

**Using Fear to Promote Climate Action: An Analysis of the Effectiveness of Fear  
Appeals in the Context of Climate Change**

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### **Abstract**

Fear appeals are a commonly used technique to steer a person's behavior. Past research investigated the effectiveness of fear appeals in a wide variety of domains. However, there is discussion between scientists whether fear appeals do work effectively in general. Besides, there is only little research performed to examine the effectiveness of fear appeals in climate context. Therefore, the purpose of this study was to find more understanding for the working of fear appeals and their effectiveness in the context of climate change. For a fear appeal to be effective, both a threat and coping appraisal should be included. A threat appraisal should include a severe situation for which a person feels susceptible, whereas a coping appraisal includes a component that evokes response efficacy and self-efficacy. To test the effectiveness of fear appeals in climate context, a digital questionnaire was spread among 145 young adolescents. Before answering the questions, participants were shown either a neutral stimulus, a stimulus containing a threat appraisal or a stimulus containing both a threat and coping appraisal. The stimuli were validated beforehand by means of a pilot study. After displaying the stimuli, variables regarding the manipulation were measured, after which behavioral intention was measured as the dependent variable. The results of the experiment indicated no evidence for the effectiveness of fear appeals. In conclusion, we found no evidence that fear appeals are effective for promoting behavioral intentions towards climate change.

*Key words:* fear appeal, threat appraisal, coping appraisal, climate change, behavioral intention

### Abstract

Een *Fear Appeal* is een veelgebruikte techniek om het gedrag van een individu te sturen. Ondanks voorgaand onderzoek de algemene effectiviteit van *fear appeals* getest heeft, is er veel discussie over de werkelijke effectiviteit van een *fear appeal*. Hierbij komt dat in het domein van klimaatverandering slechts weinig onderzoek is gedaan naar de effectiviteit van *fear appeals*. Om deze redenen zal deze thesis de effectiviteit van een *fear appeal* onderzoeken in de context van klimaatverandering. Om een *fear appeal* te laten slagen moet deze bestaan uit zowel een *threat appraisal* als een *coping appraisal*. De bouwstenen voor een *threat appraisal* zijn dat de voorgeschreven situatie ernstig is en dat een persoon zich vatbaar voelt voor deze situatie. Een *coping appraisal* voegt hier aan toe dat een persoon het gevoel heeft dat de angstopwekkende situatie nog teruggedraaid kan worden door gedragsverandering. Om de effectiviteit van een *fear appeal* in de context van klimaatverandering te testen hebben 145 participanten een digitale vragenlijst ingevuld. Voorafgaand aan de vragen zijn alle participanten blootgesteld aan een stimulus. Dit was een neutrale stimulus, een stimulus met enkel een *threat appraisal* of een stimulus met zowel een *threat appraisal* als een *coping appraisal*. De stimuli waren voorafgaand aan het experiment gevalideerd met een *pilot-study*. Na het waarnemen van de stimulus met de vragenlijst verschillende variabelen ter controle voor de manipulatie en werd gedragsintentie als afhankelijke variabele gemeten. De resultaten van het experiment vertonen geen bewijs voor de effectiviteit van *fear appeals*. In conclusie, er is geen bewijs gevonden voor de effectiviteit van *fear appeals* in de context van klimaatverandering.

*Sleutelwoorden:* fear appeal, threat appraisal, coping appraisal, klimaat verandering, gedragsintentie.

## **Using Fear to Promote Climate Action: An Analysis of the Effectiveness of Fear Appeals in the Context of Climate Change**

According to the Intergovernmental Panel on Climate Change [IPCC] (2014), the earth will face more extreme droughts, colds and heats due to climate change in the coming years. The source that provoked an acceleration for climate change seems to be human activity. Since, the IPCC (2014) showed in a recent report that climate change is in any way directly or indirectly attributed to interference by humans. The greatest predictors for changing the climate seem to be greenhouse gas emissions, which are increasingly released since the Industrial Revolution. Human activities that contribute to the release of greenhouse gasses are mainly: maintaining the food supply, including meat production (Arcari, 2017), the depletion of fossil fuels by the transport sector, among others by the usage of car (Howey, 2012) and the use of energy from households (Rosa & Dietz, 2012). The increase of concentration of greenhouse gasses in the atmosphere results in a veil holding warmth near the earth, which is causing disorder in the climate regulation where people will be affected by (Khilyuk, 2003). Among others, climate change will influence harvest and health restrictions due to the extreme weather. In practice this means shortage for water and food supplies, and health problems like overheating (Chesney et al., 2017).

Although the effects of climate change may seem unalterable, the IPCC (2014) claims that challenges coming with climate change still can be mitigated. With mitigation, the IPCC refers to human interference for reducing the sources or enhancing the sinks of greenhouse gases. Mitigation can be operative if greenhouse gas emissions are narrowed down and people are willing to adapt themselves to the climate. Therefore, the help of many individuals is needed. Most of the human activities that seem to influence climate change can be reversed into incentives to mitigate the effects of climate change. For example, the individual can help mitigate the effects by less usage of their car (Howey, 2012), or consume less meat and more plant-based products (Schiermeier, 2019). For climate action, there is especially focus on the participation of adolescents and young adults. Research by Ojala (2012) suggests that the focus lays on adolescents, because young people are most likely to suffer from negative consequences for a longer period of time. Added to that, providing hope seems to have a unique influence on young people, whereby they tend to exhibit the desired pro-environmental behavior. With this, adolescents and young adults are an important target group to address issues regarding climate change and opportunities for mitigation.

