How Personal Values Relate to the Acceptability of Climate Change Mitigation Pathways

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Abstract

Human induced climate change is a growing problem and its mitigation a collective duty. Hence, understanding the factors influencing the acceptability of different mitigation approaches is crucial. Based on the Value-Belief-Norm Theory and the 2018 IPCC report, the present work examines direct effects of egoistic and altruistic values on the acceptability of two mitigation pathways. Furthermore, it examines whether this relationship is mediated by perceived benefits. For that a cross-sectional design and a self-report survey were carried out. The findings suggest that people endorsing altruistic values preferred a low-overshoot pathway that employs renewable energy and demands behavior changes. This relationship was mediated by perceived benefits for others. Egoistic value endorsement was not significantly related to acceptability for one pathway when asked about preferences, but was related to a higher overshoot pathway, employing fossil fuels and no behavior changes, when asked to choose between both pathways. Implications of these findings are discussed.

Keywords: climate change, proenvironmental behavior, values, acceptability

How Personal Values Relate to the Acceptability of Climate Change Mitigation Pathways

The past decade went down in history as the warmest on the record (WMO, 2020). Approximately 1.08 °C of global warming above pre-industrial levels are estimated to result from human actions (IPCC, 2018). This temperature rise leads to adverse consequences and long-lasting damages for the environment as well as humankind which will continue to grow over time unless comprehensive policy and behavior changes are undertaken in a collective act (Hoesung & Birol, 2020). One of the main origins of greenhouse gas emissions, one crucial driver of global warming, is the use of energy (Hoesung & Birol, 2020). To prevent global warming of more than 1,5 degrees the energy sector needs to be radically transformed (IAEA, 2019). In his recent report the IPCC (2018) examined four different mitigation pathways for this transition. The pathways differ in their employed transition mechanisms, consequences for the environment and requirements for energy policies and personal behavior changes. Transitioning to a sustainable energy system via one of the pathways requires acceptability from the public as well as personal behavior changes. Strong negative attitudes towards transformative policies might lead to a refusal of compliance with the required changes (Bergstad, Schuitema &, 2019). Therefore, it is crucial to understand the factors that influence the degree of acceptability towards possible climate change mitigation pathways. The present work examines values as one factor possibly influencing the level of acceptability for two mitigation pathways.

Aim of this Study

Based on the VBN-Theory this study examines the relationship between personal values and acceptability of two IPCC mitigation pathways. In a first step, the direct effects of

specifically egoistic and altruistic values on the acceptability of the two mitigation pathways are explored.

According to De Groot and Steg (2008) people endorsing altruistic values are concerned about the consequences for others. Bouman and Steg (2018) stated that people endorsing egoistic values are concerned about consequences for the self. Therefore, in a second step, this paper examines whether the perceived benefits for others will explain part of the hypothesized relationship between altruistic values and the level of acceptability and whether perceived benefits for the self explain a part of the hypothesized relationship between egoistic values and acceptability.

Therefore, the question of interest in this paper is to what extent one's orientation towards altruistic and egoistic values shapes the preferences for specific mitigation pathways, as well as which role perceived benefits play in the formation of the level of acceptability. It starts with a review of relevant literature in environmental psychology.

Proenvironmental Behavior and Acceptability

Proenvironmental behavior means acting in ways that hurt the environment as little as possible or yields positive environmental outcomes (Steg & Vlek, 2009). Eriksson et al. (2006), argues that acceptability is an attitude towards proposed policies or behavior changes, meaning that the individual evaluates and thereby favors or disfavors the proposal (as cited in Schuitema & Bergstad, 2019).

How can acceptability be influenced in this context? One well-established concept, which is significantly related to the acceptability is the idea of personal values (Schultz & Zelenzy, 1998; Bidwell, 2013; Perlaviciute & Steg, 2015).

Values and the Environment

Personal values serve as general guiding principles in one's life, which pertain to preferred end-states and guide selection and evaluation of behavior and events across different situations (Schwartz & Bilsky, 1987). In the context environmental psychology four value types have been extensively examined. These can be distinguished into two categories, the self-transcendent and self-enhancement values. To the self-transcendent category belong altruistic (valuing the well-being of others) and biospheric (concern about the environmental integrity) values, whereas egoistic (concern about personal resources) and hedonic (concern about pleasurable experiences), are considered self-enhancement values (Schwartz, 1992). While the self-transcendence orientation has been found to positively predict proenvironmental behavior, the self-enhancement domain was found to be a negative predictor (Karp, 1996). Not examining the influence of values on the level of acceptability of possible mitigation pathways might overlook important ways to understand why people accept or reject certain mitigation options.

The Value Belief Norm Theory as a Theoretical Framework

Values directly and indirectly influence behavioral intentions and attitude formations (Stern & Dietz, 1994).

This is the basic assumption of the Value-Belief-Norm Theory (VBN-Theory), which compared to other prevalent theories, best explained the support for the environmental movement in a US study (Stern et al., 1999; Stern, 2000). The theory assumes that in particular egoistic, altruistic and biospheric values influence proenvironmental behavior. Today, researchers claim that the fourth value type, hedonic values, should not be disregarded when studying influences of proenvironmental behavior (Steg et al., 2014). However, the original VBN-Theory does not take them into account (Stern et al., 1993; Stern et al., 1999). The VBN-Theory suggests that values influence ecological worldviews, which are described

as an individual's general beliefs about the relationship between humans and the environment (Stern et al., 1999). According to the theory these worldviews regulate proenvironmental behavior through three processes. Firstly, by raising awareness for potential adverse consequences of one's behavior for the environment. Secondly, by shaping one's perceived ability to prevent these consequences. Thirdly, by activating personal norms, which make one feel morally obligated to behave environmentally friendly (Stern et al., 1999; Stern, 2000, Hiratsuka et al., 2018).

As this study examines the relationship between values and acceptability, the VBN theory, which clearly defines this relationship, is a qualified theoretical basis for it.

What are the Options for Climate Change Mitigation?

In its recent report the IPCC (2018) described four mitigation pathways to reach 1,5 degrees. They differ in three main aspects. The degree of change of energy usage hence one's lifestyle, the energy sources employed and the effectiveness of limiting the rise in global mean temperature (degrees of overshoot).

Pathway A aims at limiting global warming to 1.5°C with no or limited overshoot by employing low-carbon technology and has a distinct focus on sustainable consumption patterns (IPCC, 2018). Energy demand is reduced by 5%. Usage of gas and coal is reduced by 20% and 61% compared to 2010 (IPCC, 2018). So, the implementation of pathway A would call for rapid comprehensive changes in a number of sectors like the energy sector and in people's lifestyle.

