Influence of Ingroup Identification and Biospheric Values on Energy Scenario Acceptability Amongst University Students

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Abstract

Considering the unprecedented threat that global warming poses, the independent research institution TNO, published under the title Climate Neutral Energy Scenario for the Netherlands proposed the TRANSFORM future energy scenario. The TRANSFORM scenario centers around envisioning a transition towards a sustainable and climate-neutral energy system. Public acceptability of this scenario could facilitate its implementation. This thesis investigated the acceptability of the TRANSFORM scenario via students' ingroup identification and individual and group biospheric values. Additionally, the study explored the potential moderation effect (h4) of individual biospheric values on the relationship between ingroup biospheric values and acceptability. The results of our survey study (N = 323) support a positive association between ingroup identification among students and the acceptability of the TRANSFORM scenario. Furthermore, the acceptability of the TRANSFORM scenario was positively, however non significantly related to ingroup identification and ingroup biospheric values. Furthermore, the analysis revealed a negative and non-significant moderation effect, suggesting that individual biospheric values do not moderate the relationship between ingroup biospheric values and acceptability. Implications and limitations are discussed.

Keywords: public acceptability, future energy scenarios, ingroup identification, biospheric values, and university students.

Influence of Ingroup Identification and Biospheric Values on Energy Scenario Acceptability Amongst University Students

Climate change is unequivocal. The global temperature is escalating, the sea levels are rising, the concentration of greenhouse gasses are increasing, and the amounts of snow and ice are diminishing, as is the number of animal species (IPCC., 2018). The implications of these climatic alterations are increasing the required vigilance of nations globally. As we can highlight, during the 2015 Paris Agreement on Climate Change, 195 states, including the Netherlands, agreed on limiting the global average temperature increase to below 2°C above pre-industrial levels, and to pursue efforts to limit the increase to 1.5°C (UNFCCC, 2016; Vicedo-Cabrera, A.M et al, 2018). Accordingly, the Netherlands committed to a zero-net, climate-neutral energy system by 2050 (Scheeper et al., 2022).

The current energy system contributes to about three-quarters of greenhouse gas emissions, while fossil fuel accounts for approximately 80% of the total emissions (UNEP., 2022). There is a pressing need for a rapid and sustainable energy transition globally completed by each country as appropriate for their specific needs (Moran et al., 2008). This can be achieved through the development of low-carbon energy and the implementation of sustainable energy scenarios (Scheeper et al., 2022). Additionally, the role of public acceptability is crucial in ensuring the success of such sustainable energy scenarios.

The study presented in this paper explores the relationship between individual self-identification within a group, here among students, and the acceptance of a future energy system for the Netherlands. Additionally, the study examines the influence of individual biospheric values and ingroup biospheric values on scenario acceptability. The scenario used in

this study is adopted from the independent research institution TNO[1] which was published under the title Climate Neutral Energy Scenario for the Netherlands, in 2020. This document is an exploration of different strategies to achieve the Netherlands' objective of establishing a climate-neutral energy system by 2050 (Scheeper et al., 2022).

Specifically, we will concentrate our research on the TRANSFORM scenario, which investigates individuals' beliefs and subsequently influences the behavior of both individuals and groups.

Literature Review

Focusing on the TRANSFORM Scenario

The TRANSFORM scenario aims to achieve the Netherlands' energy goal of a zero net, climate-neural energy system by 2050 (Scheeper et al., 2022). The future energy scenario emphasizes the development of sustainable infrastructure and enhanced energy efficiency. One significant aspect of the TRANSFORM scenario is its emphasis on individuals' attitudes, behavioral changes, and environmental awareness. These factors play a pivotal role in driving a more radical transformation of the energy system (Scheeper et al., 2022)[2].

Assessing Public and Student Acceptability of the TRANSFORM Scenario

Understanding the social impact of implementing future energy scenarios will help policymakers and governments expedite a smoother energy transition. The success of this transition depends upon acceptability by the general population, which is characterized as both an attitude toward new technologies and potential behaviors concerning those technologies (Huijts et al., 2012). Previous research on the acceptability of sustainable energy policies has primarily focused on examining behaviors related to efficiency and reduction behavior of

[1]TNO stands for Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, which translates to the Netherlands Organisation for Applied Scientific Research in English.
[2] For further information see Figure A1 Appendix A

individuals (de Nardo et al., 2017; Gardner et al., 1996). Only a small number of studies have explored the acceptability of policies that specifically target the adoption of sustainable energy sources and the adjustment of energy usage timing (Zawadzki et al., 2022). Nonetheless, a successful introduction and implementation of sustainable technologies depend on psychological and environmental factors that influence public acceptance (Huijts et al., 2012). Before a policy is put into action, the level of public acceptance can indicate individuals' positive or negative opinions before its implementation, reflecting the population's overall attitude and mindset towards each specific policy measure (Steg, 2019). Therefore, it is important to focus on whether individuals will embrace the TRANSFORM scenario for future energy and support its implementation throughout the process. Furthermore, society is constructed of many groups and ingroups whose acceptance of the policies is imperative for its success. Therefore, it is important to consider how different segments of the population will receive the proposed policies; in this study we will focus on university students. Accordingly, the following hypothesis is put forward (see Figure 1):

H1: Strong ingroup identification of university students will increase the acceptability of the energy scenario TRANSFORM.

University Students' Acceptance of the TRANSFORM Scenario

To examine how individuals can potentially be encouraged to welcome the TRANSFORM scenario, this paper will focus on one particular group: university students. An important number of policy papers highlight the need for educational activities, describing education as "one of the most powerful tools for providing individuals with the appropriate skills and competencies to become sustainable consumers" (OECD, 2008, p.26). To gain insights into promoting pro-environmental behavior and addressing climate change, it is crucial to focus

research efforts on university students who are seen as future leaders and decision-makers in society (Brechin & Kempton, 1994). To understand individuals' attitudes and behaviors towards the environment, it is important to study their group values and ingroup identities. A recent meta-analysis found a positive relationship between identity and pro-environmental behavior among students, underscoring the need for additional research in the field of sustainable studies (Udall et al., 2021). By investigating the acceptability of the TRANSFORM energy scenario among university students, valuable insights can be gained on how to effectively engage and meet the needs of this specific population, given their influential role in shaping a sustainable environment and addressing social challenges for future generations (Barth et al., 2014; Whitley et al., 2018).