To lower the impact of the individual, campaigns are trying to encourage commitment and willingness to make people adapt to climate change. Commonly used techniques for this kind of public communication are: focusing on social conditions and role models, introducing advantages, emphasizing fear, focusing on self-efficacy and influencing perceived norms (Atkin & Rice, 2013). Specifically for encouraging people into climate action, using fear is one of the most used techniques to steer behavior (Ruiter et al., 2014). The technique to use fear is defined as a *fear appeal*. In more detail, a fear appeal is a persuasive communication that attempts to arouse fear in order to promote precautionary motivation and self-protective action (Ruiter et al., 2014). A study done by Reser and Bradley (2017), suggests that fear appeals are used specifically in climate communication to report the urgent need for behavior change. They suggest that the choice for using fear appeals seems to be based on experience with other types of risk communication. Communicating risks often evokes fear, whereby intuitive and emotional responses lead to action. The fear appeal technique has been widely deployed already, for example by illustrations on cigarette packages to make smokers repel to their smoking behavior (Ruiter et al., 2014). Specifically in the context of climate change, fear appeals have been deployed recently by the World Wildlife Fund. Examples for these campaigns are the Fight For Your World campaign (WWF UK, 2020) and the How To Save Our Planet video (WWF International, 2019). Although fear appeals are a commonly used technique, their effectiveness is highly debated by scientists (Reser & Bradley, 2017). To conclude whether fear appeals are genuinely effective, this thesis examines the effectiveness of fear appeals in promoting climate action. An overview of the literature will be given, followed by an empirical research to confirm if fear appeals have the effect in practice as described in theory.

To start with the importance of fear appeals, the use of fear appeals is a way to steer a person into a behavioral change. In case of climate action, behavioral changes, such as consuming less meat (Schiermeier, 2019) or diminishing usage of cars (Howey, 2012), are needed to mitigate the effects of climate change. To effectively change behavior or behavioral intentions with the help of fear appeals, laying focus on motivation is necessary. According to the theory of planned behavior (Ajzen, 1991), the intention to perform behavior is partially formed by motivation. Motivation in general is described as the tendency to activate one to perform a behavioral act, this tendency is reflected in choices one makes and the intensity and persistence of the effort one puts into an action (Bandura, 1994). The theory of planned behavior (Ajzen, 1991) explains that the more motivation a person has, the stronger the intention to perform a behavioral act. Subsequently, in the theory of planned

behavior (Ajzen, 1991) it is a general rule that the stronger the intention for performing the behavior, the more likely it is for the behavior to be performed. Briefly, motivation influences intention and a potent intention is needed to perform behavior.

A model that combines motivation and reason to action in the context of fear is the protection motivation theory. The protection motivation theory (Maddux & Rogers, 1983), describes that the building blocks of a fear appeal are a *threat appraisal* and a *coping appraisal*. A threat appraisal is specifically based upon a situation that is severe and for which an individual feels susceptible. This means that a fear appeal has to speak to one's vulnerability created by the behavior that is intended to change, and that the individual finds that this vulnerability is earnest. Next to the threat appraisal, a coping appraisal is needed to accept the situation and boost self-efficacy. This self-efficacy is described as the belief of a person to have the capabilities to act in a situation (Bandura, 1994). These two appraisals play a role in creating protection motivation (Maddux & Rogers, 1983). The difference with protection motivation in contrast to general motivation is that for protection motivation a reaction to a specific threat is involved, for which an activation of the individual is needed to protect herself from harm (Floyd et al., 2000). The protection motivation theory (Maddux & Rogers, 1983), illustrates an interaction where both environmental and individual sources of information can provide either threat or coping appraisals, which evoke either maladaptive or adaptive responses to the situation. To evaluate the two appraisals, it is important for the threat appraisal to be addressed first, because the threat must be identified to evaluate an adaptive response. After processing the information provided by the two appraisals and evaluating potential responses to the situation, protection motivation can arise to change one's intentions, and so can change one's behavior.

Although the protection motivation theory is a substantiated theory in psychology, the effectiveness of fear appeals in practice is highly debated among scientists. Several meta-analyses have been performed to determine the effectiveness of fear appeals, although not all demonstrate similar conclusions. According to a meta-analysis conducted by Tannenbaum and colleagues (2015), fear appeals are an effective way to motivate people into changing their behavioral intentions. Added to the general effectiveness, these researchers suggest several boosts that can be given to the fear appeal to increase its power. Examples for these boosts are when the concern of the problem is mentioned and when it responds to self-efficacy. In addition to this, the higher the amount of fear that is released, the more it would motivate people to change their behavioral intentions. In contrast to the conclusion of the meta-analysis above, a meta-analysis conducted by Ruiter and colleagues (2014) claims that

fear appeals would be ineffective. This analysis describes that the fear arousal will create a defensive behavioral intention that contrasts with the desired behavior outcome. The defensive behavioral intention occurs, because a person has the idea that the proposed behavior cannot effectively take away the threat (Roskos-Ewoldsen et al., 2004). This means that self-efficacy will not be evoked due to the severity of the threat. The meta-analysis of Ruiter and colleagues (2014) addresses that a possible explanation for the undesired behavior outcome is that many fear appeals are implemented without the presence of a coping appraisal. Whereas, a coping appraisal is required for a fear appeal to be effective (Madux & Rogers, 1983). In addition, the meta-analysis of Ruiter and colleagues (2014) suggests that a defensive response can be avoided if the threat is relevant and when the recommended behavioral change is easy to accomplish. In summary, both meta-analyses agree that the effectiveness of a fear appeal would increase when the message responds to self-efficacy. This is in line with the protection motivation theory (Maddux & Rogers, 1983), which illustrates that fear appeals solely succeed when a coping appraisal that responds to self-efficacy is included. In addition, both meta-analyses suggest that the threat or problem in the threat appraisal should be relevant to the individual for a fear appeal to be effective.

To put these ideas to the test, our study will conduct an empirical research to examine the effectiveness of fear appeals. Therefore, the effectiveness of threat and coping appraisals will be tested through a digital questionnaire. To implement this, the research will employ three conditions: a condition with only a threat appraisal, a condition with both a threat and coping appraisal and a control condition. The stimuli provided in the threat appraisal condition and in the threat plus coping appraisal condition will be validated with a pilot-study. Moreover, this research will be performed to answer whether fear appeals are effective in interventions focusing on climate action for adolescents and young adults. For this research two hypotheses will be tested. Hypothesis 1 describes that when a fear appeals only contains a threat appraisal, this fear appeal would not have an effect on behavioral intentions. In more detail, this research anticipates that the fear appraisal condition and the control condition will not be different from each other. Furthermore, Hypothesis 2 describes that fear appeals which combine a threat and coping appraisal do have a positive effect on behavioral intentions. This means that the research predicts that only the threat plus coping appraisal condition will differ from the control condition and the threat appraisal condition.

