

## Don't look up? The effect of role models on climate anxiety and climate action

Vandor, Peter; Mehrwald, Martin; Hobodites, Fabian

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# Don't look up? The effect of role models on climate anxiety and climate action

Peter Vandor  
Martin Mehrwald  
Fabian Hobodites

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**Impressum****Authors**

Peter Vandor  
Martin Mehrwald  
Fabian Hobodites

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Competence Center for Nonprofit-Organisations and Social Entrepreneurship  
Vienna University of Economics and Business  
Welthandelsplatz 1, 1020 Vienna, Austria  
[Peter.Vandor@wu.ac.at](mailto:Peter.Vandor@wu.ac.at)  
[www.wu.ac.at/sec](http://www.wu.ac.at/sec)

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**Vienna, November 2024**

# Contents

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<b>Abstract</b> .....	<b>4</b>
<b>1. Introduction</b> .....	<b>5</b>
<b>2. Climate anxiety, Role Models and Climate Action: Theory and Hypotheses Development</b> ..	<b>8</b>
2.1. Protection Motivation Theory .....	9
2.2. Role Models.....	12
<b>3. Study 1: Survey among a Community of (Social) Entrepreneurs</b> .....	<b>15</b>
3.1. Method .....	15
3.2. Results .....	17
<b>4. Study 2: Audio Priming Experiment among Students</b> .....	<b>23</b>
4.1. Method .....	23
4.2. Results .....	27
<b>5. Discussion and Conclusion</b> .....	<b>34</b>
<b>6. Bibliography</b> .....	<b>38</b>
<b>Appendix 1 – Further Information on Pretests for Study 2</b> .....	<b>48</b>
<b>Appendix 2 – Announcement of the Survey for Study 2</b> .....	<b>50</b>
<b>Appendix 3 - Authors</b> .....	<b>52</b>

# Abstract

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The psychological consequences of climate change have gained significant attention in recent academic literature and contemporary media. This paper investigates the emerging phenomenon of climate anxiety, a psychological manifestation of anxiety in response to global climate change. The study explores the complex relationship between familiarity to climate action role models, climate anxiety and pro-environmental action. Our empirical approach includes two studies: one large-scale survey of 1,150 participants within the Impact Hub global network and one audio priming experiment among 169 students at Vienna University of Economics and Business. Results indicate that role models positively influence coping appraisal and climate action. Contrary to our expectations, we also find that familiarity with role models is associated with an increase in climate anxiety. Potential explanations for the unexpected rise in anxiety include the reduction of cognitive distance to the crisis through reflections about role models, the increase of threat appraisal, and the triggering of cognitive dissonance through self-comparisons. This study contributes to understanding the intricate dynamics between role models, climate anxiety, and effective communication strategies to promote climate action. Moreover, it provides further insights on the applicability of Protection Motivation Theory on environmental issues.

# 1. Introduction

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Climate change poses an existential threat and remains one of the most significant challenges humanity faces. In spite of the consensus amongst experts about its existence and anthropogenic causes, the catastrophic current trajectory (McMichael et al., 2006; Wallace-Wells, 2019), and an increased understanding of the necessary actions to stop climate change, public and political reactions to the crisis have been irrationally slow (Guthrie, 2022; McMichael et al., 2006; Wallace-Wells, 2019). The lack of climate change mitigation efforts has been increasingly associated with negative effects on mental wellbeing (Clayton & Karazsia, 2020; Hickman et al., 2021; Pihkala, 2020).

A symptom of this distress is climate anxiety (sometimes also: eco-anxiety<sup>1</sup>). Recent research argues that this type of anxiety is a “chronic fear of environmental doom” (Clayton et al., 2017, p. 68), resulting from the anticipated damages and suffering caused by the climate crisis. Prior evidence suggests that climate anxiety is widespread, predominantly among young individuals. 91% of Americans aged 16 to 25 are worried about the climate crisis, 46% endorse the idea “humanity is doomed,” and 45% report that their distress negatively affects their day-to-day functioning (Hickman et al., 2021). An estimated 50% of American children fear that the climate crisis will cause the earth to be uninhabitable by the time they grow up (Hörnfeldt, 2018). Similarly, data from Germany shows that 71.6% of psychotherapists already have had encounters with patients with climate change-related concerns (Trost et al., 2024). The experience of distress through climate anxiety is thus itself a negative consequence of climate change on society. Moreover, as some research suggests, high levels of climate anxiety can itself contribute to the problem, by slowing behavioral responses to the crisis through “eco-paralysis” (Clayton & Karazsia, 2020; Heeren et al., 2022; Hickman et al., 2021).

In this paper we explore possible paths of reducing these individual fears through increasing familiarity with role models. Building on Protection Motivation Theory (PMT) (Floyd et al., 2000; Rogers, 1975, 1983), we investigate origins and forms of climate anxiety as well as its interplay with pro-environmental action. In particular, we examine role models and how their influence can have an impact on both individuals’ emotional and behavioral responses to the climate crisis. Earlier work has produced mixed findings on this relationship. On the one hand, prior work

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<sup>1</sup> In the respective literature, the terms climate anxiety and eco-anxiety are often used interchangeably (Pihkala, 2020).

suggests that role models can have great impact in inspiring and mobilizing for climate action (Kotcher et al., 2024; Wahlström & Uba, 2024) and the familiarity with a prominent climate role model predicted intentions to act (Sabherwal, Ballew, et al., 2021b). On the other hand, some researchers argue that positive role models have no particular effect on actions in settings of preventing negative outcomes (Lockwood et al., 2002), suggesting that their impact in the field of climate action should remain limited. Thus, this paper focuses on the following two research questions:

1. What is the effect of familiarity to climate action role models on individuals' climate action?
2. What is the effect of familiarity to climate action role models on individuals' climate anxiety?

We aim to contribute to the academic debate as well as practice in the following ways: First, our study follows the call of Heeren et al. (2022), Sangervo et al. (2022) and others, and attempts to further the debate on the complex relationship between climate anxiety and pro-environmental action, which has so far yielded conflicting results. While some studies have presented evidence of a moderate positive connection between climate anxiety/functional impairment and pro-environmental behavior (Heeren et al., 2022; Reser et al., 2011; Verplanken et al., 2020), others have found no or negative correlations (Clayton & Karazsia, 2020; Kapeller & Jäger, 2020; Stanley et al., 2021) or a non-linear relationship (Heeren et al., 2022). Approaching the relationship through the lens of Protection Motivation Theory, we argue that both climate anxiety and climate action can be best understood as reactions to processes of cognitive appraisal of threats and coping opportunities related to the climate crisis and its mitigation (Kim et al., 2013; Kothe et al., 2019). We thereby seek to add to the growing literature exploring climate action from a PMT-perspective (e.g. Cismaru et al., 2011), and present – to the best of our knowledge – the first research including role models and the experience of climate anxiety in the PMT framework.

Second, we add to research on the effect of role models in addressing the climate crisis. We contribute to the only scarcely researched understanding of the relationship between role models and climate action. Similarly, we aim to provide further understanding in the relationship between role models and climate anxiety, which currently presents itself even more unclear. We explore the effects of role models on climate action with a broader scope than political activism (cp. Sabherwal, Ballew, et al., 2021), offering an analysis of a range of different role models.

Third, we hope that our results provide insights into more and less effective, workable communication strategies that can address climate anxiety and promote pro-environmental action. Prior research suggests that this remains a challenging feat, as for instance the role of sentiment and tone in the communication of climate issues continues to be unclear (Hornsey & Fielding, 2016; Sabherwal, Pearson, et al., 2021).

To test our hypotheses, we employed a two-study research design utilizing two data sources. First, we examine the connection between role models, climate anxiety and climate action through the analysis of a comprehensive survey among entrepreneurs, freelancers and employees within the Impact Hub global network (n= 1,150). This study provided us with results with high external validity concerning actual climate action. Second, we employed an experimental priming study among students at the Vienna University of Economics and Business (n= 169). Utilizing a novel audio priming method, participants completed the priming treatment by talking about their own role models. In comparison to writing, speaking reveals more about an individual's thoughts and emotions (Woolbert, 1922), and allows for higher accessibility of memories and thoughts (Kellogg, 2007). We argue that this leads to a stronger activation of respondents' own cognitive concepts of their role models and, thus, a more effective prime. After completing the task, respondents completed an online survey on the topic of the study. This setting provided us with results with strong high internal validity on underlying processes between the familiarity to role models, climate anxiety and climate action.

Our results confirm several of our hypotheses, although not all. The outcomes indicate that most of the participants regard the climate crisis as an imminent existential threat. Also, many respondents have found role models for coping with the climate crisis in their life, including entrepreneurs, advocates of sustainable lifestyles, activists and politicians. As predicted, familiarity to such role models increases coping appraisal and, consequently, positively influences climate action.

However, contrary to our expectations, familiarity with role models was not associated with a significant decrease, but a significant increase in climate anxiety in our sample. Results from our second study provide a possible explanation: familiarity with role models does not only significantly increase individuals' coping appraisal, but also their threat appraisal, suggesting that role models might reduce the cognitive distance to the climate crisis, thereby making its threat more salient (Bendell et al., 2020; Chu & Yang, 2019). Confrontation with role models might also lead to cognitive dissonance by prompting self-comparisons (see Stone & Cooper, 2001).

The paper is structured as follows: Chapter two provides an overview of the theoretical foundation regarding climate anxiety, climate action, role models and the Protection Motivation Theory. Chapter three outlines the methodological approach as well as results for our first study among members of the Impact Hub global network. The fourth chapter provides an overview of the methodological approach and results of the audio priming experiment among university students. The paper concludes with a general discussion of results and suggestions for future research.



## 2. Climate anxiety, Role Models and Climate Action: Theory and Hypotheses Development

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Anxiety is a fundamental process with adaptive functions in both animals and humans. It can assist with motivating appropriate responses and adaptive preparations for forthcoming performances, as well as precautions for potential threats (Barlow et al., 2018; Yerkes & Dodson, 1908). In these instances, anxiety can be understood as a necessary reaction to anticipated threats. In more extreme forms, however, it can lead to dysregulation of emotion or the maintenance of a chronic state of worry (Borkovec et al., 2004), taking on maladaptive forms (Barlow, 2002; Barlow et al., 2018).

The climate crisis constitutes a very complex and grave form of such a threat, as it lacks a clear solution that could be enacted by one individual in order to avoid its consequences. Because of this, climate anxiety can frequently take on maladaptive forms, and has been associated with emotional (e.g., depression) and functional impairment (Clayton & Karazsia, 2020; Kricorian & Turner, 2022; Pihkala, 2020; Wullenkord et al., 2021). The specific concept of climate anxiety has gained significant attention in recent academic literature and contemporary media. It refers to a psychological phenomenon where individuals experience distress and anxiety related to the current and future state of the environment, including concerns about climate change, biodiversity loss, deforestation, pollution, and other ecological issues (Clayton & Karazsia, 2020; Hickman et al., 2021; Stanley et al., 2021). The term encompasses a range of negative emotional reactions to the ecological crisis, spanning from mild to very strong expressions (Hickman et al., 2021; Pihkala, 2020; Sangervo et al., 2022). They cover feelings of empathy (“secondary suffering”), temporary states of fear, but also more constant states of helplessness and anxiousness (Ágoston et al., 2022). In more extreme manifestations, it can induce chronic, severe and disproportionate symptoms like restlessness, sleep disturbance, chronic worry or irritability (Crandon et al., 2022). Pihkala (2020) finds both “practical anxiety”, motivating information on the problem as well as pro-environmental behavior, but also paralyzing forms of climate anxiety. Similarly, Wan et al. (2024) postulate an inverted U-shaped curve when it comes to the relationship between anxiety regarding climate change and individuals’ climate action.

