



## **Gain and loss framing in climate change communication videos**

*An experimental study on the effect of Videos Messages Framing on (the intention to) Pro-environmental Behaviour Change, and how this is mediated by the level of Climate Worry and Self-efficacy*

Julia van den Bout

SNR 2080431; U320791

Master's Thesis

MSc Communication- and Information Sciences

Specialization Business Communication and Digital Media

Department Communication and Cognition

School of Humanities and Digital Science

Tilburg University, Tilburg

Supervisor: Dr. M. Goudbeek

Second reader: Dr. R. Koolen

January 2022

Word count: 8151

### **Abstract**

Changing human pro-environmental behaviour (PEB) is important to lower their ecological imprint. An efficient way to aim at behavioural change is message framing. Based on previous findings, this study investigates whether gain-framed messages are more effective than loss-framed messages in climate change-related communication. However, the individual level of climate worry and self-efficacy may influence the effectiveness of the type of message framing, and it is therefore hypothesized that the effect of framing is mediated by the level of climate worry and self-efficacy. An online experiment with a between-subject design was conducted. 98 participants were randomly assigned to the gain or the loss condition, in which they were presented with a video. Before and after the video, participants were asked to fill in their level of climate worry and self-efficacy. After that, participants were asked to what extent they would change their ecological imprint to measure their intention to change PEB. Additionally, to measure their exact change in PEB, they were asked to join a community. The results showed that there is no direct effect between framing and (intention to) change PEB. However, climate worry positively mediates the relationship between video framing and the intention to change PEB. Additionally, it was found that self-efficacy does not mediate this relationship. Interestingly, it was found that higher levels of self-efficacy lead to higher intentions to change PEB. Given these significant results, future research should investigate what type of video leads to higher individual levels of self-efficacy and climate worry, which yield to higher intentions to change PEB.

*Keywords:* pro-environmental behaviour (PEB), gain framing, loss framing, climate worry, self-efficacy

## Table of Contents

<b>Gain and loss framing in climate change communication videos: .....</b>	<b>5</b>
<b>Theoretical Framework.....</b>	<b>8</b>
<b>(Intention to) change pro-environmental Behaviour .....</b>	<b>8</b>
<b>The type of Message Framing (gain versus loss) .....</b>	<b>10</b>
<b>The individual level of Climate Worry.....</b>	<b>12</b>
<b>The individual level of Self-efficacy .....</b>	<b>14</b>
<b>Method .....</b>	<b>17</b>
<b>Research Design.....</b>	<b>17</b>
<b>Participants .....</b>	<b>17</b>
<b>Materials .....</b>	<b>18</b>
<b>Procedure .....</b>	<b>20</b>
<b>Manipulation check.....</b>	<b>21</b>
<b>Instrumentation.....</b>	<b>22</b>
<i>The first dependent variable; joining a pro-environmental community.....</i>	<i>22</i>
<i>The second dependent variable; intention to change pro-environmental behaviour .....</i>	<i>23</i>
<i>Mediator variables .....</i>	<i>23</i>
<i>Control variable .....</i>	<i>24</i>
<b>Results .....</b>	<b>24</b>
<b>Pre-existing pro-environmental behaviour .....</b>	<b>25</b>
<b>Mediation analysis for pro-environmental behaviour change .....</b>	<b>25</b>
<b>Mediation analysis for the intention to change pro-environmental behaviour .....</b>	<b>26</b>
<b>Climate worry as a mediator.....</b>	<b>27</b>
<b>Self-efficacy as a mediator .....</b>	<b>28</b>

<b>Discussion.....</b>	<b>29</b>
<b>Theoretical implications .....</b>	<b>30</b>
<b>Limitations and Suggestions for Future Research .....</b>	<b>33</b>
<b>Conclusion.....</b>	<b>34</b>
<b>References .....</b>	<b>35</b>
<b>Appendix A: Climate worry scale .....</b>	<b>44</b>
<b>Appendix B: Self-efficacy Scale .....</b>	<b>45</b>
<b>Appendix C: PEB scale items.....</b>	<b>46</b>
<b>Appendix D: Online experiment.....</b>	<b>47</b>
<b>Appendix E: Mediation Analysis for the first dependent variable .....</b>	<b>53</b>
<b>Appendix F: Assumption check mediation analysis for intention to change PEB.....</b>	<b>56</b>
<b>Appendix G: Assumption check mediation analysis for the change in PEB .....</b>	<b>57</b>

## **Gain and loss framing in climate change communication videos:**

### **The Effect of Message Framing on (the intention to) Pro-environmental Behaviour Change and the Mediating Role of Climate Worry and Self-efficacy**

Anthropogenic climate change is one of the most urgent problems facing humanity (Passarelli et al., 2018). According to the Intergovernmental Panel on Climate Change (IPCC), there is a greater than 95 percent probability that human activity over the past 50 years has warmed our planet and that it is already having detrimental effects (Byerly et al., 2018; IPCC, 2014). These effects have a significant impact on water scarcity, ecosystem conversion, and biodiversity loss (IPCC, 2014). More in detail, these effects cause floods, tornadoes, hurricanes, droughts, fires, loss of forest, and heat waves, along with the disappearance of rivers and desertification (Cianconi et al., 2020). This human impact on Earth's climate is therefore cited as the top issue by the majority of nations in the world (Fagan & Huang, 2020).

These acute and chronic environmental changes have also significant long-term effects on human physical and mental health (Hickman et al., 2021). It is therefore impossible to ignore these long-term effects of climate change in our daily lives whereas these effects are expected to get worse over the next century and beyond (Haines et al., 2006; Hart & Feldman, 2016). Humans must therefore significantly change their consumptions, modes of production, economies, and energy generation (IPCC, 2014). Most of these changes are centered at the level of both government and commercial entities, but individual consumption and lifestyle decisions have a greater impact than most people realize (Williamson et al., 2018).

Governments and organizations are conducting a variety of pro-environmental initiatives, especially via social media, in an attempt to increase realization and awareness (Fernandez et al., 2016). Although people are becoming more aware of the present and

foreseeable threats climate change is bringing to the entire planet, few people are prepared to make significant lifestyle changes to lower their ecological imprint (Roeser, 2012). For example, using less packaging, lowering the heating and lighting in the house, refilling water bottles, using public transport, taking shorter showers, and recycling (Williams & Dair, 2007). Therefore, changing human environmental behaviour is an important factor in improving the planet (Byerly et al., 2018; Shafiei & Maleksaeidi, 2020).

Individuals' environmental knowledge, attitudes, societal pressures, values, and beliefs all have an impact on their pro-environmental behaviour (Kollmuss & Agyeman, 2002). Researchers and decision-makers think encouraging pro-environmental activities will contribute to these pro-environmental acts (Shafiei & Maleksaeidi, 2020). However, successfully communicating those climate change activities proves complex (Russill, 2008). Interestingly, a study has shown that an efficient way to aim at behavioural change is message framing, especially in health communication (Gallagher & Updegraff, 2011; Tuong et al., 2012). It is believed that the way arguments are presented might affect a person's attitude about the subject, despite the fact that the message contains the same information. Thus, this Prospect Theory, which is further explained in the theoretical framework, states that the kind of framing can influence decision-making and behaviour differently (Fisher & Mandel, 2021)

One commonly-used message framing in health and consumer behaviour change communication is gain versus loss framing (Ngo et al., 2022). While a gain-frame message focuses on the positive outcome of behaviour and refers to desired goals, a loss-frame message focuses on the loss of not adopting that behaviour which refers to undesirable conditions (Martino et al., 2006). Some studies have argued that messages with loss or negative frames activate defensive systems and have a greater impact on prosocial behaviour

(Arthur & Quester, 2004). In addition, loss framing can often encourage people to believe that they are contributing more effectively than gain or positive framing (White et al., 2011).

These findings contradict other studies, which suggest that gain-framed messages have a stronger impact on the intention to change behaviour because they are more effective in raising risk perceptions (Ngo et al., 2022). In addition, the use of gain or positive frames increases self-efficacy, which improves the outcome of health behaviour (Riet et al., 2008). A study by Maran and Begotti (2021) has shown that exposure to climate change information is related to negative emotions, and therefore increased individual self-efficacy beliefs about climate change (Martino et al., 2006). Meaning that self-efficacy empowers individuals to act more pro-environmentally (Mah et al., 2020). However, the level of self-efficacy is different for every individual and therefore could have an influence on the relationship between message framing and pro-environmental behaviour change (Gerhardt & Brown, 2006). Besides, the negative emotion that arises when individuals are exposed to climate change information, is referred to as climate worry (Hickman et al., 2021). This study found that people who are experiencing a higher level of climate worry are more likely to act in a pro-environmental way than people who are experiencing a lower level of climate worry. Thus, in order to influence individuals to change their behaviour, their level of climate worry has to be influenced.

So, a way to ultimately convince people to act against climate change on an individual level is through climate change message framing. Consequently, while further research should be done on the kind and accessibility of climate change information, it is also necessary to look more closely at how this information is communicated (Cheng et al., 2011; Kennedy et al., 2009). It is still unclear what type of framing is best applied to climate change communication to change environmental behaviour and how this relationship is mediated by the individual level of climate worry self-efficacy. Therefore, this study addresses the

following research question: *“To what extent does message framing (gain versus loss) in climate change communication videos affect (the intention to) pro-environmental behaviour change, and how is this mediated by the individual level of climate worry and self-efficacy?”*

## **Theoretical Framework**

### **(Intention to) change pro-environmental Behaviour**

Pro-environmental behaviour (PEB), also referred to as green-, sustainable-, or eco-friendly behaviour is as “all possible actions aimed at avoiding harm to the environment” (Balundè et al., 2019). Almost all human behaviour could be referred to as environmental behaviour, as the interaction with the environment is constant. Therefore, PEB refers to a type of behaviour that is typically viewed in the context of society at large as being protective of the environment or a tribute to a healthy environment (Balundè et al., 2019). Two widely used models that are intended to investigate pro-social behaviours and therefore provide a good foundation for investigating pro-environmental behaviour are the Norm Activation Model (Schwartz, 1977) and the Values-Beliefs-Norms Theory (Stern, 1999).

