

**PB52: Coping with Climate Change:
Communicating Climate Change: Exploring the Impact of Communication Styles on
Emotional Responses and Pro-Environmental Behaviours**

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June 28th, 2024

Abstract

Objective

The urgency of climate change necessitates widespread adoption of environmentally friendly behaviours. However, the readiness to engage in pro-environmental actions is unevenly distributed across society. People may have varying emotions toward climate change resolution behaviors, ranging from positive to negative. These emotions may be triggered by the way in which climate change is communicated to them. This study examines whether the style of climate change communication affects individuals' emotional responses, particularly enthusiasm, and whether these emotional responses influence pro-environmental behaviours. It was hypothesised that individuals exposed to an empathic and actionable communication style would exhibit more positive emotions towards climate change solutions and engage more in pro-environmental behaviour compared to those exposed to unproductive and disengaging communication.

Methods

The study involved a sample of 113 participants who completed an online questionnaire, including the enthusiasm subscale from the ICE, the PEB inventory, and exposure to one of two distinct video clips representing different communication styles, to which participants were randomly assigned. T-tests were conducted to compare the two groups, a regression analysis investigated the effect of enthusiasm on pro-environmental behaviours and a bootstrapping analysis was used to assess the mediating role of enthusiasm.

Results

The findings confirm that individuals exposed to empathic and actionable communication display higher levels of enthusiasm. However, no significant effect of enthusiasm on pro-environmental behaviour was observed, nor was there a direct relationship between communication style and engagement in pro-environmental behaviour. Additionally, the mediating effect of enthusiasm on the relationship between communication style and pro-environmental behaviour was not supported.

Conclusion

These results suggest a nuanced relationship between communication, enthusiasm, and behavioural outcomes in environmental contexts. To enhance understanding, future research should explore additional factors that influence individual engagement in pro-environmental behaviour and consider a longitudinal approach to investigate the effects of communication style on pro-environmental behavior engagement.

Keywords: Climate Change, Communication Style, Enthusiasm, Pro-environmental Behaviour

Introduction

In recent decades, climate change has gained widespread recognition as a critical global issue. The United Nations (n.d., para.1) defines climate change as “long-term shifts in temperatures and weather conditions”. These shifts may have natural causes, including changes in the sun’s activity or major volcanic eruptions. However, human activities have become the primary driver since the 19th century, as the burning of fossil fuels and subsequent emission of greenhouse gases remarkably contribute to alterations in temperature and weather patterns (United Nations, n.d.).

As outlined by the report of the Intergovernmental Panel on Climate Change (IPCC) in 2023, climate change may have a variety of notably undesirable effects on the planet and its inhabitants. That includes adverse effects on ecosystems, significant impacts on human systems (such as infrastructure), as well as negative physical and mental health consequences (Doherty & Clayton, 2011; IPCC, 2023; Watts et al., 2018).

In reaction to these undesirable effects of climate change, people may experience different emotions, spanning from pessimism to optimism. The most common emotions identified with climate change are alarm, concern, doubt, rejection, hesitation (Brulle et al., 2012; Loureiro & Allo, 2020; Shi et al., 2016), anger, sadness, guilt (Chu & Yang, 2019; Smith & Leiserowitz, 2013), hope, fear, anxiety, compassion, worry, anticipation, disgust, and surprise (Gustafson et al., 2020; Myers et al., 2012). Pessimistic emotions may be associated with the doubt that global warming cannot be limited or feelings of anxiety regarding the consequences of climate change (Iñiguez-Gallardo et al., 2021), conversely, optimistic emotions can be attributed to faith in effective solutions, meaningful policy changes or advancements in technologies (Cattell, 2021; Nordgren, 2021).

In consequence, the question arises, of why people may differ so greatly in their emotional response to climate change. Currently, the scientific literature is engaged in a discourse on the specific factors influencing diverse emotional responses to climate change (Bouman et al., 2020). Literature provides several definitions that offer insights into the diverse factors influencing people’s emotional responses. Emotions can be described as spontaneous reactions triggered by relevant stimuli. Individuals may react differently when being exposed to the same stimuli (Emmanuel & Cordero, 2011). Apart from that, the variance in individuals’ expressions of emotions toward climate change may stem from various factors, including geographic location and the extent and nature of their exposure to climate change impacts, the degree of scientific knowledge people possess, their age, and their income situation (Mosquera & Jylhä, 2023; Shi et al., 2016). Also, an individual’s

expression of emotions can be predisposed by moral perspectives, tangible actions (like active engagement), or enhanced by reflective rumination (Mosquera & Jylhä, 2023).

Besides, emotional reactions might be influenced by the type of messages about climate change. Myers et al.'s (2023) research indicates that various types of messages can influence emotional reactions to climate change. Their study explored four message types, namely, consensus, (emphasising scientific agreement about the causes and consequences of climate change) cause (providing scientific causal process information), impact (providing information about climate change impacts), and solution messages (suggesting solutions in mitigating climate change), revealing a connection between the message type and participants' expressed emotions (Myers et al., 2023). The study displayed heightened feelings of guilt in response to the cause message, increased sadness prompted by the impact message, and elevated hope following exposure to the solution message. Conversely, a decline in hope was observed in reaction to the consensus, cause, and impact messages. Additionally, the solution message mitigated feelings of anger, sadness, and fear. The study highlighted the complexity of emotional reactions to different message types, as certain messages may evoke both positive and negative emotions in individuals.

Moreover, the study by Myers et al. (2023) demonstrated that climate information messages may influence multiple emotions simultaneously. These aroused emotions may conflict in their ability to foster climate change mitigation policies. Nevertheless, the study identified that anger, hope, fear, and sadness separately and jointly predict climate policy support (Myers et al., 2023). The messages had nuanced effects across different emotions, sometimes alleviating or suppressing them. However, even though the messages increased participants' relevant knowledge, they did not effectively engage their emotions. This indicates that the messages did not elicit the desired emotional reactions. The study concluded that when messages fail to emotionally engage individuals, they can suppress policy support. Effective communication requires engaging individuals both emotionally and cognitively (Myers et al., 2023).

Consequently, these findings highlight the challenge of designing effective interventions to nudge people into acting environmentally-friendly. As research by Roeser (2012) made salient, only few individuals are willing to adapt their lifestyles and act eco-friendly. These individuals may lack a sense of urgency or they may not feel that their actions make a difference. However, emotions have been shown to be direct predictors of practical and moral decision-making (Roser, 2012). According to Salama and Aboukoura (2017), emotions play a crucial role in individuals' responses to climate change. Especially positive

emotions such as hope may increase the probability that individuals engage with the issue of climate change and adopt beliefs as well as behaviours consistent with effort to combat climate change, as positive emotions are often aroused as perceptions of efficacy (Salma & Aboukoura, 2017). Therefore, communicators must be critically aware of the role of emotions in behaviour change when transmitting information about climate change, as their messages can lead to either engagement or disengagement (Salma & Aboukoura, 2017).

