Relationship of Biospheric and Egoistic Values with Acceptability of Pathways to Mitigate Climate Change

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PSB3E-BT15: Bachelor Thesis

GR38

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June 20th, 2022

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Abstract

The Intergovernmental Panel on Climate Change (IPCC) proposed four pathways that offer different approaches to limit global warming to 1.5°C. The implementation of such approaches can only succeed when public acceptability is given. Public acceptability is influenced by values and therefore, this study investigates the relationship of biospheric and egoistic values with the acceptability of two specific pathways, which differ largely in the measures taken to mitigate climate change. The pre-registered study (N=226) obtained results that suggest that biospheric values have a positive relation with pathway A, a negative relation with pathway B, and are associated with a preference for pathway A over pathway B. The results obtained regarding egoistic values showed a non-significant relation with the acceptability of pathway A, with the acceptability of pathway B, and regarding the preference of one pathway over the other. This could be due to several factors, such as the limited reliability, or the sample with restricted generalizability. Further limitations and resulting implications are discussed at the end of the study.

Keywords: biosphere values, egoistic values, acceptability, VBN theory, climate change

Relationship of Biospheric and Egoistic Values with Acceptability of Pathways to Mitigate Climate Change

Human-induced climate change is probably the most globally concerning problem of today's time. Weather and climate extremes due to global warming have led to losses and damages of natural and human systems that are irreversible. An increase in global temperature is accompanied by an increase in severity and frequency of nature catastrophes, such as extreme weather events, as well as food and water shortages. The current notion suggests that exceeding global warming by 1.5°C above pre-industrial levels could potentially lead to consequences that are hard to reverse or mitigate, Hence it is of importance to find solutions how this goal can be achieved to (IPCC, 2018).

To limit global warming, greenhouse gas emissions have to be reduced by both the industry and individuals. This can be achieved by implementing new energy policies and behavioural changes, as well as switching to less emission-intensive energy sources. But such changes always have their advantages and disadvantages, and public acceptability, the extent to which something is evaluated favourably or unfavourably (Liu et al., 2019; Liu et al., 2020), in the general population is of utmost importance. As people are diverse in their opinions, it is important to determine who would support which measures, by which factors this is influenced, and where common ground may be found. Because when politicians want to implement changes towards a more climate-friendly country, the population has to be somehow convinced of these. Such policies and changes can only be successfully implemented when the public acceptability is high, because otherwise society is resisting the changes and politicians are reluctant to implement the changes (Steg et al., 2005; Steg et al., 2006).

Many studies investigated factors influencing acceptability of energy policies and behavioural changes to mitigate climate changes and it was found that individual factors, such

as values, are strongly influencing public acceptability (Steg et al., 2006). Research on the relationship between values and the acceptability of changes towards a pro-environmental world have mostly focused on single aspects of such changes, for example the acceptability of nuclear energy, the consumption behaviour, or the willingness to pay more taxes to improve the environment. However, to my knowledge, there is little research on the relationship of values and the acceptability of larger constructs which combine a lot of those energy policies, proposing a way to stay below global warming of 1.5°C.

The present study is aimed at examining the influence of biospheric values and egoistic values on two climate pathways that were proposed by the Intergovernmental Panel on Climate Change (IPCC). The IPCC is a working group of volunteering scientists who are gathering information on climate change and potential solutions for it, publishing those in reports on the current climate situation. These reports include proposals on how it would be possible to limit global warming to 1.5° C by the year 2100. In the year 2018, such a report was published, with four different pathways showing ways which differ in terms of energy consumption, the use of energy sources, as well as behavioural changes to achieve this. The present study will focus on Pathway 2 and 4, here referred to as Pathway A and Pathway B for simplicity reasons. Pathway A is marked by more radical lifestyle changes, cutting down current standards, and a fast energy source transition. It builds on the use of nuclear energy and renewable energy, while significantly decreasing the use of gas, coal, and oil. Pathway B on the other hand focuses on continuing with the current lifestyle with little restrictions, a slow energy transition, and use of modern technologies to mitigate climate change. Compared to pathway A, this pathway will use significantly less renewable energy, more nuclear energy, and will only slightly decrease the coal use. A significant increase of gas and oil use is planned. Further information on the different pathways can be found in Figure A1, in Appendix A.

In this paper, first, the theoretical framework Value-Belief-Norm (VBN) theory used for this study is being presented. Next, the current status of literature on biospheric and egoistic values related to acceptability of energy sources and behavioral changes is discussed.

Value-Belief-Norm (VBN) theory

The value-belief-norm theory of environmentalism explains pro-environmental behavior and environmental decision making (e.g., Stern, 2000), by proposing a causal chain of five variables: values (i.e., biospheric, altruistic, and egoistic), environmental beliefs - which includes awareness of consequences (AC) and ascription of consequences (AR) -, personal norms for pro-environmental behaviours (PEB) and environmental behaviours. Each variable directly influences the next one in the chain, hence the former variables have an indirect influence on the latter variables. The present study uses a simplified form of the VBN model, focusing on biospheric and egoistic values, as well as environmental behaviors. Furthermore, not only will be PEB investigated, but also acceptability of energy policies and energy sources.

Values are transsituational goals that vary in importance and serve as a guiding principle for a person (Schwartz, 1992). There are four key feature of values, as described by de Groot and Steg (2007), which include that "values (a) reflect beliefs on the desirability of a certain-end state, (b) are rather abstract and thus transcend specific situations, (c) serve as a guiding principle for selecting or evaluating behaviour, people, and events, (d) and are being ordered in a system of value priorities."

Biospheric values (BV) describe feeling concern for the biosphere and non-human species, while egoistic values (EV) describe feeling concern for the environment for their individual self-interest (Stern et al., 1993). Thus, environmental concern can be associated with both value orientations, but the motivations for such concern are rather different (Stern et al., 1993). Extensive research on the relationship of these two value orientations and the

acceptability of behavioral interventions, energy policies, and energy sources has been conducted, underpinning the differences between them.

Biospheric Values and Acceptability

As biospheric values are based on the concern with the environment, the opinions formed about energy sources and PBE are largely influenced by the effect that these measures have on the environment (van der Werff et al., 2013). PBE is generally positively associated with biospheric values (Steg & de Groot, 2012; de Groot & Steg, 2009) as such behaviour generally benefits the biosphere and ecosystem (Pereira et al., 2015, Steg & de Groot, 2012; de Groot & Steg, 2009). Hence, personal behaviours that could actually have an impact to mitigate climate change are positively related with biospheric values (Bouman et al., 2020), Furthermore, not only PBE on the individual basis is supported, but also far-reaching energy policies that affect the society as a whole to protect the environment (Steg et al., 2011) – again, the reasoning for the positive relation is probably the benefits for the environment that can be expected with such policies.

These aspects suggest that higher biospheric values might be linked to higher acceptability of pathway A, and lower of pathway B, because the former prioritizes a rapid transition to protect the environment, while the latter focuses on a slower transition to preserve the current way of living. Nevertheless, before generating final hypotheses, further research on the acceptability of energy sources has to be considered.

First, biospheric values are negatively related to the acceptability of nuclear energy (de Groot et al., 2012; Perlaviciute & Steg, 2015). Reasons for this negative relationship include prominent nuclear accidents in Chernobyl and Fukushima which resulted in disastrous outcomes for the environment and biosphere around the nuclear power plants. Furthermore, the ultimate disposal of atomic waste is still an issue without a solution. Not only does atomic

waste take millions of years to deteriorate, but it also is harmful to the environment. Therefore, nuclear energy threatens biospheric values.

Second, biospheric values are generally perceived to have a positive relationship with various renewable energy sources (e.g., Perlaviciute & Steg, 2015; Contzen et al., 2021; Crowe, 2020). Nevertheless, one study found no significant relationship between biospheric values and solar, wind, and hydro energy sources (Donald et al., 2021), which is contradicting the assumed positive relationship. But despite the non-significance in this study, the other research contributes significantly more. Reasons for a positive relationship are most likely the fact that renewable energies are low carbon-emission technologies, which seem to be a capable substitute for fossil fuels (Donald et al., 2021).

Third, biospheric values have a negative relationship with the acceptability of fossil fuels (Brunner & Axsen, 2020), particularly regarding gas and its extraction (Perlaviciute et al., 2021; Axsen, 2014). Reasons for this negative evaluation are the harmful effects for the environment. Earthquakes are a common consequence of gas production, and the use of such energy is responsible for large parts of the current CO2 emissions. A promising alternative to gas and fossil fuels in general might be green gas. One study found that the stronger the biospheric values were, the more positively the evaluation of such technologies was (Perlaviciute et al., 2016).

