Visitor attachment to dolphins during an interaction programme, are there implications to dolphin behaviour?

Running title: Visitor dolphin attachment

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Abstract

Millions of people visit zoos and aquariums globally each year, with a smaller number choosing to participate in animal interaction programmes which allows visitors closer contact with individual animals. These are reportedly having mixed effects in increasing conservation-related behaviours. Human-animal interactions (HAIs) during these programmes are generally positive experiences for the human participants, however are there behavioural implications for the animals involved? The Bottlenose Dolphin (*Tursiops truncatus)* is the most widely used cetacean for dolphin interactions, known as "swim with dolphin" (SWD) programmes. This study investigated visitor attachment to the dolphins they interacted with, whilst assessing behavioural implications of the dolphins. 41 visitors to a Spanish dolphinarium, who participated in a SWD were surveyed using a modified version of the Lexington Attachment to Pets Scale (LAPS). Alongside this, 15-minute continuous focal samples monitored three female dolphins (D1, D2 and D3) aged 22 - 40, split into pre (n=96), during (n=96) and post (n=96) SWD. 80% of visitors reported a sense of attachment to the dolphin they interacted with. An exploratory factor analysis extracted three factors from the survey, these were "relationships", "emotional attachment" and "non-attachment". A Friedmans Two-Way ANOVA produced significant results for some behaviour categories for each individual, including locomotory (D1: F_2=9.556, p<0.01), rest (D2: F_2 =14, p<0.01, D3: F_2=10.889, p<0.01) and individual play (D1:

F_2=11.677, p<0.01 D2: F_2=6.353, p<0.05) however, pairwise comparison showed no differences pre-post SWD. In this context it can be implied that participating in the SWD was neither enriching nor aversive for the individual animals, although due to the small sample size further research is required. As visitors reported a sense of attachment post HAI, this can have applications in improving conservation education during SWD. This study has provided scope for further research into methods that facilities can use to utilise the emotional attachment developed to individual animals to facilitate learning about conservation issues for example.

Key words: Dolphin zoo visitor attachment education behaviour

1.0 Introduction

Human-animal interactions (HAIs) are commonplace in zoos and include interactions between animals with familiar humans (zoo staff) and unfamiliar humans (visitors). Research has found that the animal's perception of these interactions can be positive, neutral or negative, based on the animals' species-specific fear of humans and past experiences (Hosey, 2008). HAIs have a profound effect on the welfare of captive animals especially in zoos and therefore research in this area is growing significantly (Ward, Sherwen & Clark, 2019).

For zoo visitors, a recent review outlined the varied response of animals to visitors according to species and situation (Sherwen & Hemsworth, 2019) but more often than not the literature generally points to a stressful response by animals whereby most studies have used behaviour as the animal-based measure across various visitor number levels. Studies have shown decreased grooming and affiliative behaviour and increased agnostic and aggressive behaviour in the Western Lowland Gorilla (*Gorilla gorilla gorilla)* (Blaney & Wells, 2004; Wells, 2005); increased stereotypic behaviour in Brown Bears *(Ursus arctos)* (Soriano, Vinyoles & Mate, 2013) and in some birds, for example increased aggression and avoidance behaviours in the Little Penguin *(Eudyptula minor)* (Sherwen, Magrath, Butler & Hemsworth, 2015). It can also induce stereotypical behaviours such as pacing in large felids (Clubb & Mason, 2007) and Black Rhinos *(Diceros bicornis)* (Burrell, Wehnelt & Waran, 2004). This behavioural response can be attributed to mostly negative and neutral HAIs between animal and visitor and suggests that for a range of species there may be welfare implications from interactions with visitors (Fernandez, Tamboski, Pickens & Timberlake, 2009). However, it is argued that the effects of visitors may be overestimated, with other variables including time of day and the weather having a greater effect (Goodenough, McDonald, Moody & Wheeler, 2019). This could be due to methodological issues and situation-specific cases linked to the number of variables affecting the results (Collins *et al.*, 2017). For example, visitor numbers are not independent of other variables such as an increase in visitors in the middle of the day when the weather is pleasant (Goodenough *et al.*, 2019).

One aspect of visitor-animal interactions that is increasing are the number of animal encounters whereby visitors experience animals up-close as an additional informal learning opportunity, with the assumption that facilitating a connection between visitors and animals will lead to increased conservation-related behaviours (Fernandez *et al.*, 2009; Ward & Sherwen, 2018). Zoos are a source of free-choice learning and so visitors need to be motivated to learn for zoo education to be effective (Altmann, 1998; Tofield, Coll, Wyle & Bolstad, 2003). Emotional responses are essential in influencing what is considered important by individuals which in turn, drives a motivational force to learn (Boler, 1999). Visitors are more likely to retain facts and have increased attention and willingness to learn where positive emotions are elicited (Renninger, Hidi & Krapp, 1992; Buchanan & Lovallo, 2001). It has been suggested that visitors want to establish bonds with animals, and having an “encounter” with a zoo animal is directly linked to forming an emotional response to that individual; which in turn is highly interrelated to learning (Boler, 1999; Myers, Olin, Saunders & Birjulin, 2004; Powell & Bullock, 2014). It has been suggested that positive human emotions are fundamental in not only learning for environmental consciousness, but also good health, creativity and resilience (Carter, 2011; Powell and Bullock, 2014). Therefore, many zoos that offer these sessions give an added dimension to the zoo visit. However, there is conflicting evidence on how successful animal encounters are in influencing long term knowledge gain and conservation attitude change (Buckley *et al.,* 2020; Godinez & Fernandez, 2019). There are a number of factors which influence how successful an interaction in a zoo is at promoting conservation mindedness. Firstly, are the characteristics of the visitors; age (Myers, Saunders and Birjulin, 2004), socioeconomic status (Lyons & Breakwell, 2004) gender (Serpell, 2004), pre-existing knowledge (Lyons & Breakwell, 2004), previous experiences with nature and perception of connection to nature (Powell & Bullock, 2014) all affect environmental concern. Secondly, are the characteristics of the animals with mammals that are "charismatic megafauna" the most likely to elicit a positive emotional response for example, Elephants, Dolphins, Tigers and Giraffe (Albert, Luqye & Courchamp, 2018; Skibins & Powell, 2013). On the opposite end of the scale, animals that are less charismatic, aesthetically pleasing or phylogenetically similar to humans elicit negative emotional reactions such as fear and disgust (Myers, Saunders and Birjulin, 2004). This can be compounded by negative associations with the species in mainstream media for example, the Hyena *(Hyaenidae spp.)* (Glickman, 1995) and Tasmanian Devil *(Sarcophilus harrisii)* (Markwell, Weiler, Skibins & Saunders, 2019). In addition, Powell & Bullock (2014) found that more active animals will elicit more positive responses from visitors.

