**Eco Anxiety levels compared between LGBTQ+ and Cishet groups of Dutch and German Nationality and the role of Environmental Action**

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**Abstract**

**Background:** Research gaps were identified in regards to the mental health impact of climate change for LGBTQ+ individuals specifically and the role of behaviours like environmental action in relation to eco-anxiety and LGBTQ+ identity. This thesis studied the relationship between eco-anxiety, environmental action, and a moderating effect of LGBTQ+ group identity in a Dutch and German population. This study compared eco-anxiety and environmental action levels between the LGBTQ+ group and cishet group, the eco-anxiety level between the Dutch and German participants was also compared. **Methods:** This study is cross-sectional and used an online survey to measure eco-anxiety and environmental action by using the Eco-Anxiety questionnaire and Environmental Action scale respectively. The sample (N=105) consisted of (n=35) individuals identifying as part of the LGBTQ+ group, the remaining (n=70) individuals were cishet. The nationality of the sample included (n=52) German participants and (n=53) Dutch participants. **Results:** The Mann-Whitney U test was used for multiple group comparisons, leading to the findings that LGBTQ+ individuals scored higher on eco-anxiety (p=<.001) and environmental action (p=.01) compared to cishet individuals. A moderate positive relationship between eco-anxiety and environmental action was found in alignment with earlier studies that studied the relationship between activism and eco-anxiety (p=<.001). However, the moderating effect of LGBTQ+ group identity on the relationship between these variables was not supported in the findings (p=.07). German participants were found to score higher on eco-anxiety compared to Dutch participants (p=<0.001). **Conclusion:** LGBTQ+ group identity was found to be connected to increased eco-anxiety and environmental action, though moderation was not found. Skewed results in the environmental action variable combined with a small sample size could have contributed to this study's inability to successfully test for moderation.

# Contents

# Introduction

The World Health Organization (WHO, 2022) has recently emphasized climate change as a global threat to mental health. The increase in natural disasters such as floods or wildfires due to climate change has been shown to facilitate the development of mental health disorders like post-traumatic stress disorder and anxiety disorders in individuals who are directly exposed (Hrabok et al., 2020). Individuals who are not exposed to natural disasters still are likely to report feeling distressed about climate change and its impact (Hrabok et al., 2020). Climate change contributes to the decline of the natural world, with devastating results for the flora and fauna worldwide (WHO, 2023). In response to the threats of climate change, an increase in climate change activism has been observed in recent years (Fisher & Nasrin, 2020). Many of these activist movements are influenced by so-called eco-emotions, specific emotions experienced regarding climate change (Stanley et al., 2021). These eco-emotions are experienced as a response to the deterioration of flora and fauna worldwide, and researchers have attempted to map climate change-related emotions in recent years (Cianconi et al., 2023). The determinants for differences in the intensity of these emotions have also been examined, such as gender and nationality differences (Wrana, 2024 ; Gökoglan, 2024). These eco-emotions and mental health disorders as a result of climate change are likely to increase in prevalence as the natural world continues to deteriorate (WHO, 2023). This burden of mental health is, however, not carried equally as vulnerable groups in society are identified as being more likely to experience both indirect and direct effects of climate change (Mann et al., 2024).

## Eco-anxiety

One of these mostly indirect effects of climate change is the emotional experience known as eco-anxiety (Pihkala, 2018). Although attempts have been made to define eco-anxiety, a recent review argues that some uncertainty remains regarding the definition (Coffey

et al., 2021). The conceptualization of eco-anxiety by Coffey et al. (2021) is similar to the description used by Ágoston et al. (2022), who designed a survey to measure eco-anxiety based on the description of Pihkala (2022a). This description refers to eco-anxiety as an emotional response as a result of observing the state of the natural environment in relation to climate change (Pihkala, 2022a). If the initial anxious response fails to disappear over time, it can instead become a mental state where the person's life is negatively affected by chronic eco-anxiety (Pihkala, 2022a). This definition of eco-anxiety will also be used in this study. A distinction is made between eco-anxiety and the anxiety that is experienced when exposed to a natural disaster (Brophy et al., 2023).

An individual's experience of eco-anxiety can range from a complete absence of symptoms to severe distress (Brophy et al., 2023). Effects associated with certain experiences of eco-anxiety include panic attacks and sleep problems (Dodds, 2021). Prolonged eco-anxiety can cause an individual to be chronically vigilant of climate change information, which can be associated with increases in muscle tension (Ágoston et al., 2022). Other types of distress include feelings of helplessness which can transition into a stronger state of feeling overwhelmed (Pihkala, 2022b). Difficulty in managing these increased levels of eco-anxiety might lead to burnout or depression (Pihkala, 2022c). For individuals who are unable to cope with eco-anxiety, mental health support may be required. Trost et al. (2024) found that therapists are seeing clients who specifically seek therapy for eco-anxiety. In response to the increased treatment of individuals suffering from eco-anxiety a framework was designed to aid mental health experts (Christodoulou et al., 2024). However, most researchers suggest caution in treating eco-anxiety in its totality as a disorder; instead describing it as a healthy initial response that in some cases can also lead to negative consequences (Pihkala, 2022b ; Wullenkord et al., 2021). Reduction of eco-anxiety levels might be required for individuals to avoid these consequences.

To alleviate eco-anxiety, individuals might expect their government to address climate change. Hickman et al. (2021) found that increased levels of worry regarding climate change in citizens was related to a view of governmental inadequacy. Therefore it is likely that eco-anxiety levels might differ between countries. Clayton et al. (2023) found differences between countries in regards to the amount that citizens were concerned about climate change, this variation was attributed to the amount of climate change disasters in countries. The WHO has recently recognized that a substantial number of governments fail to effectively reduce the mental health burden of climate change (WHO, 2022). One behaviour that could contribute to government policy change while simultaneously managing an individual's eco-anxiety level is climate change activism (Schwartz et al., 2022).

**Climate change activism and eco-anxiety**

Certain studies that examine the relationship between eco-anxiety and activism combine activism and pro-environmental behaviour in an overarching construct (Contreras et al., 2024). Stanley et al. (2021) refer instead to environmental action in relation to eco-anxiety and incorporate collective climate change activism as part of this construct, in addition to behaviours such as composting and recycling. Alisat & Riemer (2015) identified activism as a separate construct that required a definition to distinguish it from pro-environmental behaviour, and labelled activism as environmental action instead (Alisat & Riemer, 2015). This definition of environmental action in a broader collective context aimed to influence other individuals and government environmental policy will also be used in this current study (Alisat & Riemer, 2015). This study will therefore refer to activism as environmental action from this point onward, while using the term activism to align with other studies or to refer to individual actors or groups. Environmental action behaviours range from acts such as sharing a climate change related post online to organising a climate change protest (Alisat & Riemer, 2015).

Engaging in these environmental action behaviours may have positive and negative effects on an individual's eco-anxiety level. When a person suffers from eco-anxiety and engages in climate change activism this could help prevent that individual from developing mental health outcomes such as depression (Schwartz et al., 2022). Engaging in activism might also cause an individual to feel more hopeful towards the future, which could reduce depressive feelings (Schwartz et al., 2022). Engaging in environmental group activism might have a similar effect on eco-anxiety, as communicating with other activist individuals and receiving support can decrease eco-anxiety (Zurba et al., 2024). Despite several positive aspects of environmental action, some psychologists are reluctant to recommend activism to their clients who suffer from eco-anxiety (Boyd et al., 2024). This hesitancy might be related to negative effects associated with environmental action. Taking action against climate change is connected to increased levels of eco-anxiety compared to those who do not take part in activism (Ediz & Yanik, 2023 ; Dodds, 2021 ; Wullenkord et al., 2021). It is likely that climate change activists experience higher levels of eco-anxiety as they are more conscious of the climate change threats due to increased exposure to climate change information (Dodds, 2021). If taking part in environmental action does not lead to meaningful change, individuals might become discouraged and this could lead to mental health vulnerabilities (Boyd et al., 2024). A recent study revealed that some climate change activists propose the inclusion of climate anxiety as a disorder to receive sufficient recognition of the problem (Vukičević & Liu, 2024). Mental health support for those who take part in climate change activism could especially be relevant as disempowered groups who already face increased difficulties in society have been shown to be involved in climate change activism (Whitley & Bowers, 2023).

**LGBTQ+ as a vulnerable group**

One of these marginalized groups in society is comprised of lesbian, gay, bisexual, transgender, and queer/questioning (LGBTQ+) individuals and they have been identified as a group that is connected to climate change activism (Whitley & Bowers, 2023). Theoretical foundations refer to patterns where LGBTQ+ individuals had a major impact in climate change activism, as evident by the existence of specific climate change related groups created by queer individuals (Whitley & Bowers, 2023; Sbicca, 2012). One reason why the LGBTQ+ group is connected to climate change activism might be related to the political nature of the LGBTQ+ community (Whitley & Bowers, 2023). The increased likelihood of non-heterosexual individuals to engage in activist behaviour has already been observed in other areas of political protests (Swank & Fahs, 2019). Taking effective action to encourage government policy change in regards to climate change is likely to require a specific set of skills for an individual to effectively execute their plans (Alisat & Riemer, 2015). It could be argued that the LGBTQ+ community history of activism might therefore facilitate environmental action. The theoretical foundation may support the possibility of an increased likelihood of LGBTQ+ individuals to engage in environmental action.

The connection between LGBTQ+ individuals and environmental action could also be explained by the vulnerability of the group to the effects of climate change. Climate change is likely to widen societal gaps which will likely worsen the already marginalized position of the LGBTQ+ group (Whitley & Bowers, 2023). The vulnerability of the LGBTQ+ group is further reflected in the finding that individuals from this group are more likely to live in areas that are affected by climate change (Mann et al., 2024). These areas are often affected by extreme temperatures, air pollution, and are vulnerable to flooding (Mann et al., 2024). The focus of other limited research available has mainly addressed the discrimination that queer

and non-binary individuals face in the wake of natural disasters (Simmonds et al., 2021 ; Kilpatrick et al., 2023).

Research that is not focused on the connection to natural disasters has identified some vulnerabilities when it comes to the mental health of LGBTQ+ individuals in relation to climate change. Whitley and Bowers (2023) indicate that LGBTQ+ individuals are more aware and therefore more worried in regards to the threats of climate change compared to non-LGBTQ+ individuals, although this is not referred to as eco-anxiety. This increased awareness could be explained by the aforementioned finding that the LGBTQ+ community is a political movement aware of societal injustices. Eco-anxiety is hypothesized to be a possible cause for concern for queer individuals who have already been shown to receive insufficient mental health support (Kilpatrick et al., 2023). This concern is especially relevant as LGBTQ+ individuals have been shown to already have a higher likelihood of suffering from mental health problems such as anxiety and depression in general (Jonas et al., 2022). Eco-anxiety could, therefore, amplify existing mental health problems of the already vulnerable group.

