40 x 30 cm^2. The second scale that was used during training had a top part that was made out of wood with a rubber mat put on it and measured 50 x 50 cm^2. The transportation cage was 68 x 49 x 45 cm^3 with a detachable top part. The primary reinforcer was cut up pieces of pear in a bowl. For recording, an iPhone 5 was used.

3.5. Training methods

In all training, only PRT was used. If the animal showed aggression or mugging related behaviours, the trainer tried to divert the animal by asking for, or look for and capture (i.e. click the moment the animal performed a wanted behaviour), any desired behaviour such as target or looking away. If one panda came to the other pandas training session, the trainer concluded the training with an easy target -click - treat with the animal that was currently training. The training session was ended as soon as possible and the trainer walked away. If possible, the training proceeded later on when the interrupting animal was not close around or did not pay attention anymore.

To get the animals attention when entering the enclosure, clicking noises with the tongue, saying “Kom Hulken” or “Kom Svea” and making a noise by hitting the bowl with the target stick were used. Daily maintenance of the enclosure was performed by the trainer if the panda did not approach within the first minute. When the panda was on the scale or in the cage, the command “Vänta” (wait) could be given if the trainer felt the animal was calm enough, to create an association with the behaviour sitting still and “vänta”.

3.6. Behavioural Registration

The behaviours were registered with a continuous sampling method measuring all behaviours included in the ethogram (Appendix 1). To note behaviours during training, the Voice Recording app on iPhone 5 was used.

3.7. Pre-study

Before the actual study started, the trainer worked over the basics with the animals for two days. The purpose of the pre-study training was for the pandas and the trainer to get used to each other and establish a positive HAR. The trainer also made sure the pandas still understood the concept of target training. Before moving on to the actual study and training with the scale and the cage, the pandas could follow and succeed to touch the target both facing the trainer and moving away from the trainer to the sides.

3.8. Changes after pre-study

The original plan was to test out the same training plan on both animals: Continue and repeat the previously taught scale training and then move on to the transportation cage training. During these pre-study sessions, Hulken showed a lot of stress during training (Appendix 1). Therefore, the trainer and the zookeeper did not want to proceed with the planned training plan, and instead chose to focus on reinforcing calm and relaxation (Table 2). Svea performed the whole plan for the weighing in one session. Therefore, the trainer and the zookeeper chose to start directly on the transportation cage training with Svea (Table 3). Subsequently, it was not possible to compare the difference in progress between the individuals since they were on two different training plans.

3.9 Training Plans

Hulken´s training plan was divided into three parts conducted in parallel. First, the trainer and the zookeeper wanted to start to cancel out the unwanted behaviours seen during the pre-study (Appendix 1). The training started with click-treat exercises, reinforcing calm behaviours and keeping both front paws in the ground (Table 2). After a few sessions, the scale training (Table 3) started but keeping both paws on the ground (or scale) was still rewarded.
Svea´s training plan started with transportation cage-training (Table 4).

3.10. Ethogram

The ethogram included 5 categories of behaviours (Appendix 1): Avoidance, Aggression, Unwanted Behaviours, Other Behaviours Before Training and Approaching Time. Lip Licking was included in the category Other Behaviours Before Training and was used as an indicator of anticipation (Burke & Tobler, 2011). The Approaching Time was used as an indicator of either motivation to train or reduced fear of the trainer, similar to the cue-response rates used as an indicator of low fear by Ward & Melfi (2013). Mugging related behaviours (trying to reach the food-reward) were included in the Unwanted Behaviours because they can indicate frustration (Hockenhull & Creighton, 2010) or perhaps confusion in the animal.

Table 2. Training plan for Hulken to reinforce calm behaviours.

Calm State of Mind Training	
Paws on the ground	Bridge when both paws touch the ground even for a split second. Try to repeat before he has any time to do undesired behaviours.
Paws on the ground 1 sec	Both paws in the ground for 1 sec
Paws on the ground 2 sec	Both paws in the ground for 2 sec
3 sec	3 sec
5 sec	5 sec
7 sec	7 sec
10 sec	10 sec or more
Other behaviours rewarded during training	
Reinforce Calm and interactive behaviours	Still for just a moment, sitting, looking at trainer (not attention on bucket or hand) Blinking
Stay still, keep calm, wait for command	
Capture standing still	Still just for a second
Command to stay still	Give voice signal for stay still when still /almost still
Reinforce Command stay still	Keep on until association is fixed

Table 3. Training plan for Hulken´s training to get up and stay on the scale.

Scale		Stationary Scale	
Mat on Scale	The panda is practicing the target training with the scale present on the platform.	Stay 1 sec	Panda stays with all paws on scale for 1 sec. Stay signal is given, immediate bridge and primary reinforcer
One paw	Panda puts one paw on scale	Stay 2 sec	Panda stays with all paws on scale for 2 sec.
Two Paws	Panda puts 2 paws on scale	Stay 3 sec	Panda stays with all paws on scale for 3 sec
Three paws	Panda puts 3 paws on scale	Stay 5 sec.	Panda stays with all paws on scale for 5 sec.
All paws	Panda puts all paws on the scale	Stay 7 sec.	Panda stays with all paws on scale for 7 sec.
		Stay 10 sec.	Panda stays with all paws on scale for 10 sec.