Despite there being forms of anxiety that hamper individuals from taking action, there are many studies that have demonstrated the positive relationship between anxiety and action (Ágoston et al., 2024; Sangervo et al., 2022; Verplanken et al., 2020). Climate anxiety may be viewed as an adaptive response to a genuine threat (Clayton & Karazsia, 2020; Crandon et al., 2022)

leading to adaptive preparations or preventive behavior for potential threats (Barlow, 2002). Additionally, conflicting findings where anxiety led to an absence of action have mostly been reported for extreme cases. We intend to improve the understanding of this ongoing question regarding the relationship between climate anxiety and climate action (Clayton & Karazsia, 2020; Stanley et al., 2021; Wan et al., 2024).

Climate action can take on a variety of forms, such as changing consumption and mobility patterns, living habits, but also societal participation, activism or career choices (Bendell et al., 2020; Neas et al., 2022; Sangervo et al., 2022). Engaging in climate action and supporting environmental causes can bring an individual's behavior in line with personal values, consequently contributing to a sense of empowerment (Baudon & Jachens, 2021). According to Bouman et al.'s (2020) findings, worries about climate change have a positive impact on climate policy support, and, indirectly, specific and personal climate action. Similarly, Sangervo et al. (2022) found positive effects of climate anxiety on climate action for over half of their study's respondents. We argue that prior evidence suggests an increase of climate action with higher climate anxiety. Therefore, we postulate a positive correlation between climate anxiety and climate action:

**H1:** Higher climate anxiety is associated with increased climate action.

## 2.1. PROTECTION MOTIVATION THEORY

In this paper, we aim to explain the cognitive processes behind climate anxiety and climate action. Thus, we base our research on the Protection Motivation Theory (PMT) which seeks to explain decision-making regarding individual protective measures towards an imminent threat (Rogers, 1975, 1983). We argue that PMT presents itself as a useful theoretical framework in predicting individual climate action. In contrast to other theories, like the Theory of Planned Behavior (Ajzen, 1991), it acknowledges the role of emotions in the motivation to act against a threat. Moreover, contrary to other theories (e.g. Terror Management Theory, Greenberg et al., 1986), it models individual behaviour as a response towards a (preventable) threat. Thus, PMT presents a comprehensive model for predicting protective action towards the threat climate change poses. While PMT has been frequently applied in research on preventive health care such as fitness activities and vaccinations (Floyd et al., 2000), it has recently become more prevalent in predicting pro-environmental behavior and climate action (e.g. Chen, 2012; Cismaru et al., 2011; Kothe et al., 2019).

PMT models individual risk, reward, and efficacy appraisals of threats and actions (Floyd et al., 2000; Rogers, 1975, 1983) and portrays the motivation for protective action against a threat as an (implicit) cost-benefit analysis. The model describes two distinct sources of information for the underlying cognitive processes: environmental and intrapersonal sources. Environmental

sources of information involve verbal persuasion and observational learning about what happens to others in given situations. Intrapersonal sources of information consist of prior experiences with similar situations, including experiences on coping activities, and personality traits of the individual (Floyd et al., 2000; Rogers, 1983). Utilizing this information, the cognitive analysis of a threat takes into account the assessment of the threat, the planned response and its effectiveness in dealing with the threat (Rogers, 1983).

The evaluation of a threat's severity and a person's vulnerability towards it, along with the intrinsic and extrinsic rewards that arise from maladaptive responses, are integral components of the threat appraisal process (Floyd et al., 2000). The severity of the threat can refer to the potential for both physical and mental harm, as well as interpersonal threats (Rogers, 1983). Furthermore, Rogers (1983) identifies bodily pleasure or satisfaction as examples for intrinsic, and social approval as examples for extrinsic rewards stemming from maladaptive behavior. Overall, though, higher threat appraisal is associated with stronger protection motivation towards a threat (Floyd et al., 2000; Rogers, 1983).

Similarly, we argue that a more negative threat appraisal is associated both with higher climate anxiety as well as a stronger engagement in climate action. In the context of climate change, the threat appraisal process is connected to the individual's perception of it as a cause of disasters and their own vulnerability to adverse climatic developments (Sabherwal, Ballew, et al., 2021). Previous studies suggest that higher threat appraisal can positively influence actions and intentions in the area of sustainability, like saving energy or purchasing electric vehicles (Kothe et al., 2019). This is both due to a positive influence of perceived severity of climate change, as well as perceived vulnerability towards it on protection motivation (Kothe et al., 2019). Additionally, an individual's beliefs and experiences regarding climate change and extreme weather events have been found to affect pro-environmental behavior (Sambrook et al., 2021).

Correspondingly, prior evidence from other fields of research showcases the positive correlation between threat appraisal and fear and anxiety towards a threat (e.g. Britton et al., 2011; McGinty et al., 2012). Fear has especially been acknowledged to having a mediating effect between the paths of threat appraisal and protection motivation (Floyd et al., 2000; Rogers & Prentice-Dunn, 1997). Pihkala (2020) argues that climate change's perceived uncertainty and uncontrollability are important factors in climate anxiety. This can both positively influence the severity of climate change as a threat, as well as an individual's perceived vulnerability towards it. We expect our results to be in line with these prior forms of evidence. Therefore, we anticipate a positive correlation between the perceived severity of and vulnerability towards the threat climate change with climate anxiety as well as engagement in climate action:

**H2:** Higher threat appraisal is associated with increased climate action.

**H3:** Higher threat appraisal is associated with increased climate anxiety.

The second process within PMT is coping appraisal, which is sometimes also referred to as “response appraisal”. It involves assessing one’s ability to diminish or fully divert a threat. It includes evaluating the efficacy of the recommended response to a threat (Rogers, 1983), as well as the ability to successfully carry out this response (Maddux & Rogers, 1983). Conversely, the adoption of a response may be weakened by response costs, which refer to the unattractive effects (e.g. difficulty, unpleasantness, expense) associated with the response (Rogers, 1983).

We argue that more positive coping appraisal is associated with stronger engagement in climate action. Previous studies have found that a higher coping appraisal is associated with an increased likelihood of engaging in protective measures against a threat (Floyd et al., 2000). One reason is the perception of control and agency vis-à-vis the threat through higher self-efficacy and response efficacy, increasing the likelihood of engagement in such responses (Deci & Ryan, 2000; Pihkala, 2020; Wullenkord et al., 2021). A recent meta-analysis of relevant studies shows both positive correlations of response efficacy as well as self-efficacy on different forms of pro-environmental behavior (Kothe et al., 2019). In addition, Kothe and colleagues (2023) establish the first empirical evidence of a causality between self-efficacy and pro-environmental intentions. Therefore, we anticipate a positive correlation between coping appraisal and climate action:

**H4:** Higher coping appraisal is associated with increased climate action.

Moreover, we expect a negative relationship between coping appraisal and climate anxiety, meaning the higher levels of appraisal should help reduce anxiety. As highlighted by Pihkala (2020) and Wullenkord et al. (2021), the experience of uncertainty and lack of personal control over the threat is a key element of climate anxiety. We expect that a more positive appraisal of coping options counters this experience, as the knowledge about effective ways to mitigate the climate crisis through individual actions should provide individuals with a sense of agency and control. As prior evidence shows that lower autonomy and perceived competence are associated with higher climate anxiety (Wullenkord et al., 2021), we expect the sense of agency and self-efficacy provided by the perceptions of individual ways to act to have the opposite effect.

Moreover, coping appraisal may even reduce climate anxiety in the absence of reflections of one’s own actions and likelihood to act. The sheer availability of solutions and paths to action suggests that the threat itself can be overcome, and that somebody else seem to be working on it, which contradict the assumptions of inevitability. While the ‘unavailability of responses’ is an important factor in anxiety (Epstein, 1972), the belief that one has a practical way to act can significantly reduce the perceived threat of an event and thereby reduce feelings of fear and anxiety (Grupe & Nitschke, 2013; Pihkala, 2020). This suggests a negative correlation between coping appraisal and climate anxiety:

**H5:** Higher coping appraisal is associated with lower climate anxiety.

## 2.2. ROLE MODELS

The proposed research model extends the Protection Motivation Theory by an additional factor. As outlined above, higher levels of coping appraisal can be a powerful motivator for action as well as a mitigating force with respect to anxiety. In this context role models can showcase ways to provide effective responses to a specific problem and influence important decisions among individuals (Abbasianchavari & Moritz, 2021; Bosma et al., 2012). Thus, they can reinforce role model identification and generate favorable attitudes toward a message, enhancing self-efficacy (Laviolette et al., 2012) and supporting in developing an individual sense of competence (Chawla & Cushing, 2007). Generally, role models can be defined as

*"a cognitive construction based on the attributes of people in social roles an individual perceives to be similar to him or herself to some extent and desires to increase perceived similarity by emulating those attributes."* (Gibson, 2004, p. 136)

Such role models can take on different types and their influence can vary in extent: Gibson (2004) distinguishes between four cognitive dimensions in this regard. Positive role models share attributes which are admired by the individual, who strives for imitation. Contrary, negative role models show behavior deemed as unfavorable by the individual. Furthermore, role models can be characterized by the extent of attributes which an individual attends to – from specific, referring to a small set of attributes, to global where multiple attributes of a role model are attended to by an individual (Gibson, 2004).

Oftentimes, these role models are identified in proximity to an individual (Arnold et al., 2009). Nonetheless, they can be classified along a variety of structural dimensions (Gibson, 2004). Close role models are in regular interaction with the individual. In the field of pro-environmental behavior, prior research often focusses on the role model effect of family and friends (see Lawson et al., 2019; Stevenson et al., 2019). On the contrary, distant role models are persons with little to no personal interaction, like popular climate activists. Studies have shown that even in distant cases, familiarity with them was predictor for climate action intention (Sabherwal, Ballew, et al., 2021). Finally, role models can also be categorized based on their hierarchical status (Gibson, 2004). Considering these findings, we can assume there to be a diverse range of role models, including activists, social entrepreneurs, media personalities, politicians, but also family, friends, teachers and peers, among others.

Role models have been recognized as a valuable source of potential solutions in the field of climate action, particularly among youth and adolescents (Neas et al., 2022; Pereira & Freire, 2021). Their visibility and influence can inspire and mobilize others to take action on climate change (Neas et al., 2022). Generally, parents or other family members are found to be among the most influential role models, at least in retrospective research using interviews (Chawla & Cushing, 2007). Lawson et al. (2019) observed household level influences of parents and their children. Children's concern for climate change was found to be a strong predictor of climate

behaviors further underlying individual appraisal dimensions. Furthermore, children's climate behavior was positively related to parents' likelihood of engaging in those same behaviors. However, parent climate change concern alone was not related to actions from their children (Lawson et al., 2019). Valdez et al. (2018) also find that even relatively rare discussions with family or friends did predict climate change behavior in young people, while discussions with teachers did not. In addition, Baudon and Jachens (2021) find that joining groups or movements sharing similar environmental concerns can provide emotional support and, thus, effective treatment of climate anxiety.

