# The influence of stockmanship on the behaviour of black rhinoceros (*Diceros bicornis*).

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**Abstract**

Stockmanship style (the nature of the keepers' interactions with their animals) has been found to significantly alter the productivity and behaviour of domestic species. In previous studies positive human behaviour around domesticated animals has been positively correlated with productivity while the converse is true of negative human behaviour. An investigation into the stockmanship style of keepers and/or the influence this may have on exotic animals has not previously been undertaken to our knowledge.

In this study the impact of stockmanship was investigated by studying the behavioural response of black rhinos to environmental cues given by the keepers. For example, the keepers entering the inside enclosure area was a cue, and the rhinos' response was to move outside. Keeper-rhino observations were used to identify cues and any escalations thereof; if the cue did not lead to the appropriate behavioural response the cue maybe repeated or modified, for example, rattling food or shouting. Data were collected during keeper-rhino interactions, including the rhinos' latency to perform the appropriate behaviour after the keeper preformed the cue. The performance of each cue by each keeper was observed five times.

Preliminary results collected from a pair (1.1) of partially trained black rhinoceros housed at Paignton Zoo, Devon, indicated a significant difference between the latency of each rhino to respond to the keepers' cues (Anova: $F_{(2,3)}=16.24$, $p<0.001$). There was also a significant difference between the cues provided by the keepers and the rhino's latency to perform the appropriate behaviour ($F_{(2,3)}=41.14$, $p<0.001$). The latency to perform the appropriate behaviour was significantly positively correlated with cue (Pearson's correlation, $r=0.33$, $N=123$; $p<0.001$). This suggests that the keepers' escalated the cue when the rhinos did not express the appropriate behaviour rapidly after the demonstration of the cue.

## Introduction

*Stockmanship*

Stockmanship is a term used to describe how keepers behave towards their animals. Hemsworth (2003) and Lensink *et al.* (2000, 2001) stated that people who describe animals in a positive way and generally have a positive attitude towards them also interact with them in a positive way and can be considered good stockmen. A good stockman will also attend to

their animals' requirements, by providing them with the appropriate environment to improve their way of life (Boivin *et al.*, 2003). This includes the provision of appropriate housing and husbandry.

Stockmanship style is made-up of attitude, personality traits, self esteem and job satisfaction, all of which can influence the animals' behaviour, welfare and production level. Studies have shown that negative human interactions with pigs can lead to a decrease in growth rate and reproduction (Coleman *et al.*, 1996, 2000). Hemsworth *et al.* (2000) showed that negative human interactions with dairy cows decreased milk quality (protein and fat) and yield, and also increased their level of stress measured by cortisol levels. A recent study by Baker (2004) showed that positive human interactions with chimpanzee's decreased their expression of abnormal behaviours, such as regurgitation and re-ingestion, and increased their level of activity.

*Training*

Training is goal-orientated learning, where humans determine what they want the animals to learn. Training can be separated into four different types; habituation, classical conditioning; complex learning and operant conditioning. Operant conditioning is the form most training in zoos takes and can be defined as learning to anticipate future events on the basis of past experience with the consequences of ones own behaviour (Laule *et al.*, 2003). There are two basic types of operant conditioning, which use positive or negative reinforcement. In positive reinforcement a behaviour is repeated in order to gain the reinforcement (e.g. providing the right response to a command leads to a reward, reward is the reinforcement), whereas with negative reinforcement a behaviour is repeated in order to prevent the reinforcement occurring (e.g. when the right behaviour is performed the keepers' shouting stops, shouting is the reinforcement). Both positive and negative reinforcement increases the chance that a required behaviour will occur.

Stockmanship and training will interact to determine the relationship of animals with their keepers therefore this study compared black rhinoceros at different zoos with different extents of training incorporated in their husbandry regimes. This paper only presents results from Paignton Zoo where the rhinos are classified as partially trained.