Changes in visitor knowledge, attitudes and behavioural intentions are the most commonly used measures of an education programmes' success (Buckley et al., 2020). Numerous studies have shown significant increases in all these areas for a range of visitor-animal interactions such as dolphin interaction programmes (Miller et al., 2013). However, there is criticism of these methodologies as knowledge is a minor factor in predicting conservation actions (Moss, Jensen & Gusset, 2017); and having intentions does not necessarily translate into behavioural change (Ballantyne & Packer, 2016; Buckley et al., 2020). There is evidence that post visit, visitors have an increased understanding of biodiversity and how to protect it (Moss, Jensen & Gusset, 2015) although, it can be argued that it is not the visit alone that can be attributed to behavioural change (Smith, Broad & Weiler, 2008). A study by Falk et al., (2007) demonstrated both short and long-term benefits on people's attitudes and behaviour towards animals and the environment, although even this study has come under methodological scrutiny (Marino *et al.*, 2010). The encounters could be stressful situations for the individual animals involved, so there is a trade-off between the benefits to the visitor and potentially reduced welfare for the animals (Fernandez *et al.*, 2009). In order to justify the operation of these programmes, visitor benefits should be maximised whilst potentially reduced welfare situations are mitigated.

The housing of cetaceans in captivity is one of the most widely debated issues in the zoo industry on both ethical and animal welfare levels, (Grimm, 2011; Yerbury, Boyd, Lloyd & Brooks, 2017).Some also question the conservation value of captive cetacean programmes including presentations and encounters (Rose *et al*., 2017). In zoos that hold cetaceans, dolphin encounter programmes, also referred to as ‘swim with dolphin programmes’ (SWD) are commonly offered, where the zoo visitor enters the pool and interacts with the animal. There is evidence to suggest that there are benefits of the activity to humans, including reduced cortisol levels and self-reported decreases in anxiety (Webb & Drummond, 2001), and increases in short-term and long-term knowledge, attitude and behavioural intentions as well as participants engaging in more conservation-related behaviours (Miller *et al.*, 2013).

Literature on the effects of SWD on the animal in captivity are mixed, with most using behavioural changes as the welfare indicator. A number of studies have found increased stress-related behaviours during and after a SWD including breaching, tail-slapping and increased aggressive behaviour with conspecifics, suggesting the HAI is aversive (Frohoff, 1993; Brakes & Williamson, 2007). Some studies report no negative implications of the SWD for example, Brando, Kooistra & Hosey (2019) found the presence of trainers poolside or the pool itself were significant predictors of behaviour, not the SWD, whilst Kyngdon, Minot & Stafford (2003) reported little effect on behaviour in general. Trone, Kuczaj & Solangi, (2005) found no negative implications of the SWD on welfare and found increased play behaviour post-SWD; which they concluded was indicative of robust psychological health. They also noted that dolphins continued to voluntarily interact with regular park visitors post-SWD, which suggests that the dolphins were perceiving the HAI as enriching.

However, there is literature suggesting that SWD can a positive impact on the participating animals. Miller, Mellen, Greer & Kuczaj, (2011) used behavioural diversity as a welfare indicator and found it was significantly higher after the SWD compared to beforehand, suggesting the HAI was enhancing their). Claxton (2011) stated that good quality HAIs could be classed as enrichment for the animals involved, which suggests that SWD could be categorised as enrichment and therefore beneficial to the individual. Brensing et al., (2005) reported opposing results in two SWD settings, one group of dolphins showed increased avoidance behaviour to adult participants while the other group actively interacted with the participants. This highlights that management styles and life history of the animals are important factors in assessing welfare in SWD and that most conclusions are individual and situation-specific.

