Increasing the Public's Support of Zoos using Value-Congruent Framing

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Abstract

For zoos to contribute to biodiversity conservation, they need to receive support from the public. To address this issue, the present study investigated the effect of value-congruent framing on zoo support, as well as the relationship between participants' values and their rating of the importance of the four roles of the modern zoo (conservation, education, research, and entertainment). Participants' (N = 576) values were assessed by means of an online survey. This was followed by a video manipulation consisting of information about zoos and zoo animals, framed in accordance with either biospheric or hedonic values. Post-manipulation, we assessed zoo support and perceived importance of zoo roles, and analysed whether there were group differences in these measures for different value groups and framing conditions. We did not find evidence that aligning the framing of the manipulation with participants' central values (i.e., value-congruent framing) resulted in higher zoo support. We did find group differences in perceived importance of zoo roles: participants high in biospheric values rated the conservation, education and research roles as more important, while participants high in hedonic values rated the entertainment role as more important. More research is needed to examine whether value-congruent framing does not apply to zoo support at all or whether the theory and methods need revising in this context.

Keywords: values, value targeting, zoo approval, zoo roles, zoo support

Increasing the Public's Support of Zoos using Value-Congruent Framing

Zoos have been around for hundreds of years, with the oldest zoo still in existence being established in 1752 (Bauer et al., 2003). In the centuries that followed, the zoo as an institution has seen many changes, transitioning in function from pure entertainment to fulfilling other purposes such as conservation, education, and research (Reade & Waran, 1996). Despite these developments, many still consider the modern zoo to contribute little to animal welfare and conservation, arguing that animals should not be kept in captivity and that zoos are expensive and ineffective (Godinez & Fernandez, 2019). However, research has shown that zoos do in fact contribute to species conservation in a meaningful way, and this is only possible if they continue to receive support from the public (Tribe & Booth, 2003). Therefore, it is important for zoos to understand what exactly determines zoo support and whether this can be influenced. *Zoo support* refers to a person's positive evaluation of zoos and a willingness to contribute to zoos' efforts and facilities (Miller, 2012). This paper examines the determinants of zoo support and one way in which zoo support may be influenced, as well as public opinion of the importance of the various roles zoos fulfil.

Value-Congruent Framing

To explore what may successfully increase zoo support, it must first be understood what gives rise to zoo support in the first place. The theory we have chosen to apply to zoo support is that of values, a theoretical framework that is commonly used in environmental psychology (de Groot & Steg, 2009; Schwartz, 1992; Stern, 2000). Though this has not – to our knowledge – been applied specifically to zoo support and value-congruent framing before, it is a well-established theory that is used to explain a large range of attitudes and behaviours related to conservation and other environmentally relevant topics (Fornara et al., 2020), and is therefore fitting for the current study. According to this theory, values are guiding principles that are stable and enduring over time (Schwartz, 1992; Stern, 2000). Every person has many

– sometimes competing – values, and they are typically ranked in order of priority so that the most prioritized values have the biggest effect on attitudes and behaviour (Schwartz, 1992). Context determines which values have priority, since behaviour selection depends on the person's evaluation of which value is most important in that situation (de Groot & Steg, 2009). In environmental psychology, a distinction is commonly made between the following categories of values: egoistic, hedonic, altruistic, and biospheric values (Steg et al., 2014). Egoistic values serve personal resource acquisition and protection, hedonic values serve personal comfort and pleasure, altruistic values serve others, and biospheric values serve the environment (de Groot & Steg, 2009). Each person varies in the extent to which these values play a role in their day to day life, and each of these values may contribute to the same attitudes and behaviour in different ways.

Since context determines value priorities and the most prioritized values determine current attitudes and behaviours, this raises the question of how various contexts can be adapted or used to influence people's value priorities, in order to promote a certain type of attitude - in this case, zoo support. Previous research has shown that making certain values more salient can increase the likelihood that someone will act according to those values (Bolderdijk et al., 2013; Verplanken & Holland, 2002). Increasing people's knowledge can make related values more readily accessible and thus easier to act upon, decreasing the influence of opposing values (Fornara et al., 2020; de Groot & Steg, 2009). This increased saliency of a value changes the way attention is directed to information related to the salient value, which in turn affects attitudes and behaviour (de Groot & Steg, 2019, p.174). In other words, promoting certain values may lead to an increase in behaviour and attitudes that align with those values, also called value-congruence (Verplanken & Holland, 2002).