## Aim

The aim of this study was to investigate differences in stockmanship style between the keepers and the extent to which these may affect the behaviour of the rhinos. For the first part of the study at Paignton Zoo we investigated the hypothesis that good stockmanship results in a positive response from black rhinos and a low latency for performing the desired behaviour following certain cues.

## Methods

*Subjects*

Paignton zoo is home for two black rhinoceros. The male, Kingo was 21 years old at the time of study and had arrived at Paignton from Port Lympne, UK two years previously. Sita, the female was 13 years old at the time of study and had arrived two years previously from Berlin, Germany. Both rhinos were both classified as partially trained as they followed certain cues and commands but had not undertaken a formal training programme.

*Housing and Husbandry*

The rhino enclosure at Paignton Zoo comprises an indoor house with three interlinking rooms, two outdoor hardstands and a grass paddock and is approximately 0.5Ha in total size (fig. 1). The lighting indoors is supplied from artificial spotlights, UV lamps and windows, which allow natural light in from outside. The floor is concrete with under-floor heating and padded waterproof mats for extra comfort when they lie on the floor. There is a water trough, salt lick and wooden posts along the walls to scratch on. Outside each rhino has their own outdoor hardstand which leads into a large grassed area, access to the latter is rotated between both animals. Both the hardstand and the grass paddock are surrounded by foliage that both rhino regularly foraged through to find and eat the more palatable undergrowth. The outdoor enclosure also wooden walls for scratching, as well as large boulders, which separate the lower grassed area. In one of these areas is a mud pool, which in summer periods is regularly filled for them to play in.

During the study the rhino keepers arrived at the rhino house at around 0800hrs entering via the keepers' mess room where they spent much of their time. This was also close to Kingo's indoor area. The rhino keepers usually left the rhino house to tend to other animals on their section returning at about 1015hrs for tea break, at which time they were in the ness room listening to the radio and/or talking. The rhinos were let outside, usually around 1015 to 1100hrs. While the rhinos were outside, on the hard stand and/or in the paddock the indoor enclosures were cleaned, washed, dried and food was provided. The rhinos' diet included various fruit, vegetables and dried food (Table 1). Each day the keepers also provided fresh browse, which acts as food and environmental enrichment. The rhinos were then let back inside and usually remained there for the rest of the day.

For the majority of the time the rhinos were kept separate but were put together occasionally for breeding when the female came into oestrous.

Figure 1 Aerial plan of the rhino enclosure at Paignton zoo.

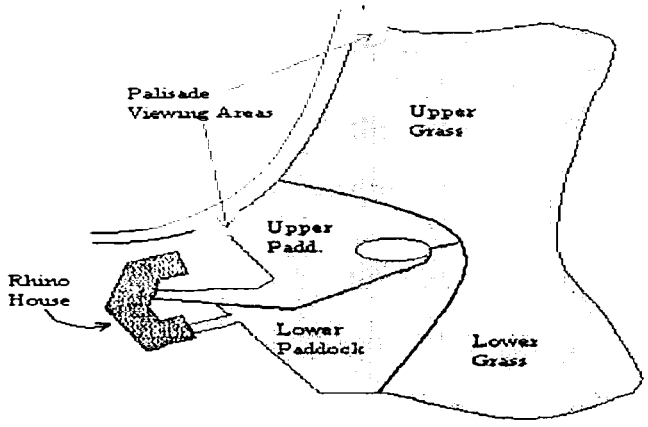



Table 1a. Daily provisioned diet for black rhinos at Paignton Zoo.

| Type of food | Kingo | Sita |
|---|---|---|
| Apple | 12 | 8 |
| Banana | 6 | 4 |
| Celery | 2 | 2 |
| Carrot | 18 | 12 |
| Bread | 1 loaf | 1 loaf |
| Potatoes | 18 | 12 |
| Lettuce | 2 | 2 |
| Acacia Pellet | 2kg | 1½ kg |
| Rhino Pellet | 1kg | ¾ kg |
| Browser Pellet | 1kg | ¾ kg |
| Hay | ¼ Bale | ¼ Bale |
| Lucerne | 2/3 Bale | 1/3 Bale |
| Browse (see table 1b) | 1-2 large branches | 1-2 large branches |
| Extra items (see table 1b) | 60% of each item | 40% of each item |