Literature on the welfare implications of participating in a SWD is conflicting. Alongside this, The success of animal encounter programmes in influencing conservation-related behavioural changed is mixed however; there is an increasing trend in industry of using these encounters with the assumption of facilitating visitor-animal connections and therefore, fostering pro-conservation attitudes and behaviours, with limited research to support this (Ward & Sherwen, 2018) . Evidence shows that emotion and learning are highly interrelated (Demasio, 1994) and forming attachment to a topic is the first step towards behaviour and attitude change (Serpell, 2004). Therefore, zoos are in a unique position to be able to educate people who might not necessarily be looking to raise their own conservation awareness (Kawata, 2011). This provides scope to investigate if visitors perceive a sense of attachment to animals during encounter programmes and how attachment could be used to maximise the conservation education potential of these programmes by increasing motivation to learn through emotional connections, whilst maintaining optimum welfare. The Lexington Attachment to Pets Scale (LAPS) is a validated questionnaire that is used to measure the strength of attachment between companion animals and their owners (Johnson, Garrity & Stallones, 1992). LAPS has been used in a zoo context by Hosey, Birke, Shaw & Melfi, (2018) who modified LAPS to measure perceived human-animal bonds between zookeepers and the animals they care for; making comparisons of perceived bonds between the zookeeper and their companion and/or zoo animal. This study aimed to assess if participants in a SWD formed a sense of attachment to the dolphins they interacted with using LAPS, and whether participating in the SWD had behavioural implications for the individual animals.

2. Methods

2.1 Visitor Attachment

The LAPS questionnaire uses 23 statements about the perceived relationship between the person and an individual or small group of animals (Johnson *et al.,* 1992). For each statement the respondent can choose from four responses ("strongly agree", "somewhat agree", "somewhat disagree", "strongly disagree"). From the 23 statements, psychometric analysis can outline subgroups regarding different aspects of attachment. The LAPS utilised by Hosey *et al.,* (2018) was modified here for use with visitors after a SWD; the statement "I interact with this animal quite often" was altered to "I choose to come and interact with the dolphins often" and "Working with this animal adds to my happiness" was altered to "Interacting with this dolphin adds to my happiness". After discussions with the participating facility, the statement similar to "I love my pet because it never judges me" was removed from the survey. This aspect of the study was approved by the NTU ARES ethics committee at level 2 (approval code: ARE859).

The dolphin LAPS questionnaires were distributed on-site to participants for completion after the SWD programme between April-May 2019 and contained two sections, section A was the dolphin LAPS and section B asked more general demographic information. Because questionnaires were distributed in a Spanish facility, it was assumed that some visitors participating in the SWD programme would speak Spanish as their first language, rather than English. Ramirez, Berumen &

Hernandez, (2014) translated and validated the LAPS questionnaire into Spanish with Mexican amendments. With the assistance of a translator, this was modified into traditional Spanish for all sections of the visitor questionnaire, then validated by a native Spanish speaker at the facility.

2.2 Dolphin Behaviour

2.2.1. Subjects, housing and SWD programme

Three female dolphins aged 45, 23 and 23 at the time of data collection that were part of a social group of 7 individuals, housed in a dolphinarium containing five pools ranging in size. Up to four SWD programmes were carried out per day, with two dolphins participating per programme. SWDs generally lasted for approximately 30 minutes, with a maximum of 12 visitors in each programme. This facility operated a trainer-controlled programme, where the participants were guided on what to do by the trainers and positive reinforcement is applied to encourage participation by the dolphins. This was usually in the form of food, toys or positive trainer interaction including tactile and vocal praise.

2.2.2. Data Collection

The study did not require any modifications to the husbandry routine of the group, which followed the EAAM Standards and Guidelines for the management of bottlenose dolphins *(Tursiops sp.)* under human care (EAAM, 2019). The animal component of the study was approved by the NTU ARES ethics committee at level 1 (no code required) and the Mundomar ethics committee. Data collection followed the ARRIVE guidelines where necessary.

Continuous focal sampling was used following an ethogram adapted from Miller *et al*., (2011) and Brando *et al.*, (2019) (Table 2.1) designed to focus on the activity budgets and event behaviours of individuals used in SWD. The individual to be observed was selected using a rota system to ensure that observations were spread evenly between the three individuals. Focal observations consisted of three conditions: pre, during and post SWD with the observation for each condition lasting 15 minutes, totalling 45 minutes of observations for each SWD session. Because the SWD generally lasted 30-35 minutes, the first 15minutes were used for behaviour recording ‘during’. However, the content of the SWD was at the discretion of the trainer and exercises were random during the session, with no fixed structure of events.

Observations were taken opportunistically based on visitors booking a SWD programme and then the SWD taking place. Dolphin behaviour was recorded from the right-hand underwater viewing window of the reproduction pool using a GoPro Hero 5 camera. Pre-SWD behaviour was recorded 20 minutes prior to the start of the SWD. This was due to staff members moving around the pool in the five minutes prior to the SWD, which may have influenced the dolphins' behaviour. During-SWD began recording as soon as the first participant entered the water and was recorded from the top left corner of the pool. Recording the during-SWD condition from above water allowed an enhanced view of the HAIs that were occurring, compared to viewing from the underwater window. Post-SWD began recording as soon as all the participants and trainers had left the poolside at the end of the session. Recordings were uploaded into BORIS behavioural software (Friard & Gamba, 2016) to record state and event behaviours these were then categorised into: 'Social', 'Locomotory', 'Rest', 'Play (Individual)', 'Human-Animal Interaction' and 'Vigilance' (Table 2.1).

Enrichment was usually given to the animals in the pool pre, post and sometimes during SWD. To ensure that any effect on behaviour caused by the enrichment was the same across treatment groups, the enrichment provided was the same for each condition. Other variables that were recorded for each session were: Weather, temperature, time, date, number of SWD participants.

Table 2.1: Ethogram of dolphin behaviour

2.3 Data analysis

2.3.1 Dolphin LAPS

Analysis was conducted using IBM SPSS Statistics Version 25 (IBM Corporation, 2017). Scores were coded as 4 = strongly disagree, 3 = somewhat disagree, 2 = somewhat agree and 1 = strongly agree. Scores were reversed for the two statements "I am not very attached to the dolphin" and "I think the dolphin is just an animal" in accordance with the original LAPS questionnaire design (Johnson *et al.,* 1992). A Mann-Whitney U test was used to compare dolphin attachment (DA) scores between males and females, as well as comparing participants who thought trainers forming bonds with dolphins was professionally appropriate and those who did not. An exploratory factor analysis (EFA), Oblimin rotation with Kaiser Normalization was used to determine the underlying sub-groups regarding attachment for the dolphin version of LAPS.