**Current study**

The current study will refer to non-LGBTQ+ individuals as cishet, indicating that they identify themselves with the gender that they were given at birth and feel attraction towards the opposite gender (Jones et al., 2022). LGBTQ+ individuals are distinguished in this study from the LGBTQ+ community which is a broader social group that for some might have negative connotations (McCormick & Barthelemy, 2020). By measuring the eco-anxiety level of LGBTQ+ individuals this study will add data to the theoretical foundation that implies increased awareness of climate change problems by LGBTQ+ individuals (Whitley & Bowers, 2023). Kilpatrick et al. (2023) identified that little is known regarding the effects of climate change on queer individuals besides a clear focus on natural disasters, the current

study will contribute by measuring the eco-anxiety level in the LGBTQ+ population. Furthermore this study will address the gap identified by Whitmarsh et al. (2022) in regards to the connection between climate change activism and eco-anxiety. By using the definition of environmental action as defined by Alisat & Riemer (2015), the construct is studied separately from pro-environmental behaviour. By examining environmental action and LGBTQ+ identity, this study will also build on earlier research that found sexuality to play a role in other types of activism (Swank & Fahs, 2019). Finally, this study will add to the earlier studies of eco-anxiety in Dutch and German populations (Wrana, 2024 ; Rupp, 2024 ; Mania, 2024) by comparing eco-anxiety scores between nationalities in a more diverse sample.

The research question is formulated as follows: How does LGBTQ+ group identity influence the relationship between eco-anxiety and environmental action, and what differences in levels of eco-anxiety and environmental action exist between LGBTQ+ individuals and cishet individuals in Dutch and German populations?

The following hypotheses are proposed to answer the research question:

H1: The LGBTQ+ population scores higher on eco-anxiety in comparison to the cishet population.

H2: The LGBTQ+ population scores higher on environmental action compared to the cishet population.

H3: The level of eco-anxiety is positively related to the level of environmental action.

H4: LGBTQ+ group identity positively moderates the association between eco-anxiety and environmental action.

H5: The German population scores higher on eco-anxiety in comparison to the Dutch population.

**Methods**

The current study was part of an overarching research project of the University of Twente into the various mental health impacts of climate change in German and Dutch populations. The current study distinguished itself by a focus on the connection between eco-anxiety and environmental action and by studying the LGBTQ+ group in addition to the cishet group in the Dutch and German population.

**Design**

This study used a cross-sectional online survey design and studied the relationship between the independent variable eco-anxiety, the dependent variable of environmental action, and the moderating effect of LGBTQ+ group membership. This study also compared the Dutch and German populations in regard to eco-anxiety, and levels of eco-anxiety and environmental action will be compared between LGBTQ+ individuals and cishet individuals. This study was approved by the University of Twente BMS ethical committee under the request number 240862.

**Participants**

*G Power Analysis*

The required final sample size of this study was calculated by using an a priori analysis, and for this purpose the program G*power (version 3.1.9.7) was used. This program was selected as it was an accessible and free updated version of the G*Power 2 software, which has seen extensive use in social sciences (Faul et al., 2007). The required tests to answer the hypothesis of this study, a linear multiple regression and comparison of two means, were selected in the program. A medium effect size was also chosen with an alpha level of .05 and a power level of .95. This effect size was decided by comparing the effect sizes of earlier comparable studies as proposed by Ünalan (2021). For this purpose the effect

size of earlier studies that were part of the overarching research project were considered (Rupp, 2024 ; Mania, 2024). The a priori analysis output recommended a sample size of $N$=176, as comparison of group means would require $n$=88 participants of Dutch and German participants, and LGBTQ+ and cishet participants.

### *Inclusion and exclusion criteria*

The participants of this study were selected in alignment with the exclusion and inclusion criteria. The inclusion criteria for this study indicated that participants possessed either a Dutch or German nationality and were at least 18 years old. Participants who were below the age of 18 were excluded as they would not be able to give informed consent by themselves. In addition, participants without a German or Dutch nationality were excluded as this study specifically compared these two nationalities. Participants who suffered from suicidal ideation in the past year or who were currently in mental health treatment were excluded due to the nature of the topic of this study. Individuals who did not give initial consent and participants who did not finish the set of questionnaires and therefore did not give consent for the second time, were also excluded.

### *Sampling method and participant recruitment*

This study used the method of convenience sampling, as this was found to be a cost-effective method to reach a high number of participants in a short period of time (Jager et al., 2017). In addition to general participant recruitment, this method was also employed to reach LGBTQ+ individuals specifically as convenience sampling has been shown to be a method to effectively reach individuals who are hard to reach via other sampling strategies (Chen et al., 2020). Snowball sampling, an online survey and efforts to reach out to community partners have also been used as these have been shown to be effective methods to reach the LGBTQ+ group (Hughes et al., 2021).

The survey link was shared on LinkedIn, Facebook and WhatsApp social media platforms. To target the LGBTQ+ group specifically the link was also shared on LGBTQ+ reddit pages and Facebook groups. The link to the study was also included in the community partner COC Twente-Achterhoek newsletter. Participants were also gathered via the University of Twente Sona system for a reward of 0.25 Sona credits. The Sona system is a program that allows University of Twente students who study psychology or communication science to participate in student organized studies in exchange for Sona credits.

**Materials**

In the data collection phase posters were used to attract participants whenever it was possible to add a picture to a recruitment message (see Appendix A). This poster contained information about the study topic and inclusion criteria, in addition to a QR code that led to the Qualtrics link (see Appendix A). The programme Qualtrics was used to design and administer the questionnaires and the programme automatically saved the collected data. This program was chosen as it was also used in the overarching research and was, therefore, easily accessible and free.

In the Qualtrics survey the participants were asked to share demographic information. The age of participants was asked in addition to their gender, whether or not they identified as being part of the LGBTQ+ group (see Appendix B & C). As part of the overarching study other demographic questions included questions about living conditions in relation to a body of water and whether or not participants live below sea level. However for the current study only the age, gender, LGBTQ+ group membership and nationality of participants were considered.

The questionnaires that appeared in Qualtrics were in order of appearance the Eco-Anxiety questionnaire (EAQ-22), Generalized Anxiety Disorder (GAD-7), Eco-Guilt

questionnaire (EGuiQ-11), Ecological Grief Questionnaire (EGriQ-6), Environmental Action Scale (EAS), Media Exposure Climate Anxiety and Mental Health (MECAMH) and the Pro-Environmental Behaviour scale (PEBS). Most of these questionnaires were included as part of the overarching project, for the current study only the EAS and EAQ-22 were relevant.

### Eco-Anxiety Questionnaire (EAQ-22)

The EAQ-22 was designed by Ágoston et al. (2022) and contains 22 items that can be answered by choosing one of four Likert scale points ranging from strongly disagree to strongly agree. The Likert scale points include the value of one for strong disagreement through a value of four for strong agreement. The 22 items of the EAQ-22 cover two factors: the habit of worrying about all forms of life on earth and the detrimental outcomes of this experience of eco-anxiety. The habit of worrying is reflected in items that measure the intensity of feelings experienced towards climate change and how persistent these feelings are, while the factor related to the outcome of these feelings includes items that measure sleeplessness and muscle tension (Ágoston et al., 2022). Participants encounter statements like "I am worried about the increasing number of natural disasters caused by climate change" (Ágoston et al., 2022). The reliability of the EAQ-22 is sufficient as reflected by Cronbach's alpha of .91 and .86 for the two factors respectively (Ágoston et al., 2022).

### Environmental Action Scale (EAS)

Alisat & Riemer (2015) designed the EAS and it contains 18 items that can be answered by selecting one of five scale points ranging from never to frequently on the other end. The values attached to the scale points are zero for never through the value of four for frequently. Items like "Took part in a protest/rally about an environmental issue" are included in the EAS and the participant is asked to think about how often they engaged in the behaviour in the past six months (Alisat & Riemer, 2015). The EAS contains two factors, one related to participating in environmental action and the other to taking charge in relation to

environmental action. The sufficient reliability of the EAS is reflected in the Cronbach's alpha of .92. The concurrent, convergent and discriminant validity of the EAS have also been evaluated as being valid (Alisat & Riemer, 2015).

***Translation process***

As part of the overarching research project and the current study, questionnaires have been translated for use in German and Dutch populations in accordance with the model designed by Tsang et al. (2017) that details the recommended steps in the process of translating and validating surveys. Questionnaires that were relevant for the current study specifically were the EAS and EAQ-22. The EAS was forward and backward translated into Dutch and English for the first time with permission from the original researchers who designed the questionnaire. The forward translation was executed by a researcher of the current study, whereas the backward translation was carried out by a researcher of the overarching research project. The German version of the EAS was adopted from the German international Youth Leading Environmental Change study as recommended by the researchers who designed the EAS (Riemer et al., 2016). The EAQ-22 was translated from English to Dutch by previous researchers as part of the overarching research (Doyle, 2024 ; Gökoglan, 2024). During the current study, that translation was translated back into English by a researcher involved in the current study. This English version was then translated back into Dutch by a researcher involved in the overarching project. This translation process served to identify translation differences and validate the translations. Changes that resulted from this translation process of the EAQ-22 were related to the Dutch scale points "mee oneens" and "mee eens", these were replaced by "helemaal mee oneens" and "helemaal mee eens", respectively and the final version was added to Qualtrics. The German EAQ-22 that was used in the overarching research and this study was the most recent German version of the EAQ-22 as translated by Zeier & Wessa (2024).

**Procedure**

***Pilot test***

Tsang et al. (2017) identified recommended steps to aid in the validation process of a translated questionnaire, in accordance with these steps the current study employed the use of a pilot test. The pilot test is identified as the final step before the initiation of the validation process (Tsang et al., (2017). The additional steps in the validation process of the translated questionnaires were beyond the scope of the current study. The pilot test also assisted in the identification of any comprehension issues due to the newly translated EAS. This pilot test was also used as an opportunity to identify possible discomfort in participants due to the LGBTQ+ identity question. Participants were recruited via WhatsApp to take part in the pilot study, which included all updated questionnaires in Qualtrics. The pilot test sample of 32 participants did not report discomfort, and based on the feedback, one item from the PEBS was changed, but this questionnaire is not relevant to the current study. The pilot test sample was therefore successfully combined with the final sample of this study.

***Main study***

When a participant followed the Qualtrics link they would be introduced first to the welcome screen (see Appendix D & E). This screen informed them of the goal and scope of this study, while also naming the exclusion and inclusion criteria. The voluntary and anonymous nature of the study was emphasized. Participants were informed about the procedure and the timeframe of 25-30 minutes that was needed to complete the survey. The contact details of all researchers involved in the study were shared on this screen as well.

By clicking the arrow, the participant continued to the informed consent screen (see Appendix F & G). Here it was indicated that the participant could drop out of the study at any moment without consequences, in line with the voluntary nature of the study. Anonymity was

emphasized again and the participant had to choose whether or not to give consent by ticking a box. Not consenting would lead a participant to be directed to the end of the survey, if a participant did give consent they would continue to the demographic questions.