Values Towards Acceptability of the TRANSFORM Scenario

The importance of values in the context of the TRANSFORM energy scenario lies in the individuals' beliefs which subsequently influence the behavior of both individuals and groups. These values, as defined by Schwartz (1992), vary in importance and serve as enduring factors that shape individuals' beliefs, attitudes, and behaviors. Values, which encompass individuals' overarching goals and guiding principles, play a crucial role in determining people's acceptance of different energy scenarios. In the context of energy, values strongly influence how individuals perceive the risks, benefits, and overall acceptability of different energy options (Steg et al., 2013). Values are considered influential because they provide a stable and lasting foundation for the development of beliefs (Bouman et al., 2020). Extensive research consistently demonstrates that values have a causal impact on shaping individuals' beliefs, attitudes, and behaviors in various contexts, including the realm of energy sustainability. (Steg, 2019). Public acceptability can only be meaningful if it strongly aligns with their value system (Parkhill et al., 2013).

Group and Individual Biospheric Values

Biospheric values reflect concerns for nonhuman species and the biosphere which highlights the importance people and groups attach to caring about nature and the environment (Stern & Dietz, 1994; De Groot & Steg, 2010; Bouman et al., 2020). Research has shown that strong biospheric values are generally positively related to pro-environmental beliefs and behavior (Boomsma & Steg, 2014). Additionally, biospheric values are very stable over time (Bouman et al., 2020), which can enlighten us on how to motivate sustainable behaviors in line with the TRANSFORM scenario. This essay will examine individual and group biospheric values.

Individual biospheric values are practical to examine in this study, due to their strength and long-term reliability to predict pro-environmental attitudes, intentions, and behavior (Wang et al., 2021). Placing emphasis on biospheric values and raising awareness about environmental issues could potentially foster greater support for environmental policies (Steg et al., 2005). The greater an individual's endorsement of these values, the more they tend to engage in actions that support the environment (Martin & Czellar, 2017; De Groot & Steg, 2009).

Tajfel & Turner (1979) suggest that individuals tend to behave based on the groups they strongly identify with in a given situation. Examination of group biospheric values can be undertaken, as the influence of group values and identities on individual behavior is evident, driven by individuals' personal desire to align their actions with the group (Schultz et al., 2007). A group prioritizing biospheric values increases the likelihood of an individual exhibiting pro-environmental behaviors (Wang et al., 2021). Given the variability of group biospheric values, focusing on them can be an effective approach to stimulate collective environmental action (Bouman et al., 2020). By recognizing and harnessing the diversity of group values,

efforts to promote environmental engagement and acceptability of energy scenarios can be more effective and foster a collective response to pressing environmental issues. However, to date, group values have not received much attention and study in research (e.g., de Groot & Steg, 2009).

Analyzing personal and group biospheric values with the TRANSFORM scenario can foster a better understanding of individual preference, how to create interventions, promote behavior change, and align policies with values-enhancing scenario acceptability (Steg, 2019). In line with this the following hypotheses are investigated (see Figure 1):

H2: Higher individual biospheric values will increase an individual's acceptability toward the TRANSFORM scenario

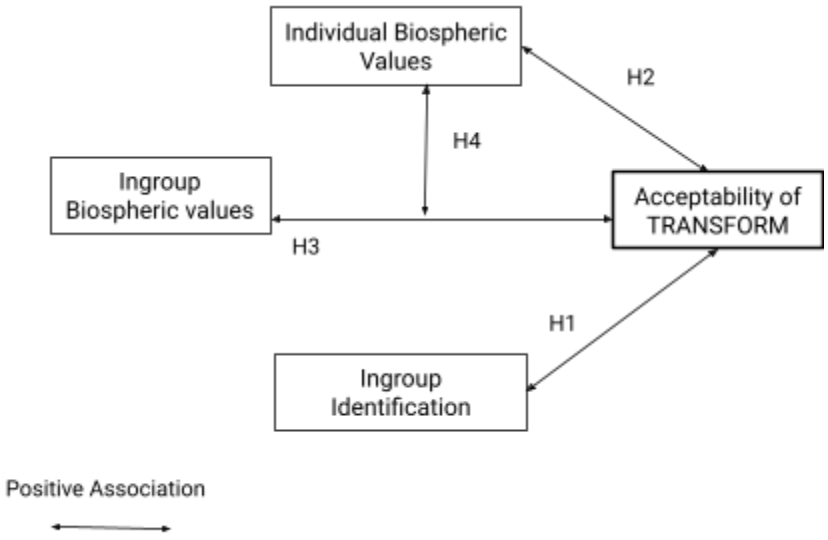
H3: Stronger perceived ingroup biospheric values are related to higher acceptability of the TRANSFORM scenario.

H4: The moderation effect of individual biospheric values on the relationship between ingroup biospheric values and the acceptability of the TRANSFORM scenario is strengthened by stronger individual biospheric values.

In the following, the relationship between ingroup membership, and individual and group biospheric values with the acceptability of the TRANSFORM scenario is examined. The presented evidence serves as a guide for the hypotheses depicted in Figure 1.

Figure 1

Overview of Hypotheses



Study Overview

This study investigates the association of social identity and biospheric values regarding students' acceptability of the TRANSFORM scenario. Firstly, we test if people's identification with their ingroup (university students) is related to the acceptability of a sustainable energy scenario. Furthermore, we investigate whether individual and ingroup biospheric values have an effect on the acceptability of the scenario. Lastly, we analyze a moderation effect of individual biospheric value on the relationship of group biospheric values and the acceptability of the TRANSFORM scenario. The results and implications will be discussed.

Method

Ethics Statement

Preceding the data collection, we obtained approval from the ethics committee of the University of Groningen, using the fast-track option due to this research fulfilling the criteria for a low-risk study.

Participants

Based on the a priori G*power analysis (Faul et al., 2007), the required sample size for

the present study is 152. This sample size was determined based on a linear multiple regression analysis with a fixed model of 0.8, an expected effect size of 0.053, and a significance level (α) of 0.05 (Liu et al., 2020). With a final working sample size of 162, the required sample size was met (Figure A2, Appendix A). A total of 323 responses were initially recorded for this study; 204 from snowballing and 119 from SONA – the first-year psychology student participant pool of the RUG. Overall, the final sample size for the main analysis consisted of 162 participants who met the inclusion criteria as being students in the Netherlands and provided valid and complete responses. Concerning the gender distribution, 102 identified as female, 57 as male, two as non-binary/third gender, and one wished not to respond to this. The average age of participants ranged from 16 to 30 with the largest age category being 21-25-year-old (51%). There were 148 participants who lived in the Netherlands, and 95 were Dutch citizens. Furthermore, 95 participants were first-year psychology students of the University of Groningen and the other 67 were students from elsewhere in the Netherlands. While participants recruited through snowballing participated voluntarily and without incentives, SONA participants received 0.4 SONA credits for the voluntary completion of the study. Means and standard deviations of all variables can be found in Table B1, Appendix B.