Table 1b. Browse and occasional food items provided for black rhinos at Paignton Zoo.

| Browse | Extra food items (usually four items per day) |
|---|---|
| Ash | Celeriac |
| Oak | Beetroot |
| Willow | Parsnips |
| Hazel | Swede |
| Elm | Turnip |
| Sycamore | Sweetcorn |
| Hawthorn | Sweet Potato |
| Lime | Mooli |
| Beech | Melon |

*Preliminary Study*

A preliminary study was completed to identify the most common cues/commands delivered by the keepers and to identify periods of the day when the majority of keeper-rhino interactions occur. This was achieved by recording the rhino-keeper interactions using ad-libitum sampling

between 0800 and 1700 hrs. All the cues and/or commands given by the keepers and the rhinos' respective behaviours were recorded. Each keeper, (n=3), was followed for five days. Keepers gave the majority of commands and cues every day around 10:15 - 11:00 and 12:15 – 13.15. Kingo had five cues/commands and Sita had three cues/commands, this was due to the different enclosures between the two rhinos (Table 2). Only those cues/commands common to both rhinos were used in the full study.

*Data collection*

Keeper – rhino interactions were observed for 2hrs daily. Each keeper (n=3) was observed interacting with each rhino (n=2) five times Four variables were recorded:

- The rhinos' latency to perform the appropriate behaviour from cue/command.
- The escalation of each command/cue (to what extent the cue/command changed if the appropriate response was not given by the rhino, table 3).
- The keepers interactions with the rhinos as **event** behaviours (e.g. patting the rhinos' head)
- The keeper's attitude as **state** behaviours (e.g. general happy mood, singing along to radio).

Table 2. The cues/commands provided by the keepers and the behavioural response expected from black rhinos at Paignton Zoo.

| Keepers command for behaviour | Kingo's behaviour/movement | Sita's behaviour/movement |
|---|---|---|
| Keeper enters the keepers' area | Acknowledgement by lifting up of head | Not applicable |
| Call name | Acknowledgement, movement of head | Acknowledgement, movement of head |
| Keeper coaxes rhino to the middle enclosure | Standing up from lying position and movement to middle enclosure | Not applicable |
| Keeper coaxes rhino to the outdoor enclosure | Moving from middle enclosure to outdoor enclosure | Moving from indoor to outdoor enclosure |
| Entering indoor enclosure | Movement from outdoor to indoor enclosure | Movement from outdoor to indoor enclosure |

*Stockmanship evaluation*

The keepers' stockmanship was measured in two ways: first, by noting their state and event behaviours (see above); secondly, the keepers were asked to complete a personality questionnaire known as 'The Big Five' (Table 4). The questionnaire was also filled in by five colleagues of the keepers to increase accuracy.

*Analysis*

A fully crossed three-way ANOVA was performed to investigate the effects of rhino, keeper and cue on the latency to perform the correct behaviour. A Pearson correlation was used to

investigate the relationship between latency to perform the behaviour and escalation of the cue.

Table 3. Levels of escalation of commands and/or cues given by keepers to elicit behaviours performed by rhinos with the numbered command/cue in brackets when the escalation is used most.