The Norm Activation Model describes three antecedents for prosocial behaviour: awareness of consequences, an ascription of responsibility, and personal norms. An individual's knowledge of potential adverse effects and acceptance of guilt for not taking environmental responsibility are the first steps in the norm activation process. People act in accordance with their own standards of behaviour due to the anticipated pride and remorse. According to the Norm Activation Theory, personal values determine whether they would take action to stop adverse outcomes if they were aware of potential negative consequences and if they feel responsible for such consequences. Additionally, the theory argues the possibility that personal norms will increase with the salience or degree of awareness of



consequences and acceptance of responsibility. Thus, a person will take action to avoid the expected adverse outcomes if the nature of their norms requires it.

The second approach, the Values-Beliefs-Norms Theory, argues that individual choice about pro-environmental behaviour can be driven by personal means. These norms are a result of three aspects: personal values, beliefs that these values are under threat, and beliefs that individuals can take action to reduce the threat and restore the values. These personal values are, for example, egoistic or altruistic values. More specifically, egoistic ideals emphasize power or achievement, as well as the costs and benefits a decision has on someone's resources, whereas altruistic values refer to behaviour that benefits another individual at a cost to oneself (Bouman et al., 2020). So, the norms are activated when an individual believes that violating the norms would have adverse effects on things they value and that by taking action, people would bear significant responsibility for those consequences.

The Norm Activation Theory and the Values-Beliefs-Norms Theory have two main differences: The Norm Activation Theory only considers altruistic values, whereas the Values-Beliefs-Norms Theory takes more values into account and explicitly evaluates individuals' relevant beliefs—for example, hedonistic values, and biospheric values. Hedonistic values emphasize the importance of obtaining pleasure, good feelings, and minimizing work, whereas biospheric values demonstrate an interest in the environment as a whole, without a direct connection to people (Bouman et al., 2020). Stern (1999) presents a causal process in which environmental beliefs affect behavioural norms, which in turn affect not only the intention to change pro-environmental behaviour but also the exact behaviour change.

Although there has been an increase in global understanding and worry about climate change over the past 25 years (Capstick et al., 2014), people still view it as a low priority

when compared to other societal issues like terrorism, health care, and the economy (Linden, 2017; Lorenzoni & Pidgeon, 2006). This could be explained by two psychological processes that may hinder individuals from changing their behaviour to act more pro-environmental (Soliman et al., 2018). First, people's perceptions of climate change as a temporally distant issue might make it seem overwhelming, which reduces people's motivation to take action by underestimating the seriousness of those dangers. Second, people tend to perceive that the acts of any single individual are too little to have a true impact on such a major global health issue (Bonniface & Henley, 2008; Soliman et al., 2018). In order to change behaviour to act more pro-environmental, it is highly essential that people are aware of the climate dangers at this time and that any individual could make a huge difference to those climate dangers. The findings of previous studies suggest that there are types of message framing that provide the potential to change people's behaviours in a more pro-environmental way by addressing these distant and impact issues (Gallagher & Updegraff, 2011; Tuong et al., 2012).

### **The type of Message Framing (gain versus loss)**

Message framing refers both to the process of selecting information, which can lead to the reversal of individual choice preferences (Tversky & Kahneman, 1981). This is due to the fact that human decision-making and human perception are not completely rational. Tversky and Kahneman (1981) explained this in their Prospect Theory which stated that the type of framing can impact human decision-making and human behaviour. People try to avoid taking risks and their decisions are sensitive to how that information is presented; gain versus loss framing is one of the most widely used message framings in health and consumer behaviour change communication (Ngo et al., 2022). Gain framing is described as information frames that emphasize the positive consequences of engaging in a particular behaviour. In contrast, loss framing is defined as information frames focusing on the negative consequences of not

undertaking a particular behaviour (Spence & Pidgeon, 2010). For example, sunscreen use may be presented in terms of the benefits of applying sunscreen (gain frame) or in terms of the risks if you do not apply sunscreen (loss frame).

Studies show that loss frames are more effective at altering risky behaviours, but gain frames are more effective when altering safe behaviours (Edwards et al., 2001). These concepts are founded on Prospect Theory, which links message framing too risk-taking (Tversky & Kahneman, 1981). Prospect Theory explains that people are more likely to take risks when they have to prevent losses (loss framing) than when they are considering gains (gain framing) because the value of losses is perceived to be relatively higher than the values of gains. Additionally, Wilson et al., (1988) explored gain-framing versus loss-framing communication approaches as used by scientists and practitioners in a theoretical review of message framing in health communication. According to the research, people are typically more intended to prevent losses than to achieve gains. Although there are numerous examples of gain and loss framing in risk and health communication that are effective, the idea has not been effectively utilized in climate change communication (Meijers et al., 2018; White et al., 2011).

In the field of health psychology, there is a distinction between behaviours that reduce risk, such as using sunscreen, and behaviours that increase risk, such as HIV testing, which are considered to have a high short-term risk (Banks et al., 1995). Finding a health issue is considered to be a significant short-term risk, to the point where a person may expect to hear negative and unpleasant news. Instead of focusing on the objective probability of a given consequence, this conceptualization of risk focuses on the subjective significance attached to the potential result. The evidence here shows that gain frames are more successful at encouraging prevention behaviour while loss frames are more effective at encouraging detection behaviour (Rothman et al., 2006). A study by Spence and Pidgeon (2010) discussed

that climate change mitigation efforts are most comparable to preventative behaviour because pro-environmental behaviour is undertaken in order to prevent potential future adverse effects of climate change issues. Therefore, the following hypothesis is formulated:

**H1:** People who were exposed to the gain-framed video are more likely to (*have more intention to*) change their pro-environmental behaviour than people who were exposed to the loss-framed video.

### **The individual level of Climate Worry**

Climate worry is defined by Hickman et al. (2021) as a personal, active, and motivational emotional state that is characterized by the repeated experience of anxious thoughts about a potentially negative event, and that is closely related to individuals' personal goals, preferences, and behaviours. Therefore, the effect of information framing on pro-environmental behaviour change may be influenced by the individual's worry level about climate change, because the effectiveness of message framing could differ between individuals. Worry is often distinguished from fear, concern, and perceived risk (Bouman et al., 2020). Specifically, worry is thought to be less overwhelming than the more intense emotion fear (Smith & Leiserowitz, 2013), more experience-based than concern (Linden, 2017), and less of a cognitive process than perceived risk (Loewenstein et al., 2001). However, according to Bouman et al. (2020) these concepts are conceptually comparable.

#### *Climate worry and (the intention to) change pro-environmental behaviour*

An individual's worry about climate change indicates that they are personally concerned about its effects and are actively and emotionally involved with the issue (Bouman et al., 2020). Previous research has shown that worry about climate change is the main predictor of climate change mitigation behaviour (Linden, 2017; Linden et al., 2019).

However, these findings did not consider whether worry can also motivate individuals to undertake more specific actions to mitigate climate change. Furthermore, various lines of research have suggested that it is unlikely for worry about something as abstract and global as climate change to directly translate into real, specific, and individual actions. Particularly, worry about climate change may be too psychologically excluded from individual climate actions, which are frequently more concrete, specific, and personal. This reduces the likelihood that worry about climate change will motivate such actions (Ajzen & Fishbein, 1977; Hornsey et al., 2016). Additionally, due to the abstraction and complexity of climate change, it might be difficult for people to know what they can do on their own and whether their efforts will have an impact (Moser, 2016; Ricci et al., 2010), making individuals more likely to wonder if they should take action themselves (Brügger et al., 2015; Evensen et al., 2018; Ricci et al., 2010). This belief in one's own ability is referred to as self-efficacy, which is further explained in the next section.

However, in the field of health communication, there are studies that investigated the effect of worry on an individual's behaviour. For example, a study by Sobkow et al. (2020) studied different factors that motivate people to comply with the suggested precautions against coronavirus infection. This study found that worry, perceived controllability, and risk perception predicted the intentions toward preventive behaviour. Interestingly, people who were worried about health were more willing to obey strict hygiene and social distancing restrictions (Sobkow et al., 2020). Another study by Freeston et al. (1994) investigated the main reasons why people worry by providing participants with two questionnaires. This study found two main reasons why individuals worry. First, individuals believe that worrying can prevent negative events from happening, reduce the impact of negative things by reducing guilt, minimize disappointment, or distract attention from thinking about worst-case scenarios. Second, individuals assume that worrying has a positive effect, such as finding

different ways of doing things (Freeston et al., 1994). Therefore, the following hypothesis is formulated:

**H2a:** people who are experiencing a higher level of climate worry are more likely to (*have more intention to*) change their pro-environmental behaviour than people who are experiencing a lower level of climate worry.

#### *The type of framing and the level of climate worry*

Loss frames present a series of negative, often threatening, outcomes. Unsurprisingly then, climate-change loss frames produce more fear than gain frames. As mentioned earlier, according to Bouman et al. (2020) the concepts ‘fear’ and ‘worry’ are conceptually comparable. Therefore, the following hypothesis is formulated:

**H2b:** People who are exposed to the climate change loss-framed video are more likely to have a higher level of climate worry change than people who are exposed to the gain-framed video.

#### *Climate Worry as indirect effect*

Hypotheses H2a and H2b are both parts of the following hypothesis:

**H2:** The change in the individual level of climate worry positively mediates the relationship between climate change video framing and (*the intention to*) pro-environmental behaviour change.

#### **The individual level of Self-efficacy**

Self-efficacy is the belief in one’s ability to successfully organize and perform courses of action and therefore is defined as ‘the belief in an individual’s own capacity to manage and control the courses of action required to handle certain situations in the immediate future

(Sawitri et al., 2015). Self-efficacy can influence the relationship between message framing and behaviour change, as the degree of self-efficacy differs between individuals (Gerhardt & Brown, 2006). The Social Cognitive Theory of human functioning emphasizes the critical role of self-beliefs in human cognition, motivation, and behaviour. According to the theory, personal agency refers to a person's capacity to consciously decide upon, carry out, and control their own course of action in order to achieve desired results. Therefore, self-efficacy holds a prominent role in the personal agency of this theory. Meaning that individuals are not only reactive to external influences, but they are also proactive and able to self-regulate (Sawitri et al., 2015).

