Understanding the Role of Eco-anxiety, Eco-grief, and Eco-guilt in Age-Related Pro-Environmental Behaviour: A Detailed Analysis in Germany and the Netherlands

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Abstract

Background: Prior studies observed that people can experience a variety of negative emotional responses like eco-anxiety, eco-grief, and eco-guilt due to climate change. Furthermore, these phenomena were found to influence the pro-environmental behaviour (PEB) of people. Moreover, age significantly influences these three concepts and PEB. This thesis focuses on the possible mediating role of eco-anxiety, eco-guilt, and eco-grief in the age-PEB relationship in the German and Dutch populations. **Methods:** This cross-sectional study used quantitative data-gathering methods in the form of an online survey. The EAQ-22, EGriQ-6, and EGuiQ-11 were applied to 85 participants to measure these concepts and the PEBS was used to measure the pro-environmental behaviour. **Results:** The findings indicated that a higher age of participants does not lead to a lower level of eco-anxiety ($p=.058$), eco-guilt ($p=.079$), and eco-grief ($p=.018$) and does not positively influence PEB ($p=.160$). Additionally, no effect for eco-anxiety ($p= .08$), eco-guilt ($p=.59$), and eco-grief ($p=.25$) on PEB was found in the sample. Furthermore, eco-anxiety, eco-guilt and eco-grief do not mediate the relationship between age and PEB ($p>.05$). However, results of the multiple mediation analysis revealed that eco-anxiety, eco-guilt, and eco-grief are positively correlated ($p<.001$) with changes in pro-environmental behaviour. **Conclusion:** In general, the multiple mediation model, which was proposed, was rejected, due to the non-significant relationships of the independent variable age with the dependent variables eco-anxiety, eco-guilt, eco-grief, and PEB. Nevertheless, the strong intercorrelation among the mediating variables and the small sample size of the study might have impacted their association with PEB and caused the observed contradictions in this relationship.

Contents

Introduction

Worldwide, a relentless surge in environmental catastrophes is being witnessed. With rising global surface temperatures, natural disasters e.g., floods, tornados, hurricanes, droughts, river desertification, glacier and forest loss, fires, and heat waves are becoming more and more frequent (Cianconi et al., 2020; WHO, 2022). Scientists agree that human activity, for instance, -burning fossil fuels, chopping down forests, or raising livestock, is to be blamed for the rapid increase of global warming (European Commission, n.d.). According to model simulations, -climate change in Germany will lead to considerably, more persistent and powerful heat waves (Zacharias et al., 2014). However, severe weather phenomena also show regional differences. As heat waves are more extreme and frequent in the south of Germany and Europe, conversely in the Netherlands, heavy floods pose the highest risk of climate change (Zacharias et al., 2014; Botzen et al., 2009). In recent years, environmental activists fought to make themselves heard. International "youth-led and -organized" movements like Fridays for Future, founded by Greta Thunberg have gained major attention from the public sphere. They advocate for climate action by exerting pressure on governments and industries, critiquing legislation, and calling upon leaders to heed scientists' recommendations, all while engaging in peaceful protests (Fridays for Future, 2021).

Furthermore, the Intergovernmental Panel on Climate Change (IPCC) stresses, that climate change not only poses a threat to the environment but also directly and indirectly causes serious mental health implications (IPCC, 2023). When talking about the direct impacts on mental health, one refers to the trauma that results from experiencing disasters caused by climate change. These significant life changes can cause post-traumatic stress disorder (PTSD), drug use disorders, depression, suicide ideation and anxiety (Léger-Goodes et al., 2022). Moreover, it can indirectly lead to negative consequences for the individual by affecting the physical and community welfare. The lack of food and water, violence and other indirect impacts on migration, economics, and social infrastructure have been connected to symptoms of stress, anxiety, grief, and depression (Léger-Goodes et al., 2022). Hayes et al. (2018) state, that there are also psychosocial consequences of climate change. They result

through being aware of climate change and know what devastating impact it has on the planet. It was shown that this also might adversely affect mental health. Furthermore, implications for the individual can be either short-term or long-term. In general, the way someone is affected depends not only on demographic factors (e.g., gender and age). Research has shown that socioeconomic factors, for instance, access to resources, information, and protection also play a role (Berry et al., 2009; Cianconi et al., 2020; WHO, 2022). Since psychological reactions to climate change can differ greatly from each other, a challenging task for clinicians is posed to diagnose these health issues (Cianconi et al., 2020). Nevertheless, several efforts have been made to describe these experiences in more detail. Ágoston et al. (2020a) introduced the concepts of ecological guilt, ecological grief, and climate anxiety. However, it is worth noting that some psychologists refrain from strictly pathologizing these behaviours, recognizing their potential for adaptive and beneficial functions. In fact, prior studies suggest that climate anxiety can induce people's ecological behaviour (Verplanken et al., 2020).

Pro-Environmental Behaviour

With the rapid onset of the climate crisis, society must act more sustainably, to counter global warming (Amen, 2008). In prior studies, various terms are used to label these behaviours. Concerning this subject, there is a widespread conversation regarding behaviour being green, sustainable, eco-friendly, and environmentally responsible (Han, 2015). In the remainder of this document, the term pro-environmental behaviour (PEB) will be used most often and shall cover alternative terms that are related to the same concept. In prior research, definitions of this term can vary largely from one another. Nevertheless, Kothe et al., (2019) describe PEB as actions taken by the people to either safeguard the environment or minimize any harm to it, to put it differently, acting in a way that is beneficial to the environment. In recent years, many studies and interventions have been aimed at finding out what evokes people's PEB (Owino, 2019; Markowitz et al, 2012). Besides, it is crucial to note that the environmental behaviour of the individual is greatly influenced by negative cognitive responses to climate change like emotional distress and anxiety about the future (Ágoston et al., 2022a; Gifford, 2014).

Eco-Anxiety, Eco-Guilt, and Eco-Grief

Due to climate change, people experience a wide range of emotional responses, such as depression, anxiety, and anger (Contreras et al., 2024). In 2022, Ágoston et al. developed new questionnaires to measure eco-anxiety, eco-guilt, and ecological grief, which she referred to as being ‘psychoterratic’. The term 'psychoterratic,' was coined by Albrecht in 2011 and encompasses a spectrum of mental health issues deriving from chronic stress which is induced by the degradation of ecosystems and destabilisation of home environments. These emotions are not isolated occurrences but rather integral aspects of the human response to the unprecedented challenges posed by human-made climate change and the potential dangers associated with an unpredictable future (Ágoston et al., 2022a). As mentioned before, the direct and indirect effects of climate change can have a detrimental impact on one's mental health. Moreover, the mere awareness of ongoing climate change can already lead to emotional distress, resulting in feelings of guilt, sadness, and anger (Léger-Goodes et al., 2022). When defining these terms, it is important to highlight that researchers may use the same term, such as "eco-anxiety," but might have different connotations or interpretations of what it encompasses (Pihkala, 2022). The term "eco-anxiety" is often used very broadly to refer to various kinds of anxieties and difficult emotions that arise from concerns about the ecological crisis (Pihkala, 2022). Furthermore, different words are used in the existing literature to refer to ecological anxiety, for instance, climate change- or environmental anxiety (Coffey et al., 2021). According to Léger-Goodes et al. (2022), feeling mildly anxious and emotional about climate change is a common reaction to a stressful situation, which is why, eco-anxiety is not yet seen as a pathological issue. Nevertheless, eco-anxiety can lead to severe mental health issues that impair the overall quality of life which in turn cause symptoms of depression and anxiety. Léger-Goodes et al., (2022) conclude that eco-anxiety can motivate people to act and make positive changes for the environment. This is in line with other research, stating that anxiety about the climate increases PEB (Innocenti, 2023). Furthermore, according to Kricorian (2022), eco-anxiety can spur people to act on climate change and adopt environmentally friendly habits. Nevertheless, several factors influencing this relationship are still unknown and must be examined further. Apart from

eco-anxiety, the term eco-guilt refers to the feeling which is experienced when an individual notices that they broke their own or societal norms regarding ecology (Ágoston et al., 2022b). Notably, Mallett et al. (2013) state that people with higher eco-guilt also were in higher support for a pro-environmental group. Next, Cunsolo and Ellis (2018) predict that eco-grief to become more frequent in society as the adverse effects of climate change intensify. Eco-grief is defined as the individual's reaction to the present or future destruction of one's physical surroundings and is often accompanied by the feeling of identity loss (Cunsolo & Ellis, 2018). Additionally, Nambiar and Singh (2023) found evidence that eco-guilt and eco-grief can influence PEB among adolescents. Furthermore, results by Yang et al. (2023) demonstrate that people actively engage in PEB to lower their eco-guilt. Similar findings showed that eco-grief positively correlates with PEB because people tend to have more knowledge about climate change and societal expectations (Nambiar & Singh, 2023). Taking the concepts of eco-anxiety, eco-guilt and eco-grief into consideration, strong emotions can indeed drive PEB. However, as aforementioned, many factors that are affecting eco-anxiety, eco-guilt, and eco-grief are still unknown. Moreover, prior research indicates that age influences eco-anxiety, eco-grief, and eco-guilt substantially (Léger-Goodes et al. 2022). Nevertheless, the literature lacks knowledge about the specific role that age plays in these concepts and the impact they may have on PEB.

Age as a Factor

In recent years, the research on eco-anxiety, eco-guilt, and eco-grief has developed further. Unfortunately, there is still a lack of understanding of how young people experience climate change (Léger-Goodes et al., 2022). In general, young people are at higher risk of having poor mental well-being due to climate change (Fatima, 2022). Nowadays, children are growing up with alarming news about climate change and the climate crisis. McMichael (2014) states that this can lead to more worry and concern in general. Additionally, Brophy et al. (2022) state that younger people experience higher levels of eco-anxiety because they are more affected by the adverse effects the climate crisis entails. Furthermore, Léger-Goodes et al., (2022) state that young people are highly affected by the climate crisis and immensely struggle with the negative mental responses to climate change. Gislason et al., (2021) are in

support of this argument and highlight the vast levels of worry and eco-anxiety that younger people experience due to climate change. In general, research supplies only a limited scope on the influence of age on eco-anxiety, eco-grief, and eco-guilt. However, several findings suggest that age is a key factor influencing mental health affectations caused by climate change (Kurisu, 2015; Léger-Goodes et al. 2022).

Furthermore, age has been found to play a significant role in shaping pro-environmental behaviour (Wang et al., 2021). This is in line with several other studies, suggesting that age positively influences PEB (Grønhøj & Thøgersen, 2009; Otto & Kaiser, 2014; Shen and Saijo, 2008). Wang et al. (2021) state that older individuals are more likely to engage in eco-friendly actions, and countries with more elderly populations tend to promote sustainability. Studies have shown that in Europe, while young people express more worry about the climate, their engagement in PEB tends to be notably less in comparison to older people (Grønhøj & Thøgersen, 2009). These findings are in line with a study conducted in the US that shows that young people score higher on environmental attitudes but are considerately less inclined toward PEB (Johnson et al., 2004). This age-behaviour link can be explained not only through the process of ageing but also through learning. Kurisu (2015) found that there are three influences on age, namely ageing, cohort and period. Ageing is seen as the changing mindset of people when they become older while cohort is about the influence of the year someone is born. Combining both aspects is then called a period (Kurisu, 2015). Therefore, it is common for different age groups to have varying perspectives, experiences, and behaviours, especially concerning complex topics like climate change and environmental issues.

Previous Research

In recent years, progress has been made in comprehending the relationship between age, climate-induced mental health implications, and pro-environmental behaviour. Prior studies suggest that young people and adolescents are more likely to experience heightened levels of eco-anxiety, eco-guilt, and eco-grief (Brophy, 2022; Aruta, 2022). However, further research must be done investigating the complex relationship between age and eco-anxiety, eco-guilt and eco-grief. Moreover, research shows that older people perform more PEB which

indicates a positive relationship between age and PEB (Wang, 2021). Taking the aforementioned into account, this study aims to investigate which role age has in the relationship with eco-anxiety, eco-guilt, eco-grief, and PEB.

Furthermore, in recent research, the concepts of eco-anxiety, eco-grief, and eco-guilt were explored especially in the light of PEB. It is often proposed that higher levels of these emotional responses to climate change can lead to environmental behaviour (Ágoston et al., 2022b). In general, there is still little knowledge about the possible mediating roles of these concepts.