| Command/Cue | Definition | Impact | Escalation level |
|---|---|---|---|
| "Hello you" "Kingo/Sita, come on" (2, 3, 4, 5) | Spoken in normal voice | Neutral | 0 |
| Opening gate (3, 4) | Gate opened allowing movement to outdoor enclosures | Neutral | 0 |
| Repetition of previous command (3, 4, 5) | Same command spoken in normal voice | Neutral | (+)1 |
| "Come on Kingo/Sita" "Come on Trouble" (3, 4, 5) | Spoken in softer, "baby-type" voice | Positive | (+)2 |
| "Good boy Kingo" "Good girl Sita" (3, 4, 5) | Spoken in soft and rewarding voice | Positive | (+)3 |
| Rattling food (3.) | Shaking a full food bucket to tempt rhinos | Positive | (+)3 |
| Coaxing, throwing down a food trail (3, 4) | Throwing food in front of the rhinos for them to follow to the outdoor enclosure | Positive | (+)4 |
| Stroking/patting (1, 3, 4) | Soft keeper contact of sensitive areas such as muzzle or behind ears | Positive | (+)5 |
| Food treats given (5) | Extra or new/different food given at certain time as a reward | Positive | (+)6 |
| "Kingo, come on boy" "Sita, come on" (3, 4, 5) | Command in stronger tone of voice | Negative | (-)1 |
| Opening and Closing gate (3) | Half closing metal gate and then opening again | Negative | (-)2 |
| Running water (3) | Turning on hose-pipe or tap | Negative | (-)3 |
| Scaring and shouting (3) | Keepers slapping against metal gate whilst shouting name | Negative | (-)4 |

Table 4. The Big Five personality traits.

| Factor | Characteristic |
|---|---|
| Openness | Imaginative against down to earth; preference for variety rather than routine; Independent versus conforming. |
| Conscientiousness | Well organised versus disorganised; careful versus careless, self-disciplined versus weak willed. |
| Extraversion | Sociable versus retiring, fun loving versus sober, affectionate versus reserved. |
| Agreeableness | Soft-hearted versus ruthless, trusting versus suspicious, helpful versus uncooperative. |
| Neuroticism | Worried versus calm, insecure versus secure, self-pitying versus self-satisfied. |

## Results

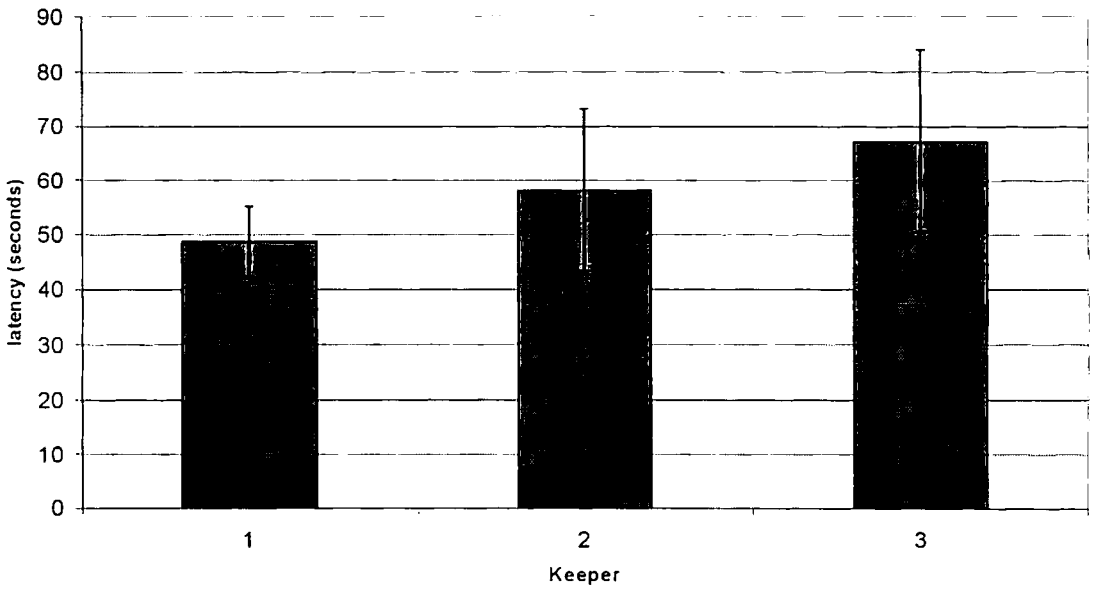
*Latency to perform correct behaviour*

Latency to perform the correct behaviour was significantly affected by cue, rhino and the cue x rhino interaction (table 5). The cue for going outside tended have the longest latency and this was probably because this command required the greatest amount of movement from the rhinos. Although there were differences in the latency to perform the correct behaviour for each keeper these were not significant (fig.2).