After answering these questions the participants who met the inclusion criteria then continued to the questionnaires. Participants who did not meet these criteria by indicating an age below 18 or a nationality other than German or Dutch were forwarded to the end of the survey. After answering the questionnaires the participant was asked to give consent for a second time on the debriefing screen (see Appendix H & I). This second consent form was included to allow participants to discontinue participation if they experienced discomfort at this point. The debriefing screen also showed mental health resources that could be consulted when needed. Participants who refused to give consent for a second time would not be included in the study, those who agreed would reach open questions. One of these open questions was related to the Sona id for UT students. Other questions regarding the experience of discomfort or comprehension issues remained in the survey after they were originally included for the pilot test. A question about interest in participation in future research was included for use in the overarching research project. After these optional open questions a participant would reach the end screen of the survey which thanked them for their participation.

**Data Analysis**

After data collection ended Rstudio (version 4.4.1) was used to execute the data analyses, and the code that was used can be found in Appendix J. The packages "tidyverse", "car", "lmtest", "ggplot2" and "interactions" were installed and loaded.

### *Data cleaning*

Participants who dropped out during the survey did not give consent for the second time and were therefore removed. As participants had the option to leave an email address, this left the opportunity to identify duplicate responses and one such duplicate response was removed. In addition, irrelevant data for the current study, like the time it took to complete the survey and Sona ID, were removed. Responses to questionnaires were then scored by assigning numbers; for example, the EAS scale that ranges from never to often was scored as one to five. The EAQ-22 that ranges from disagree to agree was coded one through four respectively. All data was prepared for the analysis, for example by converting unrealistic age numbers like 10000 to "NA". The question that asked participants if they identified as being part of the LGBTQ+ group was dummy-coded to zero and one to prepare the variable to be included in calculations. Before continuing to the more specific analyses that are intended to test the hypotheses, the parametric assumptions of the data were checked.

### *Parametric tests and descriptive statistics*

The mean, range and SD of the variable age were calculated in addition to the frequency of participant's gender, LGBTQ+ group membership and nationality. The mean of each participant's responses to the EAS and EAQ-22 was then calculated to allow for further analysis, and the composite mean and SD of these survey outcomes were also calculated to gain an overview of the data distribution. The newly created variables that included the mean of responses to the EAS and EAQ-22 were then tested to determine if the variables met the parametric assumptions. The parametric assumptions that were tested were normality, homogeneity of variance, linearity and multicollinearity. While the assumptions of linearity and multicollinearity were met, the assumptions of normality and homogeneity of variance were not met regardless of attempted transformations. Non parametric tests were then selected for the hypothesis testing phase.

*Hypothesis testing*

H1: To test the hypothesis that the LGBTQ+ population scores higher on eco-anxiety in comparison to the cishet population, the Mann-Whitney U test was used.

H2: To test the hypothesis that LGBTQ+ population scores higher on environmental action in comparison to cishet population the Mann-Whitney U test was also used.

H3: To test the hypothesis whether or not eco anxiety is positively related to environmental action the non-parametric Spearman's rank correlation test was used.

H4: To test whether or not LGBTQ+ group identity positively moderates the association between eco-anxiety and environmental action linear regression was used.

H5: The Mann-Whitney U test was again used to test the final hypothesis that the German group scores higher on eco-anxiety than the Dutch group.

**Results**

**Descriptive statistics**

In the raw Qualtrics data a total of $N$=148 participants were initially observed. Participants who did not give consent at the second consent question were removed ($n$=42), and one duplicate response was deleted as identified by the fact that this participant left an email address for future research. More than half of these ($n$=42) participants that were removed did not reach the halfway point of the total survey. Three participants were identified to have indicated unrealistic age values, like 10.000; these participants, however, also did not finish the survey and were thus already excluded from the ($n$=42) group of participants who did not consent. After this data-cleaning process was concluded, the final sample size was $N$=105. The age of the participants in this sample ranged from 18 to 75 with a mean ($M$) age of 30.69 and a standard deviation ($SD)$ of 14.39. In regards to gender 32 participants

identified as male, while 70 identified as female and finally three identified as non-binary/other. Of all participants 35 identified as being part of the LGBTQ+ group, with the remaining 70 as identifying as not part of this group. Finally, in regards to nationality 52 participants were German, 53 were Dutch.

The composite M of eco-anxiety is 2.46, with an SD of 0.48. This M balances between options two and three: somewhat disagree, somewhat agree. While the score could be described as moderate, it is closer to the scale point of "somewhat disagree" compared to the scale point of "somewhat agree". The composite M of environmental action is 1.57, with an SD of 0.45. This indicates a low level of environmental action in participants as the scale offered five options and this score falls between one, indicating "never", and two.

**Parametric assumptions for linear regression**

Before proceeding to the testing of hypotheses the parametric assumptions of the data were checked. The assumption of linearity was first tested by observing a scatterplot of just the independent and dependent variables; a moderately linear relationship was observed here (See Appendix K). The residuals also did not show a clear pattern, which was also observed as an indicator of linearity (See Appendix L). No significant multicollinearity was found in the data, as indicated by a Variance Inflation Factor (VIF) of 1.1 for both variables. The next step entailed the assumption of homoscedasticity, and this assumption was not met, as evidenced by a $p$ of .024 in the Breusch-Pagan test. The assumption of normality was then investigated by conducting the Shapiro-Wilk test and it became evident that the independent variable of eco-anxiety met the assumption of normality, while the dependent variable of environmental action did not. Further exploration revealed that the data on environmental action showed a skew to the right (see Figure 1). A log transformation and a square root transformation were attempted to normalize the distribution, but these transformations did not allow the data to meet the assumption of normality. Due to this severity of skew in the data,

and the failure to meet the assumption of homoscedasticity, nonparametric tests were considered for the hypothesis testing process.

**Figure 1**

*The frequency of EAS scores for different scale point ranges*
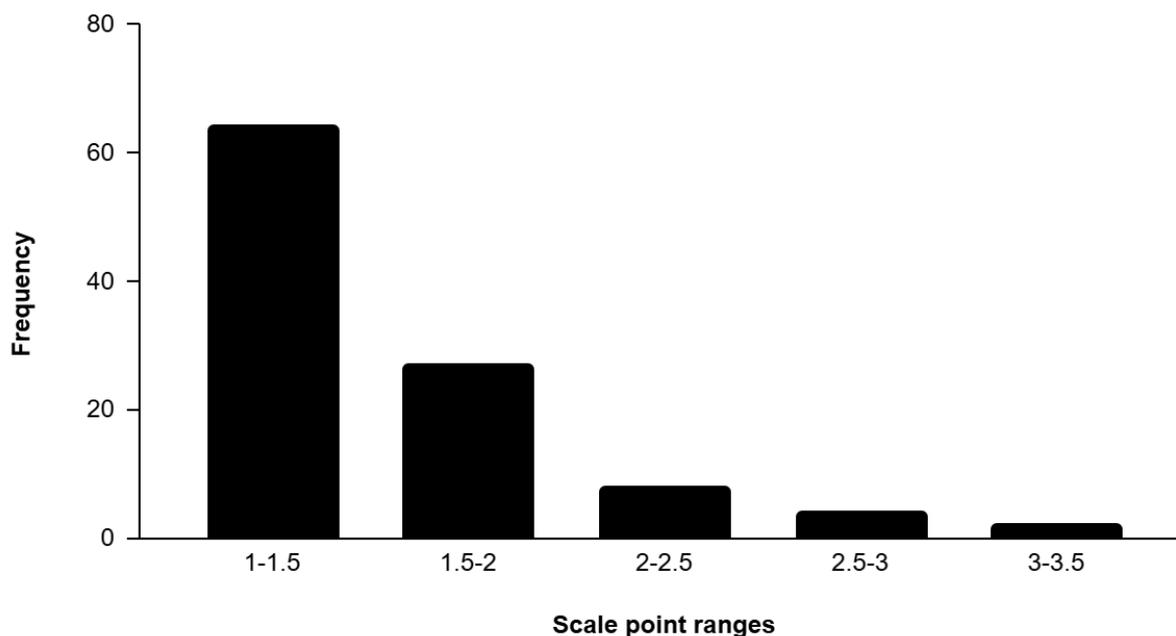


*Note.* The coded scale points of the EAS ranged from one through five. Due to the clustered nature of the EAS scores, the frequency of scores is shown as a range of scale points to show the distribution more clearly. No higher mean scores above scale point 3.5 were found.

**Hypothesis testing**

Hypothesis 1, 2 and 5 involve group comparisons, and when multiple group comparisons are made in a study the risk of causing a type I error increases, which would indicate that the findings are caused by probability (Ranganathan et al., 2016). The Bonferroni correction is recommended as being an accessible method to gain insight into whether the findings can be attributed to probability or not and therefore it has been considered for this

study (Ranganathan et al., 2016). As three comparisons are made in this study, the *p* of .05 is divided by three, leading to a new threshold of *p* .017 for the group comparisons.

*Hypothesis 1*

To test the first hypothesis, the Mann-Whitney U test was executed. The eco-anxiety level of the LGBTQ+ group (n=35) was compared to the level of eco-anxiety in the cishet group (*n*=70). The output indicated a *W* of 732 and a *p* < .001, indicating a significant difference between these groups. The *W* value indicates that the LGBTQ+ group scored higher on eco-anxiety, in accordance with the hypothesis. As three hypotheses involve the Mann-Whitney U test, the results have been combined in table 2.

**Table 2**

*The outcomes of the Mann-Whitney U tests conducted for hypothesis 1, 2, 5.*

| Compared groups | Construct of comparison | N | W | p | Median of ranks |
|---|---|---|---|---|---|
| LGBTQ+, | Eco-anxiety | 35 | 732 | <.001 | 69.50 |
| Cishet | | 70 | | | 40.75 |
| LGBTQ+, | Environmental action | 35 | 851.5 | .01 | 70.5 |
| Cishet | | 70 | | | 43.0 |
| German, | Eco-Anxiety | 52 | 2046 | <.001 | 67.75 |
| Dutch | | 53 | | | 32.50 |

*Note. The W value refers to the rank sum of the smallest sized group involved in the comparison.*

*Hypothesis 2*

The Mann-Whitney U test was also used for the second hypothesis where the group of LGBTQ+ individuals ($n$=35) were compared to the group of cishet individuals ($n$=70) based on the concept of environmental action. A $W$ of 851.5 was found with a $p$ of 0.01, and thus, there was an indication of a significant difference between the groups. In line with the hypothesis, it was found that LGBTQ+ individuals score higher on the concept of environmental action, as indicated by the $W$ value as shown in table 2.

### Hypothesis 3

Spearman's rank correlation test was used to find out if there was a positive relationship between eco-anxiety and environmental action. A $r_s$ of 0.42 was found with a $p$ of <.001 and an S of 112810, indicating a significant moderate positive relationship between these variables. As a result, this hypothesis was supported.

