

**Understanding the controversy of zoos and generating an accurate picture of their
conservation efforts**

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Abstract

This study aimed to create a clearer image of the public opinion of zoos and investigated how to make this image more positive to exploit zoos potential regarding conservation. To do so we investigated the relationship between environmental values and zoo approval and whether providing information about conservation efforts of zoos has an impact on the relationship between biospheric values and zoo approval. This study contained 318 participants, 124 of them were male, 189 were female, and 5 reported being non-binary, with a mean age of 38 years. We examined the relationship of interest by measuring environmental values using the environmental portrait value questionnaire and zoo approval. To measure the effect of information we showed participants a video of tigers in a zoo along with information. Participants either received information about conservation efforts of zoos, the entertainment aspect of zoos, or no information. The results showed a significant negative relationship between biospheric values and zoo approval. Moreover, taking hedonic values into account did not show significant changes in zoo approval. Lastly, providing information about the conservation efforts of zoos did not have an impact on the relationship between biospheric values and zoo approval. This study provides support for the idea that the public holds an inaccurate image of zoos and their conservation efforts, resulting in negative attitudes for participants concerned with the environment. If that inaccurate and negative image is to be resolved, accurate information has to be provided. We found that providing information, as we did, has no impact, inspiring future research to investigate more efficient ways of doing so.

Keywords: Environmental Values, Public Opinion, Zoo Approval, Zoo Controversy, Information

Understanding the controversy of zoos and generating an accurate picture of their conservation efforts

Since 1970, the number of birds, mammals, amphibians, and reptiles has dropped by more than half. Their rate of extinction is now 1000 times faster than before the industrial revolution (Hickel, 2021). These facts emphasize the problems climate change poses for wildlife worldwide. Zoos can play a fundamental role in conserving species threatened by recent developments due to climate change (Hutchins, 2003; Tribe & Booth, 2002). Conservation strategies carried out by zoos contribute to the greater goals of maintaining biodiversity, preventing extinction outside of zoos, and fostering positive attitudes towards wildlife (Tribe & Booth, 2002). Zoos require financial capacities to meet these goals and to engage in successful conservation programs. The major source of income of zoos are their visitors (Carr & Cohen, 2011). Therefore, understanding the public opinion of zoos and the resulting approval is crucial. Values are a vital element of an opinion and considering such will help understanding the public opinion and whether or not people visit the zoo (de Groot, 2019; Drijfhout et al., 2020). Environmental values are particularly interesting due to their relevance in the debate about the role of zoos.

Role of Zoos

Zoos can be broken down into four main purposes, namely entertainment, conservation, research, and education (Reade & Waran, 1996; Carr & Cohen, 2011). Firstly, due to the importance of visitors, zoos must focus on meeting their needs (Carr & Cohen, 2011). For the majority of visitors, such needs entail recreational and entertainment purposes, making the role of entertainment a substantial part of the zoo (Reade & Waran, 1996). Besides satisfying their visitors, zoos engage in conservation strategies aimed at reaching the greater goals, such as maintaining biodiversity, described above. Conservation strategies include captive breeding and reintroduction of threatened species, as well as the aspects of research

and education (Tribe & Booth, 2002) Research conducted by zoos aims for a better understanding of animals and their environment and thus promotes effective conservation techniques (Tribe & Booth, 2002). Education is often seen as having the greatest potential for conservation efforts (Reading & Miller, 2007). Zoos worldwide report up to 700 million visitors every year (Godinez & Fernandez, 2019). This places them in a unique position to educate the public about the environmental threats we are facing and conservation activities to work against such threats (Field & Dickie, 2007).

Conservation management

Although conservation management of zoos is present and evolving, there is still considerable criticism towards it (Keulartz, 2015). Many animals held in zoos are not part of the species involved in conservation programs. The majority of such species are popular animals that zoos are reluctant to let go of due to their importance for entertainment and attraction (Keulartz, 2015). Breeding programs are almost impossible due to a lack of space. The devotion of half of the zoos' capacities to conservation only, would enable them to accommodate not more than 800 of 7.368 endangered vertebrate species. Moreover, reintroduction programs are shown to be inefficient as well (Keulartz, 2015). This is mostly due to the loss of instincts of animals. Lastly, zoos claim to spend around 10% of their overall income on conservation but data points to less than 5% (Keulartz, 2015). Although zoos are facing difficulties and criticism towards their conservation efforts there is little doubt that zoos can significantly support the conservation of animals and their habitats and ultimately help slow the loss of biodiversity (Hutchins, 2003). Zoos are in a process of transformation and evidence shows that during the past decades, zoos' contributions to conservation have increased (Tribe & Booth, 2002).

The changing role of zoos

As indicated, zoos are transforming from attractive places devoted to the purpose of public entertainment to places of conservation with the purpose of conserving animal species and their habitats (Tribe & Booth, 2002). This change is represented in the evolution of animal exhibits. Zoos developed from displaying animals behind bars to providing animals with natural habitats and supporting the conservation of such (Ballantyne, et al., 2007). The primary reason for this transformation was the recognition of animal rights by the general public and thus the increasing dislike of holding animals captive in cages for the purpose of human entertainment (Carr & Cohen, 2011). This emphasizes the importance and impact of public perception on zoos.

Public perception

In line with the increasing recognition of animal rights by the public, pointed out by Carr and Cohen (2011), conservation is seen as the most important aspect of zoos, whereas entertainment is perceived as less important (Reade & Waran, 1996; Carr & Cohen, 2011). However, despite the expectations of zoos as a place of conservation, they are still largely considered a place of entertainment (Carr & Cohen, 2011). This is underlined by the fact that entertainment is the main motivation for visitors, rather than education or close encounters with animals (Reade & Waran, 1996). Hence, the public's view on what zoos are supposed to do does not match their image of what zoos are doing in reality, highlighting the controversy of zoos. The controversy of zoos ultimately concerns the role of zoos as conservation centers as opposed to a place of entertainment. Considering values as individual factors can help understand the public perception of zoos and their roles, as well as their motives for visiting zoos (Groot & Steg, 2009; Dirjfhout, et al., 2020).

Values

Values are defined as guiding principles as part of a person's identity, impacting processes such as behavior, decision-making, beliefs, and thoughts (Groot & Steg, 2009).

Altruistic, biospheric, egoistic, and hedonic values are the values that are relevant in the context of pro-environmental beliefs, opinions, and behavior (Steg, et al., 2014). Altruistic values are defined by a concern for the welfare of other human beings. Biospheric values represent being concerned with nature and the environment itself, without any apparent consideration of humans. Egoistic values are defined as outweighing the costs and benefits of choices that impact people's resources. Lastly, hedonic values represent a concern with one's well-being and satisfaction, while reducing the effort of behavior (Steg et al., 2014). The values that are most relevant to the controversy of zoos are biospheric values and hedonic values. By definition, biospheric values represent a concern for the conservation of the environment and its animals and hedonic values represent the entertainment aspect of zoos. Moreover, on the one hand, biospheric values are positively correlated with pro-environmental behavior, attitudes, and beliefs. Hedonic values, on the other hand, have the single strongest negative relationship with pro-environmental behavior, attitudes, and beliefs (Steg et al., 2014). In sum, values, as guiding principles, impact the approval of a concept, such as the zoo (Drijfhout et al., 2020). Additionally, hedonic and biospheric values are particularly relevant as they represent the controversy of zoos. Therefore, they are vital for understanding the public opinion on zoos.

