



Article

# Does an Animal–Visitor Interactive Experience Drive Conservation Action?

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**Abstract:** Inspiring visitors to engage in conservation-related behaviour following a zoo visit is a primary objective for most zoos. Animal–visitor interactive (AVI) experiences are often central to this goal. Yet, these interactive experiences are insufficiently evaluated from both the visitors’ and captive animals’ perspectives. The current study took place at Fota Wildlife Park and involved the construction of an environmental enrichment device during an interactive visitor experience with Sumatran tigers (*Panthera tigris sumatrae*). It aimed to simultaneously encourage pro-conservation behaviour in visitors and promote animal welfare. Visitors ( $n = 51$ ) completed a survey, observed the tigers’ behaviour and made a pledge to help tigers in the wild after completion of the AVI. Tiger behaviour was simultaneously observed by a trained researcher using occurrence or non-occurrence sampling, which found no indication that tiger welfare was compromised during the activity and was likely enhanced by engaging with the enrichment. Additionally, visitors observed a range of tigers’ behaviours. The results indicated that some visitors (8%) had continued with their pledge six weeks after the experience, and most visitors exhibited a high level of knowledge and a positive attitude towards tigers. The use of enrichment during AVIs may be a positive link between the visitor experience and animal welfare. These results can be used to guide AVIs in zoos which aim to connect people with nature and drive pro-conservation behaviour in visitors.

**Keywords:** conservation; environmental education; zoo; animal behaviour; visitor experience; interactive experience; behaviour change; Sumatran tiger; enrichment



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## 1. Introduction

The Earth is entering a sixth mass extinction, and biodiversity losses have reached critical levels; people have never been so disconnected from nature [1]. Almost half of the world’s human population is now living in cities, with little opportunity to connect with animals [1]. Zoos may offer an opportunity to bridge this gap, and indeed connecting people to nature is a common educational goal of many zoos worldwide [2,3]. Recent literature has found positive connections between zoo visits, education and understanding pro-conservation behaviour [4]. In fact, education can be enhanced with interactive material and special interventions in the zoo setting [5,6] and may even be long lasting [7,8]. However, there is a lack of research that specifically investigates the effect of up-close encounters such as animal–visitor interactions (AVIs) on visitors’ conservation behaviour.

Previous studies have found that zoo visits, which promote positive emotional experiences, instil visitors with a sense of respect and wonder for animals [9]. This may lead visitors to develop a desire to ‘save’ observed animals from extinction or take action to protect them in the wild [9–11]. One way for zoos to facilitate emotional connections with animals may be through up-close encounters with active animals [12–14]. Over 75% of institutions affiliated with the World Association of Zoos and Aquariums (WAZA) offer at least one type of AVI experience [15]. WAZA has recently issued animal–visitor interaction guidelines for its member institutions [16], which focus on ensuring the welfare of animals

participating in AVIs. However, some institutions may have differing interpretations of the WAZA guidelines [11]. Animal–visitor interactive experiences are often marketed as enriching for the animals, educational for the visitors and beneficial for the zoo in financial terms, yet little research exists to verify these assertions [17]. However, one recent study has discovered that zoo-housed elephants may benefit from feeding by the public [18]. For example, the elephants displayed some behaviours, such as increased socialisation and reduced stereotypies, which may indicate that the public feeding activity had an enriching effect on the elephants and positive welfare implications [18].

Defining and categorising animal–visitor interactive experiences can be challenging and lead to ambiguity in research findings. Hosey [19] describes a human–animal interaction (HAI) as when an individual shows a behaviour to another individual, either animal to human or human to animal, who may or may not respond. This has most commonly been applied in agricultural settings but is also suitable to describe human–animal interactions in the zoo, where an observable response from the animals may not occur [19]. AVIs in the zoo can be either direct experiences such as touching or indirect experiences such as scattering feed for animals, which may be regulated or unregulated [11]. AVIs can be further divided into eight different types of interactive experiences, including petting or walking through an enclosure [15]. Animal Ambassador Encounters (AAE) involve one-to-one close contact interactions between visitors and specially trained animals, such as hand-feeding, which may involve visitors paying a fee [20]. Initial research on visitors in zoos focused on general visitor effects on animal behaviour [21]. The specific effect of more intense visitor interactions on animal behaviour or the impact of the animals on the visitors was rarely considered. One early study on visitor experience in zoos found that visitors who had an interactive experience with elephants were more likely to support elephant conservation than those visitors who had simply viewed the animals [22]. However, recent studies indicate that visitors' connectedness to animals and willingness to support their conservation may depend on visitor demographics [12], the type of animal viewed [9,23] and the targeted conservation behaviour [24]. Connectedness may not depend on proximity or interaction with the animal [25]; however, visitors are more willing to support animals that they developed a connection with rather than contributing to broad biodiversity initiatives [24].