Table 4. Training plan for Svea´s transportation cage training.

Outside cage

Follows target	Can perform target as usual with the cage present without signs of stress.
Cage without top	
Nose in cage	Nose in the cage
Head in cage	The whole head is in the cage
One paw	One paw on the cage floor (the whole paw put down)
Two paws	Two paws on the cage floor
Three paws	Three paws on cage floor
All paws	All paws on cage floor
Whole animal	All of the panda is inside the cage, with top of, its ok if head or tail is sticking out
Turn around	Goes in cage, turns around facing opening
With top on	
Nose in cage	Nose in the cage
Head in cage	The whole head is in the cage
one paw	One paw on the cage floor (the whole paw put down)
two paws	Two paws on the cage floor
three paws	Three paws on cage floor
all paws	All paws on cage floor
Whole animal	All of the panda is inside the cage
Turn around	Goes into cage, turns around facing opening

3.11 Literature study

Primo and Google Scholar were used to search for scientific literature. The books referenced were either already in the author's possession, borrowed from Nordens Ark or accessed via Google Books. The search included words and phrases such as:
Animal Training, Positive Reinforcement, Intrinsic Motivation, Positive Reinforcement Animal, Training Enrichment, Human Animal Relationship.
Literature referenced in the found articles was also used.

For nonscientific articles, Google was used to find definitions or cases outside of scientific literature. I did not actively choose to not include any article. Included were 35 scientific articles, 9 books, both scientific and written by professional animal trainers.

Animal Training by Ramirez from 1999 was included since he is a renowned animal trainer with experience training a lot of different species.
Animal Training 101 by Jennifer Zeligs from 2014 was included since the author works professionally with training sea lions (Otariinae) at Moss Landing Marine Laboratory.

Some web-pages such as Mongabay.com were included since the article was about Ramirez (1999) and other trainers experienced in training animals.

4. Results Case Study

The re-evaluated training plans were somewhat functional. A few steps had to be added or removed as the training proceeded.

4.1 Svea´s training plan

The plan with Svea was to start with the cage training directly after the pre-study. The trainer first introduced the cage during training session no. 1. Svea approached the cage and took part of the training for a while but then left and did not come back. During the training, she also performed a lot of hissing (N=8). During the next sessions, when the trainer brought the cage bottom, Svea did not come to train until it was removed. After a discussion about HAR with the zookeeper responsible for training, it was decided to go back to scale training to establish a stronger positive HAR.

Several sessions later on training session no. 17, the trainer brought the cage bottom again and proceeded with cage training. Svea used the cage as toilet in between the training sessions which indicates she was not fearful. To see if she was comfortable going into the cage with the top on as well during training, luring was used to get her into it, i.e. the pear pieces were put into the cage. This indicated that she was not fearful of going into the cage but did not yet understand that it was the right behaviour.

4.2 Hulken´s training plan

The unwanted behaviours Stepping to Side and Hissing decreased during the training period (Figure 1 & 2). The mugging related behaviours (Grasping for Target, Grasping for Food Hand, Chewing on Target) occurred throughout the whole training period and did not increase or decrease. The Treading behaviour was of relevance for the stress level of the animal but during training it proved too complicated to count. It was hard to decide during training where one treading stopped and the next began and sometimes hard to separate it clearly from Lifting One Paw and sometimes Stepping to Side. Therefore, all Treading and Lifting One Paw were excluded and only Stepping to Side was counted. When the Scale was introduced, Hulken also showed a new behaviour. He stepped down with one or two paws from the scale in direction of the trainer. Since this behaviour was not recorded before it could not be included, although it would have been of relevance as a stress indicator. One of the last training sessions when the cage-bottom was introduced to Hulken, he showed no fear behaviours and stayed for the whole training session.

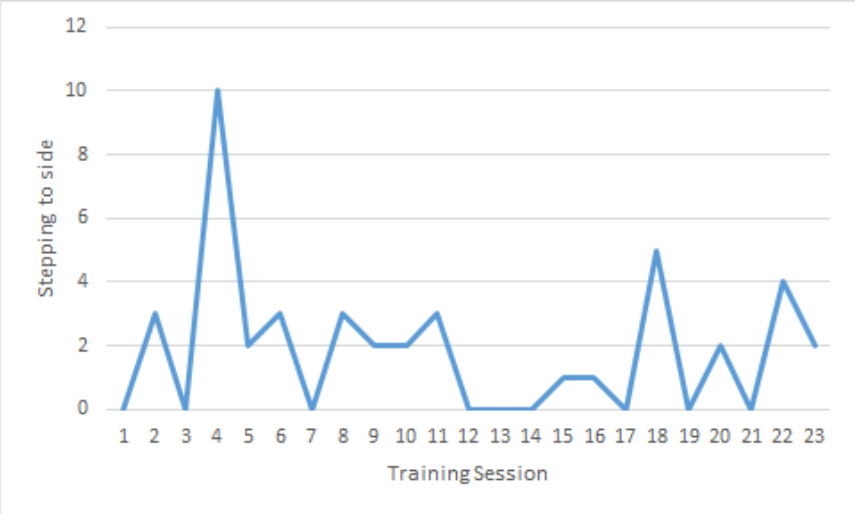

Figure 1. Frequency per training session of Hulken´s unwanted behaviour "Stepping to Side".