Design

This study involved a cross-sectional design using an English survey online that was accessible through a generated link to the digital survey platform Qualtrics XM (Qualtrics, Provo, UT). The order of variables relevant to this analysis was as follows: dependent variable (DV) acceptability of the TRANSFORM scenario, and independent variables (IVs): ingroup identification, ingroup biospheric value, and individual biospheric value. The acceptability of the TRANSFORM scenario was measured after presenting the ADAPT and the TRANSFORM

scenarios separately. The scenario was presented via summarizing bullet points, a graph on the energy supply factors (2018 vs. 2050), and a table summarizing the most important numbers (Figure A1, Appendix A). Data collection took place for the general population on the 3rd and SONA participants from the 8th of April until the 23rd of May 2023.

Materials

The survey comprised several scales to measure the different variables. Only the materials relevant to this thesis are described (Figure A3 to A6, Appendix A). The statistical software package IBM SPSS Statistics (Version 28.0.1.0) was employed to analyze the data.

Ingroup Identification

We conducted a group-level assessment of ingroup identification by administering a four-item questionnaire that focused on participants' affiliation with fellow university students, adapted from Postmes et al. (2013). The overall question was “To what extent do you agree with the following statements?”. Responses were measured using a 7-point Likert scale (1= *strongly disagree,* 7= *strongly agree*). To illustrate, one item stated “I identify with university students in the Netherlands”. This scale resulted in a Cronbach’s alpha of .79, indicating good internal consistency.

Individual biospheric values

Individual biospheric values were measured with four items. Participants indicated how much they endorsed biospheric values by answering a general question “To what extent do you agree with the following statements?”. Participants could answer on a Likert scale (1= *strongly disagree,* 7= *strongly agree*). This operationalization was derived from the Environmental PVQ (E-PVQ) (a variant of E-SVS) of biospheric values, adapted by Bouman et al. (2018). The scale yielded a Cronbach's alpha of .83, suggesting a high level of internal consistency.

Group biospheric values

Perceived group biospheric values were measured using a four-item questionnaire from Environmental PVQ (E-PVQ) (a variant of E-SVS) modified by Bouman et al. (2018). Participants were asked to indicate to what extent their ingroup (university students) endorses biospheric values. The general question was "To what extent do you agree with the following statements?". For instance: "It is important for students in the Netherlands to prevent environmental pollution". The answers were measured on a Likert scale (1= *strongly disagree,* 7= *strongly agree*). This measurement yielded a Cronbach's alpha of .81, suggesting a high level of internal consistency.

Acceptability of the TRANSFORM scenario

The acceptability of the energy scenario TRANSFORM was measured using a 7 point Likert scale. By the use of three items, participants can indicate if they found TRANSFORM "*very unacceptable*" (1) to "*very acceptable*" (7), "*very negative*" (1) to "*very positive*" (7), and "*very bad*" (1) to "*very good*" (7), derived from Perlaviciute et al. (2021). This scale resulted in a Cronbach's alpha of .89, indicating a high level of internal consistency.

Procedure

The study was pre-registered in the Open Science Framework before the survey was published (https://doi.org/10.17605/OSF.IO/ZMYRU). The present thesis was part of a larger bachelor thesis research project designed on the acceptability of energy scenarios. Though additional measures were included in the survey, only those relevant to the current paper will be presented here. First, general information about the study was provided after which informed consent was obtained. Second, demographic information was collected followed by participants completing scales and questions regarding the above-mentioned constructs. After completion,

they were thanked for their participation. Informed consent for the data being used for this research was given by all included participants. Once a sufficient number of participants participated, the survey was closed. The median time to complete the survey was 13.20 minutes (SD: 14.56).

Analysis Plan

A stepwise multiple regression analysis was used to estimate the association of ingroup identification (H1), ingroup biospheric values (H2), and individual biospheric values with scenario acceptability (H3). In the first step, ingroup identification, ingroup biospheric values, and individual biospheric values were entered as predictors of the acceptability of the TRANSFORM scenario. In the second step, the moderation effect of individual biospheric values on the relationship between ingroup biospheric values and scenario acceptability was tested (H4). Before the analysis, the variables were standardized and put on a common scale to facilitate analysis.

Assumption checks

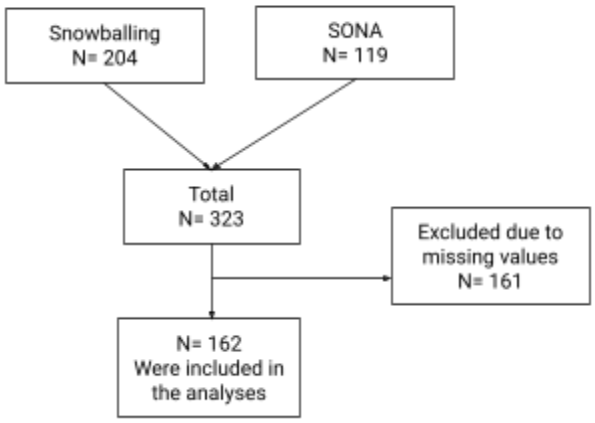
To ensure the statistical assumptions are met for the analyses above, alternative or adjusted analyses will be employed if the assumptions are violated. Nonlinear regression will be used if relationships do not appear to be linear. Concerning the linear regression for H1, H2, H3 and H4 no evidence for violation of the linearity, homoscedasticity, and normality assumptions was found (Appendix C). As no evidence for violation was found, variables were not transformed to maintain a straightforward interpretation of the results, in contrast to decisions made in the pre-registration. Multicollinearity was checked using a correlation matrix and Variance Inflation Factor (VIF), with a VIF score above 5 indicating multicollinearity. Lastly, for all three regressions, outliers were analyzed using Cook's Distance.

Data preparation

Participants who did not fill in the relevant scales were removed before running the analyses. A total of 57 responses were excluded from the analysis based on predefined exclusion criteria. Specifically, 53 responses were excluded due to missing consent, and an additional four responses were excluded because participants declined consent. Six responses were identified as failing the attention check, which stated 'Throughout this survey, please read the questions carefully and indicate the answer that most accurately represents your opinion' during the screening process. Four participants did not indicate their age resulting in the minimum participation age of 16 years could not be confirmed. Furthermore, 90 responses were excluded due to not passing the seriousness check or indicating a desire for their data to be excluded from the study. Lastly, five participants were excluded due to missing data on relevant questions of this survey (ingroup identification, ingroup biospheric values, individual biospheric values and acceptability of TRANSFORM scenario). Therefore a total of 162 participants were included in the statistical analyses (see Figure 2).

