

THE "VISITOR EFFECT"

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web supplement

ABSTRACT

Although negative visitor behaviours can cause distress or even death to zoo animals, research has shown that the mere presence of people at a zoo exhibit is associated with animal stress. The aim of this paper is to review existing research about these visitor effects. Research to date has shown that the presence, density, activity levels, size and proximity of visitors are all associated with behavioural changes in captive animals. However, almost all studies have investigated behavioural changes in primates and more emphasis is needed on studying a wider range of animal groups and stress indicators. There is also scope for integrating existing work with other areas of zoo audience research. Possible solutions to help zoos counteract visitor effects are offered.

KEYWORDS

Audience, primate, stress, visitor, welfare, zoo

Unruly visitor behaviours present problems for every zoo. Teasing, feeding, shouting, throwing stones, vandalism or even animal poisoning cause distress, or even death, to captive animals (Hediger, 1969; Venkatraman, 1988; Kumaragurubaran, 1992; Shankar *et al.*, 1996). Fortunately, these behaviours tend to be atypical and represent extreme examples; most visitors tend to simply watch, talk or point when they are at an exhibit. However, an emerging body of literature since the 1970s has demonstrated that the mere presence, and typical activities, of visitors are sometimes associated with animal behavioural changes indicative of stress (Image 1^w). The mere presence, density, size and position of visitors have been connected with undesirable behavioural and physiological changes in captive animals. It is important to understand these visitor influences so that zoos can reduce, or eliminate, stressful situations. Therefore, the objective of this paper is to draw together and summarise existing research about the possible visitor effects on the well-being of captive animals, and to suggest avenues for further research.

VISITORS AND THEIR EFFECTS

Early researchers suggested that the presence of people could either be perceived as a negative influence, a source of variability (thus a form of enrichment) or simply a changing variable that has no effect on animals (Hornaday, 1930; Morris, 1964; Hediger, 1969; Kawata, 1971; Snyder, 1975; Donaldson *et al.*, 1975; Leuthold, 1977; Hosey, 2000). Most researchers probably favoured the latter suggestion because zoo studies were conducted without accounting for visitor variables (it was not realised that the visiting public could pose a possible confounding variable in research). However, during the 1970s and early 1980s, a series of studies revealed that visitor presence was associated with changes in animal behaviour.

For example, Oswald and Kuyk (1977) studied the behaviour of three loroid primate species before, and after, the opening of a nocturnal primate house to the public. They found that most behaviours they studied increased in frequency following the opening of the house. Thompson (1976) observed an increase in the sexual behaviour of chimpanzees (*Pan troglodytes*) following an increase in zoo visitor numbers. In an unpublished study, Lahm (1981) found that general primate activity and social behaviours increased due to increased visitor density. Next, Glaston *et al.* (1984) found that social behaviour of Cotton-topped Tamarins (*Swaguinus oedipus oedipus*) differed between groups exposed to visitors and groups away from the public; the number of zoo visitors at the cage correlated negatively with the total duration of affiliative behaviours, but there was a positive correlation with the frequency of mother-young agonistic behaviours. Maki *et al.* (1987) found that the presence of zoo visitors was associated with increased intragroup aggressive behaviour amongst chimpanzees. The notion of a "visitor effect" was advanced further by Hosey and Druck (1987) who showed that active audiences provoked increased locomotory activity amongst twelve species of primates and increased frequency of visitor-directed behaviours.

Since these early studies, there has been a proliferation of investigations into the effects of zoo visitors on captive animal behaviour. Studies on captive primates seem to dominate the literature although studies about other animal-groups have also taken place (e.g. Thompson, 1989; Nimon & Dalziel, 1992; O'Donovan *et al.*, 1993; Condon *et al.*, 2003). Authors often refer to visitor effects in a collective manner rather than focusing on the specific visitor variables that could be causing these effects. The problem with this approach is that the precise visitor variables (such as visitor presence, visitor density, activity, and proximity) that influence visitor behaviour are difficult to dissect. It is meaningful to divide visitor effects into specific categories (Table 1). This approach enables an easier assessment about which aspects of visitor activities are associated with specific changes in animal behaviour. The analysis shows that there is a disproportionate amount of research across different visitor variables (each visitor variable is not equal in terms of the number of studies that have investigated it).

To further understand the relationship between visitors and animal behaviour, Hosey (2000) tackled the subject from a theoretical angle, an approach that had been previously lacking in the literature. He presented a series of hypotheses that could explain the connection between visitor activity and concomitant changes in animal behaviour, and he used previous

^w See Image 1 in the web supplement at www.zoosprint.org

Table 1. A summary of research about visitor effects on animal behaviour.