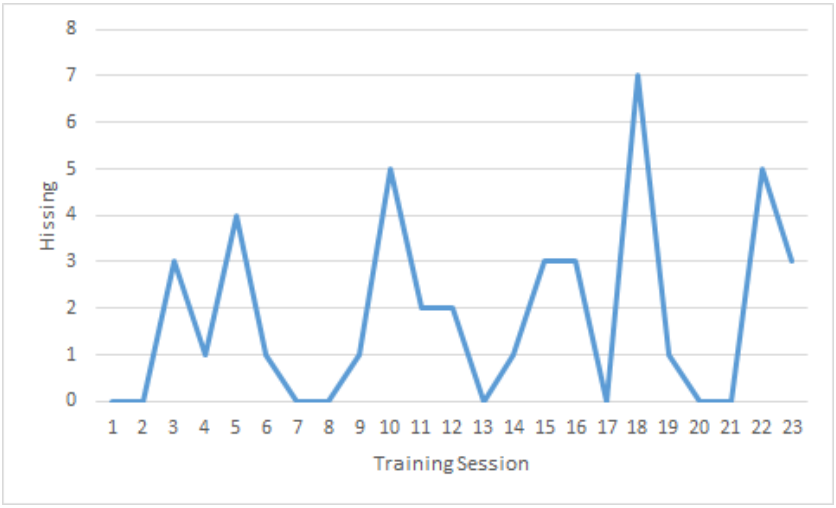

Figure 2. Frequency per training session of Hulken´s unwanted behaviour "Hissing".

4.3 Approaching times

The time it took for the animal to start approaching the trainer for each session showed a decrease during the training period (Figure 3 & 4). The times the animal did not come to train at all ($N_{Svea} = 4$, $N_{Hulken} = 9$) were left out in the diagram. The time decrease was not linear and the times the animals did not come to train at all were spread throughout the training period showing no clear increase or decrease. Overall, the approaching time when the animals came to train showed a slight decrease. The number of times the animal had an approaching time of 0 seconds were higher during the second half of the training period for both animals ($N_{Svea} = 8$, $N_{Hulken} = 5$)

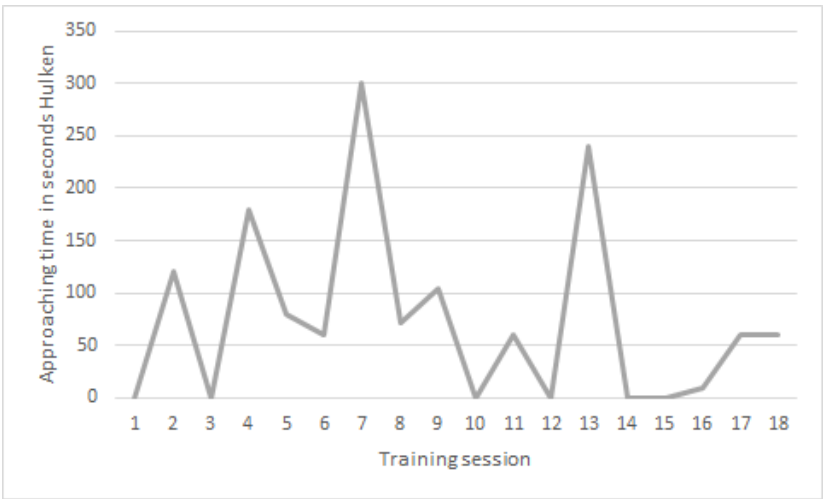

Figure 3.Hulken´s Approaching Times for each session.

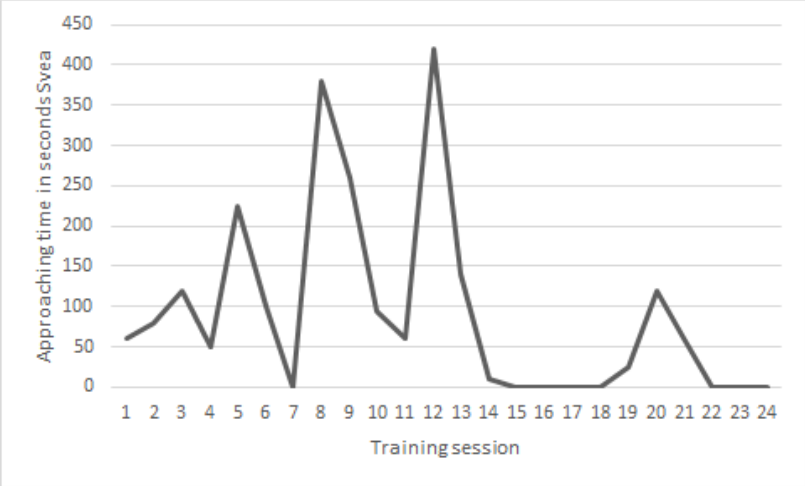

Figure 4: Svea´s Approaching Times for each session.

4.4 Lip Licking

The Lip Licking was measured as an anticipatory behaviour to see if the animals showed some motivation for training even when they did not come to train. There was not much of an increase or decrease in the Lip Licking (Figure 5). The highest number of Lip Licking was performed the times Svea did not come to train at all. The Lip Licking in Hulken could not be accurately counted because of his usual position high up in the tree right above the training platform.

