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Future Actions towards Climate Change: The Role of Threat Perception and Emotions

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Abstract
This work explores the emotional activation (anxiety, fear, and anger) resulting from the cognitive-emotional process related to the perception of climate change: a) when climate change is considered the result of human action (anthropogenic) and b) when climate change is considered the result of the planet's natural activity. An experimental study was conducted with 104 participants exposed to two types of messages about the causes of climate change. The results showed that exposure to the anthropogenic influence led to greater perception of threat to humans. Moreover, the participants in the anthropogenic sample expressed more anxiety and anger (negative emotions) than did the participants believing that climate change was due to the planet's natural activity. Fear was not significant. Additionally, we verified the differential role of emotions, depending on the type of future behavior intention: emotions act as mediators between the perception of future climate threats and future collective pro-environmental behavior action, while the perception of threat acts directly on future individual pro-environmental behavior intention.

Keywords: Global warming, negative emotions, threat perception, pro-environmental behavior intention.

1. Introduction

Scientific interest has been increasing in the evolution of the planet's climate over the last decades. The predicted consequences of climate change are not very positive, considering that global warming is likely to reach 1.5 degrees Celsius (ºC) between 2030 and 2052 if it continues to increase at the current rate (IPCC 2018 p.3). In this sense, Spain will be one of the countries most affected by extreme heat resulting from climate change; in fact, there is already evidence that a significant stretch of its coast, bathed by the Mediterranean Sea, is heating up faster than most coastal areas worldwide. Specifically, the Working Group II report of the IPCC highlights, with respect to the Mediterranean, that the temperature has already increased by 1.5ºC, while the world average is 1.1ºC. Additionally, a considerable increase in droughts has been predicted, posing a very 'relevant' risk throughout the Mediterranean region. For each degree of temperature increase, rainfall will reduce by 4%; therefore, rainfall reductions of between 5% and 20% have been predicted, depending on the ability to reduce emissions. As indicated by some studies, some records confirm that the Iberian Peninsula is experiencing an increase in the impact of heat waves in summer, namely, fire risks and the risk of extinction of species sensitive to warming, phenological changes, and the displacement of species, as well as negative impacts on human health, water resources, and food security (Carnicer et al. 2019;). To these must be added the impact of these conditions on the population's mental health (Cianconi, et al. 2020;

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Clayton and Karazsia 2020; Donoso 2021; Panu 2020). Recent research indicates that such climatic conditions imply changes in well-being and quality of life and assumes the adoption of new lifestyles and habits as an adaptation strategy, generating some concern in the population (Corral-Verdugo 2021; Stewart 2021). Past studies have warned of our current situation. For instance, at the 24th Annual Summit on Climate Change (WHO 2018), the results of the first large-scale survey study (with 25,000 participants aged over 18 years from 30 countries) on public concern about the threat of climate change were presented. The results revealed that 78% and 63% of the European citizens and US participants, respectively, were alarmed. In Spain, awareness of the effects of global warming exceeds the European average, with 87% of the population showing alarm. Hence, it is the fifth most concerned country, following Portugal, Greece, Cyprus, and Malta. This study also analyzed the number of people denying the existence of climate change. In Europe, the proportion of skeptics and deniers was 6% and 1%, respectively. In the United States, the figures are even higher, with 8% doubting and 16% denying the existence of climate change. The denial of climate change is based on the beliefs that people express about its attributable causes; perceiving it as a risk produces feelings of anxiety (Hornsey et al. 2016) when thinking about the future consequences of climate change alerted by scientific evidence. In this sense, Rahmstorf (2004) calls people who refute the scientific consensus that climate change is largely anthropogenic 'attribution skeptics.' The results of some studies indicate that 'attribution skeptics' undertake a process of cognition motivated or oriented toward attending, selecting, processing, and remembering the available information in a biased manner (Hamilton and Stampone 2014). Thus, they tend to reject and ignore information that contradicts their beliefs, ideologies, or pre-existing prejudices.

Despite the percentage of climate change deniers possibly being low, the percentage of individual or collective actions in favor of mitigating climate consequences is not high. For example, the Elcano Royal Institute in Spain conducted a survey in 2019 to gauge Spaniards' level of concern regarding climate change, as well as their level of support for various elements, instruments, and processes that could be included in the future Spanish Law on Climate Change and Energy Transition (Lázaro 2019). The results showed that 'Spanish citizens perceive climate change as the greatest threat to the world' (p.73). More specifically, high scores were obtained for environmental awareness (measured with the new ecological paradigm (NEP) scale); however, it was found that when faced with specific mitigation actions (for example, paying a higher registration fee for the emissions of gases from their own vehicles), the acceptance rate decreased, thus showing a limited degree of involvement. In this study, more than 40% of the interviewees who owned a vehicle, even those with a more pro-ecological vision (high score on the NEP scale), were unwilling to pay more taxes to limit climate change. Additionally, they did not consider climate change the responsibility of citizens; rather, they felt that governments and businesses should adopt and initiate the appropriate changes to curb climate change. In this sense, 80% of the respondents stated that existing government measures were insufficient. In general, the results of this survey suggest that sociodemographic and ideological variables play a relevant role in determining the positions of Spanish citizens toward climate change and the environment. Therefore, inconsistencies continue to be found between the degree of concern and behavior intentions. Given the above, one might wonder why, if people are

aware and concerned about the negative consequences of climate change, they do not get involved in actions that could contribute toward mitigating the consequences. Perhaps one of the reasons for this is that climate change is not experienced directly, as are other environmental threats (van der Linden 2015), although this is unclear.