As evidenced by Hendrix and Morrison's (2020) qualitative research, communication style and emotions are intricately intertwined. The study explored the emotions participants experience when communicating with groups of different sizes and found the chosen communication style, representing the method of conveying information, to largely influence the perception of that information. In this context, the language employed in conveying information establishes a framework for interpreting that information (Satpute & Lindquist, 2021). The intricate connection between words and emotions is evident in the human brain, where similar neural regions are activated in response to both emotional experiences and the semantics of words (Satpute & Lindquist, 2021). The ensuing emotional response to the communicated information can, in turn, impact the intended behavioural response (Hendrix & Morrison, 2020).

Upon reviewing the current literature, two predominant communication styles were categorised, empathetic and actionable communication versus unproductive and disengaging communication. These categories were chosen because they represent opposite ends of the spectrum. While other communication styles exist between these extremes, sufficiently distinct styles are necessary for effective comparison. The former, characterised by its educational, solution-oriented, empathic, and positive approach, has proven to be more effective in conveying information and fostering a sense of empowerment in individuals (De Boer et al., 2013; Stevens et al., 2020). Conversely, the latter style, marked by fear-based, divisive, alarmist elements, often involving blame or shame, has demonstrated lower efficacy in achieving desired behavioural outcomes (Albalawi & Nadeem, 2020; Zwarenstein et al., 2013). Nevertheless, as of current research, no conclusive evidence has been established regarding the impact of both aforementioned communication styles on emotional responses within the context of climate change.

Another critical question that arises is how the employed communication style, along with the ensuing emotional reaction, influences the behavioural responses individuals undertake in the realm of climate change. Eliciting specific emotions has been shown to increase the likelihood of individuals engaging in desired behaviours, as emotional tendencies

might be intricately linked to the expression of particular behaviours (Burghardt, 2019). As research by Mateer et al. (2022) has suggested, an individual engagement in pro-environmental behaviour (PEB), proactive actions contributing positively to environmental preservation and sustainability (Van Riper et al., 2018), is largely influenced by behavioural difficulty, structural factors, and social influences. For instance, the absence of bike lanes might dissuade someone from cycling to work, leading them to opt for a car instead. Still, scientific research lacks clarity on the role of the emotional state of an individual as an influencer on PEB. Especially with positive emotions (such as enthusiasm), there is a discernible research gap, with limited attention devoted to investigating the impact of positive emotions, such as enthusiasm, on individuals' behavioural responses within the context of climate change.

By tailoring communication styles to evoke specific emotions, messages can resonate more effectively with individuals, facilitating better comprehension and promoting the right level of engagement in PEB. Crafting climate change information to elicit the desired emotional response, such as enthusiasm, is instrumental in motivating active participation in behaviours that address climate change. Examining whether communication style significantly influences emotional and behavioural responses is crucial for optimising the impact of climate change messages. Effective communication can heighten individual engagement in PEB, as adopting such behaviours, like reducing energy consumption, directly reduces greenhouse gas emissions and slows down the pace of climate change. Therefore, this study aims to investigate how different styles of communication are related to the emotional reaction, especially enthusiasm, expressed by individuals concerning climate change and what effect that has on an individual's engagement in PEB. This study will specifically investigate the impact of empathetic and actionable communication, exploring the emotional responses it elicits and examining whether these responses prompt individuals to adopt specific PEB in the context of climate change. The research question is:

To what degree does the communication style used to convey information about climate change influence individuals' emotional responses and their involvement in pro-environmental behaviours?

In order to test the research question the following hypotheses will be investigated:

- 1. Individuals exposed to climate information presented in an empathic and actionable style of communication adopt more pro-environmental behaviours than individuals exposed to an unproductive and disengaging communication.*

2. *Individuals exposed to climate information presented in an empathic and actionable style of communication express more optimistic emotions (enthusiasm) than individuals who experience unproductive and disengaging communication.*
3. *Individuals expressing optimistic emotions (enthusiasm) adopt more pro-environmental behaviours*
4. *Individuals exposed to climate information presented in an empathic and actionable style of communication who experience more optimistic emotions (enthusiasm) and adopt more pro-environmental behaviours than individuals who experience unproductive and disengaging communication.*

Methods

Participants

This study employed a randomised controlled trial design with a between-subjects approach to investigate the impact of different communication styles in videos on participants' levels of enthusiasm and engagement in PEB. Participants for this study were selected using a volunteer sampling technique from the student population at the University of Twente. Moreover, snowball sampling was used in order to facilitate broader participant engagement. There was a total of 170 participants who took part in the study. However, 57 participants were excluded from the final analysis because they have only responded to the demographic questions of the survey and did not provide answers to the two questionnaires. The participants were divided and randomly assigned to two distinct test conditions: one group exposed to the unproductive and disengaging communication style and another group exposed to the empathic and actionable style of communication. Consequently, 63 participants were assigned to the first condition, while 50 participants were assigned to the latter condition. They took part in only one of the two conditions. To ensure a comprehensive understanding of the survey questions, individuals who did not have sufficient skills in the English language were excluded from participation. Moreover, participants who completed just the demographic survey and did not continue with the other questions were excluded from the study as well.

Materials

The study was carried out using Qualtrics, an online platform designed for conducting survey research, evaluations, and other data collection activities. The study is part of a larger investigation concerning climate change and behavioural responses. Overall, relationships

between the variables of communication style, diverse emotions and behavioural responses/ coping responses in the context of context of climate change were investigated. Consequently, participants also had to fill in questionnaires not used for this particular study. The study material used for this study included one of two distinct video clips (Appendix C), the enthusiasm scale derived from the Inventory of Climate Emotions (ICE) (Appendix D) and the Pro-Environmental Behaviour (PEB) inventory (Appendix E).

Video Clips

For this study, participants were exposed to one of two distinct short video clips. These clips conveyed either an unproductive and disengaging message about climate change or featured empathic and actionable communication on the participant. The video showcasing an unproductive and disengaging communication style is a 1 minute and 38 seconds long, titled “White House climate report says the effects of climate change are worsening.” Uploaded on the YouTube channel “CBS Evening News” in November 2023, it presents a news report detailing the escalating impacts of climate change on the American populace and the associated economic toll. The report emphasises the far-reaching and deteriorating consequences of climate change (CBS Evening News, 2023).

