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Research article

Impacts of an elderly lion *Panthera leo* exhibition at Kyoto City Zoo, Japan, on the perceptions, attitude, and behaviours of zoo enthusiasts

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Abstract

The exhibition of elderly animals in Japanese zoos is likely to attract the attention of visitors due to the cultural concept of 'Aigo'. Although it is important for visitors to form a personal connection with animals in order to promote visitors' behavioural change, the impact of exhibiting elderly animals on zoo visitors is not clear. Therefore, this study surveyed zoo visitors about the exhibit of an elderly lion *Panthera leo* (25 years old, died of natural causes in January 2021) in the Kyoto City Zoo. In order to investigate the impacts of the end-of-life care and mourning of this animal on visitors, a questionnaire was distributed to visitors who participated in the memorial events held after the animal's death. The questionnaire contained both closed-response items (gender, age, frequency, duration of zoo visits, experience with animal keeping and experience with bereavement) and open-ended questions (impressions about the exhibition and changes in lifestyle). χ^2 tests were used to associate behavioural changes and multiple-choice items, and text mining was used to analyse free text. The responses to the questionnaire (n=140) indicated that the respondents found the exhibit to be an opportunity for self-contemplation and reflection on life. There was a significant relationship between frequently visiting the zoo and reporting a change in behaviour. A small number of self-reports of behavioural attempts to become actively involved with the zoo and animals were described. These findings indicate that the exhibition of elderly animals and the death of an animal provide opportunities for zoo visitors to form a personal connection with animals, which is effective in promoting behaviour change. In order to capitalise on the interest of these visitors, it is important for zoos to proactively communicate messages such as conservation activities.

Introduction

Zoos are environmental education facilities that encourage visitors to conserve endangered species. The World Zoo and Aquarium Conservation Strategy (Barongi et al. 2015), published by the World Association of Zoos and Aquariums, calls for zoos to facilitate behavioural change among their visitors. Behavioural change in this context means encouraging learners to take new positive actions in their daily activities that support sustainable lifestyles, biodiversity conservation and environmental protection (Barongi et al. 2015). In order to encourage visitors to change their behaviour, it is not enough to provide more information: it has been shown that increasing knowledge about biodiversity does not directly lead to changes in visitor behaviour (Moss et al. 2017). Instead, feelings of connection toward animals in zoos are thought to be linked to the involvement of visitors in activities related to the conservation of endangered species (Clayton et al. 2009). In addition, regular zoo visitors are more likely to be knowledgeable about animals and to perform actions related to their conservation if they have more opportunities for education in the zoo (Godinez and Fernandez 2019). Therefore, finding ways to develop feelings of connection by visitors toward animals is of utmost importance.

In Japan, values towards animals are generally spoken of in terms of the concept of 'Aigo': ethics concerning animals that are specific to Japanese culture. Sato (2016) describes the difference between animal welfare and Aigo ethics as follows:

In Japan, ethics regarding animals has developed to emphasize the motivation to respect animals and not kill them,

Figure 1. Photograph of the Nile flower-offering stand and letter exhibition.

rather than from a belief in the need to protect the welfare of animals. Whereas the animal is the subject in animal welfare ethics, the motivation of attachment to animals in humans is the focal point of Aigo ethics. The animal is regarded as "sentient" in animal welfare ethics, and "living" in Aigo ethics. While the purpose of animal welfare ethics is to foster good conditions for animals; in Aigo ethics, it involves encouraging sympathy and respect for the animals (the Act on Aigo and Management of Animals in Japan, enforced in 1973; revised 2012). Therefore, in the context of Aigo, animals must not be killed before they naturally die.

Understanding this perspective is important when discussing the Japanese view of animals. Japanese people respect natural death and, as a result, are resistant to euthanasia (Sato 2016). Therefore, they may be more likely to be concerned about end-of-life care for animals. In the context of this unique sense of respect toward animals, the exhibition of elderly animals attracts remarkable attention among zoo visitors (Matsumoto 2013). In Japan, there is a group of visitors who is attached to specific animals, and the visitors are commonly regarded as either 'fans of animals (zoo enthusiasts)' or 'Jo-Ren (regular visitors)' (Ishida 2013; Okabe and Matsunaga 2021). Life-related events, such as the death of animals, are likely to attract the visitors' attention (Levin 2015). In other words, these events may increase visitors' interest in the animals and encourage a connection to be formed with them. However, there has been no objective research investigating how perceptions and attitudes among visitors toward elderly animals are fostered by zoos in Japan, how they are expressed, or whether behavioural change occurs because of exhibiting elderly animals. Therefore, this study focused on the exhibition of elderly animals and examined whether perceptions and attitudes toward animals among zoo visitors is related to behavioural change.