## Method

### Method pilot study

The goal of the pilot study was to select a suitable stimulus for the experiment. A within-subject experimental design was used in which three combinations of stimuli were presented to fifteen participants. All participants were between the ages of 18 and 25, which is the same targeted group as for the experiment. They were recruited using a convenience sampling method using the medium WhatsApp.

The participants were instructed to answer questions concerning three stimuli. The three stimuli consisted of an image, a threatening text and a coping text which were all written in Dutch by the researchers themselves. The first combination (Heat) of image and text highlighted problems with overheating due to climate change and targeted graphics of the new heat record of 2019 in The Netherlands (Weer Online, 2019). The second combination (Flood 1) displayed a picture of a woman and a girl on top of a car during an inundation (Joyce, 2017). The picture was combined with a text explaining the risks of floods due to climate change. The third combination (Flood 2) displayed a picture of people who were lifted into carts during an inundation. This picture was also combined with a text considering the risks of floods due to climate change (Denchack, 2019). Each combination included a comforting text which described ways to cope with the threatening image and message. See Appendix 1 for the presentation of each individual stimulus combination.

Each individual stimulus combination was presented as follows. Firstly, participants were shown a threatening image combined with a threatening text. Hereafter, the participants were asked to rate two statements concerning perceived severity and susceptibility. All statements could be answered on a 7-point Likert Scale, ranging from 1 (*totally disagree*) to 7 (*totally agree*). To measure perceived severity, participants rated the statement “I have the feeling that this situation is serious”. To measure susceptibility participants rated the statement “I have the feeling that this situation has consequences for me”. After this, participants were shown an additional piece of text concerning a coping mechanism to deal with the situation shown in the image. Participants were again asked to rate two statements, this time concerning response efficacy and self-efficacy. To measure response efficacy participants rated the statement “The mentioned actions are effective to counteract climate change”. To measure self-efficacy participants rated the statement “I am capable of carrying out the mentioned actions”. All statements were based on the literature of Harris et al., (2007), Shafiei and Maleksaeidi (2020), Chen et al., (2001) and MacDonell et al. (2013). All four items (i.e., perceived severity, perceived susceptibility, response efficacy and self-



efficacy) served as pilot study variables and were used to determine the effectiveness of each of the stimulus combinations (i.e. different levels of the independent variable). We expected the most effective stimulus combination to have the highest mean. We assume that this is an indication of a correct interpretation and reaction of the stimulus according to the fear appeal literature, in which a fear arousal is elicited and the coping information is deemed effective and useful (Maddux & Rogers, 1983). To ensure that the selected stimulus was not only the most effective on average, we also inspected each individual item of the selected stimulus combination to make sure that they scored significantly above the neutral position (i.e., which is a score of four on the 7-point Likert scale).

### **Results pilot study**

To assess which stimulus combination best suited the experiment, we first compared the descriptive statistics, after which we conducted a one sample t-test. Firstly, the means and standard deviations were computed in which all four items of each of the stimuli combinations were combined. Flood 2 scored the highest mean ( $M = 5.33$ ,  $SD = 1.7$ ), followed by Flood 1 ( $M = 5.27$ ,  $SD = 1.52$ ) and Heat ( $M = 5.07$ ,  $SD = 1.53$ ). See Table 1 for all the means and standard deviations per variable. Additionally, we performed one sample t-tests to assess whether the chosen stimulus scored significantly above the neutral position of 4 on each of the four items. The significance level was  $\alpha = .05$ , each t-test was statistically significant. The results were: perceived severity,  $t(14) = 2.67$ ,  $p = .009$ . Perceived susceptibility,  $t(14) = 2.67$ ,  $p = .009$ ., Response efficacy,  $t(14) = 3.07$ ,  $p = .004$ . Self-efficacy,  $t(14) = 2.80$ ,  $p = .007$ .

The picture and text as in Flood 2 were chosen for the experiment, since this combination scored the highest average and was statistically significant on the t-tests regarding each of the four items. However, because of the restrictions in The Netherlands concerning the COVID-19 crisis, an adjustment had to be made to the original threat and coping messages in Flood 2. The original text included a sentence which mentioned the utility of public transport for mitigating the risks of climate change. This was replaced with a text regarding the utility of cycling, since using public transport was temporarily recommended to avoid. With this adjustment the image and text as in Flood 2 was used in the experiment.

## **Method experiment**

### ***Participants and design***

One-hundred-and-forty-eight youths participated in this study. This sample size is in line with earlier, comparable research of Marksaityte and colleagues (2018), who used a minimum of twelve participants per condition and research of Carey and Sarma (2016), who used a minimum of 16 participants per condition. However, based on the a-priori tests of Carey and Sarma, we estimated that our research needed a sample of at least 28 participants per condition, to have more power. Moreover, a small sample size typically has less statistical power, our aim was therefore to recruit as many participants as possible (Prajapati et al., 2010). They could only participate if they were between the age of 18 and 25 years old. Three participants were excluded from the analyses, because they did not finish the study. Of the remaining 145 participants the distribution of age was as follows: 24 participants were 18 years old (16.6%), 15 were 19 years old (10.3%), 26 were 20 years old (17.9%), 41 were 21 years old (28.3%), 17 were 22 years old (11.7%), 11 were 23 years old (7.6%), 5 were 24 years old (3.4%) and 6 were 25 years old (4.1%). The distribution of gender and highest or current level of education are included in Table 2. Participants were recruited using a convenience sampling method in the direct environment of the researchers. The media WhatsApp, Facebook and Instagram were used to contact the target group. The experiment had a between participants design, with three conditions (threat appraisal vs. threat plus coping appraisal vs. control).