Pathway B, is classified as a higher overshoot pathway. It suggests reducing greenhouse gas emissions by using technologies such as Bioenergy with Carbon Capture and Storage (BECCS). This implies less need for individual behavior changes. Pathway B would

increase the global energy demand by 39% compared to 2010 and increase the gas usage by 37% and oil by 86% and nuclear by 106%. Additionally, this pathway allows for greenhouse-gas-intensive lifestyles as a product of economic growth (IPPC, 2018). Concerning the energy sources involved, Pathway B proposes an increase in gas by 37%, in oil by 86% and in nuclear by 106%. Coal usage would be reduced by 59%. Renewable share in electricity would increase by 25% in relation to usage proportions in 2010.

The two pathways have implications for both individual behavior choices and the preferred types of energy sources. Before hypothesizing about specific effects of altruistic and egoistic values on the acceptability of pathway A and pathway B, the literature on values and the relationship to both components is consulted.

Altruistic Values and Proenvironmental Behavior

The relationship between altruistic values and proenvironmental behavior has been examined in numerous studies (Steg et al., 2014; Stern & Dietz, 1994; Stern et al., 1995). When making choices, people pursuing altruistic values are proposed to weigh costs and benefits of their different options to the welfare of other individuals (Bouman & Steg, 2018; de Groot & Steg, 2008) Therefore, those scoring high on altruistic values are likely to act proenvironmentally, even if that would be personally costly (Steg, 2016).

Altruistic values are positively related to environmental concern, which results in a stronger activation of personal norms and is in turn positively related to proenvironmental behavior (Van der Werff and Steg, 2016). A US study found that those endorsing altruistic values were more likely to choose a transportation kind that has a lower carbon footprint when possible (Whitley, 2018). In line with this, a study by Milfont & Gouveia (2006) found a positive relationship between altruistic value endorsement and environmental preservation. The positive connection between altruistic value endorsement and proenvironmental behavior

might be explained by the positive impact these actions have for society and the well being of others, including future generations (Perlaviciute, 2021).

Altruistic Values and Preferences for Energy Sources

Research showed that altruistic values were positively related to the acceptability of wind-energy (Bidwell, 2013), which might be explained by the corresponding positive societal effects such as communal economic benefits and a reduction of green house gas emissions (Perlaviciute et al., 2021).-As the burning of fossil fuels is recognized as a main source of climate change, I assume that endorsing altruistic values is negatively associated with the acceptability of fossil fuels.

Since pathway A relies on renewable energy and personal behavior changes it is hypothesized that the higher the endorsement of altruistic values, the higher the acceptability of pathway A (H1a). As pathway B proposes carbon-dioxide intensive lifestyles and a reliance on fossil fuels and higher overshoot, it is hypothesized that the higher endorsement of altruistic values, the lower the acceptability of pathway B (H1b). Additionally, these preferences should show when making a choice between the two pathways, so that the higher endorsement of altruistic values is associated with higher chance to indicate a preference for pathway A when choosing between both pathways (H3a).

Egoistic values and proenvironmental behavior

People pursuing egoistic values have been shown to be mainly concerned about their personal costs and benefits in terms of status, power, and resources (Bouman et al., 2018). Hence, they are mostly eager to support the protection of the environment if they gain something personally and otherwise reject protective measures if they perceive their personal costs higher than the benefits (Stern and Dietz 1994). Egoistic values are negatively related to

environmental concern (Van Der Werff & Steg, 2016). People strongly endorsing egoistic values are less likely to recycle when compared to people endorsing altruistic or biospheric values (Whitley, 2018). A study on value orientations and behavioral intentions found that people strongly endorsing egoistic values were less likely to prefer a car performing high on environmental standards (de Groot, 2010).

Egoistic Values and Preferences for Energy Sources

Recent research found that people pursuing stronger egoistic values, evaluated gas extractions and their consequential earthquakes as less negatively (Perlaviciute et al., 2021). Another study showed that the level of egoistic value endorsement was positively related to the acceptability of nuclear energy and less in favor of renewable energy. (de Groot et al., 2013; Perlaviciute & Steg, 2015). These findings might be explained by the economic benefits and the lack of required personal behavior changes which gas and nuclear energy sources offer, whereas the consequences such as changes in landscape related to wind-turbines might depict too high personal costs (Perlaviciute et al., 2021; Rand & Hoen, 2017; Eiser & Pilgt, 1979).

As pathway A requires individuals to act proenvironmentally and makes use of renewable energy, it is hypothesized that the higher endorsement of egoistic values, the lower the acceptability of pathway A (H2b). Since pathway B relies on fossil fuels and does not require behavioral changes by the individual, it is hypothesized that the higher endorsement of egoistic values, the higher the acceptability of pathway B (H2a). Again, this effect should also translate into making a choice between the two pathways, so that higher endorsement of egoistic values is associated with higher chance to indicate a preference for pathway B, when choosing between both pathways (H3b).

The Role of Perceived Benefits

As values are assumed to influence behaviors mostly indirectly through beliefs and norms (Stern & Dietz, 1994; Stern, 1995), research has not only examined the direct relationships between values and the acceptability of energy sources but also potential third variables, possibly mediating these relationships have been examined. De Groot et al. (2013) proposes that, as values are general in nature, they influence behavior specific beliefs, for example about associated risks and benefits. Furthermore, Stern and Dietz (1994) suggested that people specifically adhere to the consequences that are important to them, based on their values. This has been tested in a recent study which focused on egoistic and biospheric values and found that value orientation influenced the focus of perceived consequences of different energy alternatives. The stronger people pursued egoistic values, the more important they found individual consequences, whereas the stronger they pursued biospheric values the more importance they attributed to environmental consequences (Perlaviciute & Steg, 2015). Similarly, a Danish study found that people endorsing altruistic values perceived recycling as less costly (Thoegerson & Grunert-Beckmann, 1997). Furthermore, de Groot et al. (2013) found that altruistic value endorsement was associated with the perception of more risks, while egoistic value endorsement was associated with the perception of more benefits as well as that these beliefs partly mediated the relationship between values and the acceptability of nuclear energy.

In accordance with Perlaviciute and Steg (2015) this paper reasons that people base their attitude of mitigation pathways on personal values and that these might be in part influenced by the perceived consequences and benefits for them or others. As people endorsing altruistic values are concerned about the consequences for others (de Groot & Steg, 2008; Bouman et al., 2018), this paper assumes that the perceived benefits for others will

explain part of the hypothesized relationship between altruistic values and the level of acceptability. Pathway A limits global warming more efficiently, makes use of renewable energy and therefore would have positive impacts for future generations and thereby consequences which are important to altruistic people. Hence, it is hypothesized that higher altruistic values lead to higher perceived benefits for others of pathway A, which in turn leads to higher acceptability for pathway A (Hypothesis 4a).