The second video, titled “Youth for Climate Action: Breaking Barriers,” runs for 2 minutes and 31 seconds. Uploaded in December 2019 on the YouTube channel “UN Climate Change: Learn,” it features young adults advocating for action against climate change to mitigate its effects and preserve the planet and postulate that a shift in mentality will lead to climate actions (UN Climate Change: Learn, 2019). To verify participants’ engagement with the video content, a comprehension question followed each video clip. For the initial video, participants were quizzed: ‘What is the estimated financial impact of the weather disasters discussed in the clip?’ with response options of ‘1 billion every 3 weeks’ (correct) and ‘2 billion every month’ (distractor). For the subsequent video, participants were asked: ‘According to the video, what is proposed as a solution to combat climate change?’ Response choices included the correct option ‘change of mentality’ and the incorrect option ‘only planting trees’.

Enthusiasm Scale from ICE

After watching the video clips, participants were required to complete two different questionnaires on the platform. The first one was a collection of items taken from the ICE-inventory, a scale consisting of a total of 32 items that measure participants’ scores on six different emotions related to climate change, namely anger, anxiety, sorrow, contempt, enthusiasm, guilt, powerlessness, isolation (Marczak et al., 2023). However, for this research

only the subscale of enthusiasm is used in analysis, encompassing a total of four items. The Enthusiasm subscale demonstrated a high level of internal consistency, with a Cronbach's alpha coefficient of 0.91. Per item, participants had to indicate how much they agree with the provided items on a 5-point Likert scale ranging from „I strongly disagree“ to „I strongly agree“. For instance, they were presented with statements such as “The increased public engagement with climate change gives me hope” or “I believe that there are emerging solutions that will allow us to stop climate change”(Marczak et al., 2023). All participants were required to complete the inventory, regardless of their assigned test condition.

Pro-Environmental Behaviour (PEB) Inventory

The second questionnaire is the Pro-Environmental Behaviour inventory, a reliable and valid scale designed to assess PEB across varying levels of engagement (Mateer et al., 2022). It captures PEB in two distinct dimensions, public and private PEB. Public PEB occurs within a public setting and can directly be observed by other individuals, private PEB on the other hand typically occurs in more deducted or personal settings and usually includes doing those alone without being directly observed by other people. The Private Behavior subscale exhibited a Cronbach's alpha of 0.86, and the Public Behavior subscale demonstrated a Cronbach's alpha of 0.91, both indicating very high internal consistency. Comprising eleven items (6 measuring private and 5 measuring public PEB), participants responded on a seven-point Likert scale, where 0 denotes “never” and 6 signifies “as frequently as possible.” Sample items in the questionnaire include actions like „Buy environmentally friendly and/ or energy efficient products “ or „Sign a petition about an environmental issue“ (Mateer et al., 2022).

Demographics

Furthermore, participants were asked to provide demographic information, encompassing their age, gender, nationality, and their highest level of education completed or in progress. Education options encompassed High School, Technical College, University of Applied Sciences, University, or PhD.

The statistical programme Rstudio was used to analyse the data, which allowed for effective data management.

Procedure

All data collection occurred online, either utilising the university's SONA System to recruit participants, who earn credits for their involvement, or by snowball sampling targeting friends and family. Following their signup through SONA System, participants were

forwarded to the questionnaire on the Qualtrics website. Before starting the survey, all participants received a brief written introduction (Appendix A) outlining the research topic and data handling procedures. Afterwards, they were asked to give their informed consent (Appendix B). This document provided details about potential risks of mental discomfort during participation and assured participants of their right to withdraw from the study at any point.

Once the informed consent form was signed, participants were required to provide their basic demographic information, such as their age, gender, nationality, and their highest level of education completed or in progress. Next, as part of a between-subject design, the Qualtrics system randomly assigned the participants into two different test conditions. Here, both groups of participants were provided with a link to a short video clip concerning climate change (Appendix C). Depending on the test group the participants have been randomly assigned to, they were either provided with a video featuring an empathic and actionable style of communication concerning climate change or they were presented a video showcasing an unproductive and disengaging style of communication within the context of climate change. The participants were instructed to watch the full video clip and return back to the online study when finished. Once they returned back to the online study, participants were presented with a simple question designed to assess whether they had indeed viewed the video. After that, all participants, regardless of their previously assigned test condition, proceeded with the study by answering the same set of questions. This included the enthusiasm scale of the ICE inventory (Appendix D). Here, participants had to indicate their level of agreement on four different items measuring their enthusiasm. Subsequently, they had to respond to the items of the PEB inventory (Appendix E), measuring their engagement in pro-environmental behaviour.

After completing the study, participants were thanked for their participation and given contact details for any remaining questions. Additionally, their data was securely stored in the University's online environment in compliance with the General Data Protection Regulation (GDPR) for further analysis.

Data Analysis

Before embarking on the analysis of the gathered data, it is essential to ensure that the data are sufficient to address the research questions. To achieve this, an appropriate sample size is necessary. In order to determine a satisfactory sample size for the research study, G*Power was utilised. The aim was to ascertain the number of participants required for each

of the two conditions and, consequently, the total number of participants needed for a representative sample. An a priori power analysis was conducted, given the predefined research questions, focusing on t-tests to measure the difference between two independent means. Relevant parameters, including a desired power level of 0.95, a significance level alpha of 0.05, and an effect size of 0.5, were entered into G*Power (Appendix F). To accommodate the possibility of a positive or negative relationship between variable means, a two-sided t-test was selected.

According to the statistical software's output parameters, it has been established that the study necessitates a total sample size of 210 participants, with each test condition comprising 105 participants. A total of 113 responses to the questionnaire was obtained, resulting in 50 participants allocated to the positive test condition and 63 to the negative test condition. This allocation is considered not suitable, consistent with the results of the G*Power analysis. To compensate for the limited sample size, the effect size was calculated to measure the magnitude of difference between the two groups, independent of sample size. A medium effect size (*Cohen's d* = 0.46) was found for the difference in enthusiasm scores between the two test conditions. Moreover, bootstrapping was chosen for the mediation analysis to assess the mediation effect, as it is suitable for smaller sample sizes (Fisher & Hall, 1990).

After collecting the data of the questionnaire, it was imported into RStudio for the analyses. Initially, participants who did not complete the entire inventory were excluded from the study. A total of 57 participants either did not respond to the PEB inventory or to both the PEB inventory and the ICE. These participants were excluded from the study. After their exclusion, no missing values remained. Once the data was cleansed descriptive statistics were examined to gain insights into the participants and their responses. This included analysing gender distribution, as well as assessing the overall age range, mean, and standard deviation.

