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"What Do Believers Believe in? Beliefs, Emotions, and Willingness to Engage in Collective Action on Climate Change Among Residents of a Chilean Region Affected"

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Abstract

This study examines how beliefs about the causes of climate change relate to emotions, perceptions of its effects, and willingness to engage in collective action among residents of the Valparaíso Region in Chile, a territory particularly vulnerable to this phenomenon. A survey was conducted with 809 individuals using stratified probabilistic sampling. Analysis of variance revealed significant differences among those who attribute climate change to human, mixed, or natural causes. The results show that individuals who believe in the anthropogenic origin of climate change report higher levels of negative emotions, anxiety, perceived impacts, and willingness to participate in both direct and institutional collective actions. Moreover, these individuals perceive greater negative effects of climate change on their surroundings and daily lives. In contrast, those who attribute the phenomenon to natural causes show a lower predisposition to act and a lower risk perception. The study concludes that causal attribution of climate change significantly influences people's emotional and behavioral responses, highlighting the importance of strengthening climate education and communication based on scientific evidence as key tools for fostering civic engagement in the face of the environmental crisis. The findings contribute to sustainability by strengthening environmental education, participatory governance, and collective action in vulnerable contexts.

Keywords: climate change; emotions; collective action; Chile

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1. Introduction

Climate change has been a scientific certainty for decades. Since the 1980s, research has confirmed a steady rise in global temperatures since 1880 [1], marking a turning point in our understanding of the planet's accelerated transformations. The concept of global warming dates back to the 19th century, when Fourier [2] and Arrhenius [3] studied the effects of CO_2 on Earth's temperature. In the 1930s, Callendar [4] linked fossil fuel combustion to rising temperatures, and later, Broecker [5] popularized the term "global warming." In the 1980s, the Intergovernmental Panel on Climate Change (IPCC) introduced

the broader term "climate change" to encompass both warming and its environmental consequences [6]. Today, climate change is recognized as a multidimensional phenomenon that affects ecosystems, societies, and economies, underscoring the urgency of mitigation and adaptation strategies.

Despite broad scientific consensus, beliefs about climate change vary across individuals and regions. Several studies have revealed striking geographic differences. In China, nearly 90% of respondents believe in global warming, and experience with extreme weather events strengthens this perception [7]. In the United States, perceptions are strongly influenced by political ideology and media exposure, with conservatives expressing more skepticism [8]. In Australia, most people accept that climate change exists, though debate continues over its human or natural origins [9]. In New Zealand, around 50% attribute climate change to human activity, while 16% remain skeptical about its existence or causes [10]. In Germany, although general consensus is high, some media content still expresses skepticism [11]. These findings suggest that climate change perceptions are shaped not only by geography, but also by political, educational, and experiential factors.

In Latin America, public awareness of climate change is high. According to the 2017 Latinobarómetro, between 86% and 95% of people in 17 countries recognize its existence, and exhibit behavioral patterns linked to each country's vulnerability and preparedness [12]. Similarly, a 2019 Twitter-based analysis showed that 86% to 95% of tweets on climate topics in South America were positive, indicating strong alignment between public opinion and scientific consensus [13]. These results confirm high levels of awareness in the region, although challenges persist in adapting to and mitigating the impacts of climate change.

Beliefs about climate change arise from the interplay of political ideology, personal values, emotional responses, and access to information. Understanding these beliefs is essential, as they influence environmental behaviors, support for climate policies, and willingness to cooperate globally. They also affect individuals' readiness to adopt sustainable practices [14], accept climate regulations [15], and respond to persuasive communication [16], while shaping psychological barriers that hinder effective action [17].

This study focuses on the causal attribution of climate change, understood as the beliefs people hold about its origin—whether it is the result of natural causes, human activity, or a combination of both. This variable is key to understanding how individuals interpret the climate crisis, as it directly influences their emotions, their perception of the phenomenon's effects, and their willingness to engage in collective action. Previous research has shown that those who attribute climate change to human activity tend to experience more intense negative emotions—such as concern, indignation, or anxiety—and show a greater willingness to participate in collective initiatives aimed at mitigating its consequences. In this regard, the innovation of the present study lies in empirically integrating, from a psychosocial perspective, the cognitive, emotional, and behavioral dimensions surrounding these beliefs in a highly exposed context such as the Valparaíso Region.

The main objective of this research is to analyze the relationship between beliefs about the causes of climate change and emotional responses, perceived effects, and willingness to engage in collective action among those who acknowledge its existence. By examining how individuals construct their understanding of the phenomenon and the emotions that such understanding elicits, we aim to identify the factors that facilitate or hinder civic engagement in response to climate change. The study's findings are expected to contribute to the international debate on climate change perception, emphasizing the need for interdisciplinary approaches that integrate psychological, sociological, and environmental perspectives to strengthen climate communication and action strategies in vulnerable contexts.

1.1. Theoretical Perspective

From an integrative perspective, this study brings together three theoretical frameworks—environmental psychology, collective action theory, and climate risk perception studies—to understand how beliefs about the causes of climate change (natural vs. anthropogenic) are related to climate-related emotions and dispositions toward collective action. Within environmental psychology, it has been shown that attributing climate change to human causes is associated with higher levels of negative affect (such as anxiety or ecological guilt), which act as catalysts for environmental concern and pro-environmental behavior [18,19]. Meanwhile, collective action theory suggests that identifying human causes of climate change activates a sense of group responsibility and collective efficacy, which are fundamental for mobilizing support for policies and collective action [20,21]. Finally, research on climate risk perception has shown that the stronger the belief in human causes, the greater the perceived threat, which intensifies both negative emotions and the intention to act individually and collectively [22,23]. Thus, it is proposed that identifying the anthropogenic causes of climate change is not only a key cognitive variable, but also a central node linking perception, emotion, and collective action.