Values have been used to study opinions about the conservation of wildlife and the environment in different contexts, for instance managing overabundant wildlife in Australia (Drijfhout, et al., 2020). Biospheric values were connected with approval of conservation strategies concerned with the welfare of nature and animal species (Dirjfhout, et al., 2020). Importantly, it was shown that the acceptability of conservation strategies by the public was changed by providing information about them. This supports the idea that information can facilitate a change in public opinion about a concept related to conservation, such as the zoo.

This is particularly interesting as a lack of information about conservation efforts is considered a central issue in the debate of zoos (Carr & Cohen).

Lack of information about conservation

Although the public recognizes the role of conservation in zoos, a study in Malaysia has shown that only 29% of the interviewees knew about animal reintroduction as a conservation strategy (Puan & Zakaria, 2007). This lack of information is represented in a study investigating the image of zoos portrayed by their websites. Firstly, most zoo websites portray entertainment as the most important aspect of zoos (Carr & Cohen, 2011). Secondly, there is a general lack of information about zoos as conservation centers. Detailed information about conservation strategies such as research and breeding programs is seldom found. Another study investigating the perception of zoo visitors and non-zoo visitors concluded that the general public is not aware of the benefits of zoos (Reade & Waran, 1996). This lack of information might well explain why zoos are still seen as entertainment centers and the resulting negative image of zoos, considering the demand for more focus on conservation (Carr & Cohen, 2011).

Current study

Existing literature has pointed to the potential of zoos working against the negative outcomes of climate change, such as loss of biodiversity (Hutchins, 2003; Tribe & Booth, 2002). To exploit that potential, a more positive and accurate image of zoos and their contribution towards conservation is needed (Carr & Cohen, 2011). To do so, understanding the public's opinion of zoos and how to change it by providing information is crucial. This study aimed to find out whether people with different values show differences in zoo approval. This would enable us to gain insights into the public's opinion about zoos, as well as individual differences based on such values. People with high biospheric values are concerned with nature and the environment. Therefore, the study expected participants

reporting high biospheric values to show lower zoo approval than participants with low biospheric values (Hypothesis 1). This is in line with the negative image that the zoo possesses concerning conservation efforts (Carr & Cohen, 2011). Participants being concerned with the environment and therefore conservation should show less zoo approval.

Contrarily, we expected that participants with low biospheric values, endorsing high hedonic values should lead to more zoo approval than endorsing low hedonic values (Hypothesis 2). Given a lower concern for nature and therefore conservation, participants valuing pleasure and entertainment should view zoos more positively due to their image as places of entertainment than participants valuing pleasure and entertainment less. This is in line with evidence showing that zoos are largely seen as sites of entertainment as well as entertainment being the main motive for zoo visits (Carr & Cohen, 2011; Reade & Waran, 1996).

Additionally, the study also looked at whether providing information regarding the conservation or entertainment of zoos along with a video has an impact on zoo approval among people with different levels of biospheric values. This would provide insights on how to work against the lack of information and ultimately clear the negative and inaccurate public image of zoos. This study expected that people with high biospheric values would show higher zoo approval when exposed to information about conservation efforts of zoos than information about the entertainment aspect of zoos (Hypothesis 3). This follows the reasoning that the negative relationship between biospheric values and zoo approval is due to a lack of information about conservation practices (Carr & Cohen, 2011). Resolving this by providing such information should lead to a more positive relationship. Moreover, this hypothesis was inspired by research showing that tailored information is effective to change people's opinion (Abrahamse & Matthies, 2019). Tailored information is information given to a certain group of people. We provided information about conservation efforts of zoos to participants

concerned with the environment and thus expected that such participants would show an increase in zoo approval.

In a broader context, knowing which values are important for the support of zoos and how to target them might increase the zoos' approval in the future. Assuming that an increase in zoo approval is linked to an increase in zoo visitors, zoos would benefit from such an attitude change financially. Consequently, they would have more capacities to promote conservation programs and ultimately help to effectively slow down the rapid increase of biodiversity loss due to climate change.

Method

Participants

This online study was conducted through the snowball sampling technique. 576 people started the survey, 498 of them gave informed consent. As this study was online, we excluded participants based on an attention check, duration time, age, and incomplete participation, to achieve more accurate results. Participants under the age of 18 were excluded as well as participants completing the study in less than ten minutes or more than two hours. The approximate time for completion was between 20-30 minutes, therefore less than ten minutes seemed too quick to be accurate. Participants taking more than two hours were excluded because the risk that they forgot the information provided in the manipulation was too high. The attention check consisted of a statement requiring the participants to select “strongly agree” if they were still paying attention (Appendix B). Participants failing to do so were excluded. The final number of participants was 318. 124 of them were male, 189 were female, and 5 reported being non-binary. The age ranged from 18 to 83 ($M = 38.14$, $SD = 16.17$). Of all the participants, 16.7% indicated having owned a membership for the zoo. There was no compensation for participation. Participants from 26 different countries completed the survey (Appendix A). The majority of them were Dutch ($n = 79$) or German ($n = 131$). Participants could choose to complete the study in either English, German, or Dutch.

Design

This online study used a between-group experiment with two experimental conditions and a control group condition. The pre-manipulation variable, and therefore the independent variable, consisted of the environmental portrait value questionnaire (E-PVQ) (Bouman, et al., 2018). The manipulation included two experimental conditions and a control condition, treated as the moderator variable in the analysis. The post-manipulation variable, thus the dependent variable, consisted of the zoo approval scale (Miller, 2012). As this study was conducted as part of a larger bachelor's thesis project, the specific variables of interest were chosen from a larger list of materials (Appendix B).

Materials

The E-PVQ scale of values was used to measure biospheric and hedonic values (Appendix B). The scale consists of 17 items. Each participant had to rate from 1 (totally not like you) to 7 (totally like you) how much a person described in the statement is like them. Biospheric values were measured with four items including statements such as "it is important to this person to respect the nature" ($M = 5.74$, $SD = 0.95$, $\alpha = .79$). Hedonic values were measured on a subscale with three items, such as "it is important to this person to have fun" ($M = 5.79$, $SD = 1.14$, $\alpha = .89$). For the analysis of the second hypothesis, the variables of hedonic ($Mdn = 6$) and biospheric values ($Mdn = 5.75$) were split by the median, creating two groups including people with either low or high values. Therefore participants with a value of 6 or higher were considered high for either value.