Based on these findings, we aimed to investigate whether it is possible to enhance people's zoo support by making certain zoo-related values more salient. To effectively align

information intended to enhance zoo support with people's values, we created a study design in which participants viewed an informational video about zoos and zoo animals that was either framed in order to target hedonic or biospheric values. We intended for the framing of the videos to increase the saliency of the respective values, which we expected to lead to an increase in value-congruent zoo support. We compared hedonic and biospheric values and not egoistic or altruistic values, since people tend to visit the zoo for hedonic reasons (i.e., for fun) or for biospheric reasons, for example to support the zoos' conservation or education efforts (Reade & Waran, 1996). Therefore, we excluded egoistic and altruistic values from this study because they are insufficiently applicable to zoo support and zoo-going behaviour.

Perceived Importance of Zoo Roles

The second part of the current study focuses not on participants' general zoo support but rather on participants' ratings of the importance of the various roles that zoos fulfil. It is said that the modern zoo has four roles: entertainment, conservation, research, and education (Godinez & Fernandez, 2019; Reade & Waran, 1996). In the study that originated these four roles, Reade and Waran found that the majority of zoo visitors rated the conservation, education and research roles as very important, whereas the entertainment role was considered to be of average importance (1996). A later replication study from Malaysia had different results, namely that research and entertainment were seen as equally important and that the differences between the four roles were much smaller (Puan & Zakaria, 2007). Since then, to our knowledge, no research has been dedicated to the public's perceived importance of the four roles of the zoo, despite its clear relevance to zoo support; if zoos want to increase the public's support, they need to know what the public finds important.

The current study provides an opportunity to investigate the public's perceived importance of these zoo roles once more 26 years later, with the added benefit that our design allows possible associations to be found with biospheric and hedonic values. One can

speculate that perceiving the entertainment role of the zoo as very important is likely to be correlated with hedonic values, for example. To investigate these associations, we asked all participants to rate the four roles in terms of importance, and analysed whether there were significant differences in these ratings for participants with different values. By combining this investigation of people's perceived importance of the four zoo roles with our study of value-congruent framing, we expect to paint a clear and comprehensive picture of the role of values in people's current appraisals of the modern zoo.

Expectations

Based on the existing literature on values (e.g. de Groot & Steg, 2008), we expected to see two main outcomes of the value-congruent framing part of the study: (1a) participants who endorse high biospheric values will show higher zoo support after viewing value-congruent (i.e., biospheric-framed) information about zoos than participants who endorse these same values and do not receive value-congruent information, and (1b) participants who endorse high hedonic values will show higher zoo support after viewing value-congruent (i.e., hedonic-framed) information than participants who endorse these same values and do not receive value-congruent information. In other words, for both values, value-congruent framing was expected to have a positive effect on levels of zoo support. We expected that this effect would only be present for values that participants rated as important or very important, corresponding to the earlier finding that value priming only successfully promotes value-congruent behaviour for values that are of central importance to the participant (Bolderdijk et al., 2013; Verplanken & Holland, 2002).

From the perceived importance of zoo roles measure, we expected that (2a) participants who endorse biospheric values perceive the conservation, research, and education roles of the zoo to be more important compared to participants who endorse hedonic values,

and (2b) participants who endorse hedonic values perceive the entertainment role to be more important compared to participants who endorse biospheric values.

Method

Participants

Our voluntary sample consisted of 576 participants, recruited online by the research team using convenience sampling. 150 participants failed to complete the survey, and 123 participants did not pass the manipulation check and/or attention check and were therefore excluded from the analysis. Additionally, 2 participants were excluded because they were under 18 years of age. No time constraints were applied to elimination, since passing both the manipulation and attention checks indicated sufficient participant engagement. Of the remaining 300 participants, 60.0% were female, 38.0% were male, and 2.0% were non-binary. Participants' ages ranged from 18 to 83, with a mean age of 37.87 years (SD = 15.94). Participants' most common nationalities were German, Dutch, Turkish, Indian, and American. For the full list of participant nationalities, see Appendix A. Participants were not compensated for participation.

Design

The value-congruent framing part of the study had a 2 (value score: high hedonic vs. high biospheric) × 3 (framing condition: hedonic vs. biospheric vs. control) design. Value score was measured using a questionnaire, and the framing condition was manipulated. The dependent variable, zoo support, was measured by questionnaire. For the zoo roles part of the study, the perceived importance of zoo roles was measured by questionnaire after manipulation and compared for the two value score groups.