Environmental enrichment may also enhance the visitor experience and reduce negative visitor effects in captive animals [26,27]. Enrichment is used by zoos to improve the physiological and psychological welfare of animals by providing them with environmental stimuli [28], with the goal of promoting species-typical behaviour and reducing stress [29]. Visitors also benefit from viewing animals either in enriched habitats or interacting with enrichment devices, especially if enrichment induces active, species-typical behaviour [26,30,31]. Yet, rarely are interactive visitor experiences enrichment based. The few studies that have included enrichment in interactive visitor experiences report enhanced learning and positive emotional responses for visitors and neutral to positive behavioural changes for the animals [12,32].

Research on animal behaviour during interactive visitor experiences is sparse, and results are often ambiguous. One study found a neutral effect on ring-tailed lemur (*Lemur catta*) behaviour during contact with visitors [33], while another study reported a potentially positive behavioural response (reduced aggression) during a visitor feeding experience with lemurs [17]. Individual animal preference should also be considered, since it was discovered that one Aldabran giant tortoise (*Aldabrachelys gigantea*) preferred interaction with visitors to other types of enrichment, but another did not [34]. Generally, findings suggest a neutral to positive impact of close visitor encounters on animal behaviour, though intense, longer-lasting interactions may lead to reduced animal welfare [20,35].

Felids are under-represented in visitor activities, though there is an increase in zoos offering visitors experiences with cheetahs [20]. For example, Szokalski et al. [36] investigated felid behaviour during visitor interactive experiences, which were both protected experiences with lions and tigers and hands-on with cheetahs. The authors found that

the cats responded to interactive visitor experiences with limited behavioural change. Both groups of cats spent a limited amount of time in the proximity of visitors, possibly indicating that the cats were avoiding the visitors except when food was offered [36]. More research is needed, but there was no specific evidence of reduced welfare in the cats used in the interactive experiences [36]. Although cats may not be commonly used for visitor interactive experiences, many felid species are critically endangered, and visitors are naturally drawn to these charismatic animals [12,23,24,37]. In fact, Consorte-McCrea et al. [3] state that zoos present ideal conditions for the development of connections between visitors and carnivores. If animal welfare and visitor safety are carefully controlled, visitor-felid experiences could represent an opportunity for enhanced conservation efforts by visitors for these animals.

The Sumatran tiger (*Panthera tigris sumatrae*) is critically endangered in the wild, largely due to poaching and habitat destruction for agricultural purposes, such as palm oil plantations [38,39]. As the tigers' natural habitat declines, they may become increasingly dependent on zoos for survival; thus, educating zoo visitors about their plight may become critically important in conserving this species [40]. Fota Wildlife Park contributes to tiger conservation by participating in the European Endangered Species Breeding Programme (EEP) for Sumatran tigers, and Fota has made monetary contributions to WildCats Conservation Alliance to support in-situ conservation in Kerinci Seblat National Park in the Indonesian island of Sumatra [41]. Additionally, Fota aims to inspire their visitors to help protect this species in the wild. The current research sought to promote animal welfare and inspire visitors towards pro-conservation action through a non-invasive, non-contact visitor interactive experience using environmental enrichment with Sumatran tigers (*Panthera tigris sumatrae*) at Fota Wildlife Park.