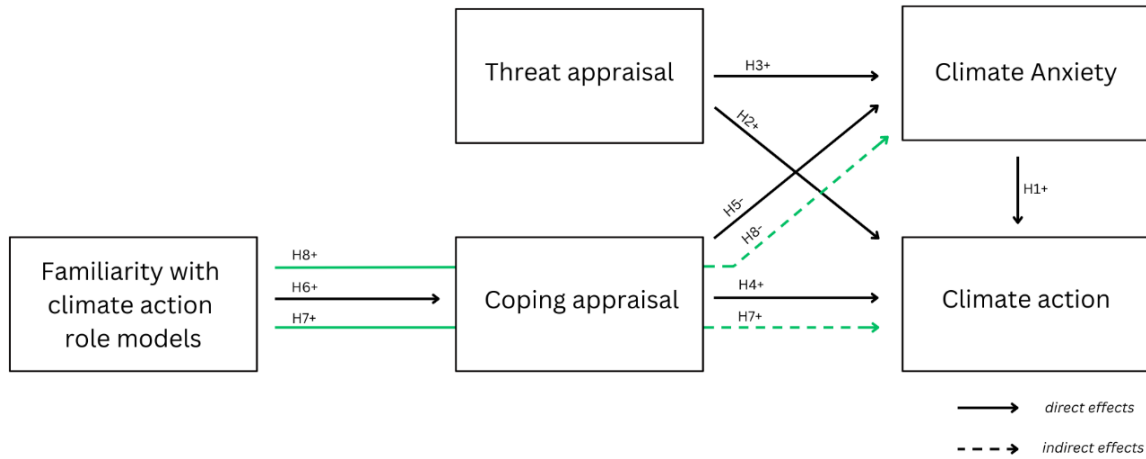
Against this background, we hypothesize that familiarity with climate action role models can act as a valuable source of environmental information, increasing both individuals' coping appraisal towards a perceived threat as well as perceived self-efficacy. When individuals see their role models as being effective in taking climate actions, they may perceive these actions as beneficial and thus feel motivated to adopt them. Additionally, also drawing from hypothesis 5, we believe that role models indirectly affect climate anxiety by providing visible agency, showcasing solutions and increasing others' self-efficacy. In this context we formulate the following hypotheses:

**H6:** Familiarity with climate action role models increases higher coping appraisal.

**H7:** Familiarity with climate action role models exerts a positive indirect effect on climate action through an higher coping appraisal.

**H8:** Familiarity with climate action role models exerts a negative indirect effect on climate anxiety through an higher coping appraisal.

Combining all our hypotheses presented above leads us to the following research model, indicating the expected relationship between climate anxiety, climate action and the familiarity to climate action role models:



**Figure 1 - Research model. Own illustration based on Rogers (1983) and Floyd et al. (2000)**

We conducted two studies to test our hypotheses: a quantitative study among the global Impact Hub network, as well as an online priming experiment among students at the Vienna University of Economics and Business. Results of these studies will be presented in the following chapters.

## 3. Study 1: Survey among a Community of (Social) Entrepreneurs

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### 3.1. METHOD

The first study was conducted among Impact Hub network members. Impact Hub is one of the world's largest entrepreneurial communities for impact at scale and provides support and co-working spaces in over 100 cities around the world (Impact Hub, 2023; Vandor et al., 2015). This sampling strategy aimed at generating results with higher external validity, meaning we focused on climate action (as opposed to the majority of work in the domain which focuses on intentions, Kothe et al., 2019) within a group of actors that also includes those who approach climate action and mitigation in their professional work. After excluding cases with incomplete responses, our sample comprises of 1,150 respondents from more than 48 countries in Africa, Asia, Europe, North America, South America, and Oceania.

**Climate anxiety** was measured with a widely used 13-items scale developed by Clayton and Karazsia (2020) which captures both emotional and functional qualities. Respondents were asked to indicate their agreement to statements such as "Thinking about climate change makes it difficult for me to sleep" and "I find myself crying because of climate change" on a scale from 1 (never) to 5 (almost always). Cronbach's  $\alpha$  reached a level of 0.917, suggesting high reliability of the instrument.

**Climate action** was captured with the use of 10 items, which were adapted with minor changes from Hornsey and Fielding (2016), comprising of both actions oriented towards one's personal life (e.g., reducing carbon footprint, using alternative modes of transportation) and towards influencing others (e.g., through activism, donating to organisations, in conversations; Cronbach's  $\alpha = 0.859$ ).

The measurement of **threat appraisal** was performed with two items previously applied by Kim et al. (2013) and Lee (2008) for severity and two additional items by Kim et al. (2013) and Plotnikoff and Higginbotham (2002) for susceptibility. Some wordings were adapted to strengthen some statements to allow for more variance in the results. The reasoning behind this process was to better capture the more dire realities of the climate crisis since those studies have been carried out in the past. One wording was changed from "Global climate change is a serious problem" (Kim et al., 2013) to "Climate change is one of the most serious problems society has ever faced." Agreement to the statements was indicated on a scale from 1 (strongly disagree) to 5 (strongly agree). As in similar work using PMT (cp. Kothe et al., 2019), the severity



subscale (Cronbach's  $\alpha = 0.70$ ) and the susceptibility subscale (Cronbach's  $\alpha = 0.715$ ) were combined into one threat appraisal subscale, reaching acceptable levels of reliability (Cronbach's  $\alpha = 0.823$ ).

**Coping appraisal** was measured using three items from Kim et al. (2013) and Witte (1996, e.g., "I am aware of effective actions I could engage in to mitigate climate change") to capture coping efficacy and a single item to capture self-efficacy adapted from Witte (1996) and So et al. (2016). The coping efficacy subscale reached Cronbach's  $\alpha$  of 0.751, the four items together 0.759. Again, the subscales were combined into one overall scale of coping appraisal for analysis.

Information on **role models** was collected in a series of questions loosely based on the procedure for identifying role models among youth proposed by Johnson et al. (2016). Respondents were first asked to indicate whether they "know people who you consider role models or inspiration for yourself on how to take action against climate change and its consequences?" The questions were deliberately framed to both cover role models in the area of direct action as well as climate adaptation. Next, respondents were asked to indicate how many individuals they knew and would consider role models in the following domains: Activism, Social Entrepreneurship, Sustainable Lifestyles, Politics, Business, Research, Other. Answer options included "none", "one", "a few (2-3)", and "many (four or more)". Finally, we invited respondents to provide a brief qualitative description of their one most important role model, indicating the first name of the person and a short description of their activities (cp. Johnson et al., 2016). The first variable was used to capture familiarity to role models in the models, the second variable (recoded into metric numbers and added up) was utilized in robustness checks. The third variable was not used in quantitative analysis but served as validation of content for the first two questions and helped researchers in the interpretation of results.

The model also included control variables, such as the respondents' age (<26, 26-35, 36-45, 46-55, or >55), years of work experience, gender (categories for female, male and non-binary), and formal educational level. The latter encompassed the following alternatives: (1) did not complete high school, (2) completed high school, (3) completed undergraduate degree, (4) completed graduate degree, and "other." The first four answer options were used to form a discrete variable. Two additional variables were included to account for respondent's expertise in climate change. First, two items adopted from Kwon et al. (2019) measured participants' expertise knowledge ("I know the problems of climate change well" and "I am more knowledgeable about climate change than others"). Agreement to the statements was indicated on a scale from 1 (strongly disagree) to 5 (strongly agree), the two items reached an acceptable level of Cronbach's  $\alpha$  (0.70). Second, respondents were asked to indicate the number of years of work experience they had in jobs "directly related to taking action against climate change or its consequences".

Finally, two general measures of wellbeing were included in the survey to control for the effect

of overall and situational wellbeing on climate anxiety: life satisfaction was measured by the single-item question "Overall, how satisfied are you with your life?" with answer options from 0% to 100% satisfaction (Dolan & Metcalfe, 2012), and stress, using a reliable single-item measure of stress from the Occupational Stress Questionnaire (Elo et al., 2003).

The survey was available in eight languages and was distributed online amongst Impact Hub members in February and March 2023. Potential respondents received at least two reminders to participate and were offered small participation incentives. A Harman's single factor test conducted for model variables suggest that a single factor can only explain 26.1% of the variance, suggesting no evidence for common method bias in the study.

## 3.2. RESULTS

### 3.2.1. Descriptive Results

The sample consists of a diverse group of respondents from five continents, with Brazil (230), Germany (105), Switzerland (90), Spain (54), and Taiwan (47) being the most frequent countries of residence. The average age in the sample is 35.47 years, with 54.3% identifying as female, 43.7% as male and 2.1% as other (1% non-binary, 1% no answer, 0.2% other identities). Within our sample, average work experience in the context of climate change is 2.4 years.

63.5% of respondents indicated that they knew people they regarded as role models with respect to fighting climate change and dealing with its consequences. The qualitative responses included a broad range of actors, which in all cases were described as performing positive or constructive activities in the area models. This validates that participants indeed understood role models as *positive* role models, and not as negative role models which are also discussed in literature (Gibson, 2004). Some examples highlight the diversity of functional roles in which respondents seek and find inspiration in dealing with the climate crisis:

*"Andrei is an **activist and entrepreneur** who took it upon himself to promote and educate the market with vegan products which are responsibly manufactured."*

*"Sochenda (Zerow) and Monorom (Compost City) who motivated me towards a new **environmental friendly lifestyle**."*

*"Greta Thunberg, Luisa Neubauer, Letzte Generation, SOLARBAKERY, Alessandra Hensle (Gemeinwohlökonomie Baden-Württemberg e.V.), Tim Weinert (Nowwork), Christian Felber (GWÖ International)."*

*„**My teacher**, Mr Kang'ombe who [...] always plays a vital role in making the people understand about climate crisis and its effects.“*

*“**My milkman** who uses bottles rather than plastic milk containers”*

*“The **mayor** in my town stopped ill-intentioned real estate sharks from building low quality apartment buildings.”*

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
<i>Core variables</i>													
1. Familiarity with role	0.63	0.48											
2. Threat appraisal	3.95	0.80	0.21 **										
3. Response appraisal	3.87	0.66	0.23 **	0.42 **									
4. Climate Anxiety	1.83	0.69	0.33 **	0.33 **	0.25 **								
5. Climate Action	3.07	0.81	-0.23 **	0.41 **	0.48 **	0.42 **							
<i>Control variables</i>													
6. Age	35.47	10.72	0.00	-0.03	0.04	-0.07 *	0.07 *						
7. Gender: female	0.54	0.50	-0.01	0.12 **	0.03	0.10 **	0.00	-0.01					
8. Gender: other	0.02	0.14	0.02	0.00	0.02	0.07 *	0.03	-0.07 **	-0.16 **				
9. Climate work experience (years)	2.40	5.23	0.17 **	0.12 **	0.22 **	0.12 **	0.28 **	0.27 **	-0.05	0.01			
10. Climate expertise	3.66	0.79	0.26 **	0.32 **	0.43 **	0.20 **	0.47 **	0.07 *	-0.08 **	0.02	0.24 **		
11. Life satisfaction	76.44	17.75	0.03	0.01	0.11 **	-0.10 **	0.02	0.12 **	0.06 *	-0.05	0.08 **	0.05	
12. Stress	3.09	1.18	0.01	0.16 **	0.04	0.20 **	0.07 *	-0.14 **	0.04	0.06	-0.06	0.03	-0.30 **

Two-tailed Pearson Correlations,  $n = 1,150$ ;  $p$ : \*  $< 0.05$ , \*\*  $< 0.01$ .

**TABLE 1. DESCRIPTIVES AND CORRELATIONS**

Many felt at least some manifestation of anxiety. Despite this, respondents report fairly low levels of climate anxiety as compared to other studies. Following the coding suggested by Clayton and Karazsia (2020) and regarding an average of 3 or higher on the climate anxiety scale as “high” level of anxiety, we find that only 5.65% indicate high levels of climate anxiety (an average above 3 on the Clayton and Karazsia (2020) scale). This is considerably lower than the 17-27% reported in the US-based sample of Clayton and Karazsia (2020) or the 12% reported in the mixed African-European sample of Heeren et al. (2022).