Materials and methods

Exhibition history and context

This study focuses on an exhibition of an elderly lion *Panthera leo* that was in its end-of-life period at the Kyoto City Zoo. The lion was an individual named Nile who died of chronic kidney failure in 2020 at the age of 25. Nile was born in 1994 and was moved to the Kyoto City Zoo in 1998, where he was kept for over 20 years, which is well beyond the average lifespan of lions in zoos (the average lifespan of lions in zoos is about 20 years; Tidière et al. 2016). The Kyoto City Zoo posted a notice to inform visitors that Nile was receiving end-of-life care and that he would not be euthanised unless his quality of life was significantly diminished. The information provided about the end-of-life care described the process of husbandry and the average lifespan and activity of lions, requested that visitors be quiet when observing the lion, and transmitted messages to convey the importance of life. This policy of not performing euthanasia was believed to be based on Aigo ethical principles and was well understood by many visitors (Okabe and Matsunaga 2021). Nile died on 31 January 2020, and a flower-offering stand was set up for one month, when the Kyoto City Zoo received many letters and bouquets of flowers (170 letters and at least five times this number of bouquets; Figure 1). In addition, for one month following his death, the zoo held an

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Table 1. Questionnaire item structure. English translation and quotation from Okabe and Matsunaga (2021).

Item	Response options
Visitor age	Under 19 years, 20–29, 30–39, 40–49, 50–59, 60–69, over 70 Do not wish to answer
Visitor gender	Male Female Do not wish to answer
Duration of Kyoto City Zoo visits	Less than 1 year (<1 year), 2–5 years, more than 5 years (>5 years), more than 10 years (>10 years)
Frequency of Kyoto City Zoo visits	Once every few years (<0.5 time/year), Once a year (1 time/year), Several times a year (>1 time/year), At least once a month (≥1 time/month),
Experience with keeping animals as pets	Currently have pets, Past experience, No experience
Experience with bereavement (human or pet)	Have experience, No experience
How did the Nile's exhibition make you feel?	Open-ended response
What lifestyle changes have you made as a result of the Nile's exhibition?	

exhibition about the history of lion husbandry at Kyoto City Zoo's exhibition facility (22 February–6 April 2020), as well as a number of memorial lectures (11 February, 23 February, 1 March and 9 March 2020). The content of the lecture centered on the history of lion husbandry at Kyoto City Zoo, the story of Nile's youth and concluded with the care of Nile in his later years.

Questionnaire development and distribution

To evaluate perceptions of the exhibition and its influence on zoo visitor behaviour, a questionnaire was developed and distributed to visitors. An outline of the questionnaire items, translated into English, is presented in Table 1. A questionnaire developed by Okabe and Matsunaga (2021) was used, which contained items selected based on factors that have been found by previous studies to influence attitudes toward animals, death, or conservation (gender: Johnson et al. 1992; age: McCutcheon and Fleming 2002; duration and frequency of zoo visits: Godinez and Fernandez 2019; experience of keeping animals: Driscoll 1992; and experience of bereavement with pets: Adams et al. 2000). Questions relating to the duration and frequency of zoo visits were specific to Kyoto City Zoo. There were also two open-ended questions: "How did the Nile's exhibition make you feel?" and "What lifestyle changes have you made as a result of the Nile's exhibition?" These questions were designed to investigate the psychological impact of the Nile's exhibition on visitors and the behavioural changes of visitors, respectively.

The questionnaire was written in Japanese, and the target respondents were Japanese visitors who participated in the memorial program (post-death lectures, donating flowers on a stand, and the history of lion husbandry exhibition) during the period following Nile's death. Due to the nature of the memorial events, participants were inevitably considered to be specific visitors who were interested in Nile's end-of-life care and had a personal connection with him. This study have defined this group of visitors as 'zoo enthusiasts'. The questionnaire was conducted after Nile's death because it was considered important for visitors to have experienced the entire process of aging, the moment of death and mourning rather than simply an exhibition of an elderly animal. The questionnaire was accompanied by a clear statement that it was being administered for research purposes and no personally identifiable information was collected. The questionnaire was administered with the approval of the Kyoto City Zoo (registry book: G32-01-B).