Moreover, the study investigated the the nature and strength of the relationship between communication styles (the predictor variable) and enthusiasm and PEB (the outcome variables), while also considering the moderating effect. To analyse these relationships, the Pearson correlation coefficient (*r*) was utilised. Given the binary nature of the predictor variable, the point-biserial correlation was applied to assess its relationship with enthusiasm and PEB. Meanwhile, for the continuous variables of enthusiasm and PEB, the Pearson correlation coefficient was employed. Values close to 0 suggest no significant effect or near-impossible prediction. Conversely, values near -1 or +1 indicate not only the feasibility of prediction but also the direction of the relationship. A positive correlation signifies that

movements in one variable correspond to movements in the same direction in the other variable, with higher values denoting stronger associations. Conversely, a negative correlation indicates that movements in one variable correspond to movements in the opposite direction in the other variable (Van Den Berg, 2022).

The study includes two inventories, namely the enthusiasm scale derived for the ICE and the PEB inventory. The enthusiasm scale included four items. The scale did not include any reversed items, thus the response to all of the items were summed up and divided by four to get the total score of a participant. The obtained number indicates the degree of enthusiasm a participant has towards climate change. Also for the PEB inventory, total scores were calculated by summing up eleven items, without any reversion necessary.

The analysis involves conducting a linear regression analysis, wherein the communication style serves as the independent variable, enthusiasm as the mediator, and PEB as the dependent variable. This approach aims to evaluate both the direct impact of communication style on PEB and the indirect effect mediated through enthusiasm. Moreover, Welch's t-tests were employed to compare the group means with each other.

Before starting with the analysis of the inferential statistics, the parametric assumptions were tested on the obtained data (Appendix G). It is crucial that the four parametric assumptions are met when conducting a linear regression analysis (Van Den Berg, 2022). To test the independence of residuals, they were plotted against the observation order, showing no discernible pattern and suggesting independence. Homogeneity of variances was checked with a residual plot against fitted values, revealing a roughly constant spread and indicating no violation. Normality was assessed with a histogram of residuals, which resembled a bell-shaped curve, confirming normal distribution. Linearity was tested with a scatterplot of the independent variable against the dependent variable, revealing a violation of the linearity assumption. Therefore, in the analysis Welch's t-tests are used to investigate the relationships between the predictor variable and outcome variable and the relationship to the interaction effect. Furthermore, bootstrapping was conducted to assess the mediation model.

The hypothesised effects are confirmed and results are considered significant when the regression coefficients for the predictor variables (communication style and enthusiasm), as well as their interaction terms, are statistically significant ($p < 0.05$), indicating a meaningful relationship between the variables.

Results

Descriptive Statistics

The analysis was conducted on a sample of 113 participants aged between 18 and 64 years ($M = 26.98$, $SD = 9.59$). Regarding gender distribution, 32.7% identified as male, while 65.5% identified as female, and 1.8% identified as non-binary or third gender. In terms of nationality, the majority, comprising 52.2% of the sample, identified as Dutch, followed by 37.2% who were German, with 10.6% reporting other nationalities. Educational attainment varied, with 73.5% of participants indicating completion of university education, 15.9% attending a university of applied sciences, 9.7% completing high school education, and 0.9% graduating from a technical college (MBO/Fachoberschule). When considering the test conditions, the unproductive and disengaging group consisted of 63 participants aged between 18 and 64 years ($M = 25.33$, $SD = 14.63$), while the empathic and actionable group comprised 50 participants aged between 18 and 58 years ($M = 24.34$, $SD = 11.61$) (Table 1).

Table 1

Demographic Characteristics of Sample Population (N=113)

Characteristic	Unproductive & Disengaging Subgroup		Empathic & Actionable Subgroup	
	Frequency	Percentage	Frequency	Percentage
Gender				
Female	38	60.3	37	74.0
Male	23	36.5	14	26.0
Non-binary/ third gender	2	3.2	0	0.0
Nationality				
Dutch	34	54.0	25	50.0
German	24	38.1	18	36.0
Others	5	7.9	7	14.0
Educational Level				
University	44	69.8	39	78.0
University of Applied Sc.	10	15.9	8	16.0
Highschool	9	14.2	2	4.0
Technical College	0	0.0	1	2.0

Note. University of Applied Sc. = University of Applied Sciences

Distribution Characteristics of the Questionnaires

The distribution characteristics of the two questionnaires were compared between the two test groups, empathic and actionable communication, and unproductive and disengaging communication. Generally, individuals in the first group scored higher in enthusiasm after viewing the video clip, as well as in PEB engagement, compared to individuals in the unproductive and disengaging communication group (Table 2). Additionally, in both test groups, individuals exhibited greater engagement in private PEB than in public PEB, with those in the empathic and actionable group scoring slightly higher than those in the unproductive and disengaging group (Table 2).

Table 2

Descriptives of ICE enthusiasm scale and PEB (N=113)

Group	Empathic & Actionable Communication		Unproductive & Disengaging Communication	
	Mean	SD	Mean	SD
Total Score ICE	3.56	0.82	3.17	0.77
Total Score PEB	2.72	0.76	2.51	0.74
PEB Subscale				
Private Behaviour	3.78	0.82	3.49	0.95
Public Behaviour	1.45	0.93	1.33	0.78

Note. SD = Standard Deviation; Minimum of total score of ICE is 1, Maximum is 5; Minimum of total score of PEB is 0, Maximum is 6

Correlation Analysis

The correlation coefficients among the variables communication style, enthusiasm, and PEB were examined to understand their associations (Table 3). As the communication style variable is binary, Point-Biserial (r_{pb}) correlations were utilised, treating the binary variable as numeric, to assess its relationship with both enthusiasm and PEB. Additionally, Pearson correlations (r) were computed between the numeric variables Enthusiasm and PEB. A moderate positive correlation exists between the variables Empathic and Actionable

Communication and Enthusiasm. Empathic and Actionable Communication also shows a slight positive correlation with Pro-Environmental Behavior (PEB). Unproductive and Disengaging Communication is moderately negatively correlated with both Enthusiasm and PEB. Lastly, Enthusiasm and PEB exhibit a very slight positive correlation.

Table 3

Correlation Coefficients between Communication Style, Enthusiasm, and PEB

Variables	EAC	UDC	Enthusiasm	PEB
EAC	-			
UDC	-1.00	-		
Enthusiasm	.24	-.24	-	
PEB	.24	-.24	.06	-

Note. EAC = empathic and actionable communication; UDC = unproductive and disengaging communication, Point-Biserial correlation (r_{pb}) coefficients are reported for the association between Communication Style (binary variable) and Enthusiasm and PEB, Pearson correlation (r) coefficients are reported for the association between Enthusiasm and PEB (continuous variables).