The manipulation consisted of a video (4:27 minutes) of Siberian tigers (*Panthera tigris altaica*) playing in a zoo enclosure. This study chose the tiger because they are viewed as the most charismatic species among zoo animals (Albert, et al., 2018). People are more likely to engage in conservation for charismatic species as they are emotionally more involved (Colléony, et al., 2017). Therefore this study hoped to find greater effects using videos of

tigers. The footage was taken from Zoo Leipzig and was chosen as it portrayed Siberian tigers in a zoo which represented their natural habitat well. Along with the videos, each experimental condition presented eight facts about tigers in the zoo and the wild. The facts were framed according to values in the two conditions. In the hedonic condition, eight fun facts about zoos and tigers were presented, such as “a tiger’s urine smells like buttered popcorn” (Appendix C). In the biospheric condition, eight facts about tiger habitats and endangerment as well as conservation efforts of zoos were presented (Appendix C). The information consisted of statements such as “this zoo’s breeding program leads to higher birth rates, gene diversity, and cub survival”. The control condition did not contain any facts.

After the manipulation, the dependent variable, zoo approval, was measured (Appendix B). Participants were asked to rate their level of agreement with a statement concerning zoos from 1 (“strongly disagree”) to 7 (“strongly agree”) ($M = 3.52$, $SD = 1.00$, $\alpha = .83$). An example of a statement is: “it is important to have animals in zoos”.

A manipulation check was used to see whether the manipulation worked and if the facts of the videos were properly read and understood (Appendix B). Participants were required to select the correct answer from a multiple-choice question, asking which fact they saw in the video, if any. The manipulation was not used to exclude participants as 47% of all the failed manipulation checks consisted of participants in the control condition. This indicates that the question was not clear enough or that other errors led to a systematic pattern of wrong answers.

Procedure

Qualtrics XM was used to create the experiment. Starting the experiment, participants read all necessary information about the experiment and gave their informed consent. Following that, we asked about their demographics including age, gender, and nationality. Next, the independent variable, E-PVQ, was measured as a pre-manipulation measurement.

Following that, the experimental manipulation was introduced, in which each participant was randomly allocated to one of the three conditions. After the manipulation, the participants responded to the zoo approval scale.

Results

The collected data was analyzed to investigate the hypotheses the study proposed and subsequently to answer the question of how biospheric and hedonic values relate to zoo approval and how this relationship is influenced by information about zoos and their animals.

To analyze the first hypothesis which stated that people with high biospheric values show less zoo approval than people with low biospheric values, indicating a negative relationship between the variables, a simple linear regression was run. For that, multiple assumptions had to be fulfilled. The assumption of linearity was validated by visual inspection of a scatterplot (Appendix D). The independence of residuals was indicated by a Durbin-Watson statistic of 2.01. Homoscedasticity and normality of the residuals were checked and validated by inspecting a plot of standardized residuals versus standardized predicted values and a normal probability plot, respectively (Appendix D). The data showed one outlier with a standardized residual of 3.05, which is slightly above the cut-off score of 3. As there were no signs of appreciable difference in the results without the outlier, the data point was kept.

As anticipated biospheric values significantly predicted zoo approval ($F(1,317) = 5.7$, $p = 0.018$). The model accounted for 1.8% of the variability in zoo approval indicating a small effect size (Cohen, 1988). Therefore, the higher participants' biospheric values the less they indicated zoo approval. Conceptually, an increase of biospheric values one led to a decrease in zoo approval by 0.14 (CI [-0.26, -0.03]).

To test the second hypothesis, which stated that participants with low biospheric and hedonic values ($n = 80$) would show less zoo approval than people with low biospheric and

high hedonic values ($n=92$), an independent t-test was conducted. There were no outliers in either group, as assessed by inspection of boxplots (Appendix D). Assessing the normality assumption using the Shapiro-Wilk test showed significant results for the second group, including participants with high hedonic values ($p < 0.001$). However, based on the large sample size ($n=92$) and the visual inspection of the histogram, the distribution for the second group was sufficiently normal, leading to continuing the analysis unchanged. There was homogeneity of variances, as assessed by Levene's test ($F=0.002, p=.97$).

Contrary to our hypothesis, participants with low biospheric and low hedonic values ($M=3.69, SD=0.98$) did not show less zoo approval than participants with low biospheric and high hedonic values ($M=3.56, SD=0.93$). This is indicated by a one-sided t-test ($t(170)=0.93, p=.18, d=.14, CI[-0.15, 0.42]$). In other words, participants reporting low concern for the environment (low biospheric values) and high concern for their own pleasure (high hedonic values) did not show more zoo approval than participants reporting low concern for both (low biospheric and hedonic values).

A moderator analysis was run to analyze the third hypothesis, which stated that the exposure to the biospheric condition would change the relationship between biospheric values and zoo approval more positively than the exposure to the hedonic condition. The Shapiro-Wilk test was used to assess the normality assumption ($p=.003$). The test indicated a violation of the assumptions, however, inspecting the normal Q-Q plot of studentized residuals and considering the large sample size ($n=217$), the analysis carried on unchanged (Appendix D). The assumption of multicollinearity was met after the independent variable was mean-centered ($VIF=1.73$). There was one outlier evident ($SDR=3.07$). However, as this participant was not categorized as an influential case or leverage point, it is kept in the sample ($LEV=0.018, COO=0.052$). Homoscedasticity was validated by plotting unstandardized predicted values against studentized residuals (Appendix D).

The data did not support the third hypothesis. Comparing the model without the interaction effect with the model including the interaction effect did not significantly change the explained variance ($F(2,214) = 0.07, p = .79$). Therefore exposing participants to the biospheric condition rather than the hedonic condition did not change the relationship between biospheric values and zoo approval positively. In other words, people with higher biospheric values did not show more zoo approval after exposing them to information regarding the conservation of zoos as opposed to information regarding the entertainment of zoos.

Discussion

The ultimate goal of this study was to investigate how to generate a positive image of zoos. As illustrated, there is considerable criticism towards zoos and their conservation efforts (Keulartz, 2015). However, the potential of zoos for working against the loss of biodiversity and the negative effects of climate change is substantial (Hutchins, 2003). To generate a more positive image of zoos and ultimately exploit their potential, we aimed to contribute to a better understanding of the public opinion about zoos and their controversy and how values influence such opinions. To do so we investigated the relationship between biospheric and hedonic values and zoo approval. These values are representative of the controversy of zoos regarding their role as conservation centers or places of entertainment, respectively. Existing literature illustrates that zoos are controversial and often still viewed negatively (Carr & Cohen, 2011; Reade & Waran, 1996). A major contributor to that negative image is a lack of information about the conservation efforts of zoos, resulting in an inaccurate image of zoos and their conservation (Carr & Cohen, 2011). Therefore, this study investigated whether providing information about such practices would bridge the lack of information and have a positive impact on the image of zoos.