Statistical analysis

The text was analysed by text data mining using the free software 'KH Coder' (ver. 3.0; Higuchi, Ritsumeikan University, Kyoto, Japan). This software uses multivariate analysis to automatically identify and classify groups of words that frequently appear in the same document, or groups of documents that contain many common words, thereby removing the potential for any selection bias that may be introduced by a human coder. KH Coder employs 'ChaSen' for extracting words from Japanese text data, R for statistical analysis, and MySQL for data organisation and retrieval (Higuchi 2016). Two analysis methods were used: word frequency lists and co-occurrence networks. In the word frequency list, the words were displayed in order of the frequency with which they appeared in the target text. A co-occurrence network is a visualisation of the patterns of associations between words on a two-dimensional plane, which allows the viewer to intuitively grasp how often they appear together. Words that form a co-occurrence network show a higher percentage of use in the same sentence than other words in the entire sentence, that is, they have similar patterns of occurrence. In other words, the groups formed by the formation of co-occurrence networks are the groups of words that were used more frequently at the same time, that is, they are considered to be well-described sentences. Another feature is the ability to go back to the original text from the detection results to explore the factors that formed the connection, making it possible to understand the overall flow of the text without any subjectivity of the analyst or the possibility of the analyst misinterpreting the results. However, it is necessary for the analyst to compensate to some extent in advance for shaky notation, fluctuating words and character errors caused by the respondent's writing. More detailed information about the above these methods is available in the KH Coder 3 Reference Manual (Higuchi 2016).

Whether or not a participant had changed their behaviour as a result of the exhibition was determined based on their response to the open-ended question, "What lifestyle changes have you made as a result of the Nile's exhibition?" Respondents only who described concrete activities (e.g., those who described going to the zoo more often, and those who read a lot of books about zoos or lions) were classified as 'change', while those who did not (e.g., those who described having an interest in animals, and those who treat life with respect) were classified as 'no change'. For the closed-ended items in the questionnaire, the χ^2 test with Haberman's definition of adjusted standardised residuals was used (Haberman 1973) to investigate the association between each option and the presence or absence of behavioural change. The statistical processing software used in this study was Statcel2 (OMS Publishing, Saitama, Japan). All data are presented as means with 95% confidence intervals.

Table 2. Summary of questionnaire results. English translation of the structure of the questionnaire developed by Okabe and Matsunaga (2021).

Items	Frequency							
Visitor age	Under 19	20–29	30–39	40–49	50–59	60–69	Over 70s	No answer
	9 (6.4%)	7 (5.0%)	13 (9.3%)	31 (22.1%)	42 (30.0%)	25 (17.9%)	12 (8.6%)	1 (0.7%)
Visitor gender	Female	Male	No answer					
	103 (73.6%)	35 (25.0%)	2 (1.24%)					
Duration of Kyoto City Zoo visits	<1 year	2–5 years	>5 years	>10 years				
	11 (8.5%)	25 (17.8%)	16 (11.4%)	86 (61.4%)				
Frequency of Kyoto City Zoo visits	<0.5 time/year	1 time/year	≥1 time/year	≥1 time/ month				
	10 (7.1%)	15 (10.7%)	60 (42.8%)	47 (33.6%)				
Experience with animal keeping as pets	Currently have pets	Past experience	No experience					
	56 (40.0%)	59 (42.1%)	25 (17.9%)					
Experience with bereavement (human or pet)	With experience	Without experience						
	131 (93.6%)	9 (6.4%)						

Results

A total of 220 questionnaire responses were recorded. In order to standardise the level of respondents' knowledge and experience with the target lion in the analysis, the responses of 140 respondents who participated in the memorial lectures were analysed. A summary of the questionnaire results is presented in Table 2. Over 70% of the respondents were female and half were in their 40s and 50s. Over 60% of the respondents had been coming to the Kyoto City Zoo for more than 10 years, and 80% of the respondents visited more than once per year. A total of 85% percent of the respondents had experience of keeping animals, and 90% of the respondents had experienced bereavement, following the loss of either a person or a pet.

