

Research article

Zoo visitors' perceptions of chimpanzee welfare are not affected by the provision of artificial environmental enrichment devices in a naturalistic exhibit

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Abstract

Zoo-housed animals are provided with many temporary elements in their exhibit, such as environmental enrichment devices (EEDs), which may not match the aesthetic of their exhibit. Some zoos object to the use of artificial EEDs in naturalistic exhibits, but there has been little research into whether the appearance of these temporary elements influences visitors' perceptions. Therefore, we investigated visitors' opinions about a naturalistic chimpanzee exhibit at Lincoln Park Zoo when EEDs were provided to the chimpanzees (*Pan troglodytes*). We wished to determine whether exhibit naturalism was important to visitors; what their perceptions were of the chimpanzees' behaviour and emotions; what their thoughts were about the suitability of chimpanzees as pets; and whether these beliefs were affected by the type of EED in the chimpanzees' exhibit. Eight EEDs were chosen for this study: four that were naturalistic in appearance and four that were designed to elicit similar species-typical behaviours, but were artificial in appearance. Visitors' responses to the survey revealed that they generally believed that exhibit naturalism was important, and that the chimpanzee exhibit was naturalistic in appearance; they viewed the chimpanzees' behaviour and feelings positively; and they did not think chimpanzees made good pets. Visitors' responses to the survey questions did not differ whether artificial or naturalistic EEDs were provided in the exhibit. These results support previous research that zoo visitors are not affected by EED aesthetic in a naturalistic exhibit, perhaps because the naturalism of the exhibit supersedes any effect or because the EEDs represent such small elements within the exhibit.

Introduction

Over the decades, zoos have transitioned to housing animals in increasingly naturalistic environments in an effort to improve animal welfare and enhance visitor perceptions of the captive environment (Ogden et al. 1990; Coe 1992; Markowitz and Aday 1998; Stoinski et al. 2001; Davey et al. 2005; Ross et al. 2011). More naturalistic environments tend also to be more complex, which can have positive effects on animal behaviour. For example, complex environments can decrease stress and aggression, through increased and varied opportunities for exploration and retreat, and by stimulating other natural behaviours (Wilson 1982; Carlstead and Shepherdson 1994). The positive influences that naturalistic exhibits can have on visitor opinions and behaviours through increased engagement

and enhanced curiosity have also been widely studied (Price et al. 1994; Davey et al. 2005; Ross et al. 2012). For example, exhibit aesthetic was an important contributing factor in an improvement of visitors' attitudes towards zoo-housed apes reported following a major renovation that made the apes' exhibit more naturalistic (Lukas and Ross 2014). With potential benefits to both education and animal care efforts, an increasing number of zoos have aimed to increase the naturalism of existing and new animal exhibits.

While exhibit design defines the permanent elements of captive environments, visitors and animals also view and experience a myriad of temporary elements that appear in zoo exhibits, which may not always match the aesthetic of the exhibit. Such elements might include toys, touchscreen computers, feeders, foraging puzzles and other items broadly



Figure 1. The chimpanzee exhibit in the Regenstein Center for African Apes, Lincoln Park Zoo as viewed from the public area.

categorised as environmental enrichment devices (EEDs). EEDs are objects intended to elicit species-specific behavioural responses from animals as well as to extend foraging time and encourage problem-solving (Shepherdson 1998; Markowitz 2011; Young 2013). EEDs are constructed from a variety of materials and may range from being very artificial in appearance to being relatively naturalistic, which may in turn influence visitors' perception of those elements (Perdue et al. 2012). The degree to which these items appear naturalistic in appearance may depend on the materials they are constructed from, the nature of the device and the institutional policy about maintaining the naturalistic aesthetic of the overall environment on display to the public. Due to the observed importance of naturalistic exhibits (Ogden et al. 1990; Coe 1992; Markowitz and Aday 1998; Stoinski et al. 2001; Davey et al. 2005; Ross et al. 2011), zoos often aim for cohesion in the appearance of the exhibit and any temporary elements provided to the animals.