## 2. Materials and Methods

### 2.1. Site and Study Group

This research received full ethical approval from University College Cork's Social Research Ethics Committee. The study took place at Fota Wildlife Park (Fota), Carrigtwohill, County Cork, Ireland (51.889585° N, 8.311276° W). The study included five Sumatran tigers (*Panthera tigris sumatrae*), all of whom were captive born and mother reared (Table 1). The Tiger Forest at Fota is divided into four enclosures with many naturalistic features throughout, including trees, dens and raised areas. A visitor walkway runs between three of the enclosures creating a 'walk-through' atmosphere, which is bi-directional, though visitors typically enter and exit along a specific route (Figure 1). In the current study, only tigers in these three enclosures (approximately 6737 m<sup>2</sup>) were observed because visitors could not easily see the other enclosure from the walkway (Figure 1). The tigers present in each enclosure varied throughout the study because of the Fota's husbandry practice of rotating individuals between enclosures. The tigers were fed five days a week at approximately 16:00 h with 5 kg of meat, which was occasionally given as a scatter feed hidden around the enclosure.

**Table 1.** Details of the tiger group housed at Fota Wildlife Park during the study.

Name	Gender	Year of Birth
Dourga *	Female	2011
Denar *	Male	2012
Mayang	Female	2012
Batak	Male	2014
Dash	Male	2019

\* Parents of Dash.



**Figure 1.** Sumatran tiger habitat at Fota Wildlife Park with visitor walkway marked with entry and exit points in red and a trail of white dots to show the approximate route through the exhibit. The three tiger enclosures included in the study marked 1, 2 and 3 in white.

## 2.2. The Enrichment Device

During this study, visitors were invited to make an enrichment device (refer to Section 2.3) for the tigers and watch as keepers administered them to the animals. The enrichment device used in this study was a ball of hay (approximately 30 cm) tied together with twine and scented with pure cinnamon oil. This type of enrichment was previously described as successful at reducing pacing and increasing enrichment-oriented behaviours and was recommended to enhance welfare for this group of tigers at Fota [42]. The hay balls (at least one per tiger) were thrown over the fence of each enclosure at a specific point, which was easily accessible for keepers and provided a clear view for visitors.

## 2.3. Procedure

The study took place between November 2019 and February 2020 on nine different weekday mornings between 11:00 and 12:00 h. Every visitor or visitor group (unless the researcher was occupied with another visitor) that walked through the tiger exhibit was approached by the primary researcher and asked if they would like to participate in a research project involving tigers. A refusal log was kept, and it was found that approximately 70% of the visitors who were approached agreed to participate in the project. Reasons for declining generally included scheduling and childcare duties.

The visitor activity included:

- (1) Construction of a cinnamon-scented hay ball;
- (2) Observation of the tigers receiving the hay ball;
- (3) Completion of a survey.

To comply with the ethical regulations associated with the study, data were only collected from individuals over the age of 18. However, participant's children were sometimes included in the activity, whereby parental consent was given for their inclusion. Once a visitor agreed to participate in the project, they were handed a sheet with an explanation of the study and a list of three actions they could take to help tigers in the wild. This included buying products with sustainably sourced palm oil, signing an online petition or adopting a tiger at Fota Wildlife Park. Then they were invited to construct a hay ball for tigers, which they scented with several sprays of cinnamon oil. This was limited to one hay ball per group. During the activity, the primary researcher explained the plight of Sumatran tigers in the wild, specifically focusing on deforestation due to the palm oil trade. The participants were asked to return to the tiger exhibit at a designated time,

approximately 30–60 min after the enrichment activity. All adult visitors who participated in the research were given a survey to complete when they returned. Then a Fota staff member would give the hay ball to the tigers. The visitors were asked to observe the tigers during the enrichment activity and indicate from a list of behaviours on the survey which ones they observed [7,8] (see Appendix A). Visitors returned the survey to the researcher on completion of the activity.

During the tiger enrichment activity, one trained researcher (also referred to as ‘the researcher’) observed the behaviour of the tigers. It was not feasible to give the visitors detailed descriptions of the tiger behaviours, such as in an ethogram. Thus, the researcher also used simplified observation and recording methods. It was also not possible to control the length of the session because of visitor prerogative, so a more traditional sampling method, such as one-zero sampling, was not used [43]. Therefore, using the same list of behaviours as the visitors, the researcher used occurrence or non-occurrence sampling to indicate which tiger behaviours occurred during the observation session. It was decided that observation sessions would begin when Fota staff threw the hay ball into the tigers’ enclosures and conclude when either the tigers stopped engaging with the enrichment or all of the visitors returned their surveys. All five of the tigers were observed by the trained researcher, but it was not possible to distinguish which tiger engaged in which activity.