Table 5 Results of a three way ANOVA to investigate the effects of cue, keeper and rhino on the latency to perform the correct behaviour.

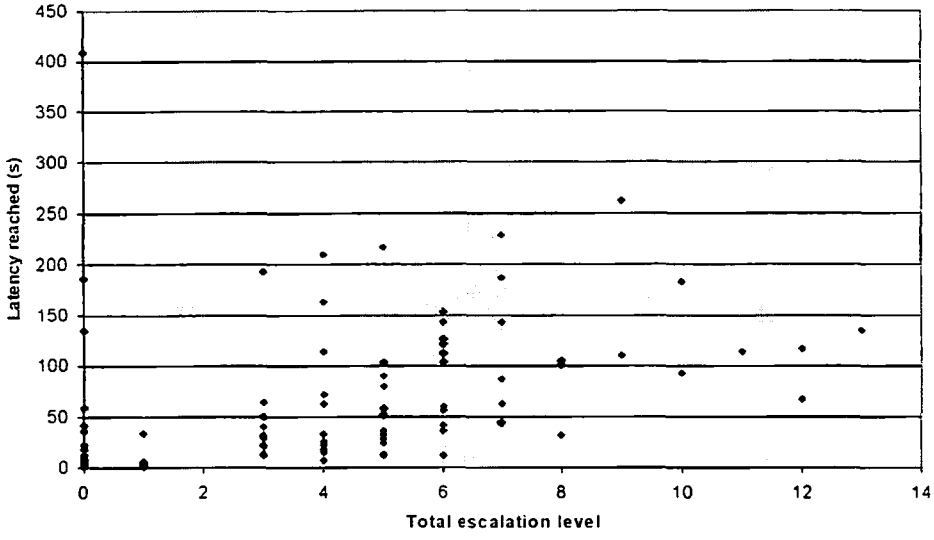
| Source | Df | F Value | Sig. |
|---|---|---|---|
| Cue | 2 | 41.14 | 0.000 |
| Keeper | 2 | 1.87 | 0.161 |
| Rhino | 1 | 16.24 | 0.000 |
| Cue*Keeper | 4 | 1.91 | 0.117 |
| Cue*Rhino | 2 | 15.7 | 0.000 |
| Keeper*Rhino | 2 | 1.72 | 0.185 |

Figure 2. Mean (± S.E.) latency of two black rhinos to perform the correct behaviour in response to cues from three different keepers.



There was a significant positive correlation between escalation and latency to perform the correct behaviour ($r = 0.33$, $p<0.001$, fig. 3). This relationship was expected because if the rhino did not perform the required behaviour then the keeper would escalate the command.

Figure 3. Correlation between the latency of two black rhinos to perform the correct behaviour and the escalation level reached by the keepers




*Stockmanship*

From a total of five personality traits, four (O.C.E.N) did not differ significantly between the three keepers (one way ANOVA). The trait 'Agreeableness' did differ significantly between the keepers ($F_{[2]} = 7.61$, $p < 0.05$). All keepers had positive state behaviours for 80% or more or the time. Keeper 2 was positive for 100% of the time but keepers 1 and 3 occasionally behaved in a negative manner whilst in the vicinity of the rhinos (fig. 4). None of the three keepers performed any negative event behaviours towards the rhinos (fig. 5). However, Kingo received more positive events than Sita, probably because his indoor accommodation is closer to the keepers' mess area.

Figure 4. The mean number of positive and negative states of each keeper whilst working around black rhinos at Paignton Zoo.