While some zoos object to the use of artificial elements within naturalistic-themed exhibits, there has been relatively little research addressing whether they detract from the appearance of the exhibit and negatively impact visitors' perceptions. To date, two studies have compared the impact of natural and artificial EEDs placed within animal exhibits on visitor perceptions. One

study compared four carnivore exhibits with varying levels of exhibit naturalism and used multiple types of artificial and natural EEDs. A total of 829 visitors were surveyed across conditions about their perception of naturalism in the exhibit, the effect of the EEDs on naturalism and behaviour of the carnivores, and general zoo animal well-being (McPhee et al. 1998). The other study focused on one naturalistic polar bear exhibit at a single zoo. Multiple types of naturalistic and artificial EEDs were presented in this exhibit to compare responses from 251 visitors who were asked open-ended questions about their opinion of the species, the zoo, the exhibit, and conservation (Kutska et al. 2009). Neither study reported an impact of the type of EED provided on visitor impressions of the animals' welfare, the exhibit's naturalism, or the zoo's conservation activities. The present study expanded on this previous research in two ways. First, we examined visitors' perceptions of exhibit naturalism and animal well-being without specifically directing visitors' attention to the EEDs in the exhibit. Second, we compared devices that were functionally equivalent, but that differed in their naturalistic appearance, with the expectation that devices across aesthetics would be used to the same degree by the animals and thus would not differentially attract the visitors' attention.

The overarching aim of this study was to contribute to knowledge about the exhibition of wild animals, with a specific focus on chimpanzees (*Pan troglodytes*), and potentially to inform future management and enrichment selection criteria in zoos. Chimpanzees were selected because previous studies have revealed that zoo visitors have more positive attitudes when observing chimpanzees in naturalistic zoo exhibits (Lukas and Ross 2014) and that seeing chimpanzees in anthropogenic settings reduces peoples' understanding of their endangered status (Ross et al. 2008). Furthermore, a study that digitally altered the environmental background of photographs in which a chimpanzee was displayed, demonstrated that when people were shown chimpanzees in human environments, such as an office, viewers tended to view them as appealing pets (Ross et al. 2011). Thus, the environment in which we view these endangered animals has the potential to influence our perceptions of their welfare, endangered status and unsuitability as pets. Our first objective was to determine whether exhibit naturalism was important to zoo visitors viewing chimpanzees in a naturalistic exhibit. Second, we sought to determine whether the appearance of EEDs (i.e. natural versus artificial) affected visitors' opinions of the naturalism of the exhibit or the chimpanzees' behaviour and emotions. Third, we wanted to investigate the impact of EED appearance on visitor opinions about the suitability of chimpanzees as pets.

Table 1. The eight EEDs presented to the six chimpanzees throughout this study showing the two different aesthetics (natural and artificial) for each of the four types. For the purpose of the study, naturalistic enrichment was defined as devices made primarily from organic material, although inconspicuous artificial materials such as hardware may have been utilised to secure or hang them. Artificial enrichment was defined as man-made devices that did not resemble natural items.

Enrichment type (number given in each session)	Description	Aesthetic	
		Natural	Artificial
Raisin logs (12)	An object with many holes drilled into the surface that could be filled with raisins (c. 15 cm long)	Wood	White cutting-board material
Shakers (6)	A hanging hollow tube filled with nuts that had one hole on the side where the nuts could be retrieved (c. 30 cm x 10 cm)	Bamboo	White PVC
Jelly balls (12)	A hollow sphere filled with sugar-free jelly with one hole from which the jelly could be retrieved (c. 10 cm in diameter)	Hollowed-out coconut shell	Red plastic ball
Forage tubes (12)	Tubes filled with peanut butter (c. 15 cm x 4 cm)	Bamboo	White PVC

Methods

Exhibit space

The Regenstein Center for African Apes at the Lincoln Park Zoo, Chicago, IL, has naturalistic exhibits housing both chimpanzees and gorillas (*Gorilla gorilla gorilla*). This study focused on one exhibit inhabited by six adult chimpanzees (two males and four females, average age 22 years) that included an outdoor yard and an indoor dayroom. The outdoor yard was composed of a natural grass substrate, living foliage, and a variety of climbing elements (trees, bamboo, and vines) that were artificially constructed but naturalistic in appearance. The indoor dayroom (Figure 1) was naturally lit with expansive windows, and included similar features as well as a deep-mulch substrate, as described by Lukas and Ross (2014).

