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Can Enrichment Make Brazilian Tapir Spend More Time on View to the Public?

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One common visitor complaint in zoos is that the nonhuman animals are not visible. This problem needs to be resolved without compromising the animals' welfare; environmental enrichment could solve the problem. This study investigated whether enrichment would increase public exposure time of lowland tapir (*Tapirus terrestris*) in the Belo Horizonte Zoo in Minas Gerais, Brazil. Observations were made before (62 hr) and during (62 hr) the introduction of enrichment using focal animal sampling with instantaneous recording of behavior. The 5 enrichment items were a bamboo fence covered in vines, logs, a sandbox, dry leaves, and bamboo bushes. Before the enrichments were applied, the tapir was not visible to the public for more than 85% of the time. In addition, during the analysis of the enrichment treatment, other variables were considered—such as weekday, time of day, and weather conditions—which could influence the animals' interaction with the enrichments. The enrichments increased and decreased the expression of some behaviors; however, public viewing time of the animals did not increase. Thus, the enrichment applied was not strong enough to overcome the animals' crepuscular behavior.

Keywords: *animal welfare, crepuscular animals, environmental enrichment,* Tapirus terrestris

The satisfaction of zoo visitors viewing nonhuman animals is positively related to the zoo's activity, size, proximity, visibility, and free-ranging environment (Bitgood, Patterson, & Benefield, 1988). Because observing more active animals is more desirable, one of the most frequent complaints that zoos receive is that the animals are not visible or are inactive (Anderson, Kelling, Pressley-Keough, Bloomsmith, & Maple, 2003).

This situation is most common when housing nocturnal species in enclosures that do not have the light–dark cycle inverted. Thus, the inhabitants of such enclosures are sleeping or resting when the zoo visitors come to observe them. Night houses or night zoos are of course

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one possible solution to this problem for small mammals (Morris, 1962), but in the case of large mammal species, such options are not always viable due to the expense of the housing or the logistical problems of operating a zoo at night.

To resolve this problem, zoos have turned to a number of techniques such as locking the animals on exhibit during visitation hours, training animals to go outside on command, and using environmental enrichment (Owen, Swaisgood, Czekala, & Lindburg, 2005). Ross (2006) showed that polar bears (*Ursus maritimus*) who are locked on exhibit compared with those who can choose to go off exhibit express more abnormal behavior (see also Law, MacDonald, & Reid, 1997, for a review regarding felids). However, reversing the animals' activity cycle for visitors' satisfaction affects the circadian rhythms of the animals. This may negatively affect the brains, behaviors, and physiologies of the animals, which can result in a decrease in cognitive flexibility and an alteration in emotionality (Karatsoreos, Bhagat, Bloss, Morrison, & McEwen, 2011). This solution highlights the problem that zoos often face—they must consider the needs of their visitors—but it is most important that they safeguard the well being of their animals.

While public education programs can reduce the complaints of visitors about hidden or inactive animals, the interaction of visitors and animals is a complicated conflict between the goals of entertainment and welfare (Fernandez, Tamborski, Pickers, & Timberlake, 2009). Animals can be trained through operant conditioning techniques to parade in front of the public to obtain food rewards, but again, we can question how this affects the animals' well being (Tarou & Bashaw, 2007). Poorly planned and implemented training can result in confused and frustrated animals, because it cannot offer the animals the full scope of opportunity, control, and reinforcement available in an enrichment program (Laule & Desmond, 1998). This then leaves us with the use of environmental enrichment—a technique that, when properly applied, gives the animals choices and control over their environments (Young, 2003).

Ungulates include some of the most widely kept captive species; however, they can be underrepresented in zoo animal behavior and welfare research, as is highlighted by the few scientific studies conducted on them (Rose & Robert, 2013).

In this study, environmental enrichment was used to tempt the Brazilian tapir (*Tapirus terrestris*) in a zoo to stay on public view for longer periods. According to Medici, Nunes, Mangini, and Ferreira (2001), this species in the wild shows crepuscular activity cycles and is sometimes viewed during the day, especially in areas of vegetation cover (e.g., in forests). Therefore, an addition of visual barriers could reduce the amount of stimulation received from the public and thereby provide a sense of security for animals (Blaney & Wells, 2004; Fabregas, Guillen-Salazar, & Garces-Narro, 2012). Opportunities to forage would create a more stimulating environment (Rose & Robert, 2013; Young, 2003), thereby motivating the animals to spend more time allowing the visitors to view them.

MATERIALS AND METHODS

Study Place, Nonhuman Animals, Housing, and Maintenance

This study was conducted from June 2011 to March 2012 in the Belo Horizonte Zoo in Minas Gerais, Brazil (19°51′41.03″S, 44°0′27.73″W). The study animal was a captive-born, 5-year-old, male tapir (*T. terrestris*). The animal was on exhibit to visitors and shared an area of

780 m^2 with two capybaras (*Hydrochoerus hydrochaeris*). The enclosure had bare soil, trees, a pond, and off-exhibit housing, which contained a food trough and a drinker. Twice a day (morning and afternoon), the animal was fed hay and vegetables.