Since egoistic people prioritize consequences for themselves (Bouman et al., 2018), perceived personal benefits are assumed to influence the relationship from egoistic values to the degree of acceptability. As pathway A cuts out fossil fuels, which might result in higher energy costs and as it requires the need for personal behavior change, it is hypothesized that higher egoistic values lead to less perceived benefits for the self of pathway A, which in turn leads to less acceptability for pathway A (Hypothesis 4b).

Method

Participants

Data was collected from a convenience sample with 312 participants of which 89 were excluded because of incomplete data provision. The remaining sample consisted of 223 participants, of which 113 were sampled via a first-year Psychology programme at the University of Groningen. 110 subjects were sampled via snowballing. After consultation of Box-plots, Cook's Distance and Mahalanobis Distance, five additional participants, which were considered as outliers according to all three methods, were removed. For clarity, the results section reports the results for the modified data set (N=218).[1] 135 (61.9%) of

[1] For the results of the data set including outliers (N=223) see Appendix A. For parsimony, the demographics will only be reported for the modified sample.

respondents indicated to be female, 78 participants (35.8 %) indicated to be male, four participants (1.8%) identified as "other" and one participant (0.5%) preferred not to answer that question. The age of the participants ranged from 18 years to 68 years (*M* = 24.1 *SD* = 9.4). Participants sampled through the first-year psychology programme at the University of Groningen received one SONA credit as compensation. Other than that, no compensation was provided. Participants were recruited via several student social media groups of the University of Groningen, buildings of the University of Groningen as well as public places in the city of Groningen.

Design

The study, conducted as a cross sectional design used a self-report online survey, conducted in English. The constructs assessed in the survey were knowledge on climate change, risk perception, perceived fairness, perceived effectiveness, personal values, perceived benefits for others, perceived benefits for the self, acceptability of the two mitigation pathways and choice between pathway A and pathway B. The independent variables of interest for the above-mentioned hypotheses are altruistic and egoistic values, perceived benefits, and dependent variables are acceptability for the two pathways and choice between the two. To avoid order effects, all items of the independent variables were randomized.

Materials

The survey used for this study was carried out using Qualtrics (Qualtrics, Provo, UT). The current study was preregistered with the Open Science Framework (OSF). The preregistration as well as the complete survey can be accessed via the following link: https://osf.io/r3km5/?view_only=c77cf7b0351548a0b9ea70b09e72c867. The statistical

software IBM SPSS Statistics (Version 28.0.1.0) was used for all statistical analyses, including a PROCESS (Version 4.1) addition.

Egoistic and Altruistic Values

Altruistic and egoistic values were assessed using the Environmental Portrait Value questionnaire (Bouman et al. 2018) which consists of seventeen items measuring the degree of identification with value related statements. The three items assessing hedonic values were removed. Respondents were asked to distinguish as much as possible between their rankings. The items measuring endorsement of altruistic values contained declarations like "It is important to me that everyone has equal opportunities". Endorsement of egoistic values was measured using items such as "It is important to me to have control over other's actions". Agreement was measured on a Likert scale ranging from 1 (*totally not like me*) to 7 (*totally like me*). The different items assessing value endorsement were averaged into an altruistic value scale (Cronbach's $\alpha = 0.72$, $M = 6.1$, $SD = 0.7$) and an Egoistic Value scale (Cronbach's $\alpha = 0.62$, $M = 3.9$, $SD = 1.0$).

Perceived Benefits of Pathway A

Two types of perceived benefits of pathway A were assessed with items conceptualized by the author. Three items measured the perceived benefits for the self. These included statements such as "The implementation of pathway A would positively affect my personal life". Perceived benefits for others were assessed by three items such as "The implementation of pathway A would positively affect the lives of others". Agreement was measured on a five-point Likert Scale of Agreement, ranging from 1) *strongly disagree* to 5) *strongly agree*. The items for the two value types were averaged into one for perceived benefits for others (Cronbach's $\alpha = 0.81$, $M = 3.7$, $SD = 0.8$) and one for perceived benefits for the self (Cronbach's $\alpha = 0.80$, $M = 3.5$, $SD = 0.8$).

Acceptability of the Pathways

Acceptability for pathway A and B was assessed using a seven-point Likert scale ranging from 1 to 7, asking to what extent one perceives the pathways as *not at all acceptable* (1) - *very acceptable* (7), *very bad* (1) – *very good* (7), *not at all necessary* (1) – *very necessary*. These items were adapted from Perlaviciute et. al (2021). The items for both acceptability measures were averaged into one scale for acceptability for pathway A (Cronbach's $\alpha = 0.83$ $M = 5.8$, $SD = 0.9$) and one scale for acceptability for pathway B (Cronbach's $\alpha = 0.85$, $M = 3.2$, $SD = 1.4$).

Choice of Pathway

Participants were asked to indicate the choice of either pathway A or pathway B with the single item "Which pathway do you prefer?" (Pathway A = 85.5%; Pathway B = 14.2%).

Procedure

The present study was approved by the Ethics Committee of Psychology of the University of Groningen prior to the start of data collection. Data was collected from April 26th to May 20th 2022.Participants had access to the survey via a link that was either sent to them or which they could open through a QR-code if they were recruited in a public building. The link led to the survey and completing it took approximately 15 minutes ($Mdn._{\text{Duration}} = 15.6$.)

Opening the link, participants received information about the study's purpose, voluntary participation and confidentiality of results. Next, they were informed that ending or leaving the study would not have any consequences. Before starting, participants could give their informed consent. The first questions involved demographics, risk perception of climate change, objective knowledge and personal values. Next, the two proposed energy pathways

were introduced. A description of both pathways can be found in the appendix (see Figure A1).

Afterwards, participants answered questions on the content of the two Pathways, to ensure that they understood them correctly. Only if answered correctly, participants could proceed. Eventually, participants filled in the questions on perceived benefits, perceived distributional fairness and acceptability. They then had to choose between the pathways and indicate how feasible they think an implementation of these pathways would be. Additionally, in a free response question, they were asked to choose one of the pathways from the perspective of a policy maker and indicate why. The second free response question asked what the participants would change about the pathways. Lastly, participants were invited to comment on the survey.

Analysis Plan

The study used two multiple linear regressions to test hypotheses 1 and 2. The independent variables where altruistic and egoistic values, regressed on the dependent variables acceptability of pathway A (H1) and acceptability of pathway B (H2). To test hypotheses 3a and 3b, a multiple logistic regression was used with the independent variables being altruistic and egoistic values, predicting the dependent variable choice between pathway A and B. Hypotheses 4a and 4b were assessed by mediation analyses, using the simple mediation model proposed by Hayes (2022). The independent variable in H4a was altruistic values, the mediator perceived benefits for others of pathway A and the dependent variable was acceptability for pathway A. In hypothesis 4b, the independent variable used was egoistic values, the mediator was perceived personal benefits of pathway A, and the dependent variable was acceptability of pathway A.