Current Study

The current study adds to the general understanding of the concepts of eco-anxiety, eco-guilt and eco-grief. It builds upon the work of Ágoston et al., (2022a) who thoroughly investigated these phenomena. As there is little understanding so far, this research dives deeper into the possible mediating role of eco-anxiety, eco-guilt and eco-grief. Within this framework, age is considered a critical individual factor, shaping these three concepts and PEB. Additionally, the mentioned mental health affectations also influence PEB. Therefore, this leads to the research question *'Is the relationship between age and pro-environmental behaviour mediated by eco-anxiety, eco-guilt, and ecological grief in the German and Dutch populations?'*. As a result, it will be hypothesised:

> *H_1: There is a significant positive relationship between age and pro-environmental behaviour in the German and Dutch populations.*
>
> *H_2: There is a significant negative relationship between age and eco-anxiety, eco-guilt, and ecological grief in the German and Dutch populations.*
>
> *H_3: There is a significant positive relationship between eco-anxiety, eco-guilt, ecological grief and pro-environmental behaviour in the German and Dutch populations.*
>
> *H_4: Eco-anxiety, eco-guilt, and ecological grief mediate the relationship between age and pro-environmental behaviour in the German and Dutch populations.*

Methods

In this segment, our study's methodology will be presented, and the obtained results will be described.

Design

To guarantee the comprehensiveness of the report and provide a better overview, the study includes the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) checklist for cross-sectional studies (see Appendix A). Furthermore, a cross-sectional study in the form of an online survey was conducted, to investigate the relationship between eco-anxiety, eco-guilt, and eco-grief and the effect on the age-PEB relationship. The survey aimed to explore the independent variable age and its influence on the dependent variable PEB. Specifically, the variables eco-anxiety, eco-guilt, and eco-grief were considered dependent on age. Simultaneously, they were also examined as independent variables of PEB when acting as mediators in the age-PEB relationship.

Sampling procedure

Participants were gathered through snowball sampling and convenience sampling. An advertisement for the online questionnaire was created and then posted on various social media platforms. The questionnaires as well as the advertisement were both available in Dutch and German (see Appendix B). The advertisement showed a short description of the study with the appeal to participate. Furthermore, a QR Code was used to simplify the process. The written advertisements sent into chat groups can be seen in Appendix C. The researchers distributed the survey through the platforms and asked family and friends to forward the advertisement. For students who want to obtain SONA points, a specific link allows them to access the survey through the SONA system. After scanning the QR Code or following the link, they reached the introduction page of the survey.

Procedure

At first, a GPower analysis was conducted to find out the sample size the study should meet (see Appendix D). After careful evaluation of the questionnaires that should be used, the next step included the translation of the different questionnaires (EAQ-22, EGriQ-6,

EGuiQ-11, and PEBS). First, the researchers independently translated the scales with the help of online translation tools (DeepL) and then they were revised by different native speakers. After the translation procedure, a German and Dutch version of the survey was created in Qualtrics. The survey was checked several times before they were distributed online. At the beginning of each survey, the participants were asked to read the information about the nature and purpose of the study (see Appendix E), and the informed consent form (see Appendix F). After they finished reading, they were asked to tick all boxes to comply with the terms and conditions. Moreover, they were provided with the contact details of the researchers involved in the study. They then had to fill out some personal information including age, gender, country of residence, and their highest achieved educational degree. To avoid any harm to the participants, everybody who ticked boxes that fell into our exclusion criteria was automatically skipped to the end of the questionnaire where they were provided with a suicide prevention number. Participants fell into the exclusion criteria if they matched with the following: age above 65 or beneath 18 years, current treatment of mental disorder, suicide attempt within the last two years, residing in another country (apart from Germany and the Netherlands). Inclusion criteria were residing in Germany or the Netherlands and being 18 to 65 years old. Participants who were in line with the inclusion criteria were asked to fill out five different questionnaires that were presented to them. When they had completed the questionnaires, they were asked whether they wanted to receive further information and contacted again by the researchers after three and six months. In this case, they were asked to fill out their email address.

Materials

The survey included five different questionnaires: the Eco-Anxiety Questionnaire, the Eco-Guilt Questionnaire, the Eco-Grief Questionnaire, the Pro-Environmental Behavior Scale, and The Climate Paralysis Scale. The Climate Paralysis Scale is not relevant to this thesis. On all scales discussed, a high score indicates a high level of Eco Anxiety, Eco Guilt, Eco Grief or PEB, respectively.

Eco-Anxiety Questionnaire. The Eco-Anxiety Questionnaire (EAQ-22) is a 4-point Likert scale that ranges from “strongly disagree” to “strongly agree”. This 22-item questionnaire is

used to measure the level of ecological anxiety of an individual and was created by Ágoston et al., (2022b). To illustrate, participants should rate on the scale, how much they agree with the sentence “I am so anxious about climate change that I cry”.

Eco-Guilt Questionnaire. The Eco-Guilt Questionnaire (EGuiQ-11) is designed to measure individual levels of ecological guilt and was developed by Ágoston et al., in 2022 (b). This 11-item questionnaire uses a 4-point Likert scale, ranging from “strongly disagree” to “strongly agree”, allowing respondents to express their degrees of guilt about environmental concerns. One statement that participants had to evaluate was “I often feel like a hypocrite when it comes to environmental action”. The EGuiQ-11 encompasses a single factor structure which was found to have excellent internal consistency (Cronbach’s alpha = 0.76).

Eco-Grief Questionnaire. The Eco-Grief Questionnaire (EGriQ-6) consists of 6 different items to measure ecological grief. It was created by Ágoston et al., (2022b) and ranges from “strongly disagree” to “strongly agree”. In the EGriQ-6 statements like “The wildlife around me has changed in a disturbing way.” were provided to evaluate their level of eco-grief. Furthermore, it is answered on a 4-point Likert Scale. Its single-factor structure has been shown to have excellent internal consistency (Cronbach’s alpha = 0.70).

Pro-Environmental Behavior Scale. The Pro-Environmental Behavior Scale (PEBS) is a scale to measure behaviours that were identified as having the most significant effect on our environment. It was developed by Markle in 2013, consists of 19 items and shows internal consistency for the full scale (Cronbach’s alpha = .86). The items were answered on Likert scales ranging from two values “no” and “yes” to five values “never” to “constantly” or “always”. The PEBS was made up of four different subscales, namely, conservation, environmental citizenship, food, and transportation. To exemplify, a question regarding conservation was: “How often do you turn off the lights when leaving a room?” and regarding environmental citizenship was: “How often do you talk to others about their environmental behavior?”. The full scale shows significant intercorrelations among the four subscales with coefficient alphas ranging from .62 to .74 and therefore meets the requirement for consistency and interrelations among subscales.

Data Analysis

The software RStudio (RStudio 2023.09.1 +494) was used to analyse the data. After importing the dataset in CSV file format and setting the working directory, all necessary packages were installed and loaded. In general, the packages “tidyverse”, “dplyr”, “knitr”, “ggplot2”, “psych”, “lavaan” and “mediation” were used. The next step involved eliminating all variables unrelated to the paper’s focus, for instance, participants who did not finish the survey or had progress beneath a value of 100. Furthermore, data that may identify the individual were excluded, namely the start and end date, status, IP address, duration in seconds, recorded date, response ID, location longitude, and preview distribution channel. Columns that showed NA, e.g., the last and first name or email address of the recipient were also eliminated. Additionally, the Eco-Paralysis Scale was excluded from the data set.

The results for all key variables were first presented as raw scores. Therefore, all the variables that were in character format were converted to numeric depending on the variable type. For instance, the variable “strongly disagree” of the EAQ-22 was coined as numeric factor 1 and “strongly agree” as numeric factor 4. The same was done with the EGriQ-6 and EGuiQ-11. The different subscales of the PEBS could be answered with two values (“no” and “yes”) and items with five values. Raw scores for the two values were then aligned with the numeric scores 1 and 5 to balance the results. Then, the different items of the subscales “Conservation”, “Environmental citizenship”, “Food”, and “Transportation” were grouped into a new variable and mean scores were calculated. The same was done for the items of the EAQ-22, EGriQ-6, and EGuiQ-11 which were grouped into three new variables. The procedure was repeated with the Dutch version of the survey, and the results were then merged into one dataset that comprehends all scores of the EAQ-22, EGriQ-6, EGuiQ-11 and PEBS of both nationalities. For the demographic variables of both nationalities, a separate table was created.

Subsequently, the descriptive statistics were analysed. The Mean (M) score and Standard Deviation (SD) were computed for age, EAQ-22, EGriQ-6, EGuiQ-11 and PEBS. Other demographic data, namely gender, country of residence, and education level were then

analysed and evaluated. The resulting four new variables were then checked for normality, linearity, independence, and homoscedasticity.

H1: Firstly, the result of the correlation matrix was used to test the first hypothesis, to put precisely, if the independent variable age has a significant positive influence on the dependent variable pro-environmental behaviour.

H2: To answer the second hypothesis, the correlations were inspected to see if there is a significant negative relationship between age and eco-anxiety, eco-guilt, and eco-grief in the German and Dutch populations with age as the independent variable and eco-anxiety, eco-guilt, and eco-grief as the dependent variable.

H3: Furthermore, a multiple regression analysis was used to test if there is a significant positive relationship between eco-anxiety, eco-guilt, and eco-grief and pro-environmental behaviour in the German and Dutch populations with eco-anxiety, eco-guilt, and eco-grief as the independent variable and pro-environmental behaviour as the dependent variable.

H4: Lastly, a multiple mediation analysis was conducted to test whether eco-anxiety, eco-grief, and eco-guilt mediate the relationship between age and PEB.

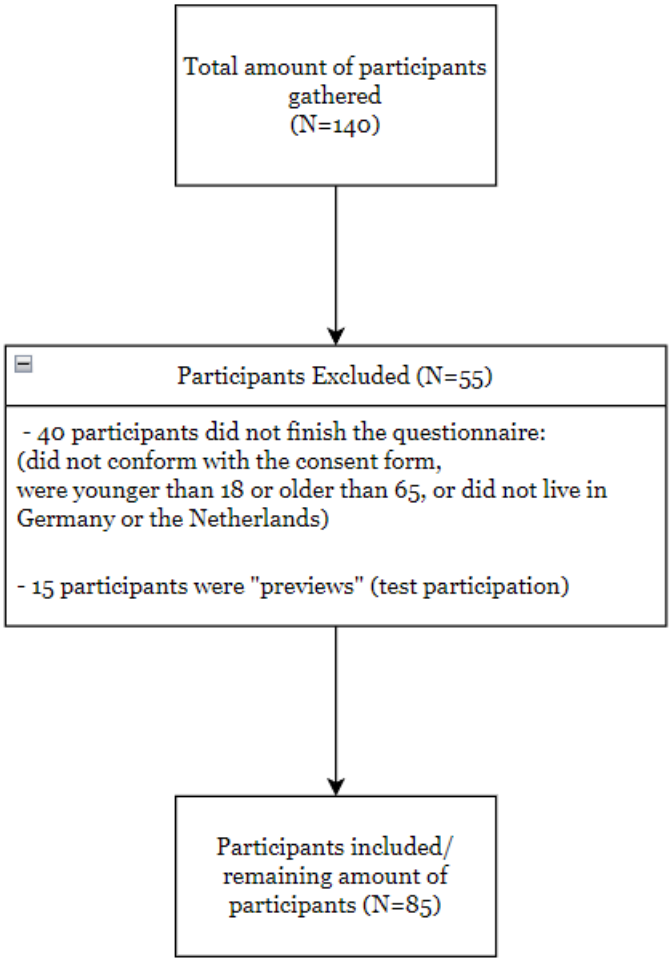
Results

Demographics

The analysis of the German language survey showed that out of 108 participants, 31 (28.7%) were excluded because they either did not complete the survey or did not conform to the inclusion criteria (see Figure 1). This was seen by a progress score beneath 100, as the online survey was designed in a way that skipped every participant who did not conform with the inclusion criteria or fell into an exclusion criterion to the end of the survey. After eliminating 4 (3.7%) test previews, the German sample consisted of 73(67.6%) participants. The same was done in the Dutch survey, where originally 32 people participated. From these observations, 9 (28.1%) were excluded due to a progress score beneath 100, and 11 (34.4%) were test previews. Therefore, the 12 (34.3%) participants that remained in the Dutch sample, lead to an overall sample size of 85 participants. The mean age of participants was 31.75 with an SD = 13.40 and ranged between 18 and 63 years.

Figure 1

Diagram with the Elimination Process of the Participants



In general, there were 30 (35.3%) male participants, and 55 (64.7%) female participants, of whom only 17 (20%) wanted to get SONA credits for their participation. Furthermore, 73 (84%) German and 12 (16%) Dutch participants were present in the sample. Regarding the education levels of the participants, 25 (29.4%) participants had Abitur (final examination of secondary education in Germany), and 25 (29.4%) had a bachelor's degree. Also, 11 participants (12.9%) had Fachabitur (German examination usually after grade 12) and 18 (21.2%) participants had a master's degree. Only one (1.2%) person had less than an educational degree and 5 (5.9%) people had other educational degrees.