Visitor variable	Examples of how variable has been associated with behavioural changes in captive animals
Presence of visitors	Visitor presence has been associated with a range of behavioural changes in captive animals. Chamove <i>et al.</i> (1988) found that visitor presence was associated with decreased affiliative behaviours, increased activity and high levels of aggression amongst primates. Thompson (1989) studied the influence of zoo-keeper presence on the behaviour of 12 species of captive ungulates; there was a greater occurrence of vigilance, approaching behaviours and vocalisation but decreased eating/drinking behaviours. In another study, Vrancken <i>et al.</i> (1990) found that visitor presence effected the spatial distribution of one gorilla (the animal tended to stay near the viewing window when the public was present). Interestingly, Mitchell <i>et al.</i> (1992a) showed that Golden-bellied Mangabeys displayed more frequent aggressive facial displays towards human visitors of the same sex. Snipp (2004) found that visitor presence within a walk-through lemur exhibit had little influence on the behaviour and exhibit use of the inhabitants.
Visitor density	Changes in visitor density have been associated with changes in animal behaviour. Hosey & Druck (1987) observed higher levels of primate behaviour in the presence of large groups of visitors compared to smaller groups. Mitchell <i>et al.</i> (1991) found that animals displayed increased aggression towards visitors, and decreased aggression towards other species in neighbouring cages, when visitor density was high. Mitchell <i>et al.</i> (1991) moved Golden-bellied Mangabeys from a cage associated with high visitor attendance to one with lower visitor numbers, and found that aggression within the group decreased, but threats towards primates in neighbouring cages increased. Fa (1986) found that the birth rate of macaque troops decreased as the number of visitors increased. Later, Fa (1989) found a positive correlation between visitor density and incidence of human-animal interactions. Fa (1992) observed increased aggression towards visitors when visitor numbers increased and stated "biting is a density-dependent phenomenon". Lambeth <i>et al.</i> (1997) reported higher levels of wounding episodes amongst Chimpanzees occurred during weekdays (high levels of visitor density). Wood (1998) reported that high crowds corresponded with diminished frequencies of foraging, object-using, grooming and playing amongst Chimpanzees. Wehnelt & Birke (2000) and Birke (2001) showed that the arrival of large groups of visitors at an Orangutan exhibit was associated with increased hiding and increased infant-mother contact. Keane & Marples (2003) observed visitor-induced behavioural stress in gorillas when visitor numbers were high. Pankhurst & Lacey (2001) observed a strong positive correlation between visitor numbers and aggressive behaviours among goats and avoidance behaviours by sheep and lambs. Simpson (2004) showed that high visitor densities were positively correlated with increased aggression in macaques and Goeldi Monkeys.
Active versus Passive audiences	Hosey (2000) concluded that the mere presence of visitors (passive groups) is not generally associated with significant behavioural changes in animal behaviour whereas active visitors are likely to produce behavioural changes. When audiences were active, there were increases in locomotory activity, spatial distribution and behaviours directed towards the audience (Hosey & Druck 1987; Mitchell <i>et al.</i> 1992b). Meder (1992) demonstrated that Lowland Gorillas watched humans more if visitors were active and observed a correlation between non-compliant visitor behaviour and the frequency of displays to visitors. Visitor noise has also been shown to influence behaviour (Birke, 2002). Condon <i>et al.</i> (2003) found that penguins spent more time swimming on the surface and less time submerged when quiet groups of visitors were present.
Size and position of visitors	Coe (1985) found that his position at a cage influenced the social ranking that an animal allocated to him. If he stood higher than the animal he was given a higher ranking. Hosey & Druck (1987) found that changes in animal behaviour were less marked when visitors were smaller.

studies (such as those reviewed above and in Table 1) to test his predictions. First, Hosey addressed the question of whether it is the presence of visitors that causes changes in captive animal behaviour or if the changes in animal behaviour produce changes in visitor behaviour. Hosey argued that if the latter was true then captive animals housed in accommodation that was both exposed to, and away from, visitors would not show significant differences in behaviour. The literature shows that this prediction is clearly not true (Glaston, *et al.* 1984; Mitchell *et al.*, 1991; Chamove *et al.*, 1988). In other words, evidence seems to imply that it is the audience that causes changes in animal behaviour and not *vice versa*, although Hosey suggested that there is probably an element of both forces to some degree (with the visitor effect dominating). Next, Hosey attempted to analyse the precise nature of the visitor effect: are visitors, and their behaviours, stressful or enriching for captive animals? He reasoned that although some studies indicate that visitors are not always stressful, there is not sufficient evidence to support a general hypothesis proposing that visitors are enriching to captive animals. Hosey's theoretical analysis is very useful but it is limited for several reasons. The study of visitor influences on captive animals is an area that has developed independently from other zoo visitor research foci; this means that Hosey's analysis did not include the findings of other areas of zoo audience research even though there is evidence to supplement, and refute, some of his conclusions (this is discussed further in Davey and Henzi, in preparation).

It is also important to point out that the bias towards primate studies means that non-primate studies are too sparse for meaningful conclusions. More studies are needed (including a wider range of animal groupings and measures of stress) before a theorisation of the subject is convincing.