Results

Table 1

Descriptive Statistics of the Scales Measuring Altruistic Values, Egoistic Values, Perceived Benefits for Others, Acceptability for Pathway A and Acceptability for Pathway B

	Altruistic Values	Egoistic Values	Other's benefits	Self-benefits	Acceptability A	Acceptability B
M	6.1	3.9	3.7	3.5	5.8	3.2
SD	0.7	1.0	0.8	0.8	0.9	1.4
Minimum	3.8	1.2	1.0	1.0	2.0	1.0
Maximum	7.0	6.6	5.0	5.0	7.0	7.0

Table 2

Pearson's Correlations for Altruistic Values, Egoistic Values, Perceived Benefits for Others, Acceptability for Pathway A and Acceptability for Pathway B.

	1	2	3	4	5	6
1. Altruistic Values	-	.03	.18**	.24**	.23**	-.29**
2. Egoistic Values	.03	-	.05	.05	-.10	.03
3. Other's benefits	.18**	.05	-	.58**	.49**	-.26**
4. Self-benefits	.24**	.05	.58**	-	.48**	-.29**
5. Acceptability A	.23**	-.10	.49**	.48**	-	-.36**
6. Acceptability B	-.29**	.03	-.26**	-.29**	-.36**	-

Note. ** Correlation is significant at the 0.01 level (2-tailed).

Altruistic Values

Altruistic values were positively correlated with perceived benefits for others under the implementation of pathway A. As expected, altruistic values were positively related to the acceptability of pathway A and negatively related to the acceptability of pathway B.

Egoistic Values

Egoistic value endorsement however, showed no significant correlations to the acceptability measures. While the non significant relationship between egoistic values and perceived benefits for others under the implementation of pathway A was to be expected, the non significant relationship between egoistic values and perceived benefits for the self under the implementation of pathway A was not expected.

Assumptions

The assumption of independent observations is a requirement of all the following analyses and was fulfilled by the study design, as every participant filled out the survey only once. To test hypotheses 1a-2b two multiple linear regression analyses were conducted. As these analyses assume linearity, homoscedasticity and normality, residual plots as well as QQ-plots (see Figures B1 & B2) were consulted, which revealed that while the linearity requirements were fulfilled, the homoscedasticity assumptions were violated. The assumption of normality was violated as well, but the data was still judged as useful, as the sample size (N=218) was considered as sufficiently large.

Hypotheses 3a and 3b were tested with a multiple logistic regression analysis which required that the dependent variable (Choice between pathway A and B) was binary, which was given. No multicollinearity between the independent variables (egoistic and altruistic values) was found (*VIF*=1.00, Collinearity tolerance = 1,00). The assumption of linearity

between the independent variables and their logits was tested by using the Box-Tidwell Test, which suggested that the linearity assumption held (see Table B1). As mentioned above, to fulfill the assumption of absence of outliers, data from participants who were according to Box-plots, Cook's Distance and Mahalanobis Distance considered outliers, were removed.

To run the mediation analyses for hypotheses 4a and 4b, Model four within Process Macro by Hayes was employed. To test for linearity, homoscedasticity and normality, residual plots and QQ-plots were consulted. These showed that the linearity assumption was met and that the homoscedasticity and normality were violated (see Figure B3 & B4). In order to get valuable results despite these violations, a heteroscedasticity consistent inference (HC4) and Bootstrapping with 5000 samples was used.[2]

Relevant Results for Hypotheses 1 & 2

For pathway A, the model was significant, F(2, 215) = 7.55, p= 0.001) and explained 6.6% ($R^2 = 0.07$) of the variance in the dependent variable. While altruistic values showed a positive relation to the acceptability of pathway A, (B = 0.33, t = 3.58 p = <0.001) egoistic values showed a negative but non significant relation (B = -0.10, t = -1,61, p = 0.109).

The model to test whether acceptability of pathway B was predictable by the level of endorsement of altruistic and egoistic values was significant $F(2, 215) = 10.25$, $p = < 0.001$, explaining 8.7% ($R^2 = 0.09$) of the variance in the outcome variable. Only altruistic values (B= -0.61 t = -4.51, $p < 0.001$) but not egoistic values (B = 0.05, t = 0.55, p= 0.582) significantly contributed to the model.

[2] It should be noted that the conducted methods to check the required assumptions partly differ from the ones that were preregistered.

To test the robustness of the analysis in light of the moderate violations of homoscedasticity, I reran the analysis using a weighted multiple linear regression[3], for which homoscedasticity is not required.

Hypotheses 3a and 3b

A binary logistic regression was employed to examine whether altruistic and egoistic values were associated with the likelihood of choosing pathway A or pathway B. The model was statistically significant, χ^2 (2, N = 218) = 17.32, $p < 0.001$, proposing that it could differentiate between those choosing Pathway A and those choosing Pathway B. The model explained between 7.6% (Cox & Snell R^2) and 13.7% (Nagelkerke R^2) of variance in the outcome variable. As portrayed in Table 1, both altruistic values and egoistic values significantly contributed to the model. The odds ratio of 0.39 for altruistic values suggests that for every one unit increase in altruistic value endorsement, subjects were 0.39 times more likely to choose pathway B. The egoistic value odds ratio of 1.67 proposes that for every one unit increase in egoistic value endorsement, participants were 1.67 times more likely to choose pathway B. This result differs to the one found when running the logistic regression with the full data set, in which egoistic values did not significantly contribute to the model (see Table D5).

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[3] The results are in line with the effects found in the linear regression, suggesting that the results of the linear regression can be interpreted despite not fulfilling the homoscedasticity assumption. For acceptability of pathway A: B_{AV} = 0.34, p = <.001; B_{EGO} = -0.10, p = 0.138

For acceptability of pathway B B_{AV}= -0. 64, p= <.001 ; B_{EGO}= 0.04, p= 0.660

Table 3

Results of the Logistic Regression

Predictor	*b*	*SE*	df	*p*	*Exp(B)*	*Exp(b)95% CI.for*	
						Lower	Upper
Altruistic values	-1.00	0.28	1	<,001	.39	0.22	0.66
Egoistic values	0.52	0.22	1	.018	1.67	1.09	2.56
Intercept	1.81	1.78	1	.309	6.09		

