



**Understanding Climate Change Threat Perception:  
Exploring Implications for Everyday Altruistic Behavior**

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### **Abstract**

Recent findings during the COVID-19 pandemic have indicated that humans may become more prosocial in response to real-world threatening situations. However, it is unknown whether similar effects are observed with global environmental threats such as climate change. This study investigates how the perception of climate change as an imminent threat is associated with everyday altruism and defensive emotions. We collected online questionnaire data from a diverse sample of 179 participants, aged 18 to 64, assessing self-report measures of perceived climate change threat, altruistic behavior, and defensive emotions (e.g. stress, anxiety). Using linear regression models, results indicated that higher levels of climate change worry are significantly associated with increased altruistic behavior, particularly among employed and older individuals.

These results suggest that the worry triggered by climate change can motivate prosocial and altruistic actions. The findings highlight an association between defensive emotional responses related to climate change and altruistic behavior in the context of global environmental threats.

*Key words:* Climate Change, Altruism behavior, Prosocial behavior, Imminent Threat, Emotional Responses

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## Introduction

The global challenge of addressing climate change is increasingly recognized, given its imminent threat to the environment, human health and economic stability (Corwin, 2020; Fox et al., 2020; Gemenne & Depoux, 2020; Palinkas & Wong, 2020b; Stirling & Derocher, 2012). This awareness prompts individuals to adopt sustainable behaviors to mitigate its effects (Hansla et al., 2008), which can be considered prosocial behavior as they benefit society at large (Knez, 2016). The perception of climate change as a threat may also evoke defensive emotions such as anxiety, fear and stress (Mobbs et al., 2020). Interestingly, defensive responses to global threats like the COVID-19 pandemic have been linked to increased altruistic behavior (Vieira et al., 2022), raising questions about the relationship between the perception of climate change threat and altruistic motivation. Therefore, this study explores how individuals' perceptions of climate change threat, along with defensive emotions, is associated with their engagement in everyday altruistic behaviors.

Climate change is increasingly recognized as a global, shared and imminent threat (Corwin, 2020; Fox et al., 2020; Gemenne & Depoux, 2020; Palinkas & Wong, 2020b; Stirling & Derocher, 2012) with its consequences manifesting in a variety of complex ways. The World Health Organization (WHO, 2013) emphasized the direct and indirect impacts of climate change on human health, including altered weather patterns, reduced quality of air, water, and food, disruptions to ecosystems and impacts on agricultural regions. Climate change also affects sea ice cycles and thickness, especially in the Arctic, threatening wildlife such as polar bears (Corwin, 2020; Stirling & Derocher, 2012). Furthermore, it is evident that climate change not only has effects on nature, human beings, and mental health (Palinkas & Wong, 2020b) but also brings permanent impacts with negative economic consequences (Tol, 2021). The consistent coverage of

climate change related events, such as earthquakes, floods, tsunamis, heat waves, and storms, in daily news reports underscores the potential for climate change to significantly impact human behavior and societal dynamics (Knez, 2016). Concurrently, studies indicate that individuals who possess awareness of climate change tend to adopt behaviors aimed at mitigating its consequences, such as embracing sustainable practices (Hansla et al., 2008). Moreover, research underscores how these behaviors, ranging from simple acts such as recycling to significant lifestyle adjustments such as reducing carbon footprints, are widely perceived as prosocial actions that benefit society (Knez, 2016). This is in line with findings by Nordlund and Garvill (2003) who found that individuals' willingness to reduce personal car use can be influenced by values, problem awareness, and personal norms, suggesting a connection between environmental concern and behaviors viewed as beneficial for society. Therefore, these studies suggest a strong correlation between engagement in sustainable and prosocial behavior, indicating that individuals who value the well-being of others are more likely to embrace environmentally friendly behaviors (Knez, 2016).

As there is widespread recognition of climate change as an imminent threat (Corwin, 2020; Fox et al., 2020; Gemenne & Depoux, 2020; Palinkas & Wong, 2020b; Stirling & Derocher, 2012), it becomes imperative to understand how individuals respond to this perception. This perception may trigger a range of emotional reactions, which emerge along a continuum influenced by the severity and proximity of the threat (Mobbs et al., 2020). Research has shown that imminent threats can trigger altruism in people (Vieira et al., 2022). For example, in the study by Vieira et al. (2022) the association between defensive responses to the real-world threat of COVID-19 and everyday altruism was investigated. It was found that individuals with higher threat perception of COVID-19 showed higher levels of everyday altruism behavior, supporting

the idea that defensive emotions triggered by imminent threats can motivate individuals to engage in altruistic behaviors. Furthermore, altruism has been linked to environmental behaviors, as altruistic individuals tend to perceive greater personal responsibility and control over environmental outcomes, leading them to engage in actions like reducing energy consumption to benefit society and the environment (Knez, 2013).

While we know climate change likely affects people's behavior, we have not systematically assessed how that behavioral change is driven by threat and particularly, by defensive responses to climate change. To fill that gap, this study will investigate the extent to which perception of climate change threat is associated with altruistic behavior. We expect that climate change threat perception will be positively associated with everyday altruism. To test this prediction, we performed an online survey to collect self-reported measures of perception of climate change threat, sustainable behaviors, defensive emotional responses, and both trait and behavioral measures of altruism.

## **Methods**

### **Participants**

The sample consisted of 179 individuals aged between 18 and 65 years ( $M = 37.69$ ,  $SD = 11.23$ , 57% female, 43% male; Table 1). This decision was made considering the availability of resources (largest number possible with available resources).

After selecting our sample based on available resources, we conducted a retrospective power analysis using G\*power to ensure that our study had sufficient power. The analysis was performed for a multiple linear regression model with 16 predictors, an effect size  $f^2$  of 0.3 (considered a moderate effect), a significance level  $\alpha$  of 0.05, and a desired power of 0.90. The

results of the power analysis indicated that a total sample size of 95 participants is required. Our study included a sample of 179 participants, exceeding the required sample size identified in the power analysis. This retrospective verification assures us that our study has adequate statistical power to detect significant effects in the proposed regression model.