This study found support for the first hypothesis, which was that biospheric values have a negative relationship with zoo approval. By definition, people with high biospheric values are concerned with the environment and conservation. As the public holds an inaccurate and negative image of the conservation efforts of zoos, people endorsing high biospheric values perceive zoos more negatively. This finding is in line with the idea that the public perceives conservation as a crucial part of the zoo (Reade & Waran, 1996). Therefore, there are expectations from the public towards the conservation efforts of zoos. The negative view of zoos, due to a concern about nature and conservation, provides support for the idea that there is a lack of information between zoos and the public about conservation practices, failing to meet such expectations (Carr & Cohen, 2011; Puan & Zakaria, 2007). Moreover, these findings give further support to the idea that linking biospheric values to the concept of conservation works (Drijfhout et al., 2020). Even though the study found a significant relationship, only a small effect size was detected. Therefore the results and interpretations need to be treated with caution.

Contrarily, the data did not support the second hypothesis, which stated that given low biospheric values in both groups, participants with higher hedonic values will show more zoo approval than participants with lower hedonic values. Therefore, the study did not support the assumption that participants who were less focused on the conservation aspects of zoos should show higher zoo approval if they value pleasure and entertainment highly.

As hedonic values were treated as being representative of the aspect of entertainment in zoos, this finding is counterintuitive, considering that the majority of zoo visitors indicate entertainment as their main motivation for zoo visits and the portrayal of zoos as sites of entertainment (Reade & Waran, 1996; Carr & Cohen, 2011). The reason for the contradictory findings might be the same reason why we chose values in the first place. Values are abstract and do not relate to specific concepts (de Groot, 2019). We used values to represent the

entertainment aspect of zoos and thus explain differences in the public opinion of zoos (Reade & Waran, 1996). However, creating this theoretical link between hedonic values and entertainment of zoos was potentially too abstract and therefore did not work in our study. This indicates that participants did not link the concept of zoos with a place to experience pleasure. This reasoning is supported by a look at the zoo membership of the participants. The vast majority of the participants never possessed a zoo membership, indicating that this study only covered a few people that visit the zoo. The aspect of entertainment in zoos is most relevant for people going to the zoo (Carr & Cohen, 2011; Reade & Waran, 1996). Hence, for the majority of the participants, the entertainment aspect might not be appealing, even though they are less concerned about nature and therefore conservation, potentially explaining why considering hedonic values did not show any effects on zoo approval. Future research should therefore examine zoo visitors to see whether hedonic values play a role in explaining their opinion of zoos.

Lastly, there was no support for the third hypothesis, which stated that the relationship between biospheric values and zoo approval would increase positively for participants exposed to the biospheric condition as opposed to the hedonic condition. Therefore, this study did not find evidence that providing information about the conservation efforts of zoos could show an increase in zoo approval for people endorsing high biospheric values. This is contradictory to the idea that the lack of information between zoos and the public about conservation efforts and the resulting lack of awareness of such efforts are responsible for the negative attitude towards zoos (Carr & Cohen, 2011; Reade & Waran, 1996). Another study showed that providing information concerning conservation did show a change in participants' opinions, which is not supported by the findings of this study, as the approval of zoos, representative of participants' opinion of the zoo, did not change. (Drijfhout et al.,

2020). Moreover, this study did not support the idea that tailored information is an effective way to change people's opinions (Abrahamse & Matthies, 2019).

The contradictory findings could be explained by the fact that changes in public opinion do occur but are not always present and often do not occur immediately or are too small to detect (Ford, et al., 2009). Alternatively, providing multiple exposures to information and measuring the subsequent change in opinion over a longer period is a promising approach as changes in public opinions are rather gradual than immediate (Ford, et al., 2009). Additionally, the abstract conceptualization of tailored information could be another reason for the contradictory findings. It is defined as providing information to a specific group of people with the purpose of changing their opinion or behavior (Abrahamse & Matthies, 2019). The definition does not provide information about the application of tailored information. Tailoring information on the basis of values did not work in this study, therefore, it remains unclear when and how to apply it. Investigating that issue and clarifying the concept for more effective use in research is needed.

Another possible explanation for the contradictory finding is that due to their concern for the environment, participants with high biospheric values have established a firm attitude towards zoos as they are hotly debated regarding their impact on and responsibility for the environment. Strong attitudes are pervasive and difficult to change (Stroebe, 2020). If such attitudes are to be changed, strong arguments must be given. Moreover, the processing motivation and ability of the individual exposed to the information must be high as well (Stroebe, 2020). All such criteria were likely not met in this study. The manipulation provided rather simple information about the conservation efforts of zoos rather than strong arguments. As the study was online, assuming high processing motivation and ability of the participants seems questionable. Therefore, future research needs to investigate whether providing stronger arguments for the conservation efforts of zoos and engaging the recipients of such

arguments has a greater impact on their attitudes. Research suggests that generating campaigns that facilitate discussion or exchange of information is an effective way of changing attitudes, whether strong or weak (Jager & Gotts, 2019).

Limitations

A study found that providing information alongside a video had a small impact on conservation engagement as well as the empathic concern and emotional experience (Miller et al., 2020). Therefore, the manipulation of the current study might not have had enough impact on the participants to influence their approval of zoos. If the public opinion of zoos is to be changed positively, further research needs to investigate effective ways to do so. A study by Carr and Cohen (2011) showed that the lack of information about the conservation efforts of zoos is partly due to the scarcity of information about such efforts on their websites. Therefore, research needs to investigate whether a change of information on such websites can lead to a change in zoo approval. Additionally, the effectiveness of other forms of providing information, such as awareness campaigns of zoos about their conservation efforts, could be targets of further research.

This study was conducted as part of a Bachelor's Thesis involving nine people. Each individual had slightly different interests. This led to the manipulation containing facts about zoos but also about tigers regardless of zoos. Given that people have different interests, some participants might have focused on the facts about the tigers more than the facts about the zoo. This can be especially true considering that tigers are considered one of the most charismatic animal species (Albert, Luque, & Courchamp, 2018). The potential unclarity of the information and shift of focus towards the tiger species instead of zoos might have interfered with the impact the information was thought to have and therefore with the results.

Besides these limitations, the study added multiple novel insights. Generally, this study was able to generate a better understanding of the public image of zoos by taking

biospheric and hedonic values into account. We showed that participants concerned with the environment tend to show less zoo approval. Providing people with high biospheric values with information about such efforts seemed to be a promising way to resolve that negative image. This idea originated from research indicating that the negative image of zoos is partly due to a lack of information about conservation efforts of zoos (Carr & Cohen, 2011). However, there was no support that providing participants with such information alongside a video impacts their approval of zoos. Future research needs to investigate how to effectively generate a positive image of zoos.

Generating a more positive and accurate image of zoos is important due to the potential of zoos. As mentioned before, climate change and the resulting loss of biodiversity is a pressing issue and zoos can be crucial in preventing, delaying, or buffering negative outcomes (Hutchins, 2003; Tribe & Booth, 2002). A positive image of zoos would likely increase the number of visitors, which results in a higher profit for zoos and ultimately more investment in conservation programs (Carr & Cohen, 2011).