Taken together, the presented findings provide support for the assumption that the higher the biospheric values, the more acceptable these individuals are of pathway A, the less acceptable of pathway, and congruent with these expectations, they are more likely to choose pathway A over pathway B. The basis for these suggestions are the facts that people who endorse high biospheric values are concerned with the biosphere and thus, their priority is likely to be a rapid transition to protect the environment such as pathway A proposes. Furthermore, the use of fossil fuels in pathway B are likely to lead to a negative evaluation of

the pathway, as well as the slow transition without any behavioural changes. Therefore, I generated the following hypotheses:

1. The higher people's biospheric values, the higher their acceptability of pathway A (H1a).
2. The higher people's biospheric values, the lower their acceptability of pathway B (H2a).
3. The higher the biospheric values, the higher the chance to decide for pathway A, when having to make a choice between pathway A and B (H3a).

Egoistic Values and Acceptability of Energy Sources

Egoistic values are related to the individual costs and benefits and are generally associated with non environmental-friendly behaviour (Steg & de Groot, 2012; de Groot & Steg, 2009). Behaving in a pro-environmentally manner is likely to threaten egoistic values, because behaviour is often associated with certain restrictions or limitations, such as adapting a vegetarian diet or using more public transportation rather than the own car. Hence, PEB is likely to outweigh the personal benefits (de Groot & Steg, 2009) which are of importance for egoistic values. Furthermore, egoistic values are linked to a negative evaluation of policies that intend to protect the environment (Steg et al., 2011; Contzen et al., 2021) and environmental activism (Steg et al., 2011). Reasons for this is the value orientation which makes the self-interest a priority, rather than the environment, as well as the fact that new policies might threaten the egoistic values by restricting individuals in their lifestyles. A similar pattern can be observed when it comes to the acceptability of willingness to sacrifice, meaning paying higher taxes to protect the environment and cutting the own standard of living. Egoistic values are negatively associated with such measures (Knez, 2016) due to the same reasons as already described. All presented information suggests that individuals endorsing higher egoistic values will probably be more acceptable of pathway B than A, due

to the fact that pathway A holds for a lot of behavioural changes and new environmental policies, while pathway B proposes to continue living the current lifestyle. But to come to a conclusion, the acceptability of energy sources has to be considered as well.

Generally speaking, it appears that those energy sources that are more advantageous for consumers' resources are more valued by individuals endorsing high egoistic values than those that are more advantageous for the environment (Perlaviciute and Steg, 2014).

First, egoistic values have a positive relationship with the acceptability of nuclear energy (de Groot et al., 2012; Perlaviciute & Steg, 2015). Reasons for this relationship are the benefits for the self which outweigh the disadvantages. Nuclear power plants require relatively little effort, are a reliable source for cheap energy, and are not having an extreme impact on the landscape, as renewably energy sources might have. These arguments seem to outweigh the risk of a nuclear accident.

Second, generally speaking, people endorsing high egoistic values are less likely to favor renewable energy sources (Perlaviciute & Steg, 2015). Nevertheless, there seem to be some exceptions; one study found no significant relationship between egoistic values and acceptability of wind energy (Bidwell, 2013), while another study actually found a positive association for these two variables (Donald et al., 2021). Both findings are contradictory to the expected negative relationship. A possible reason for these contradictory results is the environmental concern by people with egoistic values that might be more important to them than the potential disadvantages of renewable energy sources, such as the change of landscape.

Third, egoistic values seem to be positively related to the acceptability of fossil fuels, particularly in terms of gas and gas extraction positive (Perlaviciute et al., 2021; Axsen, 2014). Gas is probably an appealing energy source for individuals who endorse high egoistic

values, because the infrastructure for it is already well developed and the prices were usually relatively low.

Taken together, these findings suggest that the higher the egoistic values, the lower the acceptability of pathway A (H2a), the higher the acceptability of pathway B (H2b), and congruent with these two assumptions, the more likely to choose pathway B over pathway A (H3b). Individuals endorsing high egoistic values tend to be rather unaccepting of pro-environmental behaviours and energy policies to protect the environment. These are fundamental parts of Pathway A, but not of Pathway B. Furthermore, the general support for fossil fuels and the use of nuclear energy is rather high for people with this value orientation, which would be a further argument for them to choose Pathway B over Pathway A, and to rate the former as more acceptable than the latter.

4. The higher people's egoistic values, the lower their acceptability of pathway A (H1b).
5. The higher people's egoistic values, the higher their acceptability of pathway B (H2b).
6. The higher the egoistic values, the higher the chance to decide for pathway B, when having to make a choice between pathway A and B (H3b).

Methods

Participants

The total generated sample consisted of 291 participants. 65 (22.34%) participants were excluded due to missing values on the relevant scales (i.e., biospheric values, egoistic values, acceptability of the pathways A and B, choice between the pathways) through casewise deletion. Therefore, the final sample for the study included 226 (77.66%) participants who completed the whole questionnaire. 138 (61.1%) participants identified as female, 82 (36.3%) as male, five (2.2%) as other, and one (0.4%) person did not want to indicate their gender. The age in the sample ranged from 18 years to 68 years (M=24.04; SD=9.28).

The Ethical Committee Psychology (ECP), affiliated with the University of Groningen, granted ethical approval for this study before the recruitment of participants began. 112 (49.56%) participants of the final sample were recruited via snowballing. This recruiting method included different paths, such as reaching out to friends, family, and acquaintances; publishing the link to the study on social media platforms (e.g., Instagram, Facebook); and distributing flyers in Groningen with a QR-code to our study. Participants recruited through snowballing did not receive any form of compensation. 114 (50.44%) were recruited through SONA. SONA is a pool consisting of mostly first-year psychology students from the University of Groningen, who have to participate in studies offered on SONA as this is a requirement for their programme. Therefore, the SONA participants received compensation in form of 0.5 SONA credits after finishing the study.

Research Design and Procedure

We conducted a cross-sectional survey study in English, for which data was collected online via the Customer Experience Management software Qualtrics. The dependent variables investigated were the acceptability of pathway A, as well as pathway B, and the choice between the two pathways. The independent variables included Climate Change Risk Perception (CCRP); objective knowledge of climate change; biospheric, altruistic, and egoistic values; perceived costs and benefits of the pathways; perceived distributional fairness of the pathways; perceived effectiveness of the pathways.

Before publishing the study and starting the data collection, we preregistered the study in the Open Science Framework (link: https://osf.io/r3km5/?view_only=c77cf7b0351548a0b9ea70b09e72c867). Data was collected for three and a half weeks, from April 26th to May 22th. We adhered to the confidentiality guidelines based on the Netherlands code of conduct for research integrity. Informed consent was obtained before the assessments began, and participants were assured that their data

would remain anonymous. During the whole study, participants were able to go back and forth between the questions. They first provided demographic information (i.e., age and gender) and then answered items for the variables CCRP, objective knowledge about climate change, and for egoistic, biospheric and altruistic values. Afterwards, they received information about the pathways A and B and answered comprehension questions about the presented information correctly to ensure that they have sufficient knowledge about the pathways before continuing with the rest of the study. Even though the pathways are named pathways 2 and 4 in the IPCC report, we renamed them as Pathway A for the former and Pathway B for the latter, to avoid confusion for our participants about the missing pathways 1 and 3. Following this part, the participants answered items on the variables perceived effectiveness, perceived costs/benefits, and perceived distributional fairness. Each page also included a short summary with the most important facts of and differences between the pathway as a memory aid. The final block asked to rate the acceptability of pathway A and B, as well as to choose which pathway the participants preferred. At the end of the study, we gave the participants the opportunity to add any comments regarding the study and afterwards the SONA participants received their credits.

Materials

My research is focusing on biospheric and egoistic values as independent variables and acceptability of the pathways A and B and choice between the pathways as dependent variables. Thus, I will only describe the scales for these variables in the following section. For more information on the other scales, please look further into my colleagues' works. Each scale was analysed using the statistical software SPSS. Means and standard deviations of all variables can be found in Table B1, in Appendix B.

Values

Biospheric, egoistic, and altruistic values were measured using the Environmental Portrait Value Questionnaire (E-PVQ), published by Bouman and colleagues (2018). The scale consists of 14 items, five each for altruistic and egoistic values, from which only the egoistic values are relevant to my research (e.g., It is important to you to have control over others' actions.; see Figure A2, Appendix A), and four items for biospheric values (e.g., It is important to you to prevent environmental pollution; see Figure A2, Appendix A). The participants rated each item on a 7-point scale ranging from 1=totally not like me to 7=totally like me. We asked the participants to differentiate as much as they could between the numbers they are ascribing to the different items, and to rate those values highest which are most important to them and vice versa. Reliability for biospheric values was high, indicated by Cronbach's α=.829, but only limited for egoistic values, indicated by Cronbach's α=.645.