The study targeted individuals aged between 18 - 65 who were proficient in English. Participants were recruited through the Prolific participant pool ([prolific.com](https://prolific.com)) and were directed to Gorilla ([gorilla.sc](https://gorilla.sc)) to engage in the experimental procedures. They were compensated with 4.00 GBP for their participation. Prior to participation, individuals received an explanation of the study's procedures, digitally signed an informed consent form, and were assured of their right to withdraw at any time without facing consequences. Afterwards, participants completed an online survey consisting of various questionnaires measures, in addition to demographic information. The full survey ([See Appendix A](#)) took about 25 minutes to complete.

This study was carried out in accordance with the ethical standards, with approval obtained from the Ethics Committee of the Faculty of Social and Behavioral Sciences at Utrecht University, documented under reference number 24-0017 and valid until January 31, 2026. All collected data was securely stored and exclusively accessible to the research team, used for research purposes.

**Table 1**

*Demographic Characteristics of the Sample (N = 179)*

Characteristic	n	%
Gender		
Female	102	57
Male	77	43
Employment Status		
Employed	129	72.1

Unemployed	37	20.7
Students	13	7.26
Educational Status		
Bachelor's Degree	84	46.9
Master's Degree	33	18.4
High School Diploma	30	16.8
Post-secondary Non-tertiary	26	14.5
Doctoral Degree	6	3.35
Financial Status		
Needs are met having a little left	83	46.4
Just met the basic expenses	54	30.2
Live comfortably	34	19
Don't meet the basic expenses	8	4.47

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*Note.* Percentages are calculated based on the total sample size ( $N = 179$ ) and are rounded to two decimal places.

## Measures

To measure altruism, we utilized the self-report altruism scale (referred to as everyday altruism) developed by Rushton et al. (1981) which assessed self-reported altruistic behaviors by asking participants about the frequency (1 = Never, 5 = Very often) of engaging in 20 various altruistic acts (e.g. "I have donated goods or clothes to a charity."). To measure the internal consistency of the self-report altruism scale, we calculated Cronbach's alpha using our sample data, which yielded a value of 0.86, indicating good reliability. The mean score was 32.96 ( $SD = 10.77$ ). In addition, to assess actual altruistic behavior (donation), a behavioral task was included where participants were asked if they wished to donate part, all, or none of their compensation to a charitable organization of their choice. Participants had the option to donate between 0.00 and 4.00 GBP in increments of 0.50 GBP. This choice and the amount donated serve as behavioral indicators of altruism ( $M = 0.39$ ,  $SD = 0.69$ ).



To measure climate change threat perception, participants rated the severity, immediacy, and inevitability of the consequences of climate change on a visual analog scale. This approach aligns with the threat imminence framework, which investigates how humans and other mammals react to different levels of threat (Fanselow & Lester, 1988; Mobbs et al., 2020; Vieira et al., 2022). This assessment aimed to determine whether the perceived threat of climate change consequences was associated with individuals' altruistic behaviors.

To measure defensive emotions, the perceived stress scale (stress scale) developed by Cohen et al. (1983) was used to measure participants' perception of stress through 10 items (e.g. "In the last month, how often have you found that you could not cope with all the things that you had to do?") that evaluates how unpredictable, uncontrollable, and overloaded individuals found their lives in the past month. Participants rated their responses on a scale from 0 (Never) to 4 (Very Often). The reliability analysis of the stress scale using our sample data yielded a Cronbach's alpha coefficient of 0.90, indicating high internal consistency.

The depression, anxiety, and stress scales (Antony et al., 1998; Lovibond & Lovibond, 1995), referred to as anxiety scale, were used to assess anxiety, focusing especially on the 7 anxiety items selected for this study. Participants rated their experiences (e.g., "Over the past week, I was aware of the dryness of my mouth") over the past week on a scale from 0 (Did not apply to me at all) to 3 (Applied to me very much or most of the time). These two measures were chosen based on the threat imminence continuum framework, which explains how individuals respond to varying levels of perceived threats. Acute anxiety, as measured by the anxiety scale, corresponds to high arousal and immediate defensive readiness typical of higher threat imminence levels. In contrast, the stress scale captures generalized stress responses, reflecting broader appraisals of environmental unpredictability and uncontrollability. Together, these scales

provide a comprehensive assessment of defensive emotional responses across different levels of perceived threat imminence (Fanselow & Lester, 1988).

Moreover, fight, flight, freeze questionnaire (Maack et al., 2014) was employed to measure defensive emotional responses categorized into fight, flight and freeze reactions. In this 21-items questionnaire, participants rate their responses (1= Almost Never, 5= Almost Always) to how they typically react to potentially threatening situations (e.g. “Attacking”). The Cronbach's alpha coefficient for the questionnaire using our sample data was found to be 0.93, indicating high internal consistency among the items.

Additionally, we used the climate change worry scale (Stewart, 2021) referred to as climate change worry, which consist of 10 items measuring participants' worry about climate change by asking them to rate the frequency (1= Never, 5 = Always) of experiences described by each item (e.g. "I tend to worry when I hear about climate change, even when the effects of climate change may be some time away"). It is considered a measure of emotional responses related to climate change and involves repetitive thoughts about the potential changes in the climate and their effects, aligning it with defensive emotions. This questionnaire assesses proximal worry—concerns that are immediate and directly relevant to the individual—rather than broader social or global impacts (Stewart, 2021). The mean score for this scale was 26.31 (SD=8.71). The scale demonstrated high internal consistency (Cronbach's  $\alpha = 0.94$ ) using our sample data, indicating that the items reliably measure participants' worry about climate change.

Furthermore, selected items from the climate change anxiety scale (Cruz & High, 2022), hereafter called the climate change anxiety, specifically focused on behavioral engagement and personal experiences with climate change (Cruz & High, 2022). Behavioral engagement measures sustainable behaviors and actions taken in response to climate change anxiety, such as

recycling and conserving energy. Personal experience of climate change evaluates the personal impact and direct experiences of climate change ([See Appendix A](#); Cruz & High, 2022). In total, six items from the climate change anxiety scale were used. Participants rated how often these statements (e.g. I turn off the lights) were true for them on a scale from 1 (Never) to 5 (Almost Always). The mean score for this scale was 21.40 (SD = 3.62). To measure climate change behavior, participants rated their engagement in behaviors aimed at mitigating climate change on a scale from 1 (Never) to 5 (Very Often). To ensure the reliability of the climate change anxiety scale, Cronbach's alpha coefficient was calculated using our sample data. The analysis yielded a Cronbach's alpha of 0.73, indicating satisfactory internal consistency among the six items.