*Self-efficacy and (the intention to) pro-environmental behaviour change*

Self-efficacy in the context of environmental psychology refers to a person's belief in their capacity to change the environment for the better. No matter how great the reward is, if individuals aren't capable of performing something, they won't be able to continue if things become challenging (Bandura, 1982; Sawitri et al., 2015). According to the Social Cognitive Theory, people who believe they have a high level of self-efficacy will set more challenging goals, have higher expectations for their actions, and participate in more pro-environmental conduct than people who believe they have a low level of environmental self-efficacy (Sawitri et al., 2015). Therefore, the following hypothesis is formulated:

**H3a:** People who are experiencing a higher level of self-efficacy are more likely to *(have more intention to)* change their pro-environmental behaviour than people who are experiencing a lower level of self-efficacy.

*The type of framing and the level of self-efficacy*

Self-efficacy beliefs have an impact on an individual's development of objectives, actions taken to achieve those goals, persistence in pursuing those goals, and thoughts and feelings felt while carrying out those actions (Bandura, 1982). The study of White et al.

(2011) investigated the influence of self-efficacy to perform skin self-examination on the effects of gain-and-loss-framed messages. This study found that individuals with higher level of self-efficacy, who are presented with a loss-framed message, resulted in higher intention to perform skin self-examination than individuals who are presented with a gain-framed message. For individuals with low self-efficacy, there were no differences between the two types of framing. Thus, for health communication strategies, loss-framed messages are more effective for individuals with high self-efficacy. In addition, another health-promoting study investigated gain and loss framing on the effects of smoking. This study found that individuals with high self-efficacy reported higher levels of motivation to quit smoking after receiving a loss-framed message than a gain-framed message (Riet et al., 2008).

However, a study by Ngo et al. (2022) investigated gain-framed and loss-framed messages on climate change behaviour. These findings show that gain-framed messages are more effective in raising risk perceptions and self-efficacy, with a stronger impact on pro-environmental behaviour, compared to loss-framed messages. To reflect the differential effects of self-efficacy on gain versus loss frames, the following hypothesis is formulated:

**H3b:** People who are exposed to the gain-framed video are more likely to have a higher level of self-efficacy than people who are exposed to the loss-framed video.

*Self-efficacy (indirect effect)*

Hypotheses H3a and H3b are both parts of the following hypothesis:

**H3:** The change in the individual level of self-efficacy positively mediates the relationship between climate change framing videos and (*the intention to*) pro-environmental behaviour change.



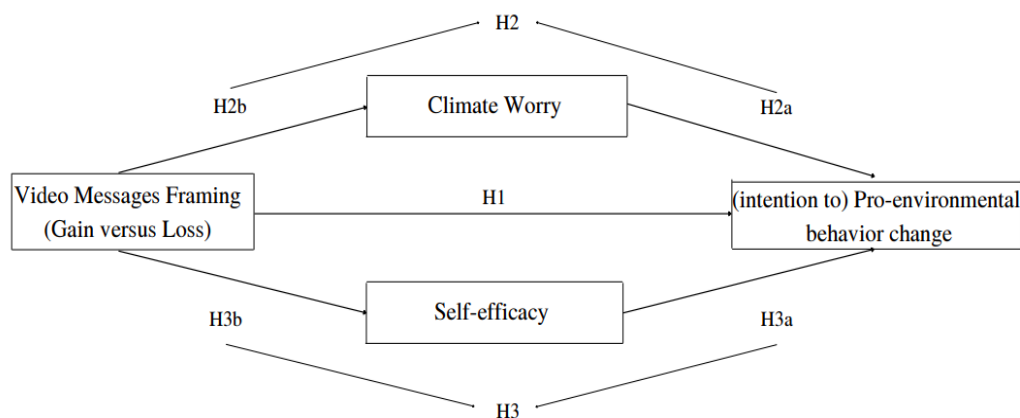
## Method

### Research Design

To test what type of framing (gain versus loss) affects pro-environmental behaviour, and to what extent this relationship is mediated by the change in the individual level of climate worry and self-efficacy, an online experiment with a between-subjects design was conducted. This study contains two dependent variables; the change in pro-environmental behaviour and the intention to change pro-environmental behaviour. The independent variable of this study was the type of message framing, with two levels; gain framing and loss framing. The participant's level of climate worry and their level of self-efficacy were measured as mediators. The design of the study and their respective independent, dependent, and mediator variables, as well as their hypothesis, are summarized in figure 1. Every participant was randomly assigned to one of the two conditions. The two types of message framing (gain versus loss) were manipulated in these conditions.

**Figure 1**

*Conceptual Model Theoretical Framework*



## Participants

Participants for this study were approached through a nonprobability sampling process, employing a combination of a convenience sample and a snowball sample. First, participants from private networks were contacted personally on the channels WhatsApp, LinkedIn, Instagram, and Facebook. Second, the researchers' private networks are being asked to spread the experiment to people from their environment. The online experiment received 116 participants in total. After controlling the dataset, some data was removed because one participant did not consent ( $N=1$ ), and a few participants did not complete the experiment ( $N=12$ ). This resulted in a sample of ( $N=103$ ) participants. No personal data such as name, age, gender, and place of residence were asked in the questionnaire, as data minimization is the norm when collecting personal data.

## Materials

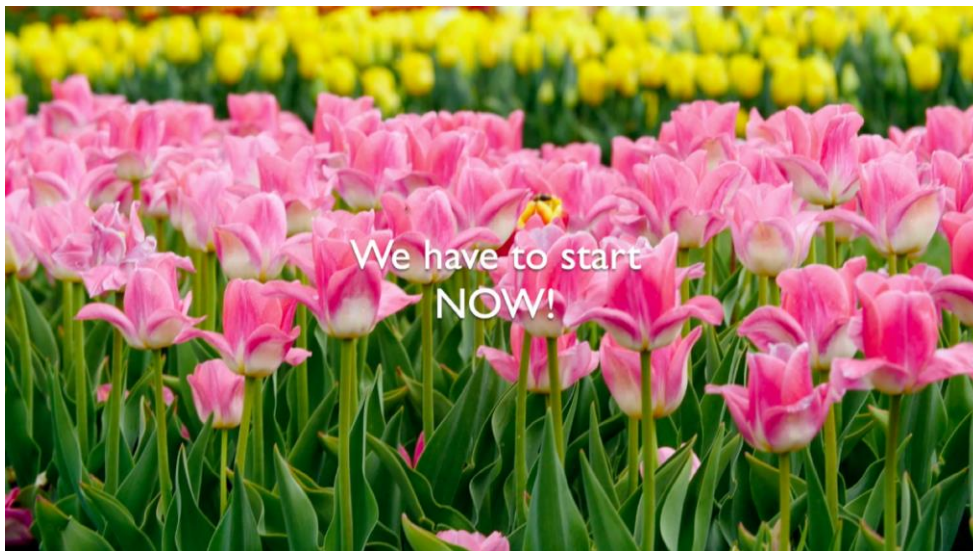
The materials were manipulated in two conditions of the independent variable; type of video message framing (gain framing versus loss framing). In both conditions, participants were provided with a climate change video. The two videos were consistent with the same type of music and duration (1:22 minutes) and were, therefore, both equal. Both videos showed the same fragments of climate change and the way people cause climate change.

### *Gain-framed video*

In the gain-framing condition, the video showed how the environment of the world could change positively when participants changed their ecological imprint in a positive way (*e.g.* “start eating vegan or start traveling by public transport”). In total, nine environmental behaviours were shown in the video, as these behaviours were the most common pro-environmental behaviours (Kaiser & Wilson, 2004). As can be seen in figure 2, the gain framing video ends with: “we have to start now”, which is a positive (gain framed) sentence.

## Figure 2

*Gain framing in climate change Communication (video)*



*Loss-framed video*

In the loss-framing condition, the video showed how the environment of the world could change negatively when participants do not change their ecological imprint (e.g. “*stop eating meat and stop driving your car*”). In total, nine environmental behaviours were shown in the video, as these are the direct opposite of the gain-framed behaviours that are the most common (Kaiser & Wilson, 2004). As can be seen in figure 3, this loss framing video ends with: “we have to stop now”, which is a negative (loss framed) sentence.

## Figure 3

*Loss framing in climate change Communication (video)*



## **Procedure**

The online experiment for this study was designed by Qualtrics. Participants were sampled through the researchers' personal social media channels and their social channels. Additionally, participants were informed about the option to opt-out at any stage of the experiment without negative consequences by providing them with a consent form. For the Qualtrics questionnaire see Appendix D.

In total, 103 participants were randomly assigned to two conditions and equally distributed over the two conditions using randomization in the survey tool Qualtrics. Firstly, participants were asked to fill in their current environmental behaviour using the pro-environmental behaviour (PEB) scale. The PEB scale can be seen in Appendix C. After that, participants were asked to fill in the climate worry and self-efficacy scale, to determine their level of climate worry and self-efficacy before they were exposed to one of the two conditions. The climate worry and self-efficacy scales can be seen in Appendix A and B. To make sure participants were not influenced by the three scales about climate change, the questionnaire provided them with a math riddle. This minimize the bias of the experiment

because participants are thinking about something else for a few seconds while continuing the experiment.

After the math riddle, participants were randomly assigned to one of the two video conditions as they were asked to watch the video fully. Then, the same climate worry and self-efficacy scales were used to determine how the videos affected their level of climate worry and self-efficacy. To measure their change in pro-environmental behaviour, participants were asked to join a community, if they really wanted to make a change at that moment. To measure their intention to change their pro-environmental behaviour, participants were asked to what extent they would change their ecological imprint. Lastly, the purpose of the study was exposed and participants were thanked for their time.

### **Manipulation check**

To ensure that participants interpreted the study's stimuli correctly three manipulation checks were included. First, after being exposed to the stimuli, participants were asked whether they were exposed to a gain-framed video or a loss-framed video (e.g. which video did you see?). Five participants did not perceive the video correctly and therefore were not included in the final dataset. This resulted in a final sample of ( $N = 98$ ) participants. Specifically, ( $N = 43$ ) participants were exposed to the negative-framed video, and ( $N = 55$ ) participants were exposed to the positive-framed video.