### 3.2.2. Hypothesis testing

In order to test Hypotheses H1 to H6, we conducted OLS Regression including the respective variables (see Table 2). Model 1 and 2 present results related to Hypothesis 1, showing a positive and significant effect of climate anxiety on climate action (Model 2,  $B=0.387$ ,  $p<0.001$ ) when added to the base model (Model 1). Model 3 and Model 5 demonstrate positive, significant effects of threat appraisal on climate action ( $B=0.280$ ,  $p<0.001$ ) and climate anxiety ( $B=0.220$ ,  $p<0.001$ ), confirming Hypotheses 2 and 3.

	<i>Model 1</i>		<i>Model 2</i>		<i>Model 3</i>		<i>Model 4</i>		<i>Model 5</i>	
	<i>DV: Climate action</i>		<i>DV: Climate action</i>		<i>DV: Climate action</i>		<i>DV: Climate anxiety</i>		<i>DV: Climate anxiety</i>	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Constant	1.210	< 0.001	0.756	< 0.001	0.549	< 0.01	1.175	< 0.001	0.655	< 0.001
Age	-0.001	n.s	0.001	n.s	0.000	n.s	-0.005	< 0.01	-0.004	< 0.05
Gender: female	0.073	< 0.10	0.006	n.s	0.009	n.s	0.173	< 0.001	0.122	< 0.01
Gender: other	0.122	n.s	-0.001	n.s	0.117	n.s	0.318	< 0.05	0.314	< 0.05
Climate work experience	0.029	< 0.001	0.023	< 0.001	0.026	< 0.001	0.016	< 0.001	0.014	< 0.001
Climate expertise	0.439	< 0.001	0.375	< 0.001	0.351	< 0.001	0.165	< 0.001	0.096	< 0.001
Life satisfaction	0.000	n.s	0.001	n.s	0.000	n.s	-0.003	< 0.05	-0.003	< 0.010
Stress	0.043	< 0.05	0.006	n.s.	0.015		0.097	< 0.001	0.075	< 0.001
Climate anxiety			<b>0.387 &lt; 0.001</b>							
Threat appraisal					<b>0.280 &lt; 0.001</b>				<b>0.220 &lt; 0.001</b>	
<i>Model information criteria</i>										
R <sup>2</sup>	0.262		0.359		0.327		0.115		0.171	
Adjusted R <sup>2</sup>	0.257		0.355		0.323		0.110		0.165	

*Ordinary least square regression, n=1,150, unstandardized coefficients and probability values are reported.*

**TABLE 2. TEST OF HYPOTHESES 1, 2 AND 3**

Additional exploratory calculations allowed us to test for an indirect effect of threat appraisal on climate action through climate anxiety. Following the mediation analysis as outlined by Hayes (2017) we can test an indirect mediation pathway through bootstrapping. This confirmed an indirect effect of threat appraisal on climate action entrepreneurs ( $B=0.072$ ), in addition to a direct effect ( $B=0.208$ ). The confidence interval of the indirect effect (95%) based on 5,000 bootstrap samples did not contain the value zero for either variable (LL: 0.0544, UL: 0.0909). This is consistent with arguments that suggest emotions such as fear or anxiety to be mediators of the relationships between threat appraisal and action in protection motivation theory (e.g. Boss et al., 2015; Floyd et al., 2000; Rogers & Prentice-Dunn, 1997).

	<i>Model 6</i>		<i>Model 7</i>		<i>Model 8</i>		<i>Model 9</i>		<i>Model 10</i>	
	<i>DV: Climate action</i>		<i>DV: Climate action</i>		<i>DV: Climate anxiety</i>		<i>DV: Coping appraisal</i>		<i>DV: Coping appraisal</i>	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Constant	0.334	< 0.05	-0.122	n.s	0.460	< 0.001	2.276	< 0.001	2.245	< 0.001
Age	0.002	n.s	0.002	n.s	-0.004	< 0.05	-0.001	n.s	-0.001	n.s
Gender: female	-0.031	n.s	-0.035	n.s	0.119	< 0.01	0.080	< 0.05	0.08	< 0.05
Gender: other	0.014	n.s	-0.001	n.s	0.304	< 0.05	0.084	n.s	0.070	n.s
Climate work experience	0.022	< 0.001	0.018	< 0.001	0.012	< 0.01	0.016	< 0.001	0.012	< 0.001
Climate expertise	0.320	< 0.001	0.252	< 0.001	0.067	< 0.05	0.329	< 0.001	0.287	< 0.001
Life satisfaction	0.001	n.s	0.000	n.s	-0.003	< 0.01	0.003	< 0.001	0.003	< 0.001
Stress	-0.010	< 0.05	-0.009	< 0.10	0.074	< 0.001	0.029	< 0.10	0.028	< 0.10
Climate anxiety	0.328	< 0.001	0.303	< 0.001						
Threat appraisal	0.207	< 0.001	0.143	< 0.001	0.191	< 0.001				
<b>Coping appraisal</b>			<b>0.281</b>	<b>&lt; 0.001</b>	<b>0.116</b>	<b>&lt; 0.001</b>				
<b>Familiarity with role models</b>									<b>0.295</b>	<b>&lt; 0.001</b>
<i>Model information criteria</i>										
R <sup>2</sup>	0.393		0.430		0.171		0.209		0.252	
Adjusted R <sup>2</sup>	0.388		0.425		0.165		0.204		0.246	

Ordinary least square regression,  $n=1,150$ , unstandardized coefficients and probability values are reported.

**TABLE 3. TESTS OF HYPOTHESES 4, 5 AND 6**

Table 3 presents the results of further tests for Hypothesis 4, 5 and 6. As seen in Model 7, adding coping appraisal increases the explanatory power of the model and coping appraisal exerts a significant positive effect on climate action (0.281,  $p < 0.001$ ). This confirms Hypothesis 4. Model 8 presents an examination of the effect of coping appraisal on climate anxiety. Against our expectations, findings reveal a positive effect of coping appraisal on our measure of climate anxiety, which suggests that higher awareness of solutions is associated with higher levels of climate anxiety. Thus, Hypothesis 5 is rejected. As shown in Model 10, familiarity with role models increases coping appraisal (0.295,  $p < 0.001$ ), confirming Hypothesis 6.

	<b>Effect</b>	<b>SE</b>	<b>LLCI</b>	<b>ULCI</b>
<i>Direct effects of Familiarity with role models on climate action</i>	0.244	0.040	0.165	0.323
<i>Indirect effects of Familiarity with role models on climate action via coping appraisal</i>	0.057	0.012	0.036	0.081
<i>Direct effects of Familiarity with role models on climate anxiety</i>	0.193	0.041	0.112	0.274
<i>Indirect effects of Familiarity with role models on climate anxiety via coping appraisal</i>	0.021	0.008	0.005	0.038

Ordinary least square regression,  $n = 1,150$ . Indirect effect are tested through bootstrapping ( $n$  of samples = 5,000), effect sizes, standard errors and the 95% confidence interval of effects are reported.

**TABLE 4: TESTS OF HYPOTHESES 7 AND 8**

Finally, Table 4 present results for testing Hypothesis 7 and 8, which postulate that effects of familiarity with role models on climate action and climate anxiety are mediated by coping appraisal. Such mediation hypotheses can tested by computing the influence of independent variables and covariates on the mediator (step 1, tested in model 10), the effect of the mediator on the dependent variables (step 2, tested in model 6 and 7), and the indirect effect via the mediation pathway using bootstrapping (step 3, Hayes, 2017). Bootstrapping tests identify both positive direct effects of familiarity with role models on climate action ( $B=0.244$ ,  $CI: 0.165-0.323$ ) and indirect effects on climate action via coping efficacy ( $B=0.057$ ;  $CI: 0.036-0.081$ ), confirming Hypothesis 7. They also confirm positive direct effects on climate anxiety ( $B=0.193$ ,  $CI: 0.112-0.274$ ) and indirect effects on anxiety action via coping efficacy ( $B=0.021$ ;  $CI: 0.008-0.038$ ), providing no confirmation of Hypothesis 8. Instead, results suggest that familiarity with climate action role models increases climate anxiety directly (potentially by highlighting the enormous challenges involved in climate action, see discussion), and indirectly through coping appraisal (potentially by increasing cognitive dissonance, see discussion).

This study provided us with robust results with high external validity when it comes to climate action. Still, it also holds several limitations. Our methodological approach does not provide tests of causality. In addition, we are dealing with a cross-sectional sample of respondents. Thus, we cannot rule out the possibility of environmental action generating feedback on climate anxiety over time, partially obscuring potential effects within our research model. Similarly, self-reported information can be influenced by various biases (Choi & Pak, 2005), potentially causing differences between reported information and real-world emotions and behavior (Brock et al., 2023). Therefore, we conducted a second study with an experimental design to address these limitations.

## 4. Study 2: Audio Priming Experiment among Students

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### 4.1. METHOD

The second study was carried out among students from the Vienna University of Business and Economics. It expands on the findings from the first study by adopting a different sampling strategy and methodological approach focusing on high internal validity. This way, in-depth views on role models and their effects on climate anxiety and climate action were observable. Compared to the sample in the first study, respondents in general did not have a strong tie to climate action and mitigation in their professional work. Young students are also a particularly relevant population in the context of this study's goals since role models have been attributed to especially influence perceptions of younger individuals in regard to sustainability (Arnold et al., 2009; Chawla, 1998).

Data was gathered via an online priming experiment in the period between May 14<sup>th</sup> and June 19<sup>th</sup>, 2024. Participants were incentivised to take part in the survey by being given the chance to win one of two cash prizes of 200 € or one of 40 coffee vouchers for the on-campus café. The cash incentive acted as an additional explorative variable as respondents were able to indicate whether they would want the entire sum or if they would want to donate parts of it, in which case the research team would double the allocated amount<sup>2</sup>. A total of 560 respondents have started the survey. After removing cases that were considered too incomplete (341), respondents that indicated that they did not consent to the GDPR note (4), people that indicated they were just testing the survey in an open text field (14), cases that were not part of the official survey period (31) and one person that was seemingly just testing and giving the same answering pattern throughout the whole survey, the final sample consisted of 169 participants across all groups.

**Survey design and priming:** The survey respondents were split into two groups: an experimental group and a control group. In both groups, survey takers would receive different priming exercises. "Priming" aims to increase the accessibility of mental concepts by temporarily activating them (Bargh et al., 1996; Higgins, 1996). It has been used in the context of climate

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<sup>2</sup> If participants chose to donate the full 200€ the team would donate another 200€. Similarly, respondents were able to donate parts of the winnings (which were doubled) and keep the rest or everything for themselves. By doubling the donated amount we sought to avoid that individuals with an intention to donate decide to claim all for themselves and make the donations themselves later to gain associated tax deductions (thereby making our variable uninterpretable).



action before, although many of these approaches have applied rather narrow priming inputs liked information boxes (Hornsey & Fielding, 2016), video presentations (Hornsey et al., 2021) or participation in simulations (Druen & Zawadzki, 2021). Similarly, priming experiments that featured role models have also often been limited to pre-selected real or made-up personalities (Dasgupta & Asgari, 2004; Gartzia et al., 2021). Contrary to these approaches, people in the experimental and the control group of this study have been presented with an audio task. The design and the key variables of the experiment are displayed in Figure 2. The goal was to ensure that both tasks in the treatment and the control group are structured as similar as possible. This approach allows us to better access personal role models and activate real experiences and thoughts that respondents may have regarding this person and their actions. As already mentioned, verbal information reveals more about an individual's emotions (Woolbert, 1922), and allows respondents to have a more immediate access to memories and thoughts (Kellogg, 2007). Similarly, Ericsson and Simon (1980) have argued that think-aloud protocols can be able to activate cognitive processes and produce information from respondent's short-term memory. While the primary aim of this study was not the collection of reliable think-aloud protocols, these indications on verbal response collection suggest that more immediate thought processes on role models will be observable through this open approach.