Materials

The manipulation in each value-congruent framing condition was an informational video about tigers and zoos that was approximately four minutes in length. The video footage depicted Siberian tigers playing in their enclosure at Leipzig zoo. Previous research has indicated that the tiger is one of the most beloved species in any zoo (Albert et al. 2018;

Macdonald et al., 2017). We presumed that a flagship species such as the tiger would receive the most sustained attention from viewers and therefore accommodate the detection of a true effect, compared to an animal that is less interesting or appealing to watch. In the hedonic and biospheric conditions, the video footage was accompanied by a series of facts about tigers and zoos that were either framed in a hedonic (e.g. "Every Wednesday, this zoo has tiger training programs for the visitors to watch") or biospheric (e.g. "This zoo's breeding program leads to higher birth rates, gene diversity, and cub survival") manner. For the full video texts, see Appendix B. In the control condition, the video footage was shown without text.

Values were assessed using the Environmental Portrait Value Questionnaire (Bouman et al., 2018). The values scale included 16 values in four categories (hedonic, egoistic, altruistic, and biospheric), that participants rated on a 9-point Likert scale ranging from −1 = opposed to my principles, 0 = not important, to 7 = extremely important, depending on the importance of each value as a guiding principle in their life. This scale resulted in four scores per participant, each score representing one type of value. For biospheric values, the mean score was M = 5.566 (SD = .914). For hedonic values, the mean score was M = 5.788 (SD = .916). Cronbach's alpha was .77, indicating high internal consistency.

Zoo support was assessed using Miller's scale measuring zoo visitors' perception of animal care and interest in supporting zoos (2012). This scale included eight statements (e.g. "I am troubled by the well-being of animals in zoos") that participants rated on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. This scale resulted in one score per participant, representing their zoo support (M = 3.214, SD = 1.081, α = .885).

Perceived importance of zoo roles was assessed using Reade and Waran's scale measuring perceived importance of the four roles of zoos (1996). Participants rated each of the four roles of the modern zoo (entertainment, research, conservation, and education) on a 5-point Likert scale ranging from 1 = not important to 5 = very important. This scale resulted

in four scores per participant, each score representing how important they perceive each of the four roles to be. The mean scores were as follows: entertainment (M = 2.07, SD = 1.09), research (M = 3.54, SD = 1.15), conservation (M = 3.83, SD = 1.18), education (M = 3.82, SD = 1.14). For this scale, Cronbach's alpha was .73.

Procedure

The full study was conducted online, as part of a larger questionnaire measuring factors related to zoos and sustainability. All data was collected over the span of one week. The sequence of the study was as follows: before the manipulation, demographic information and values were measured. This was followed by the video manipulation. Qualtrics automatically randomly assigned participants to one of the three manipulation conditions. Post-manipulation, zoo support and perceived importance of zoo roles were measured. The total study took approximately 15 to 20 minutes to complete.

For analysis, participants' biospheric and hedonic value scores were ranked and sorted into two groups: high and low scores relative to the median score. From these groups, we selected only those participants that scored either high on biospheric values and low on hedonic values or vice versa, thus excluding participants who scored high or low on both types of values. This resulted in two mutually exclusive value groups, one representing high biospheric values and one representing high hedonic values. The group with high biospheric value scores consisted of 65 participants, and the group with high hedonic value scores consisted of 72 participants.

Results

A two-way ANOVA was conducted to investigate whether value-congruent framing effectively increased zoo support. We compared the main and interaction effects of values (high biospheric vs. high hedonic) and framing condition (control vs. biospheric vs. hedonic) on zoo support. We hypothesized that there would be a significant interaction effect between these two variables, which would indicate that matching the information frame to a person's highly rated values effectively increases zoo support. Residual analysis was performed to test the assumptions for a two-way ANOVA. The homogeneity of variances assumption was met, as assessed by Levene's test for equality of variances, $p = .263$. The assumption of normality of the residuals was violated, as assessed by Shapiro-Wilk's test ($p < .001$). However, ANOVA is considered to be quite robust against violations of this assumption (Blanca Mena et al., 2017; Schmider et al., 2010), especially when the distributions of all groups are similarly skewed (Kirk, 2013). Since visual inspection showed that this was the case with our data (see Appendix C) and all other assumptions were met, two-way ANOVA was deemed acceptable for this analysis.