Acceptability

Acceptability of each pathway was measured using three items (To what extent to do you think pathway A/B is acceptable?; To what extent do you think Pathway A/B is good/bad?; To what extent do you think pathway A/B is necessary; see Figure A3, Appendix A) for both pathways separately. Participants rated each item on corresponding 7-point Likert scales (1=not at all acceptable – 7=very acceptable; 1=very bad – 7=very good; 1=not at all necessary – 7=very necessary). This scale was adapted from Perlaviciute et al. (2021), with high reliability for both pathway A, indicated by Cronbach's α=.876, and pathway B, indicated by Cronbach's α=.857.

Choice between Pathway A and Pathway B

To measure the choice between the pathways a single item was used, asking "Which pathway do you prefer?", with the options to choose between pathway A and pathway B (see Figure A4, Appendix A).

Data Analysis

To investigate the relationship of the acceptability of the pathways A and B with biospheric values and egoistic values, two multiple regression analyses were performed. The first examined the relationship between the acceptability of pathway A and biospheric values (H1a), as well as egoistic values (H2a), while the second examined the relationship between pathway B and biospheric values (H1b), as well as egoistic values (H2b). Furthermore, a binary logistic regression was performed to examine the relationship between the preference for one of the two pathways with biospheric (H3a) and egoistic values (H3b).

Assumption Checks

The data fulfilled the assumption of independence of observation, because all participants were allowed to only take part in the survey once. The regression for H1a and H2a (for P2) found evidence for the linearity assumptions to be met and for the normality and homoscedasticity assumptions to be violated. The regression for H1b and H2b found evidence for the assumptions of linearity and normality to be met, but for the homoscedasticity to be violated. The dependent variables in both regression analyses were transformed using the natural logarithm, but as this did not make a difference for the direction of the effects and only slightly had an impact on the assumption violations, the results of the multiple linear regressions were used. This procedure is deviating from the approach described in the preregistration. Comparisons of the normality (C1) and homoscedasticity plots (C2 and C3) with the untransformed dependent variables and the natural logarithm of acceptability of pathway A are depicted Appendix C. Comparisons of the normality (C4) and homoscedasticity plots (C5 and C6) for the acceptability of pathway B and its natural logarithm are depicted in Appendix C.

The logistic regression model did not have any assumption violation, as it fulfilled the assumption of linearity tested with the Box-Tidwell test.

Results

Descriptive statistics for the independent and dependent variables can be found in Appendix B. Table B1 depicts the means and standard deviations of biospheric values, egoistic values, acceptability of pathway A, and acceptability of pathway B. Figure B1 depicts the data distribution of the dependent variables, and Figure B2 depicts the data distribution of the independent variables.

Hypothesis 1a and 2a: The higher people's biospheric values, the higher their acceptability of pathway A (1a); The higher people's egoistic values, the higher their acceptability of pathway A (2a).

Multiple linear regression was used to investigate the relationship of biospheric values and egoistic values with the acceptability of pathway A. The model could explain a small amount of variance in the acceptability of pathway A (R^2 = .190, F (2, 223) = 26.144, p < .001). It was found that biospheric values were significantly positively related to the acceptability of pathway A (b=.497, p < .001), in line with our hypothesis. Egoistic values, on the other hand, were not significantly related to the acceptability of pathway A (b=.006, p=.927).

Table 2

Multiple Regression Results with Acceptability of Pathway A as the Criterion

Predictor	b	b 95% CI *[LL, UL]*	sig.
(Intercept)	2.926	*[2.026, 3.826]*	<.001
BV	.497	*[.361, .633]*	<.001
EV	.006	*[-.125, .138]*	.927

Hypothesis 1b and 2b: The higher people's biospheric values, the lower their acceptability of pathway B (1b); The higher people's egoistic values, the lower their acceptability of pathway B (2b).

Multiple linear regression was used to investigate the relationship of biospheric values and egoistic values with the acceptability of pathway B. The model could explain a very small amount of variance in the acceptability of pathway B (R^2 = .056, F (2, 223) = 6.592, p < .002). It was found that biospheric values were significantly negatively related to the acceptability of pathway B (b=-.336, p < .001), in line with our hypothesis. Egoistic values, on the other hand, were not significantly related to the acceptability of pathway B (b=.098, p=.285).

Table 3

Multiple Regression Results with Acceptability of Pathway B as the Criterion

Predictor	b	b 95% CI *[LL, UL]*	sig.
(Intercept)	4.781	*[3.547, 6.016]*	<.001
BV	-.336	*[-.523, -.149]*	<.001
EV	.098	*[-.082, .278]*	.285

Hypothesis 3a and 3b: The higher the biospheric values, the higher the chance to decide for pathway A; The higher the egoistic values, the higher the chance to decide for pathway B.

A logistic binary regression was used to test the relationships of biospheric values and egoisitic values with the preference of the two pathways. The logistic regression model was statistically significant, $\chi^2(2) = 28.662$, p < .001 and resulted in a small amount of explained variance, as shown by Nagelkerke's R^2 = .202. The result for biospheric values was statistically significant, with an odds ratio indicating that for every one-unit increase in biospheric values, the likelihood to choose pathway A over pathway B decreased by 0.367 times [*Exp(b)* = .367, 95% CI (.245, .552)]. The result for egoistic values was not statistically significant, but the odds ratio indicated an increase in the likelihood to choose Pathway B over pathway A of 1.287, with each one-unit increase in egoistic values [*Exp(b)* = 1.287, 95% CI (.879, 1.886)].

Table 4

Binary Logistic Regression Results

Predictor	b	SE	sig.	Exp(b)	Exp(b) 95% CI *[LL, UL]*
(Intercept)	2.771	1.260	.028	15.979	
Biospheric Values	-1.002	.207	<.000	.367	*[.245, .552]*
Egoistic Values	.253	.195	.195	1.287	*[.879, 1.886]*

Discussion

The aim of this paper was to investigate the relationship between both biospheric and egoistic values and the acceptability of two pathways proposed by the IPCC (2018). This research and our hypotheses were embedded in the theoretical framework of the VBN theory. In line with previous literature on values and the acceptability of energy policies and sources, as well as behavioural changes, biospheric values should be positively related with the acceptability of pathway A, but negatively with the acceptability of pathway B. Based on this, the higher the biospheric values, the more likely these individuals should be to choose pathway A over pathway B. On the other hand, egoistic values should be negatively related with the acceptability of pathway A, but positively with the acceptability of pathway B. Therefore, the higher the egoistic values, the more likely these individuals should be to choose pathway B over pathway A.

The results obtained regarding biospheric values revealed a positive relationship to the acceptability of pathway A (H1a), a negative relationship to pathway B (H2a), and conclusive with these findings a tendency to choose pathway A over pathway B (H3a). In line with our hypotheses, these outcomes suggest that the higher the biospheric values endorsed by a person, the more they prefer or are more acceptable of a pathway that has a rapid transition to mitigate global warming, building on drastic behavioural changes and relying on renewable and nuclear energy, while decreasing the use of fossil fuels (Pathway A). The pathways

describe a multi-dimensional approach, combining various aspects to protect the environment and mitigate global warming. Hence, it cannot be differentiated within this study which aspects were crucial for the decision-making process. Nevertheless, previous literature gives some indications. First, individuals with high biospheric values are concerned with the environment and biosphere, therefore it is likely that they choose the pathway that has a more rapid transition with less overshoot to make the consequences of global warming potentially less severe (Stern et al., 1993; van der Werff et al., 2013). Second, they show a tendency to evaluate PEB and energy policies positively, therefore drastic behavioural changes would probably be supported (Steg & de Groot, 2012; de Groot & Steg, 2009; Steg et al., 2011). Last, while they do have an antipathy for nuclear energy (de Groot et al., 2012; Perlaviciute & Steg, 2015), which Pathway A relies on, they also have an aversion towards fossil fuels (Perlaviciute et al., 2012; Brunner & Axsen, 2020). As pathway B includes not only nuclear energy, but also fossil fuels, it seems likely that this might have been a pivotal point to choose Pathway A over Pathway B.

The results obtained regarding egoistic values revealed non-significant relationships with the acceptability of Pathway A (H1b), the acceptability of Pathway B (H2b), as well as with the tendency to choose Pathway B over Pathway A (H3b). These findings were not in line with our hypotheses, and imply that egoistic values are not related to the acceptability or preference of the pathways. Previous literature on egoistic values and measures to mitigate climate change suggested that not having to act pro-environmentally (Steg & de Groot, 2012; de Groot & Steg, 2009) and using fossil fuels (Perlaviciute et al., 2021; Axsen, 2014) and nuclear energy (de Groot et al., 2012; Perlaviciute & Steg, 2015) as energy sources is positively associated with egoistic values. Therefore, a positive relation with the acceptability of Pathway B, rather than Pathway A was expected. As the study did not examine the relationship between the different aspects of the pathways and egoistic values, we cannot

conclude whether some specific measures might have had a significant relationship with egoistic values while others did not. I want to propose factors that might be potential explanations for the non-significant results which deviated from our hypotheses.