The following section describes the main effects of climate change in Chile, followed by a theoretical discussion that outlines the key concepts needed to understand this study. In particular, we examine beliefs about the causes of climate change, the emotional impact of climate change perception, and the relationship between those beliefs and the willingness to engage in collective action.

1.2. Climate Change and Its Effects in Chile

Chile's geography—characterized by its long coastline, arid zones, fertile valleys, and glacial regions—makes it particularly vulnerable to climate change. Rising sea levels threaten coastal cities and port infrastructure [24], while decreasing precipitation and glacier retreat affect water availability in the central and southern parts of the country [25]. In addition, rising temperatures and prolonged droughts intensify wildfires and desertification [26,27], impacting biodiversity and agricultural production.

This indicates that climate change is affecting Chile in a comprehensive manner, generating significant impacts across various sectors such as energy, water resources, the economy, and ecosystems. A temperature increase is projected throughout the national territory, with forecasts indicating rises above 2 °C in winter under the RCP8.5 scenario by the end of the 21st century [28]. These temperature changes will have direct consequences on energy demand, reducing heating consumption by between 13% and 27%, but increasing the use of energy for cooling, particularly in cities like Santiago and Antofagasta [29,30]. This variation in energy demand presents challenges for the planning and development of sustainable infrastructure that mitigates environmental impact and optimizes the country's energy efficiency.

One of the greatest challenges facing Chile is the water crisis. Since 2010, the country has experienced a megadrought that has critically affected water availability. It is projected that the magnitude and duration of both meteorological and hydrological droughts will continue to increase, with a reduction of more than 40% in winter precipitation in the south-central region under the RCP8.5 scenario [31,32]. This phenomenon, exacerbated by changes in land cover and the overexploitation of water resources, suggests a drier and more challenging future in terms of water security and agricultural sustainability [25]. The decline in river flow and reduced snowfall in the Andes Mountains directly impact drinking water supply, hydroelectric power generation, and crop viability.

In addition to these effects, climate change has far-reaching economic and ecological repercussions. Economically, rising temperatures and climate variability are impacting

agriculture, forestry, and fisheries, with projected losses of up to 12% in the GDP of these sectors [33]. It is estimated that by the year 2100, Chile's GDP could decline by between 9% and 29.6% due to the adverse effects of climate change [33]. Ecologically, the Mediterranean mountain forests in central Chile, such as those of *Nothofagus macrocarpa* and *Austrocedrus chilensis*, are at risk of decline due to increasing temperatures and decreasing precipitation, which could affect their growth and survival [34]. Although these impacts have sparked political debates on sustainable development and disaster resilience [28], there remains a pressing need to implement mitigation and adaptation policies that protect ecosystems, promote sustainable agricultural practices, and strengthen economic resilience in the face of projected climate changes.

Specifically, the Valparaíso Region—the focus of this study—can be characterized as an area strongly affected by rising temperatures, prolonged droughts, and an increased risk of wildfires. For instance, a temperature increase has been recorded due to the urban heat island effect, with a growing thermal difference between the urban center and peripheral areas [35]. Moreover, the reduction in precipitation and the rise in temperatures have intensified the wildfire risk in the hills of Valparaíso, accompanied by a community perception that such events are inevitable, despite structural barriers to their prevention [36]. Changes in land cover have also been observed, affecting the provision of ecosystem services, and highlighting the need to improve territorial planning [37].

At the climatic level, a decrease in precipitation and an increase in aridity are projected, which will impact water availability in the region [38]. Additionally, mining activity in Valparaíso faces risks of flooding and severe droughts between 2035 and 2065, threatening the stability of its infrastructure [39]. These findings highlight the urgency of developing adaptation strategies to mitigate the effects of climate change in the region.

All these effects make the Valparaíso Region a particularly relevant case for studying beliefs about climate change. Public perception often does not align with scientific findings, highlighting the importance of understanding the socio-psychological dimensions of climate change in the region. The following section presents a review of beliefs about climate change and their relationship with emotions and willingness to engage in collective action.

1.3. Beliefs About Climate Change

The evidence supporting the existence of climate change is overwhelming. However, this broad consensus within the scientific community does not necessarily extend to the general population, which, in different parts of the world, ranges from climate change denial to the certainty held by those who believe in its existence.

Climate change denial has been linked to political and religious factors, as well as the spread of misinformation. Religious beliefs have been shown to influence climate change denial, particularly among groups that view humans as the center of moral value, which makes it difficult to perceive the environmental crisis as a priority [40]. Additionally, misinformation and the influence of conservative media are key factors in climate change denial, highlighting the importance of climate literacy in countering these effects [41]. Politically, in the United States, denial is associated with trust in leaders such as Donald Trump, while in Canada it is more closely linked to conservative ideology [42]. Moreover, studies have shown that individuals more prone to believing in conspiracy theories tend to deny climate change or its anthropogenic origin [43]. In countries like Australia, although the majority acknowledges climate change, a significant percentage believes it is the result of natural temperature fluctuations on the planet [9].

On the other hand, the beliefs of those who affirm the existence of climate change are influenced by their trust in science and their political values. Individuals who trust scientific institutions and information based on empirical data are more likely to accept

the reality of climate change and support mitigation measures [44]. Perceptions of this crisis have been shown to vary by geographic context, such as in Copenhagen, where denial is low, in contrast to Houston, where the oil and gas industry plays a key role in generating skepticism [45]. Additionally, concern for the future and anxiety are factors that reinforce the acceptance of climate change and motivate pro-environmental behavior [46]. However, even among those who acknowledge climate change, psychological barriers can hinder action—such as the perception that the problem is too large to be addressed individually [47]. Finally, political ideology also plays an important role: in the United States, progressives tend to place greater trust in scientific evidence on climate change, whereas conservatives exhibit higher levels of skepticism due to their opposition to environmental regulations [48].