Ethogram

Behavioral recordings were taken by the same researcher and took place in front of the enclosure in a position that provided an uninterrupted view of the animal in all areas of the enclosure. A 36-day pilot study and acclimatization period, from July 2011 to August 2011, were instigated before the main data collection period commenced. In this period, the individual was observed using the ad-libitum method (36 hr in 1-hr sessions; Martin & Bateson, 2007) to create a list of commonly observed behavioral activities for an ethogram (Table 1).

Observations before and during a 31-day period. The observations before the introduction of the enrichment were conducted during 31 days, from December 2011 to January 2012, from 07:00 hr to 17:00 hr (when the zoo was open) for 2 consecutive hours daily using animal focal sampling (Martin & Bateson, 2007) with instantaneous sampling intervals of 1 min. The observations with the enrichment items were conducted during a 36-day period from January 2012 to March 2012, using the same methodology as previously described.

The enrichment items. Five enrichment items were chosen based on the animal's common behaviors observed during the pilot study and from bibliographic references about the natural history of the species (Holden, Yanuar, & Martyr, 2003; Lizcano & Cavalier, 2000; Medici et al., 2001; Williams, 1984). Mainly physical enrichment structures were used because these items could be used in the animal's enclosure after the end of the project. The main purpose of the introduction of the enrichment was to create a visual barrier and to stimulate foraging behavior.

Rose and Robert (2013) showed that sitatunga (*Tragelaphus spekii*) prefer to stay in tall grass areas rather than in short grass areas, so the provision of more tall grass and reedy areas

TABLE 1
Ethogram of Lowland Tapir (*Tapirus terrestris*) Behavior at the Belo Horizonte Zoo, Brazil

Behavior	*Description*
Standing	Tapir was standing in an alert posture.
Inactive	Tapir was resting with eyes open or closed.
Moving	Tapir walked in the enclosure.
Maintenance behavior	Tapir performed activities for the maintenance of his body such as scratching.
Foraging	Tapir walked, while searching and ingesting food items from the ground.
Eating	Tapir was ingesting food.
Vocalizing	Tapir produced sounds.
Flehmen	Tapir curled his upper lip, which facilitated the transfer of pheromones and other scents into the vomeronasal organ.
Swimming	Tapir was inside the pool.
Enrichment interaction	Tapir was interacting with the enrichments.
Not visible	Tapir was out of sight.

in exhibits would be beneficial to behavioral expression, sitatunga welfare, and the development of a more interesting and relevant exhibit for the visitors.

Our enrichment items consisted of a vine-covered bamboo fence, tree logs, a sandbox, mounds of dry leaves, and bamboo bushes. Each one of the enrichments was placed in the enclosure one at a time; by the end of 5 weeks, all enrichment items were available to the tapir.

Data Analysis

A Kolmogorov-Smirnov test showed that our data did not meet the requirements for parametric statistics; therefore, nonparametric statistical tests such as Wilcoxon and Kruskal-Wallis were used (in the software Minitab 12.2). Treatment responses before or during enrichment were tested with Wilcoxon tests. Weekday, time of day, and weather were also analyzed in relation to enrichment interaction with Kruskal-Wallis tests and post-hoc Tukey tests, with a 95% confidence level, for those that presented significant differences. Weekdays were classified from Monday to Sunday, time of day was classified from 07:00 hr to 17:00 hr, and weather was classified as sunny, partially cloudy, or sky completely cloudy and rainy.

RESULTS

Influence of Enrichment on the Tapir's Public-Viewing Time

The use of enrichment did not increase the exposure time of the tapir to the public ($p = .12$, 85.09% vs. 87.97%). However, the frequency of some other behaviors changed during enrichment.

Influence of Enrichment on the Behavior of the Tapir

Movement (1.47% vs. 7.20%, $W = 510.00$, $p < .05$) and interaction with enrichment (0.00% vs. 1.68%, $W = 0.00$, $p < .05$) were significantly more frequently expressed during enrichment. Inactive (5.36% vs. 0.19%, $W = 272.00$, $p < .05$) and standing (6.40% vs. 1.02 %, $W = 1{,}094.00$, $p < .05$) were significantly less expressed during the enrichment phase. Foraging, feeding, maintenance behavior, vocalizing, flehmen, and swimming showed no significant differences between treatments ($p > .05$ in all cases).