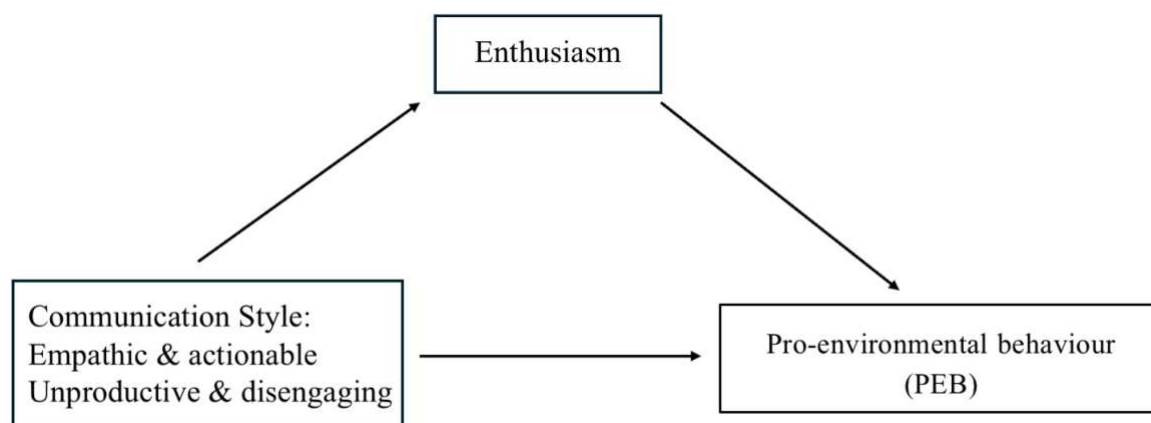
Main Analysis

Model Construction

The present study investigates the association between different communication styles and engagement in PEB, while considering the role of enthusiasm (Figure 1). The main effect is the relationship between the predictor variable of communication style and the dependent variable PEB. The indirect effect quantifies how much of the relationship between the communication style and PEB is explained by the mediator variable, enthusiasm.

Figure 1

Linear Regression Model with Interaction Effect of Enthusiasm



Findings of Main Analysis

The Welch's two-sample t-tests demonstrated no statistically significant difference in PEB between individuals that were exposed to the empathic and actionable communication ($M = 2.51, SD = 0.74$) and those exposed to the unproductive and disengaging communication ($M = 2.72, SD = 0.76, t(102) = -1.45, p = .14, 95\% CI [-0.50, 0.07]$). Thus, the first hypothesis must be rejected.

Furthermore, the Welch's t-test disclosed a statistically significant difference in enthusiasm between individuals exposed to empathic and actionable communication and unproductive and disengaging communication ($t(100) = -2.60, p = .01$). Participants that were presented the climate information in the empathic and actionable style of communication ($M = 3.56, SD = 0.82$) expressed significantly higher levels of enthusiasm compared to those participants that were exposed to the unproductive and disengaging communication style ($M = 3.16, SD = 0.77$). Consequently, the second hypothesis must be accepted.

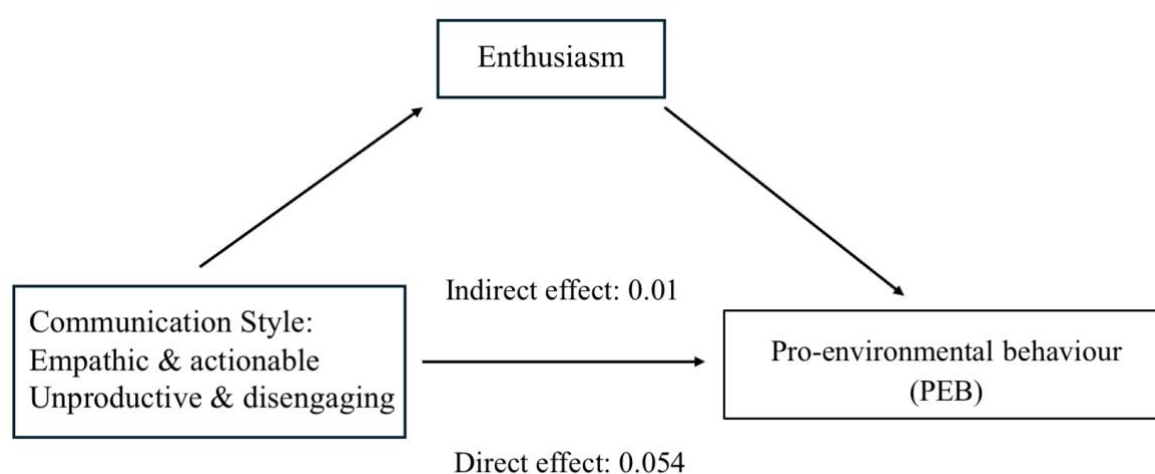
Moreover, the result of the regression analysis indicates that there was no significant effect of enthusiasm on the engagement in PEB ($b = 0.05, t(111) = 0.61, p = .54, 95\% CI [-0.12, 0.23], R^2 = -0.01$). Hence, the third hypothesis must be rejected.

For the last hypothesis a mediation analysis was conducted using bootstrapping. For the indirect effect of communication style on PEB mediated through enthusiasm (Average Causal Mediation Effect) no evidence of a significant mediation effect was found ($b = 0.01, p = .75, 95\% CI [-0.06, 0.12]$). For the direct effect of communication style on PEB (Average Direct Effect) no evidence for a statistically significant effect is found as well ($b = 0.20, p =$

.18, 95% *CI* [-0.11, 0.50]). Also, for the total effect no significant effect could be found ($b = 0.21$, $p = .13$, 95% *CI* [-0.06, 0.51]). Lastly, for the proportion of the total effect that is mediated by enthusiasm is also not statistically significant ($b = 0.05$, $p = .80$, 95% *CI* [-1.07, 1.88]). Overall, none of the tested effects are statistically significant suggesting no significant mediation effect, no significant direct effect, and no significant total effect of communication style on PEB (Figure 2). Therefore, the last fourth hypothesis must be rejected.