Beliefs about the causes of climate change vary significantly among the population and are influenced by factors such as education, political ideology, and exposure to scientific information. Despite the diversity of opinions, there has been a growing acceptance that climate change is a reality driven by human activity [49,50]. The distinction between anthropogenic and natural causes is central to this debate, as a significant portion of the population acknowledges the impact of greenhouse gas emissions generated by industry and transportation, while others still attribute climate changes to the Earth's natural cycles [51]. However, advances in scientific research have strengthened the consensus on the human origin of the problem, facilitating the development of mitigation policies based on empirical evidence [52].

One of the main obstacles to the acceptance of anthropogenic climate change is the persistence of common misconceptions, such as the belief that air pollution or the depletion of the ozone layer are the primary causes of global warming [53]. These conceptual errors can undermine support for effective mitigation policies and divert attention from the most urgent strategies, such as reducing carbon emissions and transitioning to renewable energy sources [16]. Education and political orientation also play a key role in shaping these beliefs. While citizens with higher levels of education are more likely to accept scientific evidence, political affiliation influences this acceptance, with conservative sectors showing greater resistance to acknowledging the human origin of climate change [15,54].

Exposure to reliable scientific data and effective communication of scientific consensus can increase acceptance of anthropogenic climate change, although this does not always translate into concrete mitigation actions [55]. On the other hand, generational differences also influence the perception of the phenomenon: while there is a gap between younger and older adults in accepting the climate crisis, trends indicate that all age cohorts have increased their belief in the human causality of climate change over time [52]. In this regard, science communication and environmental education play a crucial role in building a more informed society that is willing to take action against climate change.

1.4. Impact of Emotions on Climate Change Perception

Emotions play a crucial role in the perception of and response to climate change, as they can influence both the acceptance of the environmental crisis and the willingness to act. Negative emotions such as anxiety and concern have been shown to increase risk perception and the sense of urgency to take action on climate change, particularly among individuals with lower levels of political skepticism [56,57]. Likewise, incidental emotions such as guilt can strengthen support for mitigation policies by fostering a deeper sense of individual and collective responsibility in the climate crisis [58]. However, ideological polarization also shapes emotional responses, affecting how climate information is interpreted. In this regard, political affiliation and emotional reactions toward leaders influence the acceptance or rejection of climate change, which can further intensify public division on this issue [59].

On the other hand, positive emotions can play a key role in promoting pro-environmental behaviors. Studies have found that hope and confidence in the effectiveness of actions can encourage commitment to mitigation policies and foster active participation in climate initiatives [60,61]. Furthermore, preexisting beliefs about climate change interact with emotions in the interpretation of information, which can either facilitate or hinder the understanding of environmental risks [62]. Research suggests that the strategic use of emotions in climate communication is essential for generating narratives that motivate action without causing desensitization or fatalism. Consequently, understanding the interplay between emotions and beliefs is crucial for designing communication strategies and public policies that promote greater awareness and social engagement in response to climate change.

1.5. Beliefs About Climate Change and Collective Action

Beliefs about climate change play a fundamental role in collective action and the formulation of climate policies. Various studies have highlighted that trust in scientific information and the perceived effectiveness of individual and collective actions influence public commitment to climate change mitigation [63]. In particular, the perception of the effectiveness of government policies to address climate risks is positively correlated with greater support for emission reduction measures and climate change adaptation [20]. However, these beliefs can be affected by political polarization and government leadership. Research has shown that the election of political leaders who are skeptical of climate change—such as Donald Trump in the United States—can deepen the ideological divide in public opinion, weaken support for environmental initiatives, and generate a perception of collective inaction [64]. In this regard, political influence affects not only governmental decisions but also the public's willingness to engage in the fight against climate change.

Climate activism and social mobilization are also strongly influenced by beliefs about the effectiveness of collective action. When individuals perceive that their efforts can have a tangible impact on climate change mitigation, they are more likely to engage in political advocacy, responsible consumption, and community mobilization [65]. The perception of collective responsibility is another key factor in promoting pro-environmental actions. Climate change is a problem that requires the involvement of multiple actors—including governments, corporations, and civil society—in order to generate an effective response [66]. Nevertheless, one persistent challenge is the existence of structural barriers that limit the translation of activism into concrete political change [67]. The narrative of climate justice has served as a catalyst for youth mobilization, successfully raising the urgency of the issue on the public agenda, although its impact on political decision-making remains limited. Understanding how beliefs shape collective action is crucial for designing strategies that strengthen citizen participation in the fight against climate change. Within this framework, the present study poses the following research question: Are there significant differences in emotions, perceptions of the effects of climate change, and willingness to engage in collective action depending on beliefs about its causes among residents of an environmentally vulnerable Chilean region?

The formulation of the hypotheses in this study is based on previous literature that has consistently demonstrated the relationship between causal beliefs about climate change, emotional responses, and willingness to engage in collective action. Several studies have shown that individuals who attribute climate change to human causes tend to experience more intense negative emotions, such as anger, concern, or anxiety, which increases their perception of risk and urgency regarding the phenomenon [56,60]. This emotional activation has also been identified as a factor that promotes participation in collective action, particularly when the threat is perceived as being caused by human behavior and

therefore modifiable through social intervention [15,65]. Additionally, those who recognize the anthropogenic origin of climate change tend to report higher levels of perceived impact in their personal and community environments compared to those who view it as a natural phenomenon [50]. These findings support the proposed hypotheses by linking causal attribution to the emotional, perceptual, and behavioral components of responses to climate change.