First, a possible explanation is the environmental concern that might have led to different ratings on the acceptability scales. The study indirectly pointed out that egoistic values will be threatened by the effects of climate change, meaning that everyone will be affected by the consequences of global warming. Therefore, environmental concern was probably evoked and some participants might have rated the acceptability of the pathways differently than they would normally do (i.e., more in line with previous research). This could be the case, because a more rapid transition with no, or only limited overshoot, might have seemed more appealing if that means that the egoistic values will not be violated on the long term, as it potentially could be the case when choosing pathway B. As the sample was young and rather educated due to our sampling methods, the long-term consequences and threats to egoistic values might have been evaluated in such a way that pathway A seemed more attractive.

Second, the relationship between the acceptability of the pathways and egoistic values was analysed isolated from other variables. This might have led to important information being missing. As mentioned previously, individuals endorsing high egoistic values can also have environmental concern when they feel that their self-interests are being threatened. The isolation of biospheric values can also be considered in the framework of the VBN model which was simplified for this study. Variables from the model that have been excluded, might have had effects on the results that were not investigated here.

Third, the scale for egoistic value was only of limited reliability. Therefore, potential errors in terms of measurement of these value orientation might have falsified some of the data and hence, the obtained results might not be that meaningful.

Last, data collection was conducted during the war in the Ukraine which has led to an enormous increase of gas prices in the Western world and the Netherlands. An increase of prices threatens egoistic values, therefore an approach that rely on renewable energy sources, rather than fossil fuels might have influenced the relationship of egoistic values and the acceptability of the pathways. If the study had been conducted before the war started, while the gas prices were still low, pathway B might have been more positively evaluated and pathway a more negatively.

These three factors might have had an influence on the relationship between acceptability of the pathways and egoistic values, but there is no evidence for that. Rather, it can be seen as suggestions for future research.

Limitations and Future Research

The results of the present study have to be interpreted in face of their limitations. First, the generated sample is limited in its generalizability due to various factors. Considerably more women than men were recruited as participants, and the sample was rather young. Young people are known to be more progressive in terms of their opinion on climate change and the measures they are willing to take to mitigate climate change, wherefore older people such as the Boomer generation are generally more reluctant to change. Therefore, our sample might have evaluated pathway A more positively than an older sample would have done that. Furthermore, it can be suspected that the participants in the sample were mostly from an educated background, due to our recruitment methods. The participants recruited via SONA are all students, and the participants recruited via snowballing were me and my colleagues acquaintances. We discussed this matter in the group and came to the conclusion that we mostly distributed the survey to people who are similar to us. Therefore, it can be suspected that those people might be more educated than an actual cross-section of the population is,

with more knowledge about climate change as well which might have influenced the results further.

The fact that we only checked for two demographic variables, namely age and gender, might also decrease the generalizability of the study as we do not know anything about the nationality of the participants. Four of our group members are from Germany, one is from South Africa, and we are all studying in the Netherlands. Therefore, the participants in our study might be relatively international. Gathering information on the origin of them and interpreting those in relation to other variables might give important insights into cultural differences when it comes to the acceptability of measures to mitigate climate change. One last limitation regarding the sample, which is related to the previous points, are potential language difficulties while completing the survey. As mentioned, the sample was probably quite international, with many participants not having English as their first language and not being completely fluent. This might have led to translation errors and/or misunderstandings of specific items in the study. All these limitations regarding the sample suggest that it would be insightful to replicate the study with a larger sample that is more representative of the general population, while checking for more demographic variables than the current study did.

Second, the contemplation of the pathways as a whole, not differentiating between the different measures that will be implemented, limits the interpretation of our study. Previous research investigated the different subcomponents which are included in the proposed pathways, but only as single variables. The present study investigates approaches combining all those subcomponents to one multi-dimensional approach, but it did not leave the opportunity to investigate which of these measures might have had crucial influence when it came to rating the acceptability. Therefore, the interpretation can only be made regarding the preference or acceptability of a pathway and the approach taken generally, but not which of

the included measures were most important to the participants. Further research could investigate the importance of the different subcomponents and measures to the participants.

Third, the study includes various variables that have not been analysed or controlled for in this thesis. These variables might have had a mediating on the variables I investigated, or they could have been confounding. This also includes the previous mentioned limitation that the VBN model has been simplified and important variables that are directly influenced by values and in turn directly influence acceptability of specific climate measures might account for information that would give important insight, particularly for the interpretation of egoistic values. Therefore, future research could extend on the current study by investigating the other variables included and their relationship with values. Additionally, the variables relevant for the VBN model could also be included and investigated.

Fourth, the context in which the study has been conducted is important to consider when interpreting the results. As mentioned above, the data was collected during the war in the Ukraine which is accompanied by a rising inflation and immensely increasing energy prices for natural gases. Therefore, this might have influenced participants to choose pathway A over pathway B, as pathway B proposes increasing use of fossil fuels, including gas. Future research could replicate a similar study in Russia or other countries that have large resources of fossil fuels and thus may not feel as threatened in their egoistic values.

Fifth, statistical limitations in terms of limited reliability for the egoistic values scale and assumption violations for both multiple linear regressions might have had an impact on the analysed data. Therefore, it would be interesting to see if future research which generates different samples might have a better reliability score for the egoistic values scale, and to see whether evidence for fulfilled assumptions can be gathered.

Theoretical Implications

This paper builds on the value-belief-norm theory developed by Stern and colleagues (e.g., 2000). We simplified the model by disregarding the variables AC, AR, personal norms for PEB, and environmental behaviour. Instead, we directly observed the relationship between biospheric and egoistic values and acceptability of environmental protection measures. The study investigated the effects of biospheric and egoistic values on the acceptability of a conglomerate of measures to protect the environment and extended the current literature. It seems that endorsing biospheric values is of importance when it comes to decide which pathway is perceived to be acceptable to mitigate global warming and which pathway is preferred over the other. Egoistic values on the other hand appeared to be rather redundant when it comes to making a choice between the two pathways or rating the acceptability of one of the pathways.

In conclusion, this study found support for the predictions made regarding biospheric values within the VBN framework, but not for those regarding egoistic values, which is only for biospheric values in line with previous literature. The use of a simplified version of the VBN model might have led to remarkable loss of insight into the effects that egoistic values have on other variables in the chain, wherefore future research should investigate the direct influence of egoistic values on AC, AR, personal norms for PEB, and environmental behaviour.

Practical Implications

The results reported here might give policy makers important insights regarding the relationship of biospheric and egoistic values and multidimensional approaches to mitigate climate change, such as the two pathways investigated in this study. To limit global warming to 1.5° C, it is necessary to take all-encompassing measures that are associated with far-reaching changes as can be seen in Pathway A and B. Biospheric values seem to be

contributing to the acceptability of such pathways, indicating a positive relationship with a pathway entailing drastic changes and focusing on renewable energy sources rather than fossil fuels, such as in Pathway A. Pathway B, on the other hand, was negatively related to biospheric values, implying that a longer transition consisting of no behavioral changes and relying on fossil fuels and electrification is rather unacceptable. These results suggest that politicians could focus on enhancing biospheric values in order to implement drastic changes which might by accompanied by behavioural changes which have a direct impact on the people's life as well. Enhancing biospheric values would lead to a higher acceptance of drastic changes.

Furthermore, the results suggest that egoistic values are not related with the acceptability of either of the pathways, meaning that the individual benefits and interests might not contribute to the evaluation of such multi-dimensional approaches. As already mentioned previously, previous literature suggested otherwise by giving evidence for an opposite pattern of this shown with biospheric values. Nevertheless, the results of the present study suggest for policy makers that egoistic values might not be influential when it comes to choosing between ways to mitigate global warming. Therefore, the final message for politicians who want to implement measures that protect the environment might be, that message should be tailored to evoke biospheric values, as this potentially leads to higher acceptability of changes to the current lifestyle.

Conclusion

In conclusion, based on previous research and the present study, biospheric values seem to be importance for the public acceptability of the two pathways. Egoistic values, on the other hand, probably have less influence on this factor. As the pathways propose realistic measures that can limit global warming, it is important to further investigate the acceptability of those and the factors that influence and shape such acceptability. Further research should

replicate the study with a broader sample, investigate more variables that could potentially have an effect on values, and examine the importance that individuals ascribe to the different measures proposed in the pathways.

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Appendix A

Figure A1

Pathway Descriptions

Pathway Descriptions
*explanations for terms in **bold** are included in the brackets.*

We are interested in people's stand toward changes suggested by the **IPCC** *(Multidisciplinary group of United Nations experts who prepare reports about the current knowledge on climate change)* to limit the **effects expected from global warming** *(e.g. increase in heat waves, droughts, heavy rainfalls, extreme weather events, water and food shortages)*. To avoid an increase beyond **1.5° C,** the IPCC has suggested multiple pathways *(A global average temperature increase of 1.5°C above pre-industrial levels has been selected as a "tipping point" beyond which the effects of climate change are much harder to reverse or mitigate)*.