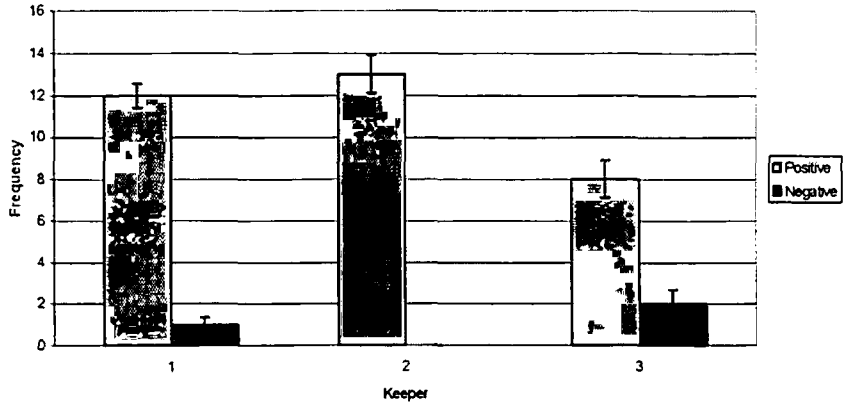
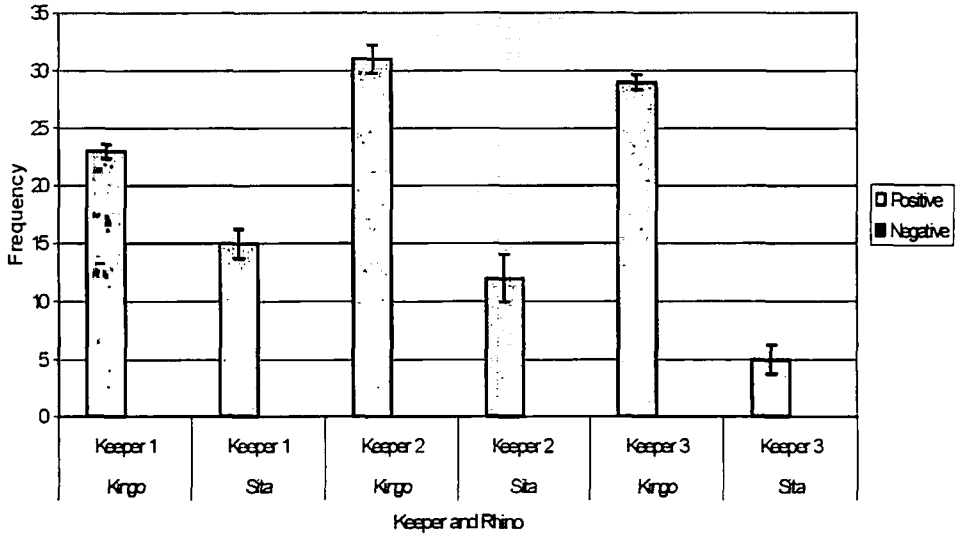


Figure 5. The number of positive and negative event behaviours performed by three keepers to two black rhinos at Paignton Zoo Environmental Park




## Conclusions

No substantial differences were found between the stockmanship styles of the keepers at Paignton Zoo. However, further data collected at Chester Zoo did highlight differences between the keepers suggesting that this we have developed an appropriate method to evaluate stockmanship in zoos.

The response of the black rhinos at Paignton Zoo to the three different keepers was not significantly different, which is expected since the stockmanship styles of the keepers were not different. This indicates good stockmanship (according to the definition of Hemsworth *et al.*, 2000).

The overall latency to perform a required behaviour at Paignton Zoo indicating that good stockmanship results in a positive response and a low latency for performing certain behaviours.

## Acknowledgements

We would like to thank the following people:

- The members of the science department at Paignton Zoo for help and advice.
- The keepers for their cooperation with the assessments.
- The curator Neil Bemment for allowing the project to take place.

And a special thank you to UFAW for a vacation scholarship awarded to Sam Ward to allow continuation of the study at other institutions.

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