Hypothesis 4a

To investigate Hypothesis 4a, a simple mediation model (Model four) was performed, using PROCESS (Version 4.1). The dependent variable was acceptability of pathway A. The independent variable was altruistic values. The mediator variable was perceived benefits for others under the implementation of pathway A. The indirect effect of altruistic values on the acceptability of pathway A via perceived benefits for others was significant (*E* = 0.12, *95% Bootstrap CI* (0.03; 0.21). Altruistic values positively affected perceived benefits for others (see Figure C1, Path A), (*B* = 0.21, *t* = 2.74*, p* =.0066, 95% *CI* (0.06; 0.36). Perceived benefits for others in turn, positively affected acceptability for pathway A (see Figure C1, Path B) (*B* = 0.56, *t* = 5.34, *p* =.0000, 95% *CI* (0.36; 0.77) The total effect of altruistic values on acceptability of pathway A has shown to be significant (see Figure C1, Path C, *(B* = 0.33, *t* = 2.89, *p* =.004, 95% *CI* (0.10; 0.55). After controlling for the mediating variable perceived benefits for others, the effect of altruistic values on acceptability for pathway A is still positive (see Figure C1, Path C'), (*B* = 0.21, t = 2.02, *p* = .044, 95% *CI* (0.01; 0.42) but reduced. This suggests a partial mediation of the relationship between altruistic values and the acceptability of pathway A by perceived benefits for others under the implementation of pathway A. This result differs to the one for the data set including outliers (Table D7 & Table D8), where a full mediation was found, as the relationship between altruistic values and acceptability for pathway A turned non significant when including perceived benefits for others under the implementation of pathway A in the model.

Hypothesis 4b

Egoistic values were not significantly related to perceived benefits for the self (see Figure C2, Path A) (*B* = 0.0406, *t* = 0.6743, *p* = .5009, 95% *CI* (-0780; 0.1592).

Perceived benefits for the self were positively related to acceptability for pathway A (see Figure C2, Path B), (*B* = 0.54, *t* = 6.45, *p* = .000, , 95% *CI* (0.37; 0.70). The total effect of egoistic values on acceptability of pathway A showed to be non significant (see Figure C2, Path C), *(B* = -0.96, *t* = -1.6200, *p* = .107, 95% *CI* (-0.22; 0.02). After controlling for the mediating variable perceived benefits for the self the effect of egoistic values on acceptability for pathway A was significantly negative (see Figure C2, Pathway C'), (*B* = -0.12, t = -2.14, *p* = .033, 95% *CI* (-0.23; -0.01). However, the indirect effect of egoistic values on acceptability for pathway A, was non significant (*E*= 0.02 Bootstrap *CI* (-0.04; 0.09). This is in line with the results for the data set including outliers (see Table D4).

Discussion

The present study aimed at understanding how egoistic and altruistic values and perceived benefits relate to preferences for climate change mitigation pathways. Based on the VBN-Theory these relations were hypothesized and examined using data from a self-report survey. When asking for the level of acceptability the results suggest that people strongly endorsing altruistic values show more acceptability of pathway A, with more sustainable energy use and higher demand for personal behavior changes. Additionally, altruistic people were found to oppose mitigation pathway B, proposing increase the energy demand and continuing fossil fuel use. These findings are in line with hypotheses 1a, 1b and 3a. Furthermore, these results are consistent with the findings that altruistic people are supportive of renewable energy sources (Bidwell, 2013), are ready to act in proenvironmental ways (Whitley, 2018) and show concern about environmental preservation (Milfont & Gouveia,

2006). The effect of egoistic values on acceptability was negative but not significant. So, one can not conclude that people strongly endorsing egoistic values reject pathway A, or support pathway B. Therefore, hypotheses 2a and 2b were not confirmed. These findings imply that egoistic value endorsement is not a relevant predictor for the acceptability of mitigation pathways.

When asking participants to choose between both pathways the results were clearer. People chose pathways as predicted in hypotheses 3a and 3b. This might imply that when just rating the acceptability for the two pathways, egoistic and altruistic values did not guide the decision as clearly as it was when making an exclusive choice. However, the choice evaluation including outliers only showed significant results for altruistic values. Because of these conflicting results further research is needed.

Supporting hypothesis 4a, it was found that the relationship between altruistic values and the acceptability for pathway A might be partially explained by perceived benefits for others. The results for the full data set even suggest a full mediation. These results show support for the idea that values influence attitudes often indirectly through specific beliefs (for example about consequences) (Stern & Dietz, 1994; Stern et al., 1995; de Groot et al., 2013).

The positive relationship between altruistic value endorsement and perceived benefits for others supports the idea that when making choices, people pursuing altruistic values are proposed to weigh out costs and benefits to the wellbeing of other individuals (Bouman et al., 2018; de Groot & Steg, 2008). Additionally, the positive relation between perceived benefits for others and the acceptability for pathway A suggests that the characteristics of this pathway (focus on renewable energy and proenvironmental behavioral changes) are perceived as benefitting others. However, perceived benefits for others might not be the only

mediator in this relationship. Another possible influence for this relationship could be the perception of benefits for the self, as these showed an even stronger positive relationship to altruistic values, suggesting that altruistic people also perceived the consequences of pathway A as benefitting the individual.

The role of perceived benefits for the self in the relationship between egoistic values and the acceptability of pathway A, is less clear. The study did not find evidence for the relationship between egoistic values and the acceptability of pathway B through perceived benefits for the self. One reason for this could be that the specific consequences, relevant for people endorsing egoistic values, were not clear from the pathway descriptions or not adequately captured with the items measuring perceived benefits for the self.

Limitations

The survey used for this study was conducted in English. Since snowballing was the sampling method and the research team mostly consisted of non-native speakers, participants might have had difficulties understanding what was asked. In further studies, one of the researchers should be present either in person or online to answer potential questions. The fact that no true random sampling was employed also constitutes a limit to the external validity of our findings. Furthermore, the results of hypotheses 1a-2b should be considered in the light of several assumption violations, namely of normality and heteroscedasticity, which might have distorted the results. Next to this, it is important to note that a mediation model ultimately assumes causal relationships (Hayes, 2022, p.83), but as the current study was purely based on correlational data no claims of causality can be made.

The fact that most of the hypothesized relations that included the egoistic value variables showed nonsignificant results might be explained by the operationalization of these. The internal consistency measure of the egoistic value scale ($\alpha = 0.64$) was considered

sufficient, but it was not as high as for the other scales included in the study. This could distort the results as the degree of egoistic value endorsement was not sufficiently measured.

Implications

Since results for egoistic values are not significant across multiple analyses this section focuses on implications relating to altruistic values. Our results imply two key findings. People endorsing altruistic values preferred and chose the more sustainable pathway. Preferences and choices of people endorsing altruistic values could in part be explained by perceived benefits for others. These findings can potentially be useful to foster acceptability for climate change policies and to potentially prompt actions based on these values.