2.3.2 Behaviour

Analysis was carried out using IBM SPSS Statistics Version 25 (IBM Corporation, 2017). Individual behaviours listed in the ethogram (Table 2.1) were grouped into six behavioural categories for analysis: Social, locomotory, rest, human-animal interaction, individual play and vigilance. 'It was anecdotally noted that the individual dolphins showed individual-specific behaviour, so data was analysed per individual, rather than as a group. A Friedmans Two-Way ANOVA was used to test for significant differences across the three conditions; pre, during and post SWD. Where the result of the analysis was significant, pairwise comparisons were carried out using a Related-Samples Wilcoxon Signed Rank Test. It was not possible to compare the pre SWD – post SWD conditions for 'human-animal interaction' due to no HAIs occurring in either group. Refusing to exhibit a trained behaviour could be considered an indicator of an aversive environment for the individual. Therefore, a Pearson's correlation was carried out between the number of SWD participants and the frequency of the 'refuse behaviour', to determine if the number of participants was having a negative effect on individual behaviour.

3. Results

3.1 Visitor Attachment

41 visitors participated in a SWD completed the dolphin LAPS questionnaire, 61% (n=25) of respondents were female and 39% (n=16) male. 80% (n=33) considered themselves to have an attachment to a dolphin, while 20% (n=8) did not. Participants who did not consider themselves to

have a sense of attachment to the dolphin did not complete the rest of the questionnaire and so were excluded from further analyses. Participants' scores were totalled and averaged, generating a 'dolphin attachment' (DA) score by gender. The mean DA scores for groups can be found in table 3.1. Female participants scored significantly less than male participants ($U=69$, $p=0.019$), indicating a greater sense of attachment to the dolphins for females. There was no significant difference in DA score between participants who thought forming a bond was professionally appropriate and those who did not ($t=-1.331$, $df=31$, $p>0.05$) suggesting that an individual's perception of keeper-animal relationships (KARs) did not influence their own attachment to the animal during the SWD.

The EFA used the 22 statements from the dolphin LAPS to create components describing attachment to animals based on the criterion of having an eigenvalue greater than 1.00. The Kaiser-Meyer-Olkin (KMO) measure verified the suitability of the sampling for the analysis with KMO = 0.519, which was above the acceptable limit of 0.5. The KMO value alongside the Bartlett's test of sphericity ($X^2_{231} = 741.623$, $p < 0.001$) indicated that the correlations between the items was sufficient enough for an EFA to be performed. The EFA identified three main components which contributed towards sense of attachment, explaining 70.83% of the total variance in the responses to the questionnaire (Table 3.2). The components were termed "relationships", "emotional attachment" and "non-attachment".

Table 3.1: Mean ± SE scores for attachment to dolphins for participants, grouped by sex and whether they thought trainers forming a bond with a dolphin was professionally appropriate. DA stands for Dolphin Attachment.

Table 3.2: Summary of the exploratory factor analysis results from all 33 participant questionnaires.

3.2 Dolphin Behaviour

96 observation sessions were recorded consisting of three conditions: pre, during and post SWD. D1 and D2 were observed for 33 sessions each, and D3 for 30 sessions. The Friedmans Two-Way ANOVA reported significant differences in behaviour categories for each individual (Table 3.3). Where pairwise comparisons were carried out, all significant results were for the ‘Pre-During’ and ‘During-Post’ conditions. There were no significant differences for behavioural categories for the ‘Pre-Post’ conditions for D1 (Figure 3.1), D2 (Figure 3.2) or D3 (Figure 3.3). For each individual, there was no correlation between the number of participants in the SWD and the frequency of the ‘refuse behaviour’ (D1 $rs=0.347$, $n=11$, $p>0.05$;, D2 $rs= 0.06$, $n=11$, $p>0.05$ and D3 $rs=-0.213$, $n=10$, $p>0.050.55$).