Environmental enrichment devices (EEDs)

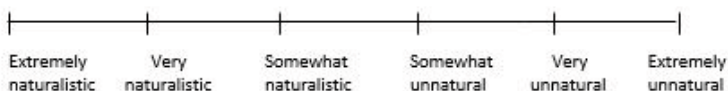
The chimpanzees in this study were routinely provided with one or more of 35 different EED types designed to solicit natural behaviour patterns. The provision of these EEDs was scheduled and documented on a monthly calendar to ensure variability in

their presentation. A subset of eight EEDs was chosen for this study: four EEDs that were naturalistic in appearance and four additional EEDs that served a similar function but were artificial in appearance (Table 1). Each EED was provided on four occasions in a counterbalanced manner. All EEDs offered in this study were previously familiar to the chimpanzees to prevent novelty effects influencing how the chimpanzees interacted with the devices. For this study, keepers placed EEDs in the exhibit space for the chimpanzees three days a week at approximately 1100, along with the chimpanzees’ prescribed group-fed morning diet (leafy greens, vegetables, and chow biscuits) and a nesting substrate (e.g. wood wool or grass hay) in accordance with their typical animal management routine. On the four days during the week when the study was not being conducted, keepers provided regularly-scheduled EEDs, which differed from the test items.

In each test session, keepers provided multiple identical EEDs that were scattered throughout the exhibit to avoid monopolisation and social competition. To balance the visual impact of each device, keepers provided the same number of EEDs in every test session. No other EEDs were provided during test sessions. The EEDs were pseudo-randomly delivered in a counterbalanced manner

Survey Questions

1. Using the scale below, how would you rate the ability of the exhibit to replicate the natural environment of the chimpanzees?



2. Using the scale below, please answer the following questions:



- A) It is important to me how natural the exhibit looks. _____
- B) These animals act the way I think they would in the wild. _____
- C) If I were a chimpanzee I would want to live here. _____
- D) Chimpanzees make good pets. _____
- E) I would recommend to my friends that they visit this exhibit _____

3. Using the scale below, please answer the following questions:



I think the chimpanzees look:

- Happy _____
- Bored _____
- Active _____
- Busy _____
- Relaxed _____
- Healthy _____

Figure 2. The survey instrument used in this study, demonstrating one possible order of questions.

across days and by aesthetic type so that the chimpanzees did not receive the same enrichment device more than once per week. For this study, keepers always provided EEDs in the chimpanzees' indoor exhibit space (408 m²), which offered optimal viewing opportunities from the public area where visitors were surveyed (Figure 1).

Visitor surveys

Visitor survey data were collected at the Regenstien Center for African Apes during two study periods in order to cover multiple seasons: October to December 2014 and July to October 2015. Trained zoo staff and research interns approached adult visitors standing directly in front of the chimpanzees' indoor exhibit during the first 10 minutes following the provision of the EEDs and asked them if they were willing to participate in the survey. Throughout the session a keeper also noted the number of chimpanzees interacting with the EEDs in the exhibit. On average, 10 surveys a session were collected (range: 2–18). Visitors who agreed to participate in the study were asked three questions in randomised order and were prompted to respond along a 6-point Likert scale (Figure 2). Participants were not directly asked about enrichment, nor did they have the EEDs pointed out to them as they were surveyed, but they were likely to have seen the EEDs from the public area.

Analysis

The data were not normally distributed so non-parametric statistics were used throughout. Comparisons across the four EED types were conducted in R (R Core Team 2015) with Kruskal-Wallis tests, while Mann-Whitney U tests were used to compare across the two EED aesthetics (artificial *versus* natural).

Results

A total of 312 surveys were collected from visitors in front of the chimpanzee exhibit; 151 from visitors while natural EEDs were provided and 161 while artificial EEDs were provided (see Table 2 for details on the visitors' responses). In every session, one or

more chimpanzees were observed interacting with the EEDs while surveys were administered. Over 86% of visitors either completely agreed, agreed, or somewhat agreed that the exhibit naturalism was important to them and that the chimpanzees' exhibit replicated the natural environment. Associated with this positive attitude, 99.7% of the visitors said that they would recommend to their friends to visit this exhibit. Visitors' impressions of the chimpanzees' feelings and behaviours were also positive. For example, 95% of visitors either completely agreed, agreed, or somewhat agreed that the chimpanzees looked happy and 69% completely disagreed, disagreed, or somewhat disagreed that they looked bored. Finally, 94% of visitors believed that chimpanzees would not make good pets.

A similar number of surveys were obtained across the four types of EEDs: 116 for balls, 122 for logs, 120 for shakers, and 114 for tubes. We first compared visitor responses to the survey questions across these four types of EEDs and found no significant differences ($p > 0.05$ for all, see Table 3). Therefore, we collapsed those data across EED type to facilitate a binary comparison between naturalistic and artificial items. Comparing the visitors' responses to the survey questions when either naturalistic or artificial EEDs were presented revealed no differences across EED condition for any of the twelve survey questions (Figure 3).