Figure 2

Mediation Model with Bootstrapped Regression Coefficients



Discussion

Theoretical Reflection & Implications

The study investigated the relationship between the two different communication styles, emphatic and actionable communication and unproductive and disengaging communication, the emotional responses, and the level of engagement in PEB in participants. The findings suggest that empathic and actionable communication can increase the perceived enthusiasm for climate change resolution among participants, indicating that when people receive information framed empathetically and with actionable steps, they feel more empowered to believe that climate change can be mitigated and that they can personally contribute to combating it. However, the study did not establish a connection between higher enthusiasm levels and increased engagement in PEB, nor did it find a direct link between communication style and PEB engagement. Consequently, it suggests that the way climate information is communicated does not significantly influence participants' engagement in PEB. This indicates that participants may not sufficiently alter their behaviour based on the

communication style or perceived enthusiasm, or at least, these factors alone do not impact PEB engagement sufficiently. This overall finding is consistent with the research by Kollmuss and Agyeman (2002), which suggests that engagement in PEB cannot be explained by a single model. Numerous additional factors, beyond emotional response and the method of information transmission, may influence PEB engagement. These factors include both external and internal influences. For instance, behaviour can be shaped by external factors, such as the available market options, the presence of necessary infrastructure, and social and cultural factors, including cultural norms. Also internally, individual's level of environmental knowledge, their attitudes toward climate change, their readiness to undertake actions demanding more time, effort, or other resources, and their sense of control over their choices and results (Kollmuss & Agyeman, 2002).

Similarities and Differences with Previous Research and Possible Explanations

In the broader context of literature, similarities and differences with previous studies can be identified. Firstly, the study by Leiserowitz et al. (2018) found positively framed communication to play a crucial role in increasing positive emotional responses in climate change initiatives. The study has shown that effective public engagement can significantly foster a sense of empowerment and personal responsibility (Leiserowitz et al., 2018), which are essential motivators for mobilising actions (Boykoff & Yulsman, 2013; Kohl, 2021). These findings are similar to the findings of the current study that found empathic and actionable communication to alleviate the level of enthusiasm in participants in the context of climate change.

Russell and Ashkanasy (2021) concluded that emotion in communication has a direct effect on engagement in PEB, but only when the emotions are negative. Emotions such as anger and fear have been found to boost PEB, whereas positive emotions did not appear to increase engagement. This finding aligns with the research by Lange and Dewitte (2020), who also found no effect of positive emotions on PEB. These results are consistent with the outcomes of the present study, that positive emotions such as enthusiasm do not significantly affect PEB engagement.

Research by Nelson et al. (2021) explored the impact of positively and negatively framed informational messages on PEB. They found that positively framed messages were slightly more effective in encouraging environmentally friendly actions, but this effect was not statistically significant. Both positive and negative frames were deemed effective interventions for PEB engagement. This general finding is consistent with the present study.

However, unlike Nelson et al. (2021), the present study did not find a significant effect of the informational messages on PEB engagement.

Nevertheless, it is crucial to note that Nelson et al. (2021) conducted their study over 19 days, allowing participants ample time to adjust their behaviour. In contrast, the present study was conducted in a single session where participants immediately engaged with one of two distinct video clips and proceeded directly to the ICE and PEB assessments. Notably, introducing a delay between video viewing and PEB assessment could have provided a more meaningful evaluation. The current design limited participants to reporting immediate engagement in PEB, relying solely on pre-video behaviour as a reference. Incorporating a delay would have allowed participants to reflect on their behaviour post-video, offering a more accurate assessment of how communication styles potentially influenced PEB engagement.

Kronrod et al. (2023) took a different approach by combining encouraging and discouraging communication in a single message, rather than separating the communication styles into distinct types. Their research demonstrated that these combined messages elicited higher engagement with new PEB and were more effective than using positive and negative frames separately. This suggests that integrating both types of communication can enhance the effectiveness of PEB interventions (Kronrod et al., 2023).

Strengths and Weak-points of the study

The study's design is notable for its direct relevance to real-world applications, offering insights that can inform the development of communication strategies about climate change. By identifying which messaging strategy elicit the highest levels of engagement and responsibility, an approach may be developed in the future to articulate more compelling and impactful campaigns to foster greater involvement in combating climate change. Besides, the use of standardised questionnaires for the measurement of climate emotions and engagement in PEB enhances the reliability of the data and allows for comparisons across studies.

However, the study has certain limitations. Firstly, the sample size did not include a sufficient number of participants, compared to the required 210 participants estimated by the G*Power analysis. (Appendix F). Due to constraints such as time and resources in participant recruitment and having to exclude participants with poor responses, the final sample size fell short of the initially computed requirement. A consequence of this study being underpowered, is that it may have limited ability to detect true effects or relationships within the data. The findings need to be interpreted with caution, recognising the potential for Type II errors and inflated effect sizes (Faber & Fonseca, 2014).

Moreover, non-random sampling methods may introduce selection bias and limit the generalisability of the findings (Raina, 2015). Consequently, the resulting sample may exhibit homogeneity in demographic characteristics, attitudes, and experiences, potentially diminishing the variability between participants and excluding important differences present in the population (Raina, 2015). For example, participants in this study mainly obtained a high school diploma or higher levels of education, excluding people with lower educational levels. As the research by Fagan and Huang (2024) displays, in some countries the attitude people have about climate change may be tied to their level of education. People with lower education are less likely to perceive climate change as a major threat (Fagan & Huang, 2024). This could potentially have an effect on their willingness to engage in PEB. As a consequence, caution should be practiced when generalising the findings beyond the sample as it may not accurately reflect the emotions and behaviours of a broader population.

Another important limitation of this study is its single-session design that may introduce immediate response bias. It is logical to assume that participants may not exhibit changes in their PEB engagement just a few minutes after being exposed to the video clip. Measuring PEB after a longer interval, such as one week, might have revealed a more significant effect. However, it is important to note that the study's design only measures correlations between variables and is not equipped to reveal causation. Therefore, the findings can only indicate the presence and strength of relationships between variables, but cannot determine the direction of influence between them. Consequently, the design of the present study may not have been robust enough to detect such effects.

Furthermore, there is uncertainty regarding whether the videos effectively evoked the intended emotional and behavioural responses in the participants. For the emphatic and actionable communication an effect on participants' level of enthusiasm towards climate change could be found, therefore, it can be assumed that the selected video was effective in evoking the intended emotional response, yet, it cannot be confirmed whether the video selected for the unproductive and disengaging communication style successfully conveyed sufficient negative emotions to the participants. An analysis of the media landscape reveals that climate change is a topic with limited newsworthiness (Brüggemann & Pröschel, 2024). The video chosen for the unproductive and disengaging communication style depicted a disastrous scenario, a characteristic often present in climate change news coverage. Consequently, participants may have been accustomed to such presentations of climate information, potentially desensitising them to the negative emotions intended to be elicited.