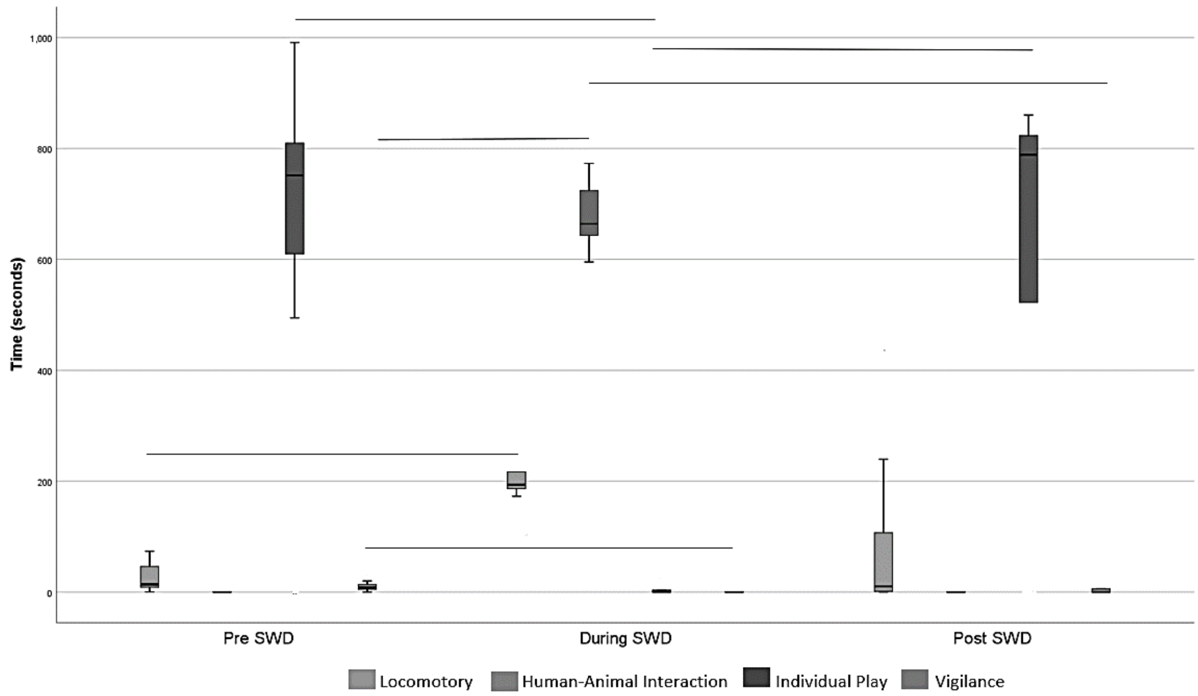

Figure 3.1: Significant behavioural categories exhibited by D3 (straight line indicates significance).

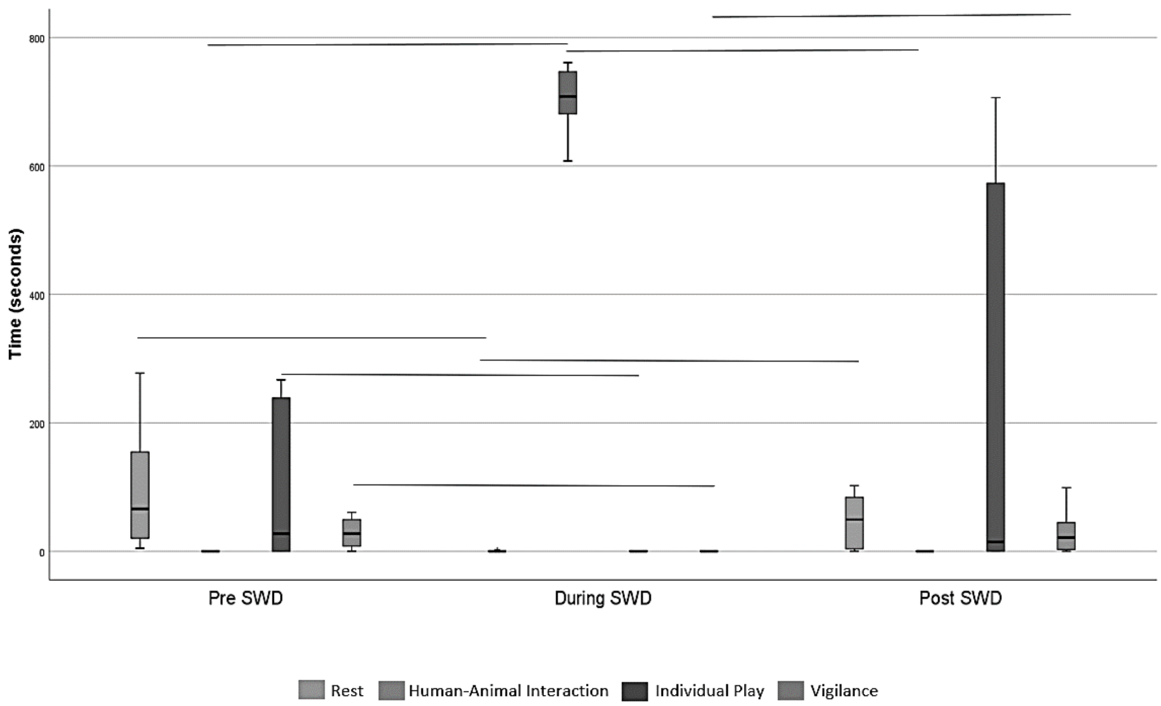

Figure 3.2: Significant behavioural categories exhibited by D3 (straight line indicates significance).