Figure 2

Participant Exclusion Process



Results

Correlational Analysis andAssumptions

Distribution of the IVs and DV are depicted in Figure D1 (Appendix D). A correlational analysis was carried out to analyze the data. Table 3 shows the descriptive statistics and correlations of each of the variables. All predictor variables were positively correlated with the acceptability of TRANSFORM (Table D4). Individual biospheric values and acceptability of the TRANSFORM scenario have the highest r= .42, $p < .001$. Furthermore, group biospheric value and acceptability are positively correlated, r= .36, $p < .001$. Additionally, ingroup identification is also positively correlated with the TRANSFORM scenario, r= .21, $p < .001$.

To test the assumptions linearity and heteroscedasticity were assessed with the standardized residual plots and the standardized residual-by-predicted values scatterplot in addition to the P-Plot of regression (Appendix C). No assumption violations were found. Individual biospheric values revealed a potential presence of three outliers (Appendix C). One outlier was found for biospheric group values. Despite being potential outliers, these data points are considered important and meaningful as they reflect the variability of the dataset. Therefore, they were included in the analyses. Additionally, Table 3, states that the variance inflation factors (VIF) were all below 5.0 showing no serious problems of multicollinearity. To conclude, all assumptions for the regression were met and we could proceed with the hypothesis tests.

Table 3

Coefficient Data Model of Acceptability of the TRANSFORM scenario and Ingroup Identification, Group biospheric values and Ingroup biospheric values.

Predictor	***B***	***Std Error***	***Beta***	***t***	***Sig***	***VIF***
Constant	1.74	.63		2.78	.006	
Ingroup Membership scores	.13	.14	.07	1.82	.071	1.04
Individual Biospheric values scores	.46	.12	.37	3.63	<.001	2.15
Group Biospheric values	.09	.14	.06	.63	.525	2.17

Hypothesis Testing

For H1 the results of our regression analysis can be found in table 3. Higher ingroup identification was not significantly related to higher acceptability of the TRANSFORM scenario at a conventional significance level (b=.04, *p*=.071) rejecting H1. The regression analysis further indicated that higher individual biospheric values were associated with higher acceptability of the TRANSFORM scenario (b=.37, *p*=.<001), supporting H2. Hypothesis 3 regression analysis results (see Table 3) indicated that there is no significant relationship between higher ingroup biospheric values and the acceptability of the TRANSFORM scenario (b= .06, *p*= .525). For H4 the moderation effect via the step 2 explained in Table 4, b= -.08 and *p*= .18 suggested the interaction between individuals' biospheric values and ingroup identification associates to decrease the scenario acceptability. However, the coefficient is not statistically significant. In the first step of the analysis, when examining the ingroup biospheric values, we obtained an R^2 value of .20, an adjusted R^2 value of .19 and sig= <.001. In the second step, when exploring the interaction effect of individual biospheric values on acceptability within the ingroup, we

observed R^2= .21 and an adjusted R^2 value of .20 and sig= .188. The moderation analysis showed that adding the interaction term increased the R^2 indicating that the interaction contributes to a better understanding of acceptability variability within the ingroup. However, when considering the interaction effect of individual biospheric values, the observed effect was not statistically significant. The interaction between individual biospheric values and acceptability within the ingroup did not significantly contribute to explaining the variation in acceptability beyond ingroup biospheric values.

Table 4

Moderation effect of Individual Biospheric Values on Ingroup Biospheric values towards Acceptability of the TRANSFORM scenario

Step and variable	*b*	se	R^2	R^2adj	t	Sig.
Step 1						
Ingroup Biospheric Values (z score)	.09	.11				
Individual Biospheric Values (z score)	.41	.11	.20	.19	3.72	<.001
Step 2						
Ingroup Biospheric Values X Individual Biospheric values	-.08	.06	.21	.20	-1.32	.188

Discussion

In our study, we aimed to explore whether ingroup identification, ingroup biospheric values and individual biospheric values are related to the acceptability of the TRANSFORM scenario by university students of the Netherlands. Our findings indicate a positive connection between all the independent variables and the dependent variable. However, we observed that only individual biospheric values are significantly associated with acceptance. While identification with the ingroup shows a tendency towards higher acceptance, it does not contribute significantly to our model. When considering the influence of individual biospheric values on the relationship between ingroup biospheric values and acceptance, we found a negative impact that is not significant. Through these findings, we strive to shed light on some of the important aspects that are related to university students' acceptance of an energy scenario.

The first hypothesis proposed that strong identification with university students would increase an individual's acceptability of the energy scenario. As expected, there is a positive connection between students' ingroup identification and acceptability. However, H1 is not supported and there is insufficient evidence to conclude ingroup identification influences the acceptability of the TRANSFORM scenario. The hypothesis derives from prior research, focusing primarily on the Social Identity Theory (Tajfel & Turner, 1979). According to which, individual behavior is influenced by the groups with which a person identifies. In addition, students who strongly identify with a pro-environmental mindset are more likely to engage in environmentally friendly actions (Udall et al., 2021). Building upon this theoretical framework, it was hypothesized that a strong ingroup identification with students would likely foster a higher acceptance of the scenario (Fritsche et al., 2018; Bouman et al. 2020). However, this only seems to be partly true. Although a positive relationship between the acceptability of the scenario and ingroup identification is evident, it is not sufficiently robust to make definitive predictions about

the higher acceptance of the TRANSFORM scenario. It can be noted that previous research focused on groups in general, such as nationalities or on political orientation (Bouman et al., 2020; Schulte et al., 2020) whereas our study focused on university students. A possible explanation for the weak association are the diverse academic backgrounds among students which can influence their environmental knowledge. Environmental knowledge and formal education is important in shaping students' environmental attitudes and involvement (Janmaimool & Khajohnmanee., 2019). However, students come from various educational backgrounds and have diverse experiences. Academic paths cover different subjects such as biology, chemistry, social sciences, engineering, and humanities, providing students with unique knowledge and perspectives that may or may not relate to the environment. Environmental knowledge provided through formal education may influence students' environmental attitudes, (Díaz-Siefer et al., 2015). Such variances in students' knowledge could influence their perspectives on the TRANSFORM scenario. Depending on the specific domain of focus pursued by students, their knowledge acquisition may vary, leading to divergent opinions regarding the TRANSFORM scenario. Future research should focus on separating students by their studied discipline and analyzing their affiliation towards the ingroups and views of the scenario.