Portraying zoos as conservation centers could change the reasons why people go to zoos and ultimately have an impact on the structure and purpose of zoos. If people that value the environment have a more positive picture of zoos they are more likely to visit zoos. Considering that they are concerned with the environment, their reason for visiting and therefore their expectations of the visit might focus on conservation rather than entertainment. As zoos aim to meet the needs and expectations of the visitors to maintain a profitable business, changing such needs and expectations could result in a change of structure (Carr & Cohen, 2011).

Future research

Future research about this topic is a key part to reach a change of purpose and therefore making use of the potential advantages of zoos. First of all, a better understanding of

the opinion of zoos needs to be generated. This includes distinguishing between zoo visitors and non-zoo visitors. A study by Reade & Waran (1996) did this. However, as this study is 26 years old, a replication would help to see changes in opinions about zoos and motivation to visit such zoos.

The controversy discussed here, conservation versus entertainment, is not the only ongoing debate regarding zoos. Keulartz (2015) recognizes a conflict between animal protectionists and conservationists. Animal protectionists argue that any form of captivity is wrong and harmful for the individual animal. Whereas, conservationists argue that any individual harm to an animal is justifiable if it is outweighed by the greater benefit of the collective species (Keulartz, 2015). The latter is represented by considering biospheric values in this research. The opinion of animal protectionists could potentially be represented by concepts such as mutualistic beliefs or animalistic values (Drijfhout et al., 2020; Manfredo, Teel, Sullivan, & Dietsch, 2017). Investigating that debate would pursue the same goals as this study did, such as understanding the public opinion fully in order to generate a positive image of zoos to exploit its potential. The debate about conservation and animal protectionism must be investigated separately to avoid adding more factors to a yet unclear debate about zoos as places of entertainment or conservation.

Conclusion

As indicated, the conservation management of zoos has great potential to work against the negative effects of climate change, such as the loss of biodiversity (Hutchins, 2003). To exploit such potential, zoos require financial resources, largely dependent on the number of visitors (Carr & Cohen, 2011). Thus, understanding the public opinion of zoos is crucial. To do that we looked at values as they have a substantial impact on peoples' opinion. This study revealed that the more participants were concerned about the environment, the less they showed approval for zoos. The assumption that participants that valued pleasure and

entertainment would see the zoo more positively due to its role as a place of entertainment did not find support. To increase the amount of visitors, the negative image of zoos and therefore the public opinion needs to be changed. Therefore, we investigated whether providing information about conservation efforts of zoos to people concerned about the environment would result in a more positive image of zoos, which was not supported by the data. Notwithstanding, this study has paved the way for further research regarding the public opinion as well as the need to change that opinion positively to exploit the potential of zoos.

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Appendix A**List of Nationalities**

Nationality	Amount
Albania	2
Austria	1
Czech Republic	5
Egypt	1
France	3
Germany	131
Great Britain	3
India	11
Ireland	2
Israel	1
Italy	5
Luxembourg	1
Mexico	1
Netherlands	79
Norway	1
Pakistan	1
Portugal	1
Romania	1
Scotland	1
Slovakia	1
Spain	1
Sweden	1
Syria	2
Turkey	42
United States	20

Appendix B

List of materials

This appendix provides the full list of materials and measurements of the experiment in the order presented to the participants.

E-PVQ scale (Bouman, et al., 2018):

Below you will find brief descriptions of different people. For each person we describe what is very important to. Please read each description carefully and indicate how much this person is like you. The meaning of the scores is as follows: 1 means that the persons is totally not like you, 7 means that the person is totally like you. The higher the score, the more the person is like you. Please try to distinguish as much as possible in your answering by using different scores. The person that is most like you should thus receive the highest score. The person that is the least like you, the lowest.

Biospheric:

- It is important to this person to prevent environmental pollution.
- It is important to this person to protect the environment.
- It is important to this person to respect nature.
- It is important to this person to be in unity with nature.

Altruistic:

- It is important to this person that every person has equal opportunities.
- It is important to this person to take care of those who are worse off.
- It is important to this person that every person is treated justly.
- It is important to this person that there is no war or conflict.
- It is important to this person to be helpful to others.

Hedonic:

- It is important to this person to have fun.
- It is important to this person to enjoy the life's pleasures.
- It is important to this person to do things he/she enjoys.

Egoistic:

- It is important to this person to have control over others' actions.
- It is important to this person to have authority over others.
- It is important to this person to be influential.
- It is important to this person to have money and possessions. It is important to this person to work hard and be ambitious.

Belief scale (Manfredo, Teel, & Henry, 2009):

Please indicate the extent to which you agree with the following statements. Agreements were measured from 1 (strongly disagree) to 7 (strongly agree).

Appropriate Use Beliefs:

- Humans should manage fish and wildlife populations so that humans benefit.
- The needs of humans should take priority over fish and wildlife protection.
- It is acceptable for people to kill wildlife if they think it poses a threat to their life.
- It is acceptable for people to kill wildlife if they think it poses a threat to their property
- It is acceptable to use fish and wildlife in research even if it may harm or kill some animals.
- Fish and wildlife are on earth primarily for people to use

Hunting Beliefs:

- We should strive for a world where there's an abundance of fish and wildlife for hunting and fishing.
- Hunting is cruel and inhumane to the animals.

- Hunting does not respect the lives of animals.
- People who want to hunt should be provided with the opportunity to do so.

Social Affiliation Beliefs:

- We should strive for a world where humans and fish and wildlife can live side by side without fear
- I view all living things as part of one big family.
- Animals should have rights similar to the rights of humans.
- Wildlife are like my family and I want to protect them.

Caring Beliefs:

- I care about animals as much as I do other people.
- It would be more rewarding to me to help animals rather than people.
- I take great comfort in the relationships I have with animals.
- I feel a strong emotional bond with animals.
- I value the sense of companionship I receive from animals.

Manipulation check:

From the following facts, please select the one you saw in the video.

- 1. A tiger's urine smells like buttered popcorn
- 2. Siberian tigers live in forests mostly untouched by humans. Out of all tiger species, their home has the most complete ecosystem
- 3. I didn't see any text

Conservation caring scale (Skibins & Powell, 2013):

Please indicate the extent to which you agree with the following statements. The agreement was measured from 1 (strongly disagree) to 11 (strongly agree).