In addition, we collected demographic information: age; sex at birth; financial status; employment status; highest level of education obtained; current mental health diagnoses and treatments. Questions related to mental health were included because certain measures, such as defensive responses, may have been influenced by anxiety and trauma.

Attentional checks were incorporated within the questionnaire items to ensure data reliability. These checks included simple questions to confirm participants were paying attention, such as asking them to select a specific response to demonstrate they were reading the instructions carefully.

### **Statistical analysis**

Statistical analyses were conducted using R, version 4.3.3 software. Bivariate correlations were calculated for all measures, corrected for multiple comparisons. The significance level adopted for these correlations was adjusted to 0.00065 (See Figure 3).

Data was analyzed using linear regression models to assess the impact of perceived climate change threat, defensive emotions and demographic variables. One model was used to evaluate self-reported everyday altruism. The diagnostic plots (Residuals vs Fitted, Normal Q-Q, Scale-Location, and Cook's distance) were used to assess the assumptions of linear regression. The results indicated that the residuals were approximately normally distributed and homoscedastic, with no significant issues of multicollinearity as assessed by the Variance Inflation Factor (VIF) ([See Appendix B](#)). Another model was used to assess donation behavior. Model diagnostics indicated that the assumptions of the linear regression model were generally met. The residuals vs. fitted values plot showed no clear pattern, suggesting that the assumption of linearity was satisfied. The Q-Q plot indicated that the residuals were approximately normally distributed. The Scale-Location plot did not show any major issues with homoscedasticity, and the residuals vs. leverage plot indicated no influential outliers significantly affecting the model. Additionally, no significant issues of multicollinearity were identified as assessed by the Variance Inflation Factor (VIF) ([see Appendix C](#)).

Moreover, GPower 3.1 software was utilized to check the statistical power of the study, ensuring sufficient power to detect significant effects.

## **Results**

### **Everyday Altruism**

To determine whether the perception of climate change threat and defensive emotional states were associated with everyday altruism, we ran a multiple linear regression using as predictors climate change threat perception (severity, immediacy and inevitability), climate

change worry, climate change anxiety, climate change behavior, fight, flight, freeze, stress scale, anxiety scale, and demographics variables (see Table 2).

Results showed that climate change worry was a significant predictor of everyday altruism ( $\beta = 0.29$ ,  $p = 0.04$ ), indicating that higher levels of climate change worry are associated with higher levels of everyday altruism. Additionally, employment status was a significant predictor, with employed individuals reporting higher everyday altruism ( $\beta = 6.42$ ,  $p = 0.003$ ). Furthermore, age showed a significant positive association with everyday altruism ( $\beta = 0.35$ ,  $p < 0.0001$ ), suggesting that older participants reported higher levels of everyday altruism. All other predictors were not significantly associated with everyday altruism (see Table 2).

However, the immediacy of climate change impacts ( $\beta = -0.07$ ,  $p = 0.06$ ) and climate change behavior ( $\beta = -1.12$ ,  $p = 0.06$ ) were close to the threshold of significance, suggesting a potential but not definitive effect.

**Table 2**

*Model 1. Estimates for Everyday Altruism*

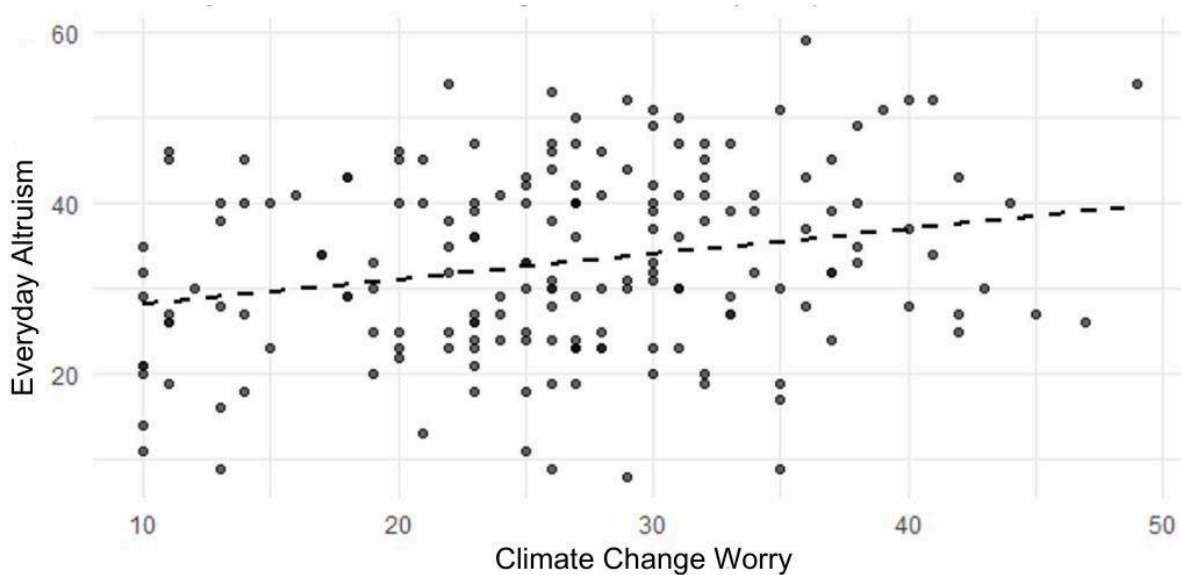
Predictor	Estimate	Std. Error	t value	p Value	95% CI lower	95% CI upper
(Intercept)	7.15	8.08	0.88	0.38	-8.82	23.11
Anxiety Scale	-0.27	0.31	-0.87	0.38	-0.89	0.34
FFFQ fear	0.15	0.16	0.94	0.35	-0.17	0.48
FFFQ fight	-0.10	0.21	-0.49	0.63	-0.52	0.31
FFFQ flight	0.09	0.18	0.48	0.63	-0.28	0.45
Climate Change Anxiety	0.79	0.48	1.64	0.10	-0.16	1.75
Climate Change Worry	0.29	0.14	2.13	0.04 *	0.02	0.57
Climate Change Behavior	-1.12	0.60	-1.86	0.06 .	-2.31	0.07
Stress Scale	0.03	0.16	0.19	0.85	-0.29	0.36