Implementation of these pathways requires changes to *industry* and *everyday behaviour on a global level*. They will affect our *lifestyles* and *economy*.
The two pathways we are focusing on differentiate in two main aspects: the **overshoot** they allow for, and the way they aim to reach a stable temperature *(Rising above 1.5°C, then being brought back down. This may bring changes that we would not be able to reverse, even if we can reverse the warming itself)*.

Pathway A aims to limit the overshoot of 1.5°C to a maximum of 1.6°C, keeping the effect of climate change as low as possible.
Pathway B does not aim to limit the overshoot of 1.5°C, allowing it to go beyond 1.6°C, risking higher effects of climate change.

To limit the effects, both pathways aim to return to 1.5°C by the end of the 21st century.

Pathway A expects rapid transitions to future energy production systems and implementation of industry and lifestyle policies. Pathway B expects slower transitions, resulting in overshoot, which is then reversed using **carbon capture** *(A future technology proposed to remove CO2 from the atmosphere and store it in the ground)*. There would be no need to change from the current CO2-emission-intensive lifestyle.

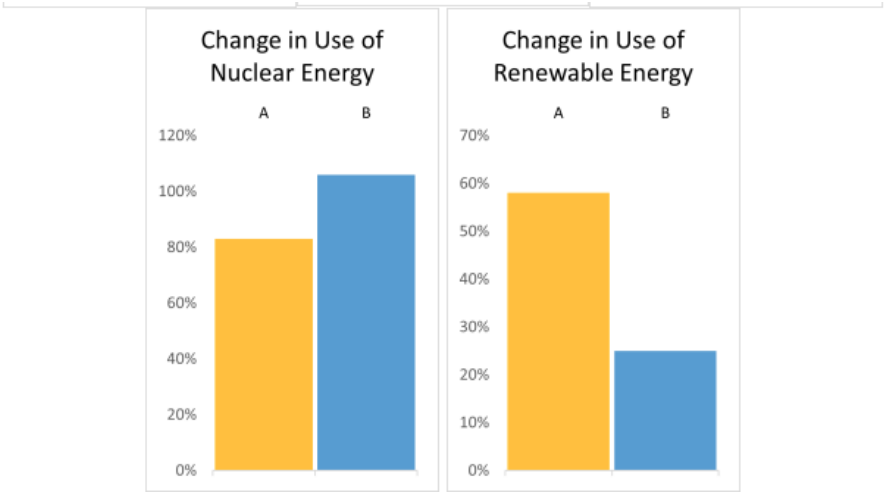
Details of the proposed energy transitions can be seen below:

Pathway A reduces energy demand by 5% by 2030

- Eating local and seasonal foods
- Reducing meat and dairy consumption
- Reducing waste in water, food and transportation industries
- Using resources more efficiently (insulation etc.)
- **Low emission innovations** *(Electric vehicles, heat pumps, district heating and cooling, future cars give off less emissions)*
- Energy-saving behaviour (walking, cycling, mass transit, lower heating)
- Organisational change (replacing business travel by video calls)
- Flood protective behaviour Heat protective behaviour (green roofs)
- Efficient water use (rationing)

Pathway B increases energy demand by 39% by 2030

- Increased economic growth and globalisation
- Increased meat and dairy consumption
- Increased demand for fuel
- Increased worldwide shipping
- **Electrification** *(replacing technologies that use fossil fuels, e.g., coal, oil, and natural gas, with technologies that run on electricity)*
- Building desalination plants to convert seawater into freshwater



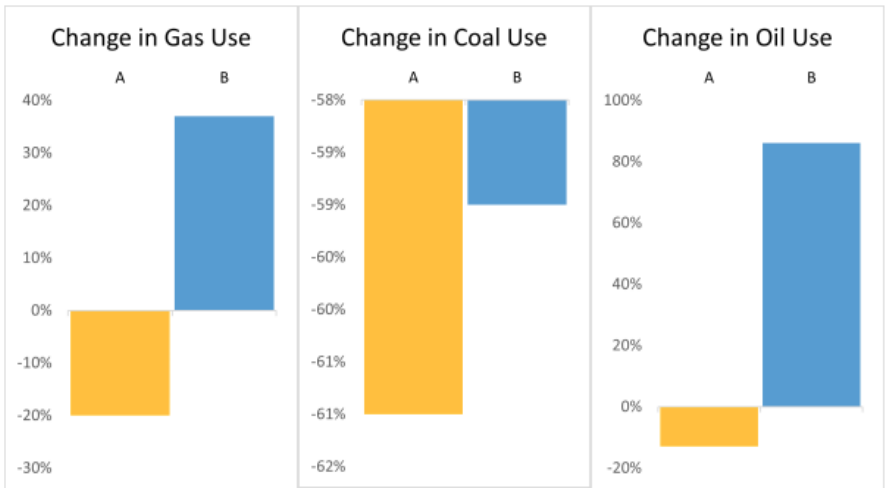


Figure A2

Biospheric, Egoistic, Altruistic Values Scale

Q14

Below you will find brief descriptions of values and their importance to you. Please read each description carefully and indicate how much the statement reflects your own beliefs. Please try to distinguish as much as possible in your answering by using different scores. The value that is most important to you should thus receive the highest score. The value that is least important, the lowest.

	totally not like me	somewhat not like me	slightly not like me	neutral	slightly like me	somewhat like me	totally like me
It is important to me to prevent environmental pollution.	○	○	○	○	○	○	○
It is important to me that every person has equal opportunities.	○	○	○	○	○	○	○

´

It is important to me to have control over others' actions.	○	○	○	○	○	○	○
It is important to me to protect the environment.	○	○	○	○	○	○	○
It is important to me to take care of those who are worse off.	○	○	○	○	○	○	○
It is important to me that every person is treated justly.	○	○	○	○	○	○	○
It is important to me to have authority over others.	○	○	○	○	○	○	○
It is important to me to respect nature.	○	○	○	○	○	○	○
It is important to me that there is no war or conflict.	○	○	○	○	○	○	○
It is important to me to be influential.	○	○	○	○	○	○	○

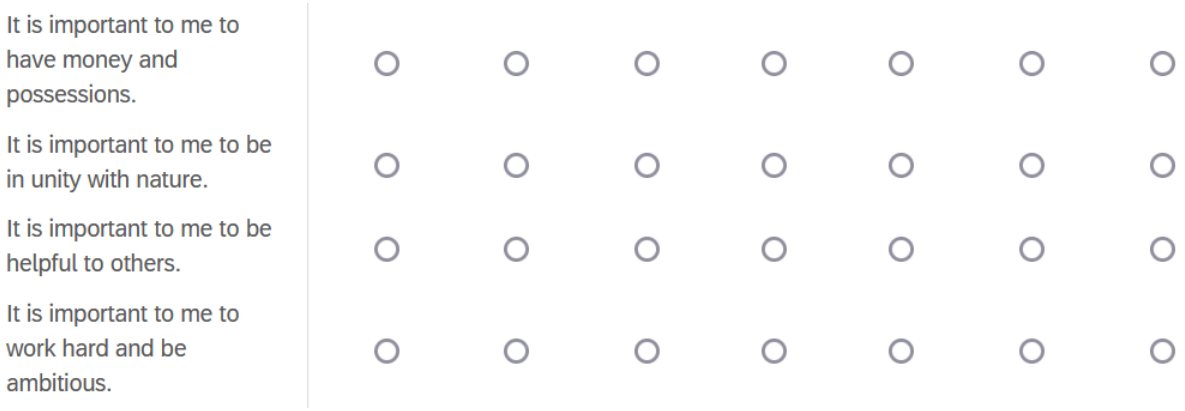
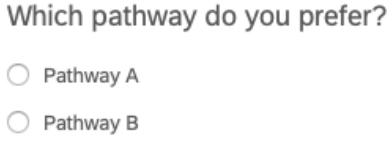


Figure A3

Acceptability Scale

Figure A4

Choice Item



Appendix B

Table B1

Means and Standard Deviations of Continuous Independent and Dependent Variables

Descriptives	Variables			
	Biospheric Values	Egoistic Values	Accepatbility Pathway A	Acceptability Pathway B
Mean	5.6726	3.9097	5.7684	3.2581
Standard Deviation	.96987	1.00417	1.10709	1.40712

Note. Responses for biospheric and egoistic values were recorded on a 7-point Likert scale ranging from 1=totally not like me to 7=totally like me. Responses for acceptability were recorded on a 7-point Likert scale with three items ranging from *not at all acceptable* (1) - *very acceptable* (7), *very bad* (1) – *very good* (7), *not at all necessary* (1) – *very necessary* (7).