Firstly, like all policies, climate related policies require sufficient acceptance and support from citizens and politicians to be implemented. Altruistic people could constitute an important group of citizens who accept new climate mitigation policies and abstain from protests and thereby alleviate the implementation of climate related policies. Secondly, the findings suggest that people endorsing altruistic values could constitute an important citizen group which shows acceptability for behavioral changes. To make use of this, one needs to ensure that people act based on their values. Verplanken and Holland (2002) have identified two crucial conditions for values to influence choices and behavior; cognitive activation and enhancement of self-focus. They showed that people who engaged with environmental words were later more likely to choose a sustainable TV set and that the engagement with self-related words led to more actions in line with the people's beliefs. However, it is important to note that these effects only held when the participants strongly endorsed the target values. Still, these findings could be used by political and activist actors when designing communication strategies, by relating them to environmental issues or the persons self-

relation. Moreover, it has been shown that for people who strongly endorse altruistic values, the potential benefits for others play a significant role in their preferences for mitigation pathways. Therefore, future interventions which aim at mitigating climate change could emphasize these benefits by messages such as “Don’t do it for yourself but your grandchildren”. Overall, altruistic values seem to be one influencing factor when it comes to the acceptability of future mitigation pathways to combat climate change and future research should continue to examine their implications on proenvironmental behavior.

Future Research

This work can be extended along several dimensions. To test the robustness and extend the scope of research, future studies should test the present results for causality by employing experimental research designs with true random samplings. For example, by activating values in one group and comparing the results to a control group. To also test to what extent self-indicated acceptability is indicative of real-world policy support behaviors, one should test for concrete behaviors such as voting behavior, financial support or intentions for activism for or in opposition against these pathways.

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Appendix A

Pathway Descriptions from Survey

Figure A1

Pathway Descriptions

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.

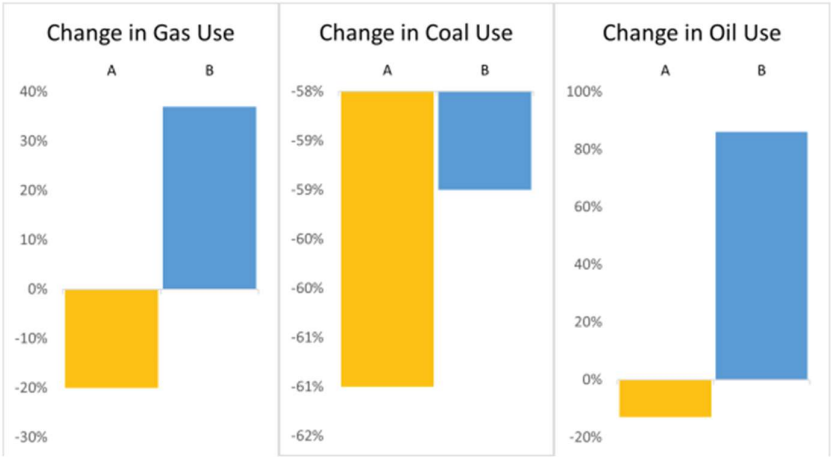
Details of the proposed energy transitions can be seen below:

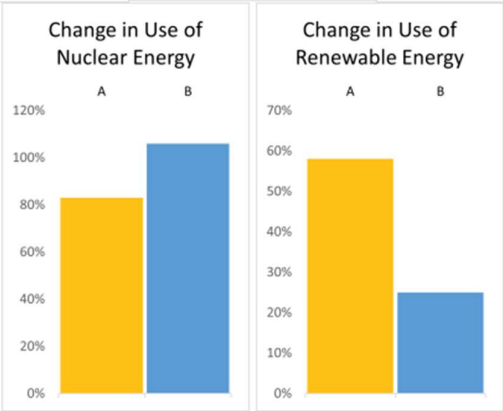
Pathway A reduces energy demand by 5% by 2030

- 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



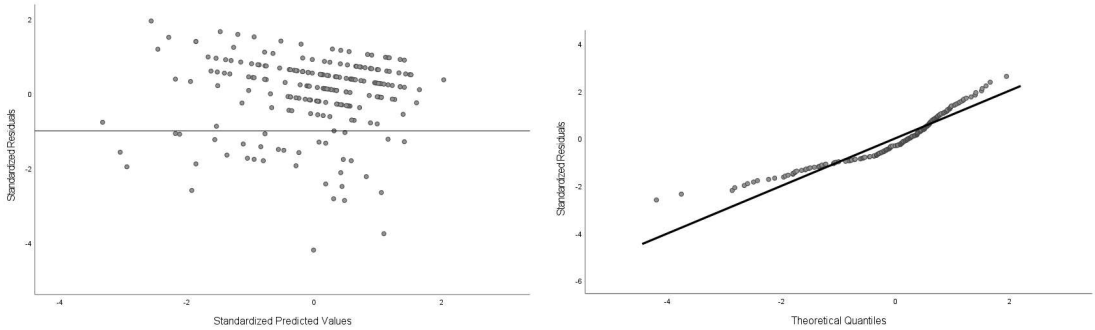


Appendix B

Assumption Checks

Figure B1

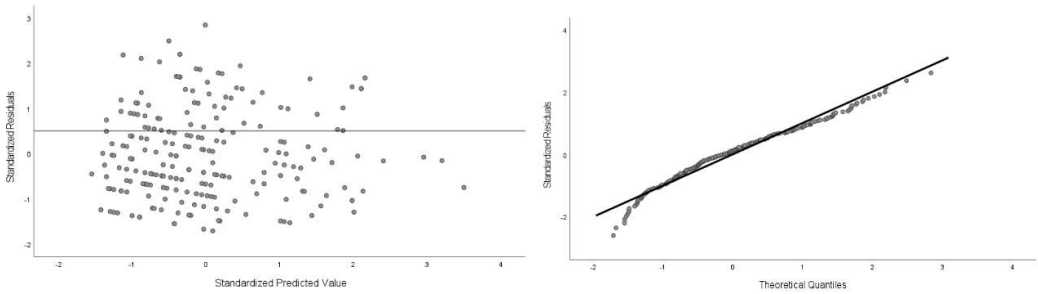
Checking the Normality Assumption for Predicting the Acceptability of Pathway A



Note. Standardized Residuals are plotted against standardized predicted values (left). Standardized Residuals are plotted against theoretical quantiles (right).

Figure B2

Checking the Normality Assumption for Predicting the Acceptability of Pathway B



Note. Standardized Residuals are plotted against standardized predicted values (left). Standardized Residuals are plotted against theoretical quantiles (right).