In order to investigate the perspectives and attitudes of the exhibition on the questionnaire responses, text mining analysis was conducted to analyse responses to the open-ended item "How did Nile's exhibition make you feel?" The number of targeted responses was 87. Prior to the analysis, ChaSen was used to detect compound words, and words that co-occurred more than five times were considered compound terms and were treated as single words for the remainder of the analyses (e.g., Kyoto-City-Zoo and Life-force). After preprocessing, 243 paragraphs and 264 sentences were identified using KH Coder. The total number of extracted words (i.e., the total number of words included in the files to be analysed) was 4,750, and the number of unique words was 813. After excluding common words that appear in most sentences (known as stop words), such as particles and auxiliary verbs, 1,809 words (639 unique words) were extracted for analysis. The 10 most frequently occurring words in the free text responses were 'Nile' (85 times), 'think' (69 times), 'animal' (35 times), 'zoo' (34 times), 'live' (32 times), 'feel' (28 times), 'watch' (25 times), 'appearance' (21 times), 'lion' (20 times), 'last' (19 times) and 'husbandry' (19 times).

The co-occurrence (percentage of words written at the same time in a single sentence, the Jaccard coefficients) network based on the 60 most frequently used words that occurred at least five times is shown in Figure 2. Based on co-occurrence, these words were automatically classified by the software into seven groups (underlined words indicate words represented in the co-occurrence network). Group A consisted of impressions of and appreciation for seeing Nile, including words such as 'seeing the last of the Nile' (n=7), 'thinking about how to live' (n=30) and 'appreciating the animals at the zoo' (n=16). Group B consisted of a group of words centered on 'human death' (n=10). In Group C, the word group centered on 'being cheered up by (Nile's) hard work' (n=9) or encouraged. Group D consisted of impressions of zoos and respect for natural death, including words such as 'Kyoto City Zoo cherishes life in its natural state' (n=8) and 'I am absolutely against the opinion of euthanasia, and would like to thank the zoo (for showing him to the end)' (n=13). Group E consisted of impressions of Nile's care, including sentences such as 'It's really great work to take care of Nile' (n=5) and '(Nile) seemed really happy' (n=5). Group F described 'getting old' (n=5). Group G had difficulty deciphering the meaning, and consequently were excluded from the analysis.

To investigate the types of behavioural changes that occurred among respondents, text mining analysis was conducted to analyse responses of the open-ended item "What lifestyle changes have you made as a result of Nile's exhibition?" Out of 140 respondents, 71 (50.7%) answered the open-ended question. Prior to the analysis, compound words were detected via