Contrary to our expectations, we found no statistically significant interaction between value group and framing condition ($F(2, 137) = .357$, $p = .700$, partial $\eta^2 = .005$) indicating that value-congruent framing does not enhance zoo support. There were also no significant main effects for value group ($p = .097$) or framing condition ($p = .888$), indicating that zoo support is not associated with the different levels of both of these variables.

Our second hypothesis was that there are differences in perceived importance of zoo roles between the two value groups. We expected that participants who endorse biospheric values perceive the conservation, research, and education roles of the zoo to be more important compared to participants who endorse hedonic values, while participants who endorse hedonic values perceive the entertainment role to be more important. To investigate

this, we compared the frequency of each response for the two value groups (high biospheric vs. high hedonic) separately; these results are presented in Table 1. To test the significance of these differences in the perceived importance of zoo roles depending on participants' reported values, we conducted four Mann-Whitney U tests, one for each zoo role. Assumptions for a Mann-Whitney U test were met: the dependent variables were ordinal, the two value groups were independent, and their distributions were similarly shaped.

As expected, median perceived importance of the entertainment role was statistically significantly higher in the hedonic value group than in the biospheric value group (U = 1636.5, z = -3.189, p = .001). Furthermore, median perceived importance of the conservation role was significantly higher in the biospheric value group than in the hedonic value group (U = 1802, z = -2.423, p = .015). These significant results indicate that participants who had high hedonic value scores found the entertainment role to be most important, while participants who had high biospheric value scores found the conservation role to be most important, which is in line with our expectations. Median perceived importance of the research role (U = 2025.5, z = -1.399, p = .162) and the education role (U = 2294, z = -.207, p = .836) were not significantly different for the two value groups. This was not in line with our expectations, as we had hypothesized that the high biospheric group would rate these two roles as more important than the high hedonic group.

Table 1

Frequencies of perceived importance of zoo roles per value group

	High biospheric values				
	Not important	Slightly important	Important	Fairly important	Very important
Entertainment	52.3 %	27.7 %	10.8 %	7.7 %	1.5 %
Research	3.1 %	16.9 %	18.5 %	32.3 %	29.2 %
Conservation	4.6 %	6.2 %	12.3 %	30.8 %	46.2 %
Education	4.6 %	13.8 %	10.8 %	35.4 %	35.4 %
	High hedonic values				
	Not important	Slightly important	Important	Fairly important	Very important
Entertainment	25.0 %	37.5 %	20.8 %	13.9 %	2.8 %
Research	4.2 %	18.1 %	30.6 %	26.4 %	20.8 %
Conservation	2.8 %	18.1 %	26.4 %	20.8 %	31.9 %
Education	0.0 %	15.3 %	25.0 %	22.2 %	37.5 %

Discussion

In the first part of our study, we aimed to examine the relation between values and zoo support by studying whether value-congruent framing of information about zoos would increase zoo support. We did not find evidence for this hypothesis, since no significant interaction effects were detected between value groups and framing conditions. In the second part of our study, we aimed to address the public's ratings of the importance of the four roles of the modern zoo by examining whether differences in the perceived importance of zoo roles exist for different value groups. We found that participants with high hedonic values rated the entertainment role as significantly more important and that participants with high biospheric values rated the conservation role as significantly more important. However, the research and education roles did not show significant differences between groups. Overall, these results suggest that there are differences between people with high biospheric values and people with high hedonic values in the context of zoos, but that value-congruent framing was not effective in increasing zoo support.

For our first hypothesis, our expectations were based on earlier studies on value activation (e.g. Verplanken & Holland, 2002). We expected that biospheric and hedonic framing would lead to an increase in value-congruent attitudes (in this case, zoo support) in participants who endorse these values by increasing the saliency of the values in question (de Groot & Steg, 2009). However, our findings provide evidence on the contrary, namely that biospheric and hedonic value-congruent framing using video recordings of zoo animals does not enhance zoo support. This may simply mean that the value-congruent framing theory fails to apply to zoo support. Previous studies have only focused on value-congruent framing in broader contexts such as pro-environmental behaviour (e.g. de Groot & Steg, 2009; Fornara et al., 2020; Verplanken & Holland, 2002), rather than applying value-congruent framing to zoos and zoo animals in particular. Our study was the first to investigate this context, so our

findings may indicate that we have found a border of this theory, namely that zoo support is not easily influenced by biospheric and hedonic value-congruent framing. Perhaps this is because zoo support encompasses more than just environmentally relevant topics; the traditional recreational aspect of the zoo, which has little to do with the environment, plays a role in zoo support as well. Previous studies on value-congruent framing have only found a significant effect in environmentally relevant contexts (e.g. Bolderdijk et al., 2013; Verplanken & Holland, 2002). Our findings, taken in conjunction with the existing literature, may indicate that the zoo context is too heterogeneous for value-congruent framing to increase zoo support effectively.