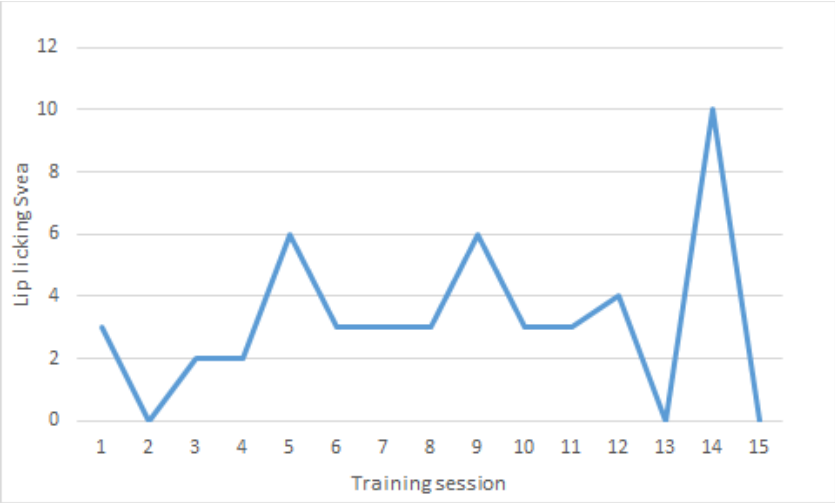

Figure 5. Frequency of Lip Licking Behaviour in Svea per session.

5. Results Literature

5.1 Training´s implications for the Human-Animal relationship

Through PTR we allow the animal to take part in an interaction with the keeper that is rewarding, i.e. food (Zeligs, 2014). Through training zoo animals with PRT, we create a learning situation where the animal is rewarded for the desired behaviours but never punished for undesirable ones (Westlund, 2013). The animal is also free at all times to end the training session and leave (Westlund, 2013). This creates an association between the trainer, the

situation, and the reward through classical conditioning (Zeligs, 2014) which may in some cases be generalized to the zookeeper even outside of the training situation. It might even be generalized to humans in general (Minier *et al.*, 2011), hence reducing or preventing stress and improve welfare.

Minier *et al*. (2011) showed a significant reduction in aggressive behaviours in a group of rhesus macaques (*Macaca mulatta*) through PRT. Both the group that was trained by one trainer and the group trained by several trainers showed significant decrease in aggressiveness whereas the non-training group showed no significant decline, according to the authors. Minier *et al.* (2011) concluded that a single trainer creating a training relationship with the animal is the best option since it allows a higher number of behaviours to be trained. They also showed that the reduction in aggression was generalized to other humans (Minier *et al.*, 2011) thus indicating an enhanced HAR with the trainer and an enhanced positive perception of humans in general.

Manciocco *et al.* (2009) showed an increase in grooming and other affiliative behaviours in common marmosets (*Callithrix jacchus*) after positive interaction with humans. The authors point out that several studies have shown positive effects of PRT but in the study, they investigated interactions without food or training. The interactions consisted of grooming, playing and sweet-talking with the animals.

Ward & Melfi (2013) showed shorter cue-response rates with time through training. The authors supposed that short response rates after a given cue indicated low fear of the trainer.

Hockenhull & Creighton (2013) found a negative correlation between behavioural problems during riding and PRT. The horse-rider relationships that included PRT experienced less behavioural problems than the ones incorporating positive punishment, according to the authors.

5.2. Can training enhance the animal´s perceived level of control?

Perceived control over the environment is important for an animal's welfare (Claxton, 2011). Control can be achieved through being able to affect the environment through behaviour. (Westlund, 2013). To be in control of the environment is essential to animals and can lead to an increase in exploratory behaviour and a decrease in fear responses (Sambrook & Buchanan-Smith, 1997). Successfully managing a task and be able to predict outcomes create a positive state of mind in the animal (Langbein *et al.*, 2009).

Operant conditioning allows the animal to do exactly that, according to Westlund (2013). Operant conditioning is behavioural change as a function of consequences (Skinner, 1968). When training, the animal needs to change and adjust its behaviour to get the outcome it wants, i.e. the rewarding treats, and thereby controlling the outcome (reward) through its behaviour (Sambrook and Buchanan-Smith, 1997).

In their study, Coleman & Maier (2010) found that PRT led to a decrease in stereotypic behaviour in rhesus macaques (*Macaca mulatta*). The authors state that training allows choices, which increases the control over the environment. Similar results with a decrease in stereotypic behaviour through training were shown in a study on training captive African wild dogs (*Lycaon pictus*) (Shyne & Block, 2010). Shepherdson *et al.* (2013) concluded that enrichment and possibly PRT, lead to lower frequencies of stereotypic pacing in captive Polar Bears (*Ursus maritimus*). Hendriksen *et al.* (2011) showed less stress indicators in horses (*Equus ferus caballus*) that were taught to go into a trailer with PRT compared to NRT.

According to Perlman *et al.* (2011), several studies show that primates taking part in controllable situations increased their exploratory behaviours and had enhanced results on

cognitive tasks. Training also gives the opportunity for the animal to choose whether or not to participate in training and it can always choose to leave the situation (Westlund, 2010).