The second hypothesis proposed individual biospheric values would expand an individual's acceptability toward the TRANSFORM scenario. As expected, people with higher biospheric values show a higher acceptability of the energy scenario. Furthermore, an individual's personal values, as related to the environment, strongly influence their willingness to accept and support environmental initiatives. This assumption is based on previous findings, indicating that personal biospheric values frequently predict various pro-environmental behavior. Individuals who prioritize values related to nature and the environment are more likely to exhibit

intrinsic motivation and a greater intention to engage in pro-environmental behavior (De Groot & Steg, 2010; Martin & Czellar, 2017). Biospheric values consistently show a positive effect on the acceptability of environmental policies (Ejelov et al., 2020). Thus, the results are in line with the existing literature, in which individuals who hold strong biospheric values exhibit higher levels of acceptability towards a sustainable energy scenario. The relationship between individual biospheric values and higher acceptability of the TRANSFORM scenario appears to be positive. One possible explanation could be that individuals who hold biospheric values have a stronger appreciation for nature and are likely to show more support for the scenario due to its focus on preserving the environment. Consequently, individuals are more likely to express support for the energy scenario due to its perceived ability to contribute positively to the preservation of nature (Linqiong & Yan, 2021). People can perceive themselves as part of the natural world and feel a sense of responsibility toward its protection. Such individuals could identify themselves with the TRANSFORM scenario. Nature-oriented people are more intrinsically motivated and inclined to engage in pro-environmental behavior (Martin & Czellar, 2017). Their values and personal connection to nature drive their desire to protect and preserve nature. These values help to shape someone's motivation to support energy scenarios, which in turn align with environmental aims to preserve nature. This significant finding suggests that individual biospheric values may play a prominent role in influencing acceptability of the TRANSFORM scenario.

The third hypothesis proposed that stronger ingroup biospheric values would be related to higher acceptability towards the TRANSFORM scenario. As expected, group biospheric values have a positive relationship with acceptability. However, ingroup biospheric values are not associated with higher acceptability of the TRANSFORM scenario. This assumption is based on

previous findings indicating that group biospheric values frequently predict various pro-environmental behavior (Schultz et al., 2007; Bouman et al., 2020). This suggests that the perceived environmental values within an ingroup have a positive influence on the environmental behaviors of its members. When ingroup members, such as students, perceive that their group highly values the environment, they are more likely to make environmentally friendly choices themselves. However, this only seems to be partly true. The results of the research suggest that while ingroup values do influence acceptability of the energy scenario, they are not strong enough to relate to the acceptability of the TRANSFORM scenario. A potential reason for this is that group biospheric values and social norms highly influence individuals' acceptance of pro-environmental measures (Boomsma & Steg, 2014). It becomes challenging to distinguish between the biospheric values associated with the ingroup and those of individuals. The strong endorsement of biospheric values within the group amplifies the probability of group members supporting and actively engaging in climate actions, including the acceptance of pro-environmental measures. These values are interconnected, creating difficulty in separating the impacts of group values, as they are highly associated (Bouman et al., 2020). Therefore, the challenge lies in disentangling the distinct effects of ingroup biospheric values and individual biospheric values, as they are intertwined and mutually reinforcing. Understanding the complexity of these relationships and their impact on environmental attitudes and behaviors necessitates a careful examination of both group dynamics and individual-level factors. This examination helps identify the factors that contribute to the acceptance of pro-environmental measures, such as the TRANSFORM scenario.

The fourth hypothesis indicated that individual biospheric values would moderate the relationship between ingroup biospheric values and the individual acceptability of the

TRANSFORM scenario. The expectation was that people with higher individual biospheric values would exhibit a stronger association between ingroup biospheric values and their acceptance of the TRANSFORM scenario. However, the relationship between group biospheric values and acceptability is decreased when participants are moderated with individual biospheric values. Despite the presence of a moderation effect, the results were negative. This indicates that individual biospheric values have a small moderating influence but are not associated with the relationship between ingroup biospheric values and the acceptability of the TRANSFORM scenario. This assumption is based on previous findings indicating a link between individual and group values (Bouman et al., 2021). These findings collectively establish a strong relationship between personal and group biospheric values, indicating their interconnectedness with self- and group identities. By further investigating other group-related findings, it is possible to uncover the significance of these factors and potentially reveal a moderating effect. This means that the relationship between individual and group values may be influenced by additional factors or conditions, and studying those influences can provide valuable insights (De Groot & Steg, 2010; Bouman et al., 2021; Wang et al., 2021;). One potential reason for this finding could be attributed to the sense of belonging within the group. Group belonging fosters a shared social identity, where individuals perceive themselves as part of a collective entity and experience connectedness and identification with the group (Allen et al., 2021). However, when it comes to analyzing such a varying population as university students, it may be difficult for individuals to identify with and examine the group's values. Individuals might not actively analyze their own values in relation to the group, particularly in large and diverse populations such as university students. As a result, it becomes difficult to disentangle the impact of group biospheric values from individual ones. Individuals may not have a clear awareness of their own values in relation

to the group. Further research could focus on the understanding of the complex interplay between individual values, external factors, and acceptability judgments in relation to future energy scenarios.

Limitations

Before drawing conclusions, limitations of the present research and their respective implications are discussed. One of the limitations is the composition of participants. The recruitment used was a snowball sampling technique that primarily relies on the researchers personal network. Consequently, this method introduced bias in the participation selection and limited the diversity in the sample. The majority of the participants were drawn from a specific institution (University of Groningen). In addition, friends and family of the researchers could compromise the external validity of the study. As they might be aware that climate change is an important issue to the researchers, making them prone to respond in line with the researcher's expectations.

The length of the survey may have contributed to the participant's fatigue or reduced attentiveness. It is worth considering the level of understanding and knowledge regarding the energy scenario of university students. Students can have difficulty in understanding the concept of energy conservation (Mweene Chabakengula et al., 2012). This observation can suggest a potential challenge in the comprehension of the energy scenario.

Another factor could have been the lack of exploration of the total energy scenario of TNO. They created the TRANSFORM and ADAPT. A comparison of both could have provided a more comprehensive understanding of what university students prefer. Such insight can inform policy, promote engagement, and support the development of sustainable and inclusive energy systems. The contrast would allow us to explore and examine the different advantages and

disadvantages of each scenario. Exploring these aspects could deepen students' knowledge and foster their engagement towards sustainable energy scenarios.