Moreover, the study's procedure may have introduced order effects, wherein the sequence of task presentation influenced participants' responses to the questionnaires (Brooks, 2012). The order in which participants completed the ICE and PEB inventory could have impacted their responses. Participants were instructed to first complete the ICE questionnaire, subsequently, they completed the PEB inventory. Had the order been reversed, participants' responses might have differed.

Finally, it is important to acknowledge that the study utilised self-report measures. Participants were tasked with responding to study questions themselves, which introduces certain limitations. Self-reported measures rely on individuals accurately reporting their emotions and behaviours (McDonald, 2008). However, this is not always guaranteed. Participants may provide responses they consider socially acceptable rather than truthful, or they may struggle to recall past events and experiences or over-/underestimate their own engagement in PEB, leading to inaccuracies (Fisher, 1993).

Conclusion

In the present study, a significant relationship was identified between empathic and actionable communication and the level of enthusiasm among participants regarding climate change. This connection suggests that leveraging emotions can be a powerful tool in climate change communication, as emotions appear to influence practical and moral decision-making (Markowitz & Guckian, 2018). When individuals feel enthusiastic about addressing climate change, they are likely to perceive a greater sense of control and willingness to engage in actions aimed at resolving climate issues which may potentially result in greater engagement in environmentally-friendly actions.

However, no effect between the applied communication style, participants' level of enthusiasm towards climate change and their engagement in PEB could be found. This lack of effect could be attributed to additional factors beyond communication style influencing PEB or the study's design, which only observed the effect on PEB within a very short time frame. Even though the mediating relationship between communication styles, enthusiasm, and PEB could not be established, the study provides a solid foundation for future research. One possible direction is to conduct a longitudinal study that tracks participants' PEB engagement over a longer period following repeated exposure to differently framed climate change messages. This approach could offer deeper insights into the long-term effects of various communication styles on behavioural processes.

Additionally, future research should explore the inclusion of additional factors in model construction. Investigating factors such as personal values, social norms, and perceived

efficacy of individual actions could enhance our understanding of PEB engagement. Including these factors may provide a more precise explanation of behavioural processes in the context of climate change and offer a comprehensive view of the determinants of PEB. Additionally, future research should ensure that the communication styles are distinctly different from each other to effectively examine their respective impacts on PEB engagement.

Lastly, even though more research in that field is required the present study portrays well that an integration of empathic and actionable communication into climate policies and initiatives may enhance public engagement and enthusiasm for climate change resolutions. By crafting emotionally resonate messages and providing clear, practical actions, policymakers and organizations could potentially empower individuals to contribute actively to climate mitigation efforts. Such an example could be a policy formulation that actively seeks public engagement through empathic communication. For instance, the media landscape could be designed to be more inclusive and emotionally engaging, ensuring that individuals feel their voices heard and valued. Empathic communication could help bridge the gaps between policy makers and the public, fostering a collaborative approach to climate action.

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Appendices

Appendix A

Opening Statement for the Online Survey

Coping with Climate Change

Welcome,

You are being invited to participate in a research study. This study is being done by the students Johanna Wolbert, Veerle Wilborts, Samua Omar Maroof and their Supervisor Anneleen Klaassen from the Faculty of Behavioural, Management and Social Sciences at the University of Twente. Your data will thus be used for three different research papers, all surrounding the topic of how individuals cope with climate change.

Taking part in this study will approximately take you 15 minutes to complete. Your participation in this study is entirely voluntary and you can withdraw at any time. We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability, your answers in this study will remain confidential. We will minimise any risks by storing the data encrypted on a private device with manually created backups following procedures of the general data protection regulation (GDPR). The data will be stored for a maximum of 3 years after the study has been completed. In the publication, no data will be used that could lead to your identification. If individual results will be used in the publication, they will be anonymised or pseudonymised to ensure confidentiality. The raw data is only accessible to the researchers themselves and their supervisor and will be regularly checked to guarantee data security.

Please read the information given underneath carefully and fill in the informed consent to continue to the questionnaire.

Appendix B

Informed Consent

Informed Consent

Taking part in the study I have read and understood the study information dated [18/03/2024], or it has been read to me. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason. I understand that taking part in the study involves a survey questionnaire completed by the participant.

Risks associated with participating in the study

I understand that taking part in the study involves the following risks: mental discomfort Presented images could be perceived as uncomfortable, however, these are common images shown in news and other media, therefore, we expect limited harm.

Use of the information in the study

I understand that information I provide will be used for the output in form of a report. I understand that personal information collected about me that can identify me, such as demographic data, will not be shared beyond the study team. Future use and reuse of the information by others I give permission for the survey data that I provide to be archived in Qualtrics so it can be used for future research and learning. The data is anonymous since no sensitive data is collected that can lead to the identification of the test subjects. The data is only used for the purpose of this research study.

Contact Details:

j.a.wolbert@student.utwente.nl

s.omarmarroof@student.utwente.nl

V.g.wilborts@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl Do you agree to all the above-

mentioned statements and confirm that you consent to take part in this study and for your data to be used for future research as described.

Appendix C

Link to the Empathic & Actionable Video Clip

Q15

Please watch the video

<https://youtu.be/5B8eajiYzjE?si=ly1dLCX1UWQkio8z>

After watching the video, please return to this survey

Link to the Unproductive & Disengaging Video Clip

Q16

Please watch the video

<https://youtu.be/oUsddpT9cGo?si=R1d5ogD93gHhqXOv>

After watching the video, please return to this survey

Appendix D*Enthusiasm Scale of Inventory of Climate Emotions*

1. The increasing public engagement with climate change gives me hope
2. I believe that there are emerging solutions that will allow us to stop climate change
3. Concrete actions for the climate allow me to be optimistic about the future
4. Social mobilization in the fight against climate change makes me feel that together we can achieve this goal