Linear Assumption Testing

Next, the linear assumptions are checked, and all Figures and outputs can be viewed in the Appendix. When checking for normality in the multiple regression analysis and the multiple mediation model, Q-Q plots were used (see Appendix G). It appears that most points follow a straight line and therefore support normality. However, there are also some outliers displayed in the plot and based on the Shapiro-Wilk test, normality is slightly violated ($p>.05$). Moreover, the results of the Breusch-Pagan test indicated that there is no violation of homoscedasticity (see Appendix H). Furthermore, when checking for linearity (see Appendix I), the pattern of points suggests linearity between the fitted values and residuals in both models. Furthermore, the results of the VIF (see Appendix J) indicate that multicollinearity was not seen to be a significant concern in this model. The Durbin-Watson test was conducted to assess if serial correlation occurred in the residuals of the mediation model (see Appendix K), and it was found that independence was given.

Descriptive Statistics

The EAQ-22 had an $M = 2.56$ with an $SD = 0.53$, which means a moderate level of eco-anxiety among the participants. The scores ranged from 1.05 to 3.55. The EGuiQ-66 had a mean of 2.44 ($SD = .72$), ranging from 1.00 to 3.91, indicating a moderate level of ecological guilt among participants. The EGriQ-6 showed a mean score of 2.49 ($SD = .64$) with a range between 1.00 and 3.67. The PEBS showed a mean of 3.34 ($SD = .69$), ranging from 1.73 to 4.61. This indicates a high level of pro-environmental behaviour.

Correlations

As displayed in Table 2, EAQ-22 and EGuiQ-66 show a strong positive correlation (.68) indicating a significant relationship. Furthermore, EAQ-22 and EGriQ-6 have the strongest positive relationship (.76). A moderate positive correlation was found between EGriQ-6 and the PEBS (.37), and EAQ-22 and the PEBS (.40). Age and PEBS have been found to have only a weak positive relationship (.16). In general, no negative correlation has been found.

Table 2

Correlation Matrix of Variables

	SD	min	max	age	EAQ-22	EGuiQ-11	EGriQ-6	PEBS
age	13.399	18	63	-	.058	.079	.018	.160
EAQ-22	.527	1.045	3.545		-	.676**	.757**	.397**
EGuiQ-11	.718	1.000	3.909			-	.570**	.238*
EGriQ-6	.642	1.000	3.667				-	.373**
PEBS	.695	1.732	4.607					-

Note. EAQ-22=Eco-Anxiety Questionnaire, EGuiQ-11 = Eco-Guilt Questionnaire, EGriQ-6 = Eco-Grief Questionnaire, PEBS = Pro-Environmental Behaviour Scale

*p<.05. **p<.001.

Hypothesis 1

To test the first hypothesis, the correlation matrix (Table 2) shows that age is not significantly correlated with PEBS (p=.160). This leads to the conclusion that there is no strong evidence for age to positively influence PEB in our sample. Therefore, the first hypothesis can be rejected.

Hypothesis 2

Furthermore, the output of calculating the correlations between each variable shows that the independent variable age is not significantly correlated with EAQ-22 (p = .058). Additionally, age has been found to not have a significant effect on EGriQ-6 (p = .018) and EGuiQ-11 (p = .079). Since age does not significantly predict either EAQ-22, EGuiQ-11 or EGriQ-6, the second hypothesis is rejected.

Hypothesis 3

Furthermore, a multiple regression analysis was conducted to examine the influence of EAQ-22, EGriQ-6 and EGuiQ-11 on PEB (see Table 3). In general, the model demonstrated a significant overall fit, F (3, 81) = 5.65, p = .0014, indicating that a significant proportion of the variance in PEB can be explained by the predictors. EAQ-22 demonstrated a non-significant effect (β = .41, t (81) = 1.8, p = .075). EGriQ-6 (β = .19, t (81) = 1.15, p = .25) and EGuiQ-11 (β

= -.07, t (81) = -.55, p = .585) were not significant. In summary, no significant effect was found, and therefore the third hypothesis can be rejected.

Table 3

Results of the Multiple Regression Model of Hypothesis 3

Effect	β	SE	p
Intercept	1.970	.349	<.001**
EAQ-22	.413	.230	.080
EGriQ-6	.194	.169	.253
EGuiQ-11	-.073	.134	.585

***p*<.001. **p*<.05.

Hypothesis 4

Lastly, multiple mediation analysis was used to examine the relationships between age, EAQ-22, EGriQ-6, EGuiQ-11 and PEBS. In the analysis, a maximum likelihood (ML) estimation method was used. The model's overall fit indicated a non-significant result (R^2 = .325, F(2, 85) = .735, p = .692). Next, the regression coefficients for the direct (Table 4) and indirect effects are presented (Table 5).

Table 4

Regression Coefficients for Direct Effects

Variable	*β*	*SE*	*z*	*p*
Age on PEBS	.008	.006	1.504	.133
EAQ-22 on PEBS	-.000	.004	-.112	.911
EGriQ-6 on PEBS	-.000	.004	-.112	.911
EGuiQ-11 on PEBS	-.000	.004	-.112	.911

Table 5

Regression Coefficients for Indirect Effects

Variable	*β*	*SE*	*z*	*p*
EAQ-22 through PEBS	.302	.076	3.957	<.001**
EGriQ-6 through PEBS	.346	.094	3.689	<.001**
EGuiQ-11 through PEBS	.247	.110	2.257	<.024*

*p<.05. **p<.001.

No significant direct relationship between age and PEBS was observed (β = .008, SE = .006, p = .133). Coefficients for the direct effect of PEBS on EAQ-22, EGriQ-6, and EGuiQ-11 were shown to be significant, indicating that a higher value of PEBS is associated with a higher value of EAQ-22 (β = .302, p = .001), EGriQ-6 (β =.346, p=.001), EGuiQ-11 (β =.247, p=.024). As seen in Table 6, the insignificant coefficients indicate that age has no indirect effect on the PEBS via the variables: EAQ-22, EGuiQ-11, EGriQ-6 (EAQ-22: β =-0.000, SE = 0.004, p = 0.911; EGriQ-6: -0.000, SE = β =0.004, p = 0.911; EGuiQ-11: β =-0.000, SE = 0.004, p = 0.911).

Table 6

Results of Defined Parameters

Defined Parameters	*β*	*SE*	*z*	*p*
ab1	-.001	.001	-.111	.911
ab2	-.001	.001	-.111	.911
ab3	-.001	.001	-.111	.912
total	.008	.007	1.206	.228

To assess possible total and specific indirect effects, covariances (Table 7) and variances (Table 8) of the variables were observed. The covariances indicate that all mediating variables are positively and significantly intercorrelated with each other. Additionally, the variances imply that the variables EAQ-22, EGriQ-6, and EGuiQ-11 are positively correlated with changes in the PEBS.

Table 7

Covariances between Variables

Variable Pair	*β*	*SE*	*z*	*p*
EAQ-22 ~~ EGriQ-6	.203	.038	5.361	<.001**
EAQ-22 ~~ EGuiQ-11	.217	.043	5.041	<.001**
EGriQ-6 ~~ EGuiQ-11	.219	.050	4.346	<.001**

*p<.05. **p<.001.

Table 8

Variances of Variables

Variable	*β*	*SE*	*z*	*p*
PEBS	.465	.071	6.519	<.001**
EAQ-22	.231	.035	6.519	<.001**
EGriQ-6	.350	.054	6.519	<.001**
EGuiQ-11	.480	.074	6.519	<.001**

*p<.05. **p<.001.

However, considering the results of the multiple mediation model in addition to the rejection of the first, second and third hypothesis, the fourth hypothesis stating that eco-anxiety, eco-grief, and eco-guilt mediate the relationship between age and PEB can be rejected.

Discussion

The report investigated the relationship between age and PEB and whether this relationship is mediated through eco-anxiety, eco-grief, and eco-guilt. In general, it was found that they do not act as mediating variables. The analysis of the results revealed that age alone did not significantly predict PEB. Also, the mediators did not have any influence or explain the relationship between age and PEB. Moreover, the variable age did not show predictive power for the three mediators' eco-anxiety, eco-grief, and eco-guilt. In accordance with existing research, the mediators were highly correlated with each other and had great internal consistency (Ágoston et al., 2022b). Considering the effect of the mediators on the PEB of participants, eco-anxiety was only marginally significant, showing a slightly higher effect on

PEB than eco-grief and eco-guilt. The latter showed only modest effects on PEB. In summary, no evidence has been found to confirm the proposed multiple mediation model.

As aforementioned, the originally anticipated positive relationship between the age of participants and the level of PEB could not be observed in the study. These results are in line with some results of prior research, that show that age can have contradicting relationships with PEB (Kurisu, 2015). A motive for the non-significant results that were obtained might be due to generational differences, that influence this relationship. A study published in 2018 (Johnson & Schwadel) investigated the relationship between age, cohort, and their support for the environment. The authors argued that due to the experience of similar socialization processes, representatives of one generation fundamentally differ from other generations, resulting in behavioural patterns that are unique to a specific generation. Prior research found that generational cohorts also influence how an individual performs PEB. This is evidenced by a study by Cline (2020), which shows that the generation of Baby Boomers is in stronger support of recycling behaviour whilst representatives of Gen X and Millennials are more inclined toward PEBs concerning travelling and food. Furthermore, research by Kim et al. (2016) examined the PEB of employees in a hospital setting and found that generational differences played a moderating role in their PEB.

Furthermore, some prior research investigating the age relationship found that age is not correlated with eco-anxiety, eco-guilt, and eco-grief (Ágoston et al., 2022b). In the study of Ágoston et al. (2022b), the correlation between age, eco-anxiety, and eco-guilt was low and there was no correlation with eco-grief. Arguably, generational differences might also play a confounding role in this case and lead to the insignificant results of this research. As mentioned before, the experiences one generation makes in a specific time and place can shape specific attitudes and behaviours of this generation. To illustrate, Wullenkord and Ojala (2023) state that young adults in 2019/2020 were more influenced by the climate crisis than adolescents of the same age ten years earlier, leading the adults in 2019/2010 to experience higher ecological worry than the previous generation. Therefore, generational differences might also influence mental health implications that emerge due to the climate crisis, for instance, eco-anxiety, eco-guilt, and eco-grief.

Moreover, when testing for the third hypothesis, the results of the multiple regression analysis indicate that the level of eco-anxiety, eco-grief, and eco-guilt does not significantly influence the PEB of participants. However, the results of the multiple mediation analysis indicate that eco-anxiety, eco-guilt, and eco-grief do indeed influence the PEB of participants. This seems contradicting to the results of the multiple regression analysis which is not in favour of a significant relationship. However, the high correlations among the variables indicate that EAQ-6, EGriQ-11, and EGuiQ-6 might be too strongly correlated with each other. Therefore, each variable explains the same part of PEBS. The inability of either eco-anxiety, eco-guilt, or eco-grief to measure a unique facet of PEB could explain why there is a significant correlation between all the variables, but no significant observed effect in the multiple regression analysis.

Furthermore, some previous studies that investigated this relationship also found no direct relationship between eco-anxiety and PEB (Mathers-Jones & Todd, 2023; Clayton & Karazsia, 2020). Mathers-Jones & Todd (2023) state that the cognitive factor of attentional bias might influence the relationship between eco-anxiety and PEB. Attentional bias is described as the proneness of individuals to pay more attention to stimuli posing a threat than other stimuli (Azriel and Bar-Haim; 2020). Very anxious individuals are often seen to have a more negative attentional bias, which can determine if the individual shows adaptive or maladaptive behaviour to climate change. As Mathers-Jones & Todd (2023) state, prior research has shown that the relationship between eco-anxiety and PEB might be influenced by the attention towards climate-related information. In essence, eco-anxiety might foster a negative attentional bias which leads to maladaptive responses to climate change rather than PEB. Nevertheless, additional factors that influence the attentional bias of individuals is still unclear and further research in this field should be conducted. Furthermore, a study by Innocenti et al. (2023) observed that eco-anxiety either fosters PEB or reduces engagement in environmental action. This relationship is mediated by the general self-efficacy of the individual. Individuals with the feeling of being able to make a positive impact on climate change, cope with their anxiety through engaging in PEB, whereas eco-anxiety triggers

negative thoughts and worries in people that show low self-efficacy and that could further lead to climate paralysis (Innocenti et al., 2023).

Limitations & Strengths

The study has several limitations that affect the validity and reliability of the findings. The highlighted limitations might have contributed to many of the non-significant outcomes that were obtained.

