

**The Influence of Educational Interventions on the Relationship Between Zoo Visitors'
Beliefs and Pro-Conservation Intentions**

Svenja Martens

S3973700

Department of Psychology, University of Groningen

PSB3E-BT15: Bachelor Thesis

Group number: 36

Supervisor: Tom Downer

Second evaluator: Dr. N. Yan

In collaboration with: Alexandra Huitfeldt, Aqsa Shakeel, Dagmar Wolf, Hilmi Deniz Ertem,

Janne Nottebom, Justus Thiedemann, Sarah van den Bosch and Vester van Beek

June 22, 2022

A thesis is an aptitude test for students. The approval of the thesis is proof that the student has sufficient research and reporting skills to graduate, but does not guarantee the quality of the research and the results of the research as such, and the thesis is therefore not necessarily suitable to be used as an academic source to refer to. If you would like to know more about the research discussed in this thesis and any publications based on it, to which you could refer, please contact the supervisor mentioned.

Abstract

Biodiversity loss is a persistently growing issue that needs to be counteracted. Zoos can have an impact on this by communicating the need for change to their visitors, and by trying to increase their sustainable behavior. Building on the growing body of existing research on pro-environmental behavior and intentions, this study investigated the association between beliefs and pro-conservation intentions, with a potential moderating effect of education. I hypothesized that stronger mutualistic beliefs would lead to increased pro-conservation intentions, and that sustainability education would enhance this relationship, in contrast to hedonic education or no education. In a between-groups experimental design, using an online questionnaire and educational videos, participants in three conditions (hedonic education, sustainability education, and control condition) were compared. A simple linear regression, as well as a moderation analysis, were conducted with data of 347 English-, Dutch-, or German-speaking adult participants. The data supported the positive association between mutualism and pro-conservation intentions; however, no effect of the educational conditions could be detected. The findings suggest that zoos should design interventions targeting mutualistic beliefs, to successfully increase their visitors' pro-conservation intentions, and thereby foster sustainable behavior. Additionally, future research should investigate different educational interventions, tailoring information to specific target groups and testing different content and context of educational interventions.

Keywords: Sustainability, Zoo, Zoo-Visitors, Pro-conservation intentions, Beliefs, Mutualism, Domination, Education, Video-Education

The Influence of Educational Interventions on the Relationship Between Zoo Visitors' Beliefs and Pro-Conservation Intentions

The ongoing climate crisis is causing a massive loss in biodiversity all around the globe, which is contributing to the extinction of countless species (Kelly & Skibins, 2021; Taylor & Duram, 2021). Whilst we cannot recover what is already lost, we still have the possibility to raise all efforts to preserve the diversity that still exists. One area where this issue can be addressed is in zoos (Ballantyne et al., 2007). The history of modern zoos dates back more than 200 years (Manson, 2000). While they were originally made for private research purposes, they have undergone major development. Nowadays, zoos are not only research facilities but also serve for animal conservation, education, and entertainment purposes (Ballantyne et al., 2007). Zoo visitors come with different expectations: some are particularly interested in the educational aspects of the zoo (Roe & McConney, 2014), some might visit mainly for the fun and entertaining aspects (Reade & Waran, 1996), and some might come for other reasons altogether. People also differ in their beliefs about animals, such as whether they should be treated similarly to humans or whether humans are superior to animals, and whether animal management should benefit us (Manfredo et al., 2009). No matter the reason a person is there, zoos have a great potential to educate and raise awareness for issues surrounding the animals they keep, and those animals' natural habitats (Ballantyne & Packer, 2011; Clayton et al., 2013; Taylor & Duram, 2021). Thereby, zoos can help their visitors to realize what they can do to counteract the loss of biodiversity and associated environmental issues and motivate them to take action towards preserving our planet. However, they are confronted with the question of how to use this potential to successfully get people more involved and raise their awareness of sustainability and conservation.

Pro-conservation Intentions

In general, there are many ways in which people can act in favor of the environment, for example by practicing behavior that counteracts biodiversity loss (pro-conservation behavior). Because assessing actual behavior was beyond the scope of this research, we decided to focus on pro-conservation intentions (PCIs), which are commonly suggested to be closely related to pro-conservation behavior (see for example, Gralton et al., 2004; Steg & De Groot, 2019). Zoos can target PCIs by enhancing people's concern for the animals and thereby increasing their care for the environmental issues that surround their habitats and endangerment (Skibins & Powell, 2013). To reach their visitors most successfully, zoos have used so-called flagship species, to reinforce their message (Albert et al., 2018; Ballantyne et al., 2007; Carr, 2016; Skibins & Powell, 2013). For example, a species-oriented campaign for tigers was found to improve conservation intentions and behaviors (Kelly & Skibins, 2021). Therefore, if zoos manage to activate their visitors' PCIs through certain animals, this would be one step towards more sustainability. Several factors impact this success, of which two important ones are the subject of this study: beliefs and education.

The Impact of Beliefs on Pro-conservation Intentions

One factor that may play a central role in the effectiveness of zoos in communicating the importance of sustainability and conservation to their visitors is the visitors' beliefs (Gralton et al., 2004; Steg & De Groot, 2019). Beliefs (sometimes referred to as value orientations) are a cognitive aspect related to pro-conservation behavior and intentions (Pooley & O'Connor, 2000; Vaske et al., 2011). Beliefs affect the direction in which we act upon our underlying values (Manfredo et al., 2009). In the context of pro-conservation behavior, research has established a dimension of mutualism-domination, that reflects peoples' opinions about wildlife and wildlife conservation (Manfredo et al., 2009). Those on the mutualistic end of the dimension feel highly connected to animals, and think they should

be treated similarly to humans. In contrast, those on the domination end of the dimension support the use of animals for human benefit (Manfredo et al., 2009; Manfredo et al., 2017; Vaske et al., 2011). Generally, there currently seems to be a movement in the population towards more mutualistic beliefs (Manfredo et al., 2009; Vaske et al., 2011). The mutualism-domination dimension was developed in the United States by Manfredo and colleagues (2009), where hunting and wildlife management is a central part of the culture. However, it has been shown to also apply to other European countries (Liordos et al., 2021; Teel et al., 2010; Vaske et al., 2011) as well as some to extent to non-European cultures (Steg & De Groot, 2019; Zainal Abidin & Jacobs, 2016). It is therefore appropriate to apply the mutualism-domination dimension in the context of this study. Overall, beliefs on the mutualism-domination dimension are known to affect people's attitudes towards animals, and we can therefore expect them to have a significant impact on pro-conservation behavior. This is why beliefs are expected to be one factor influencing how successful zoos can impact their visitors' PCIs.