### ***Procedure and materials***

For the experiment, participants were asked to fill in a digital questionnaire via Qualtrics (2019). Filling in the questionnaire took five to ten minutes. The link to the questionnaire was sent to the participants via WhatsApp, Facebook and Instagram. The participants had the option to complete the questionnaire by using a laptop or a mobile phone. Before the start of the questionnaire, the participants were asked whether they agreed with the terms and conditions displayed in the informed consent (i.e., that participation in the study was completely voluntary and the data would be processed anonymously). The informed consent is attached in Appendix B. All items in the questionnaire were formulated in Dutch. The participants were randomly assigned to one of three conditions: threat appraisal condition, threat plus coping appraisal condition or the control condition. Both the image and text that were used in the threat appraisal condition and threat plus coping appraisal condition were related to climate change, while the image and text of the control condition were

purposely kept as neutral as possible. Therefore, the control condition did not relate to climate change in any way.

The structure and order of the questionnaire was the same for all conditions. The questionnaire started with demographic questions related to gender, education and age. This was followed by the experimental manipulation. For the threat appraisal condition, the experimental stimulus contained the image and threatening text of Flood 2. For the threat plus coping appraisal condition, the experimental stimulus contained the image and the threat and coping text of Flood 2. In the control condition an image with a corresponding text of the David de Wied building, which is a part of the Utrecht University campus, was shown. This image was widely available on the internet. See Appendix C for more information on the control condition. After observing the experimental stimulus attentively, the participants were asked to fill in a set of questions concerning their personal experience with the risks of climate change. The response options for the questions were each spread on a 7-point Likert Scale, ranging from 1 (totally disagree) to 7 (totally agree). The questions measured perceived severity, perceived susceptibility, response efficacy and self-efficacy. These variables served as manipulation check variables, while behavioral intention served as the dependent variable.

**Severity.** Severity was measured by using two items (i.e., “I find the image threatening” and “The negative effects of floods are serious”). The items were based on the literature of Harris and colleagues (2007) and Shafiei and Maleksaeidi (2020). The questions were adapted to fit the current study. For severity, a reliability level of  $\alpha = .34$  and  $\omega = .36$  was determined. This indicates an unacceptable reliability level (George & Mallery, 2003). Therefore, it was decided to separate the two items and use them as two different variables: severity 1 (i.e., the item about the image) and severity 2 (i.e., the item about floods).

**Susceptibility.** Susceptibility was measured by using two items (i.e., “Climate change can have negative effects on me” and “I am vulnerable to the negative consequences of climate change”). The items were based on the literature of Shafiei and Maleksaeidi (2020) and were adapted to fit the current study. For susceptibility, a reliability level of  $\alpha = .75$  and  $\omega = .76$  was determined. This indicates an acceptable reliability level (George & Mallery, 2003).

**Response efficacy.** Response efficacy was measured by using two items (i.e., “Eating less meat helps to counteract the negative effects of climate change” and “Cycling more often helps to counteract the negative effects of climate change”). The items were based on the literature of Shafiei and Maleksaeidi (2020) and were adapted to fit the current study. For

response efficacy, a reliability level of  $\alpha = .65$  and  $\omega = .69$  was determined. This indicates a relatively questionable reliability level (George & Mallery, 2003). However, the average inter-item correlation was .525, which suggests that both items are measuring the same construct (Piedmont, 2014). Also, the value of Omega is close to the .70 range which is close to acceptable and as Cronbach's Alpha is known to underestimate the reliability level (Peters, 2018). Therefore it was decided to keep the two items in one scale, instead of separating them.

**Self-efficacy.** Self-efficacy was measured by using two items (i.e., "I am confident that I can eat less meat in the next month" and "It is easy for me to cycle more in the next month, instead of taking the car"). The items were based on the literature of Chen and colleagues (2001) and Harris and colleagues (2007). The questions were adapted to fit the current study. For self-efficacy, a reliability level of  $\alpha = .42$  and  $\omega = .42$  was determined. This indicates an unacceptable reliability level (George & Mallery, 2003). Therefore, it was decided to separate the two items and use them as two different variables: self-efficacy 1 (i.e., the item about eating less meat) and self-efficacy 2 (i.e., the item about cycling more).

**Behavioral intention.** Behavioral intention was measured by using three items (i.e., "There is a realistic chance that I will eat less meat in the next month", "If possible, I will cycle more often instead of taking the car next month" and "I intend to make small adjustments in my lifestyle in the next month, to counteract the negative effects of climate change"). The items were based on the literature of Harris and colleagues (2007) and MacDonell and colleagues (2013). The questions were adapted to fit the current study. For behavioral intention, a reliability level of  $\alpha = .74$  and  $\omega = .78$  was determined. This indicates an acceptable reliability level (George & Mallery, 2003).

At the end of the questionnaire a debriefing was given and the questionnaire was closed. There was no reward given for participation. The introduction and debriefing are included in Appendix D.

### ***Statistics***

To perform and analyze the experiment, several digital tools were used. The questionnaire was set up in Qualtrics (2019), a software package especially designed for creating questionnaires. After performing the experiment, the data were downloaded into an Excel file and uploaded to professional statistic programmes. The statistical programmes SPSS (IBM Corp, 2017), JASP (JASP Team, 2018) and R (RStudio Team, 2015) were used to analyze the data.

## Results

### Statistical considerations

Partial eta-squared ( $\eta_p^2$ ) was used as an effect-size statistic for the analysis of variances (ANOVA). The obtained effect-sizes are interpreted against the benchmarks provided by Cohen (2013), small = .01; medium = .06; large = .14. The assumption of normality was assessed using the Shapiro-Wilk Test and the Q-Q plot of residuals and the assumption of the homogeneity of variances was assessed with Levene's test. It should be noted, however, that most variables did not meet the assumption of normality and some variables did not meet the assumption of the homogeneity of variances. However, due to the relatively large sample sizes and robustness of the one-way ANOVA no alternative tests or transformation were performed (Field et al., 2012). This applies both to the F-tests of the manipulation checks and the hypothesis testing. And finally, post hoc analyses with Tukey's HSD were only performed when a F-test was statistically significant,  $\alpha = .05$ .