Firstly, a combination of snowball and convenience sampling was used to gather participants for the survey. Since these methods are non-random, biases in the selection procedure can occur, which affects the study's validity and reliability. For instance, because the participants were gathered through social media networks, the sample probably shares similar beliefs and characteristics, representing specific perspectives more than others. These factors play an important role in the generalizability of the study and result in a sample population not adequately representing the target population.

Furthermore, the study did not integrate generational or cohort differences in the analysis. As aforementioned, differences in the generations could highly influence the PEB, eco-anxiety, eco-guilt, and eco-grief. As the study did not target specific generations in the data-gathering procedure, the remaining sample was unevenly distributed regarding age. Therefore, there was no possibility to adequately compare one generation to another or to investigate how generations differ in PEB, eco-anxiety, and eco-guilt. or eco-grief. Moreover, this limitation might also account for the non-significance found in the relationship age has with the concepts: of eco-anxiety, eco-guilt, and eco-grief.

After that, the elimination procedure led to a final sample size of 85 participants, which is beneath the calculated (Gpower) minimum sample size of 120 participants to ensure the reliability of the data. Also, taking a closer look at the demographic data, most factors are not evenly distributed. Additionally, the distribution of both nationalities was unbalanced (84% German, 16% Dutch) which makes the sample population susceptible to biased results due to cultural and regional differences. Furthermore, the final sample showed only a limited representation of certain educational levels, making the findings more difficult to generalize to the population.

Next, the study design contains further limitations regarding the self-report data, which is often associated with surveys. In general, participants may answer the questions according to what they perceive to be socially acceptable rather than their actual attitudes or behaviours. Questions about PEB may be especially prone to social desirability bias since the topic is attached to societal norms and discourse. Other biases that occur in this kind of self-report data are cognitive biases where individuals have different interpretations of the same questionnaires. In addition, some of the questionnaires were translated from English to German and Dutch. Therefore, translation errors may have occurred which could lead to the misconceptions about certain questions.

A main limitation of the study was that only a few questionnaires were implemented to understand the impact of climate change on mental health. Other concepts and phenomena which are closely tied to eco-anxiety, eco-grief, and eco-guilt were not included, which makes it difficult to understand the complexity of the topic. The same applies to PEB, as measuring the actual PEB of participants solely through quantitative data-gathering methods like surveys might lead to only one dimension of PEB being examined.

After describing the study's limitations, the strengths should be considered as well. In general, the report deals with the challenge of climate change and more specifically, how climate change is shaping the mental health of people of various ages, educational backgrounds, and genders. In line with the ongoing climate crisis, the study contributes to a better understanding of mental health affectations caused by climate change, which can be regarded as highly important given the urgency of this topic. Furthermore, the study addresses eco-anxiety, eco-grief, and eco-guilt, which are considered to have only a small amount of existing research (Ágoston et al., 2022a). In comparison to prior research that has been done in this field, these concepts were measured as mediating the age-PEB relationship. The current investigation did not show significant findings for a relationship between age and PEB, nor could it be explained by a mediating role of eco-anxiety, eco-guilt, and eco-grief. However, this study offers valuable starting points for future research to explore the topic of mental health affectations caused by climate change. Moreover, this study found high

correlations and internal consistency among the variables eco-anxiety, eco-grief, and eco-guilt which is crucial for the validity and conceptualization of these questionnaires.

Implications for Future Research

This research focussed on the relationship between age and PEB and further investigated the possible mediating role of eco-anxiety, eco-grief, and eco-guilt. In future research, these complex variables could be measured more accurately using other data-gathering methods, for instance, experience sampling. This way, real-time data can be collected providing a broader assessment of the PEBs and psychological affectations. Moreover, it can minimize self-report bias and allow us to explore better individual differences and contextual factors influencing PEB, eco-anxiety, eco-grief, and eco-guilt. Furthermore, implementing qualitative methods like interviews or open questions would lead to a better understanding of the different concepts and how the individual's mental health is affected by climate change. Moreover, a more extensive study sample with a more even distribution is needed to enhance the statistical power of the study and increase generalizability. The combination of a larger study sample with experience sampling methods might give a better understanding and more accurate results about the relationships of PEB, eco-anxiety, eco-grief, and eco-guilt.

Apart from other data-gathering methods and a larger study sample, future implications may incorporate wider cultural and educational backgrounds. In the current study, only German and Dutch nationalities were considered. In future studies, the implementation of different cultures or nationalities in the study sample could give deeper insights into cultural variations of PEB or eco-anxiety, eco-guilt, and eco-grief. Additionally, it would be interesting to see if and how different educational backgrounds respond to the study. In general, this would mean that future studies should be conducted on a larger scale, leading to better generalizability of the results.

Next, future studies might explore and incorporate generational differences of their participants. Since each generation differs from the other regarding attitudes and behaviours, future studies might consider not only a linear view of age as a variable but also take differences between generations into account. Therefore, the data-gathering methods should

be carefully evaluated so that the sample size contains an equal distribution of several generations. This would make it easier to control for intergenerational differences.

Furthermore, besides eco-anxiety, eco-grief, and eco-guilt other aspects could be investigated to discover new concepts, possible mediators or moderating variables that influence the relationship between age and PEB. This new line of research may play an important role in tackling the climate crisis. Other fields of research that would be interesting to study are, besides cultural differences, the role of social norms. Investigating the role that perceived social norms play in the individual PEB or communities and how they shape the environmental action of the individual depending on the age could also help establish future interventions. Moreover, it would be important to study attention bias as a confounding factor influencing the relationship between Eco Anxiety and PEB to find out more about the mental health affectations that are caused by climate change.

Conclusion

This study was conducted to examine mental health affectations caused by climate change and how age and PEB affect these aspects in the German and Dutch populations. To answer the research question, four different hypotheses were assumed which were subsequently examined with the evaluated data. The analysis revealed that eco-anxiety, eco-grief, and eco-guilt do not mediate the relationship between age and PEB. Furthermore, there was no significant positive relationship between age and PEB and no significant relationship between age and eco-anxiety, eco-grief, and eco-guilt. Moreover, eco-anxiety, eco-guilt and eco-grief do not show a significant positive influence on PEB as suggested in the hypothesis. The biggest limitation of the study was the small sample size which led to rather unreliable findings. Nonetheless, it also incorporated several strengths, for instance, the concepts of eco-anxiety, eco-grief, and eco-guilt were measured as mediating variables. Furthermore, this research gives insights into the concepts of eco-anxiety, eco-grief, eco-guilt, and PEB and how the factor of age interacts with these phenomena. In conclusion, eco-anxiety, eco-guilt, and eco-grief do not mediate the relationship between age and pro-environmental behaviour in the German and Dutch populations. Future studies should further investigate this relationship as climate change poses an ever-growing threat to humanity.

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Appendices

Appendix A

STROBE

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-8
Objectives	3	State specific objectives, including any prespecified hypotheses	9
Methods			

Study design	4	Present key elements of study design early in the paper	9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	10-11
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	10-13
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	13
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods	13

		if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	15
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	13-14
		(*b*) Describe any methods used to examine subgroups and interactions	13-14
		(*c*) Explain how missing data were addressed	13-14
		(*d*) If applicable, describe analytical	13-14

		methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	13-14
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	15-16
		(b) Give reasons for non-participation at each stage	15-16
		(c) Consider use of a flow diagram	16
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	15

		(b) Indicate number of participants with missing data for each variable of interest	15
Outcome data	15*	Report numbers of outcome events or summary measures	15-17
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	18-21
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	21
Discussion			
Key results	18	Summarise key results with reference to study objectives	21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	24
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	26
Generalisability	21	Discuss the generalisability	25

		(external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Appendix B

Advertisements for Social Media Platforms

Appendix C

Written Advertisements for Spread via WhatsApp

German Version

Gemeinsam für eine grünere Zukunft! 🌍

Im Rahmen der Bachelorarbeit des Psychologiestudiums an der University of Twente untersuchen wir den Einfluss von Alter und Geschlecht auf die mentale Gesundheit und damit zusammenhängenden Verhaltensmustern.

Hilf uns dabei, die psychologischen Auswirkungen des Klimawandels besser zu verstehen und werde Teil unserer Studie! 🌱

Teilnahmebedingungen

- Alter: 18-65 Jahre
- Wohnsitz: Deutschland oder Niederlande

Es würde uns sehr helfen, wenn du diese Nachricht mit Familie und Freunden teilen würdest.

Danke für deinen Beitrag! 🌿

Zur Umfrage

https://utwentebs.eu.qualtrics.com/jfe/form/SV_9t0kgF7hdyW9jls

Dutch Version

Samen voor een groenere toekomst! 🌍

Als onderdeel van de bachelorscriptie van de opleiding psychologie aan de Universiteit Twente onderzoeken we de invloed van leeftijd en geslacht op mentale gezondheid en gerelateerde gedragspatronen.

Help ons de psychologische effecten van klimaatverandering beter te begrijpen en neem deel aan ons onderzoek! 🌱

Voorwaarden voor deelname

- Leeftijd: 18-65 jaar

- Woonplaats: Duitsland of Nederland

Het zou ons heel erg helpen als je dit kan delen met vrienden en familie.

Bedankt voor je hulp! 🌿

Naar de enquête

https://utwentebs.eu.qualtrics.com/jfe/form/SV_6sthWu66zvw6NAG

English Version

Together for a greener future! 🌍

As part of the bachelor's thesis in psychology at the University of Twente, we are investigating the influence of age and gender on mental health and related behavioural patterns.

Help us to better understand the psychological effects of climate change and become part of our study! 🍸

Conditions of participation

- Age: 18-65 years

- Residence: Germany or the Netherlands

It would help us a lot if you would share this message with family and friends.

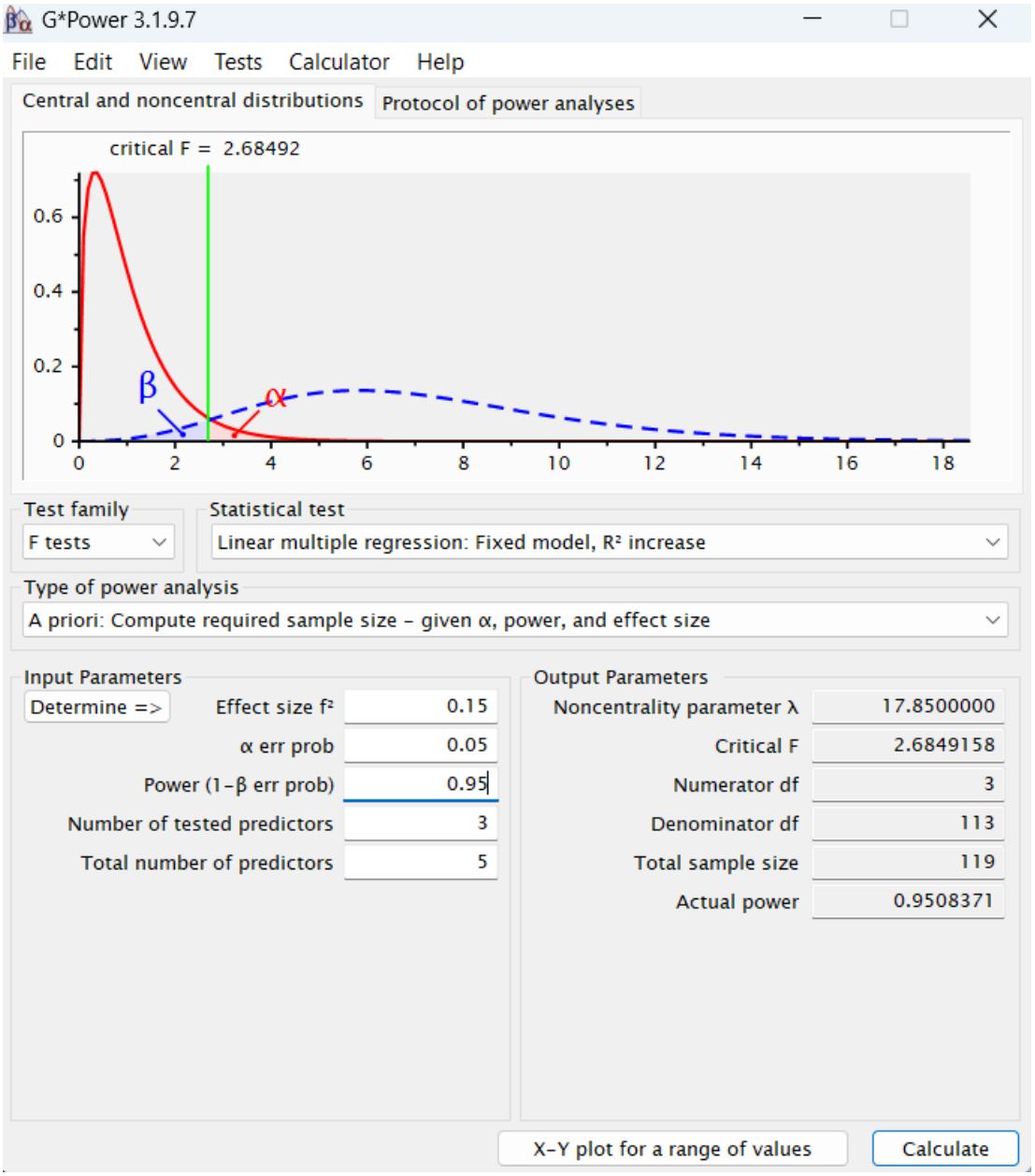
Thank you for your contribution! 🌿

To the survey

German: https://utwentebs.eu.qualtrics.com/jfe/form/SV_9tokgF7hdyW9jls

Dutch: https://utwentebs.eu.qualtrics.com/jfe/form/SV_6sthWu66zvw6NAG

Appendix D


G*Power 3.1.9.7
File Edit View Tests Calculator Help
Central and noncentral distributions
Protocol of power analyses
critical F = 2.68492
β
α
Test family
F tests
Statistical test
Linear multiple regression: Fixed model, R² increase
Type of power analysis
A priori: Compute required sample size – given α, power, and effect size
Input Parameters
Determine =>
Effect size f²
0.15
α err prob
0.05
Power (1–β err prob)
0.95
Number of tested predictors
3
Total number of predictors
5
Output Parameters
Noncentrality parameter λ
17.8500000
Critical F
2.6849158
Numerator df
3
Denominator df
113
Total sample size
119
Actual power
0.9508371
X-Y plot for a range of values
Calculate