1.2. Climate change risk perception, emotions and actions.

Previous research has indicated that interpreting a specific situation as a threat or risk (in this case, the pernicious effects of climate change on the human species) generates in a person such an emotional state that it activates the intention to undertake concrete actions to alleviate this threat perception. We believe it is necessary to understand the analysis process that humans follow to conduct ourselves according to the level of awareness we present in the face of a situation we perceive as a climate threat. Emotions are the basis of human actions, as they influence thinking and learning at an individual or collective level. Böhm (2003) also related the temporal perspective in the perception of threats, providing a classification of negative emotions: when the perceived environmental consequences have already occurred (retrospective), people feel sadness or regret, while when the threats are perceived as future (prospective) consequences, people tend to feel fear, anger, or anxiety. These prospective consequentialist emotions encompass the feelings that can arise when people anticipate the effects of climate change (Stewart 2021). In this sense, some studies suggest that specific emotions, such as anger, lead people to undertake both individual and collective environmental protection actions (Durán et al. 2007), while contrary results are obtained with emotions of fear, since it has been found that a blockage leading to non-action occurs (Roeser 2012). We have not found studies that try to clarify this issue using experimental methodology. Therefore, it seems relevant to consider that the emotions involved in the implementation of environmental actions depend on the risk analysis of each individual. Different classifications of climate risk perception can be used (Ding et al. 2011; Paek and Hove 2017). The most accepted classifications are those that consider direct (negative effects on physical processes, such as changes in the frequency, intensity, or duration of meteorological phenomena) or indirect risks (social, political, technical, or physical processes triggered by the interaction of the direct effects). Regardless of whether the risks are direct or indirect, risk perception involves two dimensions: a) cognitive (rational), which refers to the degree of knowledge people have about the risk; and b) emotional, which is related to how they feel about it (Paek and Hove, 2017). If the perception of a certain situation implies analyzing its costs and benefits in rational and emotional terms, we believe it relevant to explore this cognitive-emotional process, considering the evidence and information available on the causes of climate change that the person will evaluate. Thus, we will be able to understand the lack of correspondence between the level of environmental awareness and the intention to undertake actions to mitigate climate change and therefore, generate more appropriated intervention strategies. Moreover, understanding the emotional reactions resulting from the cognitive evaluation of climate change can facilitate the prediction and explanation of future behaviors (Iñiguez-Gallardo, et al. 2021). Clarifying the relationship between emotions, cognition, and behavioral intention can facilitate the development of intervention programs aimed at achieving better behavioral repertoires and promoting positive actions for adaptation to and mitigation of climate change among the population (Corral-Verdugo 2021). However, we must highlight that few investigations have had this

objective and that, additionally, most of the studies reviewed have been conducted with samples from American countries (van der Linden 2015), which limits the generalization of the results and necessitates considering samples with different cultural characteristics. Hence, this study has attempted to analyze this process with a Spanish sample.

2. The present study

In this study, we adopted a quasi-experimental perspective in which we manipulated exposure to information on the causes of climate change to evoke in the participants an awareness of future (prospective) climate consequences (Böhm 2003). More specifically, this study's objective was to explore the cognitive-emotional process that people experience based on their perception of climate change and depending on the type of information they evaluate. Accordingly, we analyzed whether there are differences in the activation of negative emotional states (anger, fear, and anxiety) traditionally associated with the perception of climate change threat when the cause is believed to be human action, or if, conversely, when the cause is considered the result of the planet's natural activity. We divided the sample in two groups: one would be provided with a denialist message about the causes of climate change (planet's natural activity group), and the other, with a message recognizing the anthropogenic nature of climate change (human activity group). Additionally, we used content highlighting the scientific consensus (favoring climate change as a result of the planet's natural activity vs. as a result of human activity). Some results suggest that public understanding of the scientific consensus affect the generation of beliefs and attitudes regarding the causes of climate change (Lewandowsky, et al. 2013; van der Linden 2015; van der Linden et al. 2017). As indicated by Schroeder and Kobayashi (2021), little is known about how people process the messages coming from the scientific consensus on the causes of climate change; hence, this study also aims at elucidating this topic.