5.3. Can training be intrinsically motivating for animals?

In the wild, animals constantly face challenges requiring cognitive skills (Langbein *et al.*, 2009). According to Langbein *et al.* (2009), to control one's environment is thought to produce positive emotions in animals. White (1959) linked IM to actions that allow an individual to change its environment. Control and IM could be argued to be closely tied together. Pink (2009) incorporates autonomy as one of the building stones for IM.

Zeligs describes the trainer´s role, considering motivation in training, as "convincing the animal to want what you want". A lot of trainers use play, that can be argued to be intrinsically motivated, as a positive reinforcer in training, especially in dogs. A lot of performed behaviours are derived from natural behaviours or extensions of natural behaviours (Ramirez, 1999). Variations of movement could be behaviours shown during play. Good training is, according to Hediger (1968), "disciplined play".

Langbein *et al.* (2009) showed that cognitive challenges could be intrinsically reinforcing in Nigerian Dwarf-goats (*Capra hircus*).

A lot of research has been carried out in humans considering PRT and IM. PRT in the business environment seems to work with easy mechanical tasks and when the solution is clearly given (Pink, 2009). In tasks that require creativity and problem solving, on the other hand, rewards tend to decrease productivity. In 1930, a test model that requires out of the box thinking, called the candle problem, was developed. The subject is given a candle, matches and a box of tacks and is told to somehow get the candle attached to the wall. Under pressure, people have harder to realize the obvious solution to use the box the tacks came in and attach it to the wall and put the candle in it (Pink, 2009). One needs to overcome the "functional fixedness" of the box containing the tacks and realize it can be used for other things (Pink, 2009). When humans experience that they have to succeed on a task and perform well, it can lead to "paradoxical performance" or "choking under pressure" (Baumeister and Showers, 1986). According to the authors, choking under pressure is associated with audience presence, competition, rewards and punishment.

In a study conducted in both U.S. and India, Ariely *et al.*, (2009) concluded that the ability for problem solving is negatively affected by large incentives. This may be due to the shifted focus of attention which inhibits creativity and to think outside the box (Ariely *et al.*, 2005).

Pink (2009) concludes that as long as people get paid enough, so that money is not an issue, people might be more productive from IM than extrinsic motivators. Pink (2009) describe the intrinsic motivators for humans as: *Autonomy* - to be in control, *Mastery* -the feeling of mastering a task, and *Purpose* - meaning beyond ourselves.

6. Discussion

6.1. Were the developed training plans functional?

The training plan was functional as a template but needs to be modified to fit the individual animal. Depending on species, the animal´s previous experiences and the animal´s personality, the plan could be altered in any way a trainer finds necessary. Personality can play a great role in how the animal perceives and deals with novel objects (Ward and Melfi, 2013, Bray, 2017). Bray (2017) showed that it is plausible that Red Pandas can be

categorized in two dimensions of personality: "Active/Exploratory" or "Maintenance". The Active/exploratory animals are more likely to investigate their environment and to forage in new places while the maintenance behaviour might have lower stress levels and less exoparasites due to higher levels of grooming, according to Bray (2017). Both Pandas in the current study often showed grooming behaviours before training. Svea reacted with fear the first time the bottom of the transportation cage was introduced during training. One of the last training sessions when the cage-bottom was introduced to Hulken, he showed no fear behaviours and stayed for the whole training session. Using the personality assessment in Red Panda from Bray (2017), it is plausible Hulken belongs to the Active/Exploratory group whereas Svea is more of a Maintenance personality.

6.2. What implication does training have for the HAR?

Through training, the animal is allowed a lot of choices, which in turn leads to control of the environment (Claxton, 2011; Westlund, 2013). A good HAR should inevitably lead to an enhanced perception of control since trained animals show less fear of humans and learn to associate them with reward. Training is, as mentioned above, a way to get the animal to willingly take part in potentially aversive situations such as veterinary procedures. The animal volunteering for the procedures can be assumed to derive from a positive association to the trainer, and the training situation. It is self-explanatory that a medical procedure that the animal willingly takes part in is less stressful than being restrained and forced to take part. A rough handling also impairs the HAR since a negative association is created between the trainer and the aversive situation (Claxton, 2011). Many studies have shown decreased fear in animals, which can be interpreted as the HAR being improved by training.

Claxton (2011) points out that a good HAR also is necessary for the success and quality of the training. Manciocco *et al.*, (2009) developed a positive HAR with common marmosets (*Callithrix jacchus*) solely from interacting without any intention of training and without offering any food. Subsequently, training can indeed improve the HAR but a good HAR is also necessary for the training. Zeligs (2014) describes the relationship between the trainer and the animal as a relationship bank account that is based on all previous interactions and associations. If a lot of reinforcing interactions is put into the bank account, one aversive interaction such as a necessary aversive exam can be afforded without losing the animals trust.

In the current study, the decrease in approaching time can be interpreted in both the aspect of an enhanced HAR, i.e. the animal is not fearful towards the trainer or the situation, and an increased motivation to take part in the training. It is impossible to know which factor affected the behavioural change the most since there was no way of measuring it developed for the study.