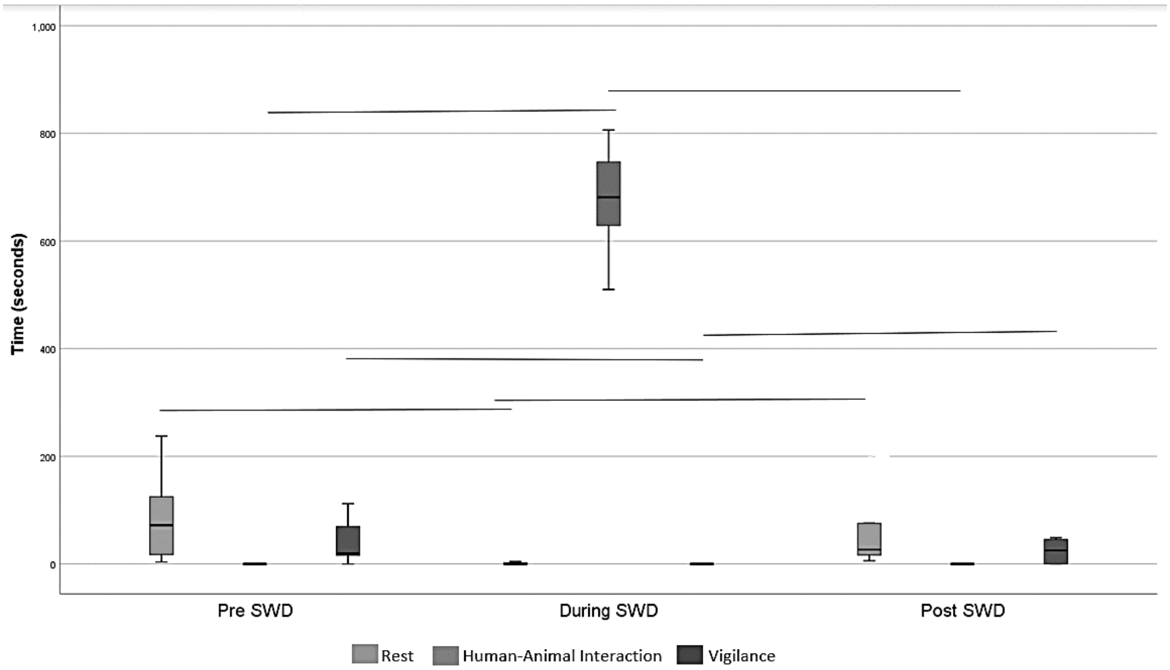

Figure 3.3: Significant behavioural categories exhibited by D3 (straight line indicates significance).

4. Discussion

An increasing amount of visitors are pursuing conservation education as the primary purpose of their visit, rather than purely entertainment (Reade & Waran, 1996). In responses, many zoos moved away from purely entertaining the visitors and more towards conservation education (Carr & Cohen, 2011). Zoos therefore face the challenge of informally educating visitors whilst providing for an enjoyable experience (Tofield *et al.,* 2003; Moss & Esson, 2010). However, the effectiveness of these programmes in promoting conservation mindedness can be argued (Godinez & Fernandez, 2019).

Visitor Attachment

After one interaction, 80% of respondents of the dolphin LAPS reported a sense of attachment with the dolphin that they had interacted with. This may be due a previous interaction that was not disclosed in the survey or could be due to the historical and cultural belief that dolphins have an affinity with humans (Montagu, 2003) and so an attachment could be expected. Although the participants may perceive to have an improved wellbeing after the interaction, it is unlikely that a HAR was formed due to the lack of opportunities for multiple HAIs to occur (Hosey, 2008, Patel, Wemelsfelder & Ward, 2019). Participants' viewing trainers that are interacting with the dolphins may influence their own perception of the dolphins and form an attachment to them. This was seen by Leighty *et al*., (2015) who compared visitor attitudes to primates when viewed with humans and without; when pictured with humans, visitors expressed an increased desire to own the animals as pets which would then influence their attachment to those individuals. This has the potential to undermine a zoos conservation aims and so should be managed appropriately with conservation education (Sherwen & Hemsworth, 2019).

Female participants scored significantly lower than males which indicated a stronger sense of attachment. This is different to Hosey *et al.,* (2018) who used LAPS to assess keeper attachment to their zoo animals and found no difference between genders, which may be due to a professional approach to interacting with the animal overriding possible gender differences. For the participants surveyed here, gender may be a factor in forming a sense of attachment and is comparable to a study by Powell & Bullock (2014) who assessed the emotional responses when viewing three carnivore exhibits. They found that females reported stronger emotional responses than males, irrespective of the animal species. It was also reported that eye contact with the animal and predispositions towards nature significantly affected emotional responses. This may be the case in the current study; however, this was not measured.

LAPS has been deemed suitable for use in a zoo context and the EFA reported three factors however, the questions did not align to the original three factors by the LAPS creators; "attachment", "people substituting" and "animal welfare/ animal rights". Therefore, for assessing attachment from a visitors' perspective we propose the following three sub-groups: "relationships", "emotional attachment" and "non-attachment". Visitors can perceive to develop a personal relationship whilst interacting with zoo animals, with some visitors frequently returning to a collection to interact with a particular animal. As well as forming an emotional attachment to the animals they interact with, or not having a sense of attachment at all, which may be the case for visitors who have a singular interaction with an animal and not have a predisposition for affinity to nature (Powell & Bullock, 2014). This can have applications for assessing emotional responses to different species or particular named individuals within a collection. For example, a named California Sea Lion *(Zalophus californianus)* that participates in presentations or a group of Ring-tailed Lemurs *(Lemur catta)* within a walk-through exhibit. This version of LAPS could have applications for investigating reasons for frequency of visiting a zoo for example, by comparing infrequent visitors and annual pass holders. It was outlined by Godinez and Fernandez (2009) that repeat visitors are more likely to participate in conservation-related behaviours, but the causal factors to this required research are still to be investigated.

Effect of SWD on Dolphin behaviour

Previous studies have drawn mixed conclusions on whether participating in a SWD is beneficial to the dolphin and so is improving, or detrimental to their welfare (Frohoff, 1993; Kyngdon *et al.,* 2003; Brensing *et al.,* 2005). Of the six behavioural categories, there were significant differences found in at least three categories for each individual; across the treatment groups pre, during and post SWD. This was expected due to the range of differences in the 'during' group compared to the 'pre' and 'post' groups including: the presence of unfamiliar humans in the pool, presence of trainers poolside, the application of positive reinforcement, the possible removal of enrichment devices and increased visitor activity on the terrace overlooking the pool. Therefore, pairwise comparison between the pre-post groups would determine if the HAIs during the SWD were influencing behaviour, similar to previous studies (Brando *et al.,* 2019; Miller *et al.,* 2011). There were no significant differences between pre-post SWD for any individual in any behavioural category; this could be interpreted as the HAIs occurring during the SWD having no effect on behaviour post-SWD, which has been reported by previous authors (Samuels & Spradlin, 1995; Brensing *et al.,* 2005; Brando *et al.,* 2019).