Appendix E

Opening Statement in Qualtrics

German Version

Willkommen!

Ziel dieser Studie ist es, den Zusammenhang zwischen Alter und psychischen Störungen sowie geschlechtsspezifische Unterschiede bezüglich Klimaangst, Klimaschuldgefühl und Solastalgie zu untersuchen. Außerdem soll erforscht werden, wie diese emotionalen Reaktionen das Auftreten von umweltfreundlichem Verhalten und Klimalähmung beeinflussen.

Die Studie wird von zwei Studenten durchgeführt, die den Bachelor der Psychologie an der Universität Twente absolvieren. Die gewonnenen Daten werden somit für ihre Bachelor-Arbeiten analysiert.

Teilnahme

Um an dieser Studie teilzunehmen, müssen Sie mindestens 18 und maximal 65 Jahre alt sein. Außerdem wird vorausgesetzt, dass Sie Ihren Wohnsitz entweder in Deutschland oder in den Niederlanden haben.

Wenn Sie sich derzeit wegen einer psychischen Störung in Behandlung befinden oder in den letzten zwei Jahren Suizidgedanken hatten, können Sie aus Sicherheitsgründen nicht an dieser Studie teilnehmen.

Die Teilnahme an dieser Studie ist völlig freiwillig und Sie haben das Recht, jederzeit ohne der Angabe von Gründen und ohne jegliche Konsequenzen zurücktreten. Alle Daten, die Sie bisher eingegeben haben, werden von der weiteren Datenauswertung ausgeschlossen. Sobald Sie jedoch den Fragebogen vollständig ausgefüllt haben, werden alle Daten anonymisiert und können nicht länger identifiziert werden, sodass eine Löschung der Daten nicht länger möglich ist.

Nach der Zustimmung zur Teilnahme werden demographische Fragen gestellt. Um Anonymität zu gewährleisten, werden keine identifizierbaren Informationen gesammelt. Der folgende Fragebogen wird 15-20 Minuten in Anspruch nehmen.

Ihre Teilnahme an dieser Studie wird sehr geschätzt und formt einen wesentlichen Beitrag zur Vertiefung unseres Verständnisses der psychologischen Auswirkungen des Klimawandels.

Kontaktangabe

Diese Studie wurde von der Ethikkommission der Universität Twente geprüft und genehmigt. Für weitere Informationen oder im Falle noch offenstehender Fragen können Sie die Forscher Killian Doyle (k.l.doyle@student.utwente.nl) oder Melisa Gökoglan (m.gokoglan@student.utwente.nl) kontaktieren. Alternativ können Sie sich auch an den Betreuer Dr. Alejandro Dominguez Rodriguez (a.dominguezrodriguez@utwente.nl) wenden.

Dutch Version

Welkom!

Deze studie heeft tot doel de relatie te onderzoeken tussen leeftijd en geestelijke gezondheidseffecten en genderverschillen hierin, waaronder klimaatangst, klimaatschuld en solastagie. Bovendien zal worden onderzocht hoe deze emotionele reacties het optreden van milieuvriendelijk gedrag en klimaatverlamming beïnvloeden.

Het onderzoek wordt uitgevoerd door twee studenten die de bachelor psychologie aan de Universiteit Twente volgen en de verkregen gegevens worden geanalyseerd voor hun bachelorscripties. To access the study in German please go to this link: https://utwentebs.eu.qualtrics.com/jfe/form/SV_9t0kgF7hdyW9jls

Deelname

Om aan dit onderzoek deel te nemen, dient u niet jonger dan 18 jaar en niet ouder dan 65 jaar te zijn. Bovendien moet u woonachtig zijn in Duitsland of Nederland.

Als u momenteel een behandeling ondergaat voor een psychische stoornis of in de afgelopen twee jaar zelfmoordgedachten heeft gehad, kunt u om veiligheidsredenen niet aan dit onderzoek deelnemen.

Deelname aan dit onderzoek is geheel vrijwillig en u heeft het recht om op elk moment, zonder opgaaf van reden en zonder enige gevolgen, uw deelname terug te trekken. Alle gegevens die u tot nu toe heeft ingevoerd, worden uitgesloten van verdere data-analyses. Zodra u de vragenlijst heeft ingevuld, worden alle gegevens echter geanonimiseerd en kunnen ze niet meer worden geïdentificeerd, waardoor het verwijderen van gegevens niet langer mogelijk is.

Na het geven van toestemming voor deelname worden demografische vragen gesteld. Om de anonimiteit te garanderen, wordt er geen identificeerbare informatie verzameld. De volgende vragenlijst duurt 15-20 minuten.

Uw deelname aan dit onderzoek wordt zeer op prijs gesteld en zal dienen als een integrale bijdrage aan het verdiepen van ons begrip van de psychologische implicaties van klimaatverandering.

Contact details

Dit onderzoek is beoordeeld en goedgekeurd door de Ethische Commissie van de Universiteit Twente. Voor meer informatie of overige vragen kunt u contact opnemen met de onderzoekers Killian Doyle (k.l.doyle@student.utwente.nl) of Melisa Gökoglan (m.gokoglan@student.utwente.nl). U kunt ook contact opnemen met de begeleider: dr. Alejandro Dominguez Rodriguez (a.dominguezrodriguez@utwente.nl).

Appendix F

Informed Consent in Qualtrics

English version

By clicking YES below, I confirm the following: I acknowledge that my involvement is entirely voluntary

I also recognize my right to withdraw my consent at any time without explanation, especially if I experience any form of discomfort or distress. This will not be followed by any consequence.

Additionally, I understand the following:

- Any data collected by the researcher will remain completely anonymous and cannot be traced back to my identity. Therefore, withdrawal is no longer possible after survey completion.

- I am aware that the information I provide will be utilized in research reports aimed at studying the impact of age and gender on mental health affectations caused by climate change. - I am not undergoing any form of medical or therapeutic treatment for a mental disorder.

- I have not experienced suicidal ideation within the last two years.

- I understand that participating in the study may lead to mental discomfort due to discussing the sensitive topic of climate change.

- I agree to maintain confidentiality regarding the study's procedures and details, refraining from sharing this information with others, as it may adversely affect the study's results.

- I authorise the retention of my provided responses in the survey database for potential future research and educational purposes.

I consent to participating in the study:

o YES, I comprehend the contents of this consent form and willingly agree to take part in this study. I also commit not to disclose the study's specifics to any other parties.

o NO (you will be directed to the end of the study

German Version

Indem ich unten auf JA klicke, bestätige ich das Folgende:

Ich habe alle Informationen gelesen und erfülle alle Teilnahmebedingungen. Ich bestätige, dass meine Teilnahme völlig freiwillig ist. Ich erkenne auch mein Recht an, meine Einwilligung jederzeit ohne Angabe von Gründen zu widerrufen, insbesondere wenn ich Unbehagen oder Stress jeglicher Form empfinde. Solch Widerruf wird keine Konsequenzen nach sich ziehen.

Darüber hinaus verstehe ich Folgendes:

- Alle vom Forscher erhobenen Daten bleiben völlig anonym und können nicht auf meine Identität zurückgeführt werden. Ein Rücktritt ist daher nach Beendigung der Umfrage nicht mehr möglich.
- Mir ist bekannt, dass die von mir zur Verfügung gestellten Informationen in Forschungsberichten verwendet werden, deren Ziel es ist, die Auswirkungen von Alter und Geschlecht auf die psychische Gesundheit aufgrund des Klimawandels darzustellen.
- Ich befinde mich derzeit in KEINER medizinischen oder therapeutischen Behandlung aufgrund einer psychischen Störung.
- Ich habe in den letzten zwei Jahren KEINE Selbstmordgedanken erfahren.
- Mir ist bewusst, dass die Teilnahme an der Studie aufgrund der Diskussion der sensiblen Thematik des Klimawandels zu psychischem Unbehagen führen kann.
- Ich erkläre mich damit einverstanden, keine Informationen über den Ablauf und die Einzelheiten der Studie zu teilen, da dies die Ergebnisse der Studie beeinträchtigen könnte.
- Ich erkläre mich damit einverstanden, dass meine Antworten in der Umfragedatenbank für mögliche zukünftige Forschungs- und Ausbildungszwecke genutzt werden.

Dutch Version

Door hieronder op JA te klikken, bevestig ik het volgende:

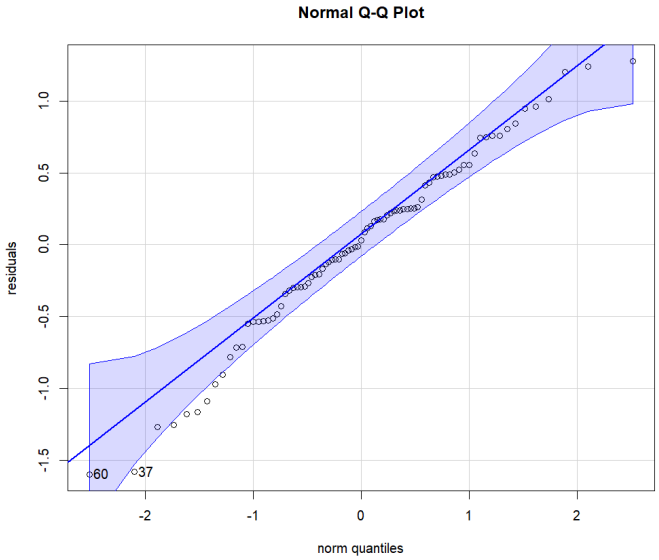
Ik heb alle gegeven informatie gelezen en voldoe aan alle deelnamevoorwaarden. Ik erken dat mijn betrokkenheid geheel vrijwillig is. Ik erken ook mijn recht om mijn toestemming op elk moment zonder uitleg in te trekken, vooral als ik enige vorm van ongemak of angst ervaar. Hieraan zullen geen consequenties verbonden zijn.

Daarnaast begrijp ik het volgende:

- Alle door de onderzoeker verzamelde gegevens blijven volledig anoniem en zijn niet te herleiden tot mijn identiteit. Daarom is intrekking na voltooiing van het onderzoek niet meer mogelijk.
- Ik ben me ervan bewust dat de informatie die ik verstrek zal worden gebruikt in onderzoeksrapporten die gericht zijn op het bestuderen van de impact van leeftijd en geslacht op de gevolgen voor de geestelijke gezondheid als gevolg van klimaatverandering.
- Ik onderga GEEN enkele vorm van medische of therapeutische behandeling voor een psychische stoornis.
- Ik heb de afgelopen twee jaar GEEN zelfmoordgedachten gehad.
- Ik begrijp dat deelname aan het onderzoek kan leiden tot mentaal ongemak als gevolg van het bespreken van het gevoelige onderwerp klimaatverandering.
- Ik ga ermee akkoord de vertrouwelijkheid te bewaren met betrekking tot de procedures en details van het onderzoek en deze informatie niet met anderen te delen, aangezien dit de resultaten van het onderzoek negatief kan beïnvloeden.
- Ik geef toestemming voor het bewaren van mijn verstrekte antwoorden in de enquêtedatabase voor mogelijk toekomstig onderzoek en educatieve doeleinden.