Table B1

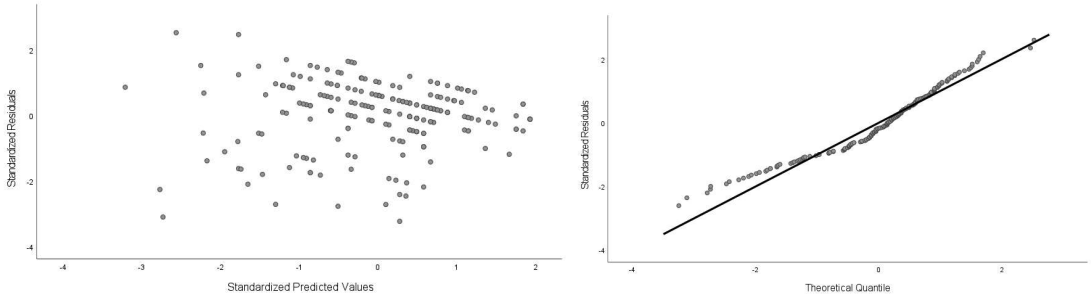
Box Tidwell Test to Check For Violations of the Linearity Assumption for Hypotheses 3a & 3b

Predictor	*b*	*SE*	df	*p*
Egoistic Values	5.65	4.48	1	.207
Altruistic Values	-8.73	10.30	1	.397
Egoistic Values x logit Egoistic Values	-2.11	1.83	1	.248
Altruistic Values x logit Altruistic Values	2.87	3.76	1	.446
Intercept	8.93	22.84	1	.696

*Note***.** As no significant interaction terms between the independent variables and the related logits were found, there is no evidence of an assumption violation.

Figure B3

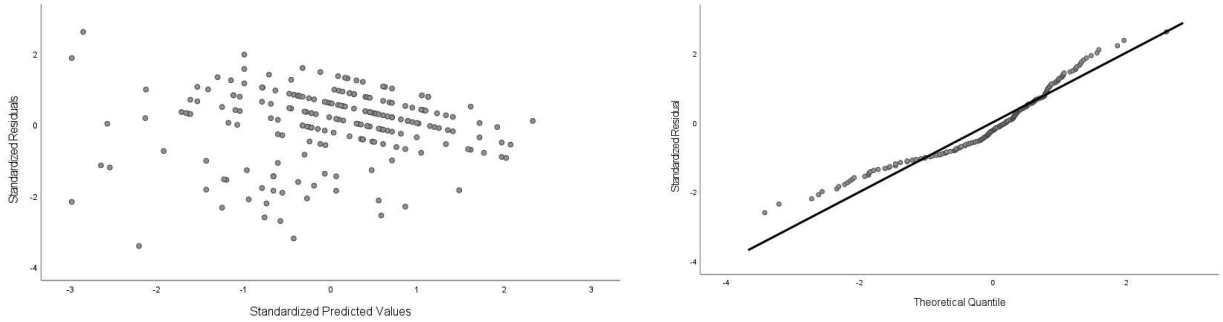
Checking the Normality Assumption for Predicting the Acceptability of Pathway A by Altruistic Values and Perceived Benefits for Others



Note. Standardized Residuals are plotted against standardized predicted values (left). Standardized Residuals are plotted against theoretical quantiles (right).

Figure B4

Checking the Normality Assumption for Predicting the Acceptability of Pathway A by Egoistic Values and Perceived Benefits for the Self



Note. Standardized Residuals are plotted against standardized predicted values (left). Standardized Residuals are plotted against theoretical quantiles (right).

Appendix C

Proposed Mediation Models

Figure C1

Mediation Model for Hypothesis 4a

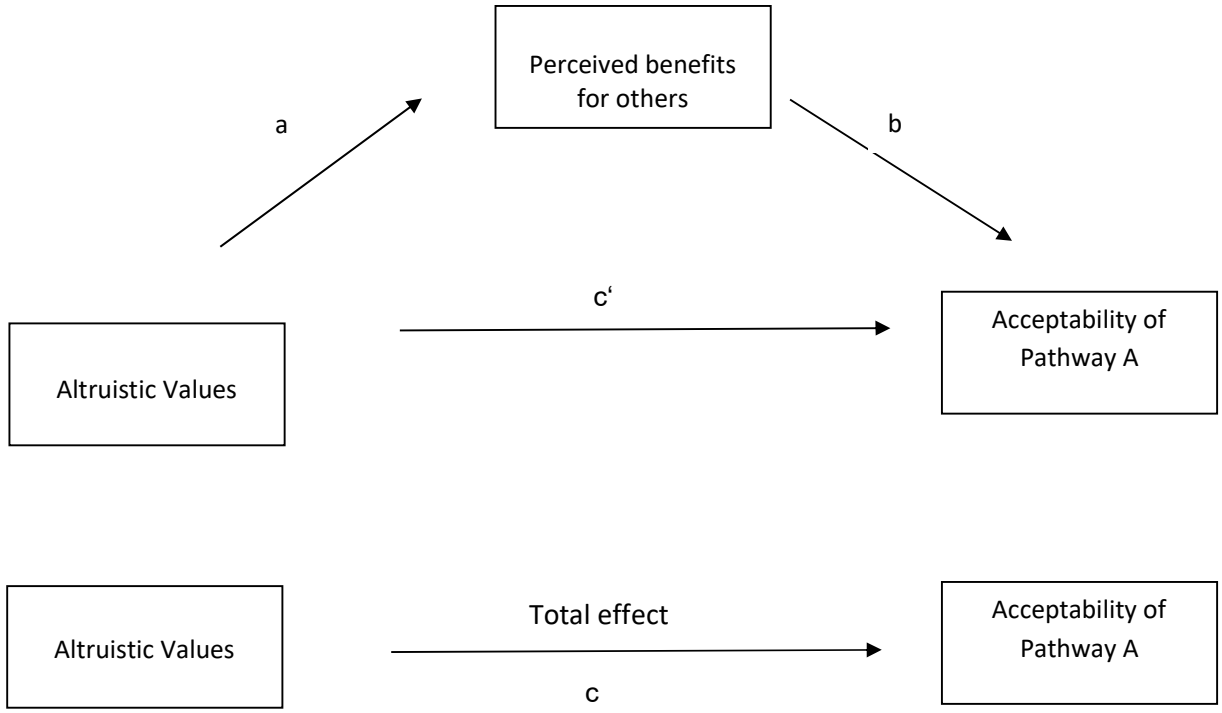
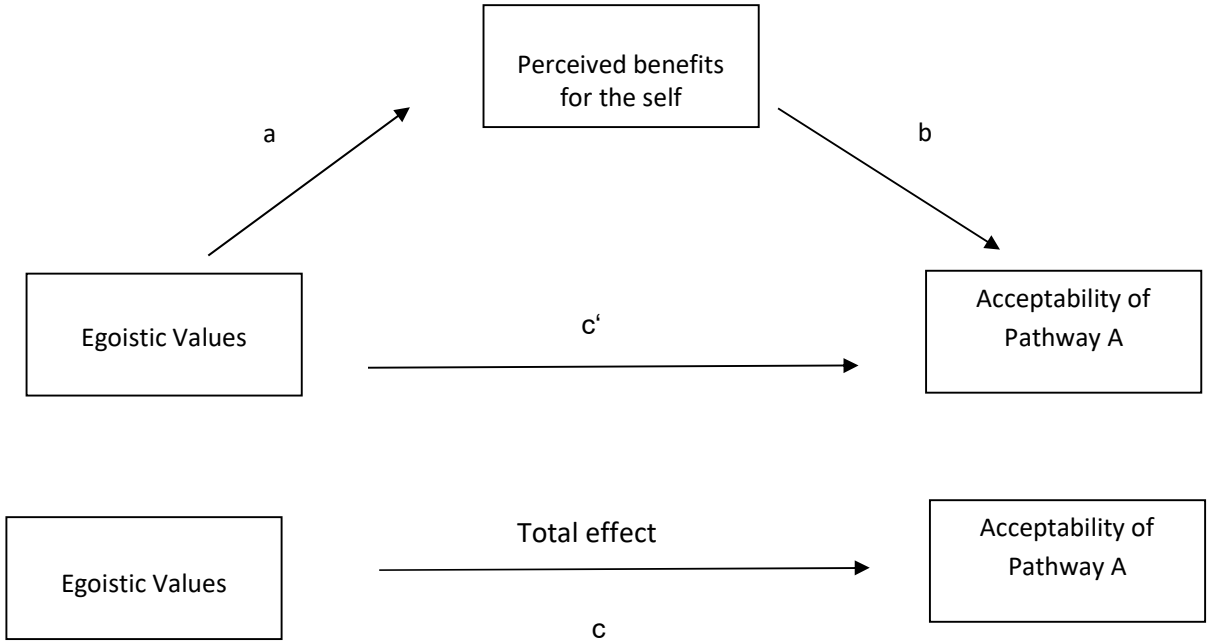