Limitations of existing research

"Visitor Effects" research has revealed intriguing insights into the people-zoo relationship. However, existing work is limited for several reasons. As mentioned above, research about visitor effects on animals has developed largely independently from other areas of visitor research (such as audience analysis, visitor circulation and responses to exhibit design). Davey and Henzi (in preparation) argue that the independence of these two research traditions is worrying because they cover overlapping objectives and research would obviously benefit from interaction. Therefore, future work should consider integrating these two research areas to provide a greater understanding about visitor-animal associations. To exemplify the point, Davey and Henzi (2005) investigated a well-known visitor circulation behaviour (the "right-turn bias"; the majority of people turn right when entering an interpretive space) that was originally documented in museum work in the 1930s. They found that the museum principle existed in a primate house and argued that the marked circulation pattern poses important implications for animal welfare management.

Another limitation impinging on the usefulness of visitor research is the lack of detailed behavioural categories and other variables employed to account for variations in observed behaviours. These limitations pose serious consequences on the inferential and predictive value of many visitor studies. An example is the division of visitors into "active and passive" groups (Hosey & Druck, 1987). Hosey and Druck (1987) define active groups as "those in which at least one person attempted to interact with the animal". However, this criterion is vague and many visitor behaviours could be included in this definition. A better division could be to define different types of activity, such as pointing or waving and different intensities/levels of these behaviours. This is important if research findings are to be of practical benefit to animal welfare workers. Most studies of visitor effects appear to focus on behavioural changes in animals rather than physiological changes such as hormonal or immunological characteristics. Indicators of stress are varied and simply measuring behavioural changes may not provide a sufficiently detailed analysis of visitor effects. Work has recently emerged reporting relationships between visitor variables and endocrinological stress levels. For example, Wehnelt *et al.* (2004) found that urinary cortisol levels (a stress indicator) in orangutans significantly increased following an increase in visitor numbers. Also, Davis *et al.* (2005) reported that zoo visitors influence HPA activity in spider monkeys.

CONCLUSION

This review has summarised existing research about the associations between visitor presence, density, size, proximity and activity with behavioural changes of captive animals. It is evident that captive animals are influenced by visitors and therefore a "Visitor Effect" does exist in some situations. However, more work is needed, incorporating a wider diversity of animal groups, stress indicators and clearly defined measures of visitor behaviour. There is also a lack of studies from outside America and Europe and this bias limits the ability to apply current knowledge to zoos in other countries. Therefore, more work is needed from other countries, particularly developing countries that house the majority of the world's biodiversity and zoos.

Given that visitor presence, and typical activities, is associated with behavioural changes in a variety of animal species, zoos must endeavour to understand them. Perhaps the first step for a zoo is to conduct research at a specific exhibit in order to determine the existence, direction and nature of visitor effects. Next, strategies to counteract them could be developed, implemented and evaluated. Possible solutions include housing animals that are most responsive to visitor variables in less visited areas, rotating animals and one-way viewing glass (Davey & Henzi, 2005).

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SIGHTING OF SIRKEER MALKOHA *PHAENICOPHAEUS LESCHENULTII* IN THE THAR DESERT

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web supplement

Jodhpur is one of the well known princely states of Rajasthan, it is also considered as a gate way to the Great Indian Desert 'The Thar' (25.6°-27.1°E & 71.9°-74.1°N). In the recent past, Jodhpur has undergone a drastic change ecologically due to ample water supply. Increased tree vegetation has attracted several avian species to this part of the 'desert'. Several garden loving species and dense forest species have been found for the first time in Jodhpur particularly the Yellow-footed Green Pigeon (*Treron phoenicoptera*) (Rahmani, 1996) and Indian Pitta (*Pitta nipalensis*) (Singh, 2001). The introduction of artificial environment and continuous water in the lakes of Jodhpur have increased the bird species from 125 (Bohra & Goyal, 1992) to 190 (checklist is under preparation).

Sirkeer Cuckoo now called Sirkeer Malkoha (*Phaenicophaeus leschenaultii*) was sighted thrice (Image 1st) in the campus of Desert Medicine Research Centre (DMRC), Jodhpur between 21 and 30 June 2004. The bird was easily identified by its cherry red curved bill and a typical walking posture (Ali & Ripely, 1983). This had not been sighted by earlier birdwatchers, viz., Whistler (1936), Bohra and Goyal (1992), Rahmani (1996, 1997), and Mukherjee (1995). Distribution of this bird according to Ali and Ripely (1983) and Grimmett *et al.* (1998) excludes the western parts of Rajasthan. There is no past history of the occurrence of this bird in the desert whereas other cuckoos like Common Hawk Cuckoo (*Hierococcyx varius*) and Migratory Pied Crested Cuckoo (*Clamator jacobinus*) are commonly seen in Jodhpur. It was seen in the open shrubs of Jodhpur region which is mainly composed of *Capparis decidua* and *Zizyphus nummularia* shrubs.

It appears that the perennial supply of water to this district of western Rajasthan have attracted several forest dwelling species from the Aravallis and Udaipur region of southern Rajasthan where these birds are in good numbers.

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* see Image in the web supplement at www.zooreach.org



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