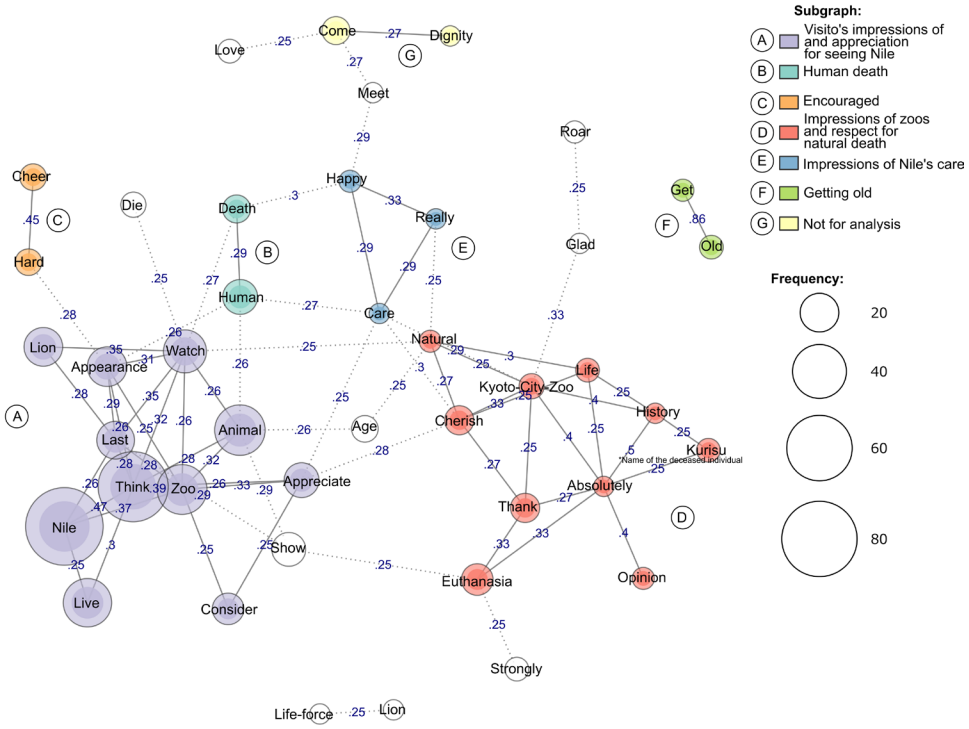

Figure 2. Co-occurrence network based on the responses to the open-ended question, "How did Nile's exhibition make you feel?"
Words with high percentage of occurrences in the same sentence at the same time are connected by a line, and words with relatively high percentage of occurrences are shown as the same group. The strength of co-occurrence (the percentage of words that appear in the same sentence at the same time) is indicated by the Jaccard coefficient, which is indicated as a number on the line. Words that are in the same group are connected by solid lines, and words that are not in the same group but show co-occurrence are connected by dashed lines. For ease of interpretation, groups of words that frequently co-occur are indicated by a coloured circle. All of these classifications were mechanically classified by the software (KHcoder).

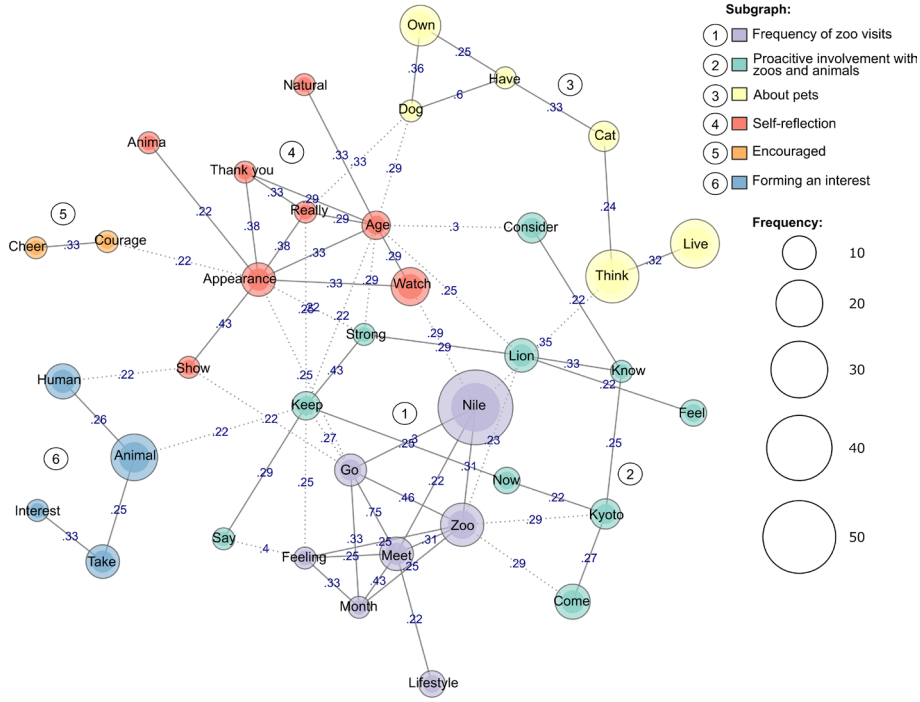

Figure 3. Co-occurrence network based on the responses to the open-ended question, "What lifestyle changes have you made as a result of the Nile's exhibition?" Words with high percentage of occurrences in the same sentence at the same time are connected by a line, and words with relatively high percentage of occurrences are shown as the same group. The strength of co-occurrence (the percentage of words that appear in the same sentence at the same time) is indicated by the Jaccard coefficient, which is indicated as a number on the line. Words that are in the same group are connected by solid lines, and words that are not in the same group but show co-occurrence are connected by dashed lines. For ease of interpretation, groups of words that frequently co-occur are indicated by a colored circle. All of these classifications were mechanically classified by the software (KHcoder).

morphological analysis using ChaSen, and words that co-occurred more than five times were extracted as single compound terms. After preprocessing, 132 paragraphs and 144 sentences were identified using KH Coder. The total number of extracted words was 2,806, and the number of unique words was 613. After stop words were excluded, 1,066 words (458 unique words) were extracted for analysis. The 10 most frequently occurring words in the free text responses were 'Nile' (53 times), 'think' (26 times), 'live' (22 times), 'animal' (20 times), 'zoo' (17 times), 'myself' (15 times), 'see' (13 times), 'last' (13 times), 'human' (11 times) and 'come' (11 times).