Influence of Weekday, Time of Day, and Weather on the Tapir's Interaction With Enrichment Items

The variables of weekday, time, and weather had a significant influence on the tapir's interaction with enrichment items (Table 2). For weekdays, interaction was greatest on Thursdays and Mondays (Thursday > Monday > Wednesday > Tuesday > Friday = Saturday = Sunday; $H = 25.74$, $df = 6$, $p < .05$ and $p < .05$ in all post-hoc comparisons). The greatest expression of behavior was between 08:00 hr and 09:00 hr (09:00 hr > 08:00 hr > all other hours, $H = 14.32$, $df = 10$, $p < .05$ and $p < .05$ in all post-hoc comparisons). This behavior was most

TABLE 2
Descriptive Statistics for Weekday, Climate, and Time of Day for Interaction With Enrichment Items by Brazilian Tapir at the Belo Horizonte Zoo, Brazil

Factor	*N*	*Mean %*	*SD*
Weekday			
Monday	147	2.44	13.15
Tuesday	44	3.38	11.12
Wednesday	112	1.02	5.07
Thursday	107	0.00	0.00
Friday	97	0.00	0.00
Saturday	122	0.00	0.00
Sunday	103	0.00	0.00
Weather			
Sunny	315	0.40	4.35
Partially cloudy	128	0.58	4.37
Cloudy	138	3.03	13.84
Raining	151	0.00	0.00
Time			
07:00 hr	56	0.71	5.94
08:00 hr	103	0.77	6.95
09:00 hr	98	3.40	15.08
10:00 hr	89	0.22	2.12
11:00 hr	55	0.00	0.00
12:00 hr	54	0.00	0.00
13:00 hr	78	0.89	5.62
14:00 hr	83	0.94	6.28
15:00 hr	75	0.00	0.00
16:00 hr	35	0.00	0.00
17:00 hr	6	0.00	0.00

frequently expressed on cloudy days and least frequently on rainy days (climatic conditions: cloudy > partially cloudy > sunny > rainy; $H = 15.80$, $df = 3$, $p < .05$ and $p < .05$ in all post-hoc comparisons).

DISCUSSION

Using physical enrichment items, an attempt was made to increase the activity level of a tapir by making his enclosure more like the natural environment. However, this did not result in increased time in which the animal was visible to the visitors. This result can be explained by the species' crepuscular behavior (Medici et al., 2001). Studies of the genus *Tapirus* show that all four species exhibit behaviors preferentially between the first night-time hours (18:00 hr to 20:00 hr) and at dawn (05:00 hr to 07:00 hr; Holden et al., 2003; Lizcano & Cavalier, 2000; Medici et al., 2001; Williams, 1984). This predominant crepuscular behavior may be related

to avoidance of human activity (e.g., hunting) or to avoidance of the hottest hours of the day and predators (Eisenberg & Redford, 1999; Foerster & Vaughan, 2002; Williams, 1984).

The evaluation of the influence of days of the week on the expression of the behavior interaction with the enrichment revealed that on Fridays, Saturdays, and Sundays, the tapir decreased the amount of interaction. On weekends, the number of visitors was higher, which resulted in increased noise (Quadros, 2008). The presence of visitors has been associated with changes in activity patterns and locomotion of mammals at the Belo Horizonte Zoo in Brazil (Quadros, 2008). Mallapur and Chellam (2002) observed that Indian leopards (*Panthera pardus*), in four different Indian zoos, were less active in the presence of visitors in contrast to days that the zoos were closed to visitors. Mahler (1984) noted that tapirs from the Audubon Park and Zoological Garden spent less time sleeping and increased their expression of other behaviors, such as foraging, when the zoo was closed. Thus, the data obtained in this study corroborate those of Mahler and Mallapur and Chellam, indicating an inverse relationship between (increased) activity level of the animals and the days of greater public presence.

Most interactions with enrichment occurred before 10:00 hr. This trend has been seen in the black rhinoceros (*Diceros bicornis*) as a strategy to avoid the hottest hours of the day (Hillman-Smith & Grove, 1994). The main effect of climate on the interaction with enrichment was that it not to occur during rain.

One solution to the problem of public viewing would be to place cameras on the animal's enclosure to record the animal's activity and interaction with enrichment items at night and then show it to the public on a viewing screen. Many zoos operate web cameras that display videos of the animals at the zoo on websites, which are available to the public (Clay, Perdue, Gaalema, Dolins, & Bloomsmith, 2011). For example, the San Diego Zoo has live webcams of polar bears and other species, which allow the visitors to control the camera's position and to zoom.

Although different types of enrichments in this study were used, they were not enough to increase the public exposure time of the animal. It is likely that the tapir maintained his crepuscular habit and performed greater activity during the night and early morning, as described in the literature. The use of enrichments and suitable management for crepuscular animals could result in improved animal welfare, as well as visitor satisfaction with animals on display.

CONCLUSION

This study showed that the introduction of enrichment items did not increase visibility of the subject animal, indicating that this problem requires a different approach. There was a significant drop in enrichment-directed behavior during the weekends, which indicated a possible relationship with the increase in visitors.

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