Additionally, we analyzed the role of emotions to determine whether there are differences in the degree of intentionality to undertake actions that reduce or mitigate the activation of such states. After reviewing the literature (O'Neill and Nicholson-Cole 2009; Feldman and Hart 2018;), we expect (H.1) participants who believe 'human activity' to be the cause of climate change (anthropogenic) to experience greater anxiety, fear, and anger (negative emotions) than those who believe 'natural activity' to be the cause (planet's natural activity). Moreover, considering some of the suggestions and results of different studies (Maibach, et al. 2014; Hartter et al. 2018), we expect (H.2) people who believe that climate change is anthropogenic, to promote greater pro-environmental, collective, and individual actions than those who believe that climate change is due to the Earth's natural activity.

3. Method.

3.1. Participants

This study sample comprised 104 participants (35 men and 69 women), with a mean age of 33.82 years (S.D. = 14.29). The participants were randomly assigned to one of two groups, so that each group would finally comprise the same number of participants (N= 52). Group 1, called 'human activity' (corresponding to those who received the message that climate change is due to human activities), comprised 17 men (32.7%) and 35 women (67.3%), with a mean age of 34.46 years (S.D. = 13.29). Group 2, called 'natural activity' (corresponding to those who received the message that climate change is a consequence of the planet's natural activity), comprised 18 men (34.6%) and 34 women (65.4%), with a

mean age of 33.17 years (S.D. = 15.33).

3.2. Procedure

In the first phase, the participants were recruited through an announcement published on the boards of faculties, libraries, civic centers, and other public organizations in Granada (Spain). In exchange for participation, individuals were offered entry into a raffle to win one of three weekend getaways for two people. The only requirement for participation was to be 18 years of age or older. In the announcement, a contact email was provided for people who required more information regarding participation; those who sent an email expressing their intention to participate received in response a questionnaire that they had to complete online through the LimeSurvey platform provided by the university. We received 168 messages (expressions of interest); however, as only 124 participants provided responses to the questionnaire, we had a response rate of 73.8%. This questionnaire included a measure to determine the degree of involvement in collective environmental actions to date and a self-reported individual pro-environmental behavior scale. In the response, the participants were also informed of the day, time, and location within the University of Granada's Faculty of Psychology the second phase of the experiment would be conducted. In order to link the data from both stages of the experiment (phases 1 and 2), each participant had to enter a personal code at the beginning of the online questionnaire (phase 1); this personal code comprised the last three digits of each participant's national identity document, followed by the initials of their parents' last names. This code was subsequently requested in phase 2 of the study to link both measures while respecting participant anonymity.

To proceed with the study's second phase, the 124 participants were cited in person in a classroom of the Faculty of Psychology of the University of Granada (Spain), although we had an experimental mortality of 20 participants, as they did not respond to the invitation. The 104 participants who participated in the second phase were received by a researcher who, to avoid interfering with the task or introducing bias in the answers, told them that the study's objective was to evaluate their views on climate change. In the meeting, they were also informed about the confidentiality of the data collected, and they were requested to provide their consent to participate. After this informative talk, the participants were assigned to one of the two groups (human activity belief vs. natural activity belief). Depending on the group to which they were assigned, each participant entered one of two rooms, where they had to respond individually to the experimental measures on a computer. Each participant, regardless of his or her assigned group, was asked to enter his or her personal code at the beginning of the online task (which had to match the one provided in phase 1). The task began for both groups with the same message briefly describing global warming. In both cases, the content of the communication presented contained messages that alluded to scientific data. The text used for each condition were taken from a blog on climate change disclosure (https://www.cambioclimatico.org/) with a Creative Commons License (to copy and redistribute the material in any medium or format). Specifically, the introductory message read by all the participants was '*The last 10 years have been very hot. This is the famous Global Warming*,' followed by the text highlighting the beliefs associated with each sample:

(1) This group was exposed to text that leads one to believe that global warming results from 'human activity' (human activity belief) through the text A (see Annex 1).

(2) This group was exposed to text that leads one to believe that global warming is a consequence of the planet's 'natural activity' (natural activity belief) with a presentation of the text B (see Annex 2).

Once the respective text was shown to each group, the participants completed the different measurement instruments. The mean time for the task was 18 minutes; after completing the task, they were thanked for their participation. This research was approved by the Ethics Committee of the University of Granada.

3.3. Variables and measurement instruments

In addition to indicating gender and age, in the first phase, the participants responded to a series of measures we considered pre-experimental. The instruments with which we measured these variables are described below.