### Hypothesis 4

Moderated linear regression was used to test the fourth hypothesis. The interaction effect of LGBTQ+ group membership on the connection between eco-anxiety and environmental action was found to not be significant, with a $p$ of .07. The adjusted r-squared of 0.239 indicates that the model explains approximately 24% of the variance in environmental action. The $F$ was 11.87 on 3 and 101 $df$. This hypothesis was rejected, the remaining output of this model can be found in table 1.

**Table 1**

*The linear regression model output including the interaction effect*

| Variable | Estimate | SE | t | p | 95% CI |
|----------|----------|------|------|-------|--------------|
| Intercept | 0.86 | 0.25 | 3.46 | <.001 | [0.37, 1.35] |

| | | | | | |
|---|---|---|---|---|---|
| Eco-anxiety | 0.26 | 0.10 | 2.55 | .01 | [0.06, 0.47] |
| LGBTQ+/Cish et | -0.67 | 0.47 | -1.44 | .15 | [-1.59, 0.25] |
| Interaction | 0.33 | 0.18 | 1.85 | .07 | [-0.02, 0.69] |

*Note.* CI refers to the confidence interval, the intercept in this output refers to the base level of the dependent variable environmental action before including eco-anxiety and LGBTQ+ group identity.

### *Hypothesis 5*

The final hypothesis was tested by use of the Mann-Whitney U test to compare the Dutch (*n*=53) and German (*n*=52) participants on the construct of eco-anxiety. The outcome as shown in table 2 showed a *W* of 2046 and a *p* < 0.001, indicating the existence of a significant difference between the nationalities. The *W* value confirms the hypothesis that the German group showed a higher degree of eco-anxiety.

### Post-hoc analysis

There was no significant interaction effect found of LGBTQ+ group identity, but the group did show a significant difference in scores on both eco-anxiety and environmental action. Therefore a post-hoc analysis was conducted by separating the LGBTQ+ group and cishet group and comparing them on the relationship between eco-anxiety and environmental action. As indicated by the significant estimate in both groups, the positive relationship between eco-anxiety and environmental action is stronger for the LGBTQ+ group. Table 3 shows the output for the LGBTQ+ group and cishet group.

### Table 3

*The linear regression model output for the LGBTQ+ and Cishet group.*

| Variable | Statistic | LGBTQ+ | Cishet |
| --- | --- | --- | --- |
| Intercept | Estimate | 0.19 | 0.86 |
| | SE | 0.51 | 0.20 |
| | t | 0.36 | 4.24 |
| | p | .72 | <.001 |
| | 95 % CI | [-0.85, 1.23] | [0.45, 1.26] |
| Eco-anxiety | Estimate | 0.59 | 0.26 |
| | SE | 0.19 | 0.08 |
| | t | 3.13 | 3.12 |
| | p | .004 | .003 |
| | 95% CI | [0.21, 0.98] | [0.09, 0.43] |

As part of this post-hoc analysis the Spearman's rank correlation was calculated for the relationship between eco-anxiety and environmental action in the separate groups of LGBTQ+ and cishet populations. This revealed a $r_s$ of 0.56 for the LGBTQ+ group with a $p$ of <.001, and a $r_s$ of 0.27 with a $p$ of .03 for the cishet group. These findings indicate a stronger correlation between eco-anxiety and environmental action for the LGBTQ+ group.

## Discussion

This study intended to provide evidence that helps to fill the research gap that exists in regards to the mental health effects of climate change on the LGBTQ+ group specifically, and it used the EAQ-22 to measure the level of eco-anxiety. In addition, this study intended to

gather insight into the relationship between environmental action as measured by the EAS and eco-anxiety. Finally, this study used the German and Dutch translated questionnaires to identify differences in eco-anxiety levels between both populations. Higher levels of eco-anxiety and environmental action were found for the LGBTQ+ group in comparison with the cishet group. Although the positive moderating effect of LGBTQ+ group membership on the connection between eco-anxiety and environmental action was not found, the post-hoc analysis suggests that this connection is stronger for LGBTQ+ individuals. A moderate positive relationship between eco-anxiety and environmental action was found, and nationality differences in eco-anxiety levels were reflected in higher eco-anxiety scores of German participants in comparison to Dutch participants.

This study illustrated that LGBTQ+ individuals experience higher levels of eco-anxiety compared to cishet individuals. This suggests that increased vulnerability to higher levels of eco-anxiety is a likely addition to the already identified vulnerabilities for LGTBTQ+ individuals in the wake of climate change. The theoretical foundation of Whitley & Bowers (2023) that LGBTQ+ individuals are more likely to acknowledge the threat and severity of climate change in comparison to cishet individuals is reflected in these increased eco-anxiety measurements. Although Whitley & Bowers (2023) did not refer to the concept of eco-anxiety in regards to the LGBTQ+ group and its increased awareness of climate change, the findings of this study echo that theoretical perspective.

The results further indicate that LGBTQ+ individuals show higher levels of environmental action compared to cishet individuals. The specific climate change action groups created by LGBTQ+ individuals and the implied connectedness of this group to environmental action as suggested by Whitley & Bowers (2023) therefore seem to be indicators of overall increased levels of environmental action of this subgroup. Swank & Fahs (2019) already identified that individuals with a diverse sexuality were more likely to engage

in political protests and suggested that this might also extend to other areas, and the data of this study suggests that environmental action can be added to those areas of protest. As LGBTQ+ individuals have been found to be more likely to engage in environmental action, this could indicate that this group feels more able to act upon their eco-anxiety and transform it into action.

The findings of this study further suggest additional support for the positive relationship between environmental action and eco-anxiety. The relationship, while moderately strong, indicates that experiencing higher levels of eco-anxiety is connected to increased environmental action. While not a causal connection, this does add to the need identified by Whitley & Bowers (2023) to gain more insight into what specific behaviours might be connected to the experience of climate change anxiety. These findings suggest the addition of environmental action as defined by Alisat & Riemer (2015) to the group of other pro environmental behaviours, including different definitions of activism, that have already been shown to be connected to higher levels of eco-anxiety (Ágoston et al., 2022 ; Whitmarsh et al., 2022). These findings also add data to the suggestion of Dodds (2021) that climate change activists might experience higher levels of eco-anxiety. Dodds (2021) suggests that activists are more likely to interact with climate change information, which increases their anxiety levels. However, the positive relationship found in the current study contradicts findings that showed that those experiencing eco-anxiety are less likely to engage in environmental action (Stanley et al., 2021 ; Contreras et al., 2024). This difference could be explained by the fact that the measure of environmental action as a concept in the current study was executed by use of the more extensive EAS. Stanley et al. (2021) included items to measure behaviours that are referred to as climate action, but the survey was less extensive. In addition, Stanley et al. (2021) studied environmental action not as a separate construct, but as part of overarching pro-environmental behaviour instead. It could be argued that the

behaviours related to taking part and taking charge in context of climate change related events were not included, which could have led to different outcomes of the construct. Stanley et al. (2021) however took other eco emotions into account, whereas the current study only included eco-anxiety in the model. This indicates that the positive relationship between eco-anxiety and environmental action that was found in this study, does not take the broader spectrum of eco-emotions into account.

This research did not find evidence for the positive moderating effect of LGBTQ+ group identity on the relationship between eco-anxiety and environmental action. This indicates that the positive relationship between environmental action and eco-anxiety that was indicated in the data, does not significantly increase in strength for LGBTQ+ individuals. Moderation has been shown to be difficult to detect in studies due to the low effect size (Vize et al., 2023). The post-hoc analysis does however indicate that the relationship between eco-anxiety and environmental action is stronger for LGBTQ+ individuals compared to cishet individuals when separately analysing the groups. It could be likely that if the moderating effect does exist, this effect was not found in the current study due to a combination of the insufficient power size combined with general difficulties in detecting moderation effects.

Finally, the data of this study indicates that German participants experience higher levels of eco-anxiety compared to Dutch participants. Although the current study made some adjustments in the Dutch translation of the EAQ-22 and aimed to have a more diverse sample, the difference was still found between the nationalities which in turn bolsters the original findings of nationality differences in eco-anxiety as found by Wrana (2024). Wrana (2024) hypothesized that the increased level of German eco-anxiety could be attributed to the government policy differences between the two countries. Donatti et al. (2024) found that there have been more climate change related incidents in Germany, and a higher amount of the population was found to have been affected by these incidents compared to the

Netherlands. Therefore the eco-anxiety differences between nationalities add to the data of Clayton et al. (2023) who connected the intensity of worry in regards to climate change to the amount of climate change related incidents. It is possible that these disasters have led to more awareness, which in turn has increased eco-anxiety levels in the German population.

**Limitations**

Design limitations of this study are likely to have contributed to the high dropout rate and insufficient sample size. The group of surveys that were part of the Qualtrics study amounted to a time investment of participants of at least 25 minutes. It has been found that especially in the context of online surveys, longer surveys are associated with higher dropout rates and fewer participants will consider taking part in the first place (Galesic & Bosnjak, 2009). It is likely that the length of the Qualtrics survey therefore contributed to the high dropout rate of this study, which undermines the power of the study.

Another limitation of the study is the nature of the sample, consisting mostly of students and a relatively young sample age. In addition, the sample contains a higher number of female participants as compared to male participants, and the sample contains a higher amount of cishet participants in comparison to the LGBTQ+ participants. This sample makeup is likely to reduce the generalizability of the findings to the broader population, as the sample likely does not represent the broader population which is a common vulnerability of convenience sampling (Mullinix et al., 2016). The cross-sectional nature of this study can also partially be described as a limitation, as eco-anxiety and environmental action have been measured only in the current moment. This translates into a difficulty to test for causality between the variables, and the influence of time cannot be taken into account (Wang & Cheng, 2020).

A final limitation is the inability of this study to compare subgroups within the LGBTQ+ group. Although grouping participants into either LGBTQ+ or cishet allowed for comparison and allowed for anonymity of participants, the overarching group of LGBTQ+ does not allow for a clear differentiation between gender identity and sexual orientation. Theoretical foundations indicated that eco-anxiety could be an escalating factor for other mental health problems of queer individuals specifically (Kilpatrick et al., 2023). As this study grouped LGBTQ+ individuals, differences observed in this study between cishet and LGBTQ+ groups could be attributed to differences in gender identity, but also sexual orientation, or a combination of both. The lack of analysis of subgroups undermines the strength and accuracy of claims made in this study. In addition some individuals, for example those who are asexual, might not identify with either label (Winer, 2024). By dividing participants in either LGBTQ+ or cishet groups these individuals either could not be included, or chose a group that did not align with their identity. This could further reduce the accuracy of the findings of this study.