### Manipulation checks

To assess the effect of the independent variable (condition) a between subjects ANOVA was performed. In total six F-tests were performed in which each manipulation check item (severity 1 and 2, susceptibility, response efficacy, and self-efficacy 1 and 2) served as a dependent variable, whereas the condition (control vs. threat appraisal vs. threat plus coping appraisal) served as an independent variable. The ANOVA revealed a significant effect for Severity 1,  $F(2, 142) = 19.35, p < .001$ , and the effect-size was large  $\eta_p^2 = .214$ . It also revealed a significant effect for Severity 2,  $F(2, 142) = 8.96, p < .001$ , the effect-size was medium  $\eta_p^2 = .112$ . Post-hoc tests for both variables showed that the condition fear and fear plus coping differed from the control group on both variables,  $p < .05$ . However, fear and fear plus coping did not differ from each other. In conclusion, the manipulation worked, as the threat appraisal condition and the threat plus coping appraisal condition were rated as significantly more threatening in comparison to the control stimulus.

All other F-tests were non-significant, meaning that the different levels of the independent variable did not differ on the dependent variables,  $F_s < 1.71, p_s > .183$ . In conclusion, the manipulation goals were not achieved for the variables susceptibility, response-efficacy and self-efficacy 1 and self-efficacy 2, because the variables did not differ between the conditions. The means and standard deviations of all the variables are presented in Table 3.

### **Hypothesis testing**

The dependent variable behavioral intention was analyzed using a one-way between subjects ANOVA using condition (threat appraisal vs. threat plus coping appraisal vs. control) as fixed factor. The F-test was not statistically significant,  $F(2, 142) = 0.67, p = .511$ , and the effect-size was small  $\eta_p^2 = .009$ . This means that the three conditions did not differ from each other. In conclusion, the results support Hypothesis 1 and do not support Hypothesis 2. Hence, the threat appraisal and the threat plus coping appraisal did not increase behavioral intentions regarding the behaviors of more cycling and eating less meat.

### **Discussion**

In summary, this research examined the effectiveness of fear appeals in the context of climate change. Currently, fear appeals are one of the most used techniques deployed to lower the impact of the individual on climate change (Ruiter et al., 2014). According to the protection motivation theory, as described by Maddux & Rogers (1983), this can be done by providing the individual a message that contains a threat appraisal and a coping appraisal. A threat appraisal should include a situation that is severe and for which the individual feels susceptible, the coping appraisal complements this situation with self-efficacy. For a fear appeal to be effective, both appraisals should be included. However, there is discussion between scientists whether fear appeals do work effectively in general (Reser & Bradley, 2017). Therefore, the purpose of this study was to find more understanding for the workings of fear appeals and their effectiveness in the context of climate change.

The effectiveness of fear appeals in climate context was tested by making use of a digital questionnaire which was spread among young adolescents. Firstly, we hypothesized that fear appeals which only contained a threat appraisal would not have an effect on behavioral intentions. Secondly, we expected that fear appeals which combined a threat- and coping appraisal would have a positive effect on behavioral intentions. This means that there was only change in behavioral intention expected whenever a coping appraisal was included. The behavioral intentions that have been measured were reducing meat consumption and cycling more often. After analyzing the results of the experiment, some conclusions can be drawn. Briefly, the study found evidence for the ineffectiveness of a fear appeal when only a threat appraisal was included. However, no evidence was found for the effectiveness of a fear appeal when both a coping and a threat appraisal were included, which is not in line with our expectations.

Hence, in our study fear appeals overall did not have an effect on behavioral intentions. More specifically, there was no evidence found for differences in behavioral

intention after seeing the provided manipulation. The results of our study support the first hypothesis, meaning that there is no effect found on behavioral intentions when merely a threat appraisal is included in the fear appeal. This is in line with the protection motivation theory of Maddux and Rogers (1983), because a fear appeal needs both a threat- and coping appraisal to succeed. This is in line with the meta-analysis of Ruiter and colleagues (2014) too, which explained that when solely a threat appraisal is used the fear appeal will not be effective. Meanwhile, there was no evidence found in our study to confirm the second hypothesis, even though this was expected based on the protection motivation theory (Maddux & Rogers, 1983). In short, we found no evidence for the effectiveness of a fear appeal when including both a threat- and coping appraisal. This contrasts with previous research, such as the meta-analysis by Tannenbaum and colleagues (2015), which confirmed that fear appeals including both a threat- and coping appraisal would generally be effective. However, the conclusions of this study have to be taken cautiously, due to methodological limitations and external complications that may have had influence on the results. Further research should correct these limitations to indicate the effectiveness of fear appeals.

The first methodological limitation was that the manipulation as used in the experiment was only partially successful. Before performing the experiment, a pilot study was conducted to validate the stimuli (i.e. manipulation) for the questionnaire. With this, the manipulation as used in the experiment was validated for the feeling of severity, susceptibility, response efficacy, and self-efficacy of the participant. In the experiment, similar findings were solely found for the severity of the manipulation and not for the other variables. In the experiment, the threat was found more severe in the conditions where a fear appeal was presented compared to the control condition. However, the participants who were presented with a fear appeal in the experiment did not perceive themselves as more susceptible, nor did these participants perceive more response or self-efficacy than the control condition. The ineffectiveness of the manipulation in the experiment could be an explanation for the unexpected findings of our study.