When investigating if there were differences pre-during and during-post, D1 performed ‘vigilance’ significantly more ‘pre-during’ ($p<0.05$) but not ‘during-post’ ($p>0.05$). The only behavioural state in this category was spy hopping, which is an exploratory behaviour and in captivity can be viewed as anticipatory (Jensen, Delfour & Carter, 2013); this behaviour was also reported by Miller *et al.,* (2011). Because SWD were at the same time every day, the individual may be perceiving the SWD as aversive and so anticipating the arrival of unfamiliar humans (Jensen *et al.*, 2013). Alternatively, with the SWD being trainer-controlled with positive reinforcement, D1 may be anticipating the food reinforcement or the trainer interaction rather than the SWD, which are considered highly valued by dolphins (Clegg *et al.,* 2018). Despite interpretation, because there was no difference between ‘pre-post’ it does not indicate that participating in the SWD is enriching or aversive for D1. Frohoff and Packard, (1995) and Brensing *et al*., (2005) suggested that increasing visitor numbers in a SWD had an adverse effect on behaviour, whereas for the three individuals in this context there was no correlation between the number of participants and the frequency of ‘refuse behaviour’. This suggests that in this context, up to the maximum number of 13 participants there were no negative implications on the dolphins from participating in the SWD, however this interpretation is likely to be situation-specific (Miller *et al.,* 2011).

Conclusion

Zoo facilities are using animal encounters to improve visitor experience and learning opportunities during a visit. Of all encounters, dolphin interaction programmes are perhaps the most topical and ethically challenged in society. This study aimed to assess if participants in a SWD formed a sense of attachment to the dolphins they interacted with and whether there were behavioural implications linked to these interactions. This study has shown that participants in these programmes do form a sense of attachment to the dolphins they interact with. In addition, this research showed that the dolphin’s behaviour was not altered pre-post SWD. Therefore, it could be possible that having up-close encounters with zoo animals such as the SWD, may have a positive influence on a visitor’s emotional response towards that animal and in turn, wider environmental issues. This would suggest that when delivered in an educational manner, animal encounters such as SWD have a place in zoos to elicit a positive emotional response from visitors which, with further research can be used as a factor to improve pro-conservation mindedness.

Research has shown that a positive emotional response is important in free-choice learning and could therefore link to stronger reports of pro-conservation mindedness when made aware of environmental issues. So long as the animal's behaviour and/or welfare is not reduced, developing a sense of emotional attachment could be utilised by zoos and marine parks to improve the conservation education offered during interactions through targeted messaging and individual action. In this context, there were no negative behavioural implications for the dolphins involved in the interaction programme, therefore there is the scope for SWD to be effective conservation education tools. However, this is a small sample size from one organisation, therefore the findings require confirmation across a larger sample of participants and organisations. Further research could be expanded to include post-visit surveys to assess the impact of the positive emotional response on conservation related behaviour.

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Tables

Table 2.1: Ethogram of dolphin behaviour

Behaviour	Description
Social	
Swim Together	Two dolphins swim in steady circles around the tank, the distance between them is less than one body-length.
Rest Together	Two dolphins lie at a spot within a distance of a maximum of one body-length.
Play Together	Two or more dolphins engage in using an enrichment device, such as an ice toy, ropes or floating devices
Chase	The dolphin swims quickly and actively after one or more dolphins for more than three seconds.
Locomotory	
Fast Swim	Dolphin sustains an increased speed, swimming in one direction, for more than three seconds, producing a wake at the surface.
Swim Horizontally	The dolphin swims slowly in one direction more than 50cm below the water surface.
Side Swim	The dolphin swims slowly in one direction on its' side more than 50cm below the water surface.
Ventral Swim	The dolphin swims upside down in one direction more than 50cm below the water surface.
Surface Swim	The dolphin swims with its head above the water, or within 50cm of the surface, moving its head above water frequently.
Dive Up	Dolphin swims towards the surface of the water at an angle of approximately 45° or greater.
Dive Down	Dolphin swims towards the bottom of the pool at an angle of approximately 45° or greater.
Interact with Object	Dolphin interacts with an object other than purpose given enrichment, which can include holding, carrying, balancing or pushing the object
Porpoise	Small bows usually performed several times in a row characterised by small forward motion leaps out of the water. The dolphin's head may re-enter the water as the tail is exiting the water.
Leap	A large aerial locomotion in which all of the dolphin's body comes completely out of the water.
Rest	
Rest	The dolphin lays on the bottom of the pool, or suspended in the water, not moving.
Drift	The dolphin lays at the water surface and floats.
Human-animal interaction	
Trainer Interaction Stationary, Movement	The dolphin is within one body-length of a trainer, either stationary looking towards them, or moving with the trainer either in the water or on the side of the pool
Participant Interaction Stationary, Movement	The dolphin is within one body-length of a SWD participant, either stationary looking towards them, or moving towards the participant who is in the water.
Refuse Behaviour	The dolphin fails to exhibit the desired behaviour, after being given the stimulus from the trainer.
Individual play	
Dive up with Toy	Dolphin swims towards the surface of the water at an angle of 45° of greater, whilst holding an enrichment device in its mouth or using its fins.
Dive down with Toy	Dolphin swims towards the bottom of the pool at an angle of 45° of greater, whilst holding an enrichment device in its mouth or using its fins.
Swim with Toy	Dolphin swims underwater whilst holding the enrichment device in its mouth or using its fins.
Rest with Toy	Dolphin rests on the bottom of the pool
Rest on Surface with Toy	Dolphin lays at the water surface, not moving whilst holding the enrichment device in its mouth or using its fins.
Surface Swim with Toy	The dolphin swims with its head above the water, or within 50cm of the surface, moving its head above water frequently whilst holding the enrichment device in its mouth or using its fins.