H1. *Individuals who attribute climate change primarily to human causes will report higher levels of negative emotions and anxiety toward the phenomenon compared to those who attribute it to natural or mixed causes.*

H2. *Individuals who believe in human causes of climate change will show greater willingness to engage in collective actions (direct, institutional, or disruptive) than those with natural or mixed causal beliefs.*

H3. *The perception of the negative effects of climate change will be higher among those who attribute it to human causes than among those who consider it a natural phenomenon.*

Finally, this study aligns with the sustainability framework by offering conceptual and empirical tools to understand how beliefs and emotions influence civic action in response to climate change—a central issue in the sustainable development agenda. By providing evidence on the factors that foster collective engagement in vulnerable territories, this research contributes to the design of more effective strategies for communication, environmental education, and public policy to address the social, ecological, and adaptive challenges posed by the climate crisis.

2. Materials and Methods

This study employed a correlational survey design, non-experimental and cross-sectional in nature [68]. Fieldwork and data collection were conducted between 22 July 2024 and 21 September 2024 and were carried out by the consulting firm H&N Servicios Integrales Spa (Santiago, Chile).

2.1. Sampling

The survey was conducted using a probabilistic, stratified sampling method with a 95% confidence level and a margin of error below ±4%. A maximum variance was assumed (P-Q = 0.5). The sample consisted of 809 residents aged 18 or older from the continental area of the Valparaíso Region. The sample was stratified based on population size, with allocation by: (1) provincial capitals, which include Los Andes, La Ligua, Quillota, San Antonio, San Felipe, Valparaíso, and Quilpué; and (2) municipalities with populations exceeding 100,000 inhabitants, specifically Viña del Mar and Villa Alemana.

The survey was administered in person, face-to-face, with responses recorded on paper and later digitized for analysis and presentation of results. Additionally, georeferencing was used to document the locations where the survey was conducted.

A survey was considered "validated" if the respondent answered all the questions in the questionnaire, the informed consent was read and accepted, the respondent was of legal age, resided in one of the provincial capitals of the Valparaíso Region or in a municipality with more than 100,000 inhabitants, the survey implementation was verified, and the respondent met the criteria for multi-stage participant selection.

2.2. Participants

The study included 809 participants with an average age of 47.00 years (SD = 17.1), of whom 52.7% were women, 46.7% were men, and 0.5% identified as another gender. Regarding the number of years participants reported living in the region, the average was 34.8 years (SD = 20.0).

Regarding marital status, 33.0% of participants reported being single, while 12.7% stated they were in a cohabiting relationship without a civil union agreement. Another 1.5% identified as being in a civil union, meaning they had a formalized civil partnership. The largest group was those who were married, accounting for 37.6% of respondents. Among those who had experienced a legal dissolution of their marriage, 7.9% identified as divorced or annulled, and 7.0% reported being widowed. Finally, 0.2% of participants either did not know or chose not to answer this question.

In terms of educational attainment, the majority of participants had completed at least secondary education (33.5%). A total of 14.1% reported incomplete secondary education, and 7.0% had completed primary education. Regarding higher education, 18.8% reported having attended technical or professional institutes, whether completed or not, while 16.1% had pursued university studies—7.7% incomplete and 8.4% complete. Only 1.2% of respondents reported having attained a postgraduate degree, 0.9% had no formal education, and 3.1% did not respond. These results indicate a predominant distribution of secondary and higher education within the sample.

Regarding the participants' occupation, 40.4% of respondents reported having salaried employment, making it the most common category. A total of 19.2% indicated working independently or being self-employed, while another 19.2% identified as retired or pensioned, resulting in 86.4% being either economically active or retired from the labor market. On the other hand, 7.7% reported engaging in unpaid work, such as household or caregiving tasks, and 7.8% stated they were currently studying. Finally, 5.6% reported being unemployed, while 0.2% did not know or chose not to respond. These results indicate that the majority of respondents are involved in the labor market, either as employees or self-employed workers, while a smaller proportion are students, engaged in unpaid domestic work, or unemployed.

2.3. Ethical Considerations

Participants provided informed consent. The document stated that participation was entirely voluntary, unpaid, and confidential. No personal data that could identify participants were collected, and the results were used exclusively for academic purposes, being published anonymously in scholarly journals.

2.4. Measures

To ensure conceptual clarity and methodological transparency, the present study included both categorical and psychometric variables. Two categorical items were used initially to identify participants' general belief in climate change and their perceived causes of the phenomenon. Subsequently, several psychosocial variables were measured using multi-item scales, whose characteristics are summarized in the table below.

Belief in Climate Change. Participants were asked to respond to the question: Do you believe that climate change is happening? with the response options: Yes, No, or Don't know/No response. This question is essential because it serves to filter those who believe in the existence of climate change. This subgroup is the focus of the present study and includes the individuals who answered the questions described below.

Causes of Climate Change (adapted from Hamilton, 2015) [49]. Participants were asked to answer the question: What do you believe is causing climate change? by selecting

one of the following options: "Mainly natural phenomena," "Both natural phenomena and human activity," or "Mainly human activity."

The following Table 1 summarizes the psychosocial variables measured with multi-item scales:

Table 1. Summary of Measured Variables, Response Scales, and Psychometric Properties.