The Impact of Different Types of Education on Pro-Conservation Intentions

The second factor that is expected to influence pro-conservation behavior is the way education is presented to someone (Ballantyne et al., 2007; Orams, 1994). Zoos have a great potential to educate (Ballantyne et al., 2007; Roe & McConney, 2014). Visitors go to a zoo with a certain pre-existing interest in the animals and are likely to engage in free-choice learning (Ballantyne & Packer, 2011). Next to presenting the obvious animal information, this is also an opportunity to inform about the environment and sustainability in direct connection to the animals that are held in the zoo. For example, in a zoo people can gain knowledge about the animals they see, their habitats, their endangerment, and more. On the other hand, they can also learn fun things that are not relevant for conservation, but an entertaining way to

engage with the animals (hedonic information). Zoos can use these different educational possibilities to promote visitors' engagement with sustainability, and their PCIs.

So far, the findings on the effectiveness of education to increase sustainable behavior and intentions are inconclusive. Previous research found that giving people structured education about animals leads to higher environmental awareness (Ballantyne et al., 2007), a higher likelihood to donate to environmental organizations, and more information seeking, in comparison to those who just enjoyed the animals and had fun (Orams, 1997). This shows that education is an important factor to consider for zoos when trying to increase their visitors' sustainability. In contrast, other studies concluded little to no effect of general education on sustainability (Swanagan, 2010; Van Valkengoed & Steg, 2019), or effects only for education that is specifically tailored to the target group (Collénoy et al., 2017). Recently, some research has also looked into the effectiveness of administering pro-environmental education through videos, but the findings are limited and inconclusive (Klein & Hilbig, 2018; Miller et al., 2020; Moskell & Turner, 2021). It is worth conducting further research on the topic, because it could be easier and more ethical and therefore a good alternative to use videos instead of live animals for education. Video education could create a variety of new possibilities if it can have the same effect as in-person education. Given the existing controversy surrounding environmental education in person as well as through videos, it becomes obvious that more research is needed on this topic. So far, the findings are ambiguous, but the practical implications for zoos – investing or not investing time and effort in different types of education – are considerable. Therefore, clarification is necessary, which is why education is part of this research.

The current study

Previous research has separately focused on the connection of PCIs to education (Orams, 1997) and beliefs (Manfredo et al., 2009; Vaske et al. 2011). However, little is

known about the combination of all three of those factors; though, it would be important to know how they are related. That knowledge will be useful for zoos to improve their communication with visitors about conservation issues and encourage them to act more sustainably. Therefore, in the current study, I will investigate the relationship between beliefs, education, and PCIs. Specifically, the influence of beliefs on PCIs will be measured, and the type of education is expected to moderate this relationship. I hypothesize that firstly, people with stronger mutualistic beliefs will show higher PCIs than those with weaker mutualistic beliefs. Secondly, I hypothesize that those who are presented with education about sustainability will indicate higher PCIs compared to those who receive hedonically framed education, or those who do not receive any information. If I find support for these hypotheses, it will support the notion that mutualistic beliefs and information about sustainability are significant influences on PCIs, and thus most important for zoos to consider if they want to improve their visitors' sustainability and conservation efforts.

Method

Participants

This study was conducted with a convenience sample, where the research team initially recruited family and friends through email or social media. 576 people started the survey. Participants were removed from the sample if they did not give informed consent, did not pass the attention check, did not complete the study, or completed the study in less than 10 minutes which we deemed not possible. As a result, the final number of participants was 347. Originally, the study included a manipulation check; however, the data showed that participants in the control condition failed the manipulation check disproportionately often. Therefore, we decided not to exclude participants based on this measure. In the final sample, participants were 39.8% male, 58.5% female and 1.7% non-binary or other, with ages ranging from 18 to 85 ($M = 38.7$, $SD = 16.3$). The sample included mostly participants from Germany

(145 participants) and the Netherlands (83 participants); however, 119 participants from 26 other countries took part as well (see Appendix A for a list of all countries). They were required to speak either English, Dutch or German and had to be at least 18 years old to participate in the research. There was no compensation for participation.

Design

A between-group experiment was conducted with three conditions. Beliefs on the domination-mutualism dimension (Manfredo et al., 2009) were assessed as the independent variable. The dependent variable was pro-conservation intentions (PCIs), and three different educational conditions served as the moderating variable. As this study was conducted as part of a larger bachelor's thesis project, the specific variables of interest were part of a larger list of materials (see Appendix B for the list of materials used for this paper). A minimum of 134 participants were needed for this study, according to an a priori power analysis, completed with G*Power (Faul et al., 2009), with an effect size of $f^2=.10$, power of .81, and $\alpha=.05$.

Materials

Beliefs

The beliefs questionnaire (Manfredo et al., 2017), which was measured on a 7-point scale from strongly disagree to strongly agree, explored participants' domination and mutualism orientations toward wildlife. Participants were asked to rate statements such as "fish and wildlife are on earth primarily for people to use" or "wildlife are like my family and I want to protect them". The mean score of the first ten items was calculated ($M = 3.6$, $SD = 0.8$, $\alpha = .74$) to represent domination beliefs. The mean score of items eleven to nineteen was computed ($M = 4.4$, $SD = 1.2$, $\alpha = .88$), reflecting mutualistic beliefs.

Education

To provide an educational condition as similar as possible to education offered in zoos, we decided to show participants a video clip about one of the so-called flagship species.

Flagship species are certain animals to which humans feel especially connected. They are typically charismatic animals (Albert et al., 2018; Skibins & Powell, 2013), that are large, active, novel, cute, and usually mammals (Carr, 2016). Through flagship species, interest in other species and awareness of more general issues can be raised. Some of the most common flagship species are tigers (Albert et al., 2018; Ballantyne et al., 2007; Skibins & Powell, 2013), pandas (Ballantyne et al., 2007; Skibins & Powell, 2013), Elephants (Skibins & Powell, 2013), gorillas and orangutans (Carr, 2016). Using these animals, zoos can reach out to their visitors to increase care for the conservation of the animals themselves, but also for broader pro-environmental behaviors. Therefore, after filling out the pre-manipulation measures, participants had to watch a 4:27 minute long video (taken from Leipzig Zoo) of Siberian tigers (*Panthera Tigris Altaica*) playing in a zoo enclosure. In the video, participants in the experimental conditions were given different educational information about tigers, framed either as hedonic (115 participants) or sustainability (119 participants) information. In the hedonic condition, participants were presented with eight fun facts about tigers in the wild and the zoo (see Appendix C), such as “A tiger’s roar can be heard about 3 kilometers away”. In the sustainability condition, participants saw eight statements, focusing on tiger habitats, endangerment, and conservation efforts (see Appendix C), for instance, “in order to conserve the habitat of one tiger, approximately 10,000 hectares of forest have to be protected.”. The participants in the control condition (113 participants) watched the video without any additional information.