Second, to test whether worry has changed after being exposed to the climate change video, a dependent t-test is performed. The data were not normally distributed for the level of climate worry before the video ( $z\text{-score skewness} = 5.67$ ,  $z\text{-score kurtosis} = -.25$ ), and after the video ( $z\text{-score skewness} = -.02$ ,  $z\text{-score kurtosis} = -.33$ ). Therefore, the p-value may not be reliable and more weight should be placed on the bootstrapped 95% confidence interval that will be provided. On average, the level of climate worry before the video ( $M = 2.74$ ,  $SD =$

.91) was lower than the level of climate worry after the video ( $M = 2.92$ ,  $SD = .92$ ). This difference was significant ( $Mdif = -.17$ ,  $t(97) = -3.18$ ,  $p = .002$ ) and generalized to the population (95% CI  $-.289$ ,  $-.074$ ). The difference represents a *small*-sized effect  $d = .19$ . Therefore, it can be confirmed that the individual level of climate worry has increased after being exposed to both climate change videos.

Finally, to test whether the individual level of self-efficacy has changed after being exposed to the climate change video, a dependent t-test is performed. The data were not normally distributed for the level of self-efficacy before the video ( $z\text{-score skewness} = -.59$ ,  $z\text{-score kurtosis} = 6.44$ ), and after being exposed to the video ( $z\text{-score skewness} = -.76$ ,  $z\text{-score kurtosis} = 1.00$ ). Therefore, the p-value may not be reliable and more weight should be placed on the bootstrapped 95% confidence interval that will be provided. On average, the level of self-efficacy before the video ( $M = 4.88$ ,  $SD = 1.22$ ) was lower than the level of self-efficacy after the video ( $M = 5.37$ ,  $SD = 1.16$ ). This difference was significant ( $Mdif = -.49$ ,  $t(97) = -3.99$ ,  $p < .001$ ) and generalized to the population (95% CI  $-.74$ ,  $-.25$ ). The difference represents a *medium*-sized effect  $d = .4$ . Therefore, the manipulations increased the individual level of self-efficacy during the experiment. Both video conditions showed how an individual could change their do ecological imprint (e.g. *stop eating meat*), this could be the explanation for the change in the individual level of self-efficacy after being exposed to one of the two conditions.

## **Instrumentation**

### *The first dependent variable; joining a pro-environmental community*

Individuals' environmental behaviour was the first dependent variable of this study. However, there is no scientific consensus regarding which measurement tool to use for measuring the change in environmental behaviour (Mónus, 2020). It is therefore interesting to

investigate different kinds of pro-environmental measures. In this study, pro-environmental behaviour is measured by observing direct behaviour at the last part of the experiment. This is measured by asking participants to join a pro-environmental community, by providing them with the option to fill out their email (e.g. *“Please leave your email below. You will receive information about what you can do to change your ecological imprint to create a better world. Pay attention! When filling out your email, you will join the Pro-Environmental Community where you will monthly receive information (e.g. how and where to donate), and you can talk to others about climate change and its impact on Earth”*). Joining a community is a long-term behaviour change, and therefore a good and different way to measure pro-environmental behaviour.

#### *The second dependent variable; intention to change pro-environmental behaviour*

Individuals' intention to change their pro-environmental behaviour was the second dependent variable of this study. Because behaviour is very difficult to observe (Mónus, 2020), it is interesting to test the intention to change pro-environmental behaviour (e.g. *How likely are you to change your ecological imprint after watching the video?*) on a 7-point scale (1 = extremely unlikely, 7 = extremely likely).

#### *Mediator variables*

The participant's climate worry was assessed using eight items from the Climate Change Worry Scale (CCWS). Respondents were asked to rate eight statements regarding their worries about climate change (e.g., *“Once I begin to worry about climate change, I find it difficult to stop”*), measured with a 5-point Likert scale (1 = never, and 5 = always). The CCWS has been validated and shown to be a reliable measurement ( $\alpha = .95$ ) and is reproduced in Appendix A.

Secondly, a scale by Zomer et al. (2010) was used to measure respondents' self-efficacy beliefs. It consists of five statements about an individual's belief to address climate change (e.g., "There are simple things I can do that reduce the negative consequences of the climate change") measured with a 7-point Likert response scales (1 = not at all, 7 = very much). The wording of the sentences was slightly changed to correspond with the preceding scales, "climate crisis" to "climate change". The scale proved a reliable measurement in the Zomer et al. (2010) study ( $\alpha=.92$ ) and is shown in Appendix B.

### *Control variable*

The control variable in this study is the pre-existing pro-environmental behaviour of the participants. Because the general pro-environmental behaviour (PEB) scale consisted of forty items, the subscale preservation (PRE) was assessed based on nine different behaviour items (e.g. "I always turn off the light when I do not need it anymore"). The nine scale items are reproduced in Appendix C. Initially, this scale is measured with a 5-point Likert scale (1 = never, 5 = always) (Mónus, 2020). However, each item was recoded into a dichotomous one (yes or no). Original 'often' and 'always' answers were collapsed as positive responses, otherwise solutions 'never', 'seldom', and 'sometimes' were collapsed as negative ones. It was assumed that in the former cases a PEB option is more or less frequently used by the respondent, while in the latter cases the given PEB option is not frequently used by the respondent (Kaiser & Wilson, 2004). In addition, simulation studies have found dichotomized indicator variables to be equally reliable as the original continuous indicators in many situations (Mónus, 2020). The scale provided a reliable measurement ( $\alpha = .80$ ).

## **Results**

This study investigated to what extent message framing (gain versus loss) in climate change communication videos affects (intention to) pro-environmental behaviour change, and



how this is mediated by the change in the individual level of climate worry and the change in the individual level of self-efficacy. First, the difference in participants' pre-existing pro-environmental behaviour between the two conditions was tested because this could influence the outcomes. Secondly, a mediation PROCESS (model 4) analysis has been performed to test whether the change in the individual level of climate worry and the change in the individual level of self-efficacy has an indirect effect on the relationship between climate change video framing and (intention to) pro-environmental behaviour change.

### **Pre-existing pro-environmental behaviour**

First, an independent sample t-test was performed to investigate if participants in both conditions score similarly on their pre-existing pro-environmental behaviour, as this could influence the outcomes. The data were normally distributed for the loss frame condition (*z-score skewness* = -1.44, *z-score kurtosis* = 1.43) but not for the gain frame condition (*z-score skewness* = -.03, *z-score kurtosis* = 4.72). Therefore, the p-value may not be reliable and more weight should be placed on the bootstrapped 95% confidence interval that will be provided. On average, the gain-frame condition ( $M = 3.02$ ,  $SD = .84$ ) reported the same level of current pro-environmental behaviour as the loss-frame condition ( $M = 3.02$ ,  $SD = .10$ ). This difference between both groups was indeed not significant ( $Mdif = -.01$ ,  $t(96) = -.04$ ,  $p = .97$ , BCa 95% CI [-0.27, 0.26]). Therefore, all participants can be considered to have the same pre-existing pro-environmental behaviour prior to the start of the experiment.

### **Mediation analysis for pro-environmental behaviour change**

First, the mediation analysis has been performed for the first dependent variable: pro-environmental behaviour change. This dependent variable was measured with the by asking participants to join a pro-environmental community. As can be seen in table 1, there were no significant direct or indirect effects. It could be that the data for this dependent variable was

too minimal because only 19 participants filled out their email to join the community. Therefore, the current section reports the second dependent variable of this study; the intention to change pro-environmental behaviour. For the entire analysis of the first dependent variable see Appendix D.

**Table 1**

*Mediation Analysis for Pro-Environmental Behaviour Change*

	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Direct effect	.25	.54	.46	.65
Indirect effect Climate Worry	.18	.56	.32	.75
Indirect effect Self-efficacy	.05	.25	.21	.84

### **Mediation analysis for the intention to change pro-environmental behaviour<sup>1</sup>**

To investigate to what extent message framing in climate change communication videos affects the intention to pro-environmental behaviour change, and how is this mediated by the change in the individual level of climate worry and the change in the individual level of self-efficacy, a mediation analysis (Model 4) was performed using the PROCESS tool (Hayes, 2017). The outcome variable for the analysis was the intention to change pro-environmental behaviour. The predictor variable for the analysis was climate change video framing. The mediator variables for the analysis were the individual level of climate worry and the individual level of self-efficacy. Before the analysis was performed, there were several assumptions had to be checked, for the assumptions see Appendix F.

<sup>1</sup> The current section only reports the intention to change PEB

### *The direct effect of message framing on intention to change PEB*

There was no significant direct effect of the type of climate change video framing on the intention to change pro-environmental behaviour,  $b = 0.08$ , 95% BCa CI  $[-.42, .57]$ ,  $t = .30$ ,  $p = .76$ . This means that there is no direct relationship between the two types of climate change video framing on the intention to change pro-environmental behaviour. Thus, the type of video framing (gain or loss) does not affect the intention to change pro-environmental behaviour. Therefore, hypothesis 1 is not supported.

### **Climate worry as a mediator**

#### *The relationship between video message framing and climate worry*

There was a relationship between video message framing and the individual level of climate worry, as this relationship was significant  $b = 0.24$ , 95% BCa CI  $[.02, .45]$ ,  $t = 2.18$ ,  $p = .03$ . This means that video message framing significantly predicts the individual level of climate worry. More specifically, to test what type of message framing (gain versus loss) influences the level of climate worry, an independent t-test was performed. The individual level of climate worry in the gain-framed condition ( $M = .07$ ,  $SD = 0.37$ ) was lower compared to the loss-framed condition ( $M = .31$ ,  $SD = 0.68$ ). Additionally, this difference was significant, ( $F(-2.2,96) = 3.6$ ,  $p = .06$ ). This means that people who were exposed to the loss-framed condition have a higher level of climate worry than people who were exposed to the gain-framed condition. Therefore, hypothesis 2b is supported.

#### *The relationship between climate worry and (intention to) PEB*

In addition, there was a relationship between the individual level of climate worry and the intention to change pro-environmental behaviour, as this relationship was significant  $b = .70$ , 95% BCa CI  $[.15, 1.24]$ ,  $t = .30$ ,  $p = .01$ . Adding that the individual level of climate worry resulted in a 23,3% change in the intention to change pro-environmental behaviour

( $R^2_{change} = 0.233$ ). This means that people who are experiencing a higher level of climate worry have more intention to change their pro-environmental behaviour than people who are experiencing a lower level of climate worry. Therefore, hypothesis 2a is supported.