	Measured Variable	Representative Items	Response Scale	Cronbach's Alpha	Confirmatory Factor Analysis
Emotions Toward Climate Change (Scale designed for this study, inspired by the structure of Izard's Differential Emotions Scale (DES), but not a formal adaptation).	Negative emotions about climate change	Anger, annoyance, rage	1 (not at all) to 7 (very much)	0.87	The theoretical three-factor model showed a good fit to the data: $\chi^2(24) = 119.33$, $p < 0.001$; CFI = 0.974; TLI = 0.961; RMSEA = 0.078 [90% CI: 0.064–0.092]; SRMR = 0.046.
	Positive emotions about climate change	Optimism, hope, confidence	1 (not at all) to 7 (very much)	0.89	
	Anxiety and fear about climate change	Fear, fright, concern	1 (not at all) to 7 (very much)	0.83	
Effects of Climate Change (scale developed ad hoc, informed by the works of Sakka, 2017, and Macfarlane and Ribbe, 2012) [69,70]		Impact on health, employment, quality of life, surroundings, and community	1 (very little)–7 (very much)	0.86	
Willingness to Engage in Collective Environmental Action (adapted from Sandoval, Hatibovic, and Bobowik [71]).	Direct collective actions	Participation in marches, boycotts, environmental strikes	1 (not at all willing)–7 (extremely willing)	0.86	The theoretical three-factor model showed a good fit to the data: $\chi^2(17) = 108.13$, $p < 0.001$; CFI = 0.985; TLI = 0.930; RMSEA = 0.090 [IC 90%: 0.074–0.106]; SRMR = 0.057.
	Disruptive collective actions	Occupying spaces or causing damage in support of the environment	1 (not at all willing)–7 (extremely willing)	0.70	
	Institutional and mediated collective actions	Voting for pro-environmental candidates, signing petitions, using social media	1 (not at all willing)–7 (extremely willing)	0.64	

To assess the structural validity of the scales used, confirmatory factor analyses were conducted, supporting the adequacy of the proposed theoretical models. For the emotional subscales, the three-factor model was consistent with the observed data, conceptually distinguishing between negative, anxious, and positive emotions. Similarly, the scale measuring willingness for collective action showed a good fit, validating its three-dimensional structure composed of direct, disruptive, and institutional/mediated actions. Although the RMSEA was at the acceptable threshold, the global fit indices (CFI and SRMR) support the adequacy of the proposed theoretical model for this scale.

2.5. Data Analysis

Descriptive statistics were used to calculate means. To determine mean differences based on the variable beliefs about the causes of climate change, which was used as a grouping variable, a one-way Analysis of Variance (ANOVA) was conducted. For variables with unequal variances (heteroscedasticity, $p < 0.05$), Welch's ANOVA was applied, and the Games-Howell post hoc test was used. For variables with equal variances (homoscedasticity,

$p > 0.05$), the classic ANOVA (Fisher) was used, followed by the Tukey HSD post hoc test. The analyses were performed using Jamovi software, version 2.3.21.0.

It is important to note that the decision to group participants into three mutually exclusive categories (natural, mixed, and human causes) was based on the explicit wording of the survey question, which asked respondents to select a single option that best represented their primary perception of the cause of climate change. This forced-choice response format allowed for the creation of mutually exclusive groups, enabling clear statistical comparisons across different viewpoints. Moreover, this approach is consistent with previous studies on climate perceptions [9,50], which have used similar typological categories to explore differences in attitudes, emotions, and behaviors.

3. Results

3.1. Descriptive Analysis

3.1.1. Beliefs About the Occurrence of Climate Change

Figure 1 presents the percentage distribution of responses regarding belief in the existence of climate change. The results indicate that a large majority of respondents (82.3%) believe that climate change is occurring, suggesting a high level of awareness of this phenomenon. In contrast, 16.9% of participants stated that they do not believe in the existence of climate change, while 0.7% reported not knowing or chose not to respond.

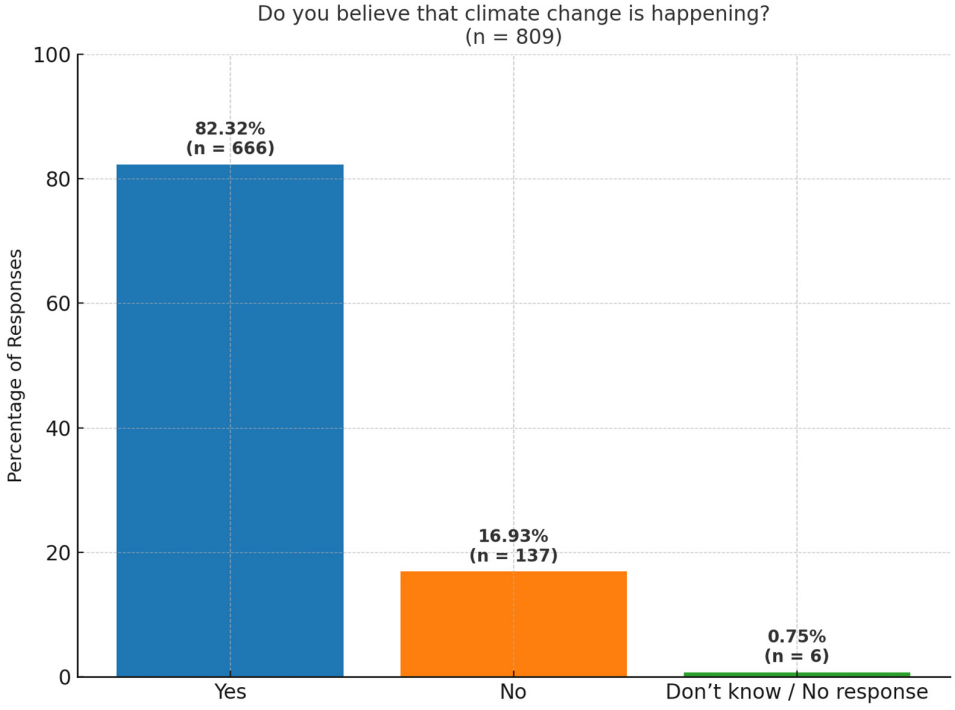

Figure 1. Beliefs about the occurrence of climate change.