The unexpected findings for the variables susceptibility, response efficacy and self-efficacy may cohere with an external complication during the implementation of our study. When this study was conducted, The Netherlands was affected by the Corona Crisis. This possibly caused an already present feeling of anxiety for the participants before starting the experiment. In case of an already present fear, there may be consequences for the accuracy of the results. Firstly, this means that the questionnaire was not filled in under neutral circumstances, therefore the overall results may be biased (Field, 2012). Secondly, fear

concerning the Corona Crisis may have had an impact on the susceptibility, response efficacy and self-efficacy that a person experienced. For the susceptibility, research by Weber (2010) has shown that a person has a limited capacity for worrying. Therefore people rank risks, whereby they prioritize the worries that are most severe. Consequently, one cannot be as much worried for one situation as for another. Increased concern regarding the susceptibility for the Corona Crisis may have decreased the concern regarding susceptibility for climate change. Herewith, participants perhaps felt less susceptible for climate change than usual. For response efficacy and self-efficacy, research by Horberg and colleagues (2011) has shown that a person's judgement regarding efficacy can be influenced by being exposed to a recent fear. Fear can evoke uncertainty and impotency, also for events other than the one that caused the fear in the first place. This uncertainty may have influenced the participants' estimate of their efficacy, causing them to rate the statements regarding efficacy lower in the experiment. In our study, the fear caused by the Corona Crisis may therefore explain the insignificant results for the variables susceptibility, self-efficacy and response efficacy in the experiment.

Subsequently, a second methodological limitation was not controlling for vegetarians and persons who do not own a car in the questionnaire. This means that, there was no question regarding the fit of the participant for the questionnaire. Therefore, persons could have participated in the experiment while the questions were not suitable for them (Field, 2012). Consequently, there may have been participants who were vegetarian or did not own a car and filled in the questionnaire, whereas they could not improve their behavioral intentions. Therefore, the results of these participants may be biased, this may explain the insignificant results for the variable behavioral intention. Hence, further research should include a controlling question for the fit of the participant.

Thirdly, after conducting the experiment the reliability of the questionnaire appeared limited. After performing several reliability analyses, two variables showed unacceptable results. Therefore, these variables (i.e. severity and self-efficacy) had to be split into two separate variables (e.g. severity 1 and severity 2). The other variables (i.e. susceptibility, response-efficacy and behavioral intentions) were measured as planned with two components. After splitting the variables severity and self-efficacy, only one item per variable remained. With this, the reliability of the study may be threatened. Since, a variable which merely contains one component cannot be measured in a reliability analysis (Field, 2012). Therefore, the reliability of the split variables can not be assured. Briefly, the shortage



of reliability for the split variables may threaten the reliability of our study. Further research should therefore update the variables severity and self-efficacy.

Alongside addressing the mentioned limitations, further research has to consider implementing a longitudinal design too. In this study, due to the shortage of time, there was solely focus on behavioral intention. As stated in the theory of planned behavior (Ajzen, 1991), behavioral intention is the phase before performing behavior. However, to examine if there is no gap between the behavioral intention and the behavioral act, a longitudinal research is needed. With this, dynamic behavior can be captured and accidental behavioral acts can be controlled, which in turn assures internal validity through eliminating alternative explanations (Park & Staicu, 2015). Hereby, the behavioral act that follows after behavioral intention can be measured, at which coincidence can be excluded. Without these measurements, it cannot be assured that fear appeals truly change behavior.

Even though the results of our study have not found evidence for the expectations as described in the protection motivation theory (Maddux & Rogers, 1983), our study can be of value. To illustrate, our study included a control condition and a large sample size. Firstly, the involvement of a control condition is momentous, because the results of a control condition determine the effect of the independent variable outside the procedure (Field, 2014). The exclusion of control conditions is a problem in the domain of fear appeals, since many studies regarding fear appeals have not included a control condition or a pre-test (Ruiter et al., 2014). Therefore, these studies cannot assure that their results are reliable. Secondly, our study contained a large sample size compared to other research regarding fear appeals such as the studies of Marksaityte and colleagues (2018) and Carey and Sarma (2016). Since, a small sample size generally has less statistical power (Prajapati et al., 2010), we aimed to recruit as many participants as possible. With this, our study is more reliable and has more power than various other studies regarding fear appeals.

Furthermore, it can be valuable to include this study in a systematic review or meta-analysis, since it provides counter-evidence to the existing theory about fear appeals and adds to the debate around its effectiveness as described in the research of Reser and Bradley (2017). The conclusion that fear appeals may not be effective is of interest, since many interventions within behavioral change in climate context focus on fear appeals (Ruiter et al., 2014). When it appears that fear appeals do not work properly, it is momentous that interventions focus on other strategies. Further research may map other strategies for interventions regarding behavioral change in climate context, and test their effectiveness.

In conclusion, our study found no evidence for the effectiveness of fear appeals within climate context. However, this conclusion has to be taken cautiously, because of the methodological limitations that should be improved and the external implications that should be controlled for.

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## Tables

**Table 1**

*Means and Standard Deviations of the Pilot Test Items*

Items	Heat		Flood 1		Flood 2	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Severity	4.87	2.10	5.40	1.88	5.47	1.89
Susceptibility	4.73	1.62	4.93	1.87	5.20	1.74
Response efficacy	5.27	1.79	5.60	1.50	5.40	1.77
Self-efficacy	5.40	1.55	5.13	1.55	5.27	1.75

*Note.* The notation Heat, Flood 1 and Flood 2 after the statistical terms *M* and *SD* refer to the three pilot study stimuli.



**Table 2**  
*Demographic Characteristics of Participants*

Characteristic	Threat appraisal		Threat plus coping appraisal		Control		Full sample	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender								
Female	34	30.1 <sup>a</sup>	35	31.0 <sup>a</sup>	44	38.9 <sup>a</sup>	113	77.9 <sup>b</sup>
Male	13	40.6 <sup>a</sup>	12	37.5 <sup>a</sup>	7	21.9 <sup>a</sup>	32	22.1 <sup>b</sup>
Highest / current education								
VMBO	1	33.3 <sup>a</sup>	2	66.7 <sup>a</sup>	0	0.0 <sup>b</sup>	3	2.1 <sup>b</sup>
HAVO	0	0.0 <sup>a</sup>	0	0.0 <sup>a</sup>	0	0.0 <sup>b</sup>	0	0.0 <sup>b</sup>
VWO	2	18.2 <sup>a</sup>	3	27.3 <sup>a</sup>	6	54.5 <sup>a</sup>	11	7.6 <sup>b</sup>
MBO	6	30.0 <sup>a</sup>	7	35.0 <sup>a</sup>	7	35.0 <sup>a</sup>	20	13.8 <sup>b</sup>
HBO	11	37.9 <sup>a</sup>	10	34.5 <sup>a</sup>	8	27.6 <sup>a</sup>	29	20.0 <sup>b</sup>
WO	27	32.9 <sup>a</sup>	25	30.5 <sup>a</sup>	30	36.6 <sup>a</sup>	82	56.6 <sup>b</sup>

*Note.*  $N=150$  ( $n=47$  for the threat appraisal condition,  $n=47$  for the threat plus coping appraisal condition and  $n=51$  for the control condition). Participants were on average 20.7 years old ( $SD=1.84$ ).