Severity Climate Change	0.05	0.05	0.91	0.36	-0.06	0.15
Immediacy Climate Change	-0.7	0.04	-1.91	0.06	-0.14	0.00
Inevitability Climate Change	0.02	0.04	0.54	0.59	-0.05	0.09
Age	0.35	0.08	4.36	<0.001 ***	0.19	0.50
Sex.Female	0.33	1.64	0.20	0.84	-2.92	3.58
Employment.Employed	6.42	2.10	3.06	0.003 **	2.28	10.56
Employment.Student	2.71	3.56	0.76	0.45	-4.33	9.74
Financial.I just meet my basic expenses	0.05	3.95	0.01	0.99	-7.75	7.85
Financial. My needs are met and I have a little left	-0.24	4.08	-0.06	0.95	-8.30	7.82
Financial. I live comfortably	-2.56	4.45	-0.58	0.57	-11.35	6.22
Education.Post secondary non-tertiary education	-1.18	2.82	-0.42	0.68	-6.75	4.39
Education.Bachelor's	-0.49	2.30	-0.21	0.83	-5.04	4.06
Education.Master's	1.43	2.70	0.53	0.60	-3.91	6.76
Education.Doctoral	-2.80	4.61	-0.61	0.54	-11.90	6.29

*Note.* CI = Confidence Interval. Estimates, standard errors, t values, p values, and confidence intervals are reported to two decimal places. The confidence intervals are at the 95% level. \*p < .05. \*\*p < .01. \*\*\*p < .001.

**Figure 1**

*Scatterplot of Climate Change Worry vs Everyday Altruism*



### **Donations**

To determine whether the perception of climate change threat and defensive emotional states were associated with donation behavior, we ran a regression model with climate change threat perception, climate change worry, climate change anxiety, climate change behavior, fight, flight, freeze, stress scale, anxiety scale, stress scale and demographics variables as predictors (See Table 3).

Results showed that climate change anxiety, as measured by items related to climate behavioral engagement and personal experience, was a significant predictor of donation behavior ( $\beta = 0.03$ ,  $p = 0.05$ ), indicating that higher levels of climate change anxiety are associated with higher donation amounts. Furthermore, the employment status showed significant effects, with employed individuals ( $\beta = -0.65$ ,  $p = 0.02$ ) donating more compared to unemployed participants

( $\beta = 0.51$ ,  $p = 0.04$ ). Additionally, having a master's degree ( $\beta = 0.82$ ,  $p = 0.02$ ) was significantly associated with higher donation behavior (See Table 3).

**Table 3**

*Model 2. Estimates for Donation Behavior*

Predictor	Estimate	Std. Error	t Value	p Value	95% CI lower	95% CI upper
(Intercept)	-0.63	1.06	-0.59	0.56	-2.73	1.48
Anxiety Scale	0.06	0.04	1.45	0.15	-0.02	0.14
FFFQ fear	0.03	0.02	1.27	0.20	-0.02	0.07
FFFQ fight	-0.02	0.03	-0.60	0.55	-0.07	0.04
FFFQ flight	-0.04	0.02	-1.51	0.13	-0.08	0.01
Severity Climate Change	0.01	0.01	1.09	0.28	-0.01	0.02
Immediacy Climate Change	0.00	0.01	0.66	0.51	-0.01	0.01
Inevitability Climate Change	-0.01	0.00	-1.23	0.22	-0.02	0.00
Climate Change Anxiety	0.13	0.06	2.00	0.05 *	0.00	0.25
Climate Change Worry	-0.02	0.02	-1.28	0.20	-0.06	0.01
Climate Change Behavior	-0.09	0.08	-1.09	0.28	-0.24	0.07
Stress Scale	0.01	0.02	0.34	0.73	-0.04	0.05
Age	0.02	0.01	1.45	0.15	-0.01	0.04
Sex.Female	0.27	0.22	1.26	0.21	-0.15	0.70
Employment.Employed	-0.65	0.28	-2.34	0.02 *	-1.19	-0.10
Employment.Student	-0.31	0.47	-0.65	0.52	-1.23	0.62
Financial.I just meet my basic expenses	0.51	0.52	0.98	0.33	-0.52	1.54
Financial. My needs are met and I have a little left	1.02	0.54	1.90	0.06 .	-0.04	2.08
Financial. I live comfortably	0.92	0.59	1.58	0.12	-0.23	2.08
Education.Post secondary non-tertiary education	0.14	0.37	0.38	0.71	-0.59	0.87
Education.Bachelor's	0.28	0.30	0.94	0.35	-0.31	0.88