3.3.1. Pre-experimental measurements (phase 1)

Degree of Involvement in Collective Environmental Actions and Frequency of Individual Actions

Prior to the participants being assigned to one of the two groups, the Spanish version of the Environmental Collective Action Scale (EAS) was administered as a preliminary measure to evaluate participant involvement in collective actions of a pro-environmental nature (Carmona-Moya, et al. 2019). This scale comprises 16 items with a 5-point Likert-type response format (0= 'never' and 4= 'frequently'), which evaluates two dimensions: 1) participation actions (e.g., 'I have participated in a training activity (for example, a workshop) related to the environment') and 2) leadership actions (e.g., 'I have organized an environmental protest or demonstration'). The Cronbach's alpha obtained with the EAS for the group exposed to the 'human activity belief' was .89, and for the group exposed to the 'planet's natural activity belief,' it was .94; the sample total was .93. Additionally, the frequency of individual environmental behavior (FIEB) was measured, using four items on a 5-point Likert scale (1= 'never' and 5= 'usually'). An example of an item would be: 'How often do you buy organic fruits and vegetables, that is, those grown without pesticides or chemicals?'. An α of .83 was obtained for the sample comprising the four items, whilst it was .84 and .83 for the human activity belief and the planet's natural activity belief, respectively.

3.3.2. Experimental measurements (phase 2)

Perception of the climate change threat: We used three items to determine whether the participants perceive the consequences of climate change as a threat to people: e.g. 'To what extent do you think people's quality of life is threatened by climate change?'. Each item was evaluated on a 5-point Likert-type scale ranging from 1= 'Totally disagree' to 5= 'Totally agree.' For this three-item sample, an α of .88 was obtained, while it was .77 and .89 for the human activity belief and the planet's natural activity belief, respectively.

Emotional states: Anxiety, fear, and anger: Anxiety was assessed using two items: e.g. 'I worry that the future vitality of the planet is in danger'. An α of .70 was obtained for the human activity belief sample, .80 for the planet's natural activity belief sample, and .79 for the entire sample. Similarly, fear was evaluated through three items: e.g. 'When I think about global warming, I feel worried,'. We obtained an α of .82 for the human activity belief sample, .84 for the planet's natural activity belief sample, and .85 for the entire sample. Finally, anger was measured with three additional items: e.g. 'I feel angry about the measures taken to mitigate the effects of global warming,'. The internal consistency

coefficient obtained was .87 for both groups, and .89 for the total sample. To respond to the items related to emotions, a 5-point Likert scale was used (1= totally disagree, 5= totally agree). These items were adapted from Shepherd et al. (2018).

Future pro-environmental action intention: collective and individual: A series of items was introduced to assess whether the participants assigned to the respective groups differed in their intention to undertake actions (collective or individual) for the protection and/or defense of the environment. Specifically, in order to measure participant intention to undertake collective environmental actions (CAI) in the future, four items were used: e.g. 'Would you be willing to collaborate with an environmental group (for example, volunteering, working a summer job, etc.)?'. Each item was scored on a 5-point Likert-type scale (1= not at all willing, 5= totally willing). For the CAI, the Cronbach's α coefficient was .81 for the human activity belief group, .87 for the planet's natural activity belief group, and .85 for the total sample.

To evaluate the intention to undertake individual -environmental- actions (IAI), three items were used: e.g. 'Would you be willing to pay higher taxes to protect the environment?'. These three items were evaluated on a 5-point Likert scale (1= not at all willing, 5= totally willing). In the case of IAI items, the Cronbach's α was .92 for the human activity belief group, .86 for the planet's natural activity belief group, and .89 for the total sample.

4. Results

First, to check whether this study's results are influenced by participant exposure to message about one or the other cause of climate change (with supposedly scientific data), we compared the frequency with which each group undertook pro-environmental actions (collective and individual) prior to the experiment using a T-Student test. The results indicate no statistically significant differences between both groups in terms of the degree of involvement in collective or individual environmental actions (Table 1). In other words, the participants presented a certain behavioral homogeneity prior to being grouped and exposed to the content provided in phase 2. Thus, we ensured that the possible differences found between both groups were due to exposure to the content presented in the experimental phase and not due to other factors such as preexisting pro-environmental behavior.

Table 1. Difference in means between the 'planet's natural activity belief ' group and the 'human activity belief' group in the frequency of collective and individual pro-environmental behavior (phase 1).

	Planet's natural activity M(SD)	Human activity M(SD)	T-Student
EAS	2.18(0.89)	2.10(0.67)	$t_{(102)}$ =-.461, p=.646
FIEB	3.11(0.94)	3.29(0.95)	$t_{(102)}$ =-1.00, p=.318

Note: EAS= Environmental Collective Action Scale; FIEB= Frequency of Individual Environmental Behavior.

To respond to the first hypothesis formulated, that is, that the participants of the group exposed to the belief that climate change is due to human activities (human activity belief group) would present higher scores in negative emotions (anxiety, fear and anger) than participants who believe that climate change is due to the planet's natural activity (natural activity belief group), another T-Student test (Table 2) was performed, comparing the scores of each emotional state by group. We must indicate that the manipulation performed through the information provided to each sample was successful, given that differences were found: the human activity belief group perceived the consequences of climate change as a threat to human beings more than the natural activity belief group did. Additionally, we found that participants in the human activity belief sample scored higher on the anxiety, fear, and anger scale than did the planet's natural activity sample, with statistically significant differences being found between both groups, except for in the case of fear. Therefore, considering these results, hypothesis 1 is partially confirmed.