Appendix G

Normality of Multiple Regression Analysis



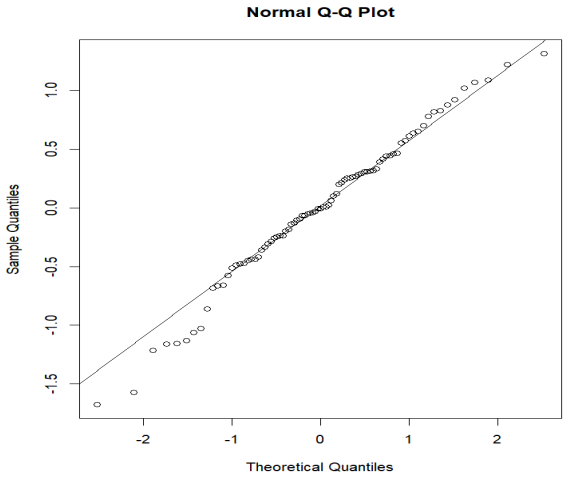
Shapiro Wilk Test of Multiple Regression Analysis

```
> shapiro_test <- shapiro.test(residuals)
> print(shapiro_test)

        Shapiro-Wilk normality test

data:  residuals
W = 0.98177, p-value = 0.2735
```

Normality of Multiple Mediation Analysis



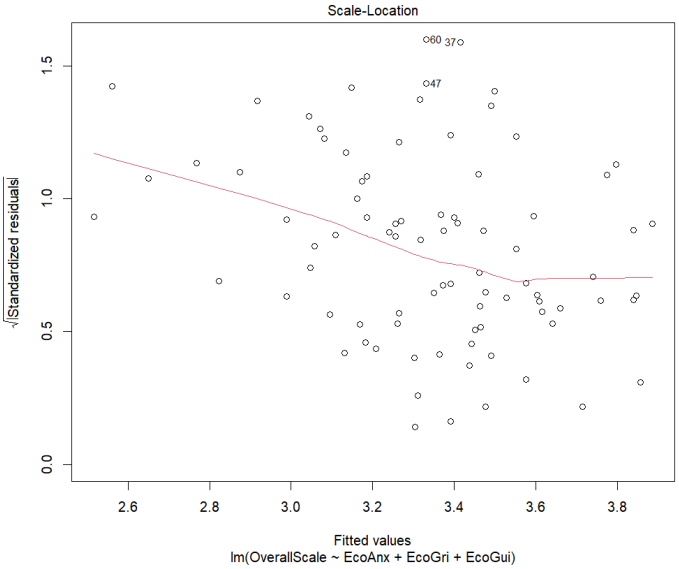
Shapiro Wilk Test of Multiple Mediation Analysis

```
        Shapiro-Wilk normality test

data:  residuals
W = 0.98477, p-value = 0.4179
```

Appendix H

Homoscedasticity in Multiple Regression Analysis

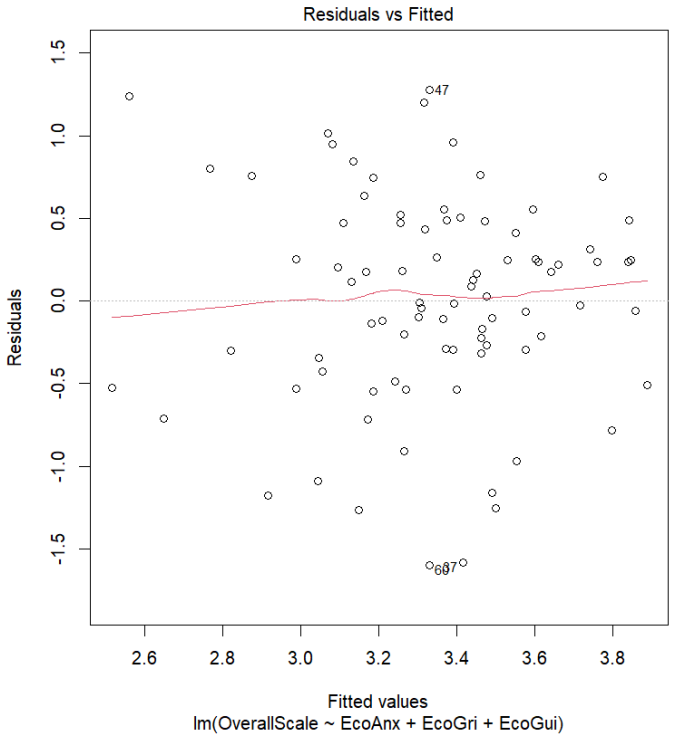


Homoscedasticity in Multiple Mediation Analysis

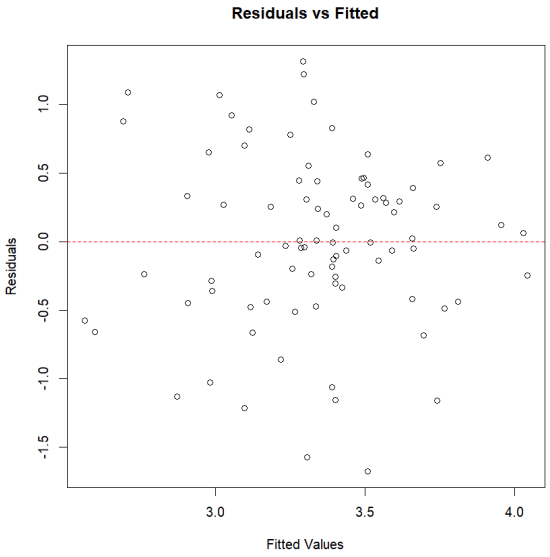
```
> car::ncvTest(model_mediation)
Non-constant Variance Score Test
Variance formula: ~ fitted.values
Chisquare = 3.516131, Df = 1, p = 0.060774
```

Appendix I

Linearity in Multiple Regression Analysis



Linearity in Multiple Mediator Analysis



Appendix J

Multicollinearity in Multiple Regression Analysis

```
> vif_results <- car::vif(model)
> print(vif_results)
  EcoAnx   EcoGri   EcoGui
2.955538 2.376129 1.870873
```

Multicollinearity in Multiple Mediator Model

```
> vif_results <- car::vif(model_mediation)
> print(vif_results)
     age   EcoAnx   EcoGri   EcoGui
1.008827 2.959187 2.381886 1.877628
>
```

Appendix K

Independence of Multiple Regression Analysis

```
> durbinWatsonTest(model)
 lag Autocorrelation D-W Statistic p-value
   1      0.08259851      1.788793   0.324
 Alternative hypothesis: rho != 0
```