6.3. Can training enhance the animals perceived level of control?

An aim of the training should, just as with enrichment, be to increase the animal´s control over its environment. According to Westlund (2013), training allows both the choice to train or not to train but also gives control in the sense that the animal controls the outcome by changing its behaviour. From the animal point of view, there is the possibility that training may be perceived as directing the human´s behaviour to give the animal treats. In other words, training the human.

When we train animals we ought to not only focus on the progress in the training plan, i.e. which step is reached. Rather, we should always pay attention to the animal's state of mind, signs of stress, frustration etc. and always have the concept of control and the HAR in mind. I do not doubt that this view is held by most zoo-animal trainers. Zoo-animal trainers

work with animals that are free to leave at any point and if we put too much pressure on them, they are free to leave the situation. In horse training, on the other hand, riders often use a lot of different training methods such as negative reinforcement and positive punishment (Hockenhull & Creighton). The horse can never choose to leave and by restraining the horse with pressure from reins, help reins etc. I argue it is pretty easy to put the horse in a state of Learnt Helplessness, i.e. no control.

Several studies have shown a decrease in stereotypic behaviour in zoo animals after a training program was implemented (Shyne & Block, 2010; Coleman & Maier, 2010; Shepherdson *et al.*, 2013). If a zoo does not have the resources to train all its animals, a training program would preferably be implemented with species prone to develop stereotypic behaviour, such as large felids, to prevent the development of and reduce stereotypies.

6.4. Can training be of intrinsic motivation for animals?

I argue that training certain behaviours might be of IM for the animal since a lot of behaviours give the opportunity for mental stimulation and exercise (Ramirez, 1999). The literature does not give an answer to whether animals can experience IM like humans do. Research in assessing positive emotions in animals has been carried out in a lot of studies (Anderson *et al.*, 2016). The case with the rhesus macaques that engage in puzzles without reward (Harlow, 1950), points towards something similar to IM.

Langbein *et al.* (2009) concluded that cognitive challenges might be of IM in Nigerian dwarf-goats (*Capra hircus*). The study included 12 goats reared under the same conditions. The goats were taught both to access water through pushing a button and by pushing the correct image on a screen (i.e. had to discriminate between symbols). The learning device with symbols had been previously used in several studies by the same lead author (Langbein *et al.*, 2009). In both tasks, the goat had to push something to get access to drinking water. When both devices were used, the goats used the learning device a third of the time. In their study, they showed that the goats were willing to discriminate between symbols to get water instead of only pushing a button, part of the time.

At both instances, something still had to be pushed. I argue that a follow up study with water *ad libitum* (no work required) and the learning device would give a better indication of the contrafreeloading concept (Working for a reward although it is available without any work) discussed in the study. Using pellets or some other food related stimulus provided both *ad libitum* and through the learning device also would be of interest for a future study.

IM is a well-established concept in human psychology. A lot of studies including discussions about IM in animals were found in the field of Artificial Intelligence and the aim was to discuss its application in that field. I argue, that discussing IM in AI requires more research into how animals experience and are driven by IM to take the field of AI further.

Suffice to say, more research into IM in animals could improve Animal Welfare through well thought out training plans including motivated behaviours and enrichments promoting these behaviours.

The workplace analogy by Pink (2009) may work for animals too. As long as we "pay" them enough, i.e. reward enough and consistently, so treats, like the money, also is an issue that is "off the table". If a trainer notices frustration in the animal, the training can always be reversed to a previous step or to a lower quality of the behaviour (Ramirez, 1999). We can

also start over with a new behaviour right away that we know the animal masters, according to Ramirez. Through rewarding enough and consistently we can also create a "work" environment that allows creativity, i.e. SEEKING and experimenting with new behaviours in shaping or dare to try new things to figure out what the trainer wants.

PRT may cause frustration if the animal does not know when the next treat will come or does not know what it is supposed to do (Hockenhull & Creighton, 2010), just like with the candle problem in humans. This may, in my experience, also narrow the animal´s focus and it may try behaviours that are known to work, instead of searching for what we want in the desired engaged SEEKING state of mind. In other words, it can lead to "choking under pressure" (Baumeister & Showers, 1986) also in animals.

6.5. *Do behaviours change throughout the training plan and if so, could it be interpreted as an enhanced HAR, increased control or enhanced motivation to train?*

Training calm behaviours with Hulken according to the plan led to a decrease in Stepping to Side and a slight decrease in Hissing. The overall impression from both the trainer and the zookeeper was a much calmer animal, more in SEEKING mode than in a stressful state of mind, even if he still showed a lot of the behaviours. It would have been useful to have had a data set with perceived stress-level for Hulken during each training session rating the level of stress perceived by the trainer.

Svea progressed through the training plan, learnt to go into the cage and follow the target around and facing the opening. It was clear she had been in the cage with the top on when it was left in the enclosure during the night. To see if she had not understood the behaviour of going in and turning around or if she was reluctant to going in, the training method luring was used to get her into the cage by putting the pear-treats in it. It was clear she was not intimidated or scared by the cage since she walked into the cage without hesitation. A suggestion for future training and an added step to the training plan would be to add another target in the far end of the cage to get her to understand she is supposed to go in all the way.