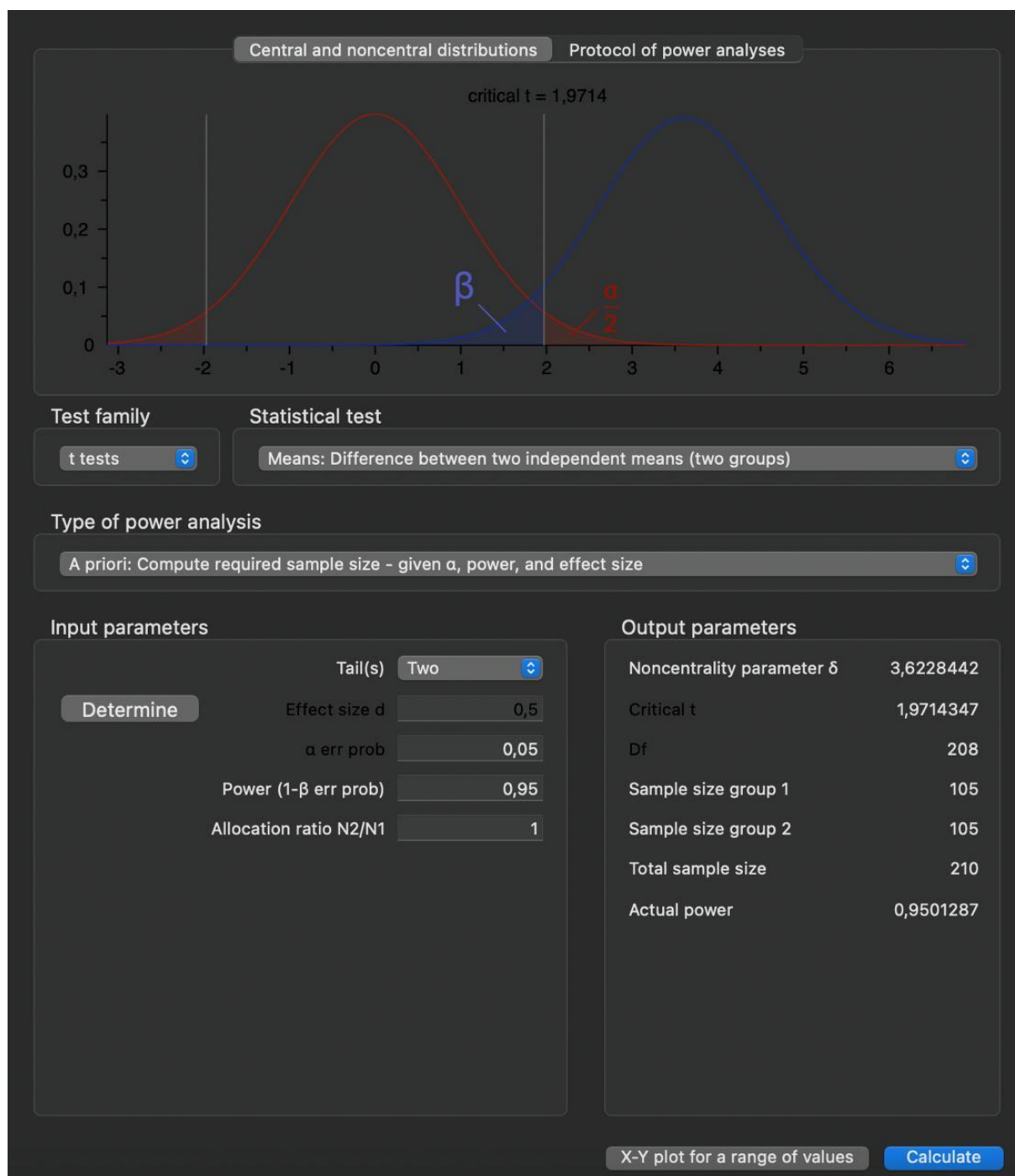
Appendix E

Pro-environmental Behaviour Inventory

1. Buy environmentally friendly and/ or energy efficient products
2. Walk or rode a bike when traveling short distances
3. Reuse or mend items rather than throwing them away
4. Avoide buying products with excessive packaging
5. Buy organic vegetables
6. Minimise use of heating or air conditioning to limit energy use
7. Talk to others in your community about environmental issues
8. Work with others to address an environmental problem or issue
9. Participate as an active member in a local environmental group
10. Sign a petition about an environmental issue
11. Donate money to support local environmental protection

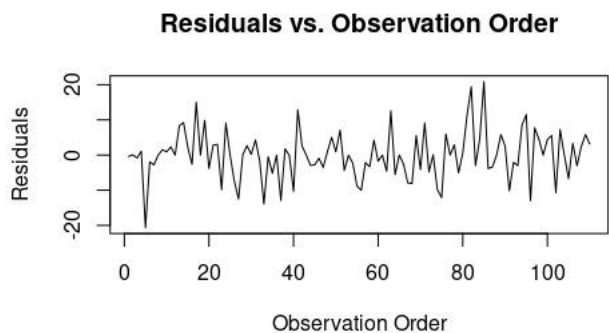
Appendix F

*G*power analysis to determine the required sample size*

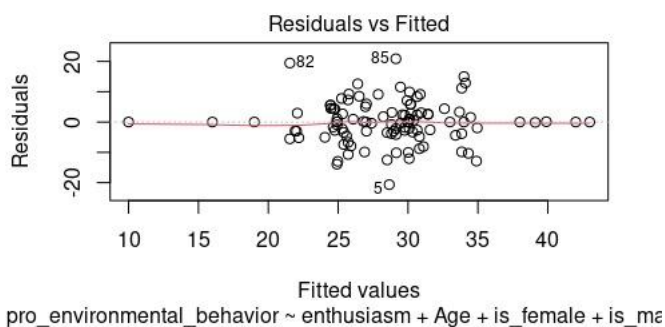


Appendix G

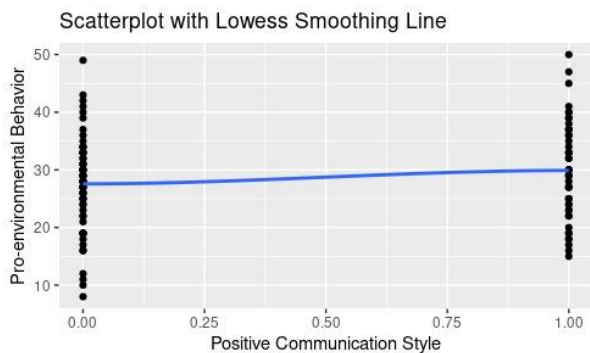
Testing of the Parametric Assumptions



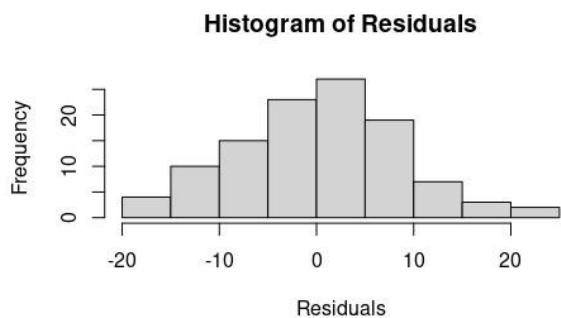
Note. Independence of Residuals



Note. Homogeneity of Variance



Note. Linearity



Note. Normality