<sup>a</sup> Reflects the percentages that are determined on the level of the row.

<sup>b</sup> Reflects the percentages that are determined on the level of the column.

**Table 3**  
*Means and Standard Deviations of Manipulation Check Items*

Condition	Control		Threat		Threat plus coping	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Severity 1	2.28	1.13	3.72	1.39	3.89	1.71
Severity 2	5.22	1.35	5.94	1.03	6.13	0.95
Susceptibility	5.30	1.06	5.54	1.11	5.29	1.26
Response efficacy	5.66	1.03	5.69	1.11	5.29	1.38
Self-efficacy 1	5.16	1.91	4.96	1.78	4.85	2.04
Self-efficacy 2	6.00	1.46	5.43	1.86	5.81	1.78

*Note.* The notation *control*, *threat*, and *threat-coping* after the statistical terms *M* and *SD* refer to the 3 conditions. *N* was different per condition but the same for all manipulation check items (control: *N* = 51, threat: *N* = 47, threat plus coping: *N* = 47).

## Appendix

### Appendix A. Stimulus Combinations for Pilot Study

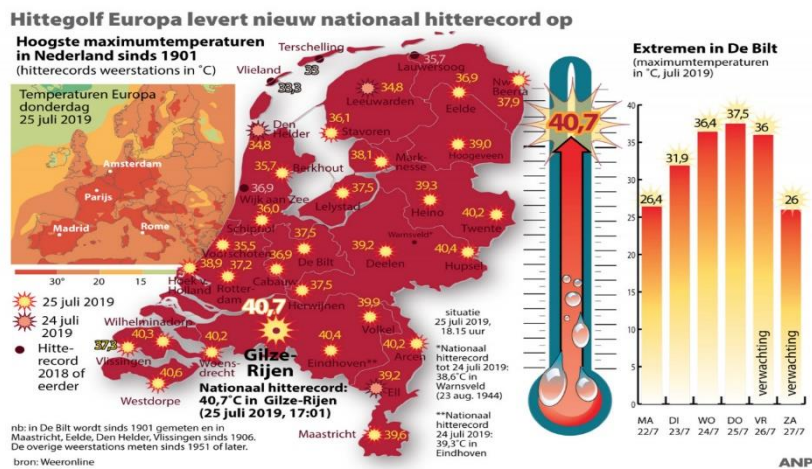


Figure A1. Stimulus Combination 1 (Heat) (Weer Online, 2019)

#### Threat appraisal text

Afgelopen zomer zijn extreme temperaturen gemeten. Nooit eerder was het zo bizar warm in Nederland als in de zomer van 2019. Een warmterecord kan veel zeggen over klimaatverandering. Een enkel warmterecord kan gebeuren, maar een scheve verhouding tussen kouderecords en warmterecords is erg bedreigend voor het klimaat. In deze eeuw staat tot dusver tegenover elk kouderecord acht warmterecords. Dit is extreem veel, deze records zouden met elkaar in balans moeten zijn om de aarde voor iedereen leefbaar te houden. Naar voorspelling zullen er steeds meer warmterecords bij komen. Deze hitte heeft veel invloed, zo zullen veel mensen ziek worden of zelfs sterven aan oververhitting.

#### Coping appraisal text

Gelukkig kan het tij nog keren, mits de mens zich gezamenlijk inzet tegen klimaatverandering. Door goed voorbereid te zijn kunnen op de korte termijn doden door oververhitting voorkomen worden, en door nu actie te ondernemen zal de kans op een warmterecord in de toekomst afnemen. Kleine beetjes kunnen al helpen, zoals vaker de fiets pakken en het maken van bewuste voedingskeuzes. Door bijvoorbeeld deze twee maatregelen, zal er minder CO<sub>2</sub> uitstoot zijn waardoor het versterkt broeikaseffect kan worden afgezwakt.



*Figure A2. Stimulus Combination 2 (Flood 1) (Joyce, 2017)*

### **Threat appraisal text**

De gevolgen van klimaatverandering hebben een drastische impact op Nederland. De aankomende jaren zal de hevigheid van neerslag toenemen. Daarbij is een ander probleem dat de zeespiegel stijgt, terwijl de bodem in Nederland steeds meer daalt. Hierdoor is de kans groot dat Nederland steeds vaker te maken zal krijgen met overstromingen. Het zou niet de eerste keer zijn dat Nederland te maken zou krijgen met overstromingen: tijdens de Watersnoodramp in 1953 vielen 1836 doden. Kinderen verdronken, vaders werden door het water meegesleurd en opa's en oma's konden niet vluchten voor het water. Tegenwoordig is Nederland veel dichter bevolkt dan in 1953, waardoor de gevolgen nog heftiger zullen zijn. Stel je voor dat je morgen in je auto zit en verrast wordt door het hoge water, zoals deze mensen overkwam?