These data reflect a widespread perception of climate change as a reality, which may be linked to the growing availability of scientific and media information about its effects, as well as the visible impacts observed in the region, such as droughts and wildfires. However, the existence of a group that does not believe in this phenomenon highlights the persistence of skepticism in certain sectors of the population, which may be influenced by various factors.

The key point of this result is that the analyses that follow will be based on the group that declared belief in climate change.

3.1.2. Causes of Climate Change

Figure 2 shows the distribution of responses regarding perceptions of the causes of climate change. The results indicate that 46.7% of respondents attribute climate change to both natural phenomena and human activity, suggesting a balanced view of the multiple factors that may contribute to this phenomenon.

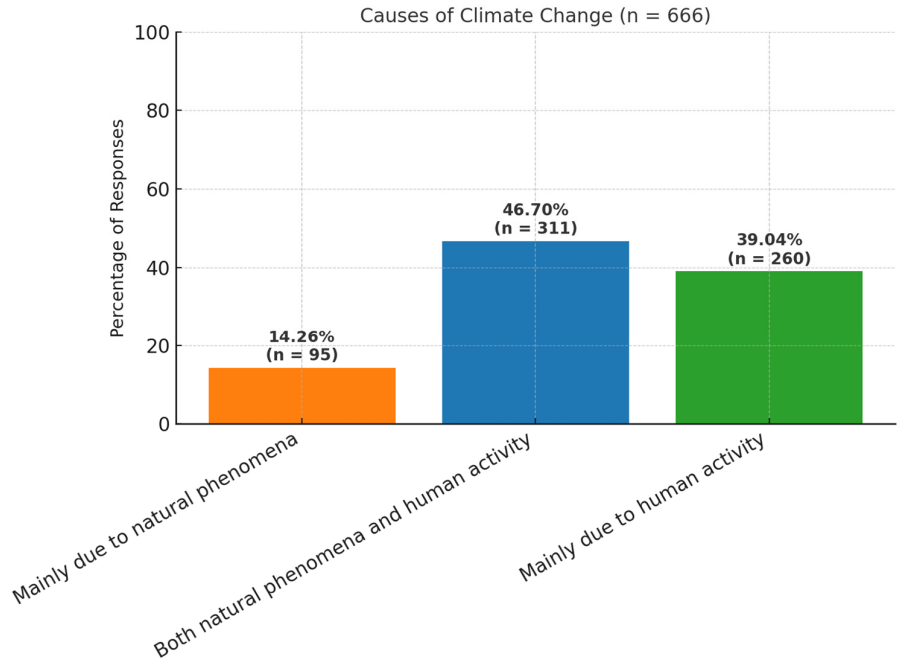

Figure 2. Causes of climate change.

On the other hand, 39.0% of participants believe that climate change is mainly caused by human activity, reflecting a significant acknowledgment of the impact of industrial activities, fossil fuel use, and deforestation on climate disruption. In contrast, 14.3% of respondents believe that climate change is primarily due to natural phenomena, suggesting a lower attribution of responsibility to human actions.

These results show that the majority of respondents acknowledge some degree of human influence on climate change, although there are differences in perceptions regarding its relative weight compared to natural factors.

Based on this question, three groups will be formed to create the grouping variable used in the mean difference analysis presented below.

3.1.3. Analysis of Variance (ANOVA)

A one-way ANOVA with Welch's correction was conducted to compare the three attribution groups—"mainly due to natural phenomena," "both natural phenomena and human activity," and "mainly due to human activity"—across the main variables (see Table 2). Due to assumption violations, post hoc comparisons were performed using the Games–Howell test.

For negative emotions, significant differences were found, $F(2, 277) = 25.74$, $p < 0.001$. The group attributing climate change to human activity reported significantly higher scores than those attributing it to natural phenomena (mean difference = −1.228, $p < 0.001$) and to both causes (mean difference = −0.848, $p < 0.001$).

For positive emotions, the differences among groups were also significant, $F(2, 256) = 7.03$, $p = 0.001$. Only the contrast between "both causes" and "human activity" was significant (mean difference = −0.576, $p < 0.001$), while the other comparisons were not ($p > 0.05$).

Table 2. Mean differences and standard deviations on the scales based on the variable Causes of Climate Change.

Causes of Climate Change	Negative Emotions Toward Climate Change		Positive Emotions Toward Climate Change		Anxiety and Fear About Climate Change		Direct Collective Actions		Disruptive Actions		Institutional and Mediated Actions		Perceived Effects of Climate Change	
	M	*DT*	*M*	*DT*	*M*	*DT*	*M*	*DT*	*M*	*DT*	*M*	*DT*	*M*	*DT*
Mainly due to natural phenomena	2.57	1.45	3.85	1.91	2.93	1.44	2.64	1.74	1.69	1.33	4.58	1.49	2.69	1.36
Both natural phenomena and human activity	2.95	1.69	3.61	1.90	3.33	1.72	2.95	1.94	1.90	1.48	5.08	1.52	2.86	1.56
Mainly due to human activity	3.80	1.82	4.19	1.74	3.98	1.79	3.98	2.06	2.13	1.61	5.28	1.50	3.66	1.67
F	25.74 ***		7.03 ***		17.72 ***		25.43 ***		3.49 ***		7.37 ***		22.53 ***	
Total	3.22	1.77	3.87	1.85	3.52	1.75	3.31	2.04	1.96	1.52	5.08	1.52	3.15	1.63

Note: *** $p < 0.001$.

Regarding anxiety and fear, the ANOVA showed significant differences, $F(2, 278) = 17.72$, $p < 0.001$. Participants in the "human activity" group reported more anxiety than those in the "natural phenomena" (mean difference = -1.051, $p < 0.001$) and "both causes" groups (mean difference = -0.642, $p < 0.001$). The difference between "natural phenomena" and "both causes" was marginally non-significant ($p = 0.059$).