Pro-conservation Intentions

Following the manipulation, participants’ PCIs were measured, using part of the conservation caring questionnaire, developed by Skibins and Powell (2013). The questionnaire uses a 9-point scale from strongly disagree to strongly agree, and includes statements such as, “I would write a letter/sign a petition to a government official supporting

the protection of this species”. The mean score of items twelve to twenty-one of the scale was computed ($M = 3.9$, $SD = 1.4$, $\alpha = .88$) to reflect PCIs.

Attention Check

To check whether they were paying attention, we added an item into the measure for PCIs, where we asked participants to click “agree” if they were paying attention.

Procedure

After receiving approval from the ethical committee of the University of Groningen, the link to the study, which was conducted through Qualtrics XM, was distributed to participants by the research team. Participants first received information about the study and gave informed consent to their participation. After choosing their language, they completed the pre-manipulation questionnaire including demographics and beliefs. Following that, Qualtrics randomly assigned subjects to one of the three conditions, after which the questionnaire assessing PCIs was filled out. Completing the study took participants approximately 20-30 minutes.

Results

This study aimed to establish a relationship between mutualistic beliefs and pro-conservation intentions (PCIs) as well as to explore a potential moderating effect of different types of education on this relationship. The data was analyzed using IBM SPSS Statistics for Windows, Version 27.0, including the PROCESS extension for moderation, as developed by Hayes (2022). The predictor variable (mutualism) and the outcome variable (PCIs) were measured on continuous Likert scales, whereas the moderator (three possible assigned educational conditions) was categorical.

Prior to the regression and moderation analysis, all necessary assumptions were checked and found to be met. Inspection of the plots of the regression of the standardized residual indicated linearity, normality, and homoscedasticity (see Appendix D). Independence

was present because participants are expected to have answered the questionnaire not more than once. Furthermore, each participant was assigned exclusively to one condition of the manipulation. Lastly, collinearity diagnostics showed that multicollinearity was not a concern for this analysis (Tolerance = .81, $VIF = 1.24$).

As a preliminary analysis, the descriptive statistics of mutualism and PCIs were screened for errors to ensure that the data is usable. No abnormalities could be detected (see Table 1). A first inspection of the correlations suggested a strong correlation between mutualistic beliefs and PCIs, $r(345) = .59, p < .001$. In contrast, the experimental conditions were found to hardly be associated with PCIs, $\eta^2 = .09$. Even though this points towards no relation between the moderator and the outcome variable, a moderation analysis was performed in the following step, to be able to draw a clear conclusion.

Table 1

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Mutualism	347	1,11	7,00	4,3810	1,19188
PCIs	347	1,00	7,80	3,9671	1,44417

Note. PCIs = Pro-conservation Intentions

As the first step of the main analysis, a simple linear regression of mutualism and conservation intention was run, with the following prediction equation: $PCIs = 0.83 + 0.72 * \text{mutualism}$. Mutualism was found to be a significant predictor for PCIs, $F(1,345) = 185.56, p < .001$, and accounted for 35% of the variance in PCIs, with adjusted $R^2 = .35$. Therefore, participants who endorsed stronger mutualistic beliefs indicated significantly higher PCIs compared to those endorsing weaker mutualistic beliefs.

The second hypothesis, which stated that type of education influences the relationship between beliefs and PCIs was tested using a moderation analysis. No difference could be detected in the way beliefs affected PCIs, between participants in condition one, who received sustainability education and participants in condition two, who received hedonic education, $b = 0.18$, $t(341) = 0.31$, $p = .760$, nor between participants in condition one and the control condition (condition three), $b = 0.53$, $t(341) = 0.87$, $p = .378$. Thus, the type of education did not have an impact on the relationship between beliefs and PCIs as displayed by the participants of this study. Furthermore, neither the interaction between the difference of condition one and two and the beliefs, $b = 0.05$, $t(341) = 0.37$, $p = .712$, nor the interaction between the difference of condition one and condition three and the beliefs, $b = -0.07$, $t(341) = -0.54$, $p = .591$, was significant. Altogether, the data shows that the relationship between participants' mutualistic beliefs and their PCIs was not influenced by the educational condition they were assigned to.

In an additional exploratory analysis, I decided to investigate the relation between domination beliefs and PCIs. Based on previous research (Manfredo et al., 2009; Manfredo et al., 2017; Vaske, 2011), I expected participants with stronger domination beliefs to show low PCIs, compared to those with weak domination beliefs. Because of the positive relationship I found between mutualism and PCIs, I wanted to examine whether the opposite could be observed for domination beliefs. Prior to conducting a linear regression analysis, all assumptions were checked. Normality, linearity, and homoscedasticity were met according to the standardized residual plots (see Appendix D). As explained above, independence was given. Lastly, collinearity was not an issue for this analysis (Tolerance = 1; VIF = 1).

To get an indication of the relation between domination beliefs and PCIs, the correlation was computed, which indicated a moderate negative relationship, $r(345) = -.40$, $p < .001$. Finally, I conducted a simple linear regression analysis with the following regression

equation: $PCIs = 6.56 - .71 * \text{domination beliefs}$. Domination beliefs were a significant predictor for low PCIs, $F(1,345) = 66.82, p < .001$, accounting for 16.2% of the variance in PCIs, with adjusted $R^2 = .16$. Therefore, participants with strong domination beliefs showed significantly less PCIs than those with weak domination beliefs. However, the negative association between domination and PCIs appears weaker than the association and mutualism on PCIs. In sum, it can be said that while education did not have an effect on participants' PCIs, beliefs did; however, mutualistic beliefs had a stronger impact on PCIs than domination beliefs.