To get a direct comparison between an open and a structured design, an additional benchmark group was introduced as a third group. In this group, respondents did not receive an audio prime but were requested to read a brief article on recent developments in global carbon emissions. The message was adapted from another priming experiment by Hornsey & Fielding (2016) in which it had served as an intervention to test the effect of negative messaging on climate action. Negative messaging is not only the commonly experienced type of messaging on climate in everyday life (see Diamond & Urbanski, 2022), but has also been the most effective intervention in the experiment of Hornsey & Fielding (2016). Thus, it serves as a suitable benchmark to evaluate the effect strengths of role models in this experiment. It is important to note that some caution must be maintained when interpreting comparisons with the benchmark group. Due to the technical demands of audio recording and the difficulties in performing it in noisy environments, Group 1 and 2 displayed higher drop-outs rates than the comparison group, requiring us to keep the survey open longer for these two groups. Thus, while initially respondents were randomized across all three groups, this introduces a systematic difference between the benchmark group on the two others. While comparisons of key variables point to no visible differences across the three groups<sup>3</sup>, the condition of randomization can only be regarded to be fulfilled for the two main groups of the study, Group 1 and 2.

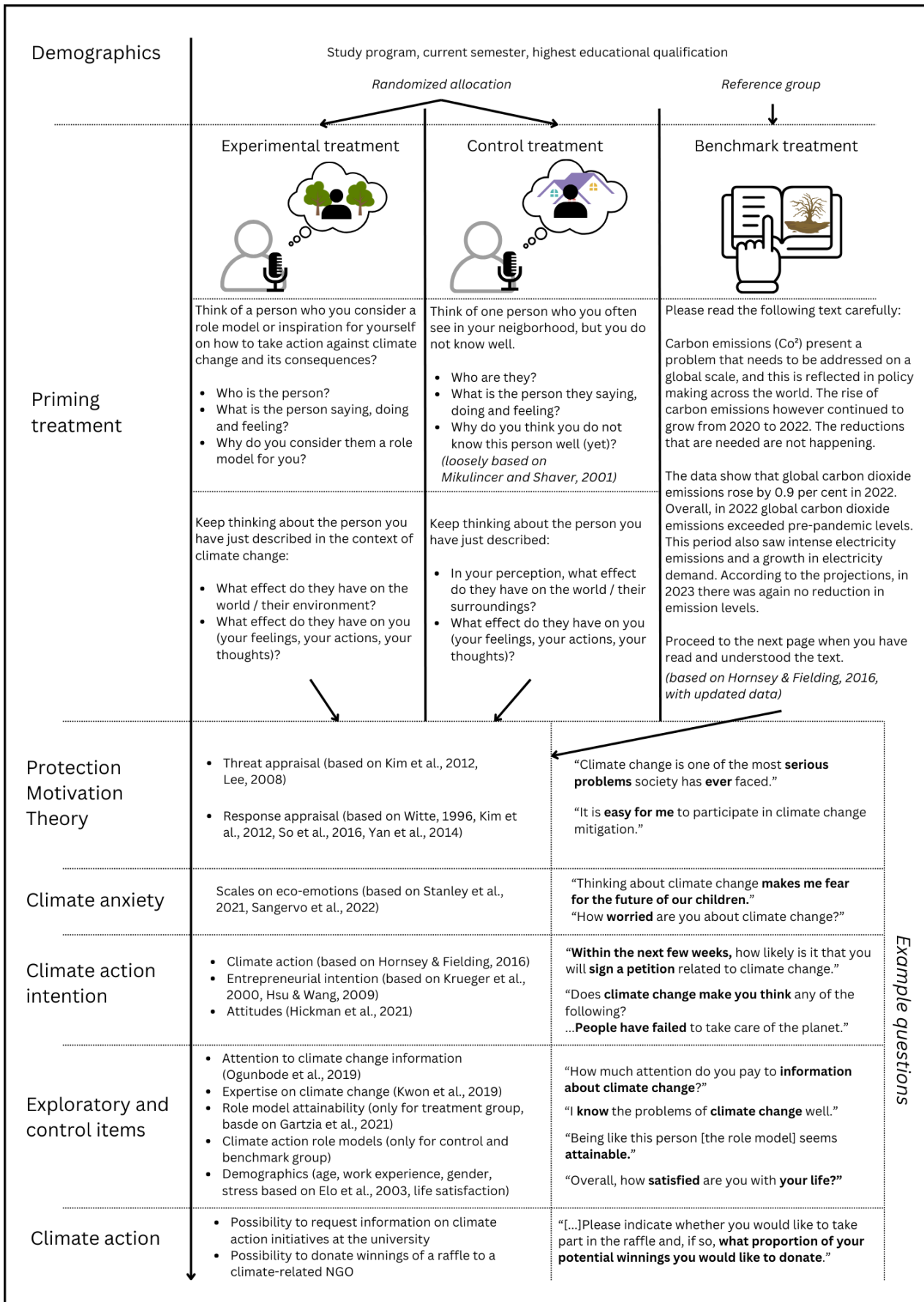
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<sup>3</sup> T-test means comparisons show no significant difference across groups for age, length of studies, highest attained level of education, work experience in climate-related jobs, perceived levels of stress and life satisfaction, or the existence of role models regarding climate change in their life.

**Role Model** perceptions have been primed by asking participants in the treatment group to think about one person that they would consider a role model on how to act against climate change. They were asked to verbally reflect about who this person is, what they are doing, why they consider them a role model and what effect their role model has on the world. We expect that activating the respondent's climate action role models, we can temporarily enhance their coping appraisal, which should lead to reduced climate anxiety and increased climate action.

The use of this innovative way of priming survey participants is novel in this field of research. Therefore, additionally steps had been taken to ensure that this method was feasible for the proposed sample population. The survey design was tested in three stages. A more detailed account of the process and the steps that were taken during these pretests can be found in Appendix 1.

- First pretest: Students on campus have been verbally surveyed by the research team to assess the prevalence of climate role models and test the key instrument for priming respondents' role model perceptions. Due to many short answers the instrument was expanded to be able to activate deeper thinking processes. A total of 29 people participated in the test.
- Second pretest: Once the survey has been set up online, a first technical pretest took place among peers and students. Overall length, usability and qualitative feedback was gathered from this test. The wording in the control group was adapted due to some difficulties in understanding how close the relationship to the person in the control group should be. A total of 30 respondents have finished at least parts of this second pretest.
- Third pretest: A final online pretest among the final survey population has been carried out. Respondents did not experience any technical issues and the overall feedback regarding the audio instrument was positive. Respondents were able to give quantitative feedback which was used to measure among other things interest in the task and compare the experimental and control group. Comparisons have been done based on these measurements to ensure that there are no significant differences in these values between the treatment and the control group. Data from this pretest has been additionally used to perform reliability checks. 27 people participated in this last pretest.



Example questions

FIGURE 2 – STUDY DESIGN WITH KEY INSTRUMENTS (STUDY 2, OWN ILLUSTRATION)

Instruments for **threat appraisal** and **coping appraisal** have carried over from the first study.

**Climate anxiety** was measured differently than in study 1 to more directly capture emotional aspects of climate anxiety. Six items based on Stanley et al (2021) have been used to measure different emotions like depression, fear and frustration regarding climate change. Respondents were asked to indicate how this issue made them feel for each of these emotions on a scale from 0 to 100. Two of the items were used to build our scale of climate anxiety.

**Climate action** was measured with an adapted version from Hornsey and Fielding (2016). Compared to study 1 the wording of the answer options was changed to capture future intentions instead of past actions. Additionally, two scales by Krueger et al. (2000) and Hsu & Wang (2019) have been slightly adapted to capture entrepreneurial intent in general and in the context of climate change. Lastly, respondents were also asked to state some of their general beliefs on how climate change will affect the planet and their life. Respondents stated their agreement in regard to questions like "I won't have access to the same opportunities that my parents had (Scale: Yes, No, Prefer not to say). A variety of **control variables** have been introduced, some of them in direct response to the results from the first study. Consistent with study 1, other control variables like age, climate expertise, gender, and life satisfaction have been included in the survey. Moreover, we compared the daily highest temperature throughout the survey period with the respective average in the time period 1991-2020 in Austria<sup>4</sup>. This allowed us to control for potential changes in the perceived proximity of climate change due to heat waves (Zanocco et al., 2018).

## 4.2. RESULTS

### 4.2.1. Descriptive Results

This study's sample consisted of 169 students of the Vienna University of Economics and Business. In total, 51 respondents were randomly allocated to the treatment path of the experiment and 64 respondents formed the control group, comprising a main sample of 115 responses for analysis. An additional 54 student received the benchmark prime prior to completing the survey.

**Manipulation check:** All but 1 respondent in the treatment group (Group 1) were able to name and describe an individual they regarded as a role model or inspiration. The largest group of role models were activists (e.g. Greta Thunberg, Luisa Neubauer,...) with 24 mentions. 16 participants described personal friends and family as climate action role models. Other publicly known

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<sup>4</sup> Data source: Geosphere Austria. (n.d.). *Klimamittelwerte 1991-2020—ZAMG*. Accessed 27 November 2024, (URL: [https://www.zamg.ac.at/cms/de/klima/informationsportal-klimawandel/daten-download/copy\\_of\\_klimamittel](https://www.zamg.ac.at/cms/de/klima/informationsportal-klimawandel/daten-download/copy_of_klimamittel))

role models were mentioned 16 times in total as well (seven participants described actors from the business world, five named politicians, four named scientists). Two respondents regard personally known entrepreneur as role models, while one respondent was not able to name a specific person. As a role model can have multiple roles in society, we allowed for stated persons to be included in multiple of these categories (e.g. a scientist can also be active as an activist).