**Strengths**

The attempt of this study to gain more insight in the impact of eco-anxiety on the LGBTQ+ group specifically does add to other steps that are being taken to take this sub-population into consideration in the context of climate change (Simmonds et al., 2021). The LGBTQ+ group is a difficult group to include in research and dividing this group into subgroups would likely lead to very low sub-sample groups, which could again influence the results negatively. By grouping LGBTQ+ individuals this study was able to administer the EAQ-22 to this sub group specifically in order to measure eco-anxiety levels and compare the group to a cishet group. By doing so, this study has responded to a need for more research into the vulnerability of the LGBTQ+ group in the context of climate change. Moreno et al. (2018) recommend that many fields of psychological research need to increase inclusivity,

and by studying the LGBTQ+ group this study has attempted to increase inclusivity in the field of climate psychology. To counter some limitations in regards to the sampling method this study attempted to reach out to community partners, in alignment with recommendations for studying the LGBTQ+ group specifically (Hughes et al., 2021). As the LGBTQ+ group is a vulnerable group, this study has also attempted to treat the survey questions related to gender and LGBTQ+ status with sensitivity in an attempt to meet recommendations of Hughes et al. (2021). This study could therefore function as part of the groundwork for more inclusive research in regards to climate change and mental health.

The strength of this study furthermore is that it aided in the validation process of the overarching University of Twente study regarding various eco-emotion questionnaires by forward and backward translating various surveys in German and Dutch. In this process, this study was the first to translate the EAS into Dutch, aiding in the overall process of validating climate change related questionnaires in different countries. In regards to this translation process, the additions made to the Dutch scale translation of the EAQ-22 and subsequent implementation of the EAQ-22 in a diverse sample have helped bolster earlier findings comparing eco-anxiety levels by nationality (Wrana, 2024). By studying environmental action in connection to eco-anxiety, while also considering the differences between LGBTQ+ and cishet individuals, this study has studied climate change and its effects on emotions and behaviour in diverse groups.

**Future directions**

This study has revealed differences between the groups of LGBTQ+ and cishet individuals in regards to environmental action and eco-anxiety, adding data to earlier theoretical findings by other researchers. However, qualitative research into the origin of these observed differences is recommended to gain more insight into the cause of these observations. A focus group study could help identify how the experience of eco-anxiety

differs between LGBTQ+ and cishet individuals. Certain research suggests for instance the possibility that LGBTQ+ individuals are able to form deep attachment to animals, which is attributed to the accepting nature of animals which opposes the discrimination that LGBTQ+ individuals often face (Videla et al., 2023). Future studies could study the relationship of this finding to LGBTQ+ eco-anxiety levels, especially since a stronger connection to nature in general has been identified as being connected to higher eco-anxiety levels (Coffey et al., 2021). Insights from the focus groups could be used to improve treatment for individuals who suffer from high levels of eco-anxiety, adding to existing treatments that attempt to take diverse sexuality and gender into account when treating clients in relation to climate change mental health conditions (Doherty et al., 2024).

Future quantitative research that focuses on the eco-anxiety levels of LGBTQ+ individuals could study subgroups, to gain insight in how individuals with different sexualities or gender identities experience eco-anxiety. By studying subgroups in a more substantive sample, a future study could attempt to reach a sufficient sample size to effectively test for moderation. In addition, this could help identify which subgroups within the LGBTQ+ group are more vulnerable to the effects of climate change.

Longitudinal research is also recommended, more specifically to gain insight into the level of eco-anxiety over time. In addition, longitudinal research could help identify eco-anxiety levels in connection to climate change environmental action to gain insight in the effect of engaging in environmental action on the level of eco-anxiety in different groups. This future research could build on the already established longitudinal study of Contreras et al. (2024), by adding the EAS as a measurement tool for environmental action. Division of participants in groups of LGBTQ+ and cishet could also help gain insight in how these groups might differ in the fluctuations of eco-anxiety in relation to environmental action behaviours. Future research into eco-emotions should consider using shortened versions of the existing

surveys to reduce dropout rates, increase the accuracy of data gathered and reduce possible distress experienced by participants.

## Conclusion

This study aimed to answer the research question: "How does LGBTQ+ group identity influence the relationship between eco-anxiety and environmental action, and what differences in levels of eco-anxiety and environmental action exist between LGBTQ+ individuals and cishet individuals in Dutch and German populations?". The findings of this study indicate significant differences in the experience of the level of eco anxiety between LGBTQ+ individuals and cishet individuals. In addition, this study found that LGBTQ+ individuals are more likely to engage in environmental action compared to cishet individuals. The moderately positive relationship between eco-anxiety and environmental action found in this study confirmed earlier studies that studied this relationship, but bolstered those findings with a more detailed measurement of environmental action. The earlier identified higher level of eco-anxiety in German participants in comparison to Dutch participants was strengthened by the similar finding in this study with a more diverse sample. Although this study did not find a moderating effect of LGBTQ+ group identity, the post hoc analyses indicate a potential for future research to test for moderation by using a larger sample. By studying the LGBTQ+ group specifically in the context of climate change, this study adds to the foundation of diversity in the field of climate change psychology and responds to the need for more research into this group in regards to climate change effects.

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# Appendix A

## Posters

**Maken we ons op een gezonde manier zorgen over het klimaat?**

U kunt ons helpen deze vraag te beantwoorden door deel te nemen aan ons onderzoek naar de psychologische effecten van klimaatverandering.

Voorwaarden: 18+, Nederlandse of Duitse nationaliteit.



**Machen wir uns auf eine gesunde Weise Sorgen um das Klima?**

Sie können uns helfen diese Frage zu beantworten in dem Sie an unserer Studie zu den psychologischen Auswirkungen des Klimawandels teilnehmen.

Teilnahmebedingungen: 18+, Deutsche oder Niederländische Staatsangehörigkeit.

**Appendix B**

**LGBTQ+ question (Dutch)**

Identificeert u zich als onderdeel van de LHBTI+ groep? (Om uw anonimiteit te garanderen kunnen wij geen specifiekere manieren aanbieden om uw genderidentiteit of seksualiteit aan te geven)


Ja/Nee

**Appendix C**

**LGBTQ+ question (German)**

Identifizieren Sie sich als Teil der LGBTQ+ Gruppe? (Um ihre Anonymität zu gewährleisten, dürfen wir Ihnen keine spezifischeren Möglichkeiten zur Angabe ihrer Geschlechtsidentität oder Sexualität anbieten)

Ja/Nein

**Appendix D**

**Welcome screen (Dutch)**

**Welkom**

Het doel van dit onderzoek is om de relatie tussen klimaatverandering, psychische stoornissen en milieuvriendelijk gedrag in de Duitse en Nederlandse bevolking te onderzoeken. Het onderzoek zal worden uitgevoerd door twee bachelor- en één masterstudenten Psychologie aan de Universiteit Twente en de verzamelde gegevens zullen worden geanalyseerd voor hun bachelor- en masterscripties.

**Deelname**

Om deel te nemen aan dit onderzoek moet u 18 jaar of ouder zijn en dient u de Duitse of Nederlandse nationaliteit te hebben. U moet ook Duits of Nederlands spreken en in een van beide landen wonen. Mensen die momenteel onder behandeling zijn voor een psychische aandoening of die het afgelopen jaar suïcidale gedachten hebben gehad, kunnen niet deelnemen aan dit onderzoek om hen te beschermen tegen mogelijke schade door deelname. Uw deelname aan dit onderzoek is geheel vrijwillig en u heeft het recht om u op elk moment terug te trekken zonder opgaaf van reden of consequenties. Alle gegevens die u tot op dat moment hebt verstrekt, worden uitgesloten van verdere analyses. Zodra de vragenlijst is ingevuld, worden alle gegevens echter geanonimiseerd en kunnen ze dus niet meer worden geïdentificeerd, waardoor het onmogelijk is om uw gegevens te verwijderen. Uw gegevens worden uitsluitend onder vertrouwelijke omstandigheden gebruikt. Demografische vragen worden gesteld zodra u hebt ingestemd met deelname. Om anonimiteit te garanderen, wordt er geen identificeerbare informatie verzameld. Uw IP-adres en locatiegegevens zullen ook niet worden vastgelegd. Het invullen van de vragenlijst duurt ongeveer 25-30 minuten. Uw

deelname aan dit onderzoek wordt zeer op prijs gesteld en zal bijdragen aan een beter begrip van de psychologische gevolgen van klimaatverandering.

**Contactgegevens**

Dit onderzoek is beoordeeld en goedgekeurd door de Ethische Commissie van de Universiteit Twente. Voor aanvullende informatie of vragen kunt u contact opnemen met de onderzoekers:


Michele Petkovski (c.m.petkovski@student.utwente.nl)

Mark Kalisvaart (m.kalisvaart@student.utwente.nl)

Finn Zolitschka (f.t.zolitschka@student.utwente.nl)


U kunt ook contact opnemen met de begeleider Dr. Alejandro Dominguez Rodriguez (a.dominguezrodriguez@utwente.nl).

**Appendix E**

**Welcome screen (German)**

**Willkommen**

Das Ziel dieser Studie ist es, den Zusammenhang zwischen Klimawandel, psychischen Störungen und umweltfreundlichem Verhalten in der deutschen und niederländischen Bevölkerung zu untersuchen. Die Studie wird von zwei Bachelor- und einer Masterstudierenden der Psychologie an der Universität Twente durchgeführt und die gesammelten Daten werden für ihre Bachelor- und Masterarbeit analysiert.

**Teilnahme**

Um an dieser Studie teilnehmen zu können, müssen Sie mindestens 18 Jahre alt sein und entweder die deutsche oder niederländische Staatsangehörigkeit besitzen, eine der beiden Sprachen sprechen und in einem der beiden Länder wohnen. Personen, die derzeit in Behandlung einer psychischen Krankheit sind oder in dem letzten Jahr suizidale Gedanken hatten, können nicht an dieser Studie teilnehmen, um sie vor möglichen Schäden durch die Teilnahme zu schützen. Ihre Teilnahme an dieser Studie ist vollkommen freiwillig, und Sie haben das Recht, jederzeit ohne Angabe von Gründen oder ohne Konsequenzen zurückzutreten. Alle bis dahin von Ihnen bereitgestellten Daten werden von weiteren Analysen ausgeschlossen. Nach Abschluss des Fragebogens werden jedoch alle Daten anonymisiert und sind daher nicht identifizierbar, was eine Löschung der Daten unmöglich macht. Die Verwendung Ihrer Daten erfolgt ausschließlich unter vertraulichen Umständen. Nach der Zustimmung zur Teilnahme werden demografische Fragen gestellt. Um Anonymität zu gewährleisten, werden keine identifizierbaren Informationen gesammelt. Auch ihre IP-Adresse und Standortdaten werden nicht erfasst. Der Fragebogen dauert etwa 25-30 Minuten.

Ihre Teilnahme an dieser Studie wird sehr geschätzt und wird dazu beitragen, unser

Verständnis der psychologischen Auswirkungen des Klimawandels zu vertiefen.

**Kontaktdaten**

Diese Studie wurde von der Ethikkommission der Universität Twente geprüft und genehmigt.