Discussion

In this study, I explored how zoos can attempt to counteract biodiversity loss by raising their visitors' awareness of sustainability and conservation. For this purpose, I first tested whether people with stronger mutualistic beliefs reported higher pro-conservation intentions (PCIs) than those with weaker mutualistic beliefs. I found support for this hypothesis in the data. Secondly, I tested whether presenting sustainability education to participants would increase the abovementioned association, more so than presenting them with hedonic education or with no information. This hypothesis was not supported. Additionally, I explored the relationship between domination beliefs and PCIs and found a negative association.

As expected, the results showed a strong association between people holding mutualistic beliefs and their PCIs. Beliefs have been found to be related to PCIs and behavior (Vaske et al., 2011), and the dimension of mutualism-domination is strongly related to people's motivation to engage in animal-related pro-conservation behavior (Manfredo et al., 2009). The association between mutualism and animal-related pro-environmental behavior has been replicated a number of times (e.g., Liordos et al., 2021; Teel et al., 2010; Vaske et al., 2011); however, the specific context of this study was not explored before. This newly

established connection between beliefs and PCIs therefore adds to the growing area of research and might have significant implications for zoos that want to engage their visitors in sustainable behavior.

In contrast, no significant connection was found between the different ways of presenting education and participants' PCIs. This is contrary to some existing research (Ballantyne et al., 2007; Orams, 1994), but in line with others (Swanagan, 2010; Van Valkengoed & Steg, 2019). One explanation for this is that education through videos does not serve as a reliable influence on people's sustainability intentions. As mentioned before, research disagrees on whether education generally can or cannot influence peoples' sustainability intentions and behavior (e.g., Ballantyne et al., 2007; Swanagan, 2000). Evidence on the effectiveness of education through videos is also mixed (Klein & Hilbig, 2018; Miller et al., 2020; Moskell & Turner, 2021), and our findings add to the notion, that video education is not a sufficient tool to increase people's sustainability. However, education is multifaceted, and focusing on different aspects may elicit different results.

The information we presented was rather general, and mostly concerned the animals and their environment. It gave little indication of what an individual person can do to help preserve the species or to act more sustainable, possibly leaving them overwhelmed with the information, but helpless as to how they can change anything (Dierking et al., 2004). It is possible that even more specific information may lead to increased PCIs (Ballantyne et al., 2007). This could for example be by talking about one individual animal and/or by encouraging an emotional connection with the animals (Ballantyne et al., 2007; Orams, 1994). Moreover, perhaps more explicit suggestions of pro-conservation behavior can elicit more motivation to do something, and raise a sense of self-efficacy, i.e., help people trust that their behavior changes towards more sustainability will have actual positive effects, which will in

turn enhance PCIs (Van Valkengoed & Steg, 2019). This way, increased specificity could change the outcomes of educational interventions.

On the other hand, education can also be too specific, so it only reaches a selection of people (Ballantyne et al., 2017; Collénoy et al., 2017). In our research, some people might have been very interested in being sustainable and engaging in pro-conservation behavior, but not have any interest in the species that was presented in this study (namely, Siberian tigers). These people might be less inclined to change their behavior based on this specific information and are therefore less affected by the education. Additionally, certain information reaches mostly those who are already familiar with the issue, whereas information aimed at a wider spectrum of people could also reach those who do not have much preexisting knowledge or interest (Ballantyne et al., 2007; Packer et al., 2022). Therefore, broader information, such as education concerning several species, may have a better effect in this case. Furthermore, as mentioned earlier, research suggests that various types of people respond differently to different animals, and therefore zoos need to make a decision on which group to primarily target, and how (Collénoy et al., 2017). This is in line with the idea that the effect of an educational intervention most likely depends on many personal factors, as well as the content, delivery style, and context of educational interventions (Abrahamse et al., 2007; Ballantyne et al., 2007; Dierking et al., 2004; Steg & De Groot, 2019). Together, the points made above could be an explanation for the controversy among previous studies: they do or do not find an effect of education, depending on how precisely and successfully interventions were tailored to the target group. Therefore, accurate designing of interventions is crucial for zoos, if they want to succeed in their efforts to improve visitors' PCIs.

Lastly, the exploration of the association between domination and PCIs showed a negative relationship. This is in line with past research (Manfredo et al., 2009; Manfredo et al., 2017; Vaske et al., 2011). Interestingly, domination showed to be much less related to

PCIs than mutualism (less than half as much). This adds to the previous findings, by suggesting that a focus on highlighting mutualistic beliefs may be more worthwhile than investing time and effort in trying to minimize peoples' domination beliefs. Zoos can profit from this knowledge when they design interventions aimed at increasing visitors' PCIs.

Strengths and Limitations

The present study had several strengths, but also some limitations that need to be considered. A clear strength of this study is its good external validity. The sample was large and multinational, which increases generalizability. Additionally, the scales used to assess beliefs and PCIs have previously been validated and showed good reliability in the present study. Consequently, we can assume that our results based on these scales are dependable. Moreover, because we used pre-existing measures, the results are directly comparable to many other studies, therefore this study adds to an existing line of research. Lastly, researching beliefs in combination with different types of education and PCIs was a new approach, attempting to broaden and connect the existing knowledge of each of the three constructs alone.

On the other hand, some limitations of the study need to be mentioned. Firstly, from a methodological perspective, it is unclear whether the videos used can be considered adequate as the manipulation, and whether the manipulation has sufficient content validity. The videos were designed to represent different types of education, and the data suggested no effect of these types of education on PCIs. However, we can only make this conclusion for our specific context: unsupervised online education in form of videos, concerning one specific species and including a certain selection of facts. These contextual factors can presumably influence the effectiveness of the educational intervention, in the positive as well as the negative direction. Further studies on this topic will be needed to investigate if the findings can be replicated and if other experiments will lead to similar results. Furthermore, there were some technical issues

with the video manipulation, for example, the video did not play on every internet browser, and the software used for this study does not trace whether participants actually watched the whole video or not. Therefore, we cannot be sure if all participants saw the video of the condition they were assigned to. This makes it unclear how much we can rely on the manipulation. Lastly, as mentioned above, we used a convenience sample, which gives the chance of having a bias in the sample. Even though our sample was very diverse, it might be less representative of the general population than if we had a random sample.

Implications

Given the above limitations, the implications of this research should be viewed with caution, but they should be considered nonetheless. In short, we found that beliefs do impact PCIs, whereas the type of education does not. For zoos that want to increase their visitors' sustainable behavior, that means they need to be aware of their specific goals, formulate a target group, and tailor educational interventions accordingly. The current study suggests that one way to address this is by targeting people's beliefs.