#### 2.4. The Visitor Survey

Before the research began, a preliminary trial was conducted with a small group of visitors at Fota Wildlife Park, the results of which guided the development of the final survey (see Appendix A). First, at the start of the survey was the list of tiger behaviours, which visitors marked if they were observed during the enrichment activity. The next part of the survey included a question about conservation membership at Fota, since previous experience with conservation and animals may affect learning [44]. This was followed by two general knowledge questions about tigers. The response options included one correct response, two incorrect choices and an ‘I don’t know’ choice. A correct response was given a score of (2), I’m not sure (1) and incorrect (0). Next, the survey included five questions on visitors’ attitude towards tigers and their conservation with a 5-point Likert-type response option, including: Strongly Disagree, Disagree, I’m not sure, Agree and Strongly Agree. A high score (5) was considered a favourable response (the most positive answer), which correlated to ‘strongly agree’ when the statement was positive. Thus, when the statement is unfavourable ‘tigers are lazy,’ scoring was reversed and (5) correlates to ‘strongly disagree.’ In the following section, the visitors were asked to take a pledge to help protect tigers. Finally, the participants were requested to provide their email addresses for a follow-up survey. Six weeks later, visitors who provided an email address were contacted and asked:

1. If they recalled the activity at the tiger enclosure at Fota Wildlife Park;
2. If they recalled their pledge to help tigers in the wild and, if so, to state it;
3. If they were able to follow through with their pledge and why or why not;
4. Would they like to add anything else.

The questions included in the follow-up study did not aim to discover if changes in visitor learning occurred after the activity. Thus, a repeated measures design was not utilised. Rather, the follow-up study was designed to ascertain if participation in the activity led this group of visitors to take conservation action. The regression model described in the data analysis (Section 2.5) allowed for results from the attitude section of the survey to be used as a predictor of conservation action.

#### 2.5. Data Analysis

Data analysis was conducted using SPSS version 26 and Excel version 1808. The accepted alpha level for these analyses was  $p < 0.05$ . The Kolmogorov–Smirnov test revealed that total knowledge score ( $p > 0.001$ ) did not follow a normal distribution, but total attitude score did ( $p = 0.200$ ). However non-parametric statistics were used unless stated because of the relatively small sample size.

First, basic descriptive statistics, represented as percentages, are reported in the results. Next, the Mann–Whitney U test was used to determine if total knowledge score and attitude score were affected by conservation membership, where totals are the combined response score for each section. Then, a binomial logistic regression was used (all assumptions of the test were met) to test whether responding to the email after the interactive experience can be predicted based on conservation membership (yes or no), and total attitude score. Descriptive data indicated that all visitors who responded to the follow-up email also followed through with their pledge. Finally, to compare the observed behaviour of the tigers between the visitors and the trained researcher, some general descriptive statistics are reported. Subsequently, each tiger behaviour was coded as 1 = absent or 2 = present for each observation session ( $n = 6$ ). It was not possible to test each visitors' observation against the researcher. Therefore, the visitor group was considered as a whole and if any visitor observed a tiger behaviour this was counted as 'present' for the group. Cohen's Kappa was then used to measure reliability between the visitors and the researcher.

### 3. Results

#### 3.1. Knowledge and Attitude

A total of 73 visitors were approached, of whom 51 agreed to participate in the study (mean 5.6 adults per interactive session). This sample comprised 21 male and 30 female participants. Of the respondents, 16 had a Fota conservation membership, and 35 did not. The majority of visitors answered the knowledge questions correctly (Table 2). There was no difference in total knowledge score between visitors who did or did not have a Fota conservation membership ( $U = 209.500$ ;  $p = 0.115$ ). The attitude section of the survey showed varied results, generally reflective of a positive attitude towards tigers (Table 2). There was no difference in total attitude score between visitors who did or did not have a conservation membership ( $U = 212.500$ ;  $p = 0.167$ ).