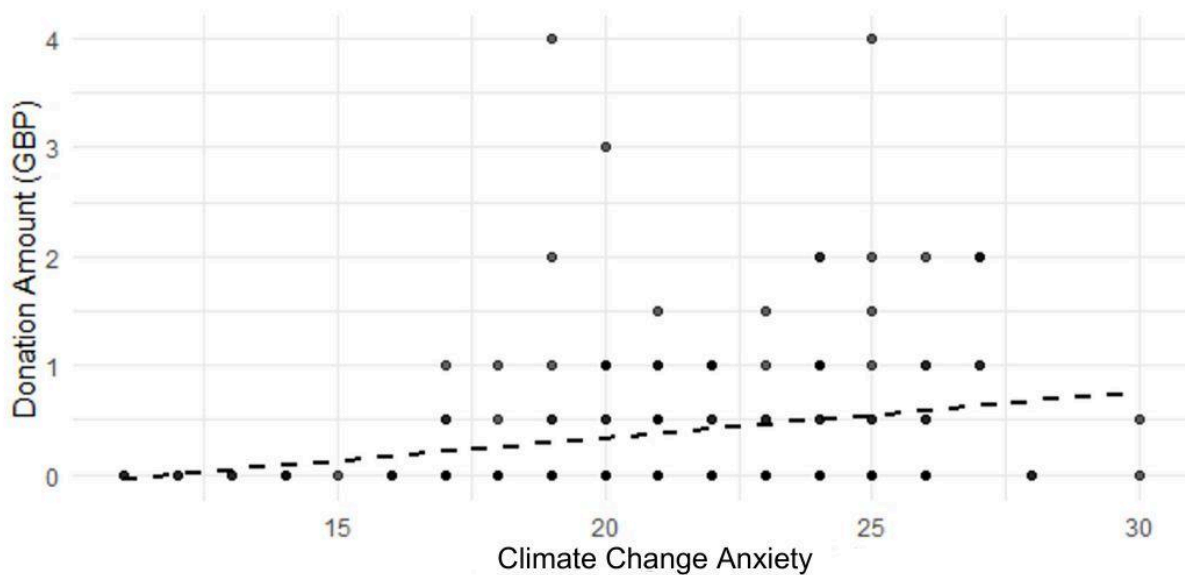


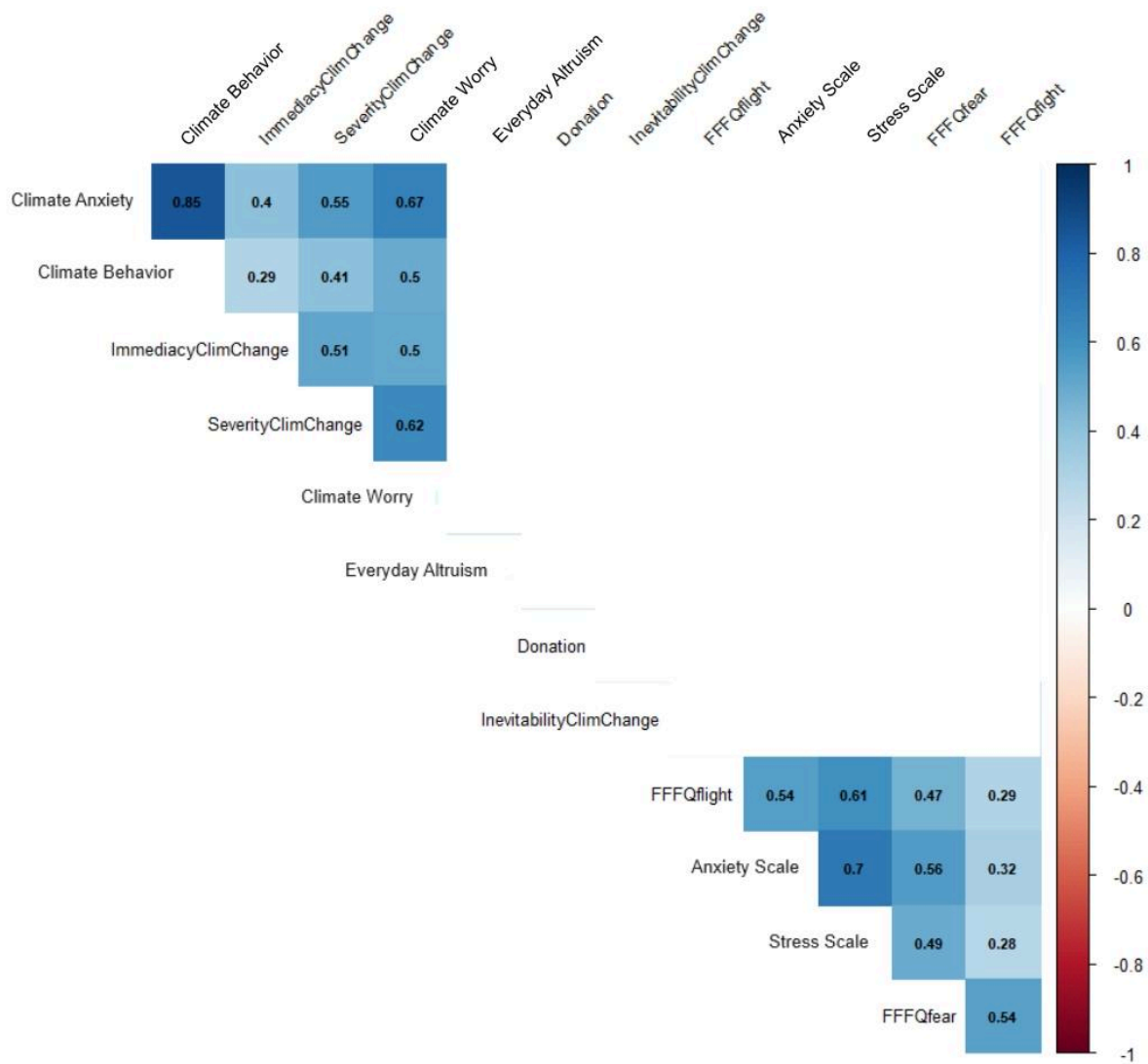
Education.Master's	0.82	0.36	2.29	0.02 *	0.11	1.52
Education.Doctoral	-0.67	0.61	-1.11	0.27	-1.87	0.53

*Note.* CI = Confidence Interval. Estimates, standard errors, t values, p values, and confidence intervals are reported to two decimal places. The confidence intervals are at the 95% level. \*p < .05. \*\*p < .01. \*\*\*p < .001

**Figure 2**

*Scatterplot of Climate Change Anxiety vs Donation Amount.*



**Figure 3***Correlation Matrix Heatmap*

*Note.* Zero-order correlations between measures of perceived climate change threat, defensive responses, donation behavior and self-reported altruism. Numbers in each cell correspond to the Pearson correlation coefficients. Cells with a white background indicate correlations that did not remain significant after applying the Sidak correction for multiple comparisons (adjusted significance level = 0.00065).

## Discussion

This study investigated the association between perceived threat of climate change, defensive emotional responses and altruistic behavior. The findings provide compelling evidence that climate change worry and climate change anxiety (measured by climate behavioral engagement and personal experience) are associated with altruistic actions. Additionally, these associations vary across demographic groups such as age, employment status, and education level.

In the context of the research, emotional states like stress, anxiety, fear and panic are considered as a spectrum of defensive responses that correspond to different intensities of perceived threats (Mobbs et al., 2020). Based on previous research showing that perceived COVID-19 as a threat was associated with higher levels of everyday altruism (Vieira, 2022), we hypothesized that experiencing more acute defensive emotions related to climate change would be associated with higher levels of self reported altruism.

Our results demonstrate that individuals reporting higher climate change worry and higher levels of climate change anxiety, as measured by everyday altruism and donation behavior respectively, reported higher levels of altruism. Considering that we assessed different emotional responses, these findings suggest that specific emotional responses to climate change uniquely motivate altruistic behaviors. Notably, other defensive emotions such as anxiety and stress did not show a significant association with altruism, indicating that this association is not explained by other predictors. This highlights that climate-specific emotions may heighten individuals' sense of urgency and responsibility, prompting them to engage in prosocial actions. The association between climate change worry and everyday altruism particularly aligns with previous studies suggesting that individuals with greater awareness of climate change are more likely to engage in

prosocial behaviors, such as embracing sustainable practices, which benefit society (Hansla et al., 2008; Knez, 2016).