*The indirect effect of video message framing on (intention to) PEB via climate worry*

Hypothesis 2a and 2b were both significant parts of the mediation process. The total effect of the individual level of climate worry is .17. This means that the change in the individual level of climate worry positively mediates the relationship between climate change framing videos and the intention to change pro-environmental behaviour. Thus, the change in the individual level of climate worry mediates the relationship between message video framing and the intention to change pro-environmental behaviour. Therefore, hypothesis 2 is supported.

### **Self-efficacy as a mediator**

*The relationship between video message framing and self-efficacy*

There was no relationship between the type of message framing on the individual level of self-efficacy, as this relationship was not significant  $b = .16$ , 95% CI  $[-.33, 0.66]$ ,  $t = .66$ ,  $p = .51$ . This means that people who are exposed to a climate change gain-framed video are not more likely to have a higher self-efficacy than people who are exposed to the loss-framed video. Thus, there is no difference in the level of self-efficacy between the loss or gain-framed conditions. Therefore, hypothesis 3b is not supported.

*The relationship between self-efficacy and (intention to) PEB*

Interestingly, the relationship between the individual level of self-efficacy and the intention to change pro-environmental behaviour was significant  $b = 0.29$ , 95% CI  $[.01, 0.53]$ ,  $t = .10$ ,  $p = .02$ . This means that people who are experiencing a higher level of self-efficacy have more intention to change their pro-environmental behaviour than people who

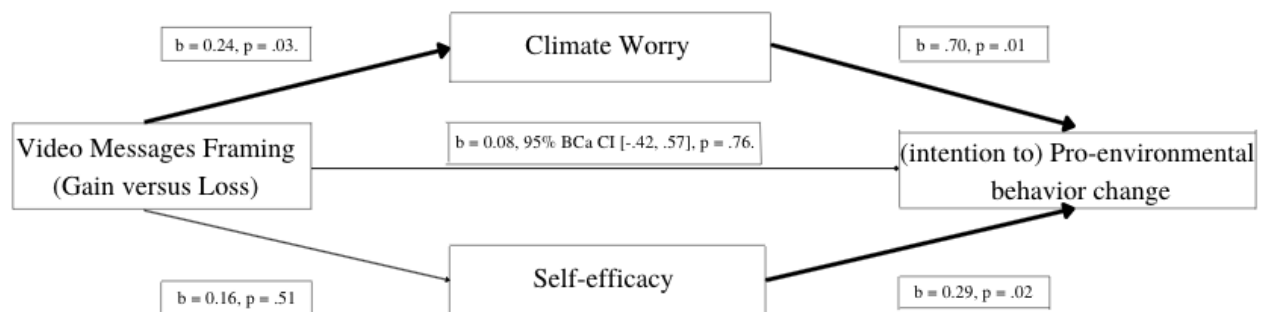
are experiencing a lower level of self-efficacy. Thus, the individual level of self-efficacy positively predicts the intention to change pro-environmental behaviour. Therefore, hypothesis 3a is supported.

*The indirect effect of video message framing on PEB via climate worry*

Hypothesis 3a and 3b were both parts of the mediation process. However, only hypothesis 3a was supported. Thus, there is no mediation of climate change framing videos and the intention to pro-environmental behaviour change via self-efficacy. Therefore, hypothesis 3 is not supported. Figure 2 shows the conceptual model including statistics.

**Figure 2**

*Conceptual Model Including Statistics*



## Discussion

This study aimed to investigate the effect of video message framing (gain versus loss) on the intention to change pro-environmental behaviour, and how this is mediated by the individual level of climate worry and self-efficacy. The results indicate that there is no direct effect between video message framing on the intention to change pro-environmental behaviour. However, this relationship only exists when it is mediated by the change in the individual level of climate worry. Additionally, it was found that the loss-framed climate change video leads to a higher level of climate worry than the gain-framed climate change

video. More specifically, a higher level of climate worry positively predicts the intention too pro-environmental behaviour change. Thus, the individual level of climate worry positively mediates the relationship between message framing and the intention too pro-environmental behaviour change.

Additionally, it was found that the individual level of self-efficacy does not mediate the relationship between video message framing and pro-environmental behaviour change, as there was no relationship between the type of message framing and the individual level of self-efficacy. Interestingly, it was found that a higher level of self-efficacy positively predicts the intention to change pro-environmental behaviour compared to a lower level of self-efficacy. Figure 2 shows the conceptual model with statistics. The current section begins with a discussion of the results in the context of previous literature, which ends with the limitations of this study and recommendations for further research.

### **Theoretical implications**

Even though the most widely used message framing in health and consumer behaviour change communication is gain versus loss framing (Ngo et al., 2022), the idea has not been effectively utilized in climate change communication (Meijers et al., 2018; White et al., 2011). The current study is the first that applied video message framing (gain versus loss) to climate change communication. However, the study showed that there is no direct effect between the type of video framing (gain versus loss) on the intention to change pro-environmental behaviour. This means that there is no relationship between message framing and the intention to change pro-environmental behaviour. This finding is not in line with the expectation, whereby the gain-framed climate change video was found to have a higher intention to change pro-environmental behaviour than the loss-framed climate change video.

#### *Mediation of climate worry*

Worry about climate change as the main predictor of climate change mitigation behaviour was already suggested by Linden et al. (2019). However, these findings did not take into account the possibility that worry can also encourage individuals to take more specialized efforts to mitigate climate change. The current study contributes to this gap by investigating the individual level of climate worry. Interestingly, this study shows that there is a relationship between climate change message framing and the individual level of climate worry. Several findings in previous research may offer some insight into why the individual level of climate worry was higher for the loss-framed condition than for the gain-framed condition. Messages with loss frames prevent a number of potentially dangerous and negative outcomes and, as a result, are more fear-based than gain-framed messages (Bouman et al., 2020). The results highlight the applicability of loss-framed videos and add to the body of research proving the effectiveness of the technique in communicating about climate change.

In the field of health communication, there are studies that investigated the effect of worry on an individual's behaviour (Freeston et al., 1994; Sobkow et al., 2020), which found that the individual level of worry predicted the intentions toward preventive behaviour. First, individuals think that worrying can stop bad things from happening, decrease the consequences of negative things by lessening guilt, reduce disappointment, or distract people from worrying about the worst-case possibilities. Second, individuals believe that worrying has benefits like helping them come up with new ideas (Freeston et al., 1994). This is in line with the findings of the current study, which showed that people who are experiencing a higher level of climate worry have more intention to change their pro-environmental behaviour than people who are experiencing a lower level of climate worry.

Thus, this current study shows that climate worry positively mediates the relationship between climate change video framing and the intention too pro-environmental behaviour

change. More specifically, loss-framed climate change videos lead to higher levels of climate worry, which in turn would yield higher intentions to change pro-environmental behaviour.

#### *Mediation of self-efficacy*

The current study shows that there is no relationship between the type of video framing on the individual level of self-efficacy. This is not in line with previous research, which stated that gain-framed messages are more effective in raising risk perceptions and self-efficacy, with a stronger impact on pro-environmental behaviour, compared to loss-framed messages (Ngo et al., 2022). However, the current study did show that after being exposed to one of the two conditions, the individual level of self-efficacy increased. Therefore, it could be that people who are being exposed to any kind of climate change video will have a higher level of self-efficacy than before being exposed to the video.

However, the current study showed that the individual level of self-efficacy cannot explain the relationship between the type of video framing on the intention to change pro-environmental behaviour. This finding is not in line with the expectation based on which a gain-framed video would trigger a higher level of self-efficacy, which in turn would yield higher intentions to change pro-environmental behaviour. However, interestingly, the current study shows that people with a higher level of self-efficacy lead to more intention to change pro-environmental behaviour. This is in line with the Social Cognitive Theory, this theory explained that individuals who have a higher level of environmental self-efficacy will set more difficult goals, hold themselves to higher standards, and engage in more pro-environmental behaviour than those who have a lower level of environmental self-efficacy (Sawitri et al., 2015). This finding contributes to environmental communication as this self-efficacy finding has not been yet discovered in the field of climate change communication.



## **Limitations and Suggestions for Future Research**

The current study has some interesting findings, however, this study also has some limitations. Firstly, it would be better to include more participants in the future. Even though the sample size was acceptable, it has only been validated by the researcher's environment. Therefore, it could be interesting to conduct the same study with more participants in the future. Moreover, as mentioned earlier, this study focuses on nine pro-environmental acts (e.g. taking public transport, and eating less meat). The current study used the same message frames for different types of pro-environmental acts, and thus, future research could consider using different types of message framing for different types of pro-environmental acts (e.g. only recycling) or adding more types of pro-environmental behaviours to test the generalizability of the findings.

Moreover, the current study focused on the intention to change pro-environmental behaviour and pro-environmental behaviour change with joining a community, which were the two dependent variables of this study. First, the measurement for the intention to change pro-environmental behaviour was not reliable, as the scale only consisted of one item. Therefore, future studies can conduct the same experiment with a reliable scale to measure the intention to change pro-environmental behaviour. Second, the findings of the pro-environmental behaviours were not reliable, because the sample size was too small and the measurement was too difficult to observe. Additionally, Therefore, future studies can conduct some field experiments to observe the impact of climate change video framing on the individual's pro-environmental change (e.g. field observations or a diary study). More specifically, observing people's behaviour is the best way to measure behaviour change, however, there are also limitations to those measurements that have to be considered (Lange & Dewitte, 2019).

Lastly, this study can conclude that the level of self-efficacy and the level of climate worry have increased after being exposed to a climate change video, however, future research could investigate different types of climate change videos that create a higher level of self-efficacy and a higher level of climate worry.

### **Conclusion**

This research aimed to identify the effect of gain and loss message framing on individuals' intention to change their pro-environmental behaviour. Based on a quantitative analysis, it can be concluded that there is no direct effect of the type of video framing on the intention to change pro-environmental behaviour. However, loss-framed climate change videos lead to higher levels of climate worry, which in turn would yield higher intentions to change pro-environmental behaviour. Meaning that climate worry positively mediates the relationship between climate change video framing and the intention to change pro-environmental behaviour. Additionally, it was found that self-efficacy does not mediate the relationship between the type of video framing on the intention to change pro-environmental behaviour. Interestingly, it was found that higher levels of self-efficacy lead to higher intentions to change pro-environmental behaviour. This is the first study that applied gain versus loss framing in a video format and in climate change-related communication. Therefore, this study provides answers to certain open-ended concerns about the effects of framing on the intention to change pro-environmental behaviour and the role of climate worry and self-efficacy. Given these significant results, future research should investigate what type of video leads to higher individual levels of self-efficacy and climate worry, which yield to higher intentions to change pro-environmental behaviour.