Play with Toy	The dolphin moves the enrichment device around using different body parts such as mouth, pectoral fins or fluke.
Vigilance	
Spyhopping	Dolphin is positioned vertically in the water, with its head poking out of the water frequently.
Other	
Not in View	The dolphin is not in view of the observer/camera.

Table 3.1: Mean ± SE scores for attachment to dolphins for participants, grouped by sex and whether they thought trainers forming a bond with a dolphin was professionally appropriate. DA stands for Dolphin Attachment.

Group	**DA Score**
All participants	43.39 ± 2.19 *(n=33)*
Male participants	49.14 ± 3.26 *(n=14)*
Female participants	39.15 ± 2.60 *(n=19)*
Participants who thought a bond was appropriate	42.17 ± 1.92 *(n=28)*
Participants who thought a bond was not appropriate	50.20 ± 9.99 *(n=5)*

Table 3.2: Summary of the exploratory factor analysis results from all 33 participant questionnaires.

Questions	**Rotated Factor Loadings**		
	Relationship	**Emotional Attachment**	**Non-attachment**
I love this animal because he/she is more loyal to me than most people in my life.	.981		
I believe this animal is my best friend.	.958		
This animal and I have a very close relationship.	.926		
This animal knows when I'm feeling bad.	.899		
This animal understands me.	.871		
This animal means more to me than any of my friends.	.807		
Quite often I confide in this animal.	.796		
I interact with this animal quite often.	.780		
I feel that this animal is part of my family.	.738		
I consider this animal to be a friend.	.722		
I consider this animal to be a great companion.	.687		
I would do almost anything to take care of this animal.	.627		
Interacting with this animal adds to my happiness.		.925	
I believe that loving this animal helps me stay healthy.		.783	

I am not very attached to this animal.		.759	
I often talk to other people about this animal.		.643	
I believe that animals should have the same rights and privileges as people.		.632	
Animals deserve as much respect as humans do.		.625	
Quite often, my feelings toward people are affected by the way they react to this animal.		.610	
I enjoy showing other people pictures of this animal.		.535	
This animal makes me feel happy.		.498	
I think this animal is just an animal.			.868
Eigenvalue	10.874	3.444	1.265
Percentage of Variance	49.43	15.66	5.8
α	.967	.872	n/a

Table 3.3: Results of the Friedmans Two-Way ANOVA and pairwise analysis for each behavioural category per individual. Where D1 = dolphin 1, D2 = dolphin 2 and D3 = dolphin. Data in bold signifies significant results.

			Related-Samples Wilcoxon Signed Rank Test		
Animal	**Behavioural Category**	**Friedmans Two-Way ANOVA**	**Pre-During**	**Pre-Post**	**During-Post**
D1	Social	$F_2 = 2.533, p > 0.05$			
	Locomotory	**$F_2 = 9.556, p < 0.01$**	**$W = -2.666, p < 0.01$**	$W = -1.077, p > 0.05$	$W = -1.481, p > 0.05$
	Rest	$F_2 = 4.095, p > 0.05$			
	Human-animal Interaction	**$F_2 = 18, p < 0.01$**	**$W = -2.666, p < 0.01$**		**$W = -2.666, p < 0.01$**
	Individual Play	**$F_2 = 11.677, p < 0.01$**	**$W = -5.521, p < 0.05$**	$W = -0.98, p > 0.05$	**$W = -2.366, p < 0.05$**
	Vigilance	**$F_2 = 8.963, p < 0.05$**	**$W = -2.366, p < 0.05$**	$W = -0.42, p > 0.05$	$W = -1.826, p > 0.05$
D2	Social	$F_2 = 3.273, p > 0.05$			
	Locomotory	$F_2 = 5.091, p > 0.05$			
	Rest	**$F_2 = 14, p < 0.01$**	**$W = -2.934, p < 0.01$**	$W = -1.125, p > 0.05$	**$W = -2.666, p < 0.01$**
	Human-animal Interaction	**$F_2 = 22, p < 0.01$**	**$W = -2.934, p < 0.01$**		**$W = -2.934, p < 0.01$**
	Individual Play	**$F_2 = 6.353, p < 0.05$**	**$W = -2.366, p < 0.05$**	$W = -6.652, p > 0.05$	$W = -1.836, p > 0.05$
	Vigilance	**$F_2 = 12.054, p < 0.01$**	**$W = -2.666, p < 0.01$**	$W = -0.255, p > 0.05$	**$W = -2.521, p < 0.05$**
D3	Social	$F_2 = 5.444, p > 0.05$			
	Locomotory	$F_2 = 4.667, p > 0.05$			
	Rest	**$F_2 = 10.889, p < 0.01$**	**$W = -2.547, p < 0.01$**	$W = -0.178, p > 0.05$	**$W = -2.666, p < 0.01$**
	Human-animal Interaction	**$F_2 = 18, p < 0.001$**	**$W = -2.666, p < 0.01$**		**$W = -2.666, p < 0.01$**
	Individual Play	$F_2 = 4.923, p > 0.05$			
	Vigilance	**$F_2 = 10.4, p < 0.01$**	**$W = -2.521, p < 0.05$**	$W = -0.560, p > 0.05$	**$W = -2.201, p < 0.05$**