For direct collective actions, the differences were also significant, $F(2, 269) = 25.43$, $p < 0.001$. The "human activity" group scored significantly higher than both the "natural phenomena" (mean difference = -1.34, $p < 0.001$) and "both causes" groups (mean difference = -1.03, $p < 0.001$). No significant difference was found between "natural phenomena" and "both causes" ($p = 0.323$).

In the case of disruptive actions, significant differences emerged, $F(2, 269) = 3.49$, $p = 0.032$. Only the comparison between "natural phenomena" and "human activity" was significant (mean difference = -0.437, $p = 0.030$); the other differences were not significant ($p > 0.05$).

Finally, two one-way ANOVAs using Fisher's test were conducted for institutional/mediated actions and perceived effects of climate change. For institutional/mediated actions, the results were significant, $F(2, 658) = 7.37$, $p < 0.001$. While the Shapiro–Wilk test indicated a violation of normality ($W = 0.947$, $p < 0.001$), Levene's test confirmed homogeneity of variances, $F(2, 658) = 0.092$, $p = 0.912$.

Regarding institutional and mediated actions, significant differences were found between groups, $F(2, 658) = 7.37$, $p < 0.001$. The assumption check using the Shapiro–Wilk normality test yielded significant results ($W = 0.947$, $p < 0.001$), suggesting a violation of the normality assumption; however, Levene's test indicated homogeneity of variances, $F(2, 658) = 0.0920$, $p = 0.912$.

Post-hoc comparisons (Tukey's) showed that the difference between "mainly due to natural phenomena" and "both natural phenomena and human activity" was significant (mean difference = -0.500, $p = 0.014$). Additionally, the difference between "mainly due to natural phenomena" and "mainly due to human activity" was even greater (mean difference = -0.701, $p < 0.001$). No significant difference was found between "both natural phenomena and human activity" and "mainly due to human activity" (mean difference = -0.200, $p = 0.257$).

The analysis for perceived effects of climate change revealed significant differences between groups, $F(2, 651) = 22.53$, $p < 0.001$. The Shapiro–Wilk normality test yielded a significant result ($W = 0.971$, $p < 0.001$), indicating a violation of the normality assumption, while Levene's test for homogeneity of variances was marginally non-significant, $F(2, 651) = 2.8095$, $p = 0.061$.

The Tukey post hoc test revealed that the comparison between "mainly due to natural phenomena" and "both natural phenomena and human activity" was not significant (mean difference = -0.177, $p = 0.613$). The comparison between "mainly due to natural phenomena" and "mainly due to human activity" showed a significant difference (mean difference = -0.977, $p < 0.001$). Likewise, the difference between "both natural phenomena and human activity" and "mainly due to human activity" was also significant (mean difference = -0.800, $p < 0.001$).

Finally, the possible relationship between sociodemographic variables and the type of belief about the causes of climate change was explored using chi-square tests. The results showed no significant associations between gender ($\chi^2(2) = 2.37$, $p = 0.305$, Cramér's $V = 0.06$), educational level ($\chi^2(18) = 27.43$, $p = 0.071$, Cramér's $V = 0.15$), or age recoded into quartiles ($\chi^2(6) = 9.23$, $p = 0.161$, Cramér's $V = 0.08$) and causal attributions of climate change. These findings suggest that, within this sample, group membership based on causal beliefs does not appear to be significantly influenced by these sociodemographic variables.

3.1.4. Effect Size Analysis

The effect size analysis, measured using ω^2, revealed that the variable with the largest effect was direct collective actions ($\omega^2 = 0.152$), closely followed by negative emotions toward climate change ($\omega^2 = 0.150$), and anxiety and fear regarding climate change ($\omega^2 = 0.106$). These values suggest that the differences between groups in these variables can be considered moderate to large in magnitude, indicating that the perception of the causes of climate change significantly influences negative emotions, anxiety, and the willingness to engage in direct collective actions (see Table 3).

Table 3. Effect sizes based on the variable Causes of Climate Change.

	ω^2 (Omega Squared)
Negative Emotions Toward Climate Change	0.150
Positive Emotions Toward Climate Change	0.044
Anxiety and Fear About Climate Change	0.106
Direct Collective Actions	0.152
Disruptive Actions	0.018
Institutional and Mediated Actions	0.019
Perceived Effects of Climate Change	0.062

On the other hand, positive emotions toward climate change ($\omega^2 = 0.044$) and perceived effects of climate change ($\omega^2 = 0.062$) showed lower, though still meaningful, effect sizes. These results suggest that although the differences between groups are statistically significant, the proportion of variance explained by beliefs about the causes of climate change in these variables is smaller compared to negative emotions and anxiety. Nevertheless, the relationship remains important from an interpretative perspective, as these variables reflect key aspects of the psychological and cognitive response to climate change.

Finally, disruptive actions ($\omega^2 = 0.018$) and institutional and mediated actions ($\omega^2 = 0.019$) had the lowest effect sizes, indicating that attribution of the causes of climate change has minimal influence on these variables. This suggests that while there are group differences in the willingness to engage in more structured or disruptive forms of action, these differences account for a relatively small portion of the variance compared to other variables. Taken together, these findings provide evidence of the importance of causal attribution in shaping emotional and behavioral responses to climate change, particularly highlighting its impact on negative emotions and direct collective action.

4. Discussion

This study provides evidence on the relationship between climate beliefs, emotions, perceived negative impacts, and willingness to engage in collective action in a Chilean region vulnerable to climate change. Specifically, it aimed to determine whether there are significant differences in emotions, perceptions of climate change effects, and willingness to take collective action based on beliefs about its causes among residents of the Valparaíso region, which is particularly susceptible to the impacts of climate change.