## References

- Arthur, D., & Quester, P. (2004). Who's afraid of that ad? Applying segmentation to the protection motivation model. *Psychology and Marketing*, 21(9), 671–696.  
<https://doi.org/10.1002/mar.20024>
- Ajzen, I. & Fishbein, M. (1977). Attitude-behaviour relations: A theoretical analysis and review of empirical research. *Psychological Bulletin*, 84(5), 888–918.  
<https://doi.org/10.1037/0033-2909.84.5.888>
- Balundė, A., Perlaviciute, G., & Steg, L. (2019). The Relationship Between People's Environmental Considerations and Pro-environmental Behavior in Lithuania. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.02319>
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37(2), 122–147. <https://doi.org/10.1037/0003-066x.37.2.122>
- Banks, S. M., Salovey, P., Greener, S., Rothman, A. J., Moyer, A., Beauvais, J. & Epel, E. (1995). The effects of message framing on mammography utilization. *Health Psychology*, 14(2), 178–184. <https://doi.org/10.1037/0278-6133.14.2.178>
- Bonniface, L. & Henley, N. (2008). 'A drop in the bucket': Collective efficacy perceptions and environmental behaviour. *Australian Journal of Social Issues*, 43(3), 345–358.  
<https://doi.org/10.1002/j.1839-4655.2008.tb00107.x>
- Bouman, T., Verschoor, M., Albers, C. J., Böhm, G., Fisher, S. D., Poortinga, W., Whitmarsh, L. & Steg, L. (2020). When worry about climate change leads to climate action: How values, worry, and personal responsibility relate to various climate actions. *Global Environmental Change*, 62, 102061.  
<https://doi.org/10.1016/j.gloenvcha.2020.102061>

- Brügger, A., Dessai, S., Devine-Wright, P., Morton, T. A., & Pidgeon, N. F. (2015). Psychological responses to the proximity of climate change. *Nature Climate Change*, 5(12), 1031–1037. <https://doi.org/10.1038/nclimate2760>
- Byerly, H., Balmford, A., Ferraro, P. J., Hammond Wagner, C., Palchak, E., Polasky, S., Ricketts, T. H., Schwartz, A. J., & Fisher, B. (2018). Nudging pro- environmental behavior: evidence and opportunities. *Frontiers in Ecology and the Environment*, 16(3), 159–168. <https://doi.org/10.1002/fee.1777>
- Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., & Upham, P. (2014). International trends in public perceptions of climate change over the past quarter century. *WIREs Climate Change*, 6(1), 35–61. <https://doi.org/10.1002/wcc.321>
- Cheng, T., Woon, D. K., & Lynes, J. K. (2011). The Use of Message Framing in the Promotion of Environmentally Sustainable Behaviors. *Social Marketing Quarterly*, 17(2), 48–62. <https://doi.org/10.1080/15245004.2011.570859>
- Cianconi, P., Betrò, S., & Janiri, L. (2020, March 6). The Impact of Climate Change on Mental Health: A Systematic Descriptive Review. *Frontiers in Psychiatry*, 11. <https://doi.org/10.3389/fpsy.2020.00074>
- Edwards, G., Elwyn G., Covey, J., Matthews, E., & Pill, R. (2001). Presenting Risk Information A Review of the Effects of Framing and other Manipulations on Patient Outcomes. *Journal of Health Communication*, 6(1), 61–82. <https://doi.org/10.1080/10810730150501413>
- Evensen, D., Demski, C., Becker, S. & Pidgeon, N. (2018). The relationship between justice and acceptance of energy transition costs in the UK. *Applied Energy*, 222, 451–459. <https://doi.org/10.1016/j.apenergy.2018.03.165>

- Fagan, M., & Huang, C. (2020, July 27). A look at how people around the world view climate change. *Pew Research Center*. <https://www.pewresearch.org/fact-tank/2019/04/18/a-look-at-how-people-around-the-world-view-climate-change/>
- Fernandez, M., Piccolo, L. S. G., Maynard, D., Wippoo, M., Meili, C. & Alani, H. (2016). Talking about climate change via social media. *Proceedings of the 8th ACM Conference on Web Science*. <https://doi.org/10.1145/2908131.2908167>
- Fisher, S. A., & Mandel, D. R. (2021). Risky-choice framing and rational decision-making. *Philosophy Compass*, 16(8). <https://doi.org/10.1111/phc3.12763>
- Freeston, M. H., Rhéaume, J., Letarte, H., Dugas, M. J., & Ladouceur, R. (1994). Why do people worry? *Personality and Individual Differences*, 17(6), 791–802. [https://doi.org/10.1016/0191-8869\(94\)90048-5](https://doi.org/10.1016/0191-8869(94)90048-5)
- Gallagher, K. M., & Updegraff, J. A. (2011). Health Message Framing Effects on Attitudes, Intentions, and Behavior: A Meta-Analytic Review. *Annals of Behavioral Medicine*, 43(1), 101–116. <https://doi.org/10.1007/s12160-011-9308-7>
- Gerhardt, M. W., & Brown, K. G. (2006). Individual differences in self-efficacy development: The effects of goal orientation and affectivity. *Learning and Individual Differences*, 16(1), 43–59. <https://doi.org/10.1016/j.lindif.2005.06.006>
- Haines, A., Kovats, R., Campbell-Lendrum, D., & Corvalan, C. (2006). Climate change and human health: Impacts, vulnerability and public health. *Public Health*, 120(7), 585–596. <https://doi.org/10.1016/j.puhe.2006.01.002>
- Hart, P. S., & Feldman, L. (2016). The Influence of Climate Change Efficacy Messages and Efficacy Beliefs on Intended Political Participation. *PLOS ONE*, 11(8), e0157658. <https://doi.org/10.1371/journal.pone.0157658>

- Hayes, A. F. (2017). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. *Guilford publications*.
- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., Wray, B., Mellor, C., & van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. *The Lancet Planetary Health*, 5(12), e863–e873.  
[https://doi.org/10.1016/s2542-5196\(21\)00278-3](https://doi.org/10.1016/s2542-5196(21)00278-3)
- Hornsey, M. J., Harris, E. A., Bain, P. G. & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change*, 6(6), 622–626. <https://doi.org/10.1038/nclimate2943>
- Kaiser, F. G., & Wilson, M. (2004). Goal-directed conservation behavior: the specific composition of a general performance. *Personality and Individual Differences*, 36(7), 1531–1544. <https://doi.org/10.1016/j.paid.2003.06.003>
- Kennedy, E.H., Beckley, T. M., Mearns, B. L., and Nadeau, S. (2009). Why we don't "walk the talk": understanding the environmental values/behavior gap in Canada. *Hum. Ecol. Rev.* 16 (2), 151-160.
- Kollmuss, A., & Agyeman, J. (2002, August). Mind the Gap: Why do people act environmentally and what are the barriers too pro-environmental behaviour? *Environmental Education Research*, 8(3), 239–260.  
<https://doi.org/10.1080/13504620220145401>
- Lange, F., & Dewitte, S. (2019). Measuring pro-environmental behaviour: Review and recommendations. *Journal of Environmental Psychology*, 63, 92–100.  
<https://doi.org/10.1016/j.jenvp.2019.04.009>

Linden, V. S. der. (2017, April 16). Determinants and Measurement of Climate Change Risk Perception, Worry, and Concern.

[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2953631](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2953631)

Linden, V. S. der, Leiserowitz, A. & Maibach, E. (2019). The gateway belief model: A large-scale replication. *Journal of Environmental Psychology*, 62, 49–58.

<https://doi.org/10.1016/j.jenvp.2019.01.009>

Loewenstein, G. F., Weber, E. U., Hsee, C. K. & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127(2), 267–286.

<https://doi.org/10.1037/0033-2909.127.2.267>

Lorenzoni, I., Pidgeon, N.F. (2006). Public Views on Climate Change: European and USA Perspectives. *Climatic Change* 77, 73–95.

<https://doi.org/10.1007/s10584-006-9072-z>

Mah, A. Y., Chapman, D. A., Markowitz, E. M., & Lickel, B. (2020). Coping with climate change: Three insights for research, intervention, and communication to promote adaptive coping to climate change. *Journal of Anxiety Disorders*, 75, 102282.

<https://doi.org/10.1016/j.janxdis.2020.102282>

Maran, D. A., & Begotti, T. (2021). Media Exposure to Climate Change, Anxiety, and Efficacy Beliefs in a Sample of Italian University Students. *International Journal of Environmental Research and Public Health*, 18(17), 9358.

<https://doi.org/10.3390/ijerph18179358>

Martino, B., Kumaran, D., Seymour, B., & Dolan, R. J. (2006). Frames, Biases, and Rational Decision-Making in the Human Brain. *Science*, 313(5787), 684–687.