Für zusätzliche Informationen oder bei Fragen wenden Sie sich bitte an die Forscher:

Michele Petkovski (c.m.petkovski@student.utwente.nl)

Mark Kalisvaart (m.kalisvaart@student.utwente.nl)

Finn Zolitschka (f.t.zolitschka@student.utwente.nl)

Alternativ können Sie sich an den Mentor Dr. Alejandro Dominguez Rodriguez

(a.dominguezrodriguez@utwente.nl) wenden.

**Appendix F**

**Informed consent (Dutch)**

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

Ik heb alle informatie gelezen en voldoe aan alle deelnamevoorwaarden. Ik bevestig dat mijn deelname volledig vrijwillig is. Ik erken ook mijn recht om mijn medewerking aan dit onderzoek op elk moment in te trekken zonder opgave van reden, vooral als ik ongemak of stress van welke vorm dan ook ervaar. Een dergelijke intrekking heeft geen gevolgen.

**Daarnaast begrijp ik het volgende:**

- Alle door de onderzoekers verzamelde gegevens blijven volledig anoniem en zijn niet te herleiden tot mijn identiteit. Na afloop van de enquête is terugtrekking dus niet meer mogelijk.

- Ik begrijp dat de informatie die ik verstrek zal worden gebruikt in onderzoeksrapporten die tot doel hebben de impact van klimaatverandering op de psychische gezondheid aan te tonen.

- Ik onderga momenteel GEEN medische of therapeutische behandeling voor een psychische stoornis.

- Ik heb het afgelopen jaar GEEN zelfmoordgedachten gehad.

- Ik ben mij ervan bewust dat deelname aan het onderzoek psychologisch ongemak kan veroorzaken als gevolg van de discussie over de gevoelige kwestie van klimaatverandering.

- Ik ga ermee akkoord geen informatie te delen over het proces en de details van het onderzoek, aangezien dit de resultaten van het onderzoek zou kunnen beïnvloeden.

- Ik ga ermee akkoord dat mijn antwoorden worden gebruikt in de enquêtedatabase voor mogelijk toekomstig onderzoeks- en trainingsdoeleinden.

**Appendix G**

**Informed consent (German)**

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 des Klimawandels auf die psychische Gesundheit darzustellen.

- Ich befinde mich derzeit in KEINER medizinischen oder therapeutischen Behandlung aufgrund einer psychischen Störung.

- Ich habe in dem letzten Jahr 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.

**Appendix H**

**Debriefing screen (Dutch)**

U bent bijna aan het einde van de enquête gekomen. Ga door met de laatste vragen totdat u het bericht "Bedankt voor uw deelname" ziet.

Als u zich onwel voelt of psychische problemen heeft, kunt u contact opnemen met de volgende geestelijke gezondheidszorgdienst: De Luisterlijn: 0880767000; De Zelfmoordlijn: 0800 113.

Voor aanvullende informatie of vragen kunt u contact opnemen met de onderzoekers:

Michele Petkovski (c.m.petkovski@student.utwente.nl)

Mark Kalisvaart (m.kalisvaart@student.utwente.nl)

Finn Zolitschka (f.t.zolitschka@student.utwente.nl)

Begeleider: Dr. Alejandro Dominguez Rodriguez (a.dominguezrodriguez@utwente.nl)

Alle informatie die naar u kan worden teruggeleid, wordt geanonimiseerd. Alle ingevoerde gegevens zijn alleen toegankelijk voor leden van het onderzoeksteam en worden twee jaar bewaard. Zodra u deze vragenlijst hebt ingevuld, worden uw gegevens geanalyseerd en is het niet meer mogelijk om u uit het onderzoek terug te trekken.

Ik ga ermee akkoord dat mijn gegevens gebruikt mogen worden voor het onderzoek.

**Appendix I**

**Debriefing screen (German)**

Sie haben fast das Ende der Umfrage erreicht. Bitte fahren Sie mit den letzten Fragen fort, bis Sie die Meldung "Vielen Dank für Ihre Teilnahme" sehen.

Wenn Sie sich unwohl fühlen oder unter psychischen Problemen leiden, können Sie sich an den folgenden Hilfsdienst für psychische Gesundheit wenden: Suizid- und Krisentelefon Deutschland: 0800 1110111

Für zusätzliche Informationen oder bei Fragen wenden Sie sich bitte an die Forscher:

Michele Petkovski (c.m.petkovski@student.utwente.nl)

Mark Kalisvaart (m.kalisvaart@student.utwente.nl)

Finn Zolitschka (f.t.zolitschka@student.utwente.nl)

Mentor: Dr. Alejandro Dominguez Rodriguez (a.dominguezrodriguez@utwente.nl)

Alle Informationen, die zu Ihnen zurückführen können, werden anonymisiert. Alle eingegebenen Daten sind nur für Mitglieder des Forschungsteams zugänglich und werden zwei Jahre lang gespeichert. Nachdem Sie diesen Fragebogen ausgefüllt haben, werden Ihre Daten ausgewertet und es ist nicht mehr möglich, Ihre Daten zu löschen.

Ich erkläre mich damit einverstanden, dass meine Daten für die Studie verwendet werden dürfen.

**Appendix J**

**R code**

#Bachelor thesis script Mark Kalisvaart

#First I install the required packages

install.packages("tidyverse")

install.packages("car")

install.packages("lmtest")

install.packages("ggplot2")

install.packages("interactions")

#Then I load the required packages

library("tidyverse")

library("car")

library("lmtest")

library("ggplot2")

library("interactions")

#I set my working directory

setwd("G:/UTRstudio")

#I load the qualtrics csv into r studio

qualtricsraw<-

read.csv("CLIMATE+CHANGE+PROJECT+2_November+26,+2024_10.57.csv")

```
#I now view the raw qualtrics data

view(qualtricsraw)
```

#I notice 3 participants reported an age that is not possible, I turn those age variables into NA so I can continue the analysis

```
qualtricsraw$Alter.[qualtricsraw$Alter. == 7777] <- NA

qualtricsraw$Alter.[qualtricsraw$Alter. == 999999] <- NA

qualtricsraw$Alter.[qualtricsraw$Alter. == 100000] <- NA

view(qualtricsraw)
```

#I check how the variable age is treated

```
class(qualtricsraw$Alter.)
```

#Age is treated as a character, therefore I now turn it into numeric

```
qualtricsraw$Alter. <- as.numeric(qualtricsraw$Alter.)

qualtricsraw$Alter.[qualtricsraw$Alter. == 100000] <- NA
```

#I notice there are 148 participants in total

#I now remove participants who answered "no" to the second consent question

```
qualtricsraw_secondconsent <- qualtricsraw %>%

  filter(X2nd.consent != "Nein")

view(qualtricsraw_secondconsent)
```

#I now notice there are 147 participants left

#I now remove participants who did not consent to the second consent question. To do so I first code their non-response as NA

```
qualtricsraw_secondconsent$X2nd.consent[qualtricsraw_secondconsent$X2nd.consent == ""]
<- NA
```

view (qualtricsraw_secondconsent)

#Then I remove the NA participants

```
qualtricsonly2ndconsent <- qualtricsraw_secondconsent %>%

  filter(!is.na(X2nd.consent))
```

view(qualtricsonly2ndconsent)

#There are now 106 participants left

#The first and second row are the survey question and Importld, I also remove those rows

```
qualtricscleaned <- qualtricsonly2ndconsent[-c(1,2),]
```

view(qualtricscleaned)

#I now remove the columns that I won't need for the analysis

colnames(qualtricscleaned)

```
qualtricscleaneddemographics <- qualtricscleaned[, !(colnames(qualtricscleaned) %in%
c("StartDate", "EndDate", "Status", "Progress", "Duration..in.seconds.", "Finished",
"RecordedDate", "ResponseId", "DistributionChannel", "UserLanguage", "consent",
"Bildungsabschluss", "Bildungsabschluss_7_TEXT", "near.water", "below.sea.level",
"flood"))]
```

view (qualtricscleaneddemographics)

qualtricscleaneddemographicsandopenquestions <- qualtricscleaneddemographics[,

!(colnames(qualtricscleaneddemographics) %in% c("X2nd.consent", "Sona", "Comfort",

"Understanding"))]

view(qualtricscleaneddemographicsandopenquestions)

#While looking at the email addresses I noticed a duplicate entry, I therefore remove the

oldest duplicate and keep the most recent one

qualtricscleaneddemographicsandopenquestions <-

qualtricscleaneddemographicsandopenquestions[-2,]

view (qualtricscleaneddemographicsandopenquestions)

#With this final change, the final amount of participants is 105

qualtricscleaneddemographicsandopenquestion2 <-

qualtricscleaneddemographicsandopenquestions[,

!(colnames(qualtricscleaneddemographicsandopenquestions) %in% c("email.address"))]

view(qualtricscleaneddemographicsandopenquestion2)

#The demographic questions and open questions that I wont need have now been removed. I

will now remove the questionnaires that I will not be using

qualtricscleanedfinal <-qualtricscleaneddemographicsandopenquestion2[,

!(colnames(qualtricscleaneddemographicsandopenquestion2) %in% c("GAD.7_1",

"GAD.7_2", "GAD.7_3", "GAD.7_4", "GAD.7_5", "GAD.7_6", "GAD.7_7", "EGuiQ.11_1",

"EGuiQ.11_2", "EGuiQ.11_3", "EGuiQ.11_4", "EGuiQ.11_5", "EGuiQ.11_6",

"EGuiQ.11_7", "EGuiQ.11_8", "EGuiQ.11_9", "EGuiQ.11_10", "EGuiQ.11_11",

"EGriQ.6_1", "EGriQ.6_2", "EGriQ.6_3", "EGriQ.6_4", "EGriQ.6_5", "EGriQ.6_6",

"PEBS._1", "PEBS._2", "PEBS._3", "PEBS._4", "PEBS._5", "PEBS._6", "Q23_1", "Q24_1",

"Q24_2", "Q25_1", "Q25_2", "Q26_1", "Q27_1", "Q27_1_TEXT", "Q28_1", "Q28_2",

"Q28_3", "Q29_1", "Q29_2", "Q29_3", "Q62", "Q63_1", "Q63_2", "Q63_3", "Q63_4",

"Q63_5", "Q63_6", "Q63_7", "Q63_8", "Q63_9", "Q64_1", "Q64_2", "Q64_3", "Q64_4",

"Q64_5", "Q64_6", "Q68_1", "Q68_2", "Q68_3"))]

view(qualtricscleanedfinal)

#I remove 1 final demographic variable

qualtricscleandfinal2 <-qualtricscleanedfinal[, !(colnames(qualtricscleanedfinal) %in%

c("rural.urban"))]

#Now only the variables that I will need for the analysis remain. I will prepare the variables

for analysis by assigning scores to the scales now

#First I test it on one item

recodedanxiety <- qualtricscleandfinal2 %>%

  mutate(anxitem1 = dplyr::recode(EAQ.22_1,

        "stimme nicht zu" = 1,

        "stimme eher nicht zu" = 2,

        "stimme eher zu" = 3,

        "stimme zu" = 4))