It is important to note the different patterns observed in everyday altruism and donation. The analysis showed that these measures, although related, are not identical and capture different facets of altruistic behavior. While both measures are indicative of altruism, they may capture different aspects of prosocial behavior. Everyday altruism measures a broader range of everyday altruistic acts, whereas donation behavior is a specific, tangible action. This distinction might explain why climate change worry is associated with everyday altruism, reflecting a general readiness to help in everyday situations due to a concern about climate change. In contrast, climate change anxiety is associated with donation, suggesting that individuals who exhibit sustainable behaviors and have personal experiences with climate change may feel a stronger urgency to contribute financially due to a heightened sense of responsibility from their sustainable behaviors and personal experiences.

The role of age, employment status, and education level as moderators in these relationships highlights the importance of demographic factors. Our results indicate that older participants tend to report higher levels of everyday altruism. This suggests that age amplifies altruism, possibly due to greater life experience. These findings align with previous research indicating that altruistic tendencies increase with age due to accumulated life experience and social responsibility (Sze et al., 2012; Midlarsky & Hannah, 1989).

Additionally, our findings indicate that having a master's degree is significantly associated with higher donation behavior, suggesting that higher educational achievement may increase individuals' likelihood of engaging in altruistic actions.

Furthermore, the results show that employment status was a significant predictor of both everyday altruism and donation behavior. Employed individuals reported higher levels of altruism and were more likely to donate compared to unemployed individuals. This stability and structured support may not only increase their awareness and concern for climate change but also provide the necessary resources to act on these concerns through donations and other altruistic behavior. Recent findings by Rhoads et al. (2021) align with our results, indicating that higher levels of well-being, such as education and economic resources, promote positive subjective states, which in turn encourage engagement in altruistic behaviors. These findings underscore the role of stable employment and supportive environments in fostering altruistic actions.

One of the critical questions arising from these findings is the directionality of the observed associations. Specifically, does climate change worry cause altruistic behavior, or do more altruistic people tend to worry more about climate change? Our study does not establish causality. This remains an area for future research to explore, possibly through longitudinal studies that can better assess the direction of these relationships.

Despite these significant findings, the study has limitations. The sample, although diverse, may not be representative of all demographic groups, potentially limiting the generalizability of the findings. The reliance on self-reported measures may also introduce bias, as participants might over-report socially desirable behaviors.

Future research should aim to replicate these findings in more diverse and representative samples to enhance the generalizability of the results. Additionally, investigating the interplay between climate change threat perception, defensive emotions, and altruistic behavior through rigorous longitudinal designs would offer valuable information on how these factors interact over time and potentially influence each other.

In conclusion, this study underscores the significance of defensive emotions, particularly worry and climate change anxiety (measured by climate behavioral engagement and personal experience), in associating with altruistic behaviors in the context of climate change. Our findings extend the understanding of how perceived environmental threats can drive prosocial responses, highlighting the potential for emotional responses to motivate actions that benefit society in the face of global environmental challenges.

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## **Appendix A**

### **Online Questionnaire**

#### **Information about the study**

The aim of this study is to discover how people respond to dangerous or stressful situations, and whether this is related to differences in personality. We will measure this with questionnaires and short computer tasks. The questionnaires will ask about your thoughts, emotions and usual behaviors. The study will take about 30 minutes in total.

You will be compensated 4.00 GBP through the Prolific platform after completing the study.

Your participation is strictly voluntary and you can quit at any point without having to give a reason. Data collected within this study will be handled in accordance with GDPR regulation (<https://gdpr-info.eu/>).

#### **Statement of consent:**

I confirm that:

- I have read the letter of information and have no further questions.
- I know that participation is completely voluntary and I can quit at any point,
- I am 18 years or older.

By filling out the details below and clicking 'Next' I agree to participate in the study.

Please write your initials in the box below

Please select today's date in the box below (DD/MM/YYYY)

Please fill in your Prolific ID number:

---

**Welcome to our study!**

To ensure the program runs smoothly, please close all other tabs on your browser, and maximize this window (without browser address bar or control panel).

For desktop devices, typical key commands to do this are:

- **"F11"**
- **"Fn/Function" + "F11"**
- **"Command" + "Ctrl" + "F"**
- **"Fn" + "F"**

---

**In this part of the study, you will need to answer some questions.**

**Attentional Checks:**

Please note that there will be attentional checks throughout the study.

Failing these checks may result in disqualification from the study and forfeiture of payment.

Pay careful attention to ensure accurate data collection and completion of the study requirements.

---

What is your age?

---

What was your sex at birth?

- Male
- Female
- Other

---

Current employment status

- Unemployed
- Employed
- Student

How would you describe your overall personal financial situation?

- I don't meet my basic expenses
- I just meet my basic expenses
- My needs are met and I have a little left
- I live comfortably

Highest level of education obtained

- Early childhood education
- Primary education
- High school education
- Post-secondary non-tertiary education
- Bachelor's or equivalent level
- Master's or equivalent level
- Doctoral or equivalent level

---

Have you ever been diagnosed with a mental health condition by a professional?

- Yes, in the past
- Yes, currently
- No

---

Please, specify the type of mental health condition:

--

---



---

Have you ever received any form of treatment for a mental health condition?

- Yes, in the past
- Yes, currently
- No

---

Please, specify the type of mental health condition:

---



---

How many hours did you sleep on average per day during the last 7 days? (Express in numbers)

---



---

Please rate how often the following statements are true for you.

---

I have been directly affected by climate change

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I know someone who has been directly affected by climate change

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I recycle



Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I turn off the lights

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I try to reduce my behaviors that contribute to climate change

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I feel guilty if I waste energy

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I worry about climate change more than other people.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

Thoughts about climate change cause me to have worries about what the future may hold.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet).

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

Please select the option 'Often'

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I worry that outbreaks of severe weather may be the result of a changing climate.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I worry about climate change so much that I feel paralyzed in being able to do anything about it.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I worry that I might not be able to cope with climate change.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I notice that I have been worrying about climate change.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

Once I begin to worry about climate change, I find it difficult to stop.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

I worry about how climate change may affect the people I care about.