<https://doi.org/10.1126/science.1128356>

- Meijers, M. H. C., Remmelswaal, P. & Wonneberger, A. (2018). Using Visual Impact Metaphors to Stimulate Environmentally Friendly Behavior: The Roles of Response Efficacy and Evaluative Persuasion Knowledge. *Environmental Communication*, 13(8), 995–1008. <https://doi.org/10.1080/17524032.2018.1544160>
- Mónus, F. (2020). Environmental perceptions and pro-environmental behavior comparing different measuring approaches. *Environmental Education Research*, 27(1), 132–156. <https://doi.org/10.1080/13504622.2020.1842332>
- Moser, S. C. (2016). Reflections on climate change communication research and practice in the second decade of the 21st century: what more is there to say? *WIREs Climate Change*, 7(3), 345–369. <https://doi.org/10.1002/wcc.403>
- Ngo, C. C., Poortvliet, P. M., & Klerkx, L. (2022). The persuasiveness of gain vs. loss-framed messages on farmers' perceptions and decisions to climate change: A case study in coastal communities of Vietnam. *Climate Risk Management*, 35, 100409. <https://doi.org/10.1016/j.crm.2022.100409>
- Passarelli, R., Michel, D., & Durch, W. (2018). From “Inconvenient Truth” to Effective Governance. *Oxford Scholarship Online*. <https://doi.org/10.1093/oso/9780198805373.003.0008>
- Ricci, M., Bellaby, P. & Flynn, R. (2010). Engaging the public on paths to sustainable energy: Who has to trust whom? *Energy Policy*, 38(6), 2633–2640. <https://doi.org/10.1016/j.enpol.2009.05.038>
- Riet, J. V. T., Ruiter, R. A., Werrij, M. Q., & de Vries, H. (2008). The influence of self-efficacy on the effects of framed health messages. *European Journal of Social Psychology*, 38(5), 800–809. <https://doi.org/10.1002/ejsp.496>



- Roeser, S. (2012). Risk Communication, Public Engagement, and Climate Change: A Role for Emotions. *Risk Analysis*, 32(6), 1033–1040. <https://doi.org/10.1111/j.1539-6924.2012.01812.x>
- Rothman, A. J., Bartels, R. D., Wlaschin, J. & Salovey, P. (2006). The Strategic Use of Gain- and Loss-Framed Messages to Promote Healthy Behavior: How Theory Can Inform Practice. *Journal of Communication*, 56(suppl\_1), S202–S220. <https://doi.org/10.1111/j.1460-2466.2006.00290.x>
- Russill, C. (2008). Tipping Point Forewarnings in Climate Change Communication: Some Implications of an Emerging Trend. *Environmental Communication*, 2(2), 133–153. <https://doi.org/10.1080/17524030802141711>
- Sawitri, D. R., Hadiyanto, H., & Hadi, S. P. (2015). Pro-environmental Behavior from a Social Cognitive Theory Perspective. *Procedia Environmental Sciences*, 23, 27–33. <https://doi.org/10.1016/j.proenv.2015.01.005>
- Schwartz, S. H. (1977). Normative Influences on Altruism. *Advances in Experimental Social Psychology*, 221–279. [https://doi.org/10.1016/s0065-2601\(08\)60358-5](https://doi.org/10.1016/s0065-2601(08)60358-5)
- Shafiei, A., & Maleksaeidi, H. (2020). Pro-environmental behavior of university students: Application of protection motivation theory. *Global Ecology and Conservation*, 22, e00908. <https://doi.org/10.1016/j.gecco.2020.e00908>
- Smith, N. & Leiserowitz, A. (2013). The Role of Emotion in Global Warming Policy Support and Opposition. *Risk Analysis*, 34(5), 937–948. <https://doi.org/10.1111/risa.12140>
- Sobkow, A., Zaleskiewicz, T., Petrova, D., Garcia-Retamero, R., & Traczyk, J. (2020). Worry, Risk Perception, and Controllability Predict Intentions Toward COVID-19 Preventive Behaviors. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.582720>

- Soliman, M., Alisat, S., Bashir, N. Y., & Wilson, A. E. (2018). Wrinkles in Time and Drops in the Bucket: Circumventing Temporal and Social Barriers to Pro-Environmental Behavior. *SAGE open*, 8(2), <https://doi.org/10.1177/2158244018774826>
- Spence, A. & Pidgeon, N. (2010). Framing and communicating climate change: The effects of distance and outcome frame manipulations. *Global Environmental Change*, 20(4), 656–667. <https://doi.org/10.1016/j.gloenvcha.2010.07.002>
- Stern, P. C. (1999). Information, Incentives, and Pro-Environmental Consumer Behavior. *Journal of Consumer Policy*, 22(4), 461–478. <https://doi.org/10.1023/a:1006211709570>
- IPCC, (2014, January): Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Tuong, W., Larsen, E. R., & Armstrong, A. W. (2012). Videos to influence: a systematic review of the effectiveness of video-based education in modifying health behaviors. *Journal of Behavioral Medicine*, 37(2), 218–233. <https://doi.org/10.1007/s10865-012-9480-7>
- Tversky, A. & Kahneman, D. (1981). The Framing of Decisions and the Psychology of Choice. *Science*, 211(4481), 453–458. <https://doi.org/10.1126/science.7455683>
- White, K., Macdonnell, R., & Dahl, D. W. (2011). It's the Mind-Set that Matters: The Role of Construal Level and Message Framing in Influencing Consumer Efficacy and

Conservation Behaviors. *Journal of Marketing Research*, 48(3), 472–485.

<https://doi.org/10.1509/jmkr.48.3.472>

Williams, K., & Dair, C. (2007). A framework of sustainable behaviors that can be enabled through the design of neighborhood-scale developments. *Sustainable Development*, 15(3), 160–173. <https://doi.org/10.1002/sd.311>

Williamson, K., Satre-Meloy, A., Velasco, K., & Green, K., (2018). Climate Change Needs Behavior Change: Making the Case For Behavioral Solutions to Reduce Global Warming. Arlington, VA: Rare.

Wilson, D. K., Purdon, S. E. & Wallston, K. A. (1988). Compliance to health recommendations: a theoretical overview of message framing. *Health Education Research*, 3(2), 161–171. <https://doi.org/10.1093/her/3.2.161>

Wood, R., & Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *Journal of Personality and Social Psychology*, 56(3), 407–415. <https://doi.org/10.1037/0022-3514.56.3.407>

Zomeran, M., Spears, R., & Leach, C. W. (2010, December). Experimental evidence for a dual pathway model analysis of coping with the climate crisis. *Journal of Environmental Psychology*, 30(4), 339–346.  
<https://doi.org/10.1016/j.jenvp.2010.02.006>

### **Appendix A: Climate worry scale**

Read each statement and indicate how frequently each statement applies to you. Respond in terms of how you generally feel. There are no right or wrong answers. Measured with a 5-point Likert scale (1 = Never, 5 = Always).

- 1) I worry about climate change more than other people.
- 2) Thoughts about climate change cause me to have worries about what the future may hold.
- 3) I tend to seek out information about climate change in the media (e.g., TV, newspapers, Internet).
- 4) I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.
- 5) I worry that outbreaks of severe weather may be the result of a changing climate.
- 6) I notice that I have been worrying about climate change.
- 7) Once I begin to worry about climate change, I find it difficult to stop.
- 8) I worry about how climate change may affect the people I care about.

## **Appendix B: Self-efficacy Scale**

Please indicate to what extent you agree or disagree with each of the following statements.

All measures applied 7-point Likert scale response scales (1 = not at all, 7 = very much).

- 1) There are simple things I can do that reduce the negative consequences of climate change.
- 2) I can change my daily routines to combat climate change.
- 3) There are things I can do that can make a difference in reducing the negative consequences of climate change.
- 4) My individual actions will contribute to a solution to climate change.
- 5) Changes in my daily routines will contribute to reducing the negative consequences of climate change

**Appendix C: PEB scale items**

- 1) I would help raise money to protect nature
- 2) If I ever have extra money, I will give some to help protect nature
- 3) I try to tell others that nature is important
- 4) I like to go on trips to places like forests away from cities
- 5) I would like to sit by a pond and watch dragonflies
- 6) I like the quiet of nature
- 7) To save energy in the winter, I make sure the heat in my room is not on too high
- 8) I always turn off the light when I do not need it anymore
- 9) I try to save water by turning off the water when I brush my teeth

## **Appendix D: Online experiment**

Dear participant,

I appreciate your interest in participating in this study. My name is Julia van den Bout and I am doing my master's degree at the University of Tilburg. Please read the information about this study carefully and indicate if you agree.

The purpose of this study is to explore the effect of communication on pro-environmental behaviour. There is a lot of research available about climate change, but how this should be communicated needs to be further examined.

Within this experiment, you will be presented with a climate change video. Please make sure you are making this questionnaire on your phone, only then you can see the video on full screen. Before you are exposed to the video, you will be asked about your current environmental behaviour, which will serve as input for the study. Besides, your level of climate worry and level of self-efficacy (= zelfeffectiviteit) is tested, using a number of items. The questions concern your behaviour and opinion, which means that there are no right or wrong answers.

The questionnaire should take around 10 to 15 minutes to complete. The data will be used for research purposes only. Participants remain completely anonymous during the data collection and data analysis. Therefore, there is no need to fill in your name and gender. All gathered data would be stored confidentially under GDPR guidelines (General Data Protection Regulations). Participation in this study is entirely voluntary, and no valid reason must be given in order to participate. Participants have the right to withdraw from the experiment at any time, due to any reason. If you have any further questions concerning the study or would like additional information, please consult Julia van den Bout in the email below:

[j.j.j.vdnbout@tilburguniversity.edu](mailto:j.j.j.vdnbout@tilburguniversity.edu)

By checking “I consent”, I acknowledge the following statements:

- I am 18 years or older.
- I have read the information letter about the study.
- I know that participation in this study is voluntary.
- I can withdraw from the study at any time, for any reason, without it having any consequences
- ☐ I do consent
- ☐ I do not consent

**Q1** Please indicate to what extent your own behaviour is pro-environmental (= behaviours in which you take protective actions toward the environment)

Never - almost never - occasionally - almost every time - every time

**Q2** Please indicate if the following nine behaviours apply to you. Fill in with “yes” or “no”.

- 1) I would help raise money to protect nature
- 2) If I ever have extra money, I will give some to help protect nature
- 3) I try to tell others that nature is important
- 4) I like to go on trips to places like forests away from cities
- 5) I would like to sit by a pond and watch dragonflies
- 6) I like the quiet of nature
- 7) To save energy in the winter, I make sure the heat in my room is not on too high
- 8) I always turn off the light when I do not need it anymore
- 9) I try to save water by turning off the water when I brush my teeth

**Q3** Now, your feelings towards climate change will be questioned. Read each statement carefully and indicate how frequently each statement applies to you. Respond in terms of how you generally feel. There are no right or wrong answers.

- 1) I worry about climate change more than other people.
- 2) Thoughts about climate change cause me to have worries about what the future may hold.



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

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

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

6) I notice that I have been worrying about climate change.

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

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

Measured with a 5-point Likert scale (1 = Never, 5 = Always).

**Q4** The following questions are about your own ability to successfully organize and perform courses of action. Please indicate to what extent you agree or disagree with each of the following statements. Respond in terms of how you generally feel. There are no right or wrong answers.