#now I apply it to all items

recodedanxiety2 <- recodedanxiety %>%

  mutate(anxitem2 = dplyr::recode(EAQ.22_2,

        "stimme nicht zu" = 1,

```
                    "stimme eher nicht zu" = 2,

                    "stimme eher zu" = 3,

                    "stimme zu" = 4),

        anxitem3 = dplyr::recode(EAQ.22_3,

                    "stimme nicht zu" = 1,

                    "stimme eher nicht zu" = 2,

                    "stimme eher zu" = 3,

                    "stimme zu" = 4),

        anxitem4 = dplyr::recode(EAQ.22_4,

                    "stimme nicht zu" = 1,

                    "stimme eher nicht zu" = 2,

                    "stimme eher zu" = 3,

                    "stimme zu" = 4),

        anxitem5 = dplyr::recode(EAQ.22_5,

                    "stimme nicht zu" = 1,

                    "stimme eher nicht zu" = 2,

                    "stimme eher zu" = 3,

                    "stimme zu" = 4),

        anxitem6 = dplyr::recode(EAQ.22_6,

                    "stimme nicht zu" = 1,
```

```
                "stimme eher nicht zu" = 2,

                "stimme eher zu" = 3,

                "stimme zu" = 4),

anxitem7 = dplyr::recode(EAQ.22_7,

                "stimme nicht zu" = 1,

                "stimme eher nicht zu" = 2,

                "stimme eher zu" = 3,

                "stimme zu" = 4),

anxitem8 = dplyr::recode(EAQ.22_8,

                "stimme nicht zu" = 1,

                "stimme eher nicht zu" = 2,

                "stimme eher zu" = 3,

                "stimme zu" = 4),

anxitem9 = dplyr::recode(EAQ.22_9,

                "stimme nicht zu" = 1,

                "stimme eher nicht zu" = 2,

                "stimme eher zu" = 3,

                "stimme zu" = 4),

anxitem10 = dplyr::recode(EAQ.22_10,

                 "stimme nicht zu" = 1,
```

```
            "stimme eher nicht zu" = 2,

            "stimme eher zu" = 3,

            "stimme zu" = 4),

anxitem11 = dplyr::recode(EAQ.22_11,

            "stimme nicht zu" = 1,

            "stimme eher nicht zu" = 2,

            "stimme eher zu" = 3,

            "stimme zu" = 4),

anxitem12 = dplyr::recode(EAQ.22_12,

            "stimme nicht zu" = 1,

            "stimme eher nicht zu" = 2,

            "stimme eher zu" = 3,

            "stimme zu" = 4),

anxitem13 = dplyr::recode(EAQ.22_13,

            "stimme nicht zu" = 1,

            "stimme eher nicht zu" = 2,

            "stimme eher zu" = 3,

            "stimme zu" = 4),

anxitem14 = dplyr::recode(EAQ.22_14,

            "stimme nicht zu" = 1,
```

```
              "stimme eher nicht zu" = 2,

              "stimme eher zu" = 3,

              "stimme zu" = 4),

anxitem15 = dplyr::recode(EAQ.22_15,

              "stimme nicht zu" = 1,

              "stimme eher nicht zu" = 2,

              "stimme eher zu" = 3,

              "stimme zu" = 4),

anxitem16 = dplyr::recode(EAQ.22_16,

              "stimme nicht zu" = 1,

              "stimme eher nicht zu" = 2,

              "stimme eher zu" = 3,

              "stimme zu" = 4),

anxitem17 = dplyr::recode(EAQ.22_17,

              "stimme nicht zu" = 1,

              "stimme eher nicht zu" = 2,

              "stimme eher zu" = 3,

              "stimme zu" = 4),

anxitem18 = dplyr::recode(EAQ.22_18,

              "stimme nicht zu" = 1,
```

```
        "stimme eher nicht zu" = 2,

        "stimme eher zu" = 3,

        "stimme zu" = 4),

anxitem19 = dplyr::recode(EAQ.22_19,

        "stimme nicht zu" = 1,

        "stimme eher nicht zu" = 2,

        "stimme eher zu" = 3,

        "stimme zu" = 4),

anxitem20 = dplyr::recode(EAQ.22_20,

        "stimme nicht zu" = 1,

        "stimme eher nicht zu" = 2,

        "stimme eher zu" = 3,

        "stimme zu" = 4),

anxitem21 = dplyr::recode(EAQ.22_21,

        "stimme nicht zu" = 1,

        "stimme eher nicht zu" = 2,

        "stimme eher zu" = 3,

        "stimme zu" = 4),

anxitem22 = dplyr::recode(EAQ.22_22,

        "stimme nicht zu" = 1,
```

```
                    "stimme eher nicht zu" = 2,

                    "stimme eher zu" = 3,

                    "stimme zu" = 4)

  )

view(recodedanxiety2)

#Now that eco anxiety is recoded, the same process will be done for the EAS

#I will again first test it on one item

recodedanxietyandactivism <- recodedanxiety2 %>%

  mutate(climitem1 = dplyr::recode(Q50_1,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5))

view(recodedanxietyandactivism)

#Now I will apply the coding scheme to the remaining items of the EAS

recodedanxietyandactivism2 <- recodedanxietyandactivism %>%

  mutate(climitem2 = dplyr::recode(Q50_2,

                    "1. Nie" = 1,

                    "2." = 2,
```

```
                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem3 = dplyr::recode(Q50_3,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem4 = dplyr::recode(Q50_4,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem5 = dplyr::recode(Q50_5,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,
```

```
                    "5. Häufig" = 5),

climitem6 = dplyr::recode(Q50_6,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem7 = dplyr::recode(Q50_7,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem8 = dplyr::recode(Q50_8,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem9 = dplyr::recode(Q50_9,
```

```
                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem10 = dplyr::recode(Q50_10,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem11 = dplyr::recode(Q50_11,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem12 = dplyr::recode(Q50_12,

                    "1. Nie" = 1,

                    "2." = 2,
```

```
                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem13 = dplyr::recode(Q50_13,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem14 = dplyr::recode(Q50_14,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,

                    "5. Häufig" = 5),

climitem15 = dplyr::recode(Q50_15,

                    "1. Nie" = 1,

                    "2." = 2,

                    "3. Ab und zu" = 3,

                    "4." = 4,
```

```
                              "5. Häufig" = 5),

    climitem16 = dplyr::recode(Q50_16,

                              "1. Nie" = 1,

                              "2." = 2,

                              "3. Ab und zu" = 3,

                              "4." = 4,

                              "5. Häufig" = 5),

    climitem17 = dplyr::recode(Q50_17,

                              "1. Nie" = 1,

                              "2." = 2,

                              "3. Ab und zu" = 3,

                              "4." = 4,

                              "5. Häufig" = 5),

    climitem18 = dplyr::recode(Q50_18,

                              "1. Nie" = 1,

                              "2." = 2,

                              "3. Ab und zu" = 3,

                              "4." = 4,

                              "5. Häufig" = 5)

  )
```

```
view(recodedanxietyandactivism2)
```

#Finally I will prepare the LGBTQ+ question for analysis by dummy coding it

```
fullyrecodeddata3 <- recodedanxietyandactivism2 %>%

  mutate(LGBTQrec = ifelse(LGBTQ..identity == "Ja", 1, 0))

view(fullyrecodeddata3)
```

#Now I will create 2 new mean variables for eco-anxiety and activism in order to prepare them for analysis

#First for eco anxiety

```
ecoanxietymean <- fullyrecodeddata3 %>%

  mutate(Meaneco = rowMeans(fullyrecodeddata3[, c("anxitem1", "anxitem2", "anxitem3",
"anxitem4", "anxitem5", "anxitem6", "anxitem7", "anxitem8", "anxitem9", "anxitem10",
"anxitem11", "anxitem12", "anxitem13", "anxitem14", "anxitem15", "anxitem16",
"anxitem17", "anxitem18", "anxitem19", "anxitem20", "anxitem21", "anxitem22")], na.rm =
TRUE))

view(ecoanxietymean)
```

#then for climate change activism

```
activismmean_anxietymean <- ecoanxietymean %>%

  mutate(Meanactiv = rowMeans(ecoanxietymean[, c("climitem1", "climitem2", "climitem3",
"climitem4", "climitem5", "climitem6", "climitem7", "climitem8", "climitem9",
"climitem10", "climitem11", "climitem12", "climitem13", "climitem14", "climitem15",
"climitem16", "climitem17", "climitem18")], na.rm = TRUE))

view(activismmean_anxietymean)
```

```
#With all variables ready for analysis I now proceed to the demographic analysis first

#First I look at the age mean, sd and range

age_mean <-mean(activismmean_anxietymean$Alter.)

age_mean

#The age mean is 30.69

ggplot(activismmean_anxietymean, aes(y = Alter.)) +

  geom_boxplot()+

  labs(title = "Final Sample Age Boxplot", y = "Age")

age_sd <-sd(activismmean_anxietymean$Alter.)

age_sd

#The age SD is 14.39

age_range <-range(activismmean_anxietymean$Alter.)

age_range

#The age range is 18 - 75

#I now look at the gender distribution

gender_distribution <-table (activismmean_anxietymean$Geschlecht)

gender_distribution

#The distribution is as follows: 32 Male, 70 Female, 3 Non-Binary/other

#Now I check the LGBTQ+ group distribution

lgbtq_distribution <-table(activismmean_anxietymean$LGBTQ..identity)
```

lgbtq_distribution

#A total of 35 Participants identify as part of the LGBTQ group, 70 identify as not being part of the LGBTQ group

#Now I look at Nationality

nationality_distribution <-table(activismmean_anxietymean$nationality)

nationality_distribution

#A total of 53 participants are German, 53 participants are Dutch

view(activismmean_anxietymean)

#Now the assumptions will be tested, starting with the assumption of linearity. I first test just the iv and the dv in a scatterplot

plot(activismmean_anxietymean$Meaneco, activismmean_anxietymean$Meanactiv, main = "Scatterplot Eco anxiety - Climate change activism",

   xlab = "Eco Anxiety", ylab = "Climate Change Activism", pch = 19)

#The dots seem to very broadly follow a line, though many data points are lacking at the higher value of the x axis

#I now create a linear model to further test the linearity as I am doubtful about this scatterplot

ivdvmodel <-lm (Meanactiv ~Meaneco, data = activismmean_anxietymean)

summary(ivdvmodel)

#There seems to be a hint of a positive relationship between iv and dv, both p values are below 0.05 as well.

#However, the r squared indicates only 20% is explained by the iv.