**Table 2.** Results of the survey administered to groups visiting Fota Wildlife Park who participated in the interactive tiger experience, represented as the percent of respondents to choose each response category.

Knowledge Questions * ( $n = 51$ )	Responses				
	Correct	I don't know	Incorrect		
How many tigers remain in the wild?	56.9	35.3	7.8		
Why are tigers endangered?	84.3	11.8	3.9		
Attitude Questions ( $n = 51$ )	Responses				
	SA	A	NS	D	SD
I think tigers are lazy	0.00	11.8	9.8	56.9	21.6
Tigers should not be kept in captivity	9.8	29.4	25.5	31.4	3.9
Something should be done to help tigers in the wild	68.6	29.4	2.0	0.0	0.0
Having a close experience or encounter with the tigers makes me appreciate them more	52.9	39.2	5.9	2.0	0.0
I feel that I can do something to help stop the extinction of tigers †	12.0	50.0	32.0	4.0	2.0

SA = Strongly agree, Agree, S = I'm not sure, D = Disagree, SD = Strongly disagree; \* see Appendix A for exact wording of knowledge questions; † 50 responses.

#### 3.2. Visitor Pledge and Follow-Up

The findings showed that approximately 66% of study participants intended to take some form of action to help tigers. The majority of these (79%) involved using sustainably sourced palm oil (Table 3). Although 43% of participants provided an email address for the follow-up study, only 18% responded to the follow-up email. This corresponds to four out of the original 51 survey respondents. However, all of the email respondents recalled the activity and their pledge; they were all able to describe their pledge, and they all mentioned palm oil. Additionally, all of the respondents reported following through on their intended action to buy sustainably sourced palm oil. Open comments included: 'I really enjoyed

the activity', 'We need to do more', 'I must renew my Fota conversation membership' and 'This email has reminded me about palm oil'.

**Table 3.** Results of visitor pledge during the interactive tiger experience at Fota Wildlife Park showing (A) a description of the conservation actions, (B) percent of visitors to choose that action, (C) percent of visitor to choose action in conjunction with another action and (D) total percentage of times the respondents chose each pledge.

A. Description of Conservation Actions	B. Percent of Group to Choose Action Once	C. Chosen in Conjunction with Another Action *	D. Total Percent of Time Action Was Chosen
Either no action was stated, or the visitor responded that they did not intend to take action	33.3	0	33.3
Buy products using sustainably sourced palm oil	17.7	35.4	53.1
Sign an online petition to sign tigers	11.8	35.4	47.2
Sponsor a Sumatran tiger at Fota Wildlife Park	0	7.9	7.9
Other action with space for visitor to fill in their intended action	0	2	2

Note: \* Some visitors chose more than one action.

The regression model explained 58.4% (Nagelkerke  $R^2$ ) of the variance in responding to the follow-up email and correctly classified 85.7% of cases. However, it was not statistically significant ( $\chi^2(2) = 9.491, p > 0.05$ ). However, all four email respondents have a conservation membership and either agreed or strongly agreed that an up-close experience helps them feel connected and they felt empowered to help tigers. One of these respondents hand wrote on their survey that they felt empowered after the activity at Fota.

### 3.3. Behavioural Observation of Tigers

Visitors ( $n = 49$ ) reported seeing a diverse range of behaviours during the tiger enrichment activity. The most frequently observed behaviour reported by visitors was engagement with enrichment (51%), followed by feeding (41%) and locomotion (39%). Pacing was reported by 29% of visitors. The most commonly observed behaviour by the trained researcher was engagement with enrichment (100%) followed by inactivity, locomotion and exploration, which were all observed in 66% of the observation sessions. The result of the Cohen's Kappa test ( $k = 0.241$ ) showed minimal agreement between the public and the trained researcher and was near significant ( $p = 0.054$ ), indicating a lack of agreement about the behaviours they observed during the same sessions. However, engagement with enrichment was reported in every session by both the researcher and the public.