Discussion

Some zoos restrict the use of artificial environmental enrichment devices (EEDs) due to concerns that such items will be disruptive to the naturalistic appearance of such spaces (Kreger et al. 1998). Contrary to this concern, however, our results supported previous research that concluded that zoo visitors appear unaffected by such artificial environmental additions (McPhee et al. 1998; Kutska 2009). We detected no significant differences in visitor perceptions about the naturalism of the chimpanzee exhibit, the behaviour and feelings of the chimpanzees, nor the suitability of chimpanzees as pets when artificial EEDs were provided to the chimpanzees compared to when they were provided with more naturalistic EEDs. These data lead us to support the assertion that

Table 2. The average and standard deviations of responses given by 312 zoo visitors to survey questions on a 6-point Likert scale. For all questions, the scale ranged from 1 = "Completely Agree" to 6 = "Completely Disagree" except for the question "Ability of the exhibit to replicate the natural environment" for which the scale ranged from 1 = "Extremely Naturalistic" to 6 = "Extremely Unnatural".

	Survey question	Average response on Likert scale	Standard deviation
Impressions of the exhibit	Ability of the exhibit to replicate the natural environment.	2.33	0.27
	Important to me how natural the exhibit looks.	1.83	0.86
	I would recommend to my friends that they visit this exhibit.	1.58	1.10
Chimpanzee behaviours and feelings	If I were a chimpanzee I would want to live here.	3.25	1.48
	These animals act the way I think they would in the wild.	1.03	0.97
	I think the chimpanzees look happy.	2.14	0.61
	I think the chimpanzees look bored.	4.19	0.80
	I think the chimpanzees look active.	2.36	1.22
	I think the chimpanzees look busy.	2.43	1.03
	I think the chimpanzees look relaxed.	1.93	1.07
Think the chimpanzees look healthy.	1.66	0.61	
Pets	Chimpanzees make good pets.	5.36	0.53

Table 3. Kruskal-Wallis results for each survey question within the natural and artificial aesthetics across the four conditions of EED type, all tests had 3 degrees of freedom.

		Kruskal-Wallis Test			
		Natural EEDs		Artificial EEDs	
	Survey question	H	p	H	p
Impressions of the exhibit	Ability of the exhibit to replicate the natural environment	1.39	0.62	4.28	0.23
	It is important to me how natural the exhibit looks.	4.03	0.26	1.48	0.69
	I would recommend to my friends to visit this exhibit.	0.39	0.85	2.24	0.32
Chimpanzee behaviours and feelings	If I were a chimpanzee I would want to live here.	1.25	0.74	0.62	0.89
	These animals act the way I think they would in the wild.	3.60	0.31	4.46	0.22
	I think the chimpanzees look happy.	0.90	0.82	1.17	0.76
	I think the chimpanzees look bored.	0.34	0.35	3.06	0.38
	I think the chimpanzees look active.	1.29	0.33	3.67	0.30
	I think the chimpanzees look busy.	4.01	0.26	2.99	0.39
	I think the chimpanzees look relaxed.	1.37	0.38	2.73	0.44
	I think the chimpanzees look healthy.	1.31	0.33	2.37	0.30
Pets	Chimpanzees make good pets.	5.36	0.15	0.32	0.36

the influence of artificial EEDs is not sufficient to detract from the naturalism of an exhibit space nor is it likely to influence visitor opinions about exhibit design or promote anthropomorphic perceptions.

Visitors indicated that exhibit naturalism was important to them and that the chimpanzee exhibit at Lincoln Park Zoo met that expectation. In this context, enrichment appearance did not seem

to influence visitor’s opinions about the chimpanzees’ welfare, as evidenced in their consistent responses to questions about the chimpanzees’ emotions and behaviours across conditions. Not only was there no difference in visitors’ responses across conditions, but their responses also revealed that they held a positive opinion about the chimpanzees’ welfare in this exhibit. Lastly, the artificial EEDs did not have any effect on visitors’ opinions on the suitability