#The f-statistic indicates that the relationship does however exist

#I will now check the residuals

residualsivdvmodel <-residuals(ivdvmodel)

plot(ivdvmodel$fitted.values, residualsivdvmodel,

   xlab = "Fitted",

   ylab = "Residuals",

   main = "Residuals versus Fitted")

abline(h = 0, col = "green")

#The residual plot does not show a clear shape like a curve, so I feel safe in identifying the assumption of linearity to be met between just iv and dv. I will now continue to the full model that includes the moderator variable

ivdvmodelplusmoderator <-lm (Meanactiv ~ Meaneco * LGBTQrec, data = activismmean_anxietymean)

summary(ivdvmodelplusmoderator)

#The r squared shows that 26% is explained by the iv and moderator variable

#The f statistic indicates that the model seems to be significant

#The relationship between iv and dv is again shown to be significant

#The moderator variable LGBTQ identity is however not significant with a p value of 0.15

#The interaction between the independent variable and LGBTQ identity is also not significant with a p value of 0.067

#If the fact that the moderator is not significant is ignored, it is observed that the moderator does have a slight positive effect

#I check the residuals of the model including the moderator

residualsmoderatormodel <-residuals(ivdvmodelplusmoderator)

plot(ivdvmodelplusmoderator$fitted.values, residualsmoderatormodel,

   xlab = "fitted",

   ylab = "residuals",

   main = "residuals versus fitted")

abline(h = 0, col = "green")

#Based on the residuals not showing a clear pattern like a curve for example, I feel safe in identifying that the assumption of linearity is not violated when including the moderator

#Now I continue to the assumption of multicollinearity

multicollinearitymodel2 <-lm(Meanactiv ~ Meaneco + LGBTQrec, data = activismmean_anxietymean)

vif(multicollinearitymodel2)

#The vif indicates that the assumption of multicollinearity is met with 1.0983

#I now continue to the assumption of homoscedasticity

homoscedasticitymodel <- lm(Meanactiv ~ Meaneco + LGBTQrec, data = activismmean_anxietymean)

bptest(homoscedasticitymodel)

#The assumption of homoscedasticity is violated as indicated by a p-value of 0.024

#To further investigate the violation of the assumption i plot a qqplot of the residuals

plot(homoscedasticitymodel, which = 2)

#I notice a few strong outliers, and some deviation from the line. I choose to further investigate

view(activismmean_anxietymean)

boxplot(activismmean_anxietymean$Meanactiv, main = "Activism boxplot", ylab = "Activism")

#I notice 5 outliers that are beyond the whisker of the boxplot.

boxplot(activismmean_anxietymean$Meaneco, main = "Eco Anxiety boxplot", ylab = "Eco Anxiety")

#The boxplot for eco anxiety does not show any outliers. it seems quite normally distributed. The outliers are only present in the activism variable.

boxplotoutliers <- boxplot(activismmean_anxietymean$Meanactiv, plot = FALSE)

outliersboxplotactivism <- boxplotoutliers$out

outliersboxplotactivism

#The outliers are 2.6, 2.5, 3.2, 2.8, 3.2, 2.6. i checked the data and the input does not seem suspicious, these could be actual responses.

barplot(table(activismmean_anxietymean$Meanactiv), main = "Activism responses plot")

#There seems to be a high concentration of data on the left side, a right skew. I attempt to transform the variable to see if that fixes the issue.

```
activismmean_anxietymean$Activismlogtransform <-

log(activismmean_anxietymean$Meanactiv)

barplot(table(activismmean_anxietymean$Activismlogtransform), main = "Log transformed

activism variable plot")

head(activismmean_anxietymean$Meanactiv)

head(activismmean_anxietymean$Activismlogtransform)
```

#The transformation seems to have had little effect, possibly due to the fact that the data is

clustered around relatively low values. I try the square root transformation now.

```
activismmean_anxietymean$Activismsquareroottransform <-

sqrt(activismmean_anxietymean$Meanactiv)

barplot(table(activismmean_anxietymean$Activismsquareroottransform), main = "Square

root transformed activism variable plot")
```

#The square root transformation also had little effect, I will use the shapiro test to gain more

insight into the normality assumption

```
shapiro_anxiety <- shapiro.test(activismmean_anxietymean$Meaneco)

shapiro_activism <- shapiro.test(activismmean_anxietymean$Meanactiv)

print(shapiro_anxiety)

print(shapiro_activism)

qqnorm(activismmean_anxietymean$Meaneco)

qqline(activismmean_anxietymean$Meaneco, col = "green")

qqnorm(activismmean_anxietymean$Meanactiv)
```

qqline(activismmean_anxietymean$Meanactiv, col = "green")

#The skewness is so severe that transformation does not work. Therefore I will consider non parametric tests.

#I will now calculate the mean and SD of eco anxiety and climate change activism

meananxiety<- mean(activismmean_anxietymean$Meaneco, na.rm = TRUE)

print(meananxiety)

sdanxiety<- sd(activismmean_anxietymean$Meaneco, na.rm = TRUE)

print(sdanxiety)

meanactivism<-mean(activismmean_anxietymean$Meanactiv, na.rm = TRUE)

print(meanactivism)

sdactivism<-sd(activismmean_anxietymean$Meanactiv, na.rm = TRUE)

print(sdactivism)

#I will now continue to hypothesis testing.

#Hypothesis 1 , 2 and 5 require a mann-whitney test. Hypothesis 3 requires spearmans correlation, hypothesis 4 requires a moderated linear model that is able to also account for the problems in the dependent variable of my model

#Hypothesis 1

mannwhitneyoutcome <-wilcox.test(Meaneco ~ LGBTQrec, data = activismmean_anxietymean)

print(mannwhitneyoutcome)

```
activismmean_anxietymean$rankedecoanxiety <-

rank(activismmean_anxietymean$Meaneco)

aggregate(rankedecoanxiety ~ LGBTQrec, data = activismmean_anxietymean, FUN =

median)

view(activismmean_anxietymean)

#Double checking in the table that I correctly interpret the dummy coded variable

table(activismmean_anxietymean$LGBTQrec)

#Those with LGBTQ group identity indeed have a higher mean of eco anxiety as i predicted

#Hypothesis 2

mannwhitneyoutcome2 <-wilcox.test(Meanactiv ~ LGBTQrec, data =

activismmean_anxietymean)

print(mannwhitneyoutcome2)

activismmean_anxietymean$rankedactivism <- rank(activismmean_anxietymean$Meanactiv)

aggregate(rankedactivism ~ LGBTQrec, data = activismmean_anxietymean, FUN = median)

#Double checking in the table that I correctly interpret the dummy coded variable

table(activismmean_anxietymean$LGBTQrec)

#Those with LGBTQ group identity also have a higher mean of activism as i predicted

#Hypothesis 3

cor.test(activismmean_anxietymean$Meaneco, activismmean_anxietymean$Meanactiv,

method = "spearman")
```

#As predicted, there is a significant positive relationship between eco anxiety and climate change activism though it is moderate in strength.

#Hypothesis 4

modlinmodel <-lm(Meanactiv ~ Meaneco * LGBTQrec, data = activismmean_anxietymean)

summary(modlinmodel)

confint(modlinmodel)

#Here it is seen that the interaction is not statistically significant. The main effect of LGBTQ membership is also not significant. I therefore reject the hypothesis that there is a moderating effect of LGBTQ group identity.

#Hypothesis 5

mannwhitneyoutcome3 <-wilcox.test(Meaneco ~ nationality, data = activismmean_anxietymean)

print(mannwhitneyoutcome3)

activismmean_anxietymean$rankedanxietynationality <- rank(activismmean_anxietymean$Meaneco)

aggregate(rankedanxietynationality ~ nationality, data = activismmean_anxietymean, FUN = median)

#German participants score higher on eco anxiety, in line with my prediction

#Post hoc analysis LM

LGBTQseperate <-lm(Meanactiv ~ Meaneco, data = subset(activismmean_anxietymean, LGBTQrec == "1"))

```
summary(LGBTQseperate)

confint(LGBTQseperate)

Cishetseperate <-lm(Meanactiv ~ Meaneco, data = subset(activismmean_anxietymean,

LGBTQrec == "0"))

summary(Cishetseperate)

confint(Cishetseperate)

#Post hoc analysis spearman

cor.test(subset(activismmean_anxietymean, LGBTQrec == "1")$Meaneco,

subset(activismmean_anxietymean, LGBTQrec == "1")$Meanactiv, method = "spearman")

cor.test(subset(activismmean_anxietymean, LGBTQrec == "0")$Meaneco,

subset(activismmean_anxietymean, LGBTQrec == "0")$Meanactiv, method = "spearman")
```
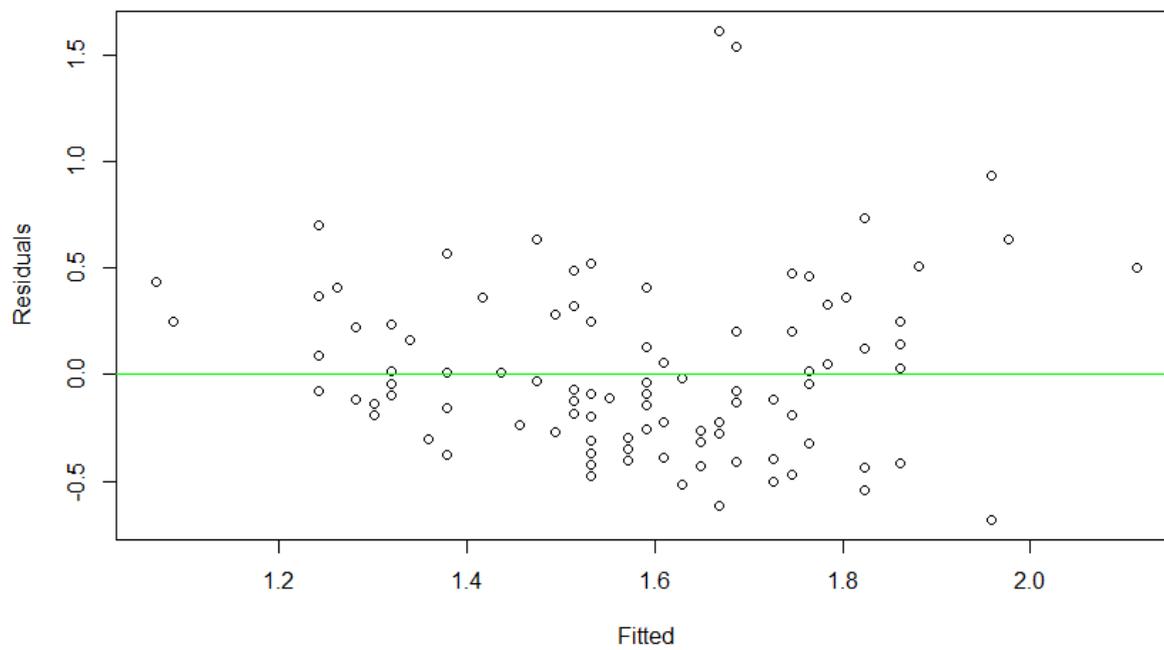
**Appendix K**

**Scatterplot of the independent variable Eco Anxiety and the dependent variable**

**Environmental Action (climate change activism)**

## Appendix L

## Plot of the residuals against the fitted values

**Appendix M**

**AI statement**

During the preparation of this work the author used ChatGPT (version 4o mini) in order to assist in brainstorming and as assistance in regards to programming code in R. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.