Figure B1

Data Distribution of the Dependent Variables Acceptability of Pathway A (AA) and Acceptability of Pathway B (AB)

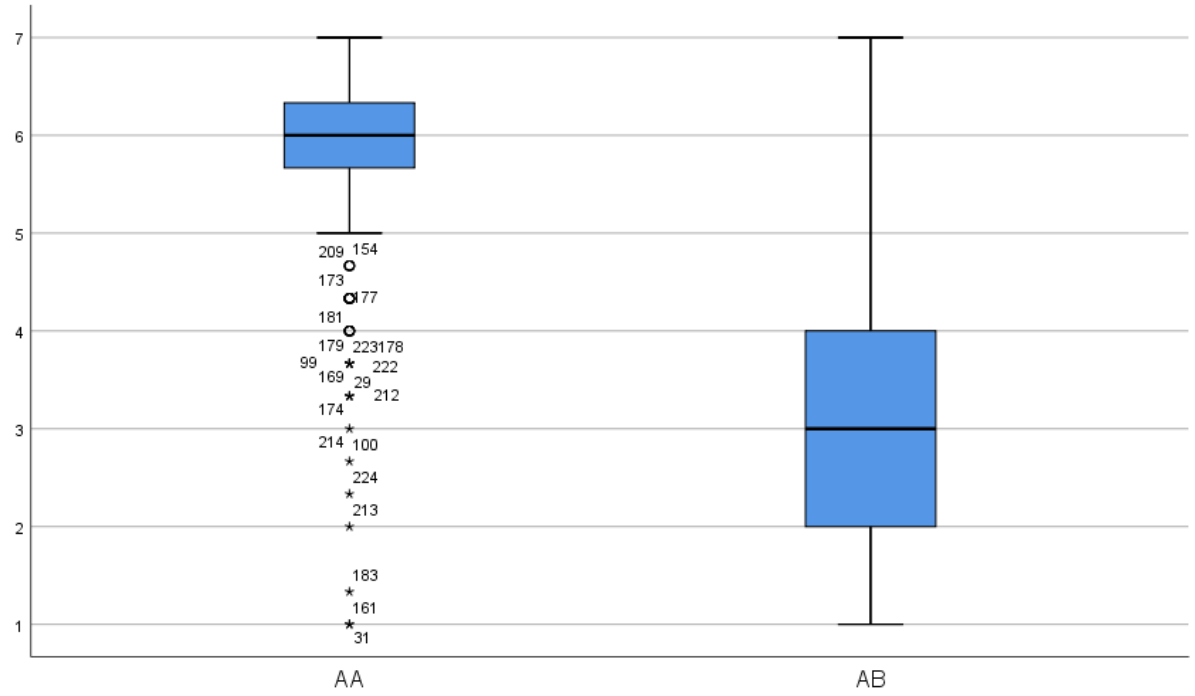
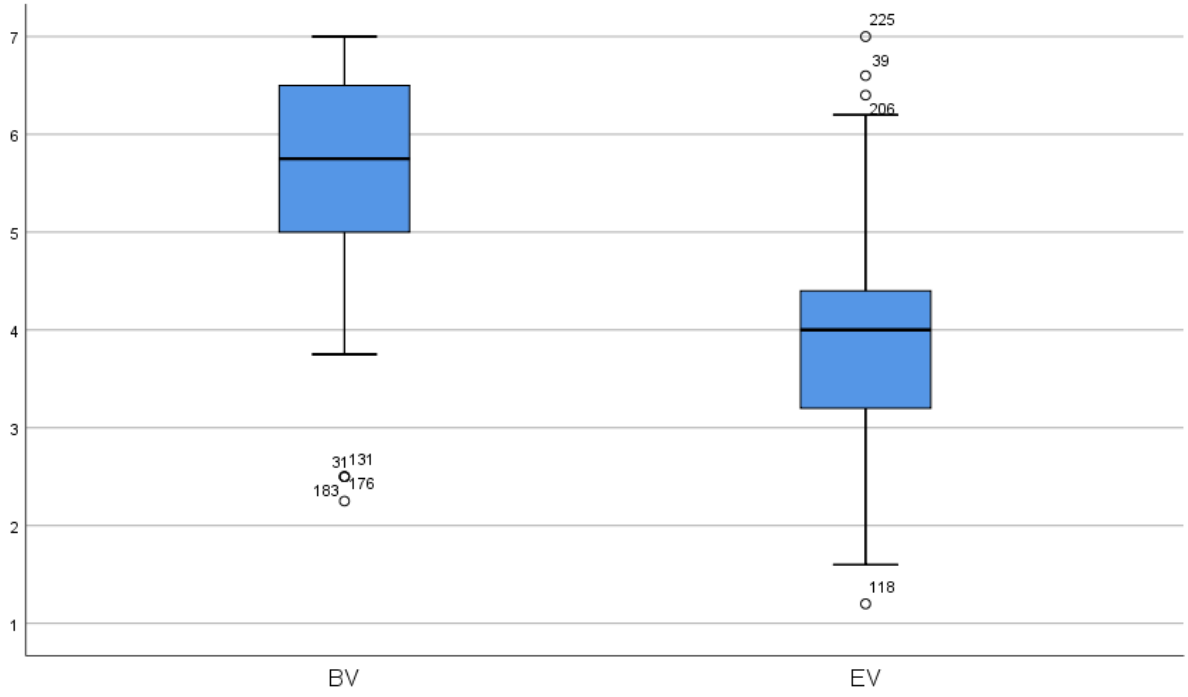


Figure B2

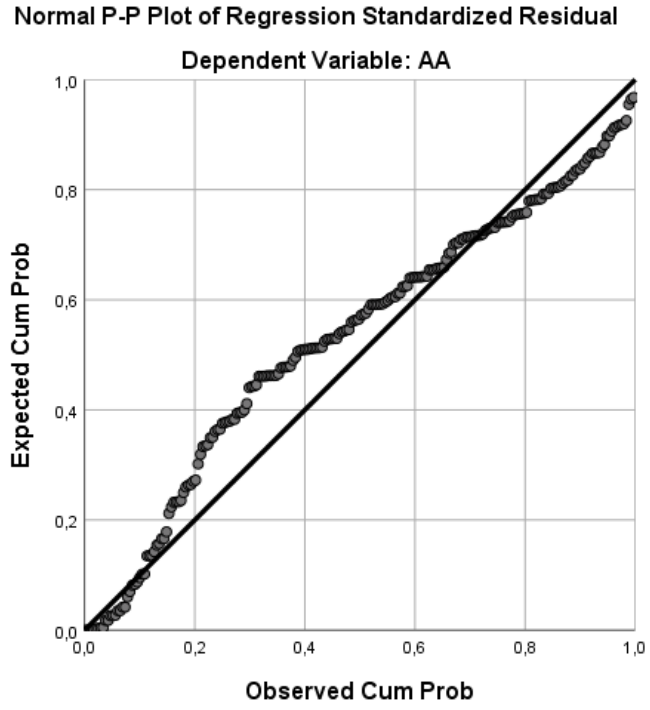
Data Distribution of the Independent Variables Biospheric Values (BV) and Egoistic Values (EV)



Appendix C

Figure C1

Normal P-P Plot of Regression Standardized Residuals for the Dependent Variable Acceptability of Pathway A (AA) and its Natural Logarithm (AAln)



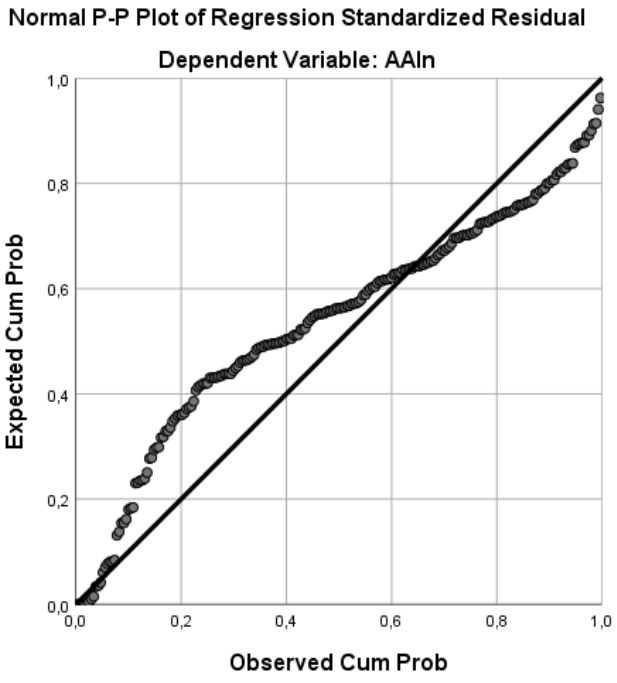


Figure C2

Partial Regression Plot for Biospheric Values (BV) and the Dependent Variables Acceptability of Pathway A (AA) and its Natural Logarithm (AAln)