Lastly, it is important to acknowledge the context in which the study is conducted. Kuzemko et al. (2022) suggested the war between Russia and Ukraine has shifted the political focus from environmental sustainability towards geopolitical supply security in the European Union's energy policies. Furthermore, the direct impact of the shifting geopolitical situation on one's own personal life, such as the increased cost of coal and gas, and individual's apprehension about the war could have affected how participants would view the energy scenario moving forward and thus how they answered the survey. Individuals might be more likely to feel more pessimistic towards new energy scenarios and thus decreased their acceptability towards the scenario.

Suggestions for future research

An interesting possible study suggestion would be to investigate all the potential values which could significantly shape attitudes toward sustainable energy. While this study primarily focused on biospheric values, it could be interesting to explore other values from the Value Belief and Norm Theory (Stern, 2000). This theory includes altruistic, egoistic and hedonic values. All of them highlight the importance of values in predicting sustainability behavior (Steg et al., 2011). By incorporating these various values into future research, a more comprehensive understanding of the factors that shape attitudes toward sustainable energy might be achieved. This knowledge can inform the development of tailored strategies and interventions that effectively engage individuals across different value orientations, ultimately encouraging the acceptability towards the TRANSFORM scenario.

Conclusion

To conclude, this research contributes to the existing literature on environmental psychology, more precisely investigating the level of acceptance regarding the TRANSFORM scenario within the context of university students. The study found that individual biospheric values, ingroup biospheric values, and intergroup identification are associated with the acceptability of a realistic energy scenario. However, no evidence for a moderation effect of individual biospheric values via the ingroup biospheric values was found. Furthermore, the research suggests that individual biospheric values enhance students' acceptance of a specific scenario. In the future, utilizing and replicating these findings, while introducing further variables could provide a more comprehensive understanding and explanation of acceptability of future energy scenarios, such as the TRANSFORM scenario.

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Appendix A

Figure A1

Scenario Description

Presentation of Scenario B

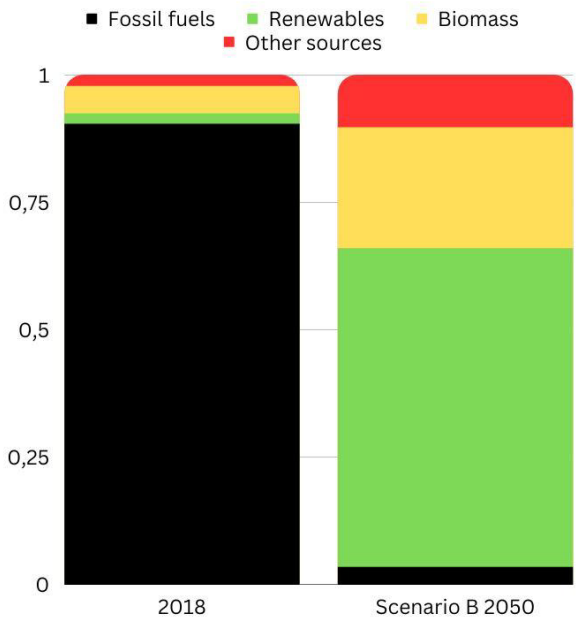
Below are several graphs and information on Scenario B. **Please read the descriptions carefully to understand the scenarios**. You will be asked a series of questions about the details of the scenario and its advantages,disadvantages and acceptability. Note: hover over underlined words for more information about the concept.

In scenario B:

- The Netherlands relies on its strong knowledge and innovative business community to transition to cleaner energy sources.
- The country focuses on using renewable technologies while also developing a more circular economy, which helps reduce energy usage.
- The government plays an important role in facilitating and promoting the adoption of sustainable technologies.
- People become more aware of their energy usage and make changes to reduce their carbon footprint. This includes behavior like eating less meat and choosing seasonal foods.
- New technologies, such as electric and hydrogen-powered transportation, are welcomed and encouraged.
- The demand for energy decreases as people's mobility behavior changes and industries shift towards less energy-intensive processes.
- Companies are making big changes to become more sustainable.
- The service sector grows as the economy shifts towards more sustainable, circular practices.
- The agricultural sector switches to more sustainable energy sources, such as solar panels, wind turbines and geothermal energy for farm operations.
- To meet international climate goals, international aviation and shipping are required to reduce their greenhouse gas emissions by 95%.
- Carbon Capture and Storage is only used to a limited extent, and biomass is only used if no other

options are available.

The below graph indicates the percentages of Dutch energy supply sources in 2018 compared with those projected by scenario B in 2050.



The table below provides you with more detailed information on the scenario.

	Scenario B
National greenhouse gas reduction target	2030: 55% 2050: 100%
Greenhouse gas reduction target international flying and shipping	2050: 95%
Fossil fuel prices	Constant after 2030
Energy demand	
• Industry	↓
• Service sector	↑↑
• Agriculture sector	↓
Industry production	↓
Mobility demand*	
• Domestic	↓
• International	↓
Biomass availability**	
• Domestic	++
• Imports	++
Use CO2 capture and storage (CCS)***	+
Use coal-fired power plants	No

↑ means growth, ↓ shrinkage and ↑↑ extra growth, +++ means large, ++ moderate and + limited availability

Explanation of terms

* **Mobility demand:** transportation (e.g. cars, buses, trains, bicycles)

** **Biomass availability:** availability of organic matter for energy production (e.g. wood, vegetable and garden waste, sewage)

*** **CO2 capture and storage:** technology capturing and storing CO2 underground or in long-term storage facilities (e.g. gas reservoirs, deep ocean sediments)