Existing connection to wildlife:

- I actively seek opportunities to view wildlife
- I feel a deep connection to wildlife
- I am highly motivated by the need to interact with wildlife
- I enjoy viewing all types of wildlife
- I spend a lot of time learning about wildlife
- I have a responsibility to do all I can to protect wildlife

Conservation caring:

- I am deeply concerned about the care and well-being of this animal at this site
- This species has as much right to exist as any human being
- Ensuring this species' survival is my highest priority
- My emotional sense of well-being will be severely diminished by the extinction of this species
- I need to learn everything I can about this species
- I would protest this site if I learned of the mistreatment of this animal I will alter my lifestyle to help protect this species
- My connection to this animal has increased my connection to the species as a whole
- Wildlife protection must be society's highest priority

Behaviour-species oriented:

- I would support entrance fees at this site being \$10–25 higher if the extra money were used for the care and survival of this species
- I will donate up to \$75 to “adopt” this animal at this site
- I will make a charitable contribution up to \$150 to help purchase habitat in the wild for this species

- I will become a member of an organization committed to protecting this species, within the next 6 months
- I will volunteer at an event designed to help the conservation of this species, within the next 6 months
- Before my visit is over, I will sign up for a mailing/email to receive updates about the care and conservation of this animal
- I would write a letter/sign a petition to a government official supporting the protection of this species

Behaviour-biodiversity oriented:

- Even if I never return, I will provide ongoing financial support to this site
- If asked, I would donate as much as \$50 to help protect a species
- I've never heard of I will endorse a public policy that severely restricts future growth & development in order to protect wildlife
- Elected officials' views on wildlife will be a major factor in my voting
- Even when they are more expensive or harder to find, I will buy groceries & products that support wildlife conservation

The attention check was included in the end of the conservation scale:

- To show that you are still paying attention, please select Strongly Disagree as your answer for this statement

Zoo approval scale (Miller, 2012):

Please indicate the extent to which you agree with the following statements. The agreement was measure from 1(strongly disagree) to 7(strongly agree)

- Animals in zoos often display natural behavior

- Zoos provide the highest levels of animal care
- I am troubled by the well being of animals in zoos
- Zoo exhibits are great places for animals to live
- It is important to have animals in zoos
- It is important to support zoos
- I am interested in visiting zoos in the future
- I am interested in donating money to zoos

Acceptability of Zoos (Liu et al., 2019):

Below you will find brief descriptions of different statements. Please read each description carefully and indicate how much you agree with that statement. The agreement was measured from -3 to 3.

- Please select how acceptable you think zoos are. (-3 = very unacceptable; 3 = very acceptable)
- Please select how good you think zoos are. (-3 = very bad; 3 = very good)
- Please select how positive you think zoos are. (-3 = very negative; 3 = very positive)
- Please select how necessary you think zoos are. (-3 = very unnecessary; 3 = very necessary)

Perceived role of zoos (Reade & Waran, 1996):

The modern-day zoo is generally considered to fulfill four roles: entertainment, research, conservation, and education. Please indicate how important each of these four roles is to you. The importance was measure from not important (1) to very important (5)

Lastly, a donation link asking participants to help contribute to the conservation of tigers was used: Click the next button to complete the survey. If you care about tigers and would like to contribute to their conservation, click here to make a donation in order to adopt a tiger. Your contribution would help to protect the last remaining 3,900 wild tigers.

Appendix C

List of facts

The facts for the biospheric condition were as follows:

- 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.

German version:

- Derzeit befinden sich 287 sibirische Tiger im europäischen Zuchtprogramm, das Möglichkeiten für Forschung und tierärztliche Ausbildung bietet.
- Dieser Zoo spendet für das Tigerschutzprogramm der Weltnaturschutzunion, welche die Populationen in verschiedenen Projekten bereits um 40 % erhöht hat.
- Dieser Zoo informiert über die Bedrohungen denen Tiger ausgesetzt sind, und darüber, wie Besucher den Tigern helfen könne.

- Das Tigerzuchtprogramm dieses Zoos führt zu einer höheren Geburtenrate, einer größeren Genvielfalt und einer höheren Überlebensrate der Jungtiere.
- Sibirische Tiger leben in vom Menschen weitgehend unberührten Wäldern. Im Vergleich zu anderen Tigerarten hat das Zuhause der sibirischen Tiger das vollständigste Ökosystem.
- Um den Lebensraum eines einzigen Tigers zu erhalten, müssen etwa 10 000 Hektar Wald geschützt werden.
- Tiger unterstützen die Gesundheit des Ökosystems, indem sie dazu beitragen die Population von Pflanzenfressern kontrollieren.
- Nach einem Jahrhundert des Rückgangs sind die Populationen des Sibirischen Tigers in Indien, Nepal, Bhutan, Russland und China stabil oder nehmen zu

Dutch version:

- Het Europese fokprogramma heeft op dit moment 187 siberische tijgers. Het programma biedt mogelijkheden voor het opleiden van onderzoekers en dierenartsen.
- Deze dierentuin draagt financieel bij aan het International Union for Conservation of Nature tijger-beschermingsprogramma, dat de tijgerpopulaties heeft doen toenemen met 40%.
- Deze dierentuin leert bezoekers over de dreigingen die tijgers ervaren en hoe iedereen hierbij kan helpen.
- Het fokprogramma van deze dierentuin leidt tot hogere geboortecijfers, genetische diversiteit, en overleving van tijgerwelpjes.
- Siberische tijgers leven in bossen die door mensen nauwelijks zijn aangetast. Van alle tijgersoorten hebben siberische tijgers het meest complete ecosysteem.
- Om de natuurlijke leefomgeving van één tijger te behouden moet ongeveer 10.000 hectare aan bos worden beschermd.

- Tijgers dragen bij aan gezonde ecosystemen door de herbivoor populaties onder controle te houden.
- Na een eeuw aan bedreigingen zijn siberische tijgerpopulaties stabiel of nemen ze toe in India, Nepal, Bhutan, Rusland en China.

The facts for the hedonic condition were as follows:

- Tigers have been around for a long time, about 2 million years.
- A tiger's roar can be heard about 3 kilometers 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.

German version:

- Das Urin eines Tigers riecht nach frischem Popcorn.
- Das Brüllen eines Tigers kann man bis zu 3 Kilometer weit hören.
- Tiger gibt es schon seit ungefähr 2 Millionen Jahren.
- Tiger können brüllen aber nicht schnurren
- Dieser Zoo bietet die Möglichkeit, sich Tigern auf bis zu 10 Meter zu nähern und dennoch in Sicherheit zu sein.
- Jeden Mittwoch gibt es in diesem Zoo ein Tiger-Trainingsprogramm, bei dem die Besucher zusehen können.

- Zweimal pro Woche wird bei der Tigerfütterung eine Jagd simuliert, welche die Zoobesucher beobachten können.
- In der Nähe des Tigergeheges bietet der Zoo Getränke an, die die Besucher genießen können, während sie die Tiger beobachten.