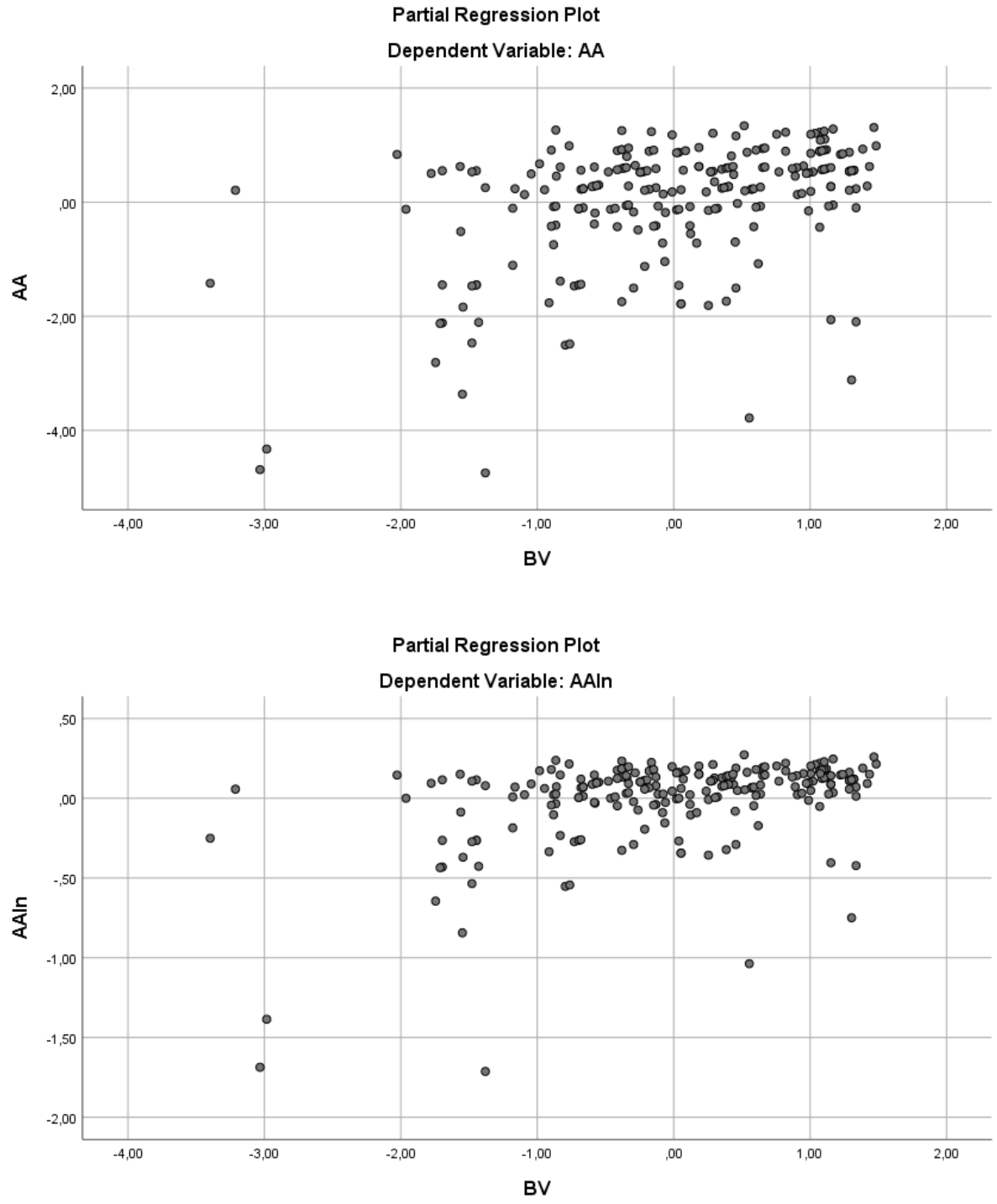
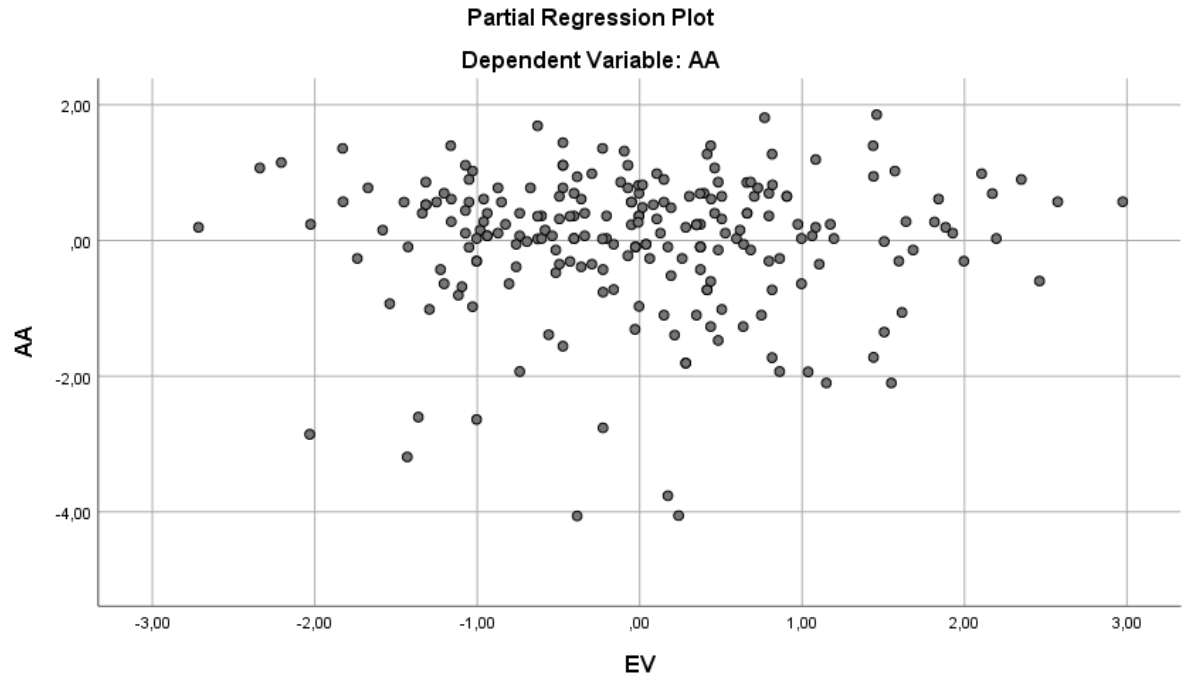


Figure C3

Partial Regression Plot for Egoistic Values (EV) and the Dependent Variables Acceptability of Pathway A (AA) and its Natural Logarithm (AAln)



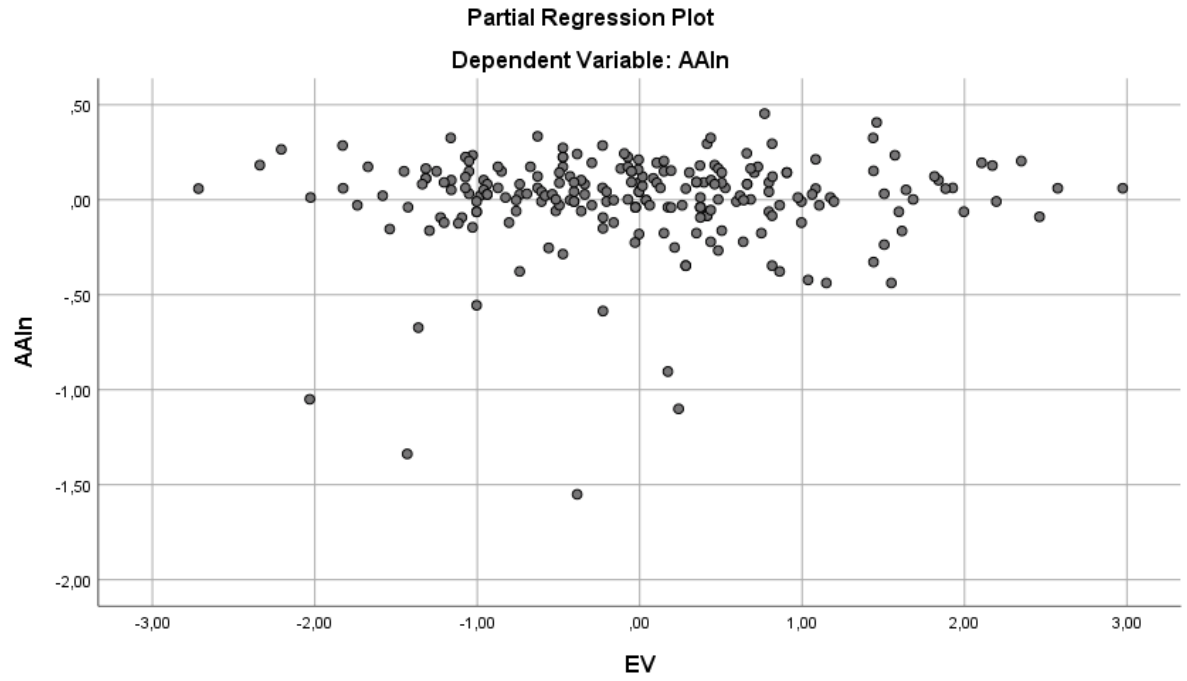
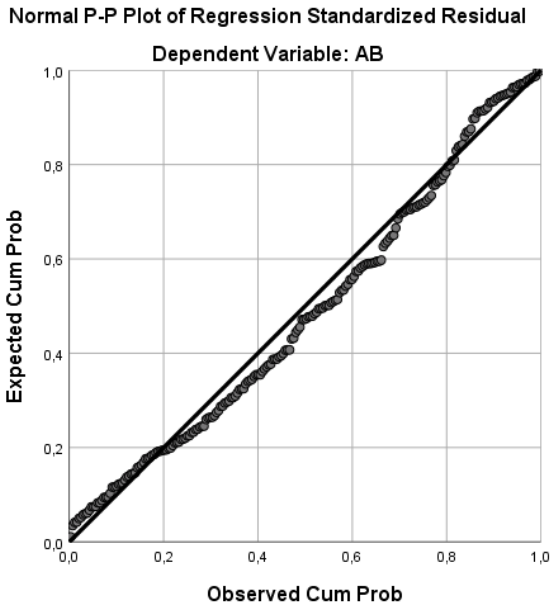