Because beliefs are difficult to change (Vaske et al., 2011), it is questionable whether zoos have a realistic chance to influence someone's beliefs within the short duration of their visit. However, there is some evidence suggesting that certain types of education may indeed have the potential to emphasize beliefs (Graltion et al., 2004). Additionally, it might be helpful to focus on making pro-environmental beliefs more salient, for example by targeting education specifically at environmental beliefs (Pooley & O'Connor, 2000). The findings of the current study indicate that the focus should lay on highlighting mutualistic beliefs, rather than attempting to minimize domination beliefs. Consequently, if zoos were able to find a way to foster the mutualistic beliefs of their visitors, the findings of this study suggest that this would be a way to increase visitors' PCIs and motivate sustainable behavior.

On the other hand, the current study did not find support for the use of educational efforts toward zoo visitors' sustainability. However, the findings of this study only apply to a certain context. As discussed above, the current findings could be explained by the notion that educational interventions might only be effective if they are tailored to a specific target group (Abrahamse et al., 2007; Collénoy et al., 2017). Therefore, I would suggest for zoos to design different specific interventions for clearly defined target groups. This could involve offering broader information on one hand, as well as species- or animal-specific information on the other hand (Ballantyne et al., 2007; Packer et al., 2022). For example, by presenting some information aimed at people with high prior knowledge and interest, and some information for visitors who are completely new to the topic. Based on the finding that beliefs play a central role in the development of PCIs, zoos should also look into designing educational interventions aimed at increasing their visitors' mutualistic beliefs, to increase sustainability.

Future Research

This study investigated the relationship between beliefs, education, and PCIs in conjunction with each other for the first time. As mentioned above, even though we did not find a significant impact of education on PCIs, education might have an impact if it is specifically tailored to a target group. Therefore, different ways of designing and presenting education should be explored in future studies. For instance, studies need to investigate which target group is most affected by animal-specific information, and what kind of information is most effective (e.g., the animal's name, age, life story, etc.). Secondly, it should be established who profits most from species-specific information and which species are most suitable for this. Previous research has found the use of flagship species with certain typical characteristics to be most effective (Albert et al., 2018; Ballantyne et al., 2007; Carr, 2016; Skibins & Powell, 2013); however, less popular species might be equally suitable, if they are presented to zoo visitors in an appealing way (Skibins & Powell, 2013). With the knowledge

gained through such studies, it will be possible for zoos to design very precise interventions for a target group of their choice.

Additionally, the relation between beliefs and education should be investigated in more detail. Specifically, it has been suggested that certain types of education could actually impact beliefs (Gralton et al. 2004), and it should be explored how educational interventions can target beliefs to highlight mutualism. For this, it could also be helpful to explore more constructs such as education in combination with beliefs, which would enable the design of a more comprehensive approach to zoo visitors' behavior change.

Conclusion

To conclude, this study aimed to find out how zoos can increase their visitors' connection to nature and their sustainability. To answer this question, the association of beliefs and education with pro-conservation intentions (PCIs) was investigated. Based on this research, there is no reason to encourage zoos to implement educational interventions such as the one used in the present study; however, future research should test educational interventions with different content and context. Meanwhile, the current findings suggest that zoos focus their efforts on designing interventions aimed at their visitors' beliefs, specifically targeting mutualism. Successfully implementing such interventions is the first important step toward increasing zoo visitors' PCIs, thereby increasing their sustainability which will ultimately counteract the current drastic increase in biodiversity loss, and prevent further damage.

References

- Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2007). The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. *Journal of Environmental Psychology*, 27(4), 265–276. <https://doi.org/10.1016/j.jenvp.2007.08.002>
- Albert, C., Luque, G. M., & Courchamp, F. (2018). The twenty most charismatic species. *PLOS ONE*, 13(7), e0199149. <https://doi.org/10.1371/journal.pone.0199149>
- Ballantyne, R., & Packer, J. (2011). Using tourism free-choice learning experiences to promote environmentally sustainable behaviour: the role of post-visit ‘action resources’. *Environmental Education Research*, 17(2), 201–215. <https://doi.org/10.1080/13504622.2010.530645>
- Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: lessons from research in zoos and aquariums. *Environmental Education Research*, 13(3), 367–383. <https://doi.org/10.1080/13504620701430604>
- Carr, N. (2016). An analysis of zoo visitors’ favourite and least favourite animals. *Tourism Management Perspectives*, 20, 70–76. <https://doi.org/10.1016/j.tmp.2016.07.006>
- Clayton, S., Luebke, J., Saunders, C., Matiasek, J., & Grajal, A. (2013). Connecting to nature at the zoo: implications for responding to climate change. *Environmental Education Research*, 20(4), 460–475. <https://doi.org/10.1080/13504622.2013.816267>
- Colléony, A., Clayton, S., Couvet, D., Saint Jalme, M., & Prévot, A. C. (2017). Human preferences for species conservation: Animal charisma trumps endangered status. *Biological Conservation*, 206, 263–269. <https://doi.org/10.1016/j.biocon.2016.11.035>
- De Groot, J. I. M., & Steg, L. (2009). Mean or green: which values can promote stable pro-environmental behavior? *Conservation Letters*. <https://doi.org/10.1111/j.1755-263x.2009.00448.x>

- Dierking, L. D., Adelman, L. M., Ogden, J., Lehnhardt, K., Miller, L., & Mellen, J. D. (2004). Using a Behavior Change Model to Document the Impact of Visits to Disney's Animal Kingdom: A Study Investigating Intended Conservation Action. *Curator: The Museum Journal*, 47(3), 322–343. <https://doi.org/10.1111/j.2151-6952.2004.tb00128.x>
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. doi: 10.3758/brm.41.4.1149
- Gralton, A., Sinclair, M., & Purnell, K. (2004). Changes in Attitudes, Beliefs and Behaviour: A Critical Review of Research into the Impacts of Environmental Education Initiatives. *Australian Journal of Environmental Education*, 20(2), 41–52. <https://doi.org/10.1017/s0814062600002196>
- Hayes, A. F. (2022). *Introduction to Mediation, Moderation, and Conditional Process Analysis, Third Edition: A Regression-Based Approach (Methodology in the Social Sciences)* (Third ed.). The Guilford Press.
- Kelly, A., & Skibins, J. C. (2021). Inspiring wildlife conservation behaviors through innovations in zoo exhibit design. *Visitor Studies*, 24(1), 79–99. [https://doi-org-proxy-ub.rug.nl/10.1080/10645578.2020.1824881](https://doi-org.proxy-ub.rug.nl/10.1080/10645578.2020.1824881)
- Klein, S. A., & Hilbig, B. E. (2018). How virtual nature experiences can promote pro-environmental behavior. *Journal of Environmental Psychology*, 60, 41–47. <https://doi.org/10.1016/j.jenvp.2018.10.001>
- Liordos, V., Kontsiotis, V. J., Eleftheriadou, I., Telidis, S., & Triantafyllidis, A. (2021). Wildlife Value Orientations and Demographics in Greece. *Earth*, 2(3), 457–467. <https://doi.org/10.3390/earth2030027>
- Manfredo, M. J., Teel, T. L., & Henry, K. L. (2009). Linking Society and Environment: A Multilevel Model of Shifting Wildlife Value Orientations in the Western United