Never	Rarely	Sometimes	Often	Almost always
-------	--------	-----------	-------	---------------

---

Instructions: For the following questions, use your mouse to select the place on the scale that best represents your response.

---

1. How severe do you think the consequences of climate change will be?

There will be no  
consequences

The planet will  
become  
uninhabitable

---

2. How soon do you perceive the consequences of climate change to be?

Not for a very  
very long time

Now

---

3. How unavoidable do you perceive the consequences of climate change to be?

Completely  
avoidable

Completely  
unavoidable

---

**In this part of the study, you will need to answer some extra questions.**

**Attentional Checks Reminder:**

Please note that there will be attentional checks throughout the study.

Failing these checks may result in disqualification from the study and forfeiture of payment.

Pay careful attention to ensure accurate data collection and completion of the study requirements.

---

For each of the following statements, please select the option that reflects the frequency with which you have carried out the following acts

---

I have helped a stranger with car troubles (e.g., replace a flat tire, jump-start a car,...).

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have given directions to a stranger.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have made change for a stranger.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have given money to a charity.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have given money to a stranger who needed it (or asked me for it).

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have donated goods or clothes to a charity.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have done volunteer work for a charity.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have donated blood.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have helped carry a stranger's belongings (books, parcels, etc).

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

Please select the option 'Once'

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have delayed an elevator and held the door open for a stranger.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have allowed someone to go ahead of me in a lineup (e.g. in the supermarket)

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have given a stranger a lift in my car.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have pointed out a clerk's error (in a bank, at the supermarket) in undercharging me for an item

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have let a neighbour whom I didn't know too well borrow an item of some value to me (e.g. a dish, tools, etc.)

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have bought charity items before (e.g. Christmas cards, plush toys...) because I knew it was for a good cause

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have helped a classmate who I did not know that well with a homework assignment when my knowledge was greater than his or hers.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

Please select the option 'Once'

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have before being asked, voluntarily looked after a neighbour's pets or children without being paid for it.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have offered to help a handicapped or elderly stranger across a street.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have offered my seat on a bus or train to a stranger who was standing.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

I have helped an acquaintance to move households.

Never	Once	More than once	Often	Very often
-------	------	----------------	-------	------------

---

Please read each statement and indicate how much the statement applied to you **over the past week**.

---

Over the past week, I was aware of dryness of my mouth

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

Over the past week, I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

Over the past week, I experienced trembling (e.g. in the hands)

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

Over the past week, I was worried about situations in which I might panic and make a fool of myself

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

Over the past week, please select the option 'Applied to me very much or most of the time'

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

Over the past week, I felt I was close to panic

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

Over the past week, I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree	Applied to me very much or most of the time
----------------------------	---	--	---



	of the time	or a good part of time	time
--	-------------	------------------------	------

---

Over the past week, I felt scared without any good reason

Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
----------------------------	---	---	---

---

The questions in this questionnaire ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate how often you felt or thought a certain way (Never; Almost Never; Sometimes; Fairly Often; Very Often)

---

In the last month, how often have you been upset because of something that happened unexpectedly?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you felt that you were unable to control the important things in your life?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you felt nervous and stressed?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you felt confident about your ability to handle your personal problems?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you felt that things were going your way?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

Please select the option 'Fairly often'.

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you found that you could not cope with all the things that you had to do?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you been able to control irritations in your life?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you felt that you were on top of things?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you been angered because of things that happened that were outside of your control?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Never	Almost never	Sometimes	Fairly often	Very often
-------	--------------	-----------	--------------	------------

---

Please read each word from the list and indicate how you typically react to potentially threatening situations. Do not spend too much time thinking about each word.

---

Empty

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Attacking

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Blank

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Scared

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Vacant

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Detached

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Disengaged

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Terrified

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Fearful

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Please select the option 'Most of the time'

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Confrontational

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Outraged

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Disconnected

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Ready to fight

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Dazed

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Yelling

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Frightened

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Resisting forcefully

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Please select the option 'Most of the time'

Almost never	Sometimes	About ½ the	Most of the time	Almost always
--------------	-----------	-------------	------------------	---------------

		time		
--	--	------	--	--

---

Argumentative

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Afraid

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Threatened

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

Petrified

Almost never	Sometimes	About ½ the time	Most of the time	Almost always
--------------	-----------	------------------	------------------	---------------

---

You will be compensated for participating in this experiment with the equivalent of €4,00. It is possible for you to donate all or part of your compensation to a charity of your choice instead.

Select below how much would you like to donate.

- 0,00 GBP (no donation)
- 0.50 GBP
- 1.00 GBP
- 1.50 GBP

- 2.00 GBP
  - 2.50 GBP
  - 3.00 GBP
  - 3.50 GBP
  - 4.00 GBP (donate all of your compensation)
- 

### **Debriefing form**

The experiment is complete. We want to thank you for your contribution!

#### **Here you can read some more background about the study.**

When people face dangerous or stressful situations (e.g., a conflict, pandemic) they may display emotional responses like anxiety or fear. Previous research has shown that these emotional responses can be variable between people, and can determine how individuals tend to relate to others. The questionnaires you filled out in this study were meant to assess how individuals typically respond to stressful situations, and how they affect their behavior towards others. In the computer task, the loud scream was used to slightly frighten you. Your responses in that task will help us further understand how sensitive individuals are to stressful events.

Regardless of whether you selected how much money you would donate in the previous question, you will still receive full compensation if the attentional checks have been adequately met.

I Agree

I once again give permission for using my data.

---

To receive your compensation, **please copy the completion code below and open the link.** The link will take you back to Prolific where your participation will be confirmed using the completion code below, and your compensation will be processed.

**COPY THIS CODE: CNHD9COQ**

Pressing this link will open a new tab to Prolific. Please also press "Next" below to formally close the experiment.