Figure A2

G power evidence

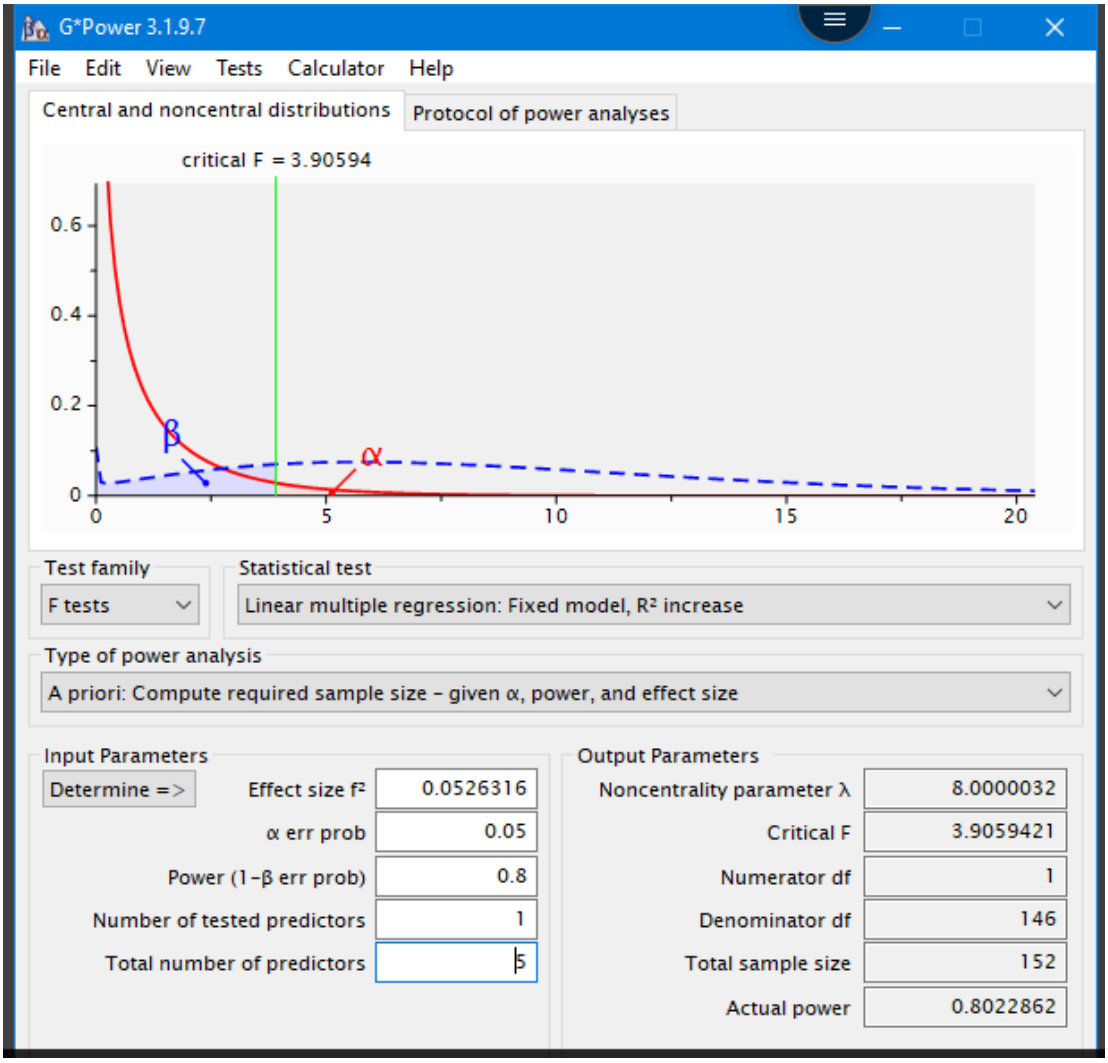


Figure A3

Ingroup Identification Scale

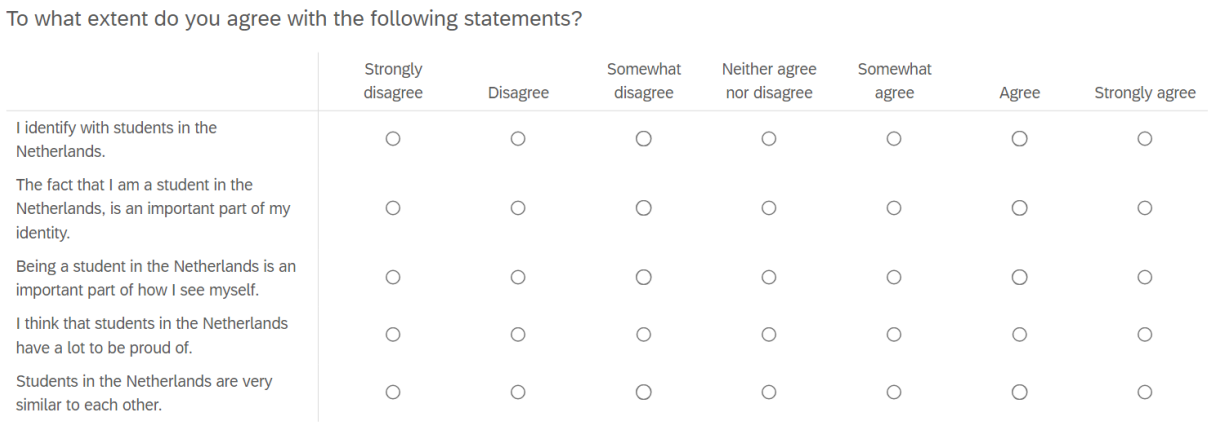


Figure A4

Individual Biospheric Value Scale

Figure A5

Group Biospheric Values Scale

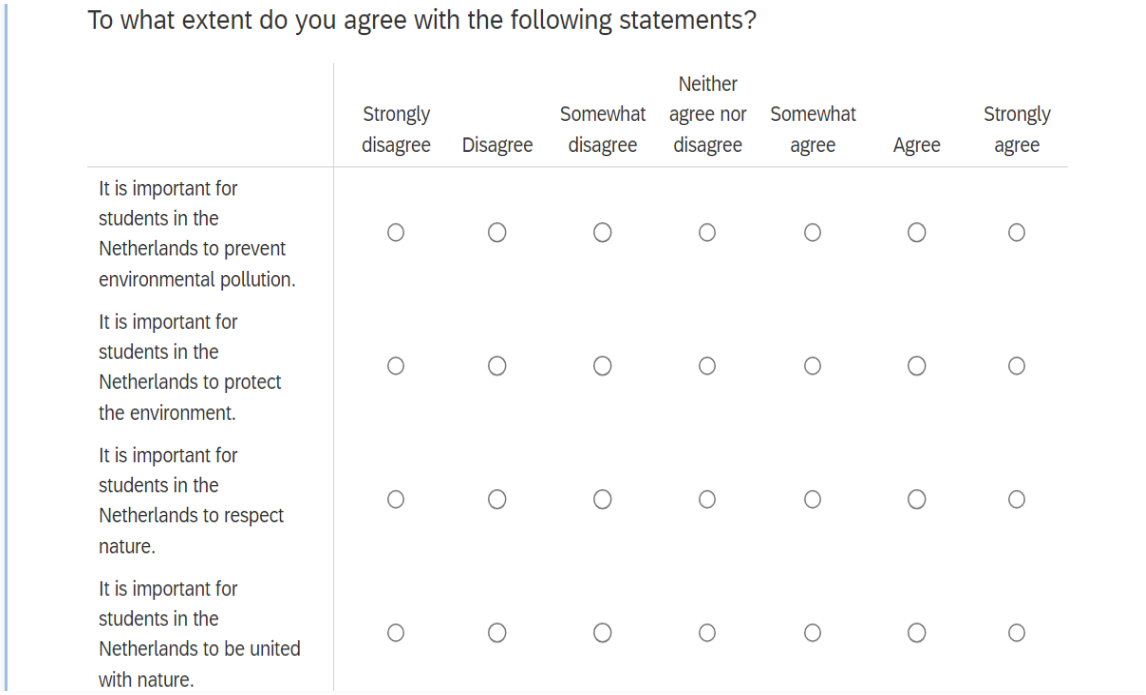
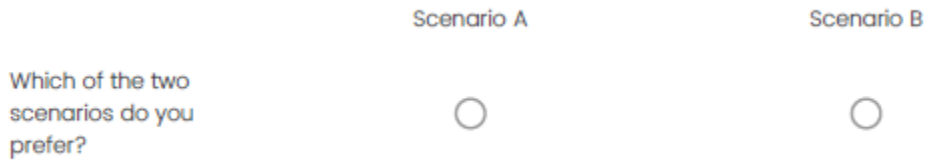


Figure A6

Choice Item



Appendix B

Table B1

Means, Standard Deviations, and Correlations Between Core Study Variables

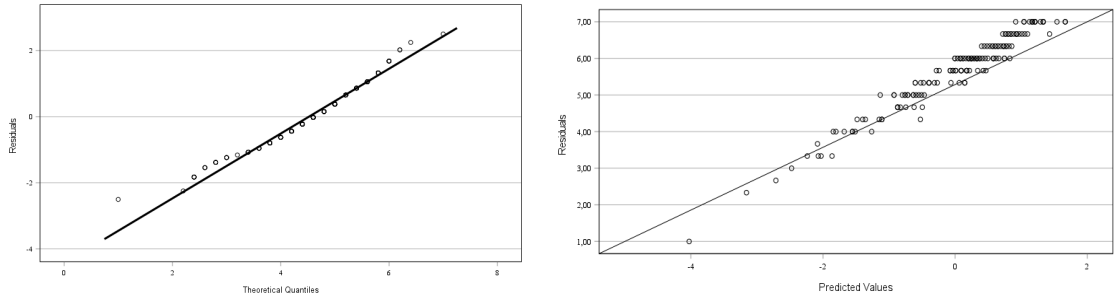
Descriptive	Variables			
	Ingroup Identification	Individual Biospheric Values	Group Biospheric Values	Acceptability of TRANSFORM scenario
Mean	4.50	5.92	5.78	5.63
Standard Deviation	1.02	.85	0.76	1.06

Note. Responses for Ingroup Identification, Individual Biospheric Values and Group Biospheric values were recorded on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. Responses for Acceptability of the TRANSFORM scenario were recorded on a 7-point Likert scale with three items ranging from “very unacceptable” (1) to “very acceptable” (7), “very negative” (1) to “very positive” (7), and “very bad” (1) to “very good” (7).