## 4. Discussion

Animal–visitor interactions may be instrumental in developing positive emotional experiences that inspire visitors' willingness to conserve the species they interacted with. However, it is imperative to consider the animals' behavioural responses to these types of activities. The current study found that the interactive experience likely inspired some participants towards conservation action, and there was no evidence of reduced welfare in the tigers based on behavioural observations conducted by the trained researcher.

### 4.1. Visitors' Experience

The majority of visitors answered the knowledge questions correctly on the survey. This is similar to previous studies that reported that zoo and aquarium visitors already have a high level of conservation knowledge upon arrival [45,46]. Adelman et al. [45] reflected that this is probably because these visitors are self-selected groups (they chose to visit the zoo or aquarium), which may suggest a pre-existing knowledge or empathy towards conservation. Therefore, in the current study, it was hypothesised that increased

knowledge may be associated with having a wildlife conservation membership at Fota Wildlife Park. However, the findings of the total knowledge and attitude score did not support this. Myers et al. [9] also found that visitors' emotional responses to animals were not related to zoo membership. Conversely, it has been reported in a major review study that repeat zoo visitors are more likely to engage in conservation action [47], and conservation membership can be a predictor of positive behaviour change [48]. Connections between prior knowledge, visitor experience, zoological memberships and proclivity towards conservation action should continue to be investigated with various treatment groups and more diverse conservation questions.

Visitors displayed varying attitudes towards tigers. Most visitors did not agree that tigers were lazy; the active behaviour they witnessed during the enrichment experience likely influenced visitors' positive perception of the cats [49]. Previous studies also report that seeing active animals led to positive visitor experiences [12,13]. Responses from visitors regarding the question, 'tigers should not be kept in captivity' varied. Few previous studies have examined zoo visitors' thoughts about keeping animals in captivity, but generally, visitors prefer to see animals in naturalistic settings [50]. One previous study found that zoo visitors have a more positive perception of zoo animals than non-zoo visitors [51]. In the current study, slightly more visitors agreed than disagreed that tigers should not be kept in captivity, with a quarter of visitors undecided. It is important for zoos to understand visitors' attitudes towards captivity if they aim to effectively shape their educational programmes to maximise learning and promote ex situ conservation. Future research should continue to consider how AVIs can enhance visitors' perception of captivity.

Nearly all of the participants (98%) agreed or strongly agreed that tigers should be helped in the wild. This may suggest feelings of empathy or conservation caring. Conservation caring, visitors' emotional connection to and care for wildlife, may be indicative of connectedness, an important step towards conservation action, especially when it is directed at a specific species as in the current research [10,24]. Similarly, most visitors reported that the interactive experience made them appreciate tigers more. This concurs with previous research that reports an up-close or interactive experience with animals enhances visitors' respect and appreciation for the animals and is likely to lead to conservation action [11,13]. The goal of environmental education programmes should be responsible citizen behaviour, including developing a sense of empowerment and ownership of conservation problems [52]. In the present study, the statement 'I feel that I can do something to help stop the extinction of tigers' was intended to assess if visitors had developed an awareness of actions they could personally take to conserve tigers in the wild. The majority of study participants answered this question with a positive response. Participation in the interactive experience, during which visitors were told specific ways to help tigers and asked to pledge to do these activities, likely led to conservation self-efficacy (a belief in their own ability to help the environment) [53,54]. However, 38% of visitors were unsure or disagreed that they could help tigers, making it unclear if these visitors realise that they can contribute to conservation, for example, by purchasing certain products. Additionally, some visitors may still see the tigers' plight as something irrelevant to their own life [1] that they do not have control over. Visitors may respond differently to various types of conservation and educational material. It is critically important for zoos to understand if their conservation messages are effective. Therefore, future studies should tease out the most effective way to engage with different visitor groups so that conservation activities can be adapted to suit a range of visitors.

Concerning the visitor pledge, 66% of participants indicated on the survey that they intended to act to save tigers. Most of these pledges involved using sustainably sourced palm oil. Although Skibins and Powell [23] report that visitors are willing to support a specific animal which they viewed by adopting it, none of the visitors at Fota pledged to adopt a tiger. It may be that visitors were put off by the financial requirement of this (EUR 60) and preferred to make a lifestyle adjustment regarding palm oil rather than contributing monetarily. This is supported by the fact that several visitors indicated that they would



sign a petition to help tigers, another action that does not require a monetary donation. In future studies, it may be important for educators and presenters to 'up sell' these financial supports so that visitors fully understand the conservation benefits to animals of making a monetary contribution.