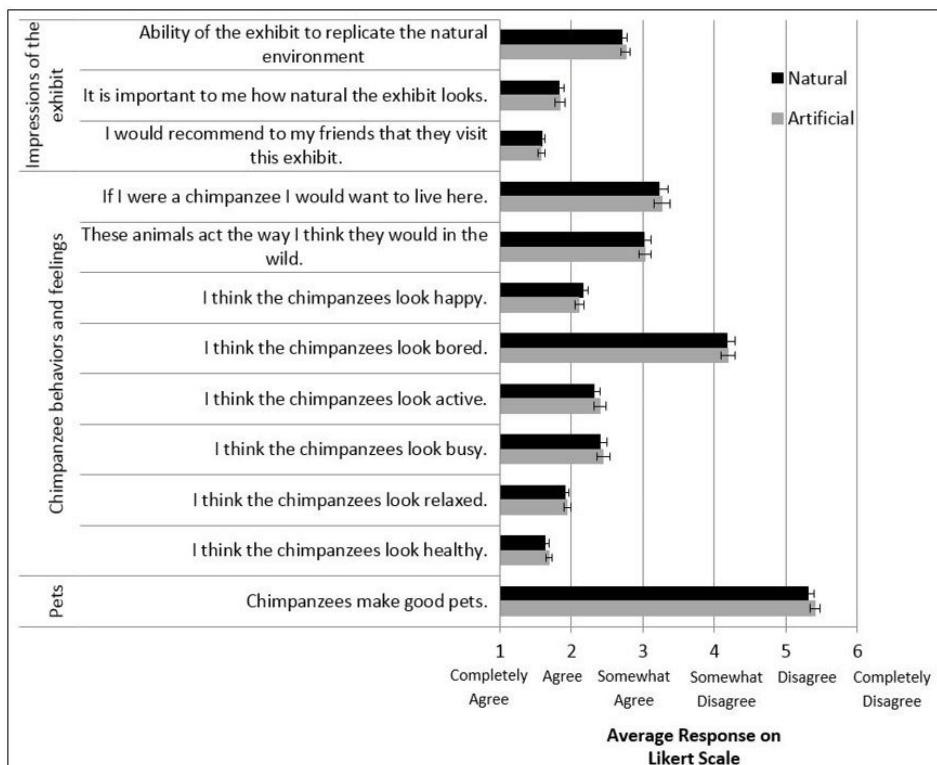


Figure 3. The average responses given to survey questions by zoo visitors in the artificial EED condition compared to those in the natural EED condition. All responses were given on a 6-point Likert scale for which the scale ranged from 1 = “Completely Agree” to 6 = “Completely Disagree” except for the question “Ability of the exhibit to replicate the natural environment” for which the scale ranged from 1 = “Extremely Naturalistic” to 6 = “Extremely Unnatural.” Pairwise comparisons using Mann-Whitney U tests showed no significant differences between conditions for all questions ($p > 0.05$ for all).

of chimpanzees as pets. This question addressed the concern that anthropogenic elements of the environment may affect the way that this species is viewed by the public. We considered the potential for similar effects to arise from the presence of artificial enrichment, however it appears that such elements did not substantively override the overall naturalistic effect of the exhibit design.

Although these results suggest that enrichment aesthetics did not influence visitor perceptions of the exhibit space or the resident chimpanzees' wellbeing, this study did not address the impact of different EED aesthetics in a non-naturalistic environment, where there could be a more significant impact of EED type. The overall naturalism of the study exhibit may have overcome any effects of EED aesthetics on visitor perceptions that may be created when viewing animals in a non-naturalistic exhibit. We also note that the EEDs used in this study were relatively small in size, making them potentially less obvious to visitors within the large naturalistic chimpanzee exhibit at Lincoln Park Zoo. Future studies are required to test the impact of providing larger, more visually obtrusive EEDs in a naturalistic exhibit to determine if these have an adverse effect on visitor perceptions, and also if and how animal behaviour varies as a function of enrichment type (Perdue et al. 2012). Although chimpanzees interacted with the EEDs in every sessions while the visitors were surveyed, we did not conduct a more fine-grained analysis of their interactions with, or use of the different EEDs.

These data suggest that the naturalism of EEDs provided to zoo animals from the standpoint of zoo visitors should be less of a concern in a naturalistic exhibit than its efficacy to elicit natural behaviours and the ease with which it can be implemented by keeper staff. Further research on this subject is important due to the impact that exhibits can have on visitors' opinions about zoo animal welfare and their interest in the species they observe in a zoo, especially given that the visitor experience and their opinions are integral in potential future support of conservation programs and zoo campaigns (Falk et al. 2007). Therefore, although it appears that the enrichment devices used in this study did not influence visitor opinions, additional assessments should be done before using more human-centric objects as enrichment, particularly in a less naturalistic exhibit.

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