Dutch version:

- De urine van een tijger ruikt naar (beboterde) popcorn.
- De brul van een tijger kan je wel op 3 kilometer afstand horen.
- Tijgers bestaan al heel lang, al ongeveer 2 miljoen jaar.
- Tijgers kunnen wel brullen maar niet spinnen
- Deze dierentuin biedt bezoekers de mogelijkheid om de tijgers op een veilige manier van slechts 10 meter afstand te bekijken.
- Elke woensdag heeft deze dierentuin trainingsprogramma's met de tijgers waar bezoekers naar mogen kijken.
- Twee keer per week krijgen de tijgers te eten door het simuleren van een jacht waar de bezoekers naar mogen kijken.
- Deze dierentuin biedt drankjes aan voor de bezoekers om van te genieten tijdens het kijken naar de tijgers

Appendix D

Graphs validating assumption checks

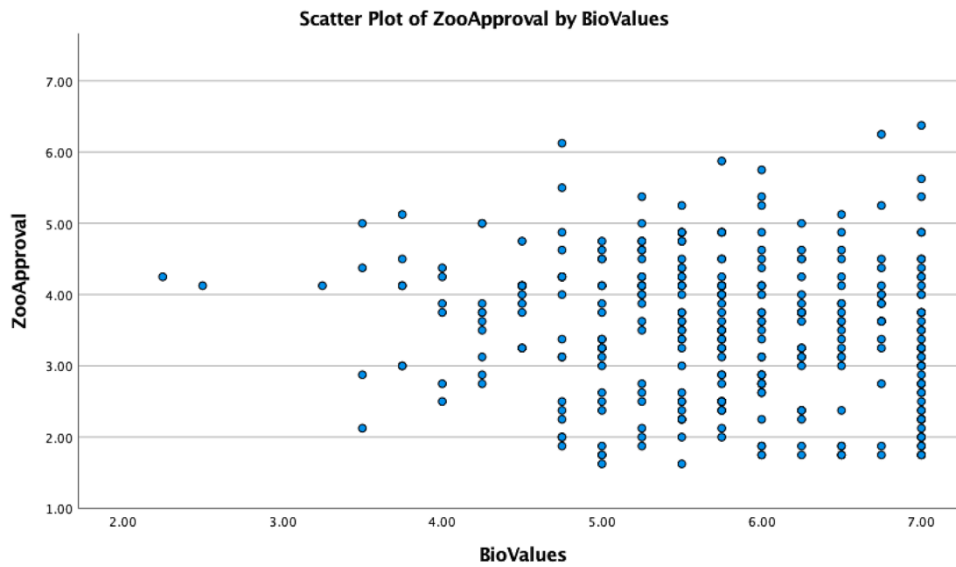


Figure 1. A scatter plot showing the relationship between zoo approval, on the y-axis, and biospheric values on the x-axis. This scatterplot was used to validate the assumption of a linear relationship for the first hypothesis.

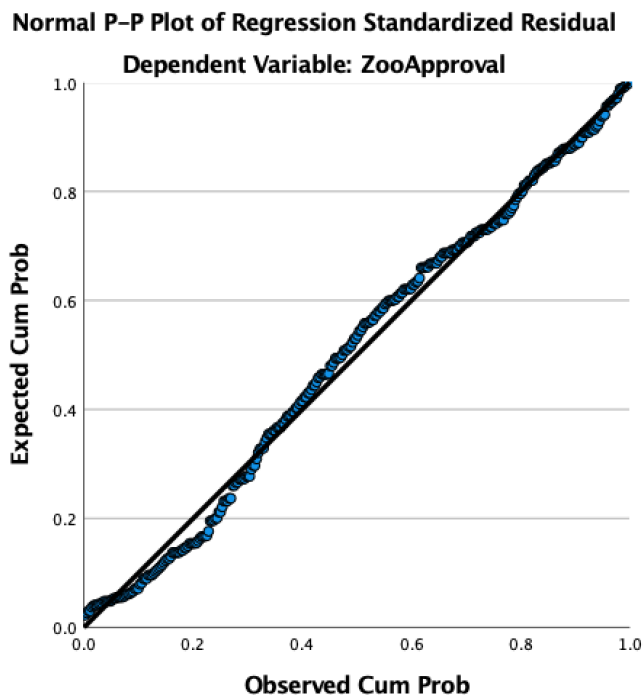


Figure 2. A normal probability plot showing the relationship between the expected cumulative probability (y-axis) and the observed cumulative probability (x-axis). This P-P plot was used to assess the normality of the residuals for the first hypothesis.

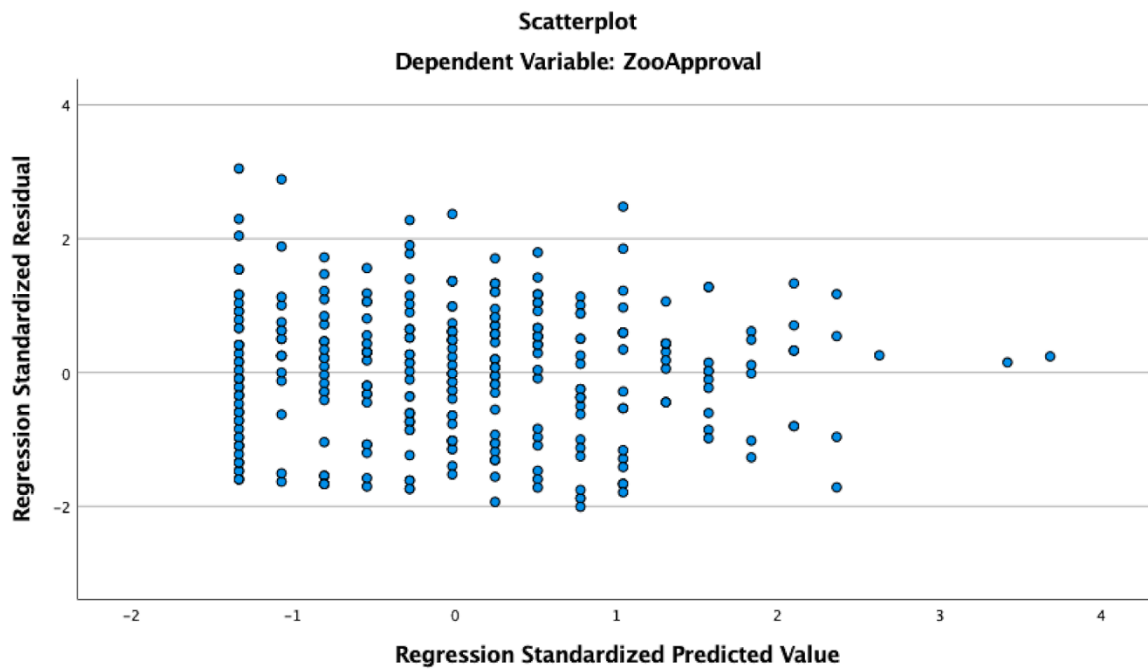


Figure 3. This scatterplot shows the relationship between the standardized predicted value (x-axis) and the standardized residual (y-axis). This scatterplot was used to assess the homogeneity of variance for the first hypothesis.