1) There are simple things I can do that reduce the negative consequences of climate change.

2) I can change my daily routines to combat climate change.

3) There are things I can do that can make a difference in reducing the negative consequences of climate change.

4) My individual actions will contribute to a solution to climate change.

5) Changes in my daily routines will contribute to reducing the negative consequences of the climate crisis

All measures applied 7-point Likert scale response scales (1 = not at all, 7 = very much).

**Q5** It is almost time to see the video! But first, you will have to do a math riddle. This math riddle indicates which video you will be exposed to. So take your time to answer it.

Which number belongs on the question mark?

$1 + 4 = 5$ ,  $2 + 5 = 12$ ,  $3 + 6 = 21$ ,  $8 + 11 = ?$

- a) 40
- b) 96
- c) 51
- d) 19

The right answers were A and B! On the next page, you will find the video based on your answer.

Randomizer: positive or negative video

**Q6** Next up is the video. Please watch it carefully till the end. Make sure you watch the video in full screen and with the sound on.

**Q7** Now that you have watched the video, please indicate your feelings towards climate change. Read each statement carefully and indicate how frequently each statement applies to you. Respond in terms of how you generally feel. There are no right or wrong answers.

- 1) I worry about climate change more than other people.
- 2) Thoughts about climate change cause me to have worries about what the future may hold.
- 3) I tend to seek out information about climate change in the media (e.g., TV, newspapers, Internet).
- 4) I tend to worry when I hear about climate change, even when the effects of climate change may be some time away.
- 5) I worry that outbreaks of severe weather may be the result of a changing climate.
- 6) I notice that I have been worrying about climate change.
- 7) Once I begin to worry about climate change, I find it difficult to stop.
- 8) I worry about how climate change may affect the people I care about.

Measured with a 5-point Likert scale (1 = Never, 5 = Always).

**Q8** After watching the video, indicate these statements about your own ability to successfully organize and perform courses of action. Please indicate to what extent you agree or disagree

with each of the following statements. Respond in terms of how you generally feel. There are no right or wrong answers.

- 1) There are simple things I can do that reduce the negative consequences of climate change.
- 2) I can change my daily routines to combat climate change.
- 3) There are things I can do that can make a difference in reducing the negative consequences of climate change.
- 4) My individual actions will contribute to a solution to climate change.
- 5) Changes in my daily routines will contribute to reducing the negative consequences of climate change

All measures applied a 7-point Likert scale response scale (1 = not at all, 7 = very much).

**Q9** How likely are you to change your ecological imprint after watching this video?

**Q10** Do you really want to make a change right now?

Please leave your email below.

You will receive information about what you can do to change your ecological imprint to create a better world.

Pay attention! When filling out your email, you will join the Pro-Environmental Community where you will monthly receive information (e.g. how and where to donate), and you can talk to others about climate change and its impact on Earth.

**Q11** Thanks for answering the questions and watching the video. To ensure which video you have seen during this experiment, I am curious about the following:

Which video did you see?

- a) positive video
- b) negative video

This is the end of this experiment. Thanks again for participating! As you may have noticed, this study is about the type of climate change communication and its effect on pro-

environmental behaviour. It could be that you have seen a positive (gain-frame) video or a negative (loss-frame) video about climate change and its individual impact on Earth. While the gain-frame video focuses on the positive outcome of behaviour, the loss-frame video focuses on the loss of not adopting that behaviour.

## **Appendix E: Mediation Analysis for the first dependent variable**

To investigate to what extent message framing in climate change communication videos affects pro-environmental behaviour change, and how is this mediated by the change in the individual level of climate worry and the change in the individual level of self-efficacy, a mediation analysis (Model 4) was performed using the PROCESS tool (Hayes, 2017). This tool made it possible to see the direct effect of the independent variable on the dependent variable, and the indirect effects of the two mediators. The outcome variable for the analysis was pro-environmental behaviour change. The predictor variable for the analysis was climate change video framing. The mediator variables for the analysis were the individual level of climate worry and the individual level of self-efficacy.

### *The direct effect of message framing on pro-environmental behaviour change*

There was no significant direct effect of the type of climate change video framing on the intention to change pro-environmental behaviour,  $b = .25$ , 95% BCa CI  $[-.15, .34]$ ,  $t = .46$ ,  $p = .65$ . This means that there is no direct relationship between the two types of climate change video framing on pro-environmental behaviour change. Thus, the type of video framing (gain or loss) does not affect the intention to change pro-environmental behaviour. Therefore, hypothesis 1 is rejected.

### **Climate worry as the mediator**

#### *The relationship between video message framing and climate worry*

There was a relationship between video message framing and the individual level of climate worry, as this relationship was significant  $b = 0.24$ , 95% BCa CI  $[.02, .45]$ ,  $t = 2.18$ ,  $p = .03$ . This means that video message framing significantly predicts the individual level of climate worry. To test what type of message framing (gain versus loss) influences the level of climate worry, an independent t-test was performed. The individual level of climate worry in the gain-framed condition ( $M = .07$ ,  $SD = 0.37$ ) was lower compared to the loss-framed

condition ( $M = .31$ ,  $SD = 0.68$ ). Additionally, this difference was significant, ( $F(-2.2,96) = 3.6$ ,  $p = .06$ ). This means that people who were exposed to the loss-framed condition have a higher level of climate worry than people who were exposed to the gain-framed condition. Therefore, hypothesis 2b is accepted.

*The relationship between climate worry and pro-environmental behaviour change*

In addition, there was no relationship between the individual level of climate worry and pro-environmental behaviour change, as this relationship was not significant  $b = .18$ , 95% BCa CI [.15, 1.24],  $t = .56$ ,  $p = .75$ . This means that the individual level of climate worry does not predict pro-environmental behaviour change. Therefore, hypothesis 2a is supported.

*The indirect effect of video message framing on pro environmental behaviour change via climate worry*

Hypothesis 2a and 2b were both not significant parts of the mediation process. This means that the change in the individual level of climate worry does not mediate the relationship between climate change framing videos and pro-environmental behaviour change. Therefore, hypothesis 2 is supported.

**Self-efficacy as mediator**

*The relationship between video message framing and self-efficacy*

There was no relationship between the type of message framing on the individual level of self-efficacy, as this relationship was not significant  $b = 0.16$ , 95% CI [-.33, 0.66],  $t = .66$ ,  $p = .51$ . This means that people who are exposed to a climate change gain-framed video are not more likely to have a higher self-efficacy than people who are exposed to the loss-framed video. Thus, there is no difference in the level of self-efficacy between the loss or gain-framed conditions. Therefore, hypothesis 3b is rejected.

*The relationship between self-efficacy and pro-environmental behaviour change*

There was no relationship between the individual level of self-efficacy and the intention to change pro-environmental behaviour, as this relationship was significant  $b = 0.05$ , 95% CI  $[-.44, 0.55]$ ,  $t = .21$ ,  $p = .84$ . This means that there is no difference in the level of self-efficacy and the effect on pro-environmental behaviour change. Therefore, hypothesis 3a is supported.

*The indirect effect of video message framing on PEB via climate worry*

Hypothesis 3a and 3b were both not significant parts of the mediation process. Thus, there is no mediation of climate change framing videos and pro-environmental behaviour change via self-efficacy. Therefore, hypothesis 3 is rejected.

## Appendix F: Assumption check mediation analysis for intention to change PEB

### Influential cases;

1. **Cook's distance:** Largest Cook's distance was 0.13, there is no cause for concern (because  $< 1$ ), therefore the cook's distance is met.
2. **Centered leverage values:** Largest leverage value was 0.25, with cause for concern (because the average leverage is:  $(k + 1)/n = 5/98 = 0.05$ , and the value is more than three times (0.15) this value. Therefore, the centered leverage value is **not met**.
3. **Mahalanobis distance:** 9 cases with cause for concern. These 9 cases did not have concerning Cook's distance or leverage values, so they probably are OK.
4. **Residuals (casewise diagnostics):** There are 5 cases with standardized residuals (5 out of 98), so around 5% of the data with outliers. There is no cause for concern. Therefore, checking for outliers has been met.
5. **Multicollinearity (Coefficients):** Indicators of multicollinearity do look good (i.e., all VIFs  $< 1.53$ , average VIF = 1.33, and Tolerance  $> .2$ ). Regression might be biased because the average VIF is greater than 1.

### Independence of error;

6. **Durbin-Watson:** 1.69, that is  $< 1$  or  $> 3$ , independence of error has been met, which is desirable and indicates that errors (residuals) are uncorrelated.
7. **Homoscedasticity, heteroscedasticity, and linearity:** The dots are randomly and evenly dispersed throughout the graph. Inspection of standardized residuals and predicted scores in the (partial) regression plots showed no heteroscedasticity (no funneling dotted clouds) or non-linearity.



## Appendix G: Assumption check mediation analysis for the change in PEB

### Influential cases;

1. **Cook's distance:** Largest Cook's distance was 0.11, there is no cause for concern (because  $< 1$ ), therefore the cook's distance is met.
2. **Centered leverage values:** Largest leverage value was 0.2, with cause for concern (because the average leverage is:  $(k + 1)/n = 5/98 = 0.05$ , and the value is more than three times (0.15) this value. Therefore, the centered leverage value is **not met**.
3. **Mahalanobis distance:** 13 cases with cause for concern. These 9 cases did not have concerning Cook's distance or leverage values, so they probably are OK.
4. **Residuals (casewise diagnostics):** There are 13 cases with standardized residuals (13 out of 98), so around 13% of the data with outliers. There is no cause for concern. Therefore, checking for outliers has been met.
5. **Multicollinearity (Coefficients):** Indicators of multicollinearity do look good (i.e., all VIFs  $< 1.53$ , average VIF = 1.33, and Tolerance  $> .94$ ). Regression might be biased because the average VIF is greater than 1.

### Independence of error;

6. **Durbin-Watson:** 1.95, that is  $< 1$  or  $> 3$ , independence of error has been met, which is desirable and indicates that errors (residuals) are uncorrelated.
7. **Homoscedasticity, heteroscedasticity, and linearity:** The dots are randomly but not evenly dispersed throughout the graph. Inspection of standardized residuals and predicted scores in the (partial) regression plots showed heteroscedasticity (funneling dotted clouds).