On the other hand, it may be the case that the specific values used in our study need to be adapted to the zoo context further to detect a true effect of value-congruent framing on zoo support. For the current study, we applied the theoretical framework of values, due to its well-established body of evidence and its common use in environmental psychology (de Groot & Steg, 2008). However, although we chose biospheric and hedonic values from this framework to represent the two main reasons for visiting and supporting zoos, some research has suggested a new category of values concerning animals specifically (Dietz, Allen, & McCright, 2017). This value type was recently added to the existing literature on values based on the finding that the biospheric value type fails to adequately capture people's values in studies that focus on animals and animal treatment in particular, as is the case with our study. In fact, Dietz and colleagues showed that animal concern values and biospheric values play distinctly separate roles in animal conservation issues. For this reason, it may be appropriate to add this novel animal-related value type to the theoretical framework in a future replication of this study, to see whether this leads to different results.

Alternatively, a possible methodological reason for our findings is that influencing value priorities is not as straightforward as watching a four-minute video with value-framed

information. As mentioned in the introduction, value priorities vary depending on the context (Schwartz, 1992). Therefore, we have tried to influence value priorities by adapting the context (i.e., the videos) to increase the saliency of certain values. However, video footage may not be the ideal medium to achieve this. A study by Miller and colleagues (2020) found that video footage of animals was not an effective method of getting people involved in conservation in comparison to live viewings of the same animals. This finding suggests that the video format used in the current study may have been insufficiently impactful and therefore failed to influence value priorities. On the other hand, videos are more effective in educating people about environmental issues than simple pamphlets (Ahmad et al., 2015). Therefore, future studies on value-congruent framing in the zoo context could make use of live experiences over pre-recorded footage if possible, though videos are preferred over pamphlets if resources do not allow for live viewing.

A similar possibility is that participants did not actively process the framing information due to the format in which it was presented, namely as a viewing experience. Our study assumed a passive framing process. This is different than the approach used by Verplanken and Holland in their successful value-congruent framing study (2002); they used priming stimuli in a questionnaire that participants thought was part of a separate study. Since it was in a questionnaire, participants interacted with the value-framed information, rather than being passively exposed to it through viewing. An earlier study indicated that an interactive experience with zoo animals was more effective in increasing zoo support than a mere viewing experience (Swanagan, 2000). Perhaps this finding can be extended to value-congruent framing as well. Therefore, future studies investigating value-congruent framing in the zoo context could include a more interactive manipulation, such as a problem-solving task involving priming stimuli, rather than a mere viewing experience.

There may also be a temporal aspect to value-congruent framing that has not been included in the theoretical framework before. In designing this study, we have followed the existing literature and taken a single manipulation approach: the videos were intended to influence value priorities as well as provide information about zoos and zoo animals. In the future, it may be promising to divide the manipulation into two steps; first, the targeted values are made more salient using a priming task, and this is followed by the information that is meant to increase zoo support. A similar approach was used by Blankenship and Wegener (2012), who successfully strengthened attitudes by first activating attitude-relevant values and then providing participants with a persuasive message aimed to inform the attitude in question. This corresponds to de Groot & Steg's (2019) description of influencing values to promote pro-environmental behaviour: increasing value saliency will alter the way attention is directed to value-congruent information, which in turn influences attitudes and behaviour. This description seems to imply that increased value saliency needs to precede value-congruent information in order to successfully increase zoo support. If this approach results in significant findings when applied to the zoo context, it could provide an important revision to the current theoretical framework since no studies have explicitly studied the sequence in which value-congruent framing is most effectively carried out yet.