	Mean	S.D.	1	2	3	4	5	6	7	8	9
<i>Core variables</i>											
1. Familiarity with role models	0.44	0.50									
2. Threat appraisal	3.57	0.91	0.26 **								
3. Response appraisal	3.65	0.64	0.19 *	0.39 **							
4. Climate Anxiety	50.01	28.93	0.21 *	0.69 **	0.21 *						
5. Climate Action	2.85	0.68	0.20 *	0.63 **	0.56 **	0.60 **					
<i>Control variables</i>											
6. Age	23.43	3.15	-0.05	0.19	0.18	-0.06 *	0.16				
7. Gender: female	0.58	0.50	0.08	0.24 **	0.21 *	0.36 **	-0.42	-0.04			
8. Climate expertise	2.40	5.23	0.10	0.19 *	0.22 *	0.18 *	0.17	0.12	0.10		
9. Life Satisfaction	3.63	0.74	-0.10	-0.18	0.08	-0.19 *	0.01	0.31	-0.08	0.05	
10. Temperatur deviation on day of survey	0.58	2.23	-0.06	0.12	-0.06	0.15	0.14	0.07	0.06	0.01	0.00

*Two-tailed Pearson Correlations, n = 115 (treatment group, control group; p: \* < 0.05, \*\* < 0.01. Gender: female: female = 1, male = 0 (no other answers in sample), climate expertise: two-item scale (Kwon et al. 2019): 1 (low) - 5 (high), life satisfaction: scale: 0 (low) - 100 (high), temperature deviation on day of survey:  $\Delta$  highest daily temperature cp. to average 1991-2020 in Austria in Celsius, climate anxiety: two item scale (Stanley et al. 2021): 0 (no) - 100 (high), threat appraisal: four-item scale (Kim et al. 2013, Lee 2008), scale: 1 (low) - 5 (high), coping appraisal: three-item scale (Kim et al. 2013, Witte 1996): 1 (low) - 5 (high), familiarity with climate action role models: treatment group=1, control group=0, climate action: ten-item scale (Hornsey and Fielding 2016): 1 (low) - 5 (high).*

**TABLE 5. DESCRIPTIVES AND CORRELATIONS**

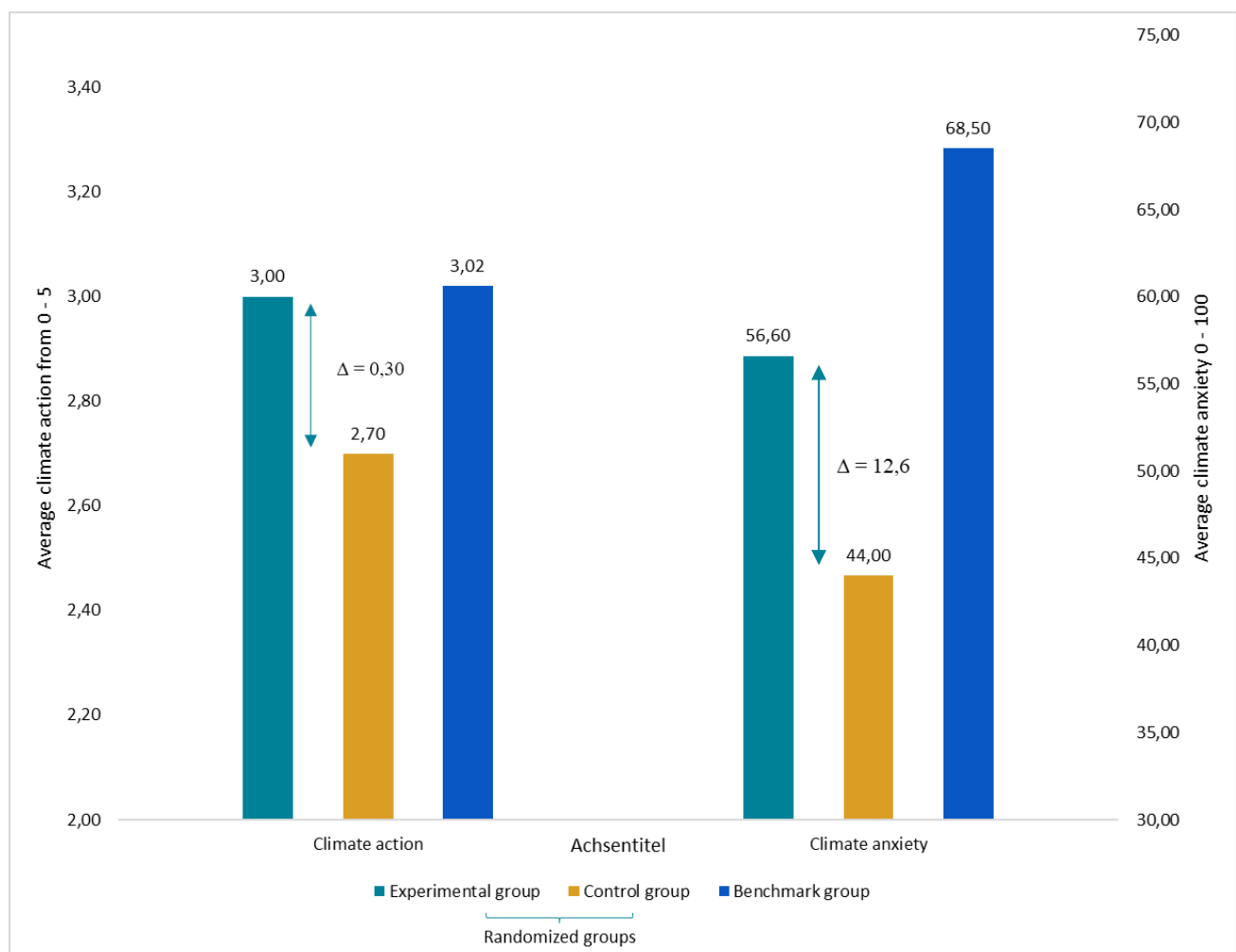
The average age in the core sample is 23.43 years (see Table 5). 44.3% of our sample identifies as male and 55.7% as female. The study duration of respondents spans from 1 to 12 semesters, with the average being 4.6 semesters at the time of completing the survey. The average temperature deviation from the 1991-2020 temperature mean was + 0.58 Celsius, which is a fairly low deviation in present-day Austria<sup>5</sup>.

#### 4.2.2. Hypothesis testing

First, independent sample t-tests were performed to investigate the overall effect of the treatment. Results show that the level of climate action intentions is higher in the treatment group (M = 3.00, SD = 0.74) compared to the control group (M = 2.70, SD = 0.63, t = 2.33, p <

<sup>5</sup> In comparison: In 2023, temperatures in Vienna were on average 2.8 degrees Celsius warmer than during 1991-2020. Data source: Geosphere Austria. (n.d.). *Klimamonitoring*. Accessed 28 November 2024, (URL: <https://www.zamg.ac.at/cms/de/klima/klima-aktuell/klimamonitoring/?station=5904&param=t&period=period-y-2023&ref=1>)

0.05). Again, contrary to our expectations, the treatment group also experiences higher levels of climate anxiety ( $M = 56.6$ ,  $SD = 29.1$ ) than the control group ( $M = 44.0$ ,  $SD = 28.2$ ,  $t = 2.35$ ,  $p < 0.05$ ). As demonstrated in Figure 3, the effect of priming role models on climate action is similarly effective as the pessimistic message of the “benchmark prime” in Group 3 ( $M = 3.02$ ,  $SD = 0.65$ ,  $t = -.11$ ,  $p = n.s.$ ). At the same time, levels of climate anxiety are even higher in Group 3 that received pessimistic messaging ( $M = 68.5$ ,  $SD = 24.0$ ,  $t = 2.29$ ,  $p < 0.05$ ). These findings provide a first confirmation of the results of Study 1, showing that access to role models increases climate action (to the same degree as pessimistic messaging), but also climate anxiety (albeit less than pessimistic messaging).



**FIGURE 3. MEANS COMPARISONS**

	<i>Model 6</i>		<i>Model 7</i>		<i>Model 8</i>		<i>Model 9</i>		<i>Model 10</i>	
	<i>DV: Climate action</i>		<i>DV: Climate action</i>		<i>DV: Climate anxiety</i>		<i>DV: Coping appraisal</i>		<i>DV: Coping appraisal</i>	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Constant		n.s.		n.s.		n.s.		< 0.001		< 0.001
Age	0.150	< 0.05	0.100	n.s.	-0.058	n.s.	0.150	n.s.	0.160	< <b>0.10</b>
Gender: female	0.158	< 0.05	0.092	n.s.	0.217	< 0.01	0.246	< 0.01	0.231	< 0.05
Climate expertise	0.056	n.s.	0.007	n.s.	0.041	n.s.	0.214	< 0.05	0.194	< 0.05
Life satisfaction	0.129	< 0.10	0.083	n.s.	-0.053	n.s.	0.076	n.s.	0.092	n.s.
Temperature deviation on day of survey	0.033	n.s.	0.075	n.s.	0.062	n.s.	-0.091	n.s.	-0.080	n.s.
Climate anxiety	0.293	< 0.01	0.337	< 0.001						
Threat appraisal	0.394	< 0.001	0.237	< 0.05	0.647	< 0.001				
<b>Coping appraisal</b>			<b>0.359</b>	<b>&lt; 0.001</b>	<b>-0.076</b>	<b>&lt; n.s.</b>				
<b>Familiarity with role models</b>									<b>0.166</b>	<b>&lt; 0.10</b>
<i>Model information criteria</i>										
R <sup>2</sup>	0.518		0.614		0.539		0.137		0.164	
Adjusted R <sup>2</sup>	0.487		0.585		0.509		0.098		0.117	

Ordinary least square regression,  $n = 115$  (treatment group, control group), standardized coefficients are reported. Gender: female: female = 1, male = 0 (no other answers in sample), climate expertise: two-item scale (Kwon et al. 2019): 1 (low) - 5 (high), life satisfaction: scale: 0 (low) - 100 (high), temperature deviation on day of survey:  $\Delta$  highest daily temperature cp. to average 1991-2020 in Austria in Celsius, climate anxiety: two item scale (Stanley et al. 2021): 0 (no) - 100 (high), threat appraisal: four-item scale (Kim et al. 2013, Lee 2008), scale: 1 (low) - 5 (high), coping appraisal: three-item scale (Kim et al. 2013, Witte 1996): 1 (low - 5 (high), familiarity with climate action role models: treatment group=1, control group=0, climate action: ten-item scale (Hornsey and Fielding 2016): 1 (low) - 5 (high).

**TABLE 6. STUDY 2: TEST OF HYPOTHESES 1, 2 AND 3**

Second, we tested our hypotheses using multivariate OLS Regressions (see Table 6) to test effects in the experiment and control group. Model 1 and 2 present results related to Hypothesis 1, showing a significant effect of climate anxiety on climate action (Model 2,  $\beta=0.557$ ,  $p<0.001$ ) when added to the base model (Model 1). Model 3 and Model 5 also show positive, significant effects of threat appraisal on climate action ( $\beta =0.576$ ,  $p<0.001$ ) and climate anxiety ( $\beta=0.620$ ,  $p<0.001$ ), confirming Hypotheses 2 and 3. Like in Study 1, additional testing also confirms the indirect mediation between threat appraisal and climate action via climate anxiety ( $B= 0.135$ , LL: 0.030, UL: 0.221), underscoring the integral part of anxiety in building motivation for protective action (Floyd et al., 2000; Rogers & Prentice-Dunn, 1997). As seen in Model 7 (Table 7), adding coping appraisal increases explanatory power and exerts a significant positive effect on climate action ( $\beta = 0.349$ ,  $p <0.001$ ), which confirms Hypothesis 4. The effect of coping appraisal on climate anxiety, however, is negative and not significant (Model 8,  $\beta = -0,076$ ,  $p = n.s.$ ). Thus, similar to the results of Study 1, Hypothesis 5 is rejected. The experimental treatment exerts a weakly significant positive effect on coping appraisal ( $\beta = 0.166$ ,  $p <0.1$ ), confirming Hypothesis 6.