Appendix L

RScript of Dataanalysis

```
#install and load packages
install.packages("tidyverse")
library(tidyverse)
install.packages("dplyr")
library(dplyr)
# Get the current working directory
current_directory <- getwd()
# Print the current working directory
print(current_directory)
#import dataset
dataGer <- read.csv("Mental health affectations caused by climate change in German and
Dutch population (German)_3 December 2023_05.53.csv")
view(dataGer)
#cleandata
# Filter participants
filtered_data <- dataGer[dataGer$Finished == "True", ]
filtered_data <- filtered_data[filtered_data$DistributionChannel == "anonymous", ]
filtered_data <- filtered_data %>%
  filter(!is.null(Q41) & Q41 %in% c("Deutschland", "Niederlande"))
#dataset for demographics
demographics_data <- filtered_data[, 19:24]
#analyse demographics
gender_counts <- table(demographics_data$Q23)
print(gender_counts)
demographics_data$Q27 <- as.numeric(demographics_data$Q27)
```

```
mean_Q27 <- mean(demographics_data$Q27)
sd_Q27 <- sd(demographics_data$Q27)
q41_counts <- table(demographics_data$Q41)
print(q41_counts)
q42_counts <- table(demographics_data$Q42)
print(q42_counts)
q42_percentages <- prop.table(table(demographics_data$Q42)) * 100
q42_percentages_df <- as.data.frame(q42_percentages)
#creating scales
cols_to_recode <- 26:47
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "stimme nicht zu"      ~ 1,
    . == "stimme eher nicht zu" ~ 2,
    . == "stimme eher zu"       ~ 3,
    . == "stimme zu"            ~ 4,
    TRUE                        ~ NA_real_
  )))
filtered_data <- filtered_data %>%
  mutate(EcoAnx = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- 48:53
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "stimme nicht zu"      ~ 1,
    . == "stimme eher nicht zu" ~ 2,
    . == "stimme eher zu"       ~ 3,
    . == "stimme zu"            ~ 4,
    TRUE                        ~ NA_real_
  )))
filtered_data <- filtered_data %>%
  mutate(EcoGri = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- 54:64
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "stimme nicht zu"      ~ 1,
    . == "stimme eher nicht zu" ~ 2,
    . == "stimme eher zu"       ~ 3,
    . == "stimme zu"            ~ 4,
    TRUE                        ~ NA_real_
  )))
filtered_data <- filtered_data %>%
  mutate(EcoGui = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(65:70, 71)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nie", "heiÃŸ")      ~ 1,
    . %in% c("selten")     ~ 2,
    . %in% c("manchmal", "warm")    ~ 3,
    . %in% c("hÃ¤ufig")            ~ 4,
    . %in% c("immer", "kalt")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Cons = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(72:77)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nein", "nie", "24 oder weniger")      ~ 1,
```

```
    . %in% c("selten", "25-29")      ~ 2,
    . %in% c("manchmal", "30-34")    ~ 3,
    . %in% c("oft","35-39")          ~ 4,
    . %in% c("ja", "stÃ¤ndig", "40 oder mehr")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(EnvCit = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(78:80)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nein")      ~ 1,
    . %in% c("ja", "ich esse kein Rindfleisch/Schweinefleisch/GeflÃ¼gel")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Food = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(81:83)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nie")      ~ 1,
    . %in% c("gelegentlich")    ~ 3,
    . %in% c("hÃ¤ufig")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Trans = rowMeans(select(., cols_to_recode), na.rm = TRUE))
#create dataset with new variables
CoolData <- data.frame(
  EcoAnx = filtered_data$EcoAnx,
  EcoGui = filtered_data$EcoGui,
  EcoGri = filtered_data$EcoGri,
  Cons = filtered_data$Cons,
  EnvCit = filtered_data$EnvCit,
  Food = filtered_data$Food,
  Trans = filtered_data$Trans)
#dataset for demographics
demographics_data <- filtered_data[, 19:24]
#creating scales
cols_to_recode <- 26:47
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "stimme nicht zu"      ~ 1,
    . == "stimme eher nicht zu" ~ 2,
    . == "stimme eher zu"       ~ 3,
    . == "stimme zu"            ~ 4,
    TRUE                        ~ NA_real_
  )))
filtered_data <- filtered_data %>%
  mutate(EcoAnx = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- 48:53
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "stimme nicht zu"      ~ 1,
    . == "stimme eher nicht zu" ~ 2,
    . == "stimme eher zu"       ~ 3,
    . == "stimme zu"            ~ 4,
    TRUE                        ~ NA_real_
  )))
filtered_data <- filtered_data %>%
```

```
  mutate(EcoGri = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- 54:64
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "stimme nicht zu"      ~ 1,
    . == "stimme eher nicht zu" ~ 2,
    . == "stimme eher zu"       ~ 3,
    . == "stimme zu"            ~ 4,
    TRUE                        ~ NA_real_
  )))
filtered_data <- filtered_data %>%
  mutate(EcoGui = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(65:70, 71)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nie", "heiÃŸ")       ~ 1,
    . %in% c("selten")      ~ 2,
    . %in% c("manchmal", "warm")    ~ 3,
    . %in% c("hÃ¤ufig")            ~ 4,
    . %in% c("immer", "kalt")       ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Cons = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(72:77)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nein", "nie", "24 oder weniger")       ~ 1,
    . %in% c("selten", "25-29")      ~ 2,
    . %in% c("manchmal", "30-34")    ~ 3,
    . %in% c("oft","35-39")            ~ 4,
    . %in% c("ja", "stÃ¤ndig", "40 oder mehr")       ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(EnvCit = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(78:80)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nein")       ~ 1,
    . %in% c("ja", "ich esse kein Rindfleisch/Schweinefleisch/GeflÃ¼gel")       ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Food = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(81:83)
filtered_data <- filtered_data %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nie")       ~ 1,
    . %in% c("gelegentlich")    ~ 3,
    . %in% c("hÃ¤ufig")       ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Trans = rowMeans(select(., cols_to_recode), na.rm = TRUE))
#create dataset with new variables
CoolData <- data.frame(
  EcoAnx = filtered_data$EcoAnx,
  EcoGui = filtered_data$EcoGui,
  EcoGri = filtered_data$EcoGri,
  Cons = filtered_data$Cons,
```

```
  EnvCit = filtered_data$EnvCit,
  Food = filtered_data$Food,
  Trans = filtered_data$Trans)
##same procedure with dutch data
dataDutch <- read.csv("C:/Users/THEDOYLER/Downloads/dataDutch.csv",
header=FALSE)
View(dataDutch)
filtered_dataD <- dataDutch[dataDutch$V5 == "100", ]
filtered_dataD <- filtered_dataD[filtered_dataD$V16 == "anonymous", ]
filtered_dataD <- filtered_dataD[-6, ]
#dataset for demographics
demographics_dataD <- filtered_dataD[, 19:24]
#analyse demographics
gender_counts_D <- table(demographics_dataD$V19)
print(gender_counts_D)
demographics_dataD$V20 <- as.numeric(demographics_dataD$V20)
mean(demographics_dataD$V20)
sd(demographics_dataD$V20)
nat_counts_D <- table(demographics_dataD$V21)
print(nat_counts_D)
deg_counts_D <- table(demographics_dataD$V22)
print(deg_counts_D)
q42_percentages <- prop.table(table(demographics_dataD$Q42)) * 100
q42_percentages_df <- as.data.frame(q42_percentages)
#creating scales
cols_to_recode <- 26:47
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "mee oneens"      ~ 1,
    . == "erder mee oneens" ~ 2,
    . == "erder mee eens"       ~ 3,
    . == "mee eens"            ~ 4,
    TRUE                       ~ NA_real_
  )))
filtered_dataD <- filtered_dataD %>%
  mutate(EcoAnx = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- 48:53
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "mee oneens"      ~ 1,
    . == "erder mee oneens" ~ 2,
    . == "erder mee eens"       ~ 3,
    . == "mee eens"            ~ 4,
    TRUE                       ~ NA_real_
  )))
filtered_dataD <- filtered_dataD %>%
  mutate(EcoGri = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- 54:64
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . == "mee oneens"      ~ 1,
    . == "erder mee oneens" ~ 2,
    . == "erder mee eens"       ~ 3,
    . == "mee eens"            ~ 4,
    TRUE                       ~ NA_real_
  )))
filtered_dataD <- filtered_dataD %>%
```

```
  mutate(EcoGui = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(65:70, 71)
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nooit", "heet")      ~ 1,
    . %in% c("zelden")     ~ 2,
    . %in% c("soms", "warm")    ~ 3,
    . %in% c("vaak")            ~ 4,
    . %in% c("altijd", "koud")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Cons = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(72:77)
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nee", "nooit", "24 of minder")      ~ 1,
    . %in% c("zelden", "25-29")     ~ 2,
    . %in% c("soms", "30-34")    ~ 3,
    . %in% c("vaak","35-39")            ~ 4,
    . %in% c("constant", "ja", "40 oder meer")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(EnvCit = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(78:80)
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nee")      ~ 1,
    . %in% c("ja", "ik eet geen rundvlees/varkenvlees/gevogelte")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Food = rowMeans(select(., cols_to_recode), na.rm = TRUE))
cols_to_recode <- c(81:83)
filtered_dataD <- filtered_dataD %>%
  mutate(across(cols_to_recode, ~ case_when(
    . %in% c("nooit")      ~ 1,
    . %in% c("af en toe")    ~ 3,
    . %in% c("vaak")      ~ 5,
    TRUE                        ~ NA_real_
  ))) %>%
  mutate(Trans = rowMeans(select(., cols_to_recode), na.rm = TRUE))
#create dataset with new variables
CoolData1 <- data.frame(
  EcoAnx = filtered_dataD$EcoAnx,
  EcoGui = filtered_dataD$EcoGui,
  EcoGri = filtered_dataD$EcoGri,
  Cons = filtered_dataD$Cons,
  EnvCit = filtered_dataD$EnvCit,
  Food = filtered_dataD$Food,
  Trans = filtered_dataD$Trans)
#merging data together (demo)
combined_data <- bind_rows(demographics_dataD, demographics_data)
combined_data <- combined_data %>%
  mutate(Q27 = coalesce(Q27, V20),
         Q23 = coalesce(Q23, V19),
         Q41 = coalesce(Q41, V21),
         Q42 = coalesce(Q42, V22),
         Q42_7_TEXT = coalesce(Q42_7_TEXT, V23),
```

```
      Q31 = coalesce(Q31, V24))
combined_data <- combined_data %>%
 rename(age = Q27,
      gender = Q23,
      nationality = Q41,
      level_ed = Q42,
      level_sonst = Q42_7_TEXT,
      Sona = Q31)
combined_data <- select(combined_data, -V19, -V20, -V21, -V22, -V23, -V24)
#merging data together (hypotheses)
combined_data2 <- bind_rows(CoolData, CoolData1)
combined_data2 <- combined_data2 %>%
 combined_data <- combined_data %>%
 rename(age = Q27,
      gender = Q23,
      nationality = Q41,
      level_ed = Q42,
      level_sonst = Q42_7_TEXT,
      Sona = Q31)
combined_data <- select(combined_data, -V19, -V20, -V21, -V22, -V23, -V24)
#merging data together (demo)
combined_data <- bind_rows(demographics_dataD, demographics_data)
combined_data <- combined_data %>%
 mutate(Q27 = coalesce(Q27, V20),
      Q23 = coalesce(Q23, V19),
      Q41 = coalesce(Q41, V21),
      Q42 = coalesce(Q42, V22),
      Q42_7_TEXT = coalesce(Q42_7_TEXT, V23),
      Q31 = coalesce(Q31, V24))
combined_data <- combined_data %>%
 rename(age = Q27,
      gender = Q23,
      nationality = Q41,
      level_ed = Q42,
      level_sonst = Q42_7_TEXT,
      Sona = Q31)
combined_data <- select(combined_data, -V19, -V20, -V21, -V22, -V23, -V24)
#merging data together (hypotheses)
combined_data2 <- bind_rows(CoolData, CoolData1)
combined_data2 <- combined_data2 %>%
 combined_data <- combined_data %>%
 rename(age = Q27,
      gender = Q23,
      nationality = Q41,
      level_ed = Q42,
      level_sonst = Q42_7_TEXT,
      Sona = Q31)
combined_data <- select(combined_data, -V19, -V20, -V21, -V22, -V23, -V24)
##lost datasets:
# Merge the datasets based on specified conditions
general_demographics <- merge(
 x = demographics_data,
 y = demographics_dataD,
 by.x = c("Q23", "Q27", "Q41", "Q42", "Q42_7_TEXT", "Q31"),
 by.y = c("V19", "V20", "V21", "V22", "V23", "V24"),
 all = TRUE  # Use all = TRUE for a full outer join, or adjust based on your needs
)
```

```
# View the merged dataset
head(general_demographics)
general_demographics <- general_demographics %>%
  rename(
    gender = Q23,
    age = Q27,
    nationality = Q41,
    ed.level = Q42,
    other = Q42_7_TEXT,
    SONA = Q31
  )
library(dplyr)
# Create a new dataset including complete combined_data2 and "age" from combined_data
ew_dataset <- bind_cols(select(combined_data2, everything()), age = new_dataset$age)
# Display the new dataset
print(new_dataset)
new_dataset <- combined_data %>%
  slice(-43)
ew_dataset <- ew_dataset %>%
  rowwise() %>%
  mutate(OverallScale = sum(c(Cons, EnvCit, Food, Trans), na.rm = TRUE))
ew_dataset$OverallScale <- ew_dataset$OverallScale / 4
# Assuming 'Gender' is a categorical variable in your dataset
table(new_dataset$gender)
table(new_dataset$age)
summary(new_dataset)
hist(new_dataset$age, main = "Age Distribution", xlab = "age")
table(new_dataset$nationality)
table(new_dataset$level_ed)
barplot(table(new_dataset$level_ed), main = "Education Distribution", xlab = "Education
Level")
table(new_dataset$Sona)
library(knitr)
table_counts <- table(new_dataset$level_ed)
table_output <- kable(table_counts, caption = "Distribution of level_ed")
print(table_output)
table_counts <- table(new_dataset$level_sonst)
table_output <- kable(table_counts, caption = "Distribution of level_sonst")
print(table_output)
##descriptive statistics
summary(ew_dataset)
mean(ew_dataset$EcoAnx)
sd(ew_dataset$EcoAnx)
mean(ew_dataset$EcoGri)
sd(ew_dataset$EcoGri)
mean(ew_dataset$EcoGui)
sd(ew_dataset$EcoGui)
mean(ew_dataset$age)
sd(ew_dataset$age)
mean(ew_dataset$OverallScale)
sd(ew_dataset$OverallScale)