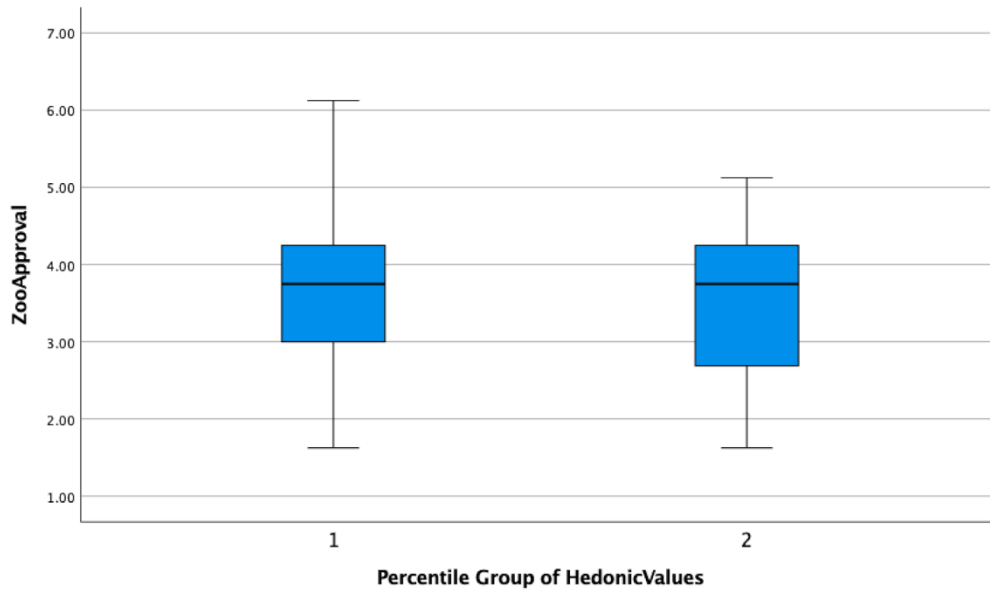


Figure 4. This boxplot shows the distribution of observations for the two groups compared in the second hypothesis. The left boxplot depicts the group of participants with low biospheric and hedonic values. The right boxplot depicts the group of participants with low biospheric and high hedonic values. This boxplot was used to assess outliers for the second hypothesis.

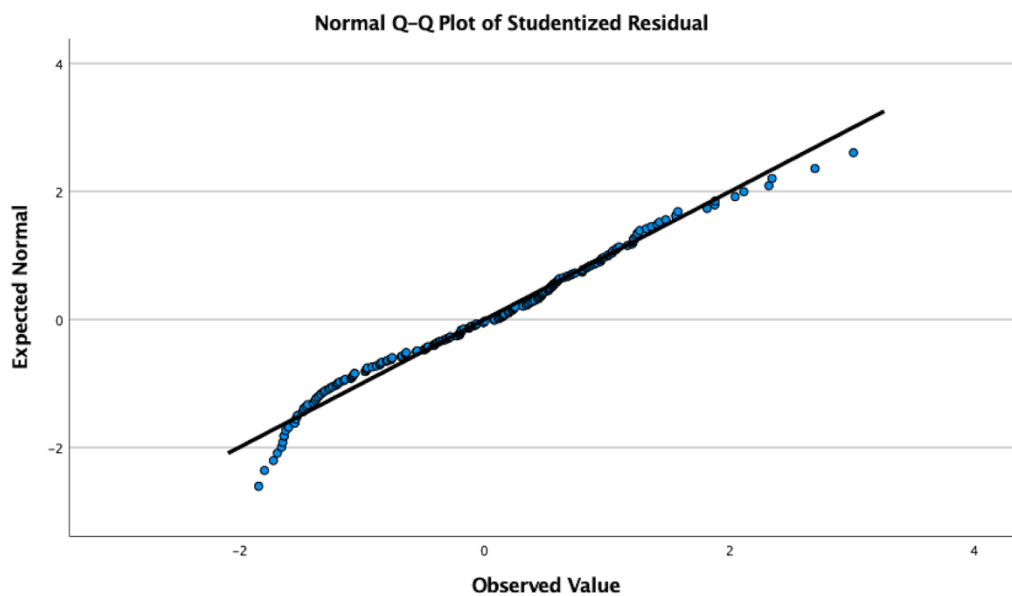


Figure 5. This normal Q-Q plot depicts the relationship between the observed value (x-axis) and the expected normal value (y-axis) of studentized residuals. This plot was used to assess the normality assumption for the third hypothesis.

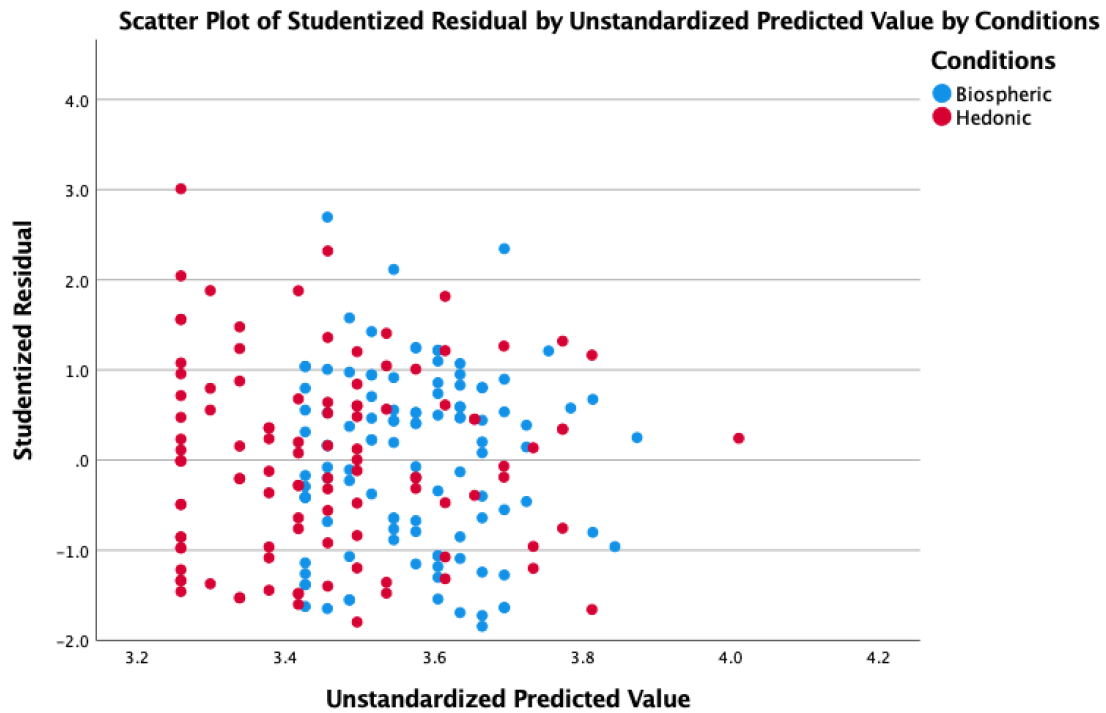


Figure 6. This scatterplot shows the relationship between the unstandardized predicted value (x-axis) and the studentized residual (y-axis). The blue dots represent the observation made in the biospheric conditions, whereas the red dots represent the observation in the hedonic condition. This scatterplot was used to assess the homogeneity of variance for the third hypothesis.