Figure C4

Normal P-P Plot of Regression Standardized Residuals for the Dependent Variable Acceptability of Pathway B (AB) and its Natural Logarithm (ABln)



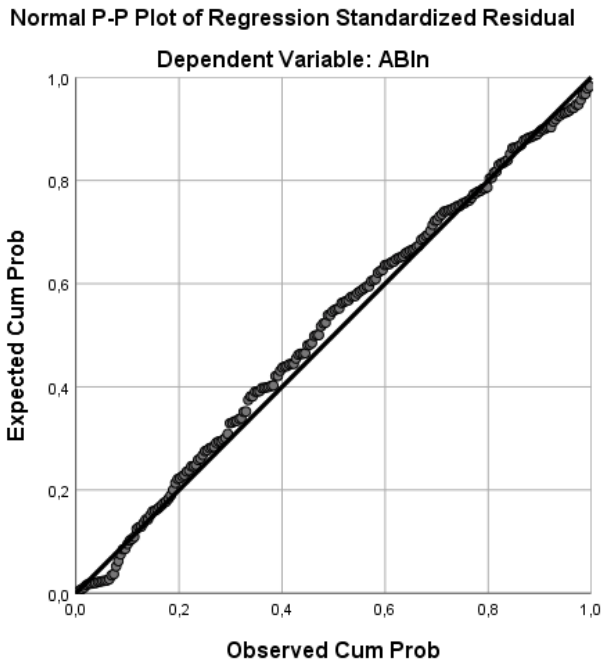
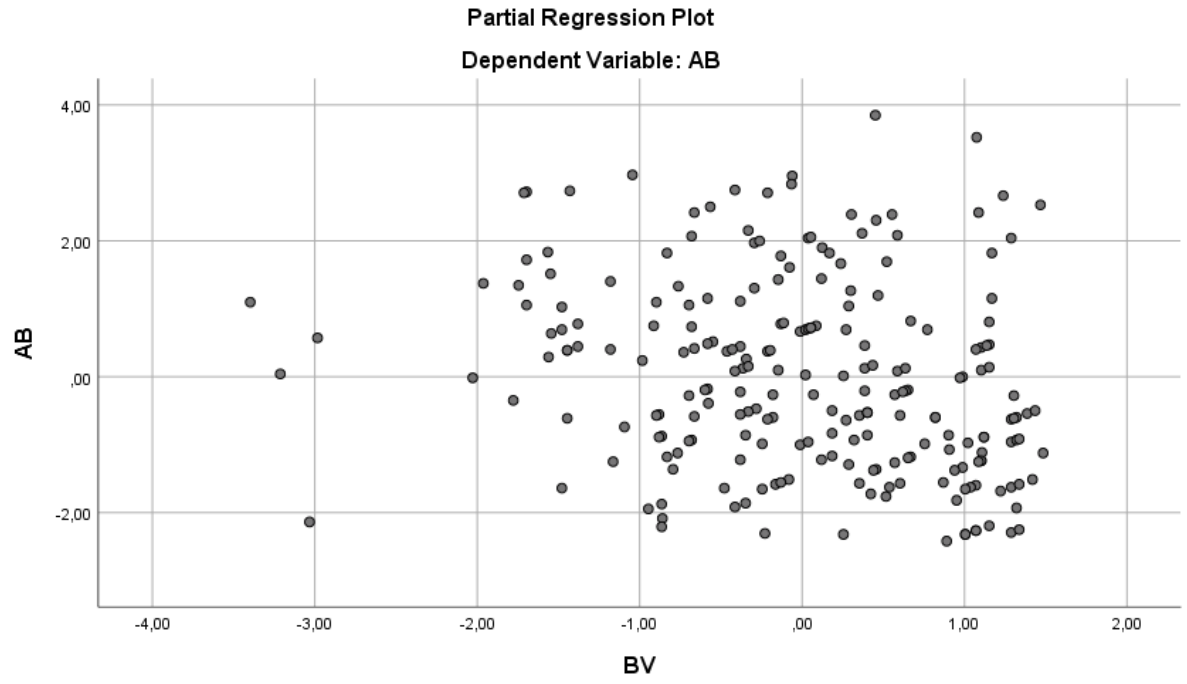


Figure C5

Partial Regression Plot for Biospheric Values (BV) and the Dependent Variables Acceptability of Pathway B (AB) and its Natural Logarithm (ABln)



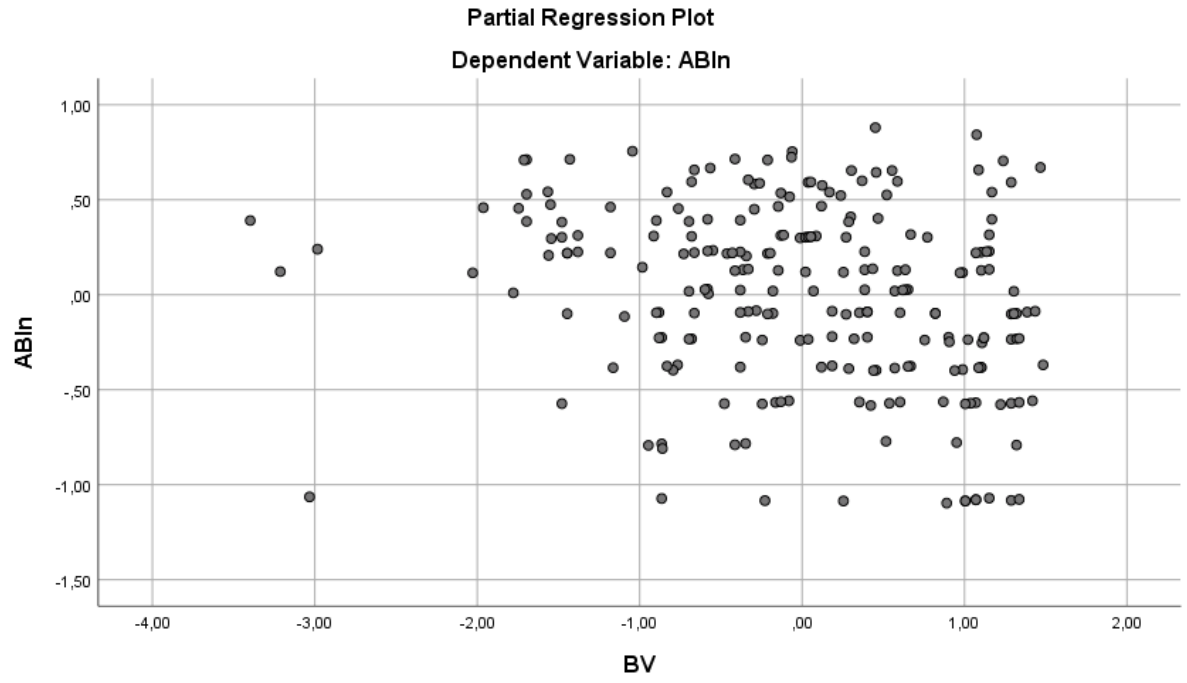


Figure C5

Partial Regression Plot for Egoistic Values (EV) and the Dependent Variables Acceptability of Pathway B (AB) and its Natural Logarithm (ABln)