**Thank you again for your contribution to our research. Stay safe and have a good day!**

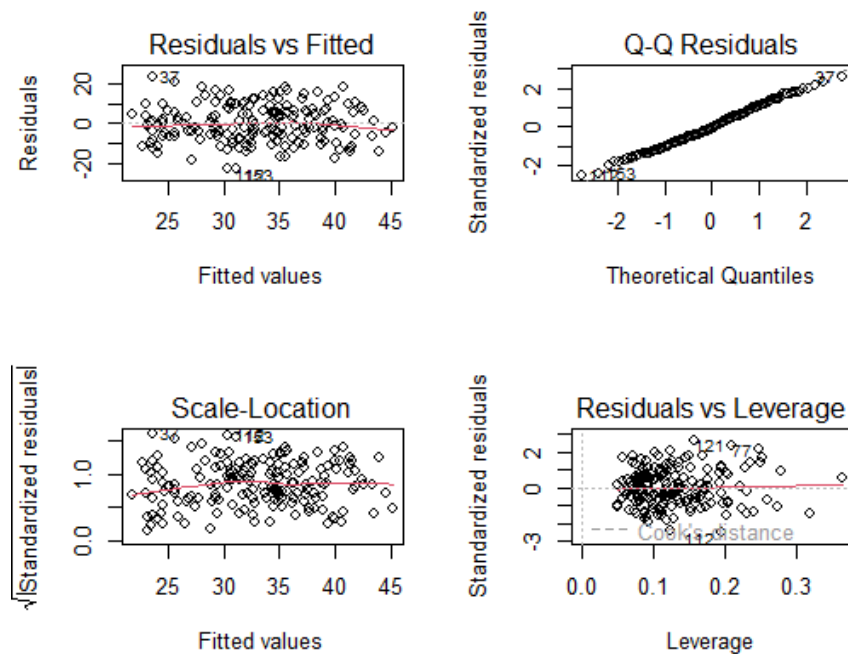


## Appendix. B

### Everyday Altruism

#### Figure B1

#### *Diagnostic Plots for Everyday Altruism Model*



*Note.* This figure includes multiple diagnostic plots for the Everyday Altruism model: (1) Residuals vs Fitted, (2) Normal Q-Q, (3) Scale-Location, and (4) Residuals vs Leverage. These plots are used to check various assumptions of the regression model, including homoscedasticity, normality of residuals, and the presence of any influential outliers.

**Table B1***Generalized Variance Inflation Factor (GVIF) Values for Predictor Variables*

Predictor	GVIF	Df	GVIF <sup>1/(2*Df)</sup>
Anxiety Scale	2.60	1	1.61
FFFQ fear	2.18	1	1.48
FFFQ fight	1.59	1	1.26
FFFQ flight	1.91	1	1.38
Severity Climate Change	2.26	1	1.50
Immediacy Climate Change	1.73	1	1.31
Inevitability Climate Change	1.12	1	1.06
Climate Change Anxiety	5.65	1	2.38
Climate Change Worry	2.70	1	1.64
Climate Change Behavior	4.25	1	2.06
Stress Scale	2.72	1	1.65
Age	1.47	1	1.21
Sex	1.23	1	1.11
Employment	1.64	2	1.13
Financial	1.89	3	1.11
Education	1.72	4	1.07

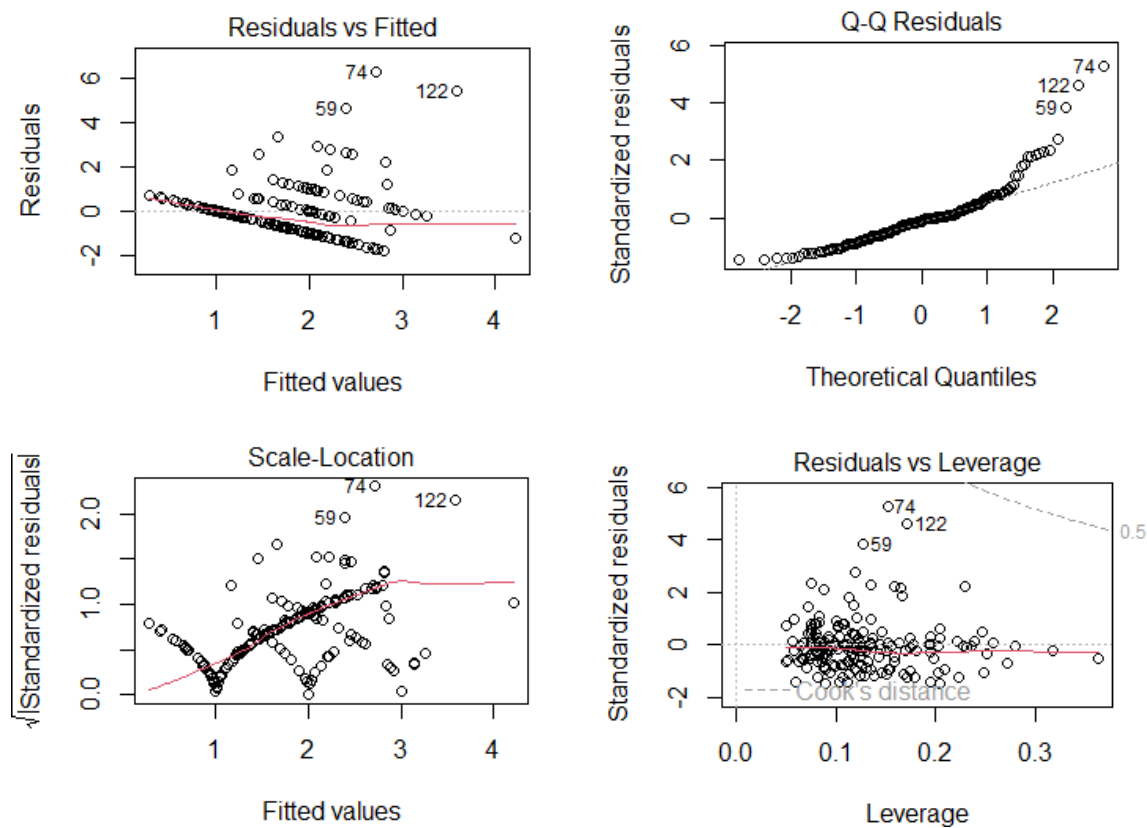
*Note.* GVIF = Generalized Variance Inflation Factor, Df = Degrees of freedom, GVIF<sup>1/(2\*Df)</sup>  
= Generalized Variance Inflation Factor adjusted for degrees of freedom.

## Appendix. C

### Donation

#### Figure C1

#### *Diagnostic Plots for Donation Model*



*Note.* This figure includes multiple diagnostic plots for the Donation Behavior model: (1) Residuals vs Fitted, (2) Normal Q-Q, (3) Scale-Location, and (4) Residuals vs Leverage. These plots are used to check various assumptions of the regression model, including homoscedasticity, normality of residuals, and the presence of any influential outliers.

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