### **Coping appraisal text**

Het is echter nog niet te laat. Op dit moment zijn de dijken nog goed bestand tegen stormen, neerslag en andere gevaren die kunnen zorgen voor overstromingen. Het is daarom belangrijk om klimaatverandering tegen te gaan, om te zorgen dat overstromingen voorkomen zullen worden. Zo heeft het nut als Nederlanders hun dieet aanpassen en minder vlees gaan eten. We kunnen koken op elektriciteit in plaats van gas of kiezen voor het openbaar vervoer in plaats van de auto. Allemaal kleine aanpassingen die een groot effect hebben en bijdragen aan het tegengaan van klimaatverandering. Samen kunnen we Nederland

beschermen, zodat ook onze kinderen zich geen zorgen hoeven te maken over overstromingen.



*Figure A3. Stimulus Combination 3 (Flood 2) (Denchak, 2019)*

### **Threat appraisal text**

Intense buien kunnen een grote invloed hebben op de maatschappij. Één van de deze gevolgen is lokale wateroverlast. Het blijkt dat 59% van al het landoppervlak van Nederland kwetsbaar is voor overstromingen. Dit kan dus ook voor u gelden. Er zijn sterke aanwijzingen dat de intensiteit van buien extremer zal worden naar mate klimaatverandering vordert. Als de temperatuur stijgt, neemt de hoeveelheid waterdamp in de lucht toe. Meer waterdamp betekent meer regen. Dit heeft dan ook veel gevolgen voor de maatschappij. Of uw huis onder water komt te staan hangt af van de snelheid, kracht, waterhoogte en de omvang van het overstroomde gebied.

In extreme gevallen is er grote kans op stroomuitval, en indien uw water overstroomt raakt is er ook explosiegevaar. Droog en warm blijven tijdens overstromingen is ook erg lastig, en het gevolg hiervan is dat ook veel mensen onderkoelt raken.

### **Coping appraisal text**

Hoewel Nederland op dit moment voldoende maatregelen genomen heeft tegen wateroverlast en overstromingen blijft de waterspiegel stijgen. Gelukkig is het niet te laat om de effecten van klimaatverandering tegen te gaan. Het doel is om de Co2 uitstoot te verminderen, want meer Co2 betekent extreme temperaturen en dit leidt tot extremere neerslag. U kunt hieraan bijdrage door kleine aanpassingen te maken aan uw levenspatroon. Denk hierbij aan het aanpassen van uw voeding, door bijvoorbeeld minder vlees te eten. In

plaats van uw eigen vervoer zou u kunnen kiezen voor het openbaar vervoer of indien mogelijk de fiets. Deze kleine aanpassingen lijken insignificant maar met wanneer we dit met zijn alle doen kunnen we de negatieve effecten van klimaat tegengaan.

## Appendix B. Informed Consent

Beste participant,

Welkom bij dit experiment!

Deze vragenlijst is bedoeld voor volwassenen tussen de 18 en 25 jaar. Indien je niet in deze groep valt, kun je helaas niet deelnemen aan dit onderzoek. Het experiment is gemaakt in het kader van het bacheloronderzoek voor de opleiding Psychologie aan de Universiteit Utrecht en betreft een vragenlijst.

De vragenlijst is anoniem; de gegevens worden met de grootste vertrouwelijkheid behandeld en worden alleen op groepsniveau bekeken. Deelname aan de vragenlijst is vrijwillig, je mag op ieder moment stoppen zonder opgave van redenen en consequenties. Er is geen tijdslimiet aan het beantwoorden van de vragen. Het experiment zal ongeveer 5 tot 10 minuten duren.

Mocht je vragen hebben dan kan je een mail sturen naar: [r.k.chote@students.uu.nl](mailto:r.k.chote@students.uu.nl)

Bij voorbaat hartelijk dank voor je medewerking,

Met vriendelijke groet,

Myrthe van Kraanen, Ryan Chote & Iris Schoenmaker  
Studenten Psychologie en Liberal Arts & Sciences  
Sociale Wetenschappen, Universiteit Utrecht

Ik verleen toestemming aan de onderzoekers van de Universiteit Utrecht om mijn gegevens anoniem te gebruiken voor het huidige onderzoek. Ik ben 18 jaar of ouder en ik begrijp dat er vertrouwelijk met mijn gegevens om zal worden gegaan en ik op elk moment mag stoppen. Ik heb de voorgaande informatie gelezen en begrepen.

- Ik ga akkoord en neem deel aan het onderzoek
- Ik ga niet akkoord en neem niet deel aan het onderzoek

## Appendix C. Control Condition



*Figure B1.* Image Control Condition

### **Text control condition**

Het David de Wied gebouw is een van de vele gebouwen van de Universiteit Utrecht. David de Wied was een Nederlands hoogleraar farmacologie, die na de oorlog geneeskunde studeerde. In 2011 werd het gebouw van de faculteit Bètawetenschappen naar hem vernoemd. In 2019 werd besloten om het gebouw te vernieuwen. Het complex zal een grootschalige verbouwing ondergaan en wordt de high-end ontmoetingsplek waar toponderzoek samenkomt. Doordat het gebouw stap voor stap wordt aangepast, zullen er steeds meer werkplekken en uitstekende flexibele labs komen. Er wordt een zogenoemde ‘EM-square’ toegevoegd. Dit is een faciliteit met hoogwaardige en gevoelige elektronenmicroscopen. Om dit te bereiken zal de bestaande helling naar de entree vervangen worden door een groot grasveld, waardoor de entree licht en open wordt. In totaal liggen de bouwkosten rond de 22 miljoen.



## **Appendix D. Debriefing Text**

Bedankt voor je medewerking.

De vragenlijst die je hebt ingevuld had betrekking op het gebruiken van angst en bedreiging in klimaatcampagnes. Mogelijk sloten de beelden en vragen niet bij elkaar aan, dit kan komen doordat je in de controleconditie zat. Wij verzoeken je vriendelijk om de inhoud van dit onderzoek niet te bespreken met personen die mogelijk nog aan het onderzoek gaan meedoen.

Mocht je nog vragen hebben over het onderzoek of wil je het verslag ontvangen, neem dan contact op door een mail te sturen naar: [r.k.chote@students.uu.nl](mailto:r.k.chote@students.uu.nl)

Door op volgende te klikken sluit u het experiment af.