Table 2. Effect of threat on manipulation checks and dependent variables.

		Group 1 M (SD)	Group 2 M(SD)	T-Student	D-Cohen
threat	Perceived	4.08 (.90)	4.60 (.41)	$t_{(102)}$=-3.75, p=.000	-.74
	Anxiety	3.79 (.98)	4.14 (.68)	$t_{(102)}$=-2.08, p=.039	-.41
	Fear	3.40 (.94)	3.62 (.81)	$t_{(102)}$=-1.25, p=.212	-
	Anger	3.07 (1.14)	3.69 (.86)	$t_{(102)}$=-3.15, p=.002	-.61

Group 1: Condition: Planet's natural activity belief
Group 2: Condition: Human activity belief

Differences were expected between both groups regarding collective and individual pro-environmental action intention measures; however, no significant differences were found between both groups in the intention to undertake collective environmental actions (CAI) (hypothesis 2). Similarly, no significant differences were found between both groups regarding the intention to undertake pro-environmental individual actions (IAI) (see Table 3). Hence, hypothesis 2 has not been confirmed.

Table 3. Differences between the 'planet's natural activity belief ' group and the 'human activity belief' group in the frequency of collective action intention and individual actions intention.

	Planet's natural activity M(SD)	Human activity M(SD)	T-Student

CAI	3.07(1.15)	2.77(.87)	$t_{(102)}$=1.509, p=.134
IAI	3.38(.93)	3.41(1.06)	$t_{(102)}$=-.163, p=.871

Note : CAI= Collective Action Intention; IAI= Individual Actions Intention

However, the perception of threat (manipulation check) is very high in both groups (greater than 4 points; see Table 2), although there are significant differences between them, which could be explained by the weight that emotions can have for each group. This result suggests that negative emotions act as mediators between such perception and intention; therefore, we investigated different mediation models with our data.

4.1.-Mediation Models

We considered anger, fear, and anxiety mediating variables between the perception of climate change threat and the degree of behavioral intention (individual and collective) to compare the two. Accordingly, we used the PROCESS interface (Hayes 2012) applied to SPSS, so that three regression equations were generated for each of the emotions and dependent variables considered (collective action intention and individual action intention), finally obtaining six mediation models. When we take collective action intention as the dependent variable, the perception of threat as the independent variable, and emotions as mediating variables, an indirect effect is found between the perception of climate change threat and collective action intention, with emotions always acting as mediators in the process (Figures 1, 2, and 3). Figure 1 shows the results obtained in the regression with anger as the mediating variable. The perception of threat was a significant predictor of anger, explaining 16% of the variance ($p < .001$), although it was not a significant predictor of collective action intention. The perceived threat of climate change together with anger contributed 10% to the explanation of the collective action intention variance ($p < .01$).

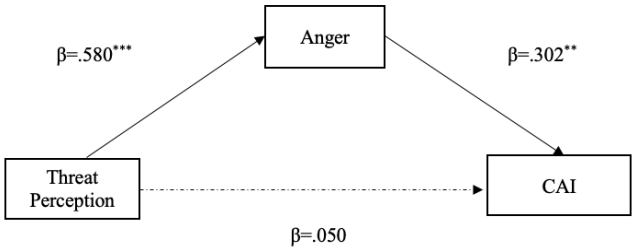

Figure 1: *Beta coefficients for the relationship between climate change threat perception, anger, and collective action intention.*

When we considered fear the mediating variable between threat perception and collective action intention (Figure 2), we found that perception was a significant predictor

of fear, contributing 22% to the explained variance (p <.001). In line with the previous results, the relationship between threat perception and the collective action intention was insignificant. Finally, threat perception and fear combined explained 11% of the collective action intention variance (p <.01).

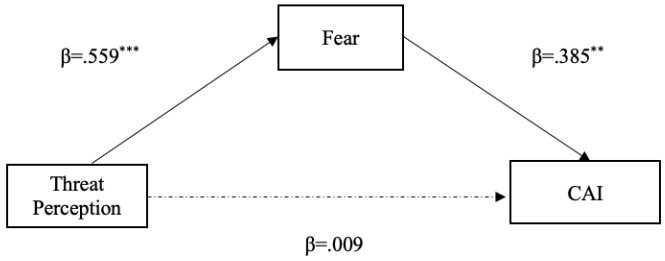

Figure 2: *Beta coefficients for the relationship between perception of climate change threat, fear, and collective action intention.*

In figure 3 shows the results of a series of regression equations that consider anxiety the mediating variable. In the first equation, the perception of climate change threat was a significant predictor of anxiety, contributing 31% to the variance (p <.001), while a second relationship showed that threat perception was not a significant predictor of collective action intention. Together, threat perception and anxiety contributed 6% to the collective action intention variance (p <.01).