The approaching times showed a decrease in both animals throughout the period. Assuming the approaching time indicated the level of motivation to take part in the training sessions, it can be suggested that the motivation for both animals increased throughout the training period. It can also be argued that a low approaching time can indicate a level of low fear, similar to the response rate in Ward & Melfi (2013). This result could therefore possibly be due to increased motivation to train or less fear, creating a better HAR. It could also be a combination of both. The Lip Licking could be interpreted as an anticipatory behaviour and showed the highest frequency when Svea did not come to train. This could indicate some level of motivation although not strong enough to come down from the tree. It can with certainty be interpreted as a clear motivation to eat the pear but not as a motivation to train.

When the cage was introduced to Svea, she got scared during the session and did not come back to train for the next sessions when the cage was present. At session no. 17, the cage was reintroduced. This time, Svea did not leave or show high levels of fear. This could be due to an enhanced HAR between Svea and the trainer or an increased perceived control over the training situation. Considering the decrease in approaching times combined with the decrease in unwanted behaviours in Hulken and the acceptance of the Transportation Cage in Svea, it is plausible that the HAR between the pandas and the trainer was enhanced.

Ward & Melfi (2013) measured response rates in animals during training and considered a short cue-response to be an indicative of low fear in the animal. The authors also suggested that training can reduce fear of humans, thus improving the HAR. The cues observed in the

study was approaching the animal without calling for it, request the animal to move from the inside to the outside of the enclosure and to move from the outside to inside. A strength in the study design by Ward & Melfi is that they looked at different species from different taxa, namely: black rhinoceros (*Diceros bicornis*), sulawesi crested black macaques (*Macaca nigra*) and Chapman zebra (*Equus quagga chapmani*). They included animals from different zoos which gave a higher number of test subject for more reliable statistical analysis. Although, they had to take into account that differences in the results could be affected depending on zoo. Using animals from different zoos can possibly give a lot of error sources since there are different trainers and different enclosures. On the other hand, the results can be assumed to apply to other zoos outside of the study as well, compared to if only one zoo and a few trainers had been used.

6.6. Pros and cons of the methods of the current study

The method in the current study in measuring behaviours during training and advancing through a training plan was inadequate for getting sufficient data to test statistically. Since the trainer also performed daily routines, a lot of Lip Licking was probably not observed due to this. Hulkens Lip Licking was not included in the results since his position high up in a tree right above the training platform made it hard to see and count the behaviour. The approaching times may not always have been exact and due to the trainer being concentrated on the training, a lot of behaviours performed during training was also missed or had to be left out completely due to inconsistent observations. The number of study subjects would also preferably have been higher as well as the total number of training sessions.

An advantage of the study design was that there was only one person in the enclosure during training. Thus, letting a positive HAR form between the trainer and the animal without interruptions or distractions from other people, apart from onlookers outside of the enclosure.

An advantage of also including a literature study was that it gave answers and insight into questions relevant for the case study, such as HAR, control and motivation. A pure literature study would have been able to more deeply analyze the concept of IM in animals. The literature part of the study may have been biased towards a positive view of the effects training has on animal welfare. Although, no articles have been excluded because of results. Rather, no articles that showed no positive effects from training were found during the search. References from articles were used to search further into the available literature. The authors of these articles may also have been biased to reference articles strengthening their thesis and belief.

6.7. Conclusions

In conclusion, I argue that training can enhance the HAR through creating a positive association between human and reward. Training can create a positive emotional state in animals since it activates SEEKING with a release of dopamine in the brain. Training allows the animal to control the situation (Westlund 2013). Control also creates positive emotions (Langbein *et al.*, 2009) associated with the training situation. Therefore, it is plausible that the training also can be of IM as well as extrinsic (reward-based) motivation and that one does not exclude the other. If a behaviour is reinforcing in itself and we incorporate that behaviour in the training program, performing that certain behaviour could be intrinsically motivated, thus creating positive emotions, even if it is also extrinsically rewarded. More research is needed on how to assess and measure IM in animals. Activities of IM in humans is linked to well-being (Panksepp, 2004) and if we can include IM behaviours in a training program, or

promote them through enrichment, this can have a positive effect on zoo animal and enhance zoo animal welfare.

7. Summary

Zoo animals are trained for a lot of different reasons. Training can be used to make checkups and other medical procedures less aversive for the animal. A lot of training is also performed for physical exercise and mental stimulation, especially in marine mammals such as dolphins and sea lions. The most common training method is Positive Reinforcement Training (PRT) which means that a correctly performed behaviour is rewarded. The reward is usually something food related. A clicker or a whistle is usually used to tell the animal when the correct behaviour is performed. The animal is taught to associate this signal with the food reward through classical conditioning, the same concept as in Pavlov´s dogs. When the whistle blows or the clicker clicks, the animal gets feed-back the very moment the correct behaviour is performed and is immediately aware of that the reward is coming. This signal is called a bridge stimulus.

Zookeepers work a lot with giving the animals enrichment that stimulates natural behaviours. These can for example be in the form of food that requires some work to reach, a scent the animal finds interesting or toys. It is possible that training also can have an enriching effect on animals, according to several studies. A successful enrichment should give the animal increased control over the environment. The feeling of control is linked to the possibility of making choices in the environment and to be able to affect the environment through behaviour. Training can be considered to give control to the animal in the aspect that it, first of all, involves the choice to train or not to train. The animals in the zoo are at all times free to leave the training situation or to decide not to train at all. Second, it also allows the animal to perform a behaviour that gives it something it wants.