However, feeling empowered and intending to take action does not necessarily translate into conservation behaviour [48,54]. A large meta-analysis of environmental education data discovered weak to moderate correlations between pro-environmental knowledge, attitude, intention to act and behaviour [55], and a follow-on study 20 years later found similar results [56]. More recently, it was found that conservation knowledge is related to positive behaviour, but engaging with nature programmes and conservation memberships are more significant predictors of pro-conservation behaviour [48]. In the current study, most visitors indicated that they would act to help tigers in the survey, yet only 50% of visitors gave their email address for the follow-up study, fewer still ( $n = 4$ ) responded to the email. However, it is encouraging that of those visitors who responded to the email, 100% of them recalled the activity, remembered their pledge and reported that they had followed through with their intended action. In a similar study to the current research, only 50% of visitors could mention an action they had undertaken to help penguins a year later, but they had a much longer period between the activity and the email than the current study [57]. Of course, it must be considered that visitors who provide their email address may be more conservation minded and likely to follow through with the action. Interestingly and in contrast to Moss et al. [48], the findings did not indicate that conservation membership or positive attitude affected visitor response to the email, but this may be due to the sample size in the current study. Equally, some visitors may have followed through with their pledge even if they did not respond to the email, or visitors who reported following through with their pledge may not have been truthful or were influenced by other experiences [54,57,58]. Still, the findings of this study provide tentative evidence that some participants who experienced an up-close interactive tiger activity were inspired towards conservation action and did reportedly follow through with their pledges. It is likely that the opportunity to participate in a conservation activity on-site positively influenced subsequent behaviour [47]. Zoos must strive to engage all of their visitors in long-term conservation action, or it might become difficult to justify AVIs, since there may be little conservation benefit to the species involved.

#### 4.2. Animal Behaviour

Observing active animals can create opportunities for visitor learning [14,59] and contribute to positive emotional experiences, which can lead to pro-conservation behaviour by zoo visitors [12,13,60]. In the current study, the tigers' behaviour was observed by both a trained researcher and the participants of the interactive experience; however, little agreement occurred between the researcher and the visitors. The most likely explanation for this is that the public misinterpreted behaviours such as locomotion and recorded this as pacing, a commonly misunderstood behaviour by visitors [61]. However, it is critically important the visitors are educated about pacing, since visitors' attitude and support of zoos are likely to decrease when they observe pacing in captive felids [62]. Interestingly, although the tigers did not have food in their enclosures, visitors repeatedly reported seeing the tigers eating. It is probable that they misidentified the tigers' engagement with enrichment (licking the hay ball) as feeding. It is also possible that public observers forgot to record less-exciting behaviours such as inactivity. However, Wark [63] reported that the most commonly observed behaviours that were recorded by researchers during an inter-reliability testing trial were inactive and not visible. The findings from the present study suggest that visitors require moderate training during active animal periods or exposure to interpretation if they are to accurately understand animal behaviour in the zoo, especially if those behaviours are rare [63,64].

Yet, the up-close, hands-on experience appeared to instil some visitors with appreciation, which may have contributed to the positive findings surrounding conservation action.

Furthermore, during an activity such as the one described here, the animals are likely to be focused on the enrichment, not the visitors, but the visitors still get to have an up-close encounter, effectively balancing visitor enjoyment and animal welfare [12]. Additionally, none of the tiger behaviours observed by the trained researcher were indicative of reduced welfare during the activity. However, future research should also consider individual animal's behaviour and observe behaviour before and after the activity to ensure there are no unforeseen negative effects.