- States. *Social Science Quarterly*, 90(2), 407–427. <https://doi.org/10.1111/j.1540-6237.2009.00624.x>
- Manfredo, M. J., Teel, T. L., Sullivan, L., & Dietsch, A. M. (2017). Values, trust, and cultural backlash in conservation governance: The case of wildlife management in the United States. *Biological Conservation*, 214, 303–311. <https://doi.org/10.1016/j.biocon.2017.07.032>
- Mason, P. (2000). Zoo Tourism: The Need for More Research. *Journal of Sustainable Tourism*, 8(4), 333–339. <https://doi.org/10.1080/09669580008667368>
- Miller, L. J., Luebke, J. F., Matiasek, J., Granger, D. A., Razal, C., Brooks, H. J. B., & Maas, K. (2020). The impact of in-person and video-recorded animal experiences on zoo visitors' cognition, affect, empathic concern, and conservation intent. *Zoo Biology*, 39(6), 367–373. <https://doi.org/10.1002/zoo.21565>
- Moskell, C., & Turner, R. W. (2021). Can a YouTube video lead to changes in environmental beliefs, attitudes, norms, and intended behavior? *Journal of Environmental Studies and Sciences*, 12(1), 10–17. <https://doi.org/10.1007/s13412-021-00719-9>
- Orams, M. (1994). Creating Effective Interpretation for Managing Interaction Between Tourists and Wildlife. *Australian Journal of Environmental Education*, 10, 21–34. <https://doi.org/10.1017/s0814062600003062>
- Orams, M. B. (1997). The effectiveness of environmental education: can we turn tourists into "greenies"? *Progress in Tourism and Hospitality Research*, 3(4), 295–306.
- Packer, J., Ballantyne, R., Hughes, K., Sneddon, J., & Lee, J. (2022). Differences between Zoo/Aquarium Staff and Visitors' Values, Beliefs, and Pro-Environmental Behaviors: Consequences for Environmental Communication. *Visitor Studies*, 25(1), 85–103. <https://doi.org/10.1080/10645578.2022.2032927>

- Pooley, J. A., & O'Connor, M. (2000). Environmental Education and Attitudes: Emotions and Beliefs are What is Needed. *Environment and Behavior*, 32(5), 711–723. <https://doi.org/10.1177/0013916500325007>
- Reade, L. S., & Waran, N. K. (1996). The modern zoo: How do people perceive zoo animals? *Applied Animal Behaviour Science*, 47(1–2), 109–118. [https://doi.org/10.1016/0168-1591\(95\)01014-9](https://doi.org/10.1016/0168-1591(95)01014-9)
- Roe, K., & McConney, A. (2014). Do zoo visitors come to learn? An internationally comparative, mixed-methods study. *Environmental Education Research*, 21(6), 865–884. <https://doi.org/10.1080/13504622.2014.940282>
- Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franěk, M. (2005). Values and their Relationship to Environmental Concern and Conservation Behavior. *Journal of Cross-Cultural Psychology*, 36(4), 457–475. <https://doi.org/10.1177/0022022105275962>
- Skibins, J. C., & Powell, R. B. (2013). Conservation caring: Measuring the influence of zoo visitors' connection to wildlife on pro-conservation behaviors. *Zoo Biology*, 32(5), 528–540. <https://doi.org/10.1002/zoo.21086>
- Steg, L., & de Groot, J. I. M. (Eds.). (2019). *Environmental psychology: an introduction* (Second, Ser. Bps textbooks in psychology). John Wiley & Sons. Retrieved 2022, from <http://gateway.library.qut.edu.au/login?url=https://onlinelibrary.wiley.com/doi/book/10.1002/9781119241072>.
- Steg, L., Perlaviciute, G., Van der Werff, E., & Lurvink, J. (2012). The Significance of Hedonic Values for Environmentally Relevant Attitudes, Preferences, and Actions. *Environment and Behavior*, 46(2), 163–192. <https://doi.org/10.1177/0013916512454730>

- Swanagan, J. S. (2000). Factors Influencing Zoo Visitors' Conservation Attitudes and Behavior. *The Journal of Environmental Education*, 31(4), 26–31.
<https://doi.org/10.1080/00958960009598648>
- Taylor, J. A., & Duram, L. A. (2021). Linking Personal Experience to Global Concern: How Zoo Visits Affect Sustainability Behavior and Views of Climate Change. *Sustainability*, 13(13), 7117. <https://doi.org/10.3390/su13137117>
- Teel, T. L., Manfredi, M. J., Jensen, F. S., Buijs, A. E., Fischer, A., Riepe, C., Arlinghaus, R., & Jacobs, M. H. (2010). Understanding the Cognitive Basis for Human-Wildlife Relationships as a Key to Successful Protected-Area Management. *International Journal of Sociology*, 40(3), 104–123. <https://doi.org/10.2753/ij0020-7659400306>
- Van Valkengoed, A. M., & Steg, L. (2019). Meta-analyses of factors motivating climate change adaptation behaviour. *Nature Climate Change*, 9(2), 158–163.
<https://doi.org/10.1038/s41558-018-0371-y>
- Vaske, J. J., Jacobs, M. H., & Sijtsma, M. T. J. (2011). Wildlife value orientations and demographics in The Netherlands. *European Journal of Wildlife Research*, 57(6), 1179–1187. <https://doi.org/10.1007/s10344-011-0531-0>
- Zainal Abidin, Z. A., & Jacobs, M. H. (2016). The Applicability of Wildlife Value Orientations Scales to a Muslim Student Sample in Malaysia. *Human Dimensions of Wildlife*, 21(6), 555–566. <https://doi.org/10.1080/10871209.2016.1199745>

Appendix A

Participants' Nationalities

- Albania
- Austria
- Azerbaijan
- Basque
- Germany
- Great Britain
- Luxembourg
- Croatia
- Czech Republic
- Egypt
- France
- India
- Ireland
- Israel
- Italy
- Mexico
- Netherlands
- Norway
- Pakistan
- Portugal
- Romania
- Scotland
- Slovakia
- Sweden
- Syria
- Turkey
- US

Appendix B

Measures

Beliefs

The scale used to assess beliefs was developed by Manfredi et al. (2017).