Figure C2

Mediation Model for Hypothesis 4b



Appendix D

Results for the Data Set Including Outliers

Table D1

Correlations of All Relevant Variables

Variable	Altruistic Values	Egoistic values	Perceived benefits for others	Perceived self benefits	Acceptability for Pathway A	Acceptability for Pathway B
Altruistic values	-	.10	.25**	.31**	.28**	-.31**
Egoistic values	.10	-	.10	.09	.02	.02
Perceived benefits for others	.25**	.10	-	.62**	.50**	-.28**
Perceived self benefits	.31**	.10	.62**	-	.48**	-.31**
Acceptability of Pathway A	.28**	.02	.50**	.48**	-	-.29**
Accepatbility of Pathway B	-.31**	.02	-.28**	-.31**	-.29**	-

Note. **. Correlation is significant at the 0.01 level (2-tailed). No significant differences to the results from the data set without outliers were found.

Table D2

Results of the Multiple Linear Regression Predicting Acceptability for Pathway A by Altruistic and Egoistic Value Endorsement Including Outliers

Predictor	*b*	*SE*	*t*	*p*	Fit
Altruistic values	0.42	.10	4.22	<,001	
Egoistic values	-0.00	.07	-0.06	.956	
Intercept	3.21	.65	4.92	<,001	
					R^2= .075

Note. No significant differences to the results from the data set without outliers were found.

Table D3

Multiple Linear Regression Model Predicting Acceptability for Pathway A by Altruistic and Egoistic Value Endorsement Including Outliers.

Model	Sum of Squares	df	Mean Square	*F*	*p*
Regression	20.46	2	10.23	8.97	<,001
Residual	250.93	220	1.14		
Total	271.39	222			

Table D4

Results of the Multiple Linear Regression Predicting Acceptability for Pathway B by Altruistic and Egoistic Value Endorsement Including Outliers

Predictor	*b*	*SE*	*t*	*p*	Fit
Altruistic values	-0.61	.12	-4.91	<,001	
Egoistic values	0.07	.09	.79	.432	
Intercept	6.68	.81	8.23	<,001	
					R^2= .099

Note. No significant differences to the results from the data set without outliers were found.

Table D5

Multiple Linear Regression Model Predicting Acceptability for Pathway B by Altruistic and Egoistic Value Endorsement Including Outliers.

Model	Sum of Squares	df	Mean Square	*F*	*p*
Regression	42.39	2	21.19	12.10	<,001
Residual	385.37	220	1.75		
Total	427.76	222			

Table D6

Results of the Logistic Regression Including Outliers

Predictor	*b*	*SE*	df	*p*	*Exp(B)*	*Exp(b)95% CI.for*	
						Lower	Upper
Altruistic values	-1.12	.25	1	<,001	.33	.20	.54
Egoistic values	.29	.20	1	.143	1.34	.91	1.99
Intercept	3.78	1.56	1	.015	43.89		

Note. These findings differ from the ones found for the modified data set, where egoistic values showed a significant effect.

Table D7

Mediation Analyses for Hypothesis 4a – Including Outliers

	Coefficient	*SE*	*t*	*p*	*95% CI*	
					LLCI	*ULCI*
Path *a*	0.28	0.07	3.85	.0002	0.14	0.43
Path *b*	0.63	0.12	5.04	0,000	0.38	0.87
Path *c*	0.42	0.14	3.07	0.0024	0.15	0.69
Path *c'*	0.25	0.13	1.88	0.0619	-0.01	0.50

Note. The indirect effect was sign. (*E*= 0.1774) Bootstrap *CI* (0.0752; 0.2967).

These results differ to the ones obtained with the modified data set, where only a partial mediation was found.

Table D8

Variance Accounted for per Model Hypothesis 4a Including Outliers

Model for Path	R^2	*df 1*	*df 2*	*F*	*p*
Path a	0.06	1	221	14.80	.0002
Path b & Path c'	0.27	2	220	15.92	.0000
Path c	0.08	1	221	9.41	0.0024

Table D9

Mediation Analyses for Hypothesis 4b Including Outliers

	Coefficient	*SE*	*t*	*p*	*95% CI*	
					LLCI	*ULCI*
Path *a*	0.08	0.06	1.32	.1897	-0.04	0.20
Path *b*	0.60	0.10	5.83	0.0000	0.40	0.81
Path *c*	0.03	0.09	0.29	0.7723	-0.15	0.20
Path *c'*	-0.02	0.08	-0.28	0.7834	-0.18	0.14

Note. No significant differences to the results from the data set without outliers were found.

Model 4 and a heteroscedasticity consistent standard error (HC4) was used.

The number of Bootstrap samples for Percentile Bootstrap Confidence Intervals was 5000.

The indirect effect was not sign. (*E*= 0.0481) Bootstrap *CI* (-0.0234; 0.1283).

Table D10

Variance Accounted for per Model Hypothesis 4b Including Outliers

Model	R^2	*df 1*	*df 2*	*F*	*p*
Path *a*	.01	1	221	1,73	.1897
Path b & Path c’	0.23	2	220	17.01	.0000
Path c	0.00	1	221	0.08	.7723