The co-occurrence network based on the 60 most frequently used words that occurred at least four times is shown in Figure 3. These words were automatically categorised into six groups by the software based on their co-occurrence. Group 1 described frequency of zoo visits using words such as 'I started going to the zoo every month to meet Nile' (n=8). Group 2 consisted of word groups describing proactive involvement with zoos and animals, including 'I have a stronger desire to become a zookeeper' (n=2), 'I now read books to know about lions and consider their conservation' (n=4) and '(To see Nile), I now started to come to Kyoto' (n=4). Group 3 described feelings about pets, such as 'think about the life of my own dog or cat' (n=8). Group 4 consisted of words of self-reflection, such as 'It is natural for animals to age, and I really want to thank you for showing me this appearance' (n=7). Group 5 consisted of the words of encouragement, including 'encouraged' (n=4) and 'cheered up' (n=4). Group 6 reflected forming an interest, including word groups such as 'I took an interest in animals' (n=10).

Among these descriptions, 25 visitors (17.9%) described concrete changes in behaviour or lifestyle (responses included in Groups 1–3 shown in Figure 3). The other responses described attitudes toward life and interest in animals, and it was not possible to determine whether these were associated with actual behaviour change; therefore, these responses were treated as indicating that behavioural change had not occurred. It was attempted to statistically investigate how the characteristics of the respondents were related to whether or not they reported a change in behaviour. There was no significant association between self-reports of behaviour change and animal keeping experience (P = 0.09). The associations between behavioural change (as a binary variable) and the frequency of Kyoto City Zoo visits are shown in Figure 4. The results indicated that the group of respondents that visited the Kyoto City Zoo at least once per month was significantly biased toward showing a behavioural change (χ^2=11.1, P<0.01), whereas the group that visited several times per year was significantly biased toward exhibiting no behavioural change (P<0.05).

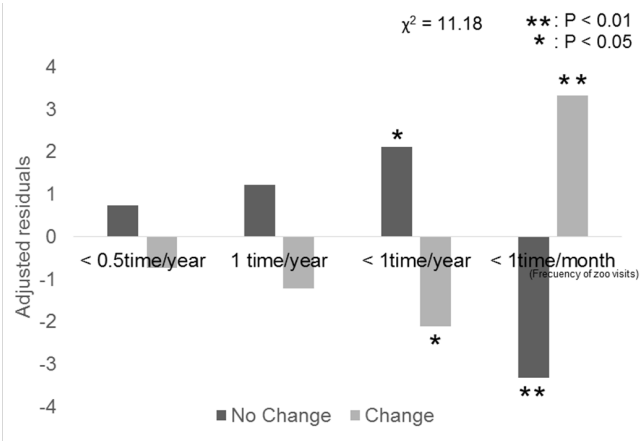

Figure 4. Relationship between the frequency of Kyoto City Zoo visits and self-reported behavioural change as a result of the elderly lion exhibition.

Discussion

In the questionnaire used to form the co-occurrence network in this study, there were no descriptions in which a particular individual repeated the same word excessively. In addition, the minimum frequency of occurrence of a word was set to five or four times, with the result that even small number of descriptions could be reflected in the network. Therefore, the co-occurrence network appropriately captured the overall flow of sentences in the questionnaire responses.

The co-occurrence networks based on the open-ended responses to, "How did Nile's exhibition make you feel?" revealed that many respondents focused on Nile, zoos and animals, and the human way of life. Some responses included thinking about their own lives and the care of animals in zoos based on the care of Nile (Group A), comparisons with human death (Group B), and being encouraged by the way Nile lived (Group C). In short, some respondents reflected on their own way of life. Comments on the exhibition itself included descriptions of the respect for natural death (Group D) and the labour of care (Group E). Thus, most of the respondents' interests were centered on life and death, how to live and how to treat life. Moreover, it is possible that the cultural background of Aigo ethics (Sato 2016) influenced their attitudes.