Appendix C

Figure C1

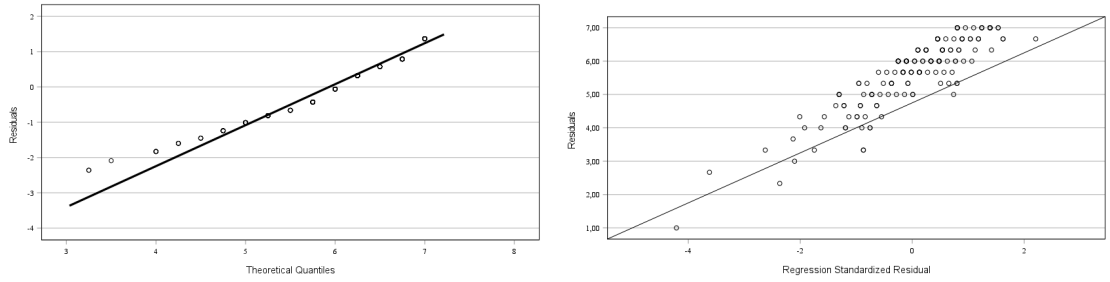
Assumption Check for Ingroup Identification (H1)



Note. Normality Assumption (left) and Homoscedasticity & Linearity Assumptions (right).

Figure C2

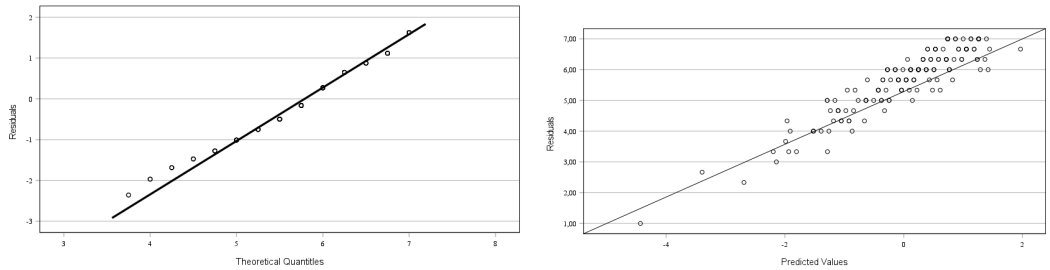
Residual for Assumption Check for Individuals Biospheric Values (H2)



Note. Normality Assumption (left) and Homoscedasticity & Linearity Assumptions (right).

Figure C3

Residual for Assumption Check for Group Biospheric Values (H3)



Note. Normality Assumption (left) and Homoscedasticity & Linearity Assumptions (right).

Appendix D

Figure D1

Means, Standard Deviations, and Correlations Between Core Study Variables

Variable	**Mean**	**SD**	**1.**	**2.**	**3.**	**4.**
1. Ingroup Identification	4.50	1.03	–			
2. Individual biospheric values	5.93	0.86	.16	–		
3. Group biospheric values	5.79	0.75	.18	.72	–	
4. Acceptability of the TRANSFORM scenario.	5.64	1.07	0.36**	0.42**	0.21**	–

Note. $N = 162$.

* $p < .05$. ** $p < .01$.