	<i>Model 6</i>		<i>Model 7</i>		<i>Model 8</i>		<i>Model 9</i>		<i>Model 10</i>	
	<i>DV: Climate action</i>		<i>DV: Climate action</i>		<i>DV: Climate anxiety</i>		<i>DV: Coping appraisal</i>		<i>DV: Coping appraisal</i>	
	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p	Coeff.	p
Constant		n.s.		n.s.		n.s.		< 0.001		< 0.001
Age	0.150	< 0.05	0.100	n.s.	-0.058	n.s.	0.150	n.s.	0.160	< <b>0.10</b>
Gender: female	0.158	< 0.05	0.092	n.s.	0.217	< 0.01	0.246	< 0.01	0.231	< 0.05
Climate expertise	0.056	n.s.	0.007	n.s.	0.041	n.s.	0.214	< 0.05	0.194	< 0.05
Life satisfaction	0.129	< 0.10	0.083	n.s.	-0.053	n.s.	0.076	n.s.	0.092	n.s.
Temperature deviation on day of survey	0.033	n.s.	0.075	n.s.	0.062	n.s.	-0.091	n.s.	-0.080	n.s.
Climate anxiety	0.293	< 0.01	0.337	< 0.001						
Threat appraisal	0.394	< 0.001	0.237	< 0.05	<b>0.647</b>	< <b>0.001</b>				
<b>Coping appraisal</b>			<b>0.359</b>	< <b>0.001</b>	<b>-0.076</b>	< <b>n.s.</b>				
<b>Familiarity with role models</b>									<b>0.166</b>	< <b>0.10</b>
<i>Model information criteria</i>										
R <sup>2</sup>	0.518		0.614		0.539		0.137		0.164	
Adjusted R <sup>2</sup>	0.487		0.585		0.509		0.098		0.117	

Ordinary least square regression,  $n = 115$  (treatment group, control group), standardized coefficients are reported. Gender: female: female = 1, male = 0 (no other answers in sample), climate expertise: two-item scale (Kwon et al. 2019): 1 (low) - 5 (high), life satisfaction: scale: 0 (low) - 100 (high), temperature deviation on day of survey:  $\Delta$  highest daily temperature cp. to average 1991-2020 in Austria in Celsius, climate anxiety: two item scale (Stanley et al. 2021): 0 (no) - 100 (high), threat appraisal: four-item scale (Kim et al. 2013, Lee 2008), scale: 1 (low) - 5 (high), coping appraisal: three-item scale (Kim et al. 2013, Witte 1996): 1 (low - 5 (high), familiarity with climate action role models: treatment group=1, control group=0, climate action: ten-item scale (Hornsey and Fielding 2016): 1 (low) - 5 (high).

**TABLE 7. STUDY 2: TEST OF HYPOTHESES 4, 5 AND 6**

Lastly, we explore the effects of familiarity with role models on climate anxiety and climate action via its effect on coping appraisal. Linear regressions including controls for age, gender, expertise, life satisfaction, and temperature differences show a significant total effect of being in the experimental group on climate action ( $\beta = 0.174$ ,  $p < 0.05$ ) and climate anxiety ( $\beta = 0.166$ ,  $p < 0.1$ ). Table 8 presents the results of bootstrapping tests of the direct and the indirect effect of the treatment on climate anxiety and climate action via the mediator coping appraisal (Hayes, 2017). The tests confirm a significant indirect effect of familiarity with role models on climate action via coping appraisal ( $B=0.109$ ,  $CI: 0.002-0.249$ ) but not on climate anxiety ( $B=1.296$ ,  $CI: -0.581-4.455$ ). These results confirm H7 but not H8, suggesting that a more positive appraisal of ways to cope with the climate crisis mediates the effect of role models on climate action, but not on climate anxiety.



<b>Testing Hypotheses 7 &amp; 8:</b>	<b>Effect</b>	<b>SE</b>	<b>LLCI</b>	<b>ULCI</b>
<i>Direct effects of familiarity with role models on climate action</i>	0.128	0.104	-0.079	0.334
<i>Indirect effects of familiarity with role models on climate action via coping appraisal</i>	0.109	0.064	0.002	0.249
<i>Direct effects of familiarity with role models on climate anxiety</i>	7.605	5.042	-2.391	17.601
<i>Indirect effects of familiarity with role models on climate anxiety via coping appraisal</i>	1.296	1.273	-0.581	4.455
<b>Post-hoc analysis:</b>				
<i>Indirect effects of familiarity with role models on climate action via threat appraisal</i>	0.167	0.075	0.033	0.329
<i>Indirect effects of familiarity with role models on climate anxiety via threat appraisal</i>	7.772	3.393	1.569	14.836

*Ordinary least square regression, n = 115 (treatment group, control group). Indirect effect are tested through bootstrapping (n of samples = 5,000), effect sizes, standard errors and the 95% confidence interval of effects are reported.*

**TABLE 8. STUDY 2: TEST OF HYPOTHESES 7 & 8, POST-HOC ANALYSIS**

#### 4.2.3. Further analyses and robustness checks

The remaining unexplained direct effects of role models on climate action and climate anxiety in Study 1, as well as the rejection of H8 in Study 2 prompted further curiosity in the research team about the nature of influence of role models. This led to the post-hoc exploration of threat appraisal as potential mediator of the relationships between role models and climate action as well as climate anxiety.

We argue that it is impossible to think about role models addressing the climate crisis without subconsciously also **being reminded of the associated challenges and threats** of the crisis itself – and thereby increasing both anxiety and the intention to act (see arguments and findings on Hypotheses 2 and 3). An explorative, inductive analysis of participants' audio recordings for the role model prime in Group 1 provide numerous examples of this, e.g.

I17: *"she [the role model] is at every conceivable press conference and demonstration what she feels and an anger against the generations that have destroyed the climate."*

I37: *"She said a sentence at a press conference that I still have in my head simply because it is so concise. it's about the irreversibility of the damage to ecosystems..."*

Additional responses pointed to the limitations of individuals role models in the context of the climate crisis per se. They suggest that even the most inspiring role models face and remind us of the **limits of individual agency** vis á vis a global crisis, e.g.

I6: *"it's frustrating, of course, because you don't really make a difference as a person, unless everyone says yes"*

I27: [the role model is] *"...an inspiration for me because it persists, because so many of my friends, we get tired or we just know what the problem is. We see the big problems and we also know that in the current society we are currently unable to overcome them"*

*in the system within capitalism and that obviously the large parts of society are not really prepared to change anything about how we live together, how our economic system works and so on. That means you actually know you're fighting against windmills, and you know that it's actually all pointless."*

Some responses also named role models whose actions themselves **carry additional threat or challenge**:

*I22 [About a radical activist role model] ...it must be very exhausting, so I also talked to her, and I think you feel abandoned and overwhelmed very often when you are transported away and locked in the examination cell for something that all of us should actually do. I have thought joining her for a long time, but unfortunately [...] I am currently not psychologically able to get locked up and go through this."*

Study 2 data allowed us to test whether in fact familiarity with role models increased threat appraisal and thereby exert an indirect effect on climate action and climate anxiety. The post-hoc analyses in Table 8 confirm these relationships. Familiarity with role models indeed exerts a significant and strong indirect effect by increasing threat appraisal on both climate action intentions ( $B=0.167$ ,  $CI: 0.033-0.329$ ) and climate anxiety ( $B=7.772$ ,  $CI: 1.569-14.836$ ).

## 5. Discussion and Conclusion

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This paper aimed to shed light on the connection between the familiarity to climate action role models, climate anxiety and individuals' climate action. We were able to test our hypotheses on various interconnections between these phenomena through our combination of a quantitative and an experimental empirical approach. Protection Motivation Theory proves as a useful and robust framework to predict climate action, mirroring earlier work utilizing PMT for predicting climate action (Frantz et al., 2024). Results of both studies indicate that a higher threat appraisal as well as a higher coping appraisal led to an increase in climate action, but also climate anxiety among respondents.

Our findings provide further evidence on the positive relationship between climate anxiety and climate action (see Bouman et al., 2020; Pihkala, 2020). Results support H1, indicating a significant positive effect of climate anxiety on general climate action, including personal action as well as climate policy-support. These results are in line with prior evidence on the topic (e.g. Bouman et al., 2020; Sangervo et al., 2022). Self-reported climate action among our respondents is high, although they acknowledge the cost of realizing it. The majority reported a broad repertoire of climate action, which they use, which also mirrors results from other studies in the field (e.g. Brock et al., 2023). 74.0% of our large-scale quantitative study argued to at least sometimes take steps to reduce their personal carbon footprint. In addition, climate anxiety is widespread, but seems less pronounced than in comparable studies among youth (e.g. Hickman et al., 2021).

Second, results support H2, indicating a positive correlation between the threat appraisal for climate change and personal climate action. Therefore, this paper provides further evidence that a higher appraisal towards consequences of the threat increases motivation to act towards mitigating climate change. Our findings echo one of the core concepts of PMT, which argues that higher threat appraisal leads to stronger motivation to protect oneself against an imminent threat (Rogers, 1983), also in the context of climate change and pro-environmental behavior. In a similar vein, we find a significant positive correlation between threat appraisal and climate anxiety.

In addition, our study provides evidence on the effect of the familiarity to role models on both climate anxiety and climate action. There are many role models for combating the climate crisis, ranging from entrepreneurship and sustainable lifestyles to activism and media. Two thirds of respondents in our survey sample of study 1 have found such role models in their life. Results support our hypotheses H6 and H7, showing that familiarity with role models facilitates the

process of engaging in climate action by strengthening the coping appraisal among individuals, illustrating feasibility of personal climate action. Similarly, results from our experimental study indicate a positive effect of priming role models on climate action, which is higher than priming the climate crisis alone. This suggests that communicating role models seems to be a promising strategy in inspiring climate action (see Kotcher et al., 2024; Sabherwal, Ballew, et al., 2021).

Surprisingly, however, hypotheses H5 and H8 are not supported by data in both of our studies. Our results indicate that knowledge about and access to responses on the threats posed by climate change does not decrease climate anxiety. In fact, familiarity to climate action role models reinforces climate anxiety directly and indirectly via increasing the coping appraisal. Moreover, further explorative analysis within our second data set highlights a positive correlation of familiarity with role models with threat appraisal, partially even increasing climate anxiety among respondents. This statement also holds true when controlling the results for expertise on the topic of climate change.

This invites debate about potential drivers of this adverse effect of role models. One potential explanation for this correlation could be, that role models might decrease the perceived psychological distance to the issue of climate change. A lower construal level proved to be able to heighten climate anxiety in previous studies, while increased psychological distance is associated with an increase in hope (see Bendell et al., 2020; Chu & Yang, 2019). The perception of an overwhelming responsibility can also contribute to this anxiety. Confrontation with role models might create cognitive dissonance through encouraging comparison with them (see Stone & Cooper, 2001), leading to feelings of exaggerated personal responsibility. Individuals might also perceive the suggested solutions as demanding a great deal of individual effort or responsibility, leading to anxiety, especially if they feel they cannot meet those expectations. Consequently, this could lead to overwhelming feelings and increased anxiety. While we controlled our findings for expertise and professional experience in the field, we also cannot exclude the frequency of information exposure on the topic as one potential explanation for these finding (see Whitmarsh et al., 2022). This means that role models could be directly impacting the access to information about climate change and in turn cause more anxiety. Uncertainty about the effectiveness and potential outcomes of climate change solutions can also translate into climate anxiety. A positive response efficacy might lead to a greater awareness of the uncertainties and complexities surrounding climate change solutions.

This paper contributes to multiple streams of literature. On the one hand, it provides further understanding of the growing concern of psychological implications of climate change. On the other hand, our research offers further insights on effective strategies to involve others in engaging in climate change mitigation activities, communication strategies to address climate anxiety and promote pro-environmental action (Hornsey et al., 2021).

In addition, we contribute to the discussion on the effect of role models on individuals and their

behavior. To the best knowledge of the authors, this paper provides the first study utilizing Protection Motivation Theory to analyze the effect of role models on climate anxiety and climate action, bringing these concepts together in a well-founded theoretical framework. Our study indicates how individuals can be motivated to take climate action (see Sabherwal, Ballew, et al., 2021). Role models facilitate the process of protection motivation by demonstrating feasibility of climate action. Therefore, by strengthening coping appraisal, they can increase protection motivation among individuals. Nonetheless, we also identify potential undesirable effects caused by role models as they have contributed to strengthening feelings of anxiety.