#### 4.3. Study Limitations

Certain limitations occurred during the study. In order to assess the visitor enrichment activity as a driver for conservation action, it would have been ideal to compare treatment groups of visitors who had participated in the activity and control groups who had not participated in the activity. While this was planned, the COVID-19 pandemic interrupted the original research design, and a smaller-scale study with a smaller sample size is presented here. Thus, these results should be cautiously interpreted, since the lack of a control group makes it impossible to definitively attribute any changes in visitor behaviour to the interactive experience. Future research should build on these findings by expanding the study to include control and treatment groups and other activities with various species. Like most research investigating pro-conservation behaviour change, it is not possible to know what other events might have influenced visitor behaviour or if visitors reported their behaviour accurately [58]. Additionally, the interactive experience included several parts. However, groups who experience an interactive activity may have more contact with staff [20]. In the future, it would be beneficial to determine which parts of the experience are most beneficial for visitors. Also, it was challenging to collect the animal behaviour data in a consistent method given certain constraints of the study, such as the length of the viewing session. Although the scientific procedure was as rigorous as possible, the reader should be aware of the potentially low reliability of the animal behaviour data. Future studies should strive to develop methods during which visitors collect data in a robust way to add to this study.

#### 4.4. Conclusions

The challenge for modern zoos is to balance the needs of visitors and the benefits of interactive experiences on visitors' conservation behaviour with the welfare of captive animals. The findings of the present study show that using enrichment as a base for an interactive experience provides visitors with an enjoyable, close-encounter experience with active animals, which connects them to nature and may lead to the development of pro-conservation behaviour. There was no behavioural indicator, as observed by the trained researcher, that the animals' welfare in this study was compromised during the activity. Indeed, the tigers likely benefitted from the provision of enrichment. Tigers are popular with visitors and inherently charismatic [12]; perceived attractiveness of a species often leads to greater conservation support [65]. Including tigers in safe, controlled, well-monitored and well-researched visitor experiences may contribute to their preservation in the wild. Harmonising animal welfare with visitor enjoyment is an ongoing process for zoos, which AVIs must strive to contribute to in a sustainable way. The data presented here advance the current knowledge of the contribution of AVIs to the visitor experience and animal welfare. This study should be used to inspire future animal–visitor interactive research projects in the zoo.

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### Appendix A. The Survey Administered during the Interactive Tiger Experience at Fota Wildlife Park

Please tick any tiger behaviours that you observed during the enrichment activity:

- Sleeping/Inactive/not alert
- Inactive but alert
- Grooming
- Exploration (Urine spray, sniffing, scratching)
- Feeding, chewing or looking for food
- Locomotion (running, walking, jumping, etc.)
- Pacing (repetitive purposeless movement on a given route)
- Engaging with enrichment (toys)
- Not visible (I did not see any tigers)
- Other: \_\_\_\_\_

(1) Do you have a conservation membership at Fota Wildlife Park?

a. Yes b. No c. I don't know

(2) How many Sumatran tigers currently exist in the wild?

a. Over 5000 b. About 300-400 c. They are extinct in the wild d. I don't know

(3) What is the main reason for the decline of Sumatran tigers?

a. Habitat destruction b. The pet trade c. Drought d. I don't know

**Please read the statements. Circle the answer that most closely matches how you feel.**

(4) I think tigers are lazy

Strongly Agree Agree I'm not sure Disagree Strongly Disagree

(5) Tigers should not be kept in captivity

Strongly Agree Agree I'm not sure Disagree Strongly Disagree

(6) Something should be done to help tigers in the wild

Strongly Agree Agree I'm not sure Disagree Strongly Disagree

(7) Having a close experience or encounter with the tigers makes me appreciate them more

Strongly Agree Agree I'm not sure Disagree Strongly Disagree

(8) I feel that I can do something to help stop the extinction of tigers

Strongly Agree Agree I'm not sure Disagree Strongly Disagree

**What is your pledge? Please indicate which actions you intend to take.**

- Buy products using sustainably sourced palm oil
- Sign an on-line petition to save tigers
- Sponsor a Sumatran tiger at Fota Wildlife Park
- Other: \_\_\_\_\_
- I do not intend to take any action at this time.

A UCC researcher would like to contact you in about a month to ask if you have followed through with your pledge. Your email address will not be used for any other purpose or shared with anyone else and will be discarded afterwards. **Please enter your email address here if you consent to being contacted:**

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