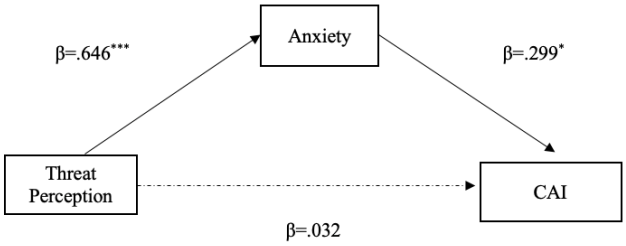

Figure 3: *Beta coefficients for the relationship between perception of climate change threat, anxiety, and intention of collective action.*

In short, these results indicate that, as expected, negative emotions mediate the relationship between the perceived threat of climate change and the intention to undertake collective actions. However, when individual action intention is taken as the dependent variable, unlike in the previous case, threat perception acts directly on action intention without the mediating effects of emotions being found (see Figures 4, 5, and 6)

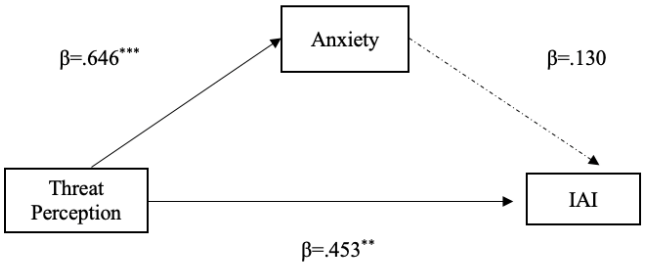

Figure 4: *Beta coefficients for the relationship between climate change threat perception, anxiety, and individual action intention.*

Figure 4 shows the results of a series of regression equations that consider anxiety the mediating variable between threat perception and individual action intention. In the first equation, threat perception was a significant predictor of anxiety, contributing 31% to the explained variance ($p < .001$). In the second equation, threat perception turned out to be a significant predictor of individual action intention, contributing 16% to the explained variance. Lastly, threat perception and anxiety combined explained 17% of the individual action intention variance ($p < .01$), although the relationship between emotions and individual action intention was insignificant. In figure 5 shows the results obtained with anger as the mediating variable between the perception of climate change threat and individual action intention. In the first relationship, threat perception contributed 16% to the explained intention variance ($p < .001$). In the second equation, threat perception turned out to be a significant predictor of individual action intention again, contributing 16% to the explained variance. Together, threat perception and anger explained 17% of the individual action intention variance ($p < .01$). However, the relationship between anger and individual intention is meaningless.

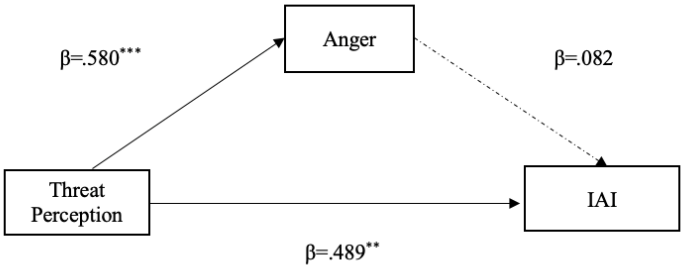

Figure 5: *Beta coefficients for the relationship between climate change threat perception, anger, and individual action intention.*

Figure 6 presents the results obtained when we consider fear the mediating variable between the perception of climate change threat and individual action intention. Threat perception was a significant predictor of fear, contributing 22% to the explained

variance (p <.001). In line with the previous results, threat perception acts as a significant predictor of individual action intention. Together, threat perception and fear explain 19% of the individual action intention variance (p <.01), with no significant relationship between this emotion and individual intention.

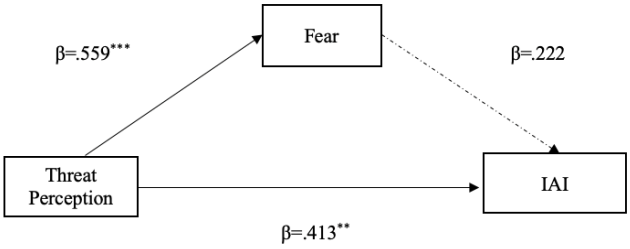

Figure 6: *Beta coefficients for the relationship between climate change threat perception, fear, and individual action intention.*

5. Discussion

As suggested by Li, et al (2022), it becomes necessary to investigate the impact of environmental threat on people's psychological experiences; in fact, climate change adaptation behaviors depend on such experiences. This study aimed at providing clarity on this. Specifically, we explored the cognitive-emotional process related to the perception of the causes of climate change based on the information emphasized: a) when the belief is that climate change is caused by human action and b) when the belief is that climate change is caused by the planet's natural activity. We presented both samples with data from supposed scientific studies to generate the perception of 'scientific consensus,' given that it can influence the formation of beliefs and attitudes about the causes of climate change (Ding et al. 2011; Lewandowsky et al. 2013; van der Linden 2015; van der Linden et al. 2017). Additionally, we explored the role emotions (anger, anxiety, and fear) play in the intention to behave, individually and collectively, in a pro-environmental way, after the perception, or not, of threat in the face of the information provided.