Animals in a zoo environment daily encounters a lot of humans, both zookeepers and visitors. Through a lot of daily interactions, a relationship is formed between the animals and the zookeepers, a so called Human-Animal Relationship (HAR). If the animal sees the zookeepers as something positive or something negative is of importance for the animal welfare. If the relationship is negative, it can create stress. Through training, the zookeeper is associated with the rewarding situation and the HAR improves and gets more positive. It is possible that this positive association can be generalized to other zookeepers who do not train the animal and maybe it can also, to some extent, be generalized to visitors.

If the animal experiences the training as "fun" would of course also be good for the animal welfare. A lot of studies have been done in assessing positive emotions and anticipatory behaviours but not much has been done in relation to training. In humanities, the concept of Intrinsic Motivation" (IM) is frequently used and research include what tasks humans perform for fun. A behaviour performed through IM is rewarding in itself, as opposed to a behaviour that is performed to obtain food, get water or other behaviours required for survival. Play and movement is thought to have an intrinsically motivating factor in many animals. If behaviours that are seen during play can be included in training, it is possible that the animal experience satisfaction though performing them, even if they are also rewarded with positive reinforcement.

In the current study, a case study with two Red Pandas (*Ailurus Fulgens*) was also done. The Pandas were trained in getting weighed and to go into a transportation cage. The goal with

the training was also to see indicators of improved HAR, control or motivation. One Panda showed a lot of unwanted behaviours related to stress that decreased throughout the study and both pandas advanced in the training plan. If the behavioural change was caused by a better HAR, increased control or motivation is hard to answer.

The conclusions in the report is that positive reinforcement training can improve a HAR between animal and zookeepers. Training can also give the animal control in the sense that it allows the animal to make a choice in training or not training and to control the coming of the reward by performing a behaviour. In this sense, from the animal's point of view, who is training who might not be as clear as for the human. The animal learns to perform a behaviour and the human gives it a reward for that. In this sense, according to the animal, it might be the animal training the human. It is also possible that performing movement or play behaviours also can be experienced as "fun". If the Red Pandas experienced a better relationship with the trainer, more control or increased motivation is impossible to say. There was a behavioural change in the animals and both going up on a scale or getting into a transportation cage will be less stressful in the future.

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10. Appendices

Appendix 1. Ethogram

Unwanted Behaviours	*Any of the following occuring during training*	**Aggression**	Any of the following occuring before or during training
Hissing	*Blowing sound through nose*	Bites/Threatens to bite trainer	Biting or trying to bite trainer (not by mistake when taking the food).
Treading	*Stationary weighing back and forth treading with front paws*	Attacking or threatens with claws	Using claws to injure or threaten to use claws on trainer.
Stepping to side	*Walking in any direction. than spinning around but not leaving, attention still on training to differ from walking away or turns away*	Defense Position	On hindlegs in defense position.
Spinning around	*Spinning around facing away from the trainer and back*	**Behaviours before training**	
Lifting one paw	*Lifting one front paw otherwise standing still*	Looking at trainer	Looking at the trainer, only counted when animal does not train.
Grasping Target	*Grasping for target with paw*	Licking lips	Moving tongue outside mouth
Grasping Food Arm	*Grasping for the trainers right arm used to bring the reward*	Grooming	Licking itself
Chewing on target	*Chewing on any part of the target stick.*	**Avoidance**	*Any of the following occuring before (when I can tell the animal is aware of my prescense) or during training*
Approaching time	*Time from the moment I can tell that the animal is aware of my presence until it starts walking towards me. If I can tell that the panda is aware of me before I enter the gate - the clock starts from*	Walks away during training Leaves	*Walks away further than approximately 1 meters during training, might be adjusted* *Leaves during training and does not come back for that training session.*

	when I enter the enclosure		
Others		Walks away / hide before training.	*Any of these behaviours occurring from the moment I can tell that the animal is aware of my presence until training starts*
Scared of Scale/Cage	*Animal reacts fearfully to scale or cage*		
Did not train at all	*Did not come to train*		
Left did not come back	*Left durin training and did not come back for that training session*		

Before training always defined as: From the moment walk into the enclosure.

After training is defined as after the signal for "Training over" is given.

For a behaviour to be considered as a new behaviour it needs to be apparently disrupted by another behaviour or a pause for more than approx 10 seconds.

Appendix II. Protocol

Training Session: Date: Time:
Weather:

Avoidance	Svea	Hulken	**Aggression**	Svea	Hulken
Walks away d.t.			Bite/threatens to bite		
Walks away/hide b.t.			Threatening on hind legs		
Turns away/ignores d .t			Agonistic approach		
Leaves d.t.			**Behaviours before training**		
Unwanted behaviours Hulken			Approaching time		

Hissing			Looking at trainer		
Treading			Licking lips		
Lifting one foot			Grooming		
Walking to side			**Other**		
Spinning around			Scared of scale/cage		
Grasping target or target arm			Did not train at all		
Grasping food arm			Left did not come back		
Chews on target					

Step reached:	Svea	Hulken		
Feeling during training. Calm, scared, stressing etc.				

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