Domination

Appropriate Use Beliefs.

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

Hunting Beliefs.

7. We should strive for a world where there's an abundance of fish and wildlife for hunting and fishing.
8. Hunting is cruel and inhumane to the animals.
9. Hunting does not respect the lives of animals.
10. People who want to hunt should be provided with the opportunity to do so.

Mutualism

Social Affiliation Beliefs.

11. We should strive for a world where humans and fish and wildlife can live side by side without fear.
12. I view all living things as part of one big family.

13. Animals should have rights similar to the rights of humans.

14. Wildlife are like my family and I want to protect them.

Caring Beliefs.

15. I care about animals as much as I do other people.

16. It would be more rewarding to me to help animals rather than people.

17. I take great comfort in the relationships I have with animals.

18. I feel a strong emotional bond with animals.

19. I value the sense of companionship I receive from animals.

Pro-Conservation Intentions

The conservation caring scale was developed by Skibins and Powell (2013). Items twelve to twenty-one were used to assess pro-conservation intentions.

Existing connection to wildlife

1. I actively seek opportunities to view wildlife
2. I feel a deep connection to wildlife
3. I am highly motivated by the need to interact with wildlife
4. I spend a lot of time learning about wildlife

Conservation caring

5. Ensuring this species' survival is my highest priority
6. My emotional sense of well-being will be severely diminished by the extinction of this species
7. I need to learn everything I can about this species
8. I would protest this site if I learned of the mistreatment of this animal
9. I will alter my lifestyle to help protect this species
10. My connection to this animal has increased my connection to the species as a whole
11. Wildlife protection must be society's highest priority

Behaviour- species oriented

12. I will donate up to \$75 to “adopt” this animal at this site
13. I will make a charitable contribution up to \$150 to help purchase habitat in the wild for this species
14. I will become a member of an organization committed to protecting this species, within the next 6 months
15. I will volunteer at an event designed to help the conservation of this species, within the next 6 months
16. Before my visit is over, I will sign up for a mailing/email to receive updates about the care and conservation of this animal

Behaviour—biodiversity oriented

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

Appendix C

Manipulation

Facts presented to the participants in the hedonic condition

English Version

- 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

- Der 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

Facts presented to the participants in the sustainability condition

English Version

- Non-sustainable palm oil production is destroying tiger habitats in Indonesia and threatening the tiger population
- 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.
- Siberian tiger habitats consist of different forests and taiga.
- The zoo featured in this video is part of an international community of zoos running cooperative breeding programs throughout Europe
- There are currently 287 Siberian tigers in the European breeding program, providing opportunities for research and vet training
- This zoo donates to the International Union for Conservation of Nature tiger protection program, 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

- 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
- 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 können.
- Das Tigerzuchtprogramm dieses Zoos führt zu einer höheren Geburtenrate, einer größeren Genvielfalt und einer höheren Überlebensrate der Jungtiere.

Dutch Version

- 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 herbivore 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
- 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