On one hand, the results showed that exposure to the belief that 'human activity' is responsible for global warming led to greater perception of threat to humans due to climate change compared with exposure to the belief that climate change was due to the planet's natural activities. Additionally, participants in the 'human activity' group expressed more anxiety and anger (negative emotions). On the other hand, the participants who were made to believe that climate change is due to natural causes presented lower scores in anxiety, fear, and anger. Previous studies have found that the probability of accepting that human activity causes climate change is greater after exposure to a consensus message (Lewandowsky et al. 2013; Deryugina and Shurchkov 2016), these results are corroborated in this study, but additionally, the intensification of two emotions—anxiety and anger—has been confirmed. Apparently, these results support Böhm's (2003) idea that specific

emotions are activated according to the perception of the consequences of an event. Our participants also confirmed that when the climate change is due to human activity, it is perceived as a more serious threat than when it is caused by the Earth's natural evolution. This leads us to conclude that awareness of humans being responsible for climate change is understood as 'something avoidable'; however, this idea should be explored in future studies, in addition to other variables that intervene in the attributions measured, such as expectations, values, perceived behavioral control, and degree of ascription of responsibility regarding climate change.

Attributional processes allow interpreting the causes of a given event, and consequently, modulate future behavior, based on the interpretation of the causes of the behavior, by adapting values and expectations to the demands considered necessary for the future (Visdómine-Lozano and Luciano, 2006). We think that analyzing the process of attributing responsibility (to others or to oneself) could also contribute to a better understanding of the relationship between perception of climatic change and future behavior. Although we matched the scientific consensus of the content presented to the two experimental groups, providing data supposedly supported by science (anthropogenic vs. natural activity), emotions (anxiety and anger) that can predispose and facilitate future actions to avoid or minimize impacts or threats were activated only in the anthropogenic group. Regarding fear, no statistically significant differences were found between the two groups. According to previous results, fear does not predispose to action (Maney et al. 2009; Corral-Verdugo 2021), and we could add, considering our results, fear is not what is activated directly when people perceive the causes of climate change as anthropocentric or, conversely, when they perceive that it obeys the planet's natural activity, instead, what they feel is extreme concern (anxiety) and rage (anger). We can state that the attributive pattern used will cause specific negative emotions. Our results support the findings of previous studies indicating that anger is a significant emotion with a good explanatory capacity for both collective and individual behavior (Kutlaca et al. 2020; Carmona 2021).

On the other hand, given the results, we explored the role of emotions in explaining future behavior intention at the collective and individual levels. This study has enabled us to analyze whether a direct or indirect relationship is established between threat perception and the intention to undertake pro-environmental actions, through negative emotions. Initially, we believed that those who consider humans responsible for climate change would show greater intention of future behavior, but we were unable to confirm this assumption; this result may be due to the sample size. The similarity found between both groups in future behavior intention could be explained if we consider that intention is not determined in the same way by the emotions the content presented to each sample was able to generate. In other words, our experiment led to the activation of anxiety and anger, although these do not seem to motivate future action. We believe that these results should be explored in larger samples.

Subsequently, we analyzed the joint effect of threat, negative emotions, and action intentions. We verified the differential role emotions play in determining whether intention would be understood as environmental collective actions or involvement in individual actions. An indirect effect was observed between pro-environmental collective action

intention and threat perception, with emotions mediating this process. These results concur with those obtained by Shepherd et al. (2018) regarding the determining role threat perception plays in collective action intention through emotions. In other words, it has an indirect effect. The results of other investigations, such as Hartmann et al. (2014), also support these findings, showing that exposure to threat increases negative emotional responses (specifically, fear), which affects behavioral intentions.

However, threat perception turned out to act directly on individual pro-environmental action intention, without the mediating effect of emotions. These findings are consistent with the results of works such as O'Connor, et al (1999), in that perceptions of environmental risk increase willingness to take actions to address environmental problems individually (using trains and buses more frequently, reducing air conditioner use, etc.).

6. Conclusions and practical implications

In conclusion, our research extends existing findings in various ways. First, we expand current research on the role of belief attribution regarding the causes of climate change (e.g., Naustdalslid 2011) by demonstrating the effects of attributing global warming and perception of threat to human causes, as well as showing that those who attribute global warming to human causes experience more intense negative emotions than those who attribute climate change to natural causes.

Second, previous research has suggested that anxiety-based emotions are likely to produce avoidance behaviors. However, we have shown that collective fear and anxiety can promote confrontational group behavioral intentions (collective action). Third, while previous research has evaluated the role of positive factors (e.g., hope) in motivating people to take action against climate change, this study focused on the influence of negative emotions on the motivation to take action (e.g., Ogunbode et al. 2021; Ogunbode 2022). Similarly, research on the causal relationships between emotional reactions and cognitive judgments is expanded with an experimental methodology, along the lines of manipulating specific emotions and analyzing their effects on risk judgments and ethical evaluations. Likewise, it can support the findings of other investigations where the negative emotional responses to learning about climate impacts support the recognition of the risks of climate change and therefore action (Wong-Parodi and Feygina, 2021).