A significant association was observed between self-reporting of behavioural change in the open-ended responses and the group visiting the zoo at least once per month (Figure 4). When considered alongside the co-occurrence network (Figure 3), this result appears to be reflected in the group of words related to the respondents' frequency of zoo visits (Group 1 and 2). A group of words relating to zoo visiting frequency was also found (Figure 3) that also included the word 'Nile', suggesting that some groups increased their visit frequency with the specific purpose of seeing Nile. In the authors' previous study (Okabe and Matsunaga 2021), individuals who frequently visited the Kyoto City Zoo were found to be biased toward 'agreeing with the exhibition policy of not being euthanised'. Therefore, attitudes toward the end-of-life care based on Aigo ethics may have influenced the frequency of visits to the Kyoto City Zoo.

Other responses that indicated behavioural change also revealed a desire to be proactively involved with animals and zoos (Group 2). A closer look at the responses revealed specific phrases, in addition to descriptions related to the frequency of visits to the zoo (i.e., 'I started coming to Kyoto'). In Group 1, specific statements relating to career development and knowledge acquisition were observed, such as 'My desire to become a zookeeper became stronger' (n=2) and 'After seeing Nile, I started reading books about lions and zoos' (n=4). This group reported becoming more proactive in their actions regarding animals and zoos.

There was no significant association between self-reports of behaviour change and animal keeping experience; however, some respondents described their pets (Figure 4; Group 3). These results are consistent with previous studies that have shown that the experience of keeping animals as pets affects a person's attitude toward animals in general (Driscoll 1992). The responses to the open-ended questions indicated that the respondents were

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aware of the comparisons they were making between zoo animals and their own pets and this may have led to them becoming more proactively involved in animal-related concerns. It is also possible that because the species targeted in this study, the lion, is in the same family as the domestic cat, it was easier for respondents to make such comparisons. These results suggest that pet owners may be encouraged to change their behaviour and become actively involved in zoo and conservation activities.

Descriptions grouped into Groups 4–6 did not describe concrete behavioural changes; however, they may reflect a change in attitude and interest. For example, Group 4 contained words related to strength and dignity in aging. Specific responses included 'I was given courage by the way he lives strongly even in old age', and this group of respondents described being inspired by witnessing Nile's aging process. Another group (Group 5) used words related to the importance of living a full life and specifically included the phrase '(Nile's appearance) gave me courage and cheer'. This suggests that the respondents in Groups 4 and 5 may have confronted life and death in response to the Nile exhibit (Group C), and changed their attitudes toward life and living, as a result of the exhibit. Finally, Group 6 contained words associated with an interest in people and animals. Fostering interest and concern about how humans and animals interact is the first step in encouraging visitors to change their behaviour (Barongi et al. 2015) and is considered as a positive response in the context of conservation strategies for zoos and aquariums.

The respondents to the questionnaire made comparisons with their ways of life and familiar animals (pets), and self-reported that they had formed a personal connection with Nile. The content presented in the two open-ended statements is considered sufficient to demonstrate the establishment of a connection between animals and visitors (Clayton et al. 2009). However, only a small number of respondents described changes in their behaviour. In particular, respondents reported an increase in their frequency of visits to the zoo. Thus, it is possible that such events that involve the life and death of animals build a group of visitors who are highly interested in zoos and animals. Forming group of visitors who establish a personal connection with animals is one of the effective ways for zoos to call for behavioural change (Grajal et al. 2017; Howell et al. 2019). The degree of positive behavioural change, such as participation in conservation activities, may be improved by incorporating specific suggestions into the content of the exhibition notices.

However, it should be noted that witnessing the aging and death of animals can also have a negative psychological impact. The death of an animal can generate a great deal of backlash from people with different perceptions of animals' death in zoos (Levin 2015). Therefore, although there is great potential for positive psychological impact, appropriately communicating and disseminating information to visitors about the zoo's policies and approach is extremely important. In addition, this study was conducted based on the self-reports of zoo visitors, and it is therefore unclear whether clear behavioural changes occurred. Therefore, it is necessary to design experiments to show clear evidence of behavioural change.

Conclusion

The exhibition of elderly animals at the zoo provided visitors, especially zoo enthusiasts, with opportunities for self-contemplation and reflection on life. A group of visitors may have increased the frequency of their visits to the zoo as a result of the exhibit of elderly animals, and a group of visitors with a personal connection to the animal was formed. However, the percentage of visitors who changed their behaviour was small, and it may be important for the zoo to send out messages in order to effectively involve this group of visitors in zoo activities such as conservation activities in the future.

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