Appendix D

Assumption Checks

Assumption Checks Main Analysis

Figure C1

Assumption Check for Normality

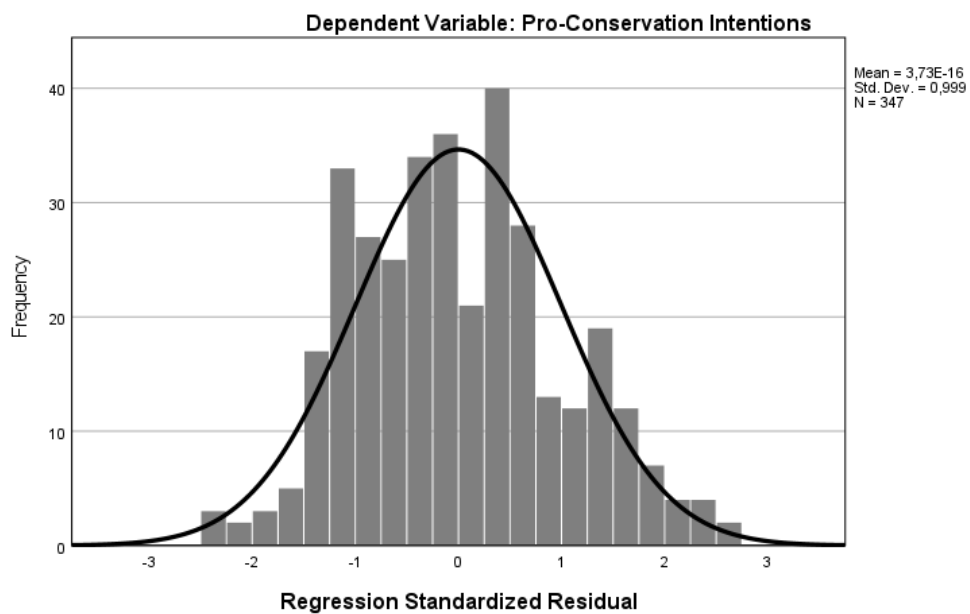


Figure C2

Assumption Check for Linearity

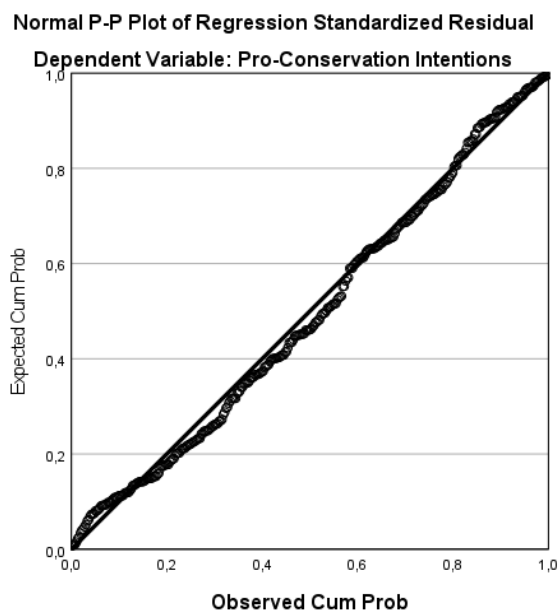


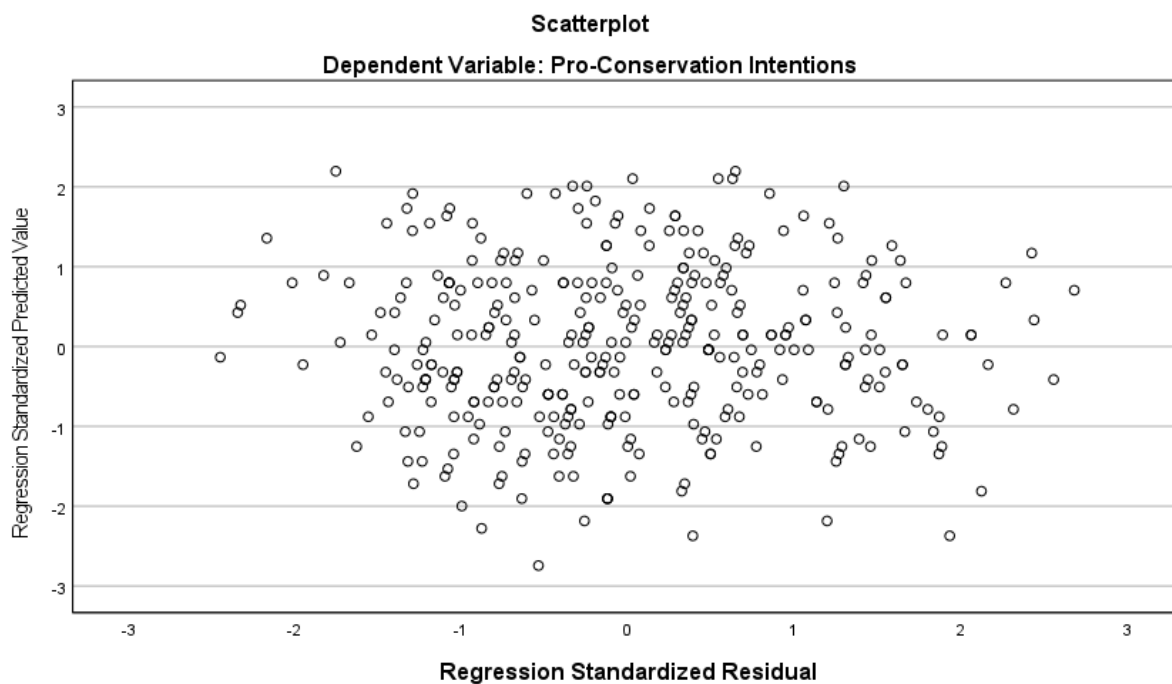
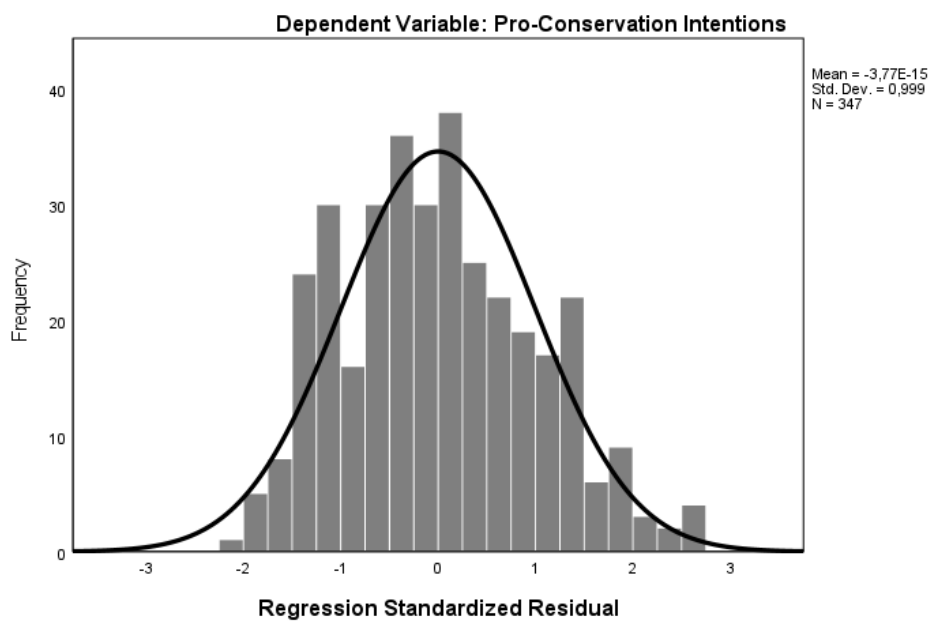
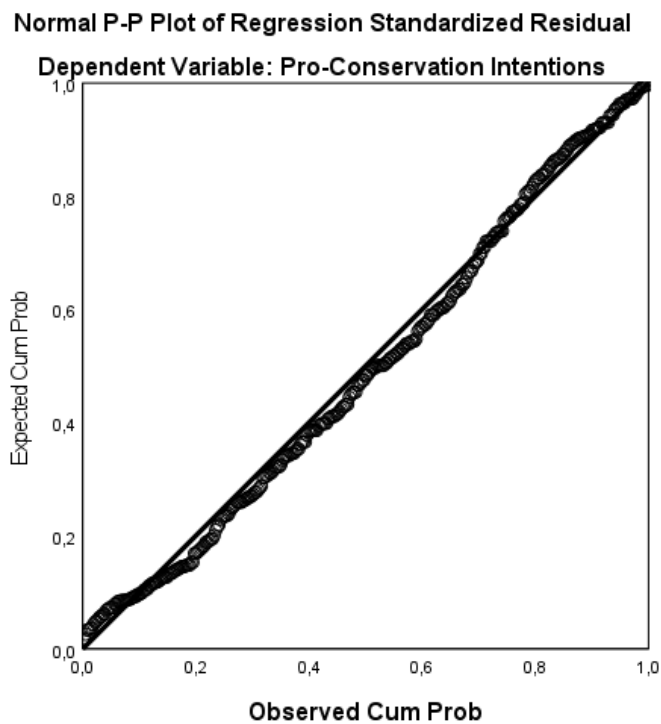
Figure C3*Assumption Check for Homoscedasticity***Assumption Checks Exploratory Analysis****Figure C4***Assumption Check for Normality*

Figure C5*Assumption Check for Linearity***Figure C6***Assumption Check for Homoscedasticity*