Moreover, this study's results can contribute to improving the design of environmental education programs and ecological advertising that promotes pro-environmental behaviors, considering the use of evocations of environmental threats. Specifically, our empirical results show that threat perception and the consequent negative emotions, such as anxiety, fear, and anger, after exposure to severe threat situations related to climate change, contribute to improving individual behavioral intentions directly, or collective intentions indirectly.

Nevertheless, it should be noted that advertising campaigns for climate action are increasingly using the latest data, information, and knowledge on climate change to reflect the threat it poses to the Earth, in an attempt to educate and convince the public (McClure

et al. 2022). This study can be used as a new source of information and knowledge to consider in future advertising campaigns, following certain models on the communication of climate change for messages of scientific and true consensus (Bayes, Bolsen and Druckman, 2020). Similarly, these results can be used strategically by political groups (Devine-Wright et al., 2022), through the use of consensus messages on climate change (Chinn and Hart, 2021). Therefore, it is important to assess people's reactions to this perceived threat and ask ourselves 'What if instead of perceiving it as a threat to us and our world, we see climate change as an ally of humanity's big change toward a more sustainable lifestyle?' (Bragg 2015), so that we are able to minimize experiencing negative emotions in favor of greater tranquility in the face of upcoming catastrophic climatic events and other dramatic changes.

7. Limitations and future research

To conclude, we would like to point out our study's limitations. One, we must refer to our sample's small size, which could have been the reason for the lack of greater differences between both groups, as well as more significant relationships between the study variables. Secondly, we must also consider the geographical distribution of the sample, since it may have been very localized in the same area. And thirdly, another limitation corresponds to the data collection method used; the administration of online questionnaires entails the risk of lack of reliable data, as well as access by all people, given that the internet is needed as a resource. We believe that future lines of research should be designed considering these limitations and replicating our results with a larger sample size. Two, we suggest conducting research with more complex statistical analyses that would enable us to understand the predictive capacity of emotions on pro-environmental action intention and including other variables related to collective action intention, thus improving the activation of negative emotions by exposing the participants to images (photographs, videos, etc.) of serious environmental threats, instead of textual content. In this sense, the texts used in both conditions, despite trying to highlight the scientific consensus (in one case in favor of climate change and in another against it), might not be enough to be able to affirm that they have produced a perception of strong threat. We believe that this study should be replicated, using other sources of information and repeated exposure measures over time.

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APPENDIX

Annex 1:

Text A provided to "human activity belief group"

Text in English (Translator):

Climate Change.org
"Your starting point on climate change on the web"
Global warming of the Earth
Global warming, realities, and challenges

The last 10 years have been the hottest since records started. This is the effect of the famous Global Warming.

The IPCC (Intergovernmental Panel on Climate Change) maintains that the warming of the climate system is unequivocal: it is not based only on LSAT (Land Surface and Air Temperature) temperature data, since it is only one line of evidence among many.

For example, this phenomenon causes the sea level to rise at an average of 2 millimeters per year, when for several thousand years, it rose just 1 millimeter per year. If the entire Antarctic ice sheet would melt, the sea level would rise by approximately 61 cm: a rise of just 6 cm would be enough to flood London and New York.

The Oregon Institute for Science and Medicine, created by Arthur Robinson, chemist Noah E. Robinson, and veterinarian Zachary W. Robinson, published The Petition Project manifesto. The project defended the idea that the accumulation of polluting gases, emitted by human beings, causes temperatures to rise increasingly and climates to change.

What scientists show is that the planet's temperature is caused by human activity.

Annex 2: Text B provided to the "Planet's natural activity belief group"

Text in English (Translator):

Climate Change.org
Your starting point on climate change on the web

Global warming of the Earth
Global warming, realities, and challenges

The last 10 years have been the hottest since records started. This is the effect of the famous Global Warming.

Scientists from the Chinese Academy of Sciences have conducted research that would indicate that global warming, present in so many alarmist studies, does not exist: according to the article published by the Manquhue Institute for Strategic Studies, the current temperature is within a natural range when taking into account other historical periods.

Hence, some of the consequences that are talked about tend to be exaggerated, as is the case of the rise in sea level, which during this last century has maintained constant without any increases compared with thousands of years ago.

The Oregon Institute for Science and Medicine, created by Arthur Robinson, chemist Noah E. Robinson, and veterinarian Zachary W. Robinson, published The Petition Project manifesto. The project defended the idea that gas emissions resulting from human activities are unrelated to climate change.

What scientists show is that the planet's temperature is naturally caused by solar activity.

The collective mobilizations undertaken in recent years to stop the deterioration of the environment are having a positive impact.