Despite these points for improvement, our study also had numerous strengths, beginning with a diverse sample: participants reported 29 different nationalities and participants' ages ranged from 18 to 83 years old. Therefore, this sample provides a good representation of the population, indicating high generalizability of our results. Furthermore, although there have been earlier suggestions for research of this kind (e.g. de Groot and Steg, 2008), this study is the first to investigate value-congruent framing in the context of zoos and animal conservation. While Verplanken and Holland (2002) studied value-congruent framing to promote general pro-environmental choices, no value-congruent framing studies have

focused on zoo support in particular. Therefore, the current study contributes to the existing literature on values by examining value-congruent framing related to zoos and zoo support, therefore expanding the field of environmental psychology and finding new avenues to reach people to encourage pro-environmental behaviour. As it is the first of its kind, the current study can serve to generate new hypotheses, and its study design is easily altered for this purpose.

Future studies can adapt our experimental design to investigate what does and does not work, allowing for refining of the theoretical framework. For example, we suggest replicating the study in-person, rather than using video recordings of animals, based on Miller's study on live vs. video animal exposure (2020), with the idea of increasing participant engagement to better allow for value-congruent framing. Furthermore, framing could take place in a more interactive way, for example by means of a seemingly unrelated task containing priming stimuli, instead of a mere viewing experience. Another suggestion is to vary the contents and length of the information frame to more effectively increase the saliency of the relevant values. Additionally, the current study did not include a measure of social desirability, so we do not know how this may have impacted our results. For this reason, future studies on value-congruent framing in the zoo context may also benefit from including a measure of socially desirable responding, since studies have shown that studies that rely on self-reporting in environmentally relevant contexts frequently encounter this problem (Ewert & Galloway, 2009; Vesely & Klöckner, 2020). The findings that result from these study suggestions will undoubtedly help finetune the theoretical framework of value-congruent framing and define its application to the zoo context.

In conclusion, value-congruent framing research has been applied to the context of pro-environmental behaviour in the past (Bolderdijk et al., 2013; Verplanken & Holland, 2002), but to our knowledge, our study is the first to investigate its effectiveness in the

context of zoos. While we did not find evidence for its effectiveness, value-congruent framing still holds promise. We suggested various alterations that can be made to our study design to thoroughly examine its effectiveness in the context of zoos. If value-congruent framing is found to be effective in this context, it can become an important component of zoos' marketing campaigns. In this way, value-congruent framing can lead to an increase in conservation efforts both directly, by influencing zoo visitors' attitudes and behaviours related to conservation and other pro-environmental issues, and indirectly, by influencing visitors' zoo support. This will ensure that zoos can remain a functional and meaningful part of our society, especially through their contributions to biodiversity conservation.

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Appendix A

Complete list of participant nationalities

Nationality	Frequency
Albanian	1
American	18
Argentinian	1
Australian	1
Austrian	1
Azerbaijani	1
British	3
British Luxembourgish	1
Czech	4
Dutch	74
Egyptian	1
French	2
German	124
German American	1
Indian	11
Irish	2
Israeli	1
Italian	5
Luxembourgish	1
Mexican	1
Norwegian	1
Portuguese	2
Romanian	1
Scottish	1
Slovak	2
Swedish	1
Syrian	2
Turkish	35
Turkish American	1

Appendix B

Hedonic frame text

Tigers have been around for a long time, about 2 million years.

A tiger's roar can be heard about 3 kilometres away.

A tiger's urine smells like buttered popcorn .

Tigers can roar but not purr.

This zoo gives the opportunity to encounter tigers up to 10 meters close while remaining safe.

Every Wednesday, this zoo has Tiger training programs for the visitors to watch.

Twice a week, this zoo feeds the tigers by simulating a hunting act for zoo visitors to observe.

Next to the tiger exhibit, this zoo offers drinks for the visitors to enjoy while observing the tigers.

Biospheric frame text

Siberian tigers live in forests mostly untouched by humans. Out of all tiger species, their home has the most complete ecosystem.

In order to conserve the habitat of one tiger, approximately 10 000 hectares of forest have to be protected.

Tigers contribute to the health of ecosystems by keeping herbivore populations under control.

After a century of decline, Siberian tiger populations are stable or increasing in India, Nepal, Bhutan, Russia and China.

There are currently 287 Siberian tigers in the European breeding programme, providing opportunities for research and vet training.

This zoo donates to the International Union for Conservation of Nature tiger protection programme, which has increased tiger populations on project sites by 40%.

This zoo teaches visitors about the threats tigers face and how everyone can help.

This zoo's breeding program leads to higher birth rates, gene diversity, and cub survival.

Appendix C

CC plots for all six (value × condition) groups