Finally, our novel audio priming method of Study 2 provides new insights in the field of priming experiments. While there are some downsides to this methodological approach (e.g. limited usability in public settings), we argue that this form of priming presents multiple advantages. First, it provided us with an opportunity to better and more immediate access respondents' memories and thoughts, and allows for higher accessibility of memories and thoughts (Kellogg, 2007; Woolbert, 1922). Second, transcribing the self-recorded treatments allows us to generate rich qualitative data for further analysis of the contents. Third, it facilitated the process for respondents in the treatment section of the survey, as no lengthy text entry was needed.

Our findings also have practical implications, particularly for those advocating for climate action. Broadly disseminating examples of climate action role models, such as activists or social/green entrepreneurs, has the potential to inspire further pro-environmental behavior among the wider public. Supporting individuals in sharing their climate action efforts can also generate ripple effects in this regard.

Nevertheless, our results also underline that climate anxiety is a real and significant concern. While low to moderate levels of climate anxiety may even be a prerequisite of climate action, especially high levels of climate anxiety, which are often present among young people, need to be addressed. Current role models and solutions seem to even exacerbate climate anxiety. Reducing high levels of climate anxiety – especially among vulnerable youth – is crucial, with potential solutions including a focus on responsible communication of underlying threats of climate change, and access to mental health support (Baudon & Jachens, 2021).

Our study is not without limitations. On the one hand, our sampling strategy focusses on two groups which are both rather homogeneous. Both the community of (social) entrepreneurs and the sample of students bring specific prerequisites, which limits generalizability of results for the global population. In addition, due to the novel priming method, comparability between the two audio treatment groups and the benchmark prime needs to be examined with caution. Finally, the climate change discourse is rapidly evolving. While our results mirror views of respondents throughout 2023 and 2024, understanding and beliefs on the topic among the population could quickly change.

Obviously, further research is necessary to increase the understanding of the complex relationship between role models, climate anxiety and climate action. One potential path for the future is to investigate long-term effects by engaging in longitudinal studies. In addition, further research needs to address the relationship between the familiarity to role models, threat appraisal and climate anxiety. Zooming in on the mechanisms of role models increasing climate anxiety through threat appraisal can provide further understanding of effective climate action communication, mitigating negative outcomes on mental health. It is important to note that there are numerous definitions of the term climate anxiety in current literature (Pihkala, 2020). Different forms of climate anxiety might lead to different reactions among individuals (Ágoston et al., 2022). This suggests that role models might also have differing effects on distinctive forms of climate anxiety. Similarly, results of this paper do not differentiate between different categories of role models. Further investigation along structural dimensions of climate action role models (Gibson, 2004) could provide even more fine-grained results. Finally, further investigation is necessary to understand the underlying mechanisms regarding undesirable effects of role models and how they might be overcome.

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## Appendix 1 – Further Information on Pretests for Study 2

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Three pretests were carried out before the launch of the survey. This approach was deemed necessary in order to test, whether the method of audio recordings for priming as well as the respective primes gather data in the treatment and control group as intended.

### **First pretest:**

The aim of this pretest was to explore if the target population could verbally name role models when briefly asked to think of one. Difficulties in overall understanding of the question would have been an indicator that changes needed to be made. The test was done physically on campus of the Vienna University of Economics and Business in Vienna by two of the authors each individually approaching students. 29 people participated in this pretest. People named role models from different fields and had different levels of personal relationship to them (e.g. Greta Thunberg, Bernie Sanders, internet personalities, personal relatives). Through this test it was observable that climate role models were accessible to a range of people in the survey population and that the instrument did not lead to confusion on who a role model could be.

As a result of this pretest the wording for the treatment group was adapted. During this test the respondents were presented with a short question "*Do you know a person who you consider a role model or inspiration for yourself on how to take action against climate change and its consequences?*". Some answers were rather short, and people did not elaborate much further on how they perceive this person as a role model. For the final survey the treatment group was also presented with a longer definition of who this person could be and asked deeper question about their chosen person.

### **Second pretest:**

The main goal of the second pretest was to observe any technical issues with the survey setup especially since the study used a novel approach in the implementation of the main priming tasks. Students and peers have had the ability to test the survey in its entirety and give open feedback after completing sections of the survey. The second test also gave a first indication on how much time it would take respondents to finish the survey. 30 people have finished at least parts of this pretest.

They were no reported issues with the audio recording tool and the open feedback was mostly positive. One person reported difficulties with understanding who the person in the control group

should be and how close of a relationship they should have. As a result of this feedback the wording in the control group was slightly adapted from "*Think of one person who you often see in your neighborhood*" to "*Think of one person who you often see in your neighborhood, but you do not know well*".

### **Third pretest:**

The third pretest was the final test before the launch of the survey. The data generated from this was used to test key instruments in terms of reliability. Additionally, participants in the treatment and control group were able to give feedback on the audio instruments by reporting their agreement to the following statements (Scale: 1 - strongly disagree to 5 - strongly agree):

- "I perceived the task I just completed as easily understandable."
- "I perceived the task I just completed as interesting."
- "After completing the task, I feel motivated to answer further questions."
- "I have the feeling that I was able to complete the task well."

Respondents could also give open feedback regarding the technical setup of the audio recording tool. The goal of these measurements was to see if the tasks were not too demanding, and people would still be receptive to the rest of the survey. Moreover, it allowed for comparisons between the treatment and control group. Ideally, the differences across these measurements would not be significant. 27 people participated in this last pretest. Respondents in the treatment group reported the tasks to be easily understandable ( $M = 4.58$ ,  $SD = 0.90$ ) and interesting ( $M = 4.17$ ,  $SD = 0.94$ ). Participants in the control group reported similar high agreement in terms of understandability ( $M = 4.00$ ,  $SD = 1.04$ ,  $t = 1.52$ ,  $p = n.s.$ ) and interest ( $M = 3.86$ ,  $SD = 1.10$ ,  $t = 0.77$ ,  $p = n.s.$ ). Respondents in the treatment group also indicated their agreement when asked to rate their level of motivation to answer further questions ( $M = 3.58$ ,  $SD = 1.08$ ) and if they were able to complete the task ( $M = 3.67$ ,  $SD = 0.89$ ). Values were similarly high in the control group for motivation ( $M = 3.36$ ,  $SD = 1.01$ ,  $t = 0.55$ ,  $p = n.s.$ ) and being able to complete the task ( $M = 3.50$ ,  $SD = 0.65$ ,  $t = 0.55$ ,  $p = n.s.$ ). It seemed that the tasks in these two groups did not lead to significantly different levels of engagement. Reliability checks showed that the eco emotions scales from Stanley et al. (2021) reached a very good level of Cronbach's  $\alpha$  (0.9).

## Appendix 2 – Announcement of the Survey for Study 2

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**Einladung: Empirische Studie mit Unterstützung der Stadt Wien (2x 200€ und 40 Kaffeegutscheine zu gewinnen) // Invitation: Empirical survey with the support of the City of Vienna (Win 2x 200€ and 40 coffee vouchers)**

\*\*\* Please scroll down for the English version \*\*\*

Sehr geehrte Studierende,

im Rahmen eines Forschungsprojektes führen wir derzeit mit Unterstützung der Stadt Wien (MA 7) eine Umfrage zu persönlichen Überzeugungen von Studierenden und deren Auswirkungen im Alltag durch.

Bitte unterstützen Sie unser Forschungsprojekt mit Ihrer Teilnahme an folgender Umfrage:  
<https://short.wu.ac.at/beliefresearch>

Die Umfrage kann auf Englisch oder Deutsch ausgefüllt werden und dauert etwa 15-20 Minuten. Vorkenntnisse sind nicht erforderlich. Am Ende der Umfrage können Sie an einer Verlosung von 2x 200€ in bar und 40 Kaffeegutscheinen für das Library Café am Campus der WU teilnehmen.

Ihre Daten werden während des gesamten Prozesses streng vertraulich behandelt. Bei Fragen steht Ihnen das Forschungsteam unter [beliefresearch@wu.ac.at](mailto:beliefresearch@wu.ac.at) gerne zur Verfügung.

Vielen Dank für Ihre Zeit und Unterstützung!

Peter Vandor

\*\*\*\*\*

Dear Students,

As part of a research project supported by the City of Vienna (MA 7), we are currently conducting a survey

on students' personal beliefs and how they manifest in their everyday lives.

Please support our research by participating in this survey: <https://short.wu.ac.at/beliefresearch>

The survey can be completed in English or German language and will take 15-20 minutes to complete. No prior knowledge is required. After completing the survey, you will be entered into a drawing for a chance to win 2x €200 in cash and 40 coffee vouchers for the Library Café on the WU campus.

Your information will be kept strictly confidential throughout the process. If you have any questions, please do not hesitate to contact the research team at [beliefresearch@wu.ac.at](mailto:beliefresearch@wu.ac.at).

Thank you very much for your time and support!

Peter Vandor

**Dr. Peter Vandor**

Leitung Social Entrepreneurship Center

Senior Researcher

**WU**

Wirtschaftsuniversität Wien

*Vienna University of Economics and Business*

Competence Center for Nonprofit Organisations and Social Entrepreneurship

Gebäude D 2, 3. OG, Zimmer 348

Welthandelsplatz 1, 1020 Wien

E-Mail: [beliefresearch@wu.ac.at](mailto:beliefresearch@wu.ac.at)

www: <http://www.wu.ac.at/sec>

## Appendix 3 - Authors

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### **Dr. Peter Vandor**

Peter Vandor is senior researcher and lecturer at WU Vienna, co-founder and head of the Social Entrepreneurship Center. In his position at the WU, he has been leading 100+ collaboration projects around research, capacity building, impact assessment and innovation, with partners such as the United Nations Development Programme, the Austrian Ministry of Social Affairs, Fraunhofer Ventures, Robert Bosch Foundation and CERN. Since 2013, he is Academic Director of the NGO Academy, a capacity building program for nonprofits and social enterprises offered in partnership with ERSTE Foundation. His research focuses on social entrepreneurs and their ecosystem, as well as immigrant entrepreneurship, and has been published in leading management journals including Journal of Business Venturing, Journal of World Business and Harvard Business Review. Peter was a SCANCOR visiting scholar at Stanford University and visiting lecturer at St. Petersburg University and Alanus University of Arts and Social Sciences.



### **Martin Mehrwald, MSc**

Martin Mehrwald is a research assistant at the Competence Centre for Nonprofit organizations and Social Entrepreneurship. He works on research projects revolving around the topics of social innovation and scaling of social enterprises. Moreover, he is involved in the coordination of the NGO Academy, which is a capacity building-programme for organizations in Central and Eastern Europe. Martin hosts the Competence Centre-Podcast Inside Impact. Currently, he pursues his PhD at the Institute for Nonprofit Management.



### **Fabian Hobodites, MSc**

Fabian Hobodites is a research assistant at the Competence Centre for Nonprofit organizations and Social Entrepreneurship and joined the team in April 2022. His main research projects revolve around the support needs of social entrepreneurs. He is involved in the European Social Enterprise Monitor Austria, monitoring of the support needs of the Impact Hub global network, as well as research projects on migrant entrepreneurship.

## Kontakt

Competence Centre for Nonprofit organizations and Social Entrepreneurship

### **WU**

Wirtschaftsuniversität Wien

*Vienna University of Economics and Business*

Gebäude D2, Eingang E, 3.Stock

Welthandelsplatz 1, 1020 Vienna

Tel.: + 43 1 313 36 / 4594

[peter.vandor@wu.ac.at](mailto:peter.vandor@wu.ac.at)

[www.wu.ac.at/sec](http://www.wu.ac.at/sec)