##check normality
qqnorm(ew_dataset$EcoAnx); qqline(ew_dataset$EcoAnx)
qqnorm(ew_dataset$EcoGui); qqline(ew_dataset$EcoGui)
qqnorm(ew_dataset$EcoGri); qqline(ew_dataset$EcoGri)
qqnorm(ew_dataset$OverallScale); qqline(ew_dataset$OverallScale)
par(mar = c(4, 4, 6, 4))  # Adjust margins as needed (bottom, left, top, right)
```

```
hist(ew_dataset$EcoAnx, main = "Histogram of EcoAnx", xlab = "Values")
hist(ew_dataset$EcoGri, main = "Histogram of EcoGri", xlab = "Values")
hist(ew_dataset$EcoGui, main = "Histogram of EcoGui", xlab = "Values")
hist(ew_dataset$OverallScale, main = "Histogram of PEBS", xlab = "Values")
#normality
# Assuming 'ew_dataset' is your data frame
plot(ew_dataset$age, ew_dataset$OverallScale, main = "Scatterplot of Age vs OverallScale",
xlab = "Age", ylab = "OverallScale")
# Assuming 'ew_dataset' is your data frame
plot(ew_dataset$EcoAnx, ew_dataset$OverallScale, main = "Scatterplot of EcoAnx vs
OverallScale", xlab = "EcoAnx", ylab = "OverallScale")
plot(ew_dataset$EcoGui, ew_dataset$OverallScale, main = "Scatterplot of EcoGui vs
OverallScale", xlab = "EcoGui", ylab = "OverallScale")
plot(ew_dataset$EcoGri, ew_dataset$OverallScale, main = "Scatterplot of EcoGri vs
OverallScale", xlab = "EcoGri", ylab = "OverallScale")
#linearity
# install.packages("ggplot2")
library(ggplot2)
# Scatterplot of Age vs OverallScale
ggplot(ew_dataset, aes(x = age, y = OverallScale)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Scatterplot of Age vs OverallScale", x = "Age", y = "OverallScale")
# Scatterplots for EcoAnx, EcoGui, and EcoGri vs OverallScale
ggplot(ew_dataset, aes(x = EcoAnx, y = OverallScale)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Scatterplot of EcoAnx vs OverallScale", x = "EcoAnx", y = "OverallScale")
ggplot(ew_dataset, aes(x = EcoGui, y = OverallScale)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Scatterplot of EcoGui vs OverallScale", x = "EcoGui", y = "OverallScale")
ggplot(ew_dataset, aes(x = EcoGri, y = OverallScale)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Scatterplot of EcoGri vs OverallScale", x = "EcoGri", y = "OverallScale")
#homoscedacity
library(ggplot2)
# Create a data frame with residuals and fitted values
residuals_df <- data.frame(
  FittedValues = fitted(mediation_model),
  Residuals = residuals(mediation_model)
)
# Additionally, you can create a Q-Q plot of residuals
qqnorm(residuals(mediation_model)); qqline(residuals(mediation_model))
dependent_variable <- "OverallScale"
formula <- paste(dependent_variable, "~ age + EcoAnx + EcoGui + EcoGri")
rgression_model <- lm(formula, data = ew_dataset)
# Print a summary of the regression results
summary(regression_model)
#correlation between variables
cor(ew_dataset$EcoAnx, ew_dataset$EcoGri)
cor(ew_dataset$EcoAnx, ew_dataset$EcoGui)
cor(ew_dataset$EcoAnx, ew_dataset$age)
cor(ew_dataset$EcoAnx, ew_dataset$OverallScale)
cor(ew_dataset$EcoGri, ew_dataset$EcoGui)
cor(ew_dataset$EcoGri, ew_dataset$age)
```

```
cor(ew_dataset$EcoGri, ew_dataset$OverallScale)
cor(ew_dataset$EcoGui, ew_dataset$age)
cor(ew_dataset$EcoGui, ew_dataset$OverallScale)
cor(ew_dataset$age, ew_dataset$OverallScale)
cor_matrix <- cor(ew_dataset[, c("age", "EcoAnx", "EcoGui", "EcoGri", "OverallScale")])
print(cor_matrix)
print(p_values)
cor_matrix <- cor(ew_dataset)
print(cor_matrix)
dependent_variable <- "OverallScale"
formula <- paste(dependent_variable, "~ age")
simple_regression_model <- lm(formula, data = ew_dataset)
summary(simple_regression_model)
#multiple regression analysis
multiple_regression_model <- lm(OverallScale ~ EcoAnx + EcoGri + EcoGui, data =
ew_dataset)
summary(multiple_regression_model)
#simple regression analyses
dependent_variable <- "EcoAnx"
formula <- paste(dependent_variable, "~ age")
simple_regression_model <- lm(formula, data = ew_dataset)
summary(simple_regression_model)
dependent_variable <- "EcoGri"
formula <- paste(dependent_variable, "~ age")
simple_regression_model <- lm(formula, data = ew_dataset)
summary(simple_regression_model)
dependent_variable <- "EcoGui"
formula <- paste(dependent_variable, "~ age")
simple_regression_model <- lm(formula, data = ew_dataset)
summary(simple_regression_model)
install.packages("mediation")
library(mediation)
mediation_data <- ew_dataset[, c("age", "EcoAnx", "EcoGui", "EcoGri", "OverallScale")]
plot(mediation_results)
moderation_model <- lm(OverallScale ~ age * EcoAnx * EcoGri * EcoGui, data =
ew_dataset)
summary(moderation_model)
library(dplyr)
general_demographics <- merge(
  x = demographics_data,
  y = demographics_dataD,
  by.x = c("Q23", "Q27", "Q41", "Q42", "Q42_7_TEXT", "Q31"),
  by.y = c("V19", "V20", "V21", "V22", "V23", "V24"),
  all = TRUE  # Use all = TRUE for a full outer join, or adjust based on your needs
)
head(general_demographics)
general_demographics <- general_demographics %>%
  rename(
    gender = Q23,
    age = Q27,
    nationality = Q41,
    ed.level = Q42,
    other = Q42_7_TEXT,
    SONA = Q31
  )
library(dplyr)
# Calculate mean and standard deviation
```

```
mean_age <- mean(general_demographics$age)
sd_age <- sd(general_demographics$age)
# Perform t-test
t_test_result <- t.test(new_dataset$age)
# Extract relevant information
t_value <- t_test_result$statistic
p_value <- t_test_result$p.value
# Print the results
cat("Mean Age:", mean_age, "\n")
cat("Standard Deviation:", sd_age, "\n")
cat("T-value:", t_value, "\n")
cat("P-value:", p_value, "\n")
general_demographics <- merge(
  x = demographics_data,
  y = demographics_dataD,
  by.x = c("Q23", "Q27", "Q41", "Q42", "Q42_7_TEXT", "Q31"),
  by.y = c("V19", "V20", "V21", "V22", "V23", "V24"),
  all = TRUE  # Use all = TRUE for a full outer join, or adjust based on your needs
)
head(general_demographics)
general_demographics <- general_demographics %>%
  rename(
    gender = Q23,
    age = Q27,
    nationality = Q41,
    ed.level = Q42,
    other = Q42_7_TEXT,
    SONA = Q31
  )
View(general_demographics)
library(dplyr)
mean_age <- mean(general_demographics$age, na.rm = TRUE)
sd_age <- sd(general_demographics$age, na.rm = TRUE)
class(general_demographics$age)
general_demographics$age <- as.numeric(as.character(general_demographics$age))
mean_age <- mean(general_demographics$age, na.rm = TRUE)
sd_age <- sd(general_demographics$age, na.rm = TRUE)
# Perform t-test
t_test_result <- t.test(general_demographics$age, na.rm = TRUE)
# Extract relevant information
t_value <- t_test_result$statistic
p_value <- t_test_result$p.value
# Print the results
cat("Mean Age:", mean_age, "\n")
cat("Standard Deviation:", sd_age, "\n")
cat("T-value:", t_value, "\n")
cat("P-value:", p_value, "\n")
library(dplyr)
# Create a contingency table for 'gender'
gender_table <- table(general_demographics$gender)
View(gender_table)
mean(gender_table_new)
sd(gender_table_new)
# Create a new data frame with specific counts for 'Male' and 'Female'
gender_table_new <- data.frame(
  Gender = c("Male", "Female"),
  Count = c(30, 55)
```

```
)
chi_square_result <- chisq.test(gender_table_new)
# Extract relevant information
chi_square_value <- chi_square_result$statistic
p_value <- chi_square_result$p.value
# Print the results
cat("Chi-Squared Value:", chi_square_value, "\n")
cat("P-value:", p_value, "\n")
gender_table <- table(general_demographics$gender)
View(gender_table)
# Create a new data frame with specific counts for 'Male' and 'Female'
gender_table_new <- data.frame(
  Gender = c("Male", "Female"),
  Count = c(30, 55)
)
SONA_table <- table(general_demographics$SONA)
View(SONA_table)
mean(SONA_table)
sd(SONA_table)
chi_square_result <- chisq.test(SONA_table)
chi_square_value <- chi_square_result$statistic
p_value <- chi_square_result$p.value
cat("Chi-Squared Value:", chi_square_value, "\n")
cat("P-value:", p_value, "\n")
ed_level_table <- table(general_demographics$ed.level)
View(ed_level_table)
mean(ed_level)
sd(ed_level)
ed_level <- data.frame(
  Education_Level = c("Bachelor", "Abitur", "Fachabitur", "Master", "Other", "No Ed. Level"),
  Value = c(25, 25, 11, 18, 5, 1)
)
print(ed_level)
contingency_table <- matrix(ed_level$Value, nrow = 1, dimnames = list(NULL,
ed_level$Education_Level))
# Perform chi-squared test
chi_square_result <- chisq.test(contingency_table)
# Print the results
print(chi_square_result)
print(ew_datset_sve)
##Correlation Matrix
selected_columns <- c("age", "EcoAnx", "EcoGui", "EcoGri", "OverallScale")
selected_data <- ew_datset_sve[selected_columns]
selected_data <- apply(selected_data, 2, as.numeric)
if (any(is.na(selected_data))) {
  # Handle missing values, for example by imputing or removing them
  selected_data <- na.omit(selected_data)
}
cor_matrix <- cor(selected_data)
p_values <- matrix(NA, ncol = ncol(cor_matrix), nrow = nrow(cor_matrix))
for (i in 1:ncol(cor_matrix)) {
  for (j in 1:nrow(cor_matrix)) {
    if (i != j) {
      result <- cor.test(selected_data[, i], selected_data[, j])
      p_values[i, j] <- result$p.value
    }
  }
```

```
}
df <- read.csv("your_data_file.csv")
selected_columns <- c("EcoAnx", "EcoGui", "EcoGri", "PEBS")
selected_data <- df[selected_columns]
selected_data <- apply(selected_data, 2, as.numeric)
if (any(is.na(selected_data))) {
  # Handle missing values, for example by imputing or removing them
  selected_data <- na.omit(selected_data)
}
cor_matrix <- cor(selected_data)
p_values <- matrix(NA, ncol = ncol(cor_matrix), nrow = nrow(cor_matrix))
for (i in 1:ncol(cor_matrix)) {
  for (j in 1:nrow(cor_matrix)) {
    if (i != j) {
      result <- cor.test(selected_data[, i], selected_data[, j])
      p_values[i, j] <- result$p.value
    }
  }
}
format_p_value <- function(p_value) {
  if (!is.na(p_value)) {
    if (p_value < 0.001) {
      return("**")
    } else if (p_value < 0.05) {
      return("*")
    } else {
      return(" ")
    }
  } else {
    return(" ")
  }
}
significance_matrix <- apply(p_values, c(1, 2), format_p_value)
print("Correlation Matrix:")
print(cor_matrix)
print("Significance Matrix:")
print(significance_matrix:)
library(readxl)
datasetfinal <- read_excel("C:/Users/THEDOYLER/OneDrive - University of
Twente/Desktop/datasetfinal.xlsx")
datasetfinal <- subset(datasetfinal, select = -c(...1, Cons, EnvCit, Food, Trans))
columns_to_format <- c("EcoAnx", "EcoGui", "EcoGri", "OverallScale")
for (col in columns_to_format) {
  # Convert scientific notation to standard decimal notation
  datasetfinal[[col]] <- format(as.numeric(datasetfinal[[col]]), scientific = FALSE)
  datasetfinal[[col]] <- gsub("^(\\d)(\\d*)$", "\\1,\\2", as.character(datasetfinal[[col]]))
}
columns_to_round <- c("EcoAnx", "EcoGui", "EcoGri", "OverallScale")
datasetfinal[, columns_to_round] <- lapply(datasetfinal[, columns_to_round], function(x)
as.numeric(gsub(",", ".", x)))
datasetfinal[, columns_to_round] <- round(datasetfinal[, columns_to_round], digits = 3)
datasetfinal <- datasetfinal[is.finite(datasetfinal$OverallScale), ]
model <- lm(OverallScale ~ age + EcoAnx + EcoGui + EcoGri, data = datasetfinal)
# Perform the multiple mediation analysis
mediation_result <- mediate(model, mediator = mediators)
# Print the results
summary(mediation_result)
```

```
# Check normality of residuals
residuals <- residuals(model)
qqPlot(residuals, main = "Normal Q-Q Plot")
# Check homoscedasticity
plot(model, which = 3)  # 3 corresponds to residuals vs. fitted values plot
# Check linearity
plot(model, which = 1:2)  # 1:2 corresponds to partial regression plots
# Check multicollinearity (VIF)
vif_values <- vif(model)
print(vif_values)
# Summary of the regression model for additional information
summary(model)
# Assuming your dataset is named datasetfinal
model_mediation <- lm(OverallScale ~ age + EcoAnx + EcoGri + EcoGui, data =
datasetfinal)
# Assuming your model is named model_mediation
vif_values <- car::vif(model_mediation)
print(vif_values)
# Assuming your model is named model_mediation
residuals <- residuals(model_mediation)
# Shapiro-Wilk test for normality
shapiro.test(residuals)
# Q-Q plot for residuals
qqnorm(residuals)
qqline(residuals)
# Plotting residuals against fitted values
plot(model_mediation$fitted.values, residuals, main = "Residuals vs Fitted", xlab = "Fitted
Values", ylab = "Residuals")
abline(h = 0, col = "red", lty = 2)
# Plotting residuals against fitted values
plot(model_mediation$fitted.values, residuals, main = "Residuals vs Fitted", xlab = "Fitted
Values", ylab = "Residuals")
abline(h = 0, col = "red", lty = 2)
# Breusch-Pagan test for homoscedasticity
car::ncvTest(model_mediation)
library(readr)
library(car)
library(ggplot2)
library(lmtest)
library(MASS)
dataset <- read_csv('datasetfinal.csv')  # Make sure to provide the correct path to your
dataset
# Define independent variables (IV) and dependent variable (DV)
X <- datasetfinal[, c('EcoAnx', 'EcoGri', 'EcoGui')]
y <- datasetfinal$OverallScale
# Fit the multiple regression model
model <- lm(y ~ EcoAnx + EcoGri + EcoGui, data = datasetfinal)
# Assumption 1: Linearity
# Scatterplot of observed vs. predicted values
plot(model, which = 1)
# Assumption 2: Independence
# Durbin-Watson test for autocorrelation in residuals
durbinWatsonTest(model)
# Assumption 3: Homoscedasticity
# Scatterplot of residuals vs. predicted values
plot(model, which = 3)
# Assumption 4: Normality
```

```
# Histogram of residuals
hist(residuals(model), main = 'Histogram of Residuals', col = 'lightblue', border = 'black', xlab
= 'Residuals')
# Q-Q plot of residuals
qqnorm(residuals(model))
qqline(residuals(model))
residuals <- residuals(model)
shapiro_test <- shapiro.test(residuals)
# Print the test results
print(shapiro_test)
# Summary of the regression model
summary(model)
vif_results <- car::vif(model_mediation)
print(vif_results)
shapiro_test <- shapiro.test(residuals)
# Print the test results
print(shapiro_test)
library(psych)
scales_data <- datasetfinal[, c("EcoAnx", "EcoGri", "EcoGui", "OverallScale")]
alpha_result <- alpha(scales_data)
print(alpha_result)
library(psych)
scales_data <- datasetfinal[, c("EcoAnx", "EcoGri", "EcoGui", "OverallScale")]
freq_table <- apply(scales_data, 2, table)
alpha_result <- alpha(scales_data)
print(alpha_result)
```