The findings indicate that individuals who recognize the human causes of climate change perceive greater negative impacts and are more willing to participate in collective actions to mitigate its effects. These results highlight the importance of climate information and education as key tools for raising awareness and fostering public engagement in addressing climate change.

Based on the results obtained, it is possible to affirm that the hypotheses formulated in this study have been empirically confirmed, reinforcing the coherence between the

proposed theoretical framework and the observed findings. Regarding H1, the analyses showed that individuals who attribute climate change to human causes experience significantly higher levels of negative emotions and anxiety toward the phenomenon compared to those who explain it through natural or mixed causes. This result supports the theoretical assumption that the perception of human responsibility intensifies negative emotional responses, likely by activating mechanisms of moral concern, urgency, or perceived threat.

Regarding H2, it was also confirmed that participants who hold anthropogenic beliefs about climate change report a greater willingness to engage in collective actions, including direct, institutional, and even disruptive forms. This trend suggests that causal attribution influences the degree of civic mobilization, as anticipated in the literature on environmental participation and collective action. Finally, H3 was likewise supported, as those who believe that climate change is mainly caused by human activity reported a higher perception of its negative effects compared to the other groups. Taken together, these results reinforce the idea that causal attribution of climate change functions as a central determinant in shaping emotions, perceived impacts, and willingness to act, thus validating the theoretical approach adopted in this study.

The analysis of variance (ANOVA) revealed significant differences between belief groups across all variables analyzed, including emotions, perceptions of the effects of climate change, and collective actions in favor of the environment. In particular, those who attribute climate change to human causes showed a significantly higher perception of its negative effects compared to those who attribute it to natural causes. This suggests that understanding the origin of the phenomenon may shape risk perception and the sense of urgency to take action [50].

Regarding collective actions, the results indicate that belief in the human cause of climate change is also associated with greater support for institutional measures, such as voting for pro-environmental candidates or signing petitions. These findings are consistent with previous studies that have identified a relationship between climate beliefs, emotions, and willingness to act [15,51]. The mean difference between those who believe in human causes and those who believe in natural causes was significant, indicating that acceptance of scientific evidence aligns with a greater willingness to engage in democratic mechanisms to address the issue [16,65]. However, no significant differences were found in disruptive actions, which may be due to the lower social acceptance of such actions or the influence of other factors, such as perceived personal and collective efficacy [20].

Another relevant finding was the relationship between emotions and beliefs about the causes of climate change. It was found that individuals who believe that climate change is caused by human activity experience stronger negative emotions, perceive more negative effects of climate change, and show a greater willingness to act. This is consistent with previous research that has identified the role of emotions in motivating collective action in general [72] and environmental collective action in particular [56,59]. However, the effect size for positive emotions was less pronounced, suggesting that while such emotions may encourage engagement, they do not necessarily generate the same sense of urgency as negative emotions [60].

Regarding the perception of the negative effects of climate change, the results indicate that it varies according to beliefs about its causes. Individuals who attribute climate change mainly to natural phenomena report a lower perception of its impacts, while those who consider it the result of both natural factors and human activity show an intermediate level of perception. In contrast, those who believe that climate change is primarily caused by human activity report a significantly higher perception of its negative effects. These findings are consistent with previous research showing that acceptance of human influence on climate change is associated with greater awareness of its risks and consequences [58].

Moreover, the literature suggests that downplaying the human role in this phenomenon can reduce the perceived severity of its impacts, which in turn affects the willingness to adopt mitigation measures and support environmental policies [14,15].

Regarding the limitations of the present study, it is important to note that, although the analyses identified significant associations between beliefs about the causes of climate change, emotions, and willingness to engage in collective action, these results should not be interpreted as evidence of direct causal relationships. The cross-sectional and correlational nature of the design prevents establishing the directionality of the observed effects. Therefore, future research should consider the use of longitudinal or experimental designs to more rigorously examine the temporal sequence and underlying causal mechanisms of these relationships.

From a political and social perspective, the results also reinforce the importance of education and information in shaping climate beliefs. Although education can increase acceptance of climate change, its impact is mediated by political orientation, with individuals holding conservative ideologies showing greater resistance to accepting scientific evidence [16,49]. This suggests the need for tailored communication strategies that address different groups, incorporating approaches that reduce polarization and promote dialogue grounded in scientific evidence [15].

In this regard, it is essential for both the state and private actors to promote climate communication policies based on scientific evidence that strengthen public understanding of the human origin of the phenomenon and emotionally engage citizens. Evidence shows that communication campaigns that incorporate emotional narratives and appeal to perceived efficacy can increase environmental concern and the willingness to act on climate change [60]. The association identified in this study between belief in the anthropogenic cause of climate change and higher levels of anxiety, negative emotions, and willingness to engage in collective action suggests that an informed and emotionally engaged public is better equipped to support and participate in mitigation and adaptation measures [56].

Similarly, it also seems advisable for public policies to promote territorially differentiated educational interventions, particularly in regions such as Valparaíso, which exhibit high levels of climate vulnerability. Evidence shows that climate education, when designed with attention to the cultural specificities of a given territory, can significantly increase acceptance of scientific evidence and self-efficacy for action [15,17]. In this regard, integrating climate change content into formal education systems, as well as developing community-based environmental literacy programs, can help bridge the gap between public perception and scientific consensus. These initiatives, along with participatory territorial planning and the implementation of preventive relocation strategies for communities in high-risk areas, constitute fundamental responses for addressing projected climate challenges and strengthening local resilience [12,66].

Finally, the findings of this study highlight the need for future research to further explore the psychological and social mechanisms that mediate the relationship between beliefs, emotions, and action in response to climate change. In this regard, the study reinforces the importance of addressing the psychosocial dimensions of the phenomenon—especially considering the magnitude of observable environmental effects in highly exposed territories such as Chile, and particularly in coastal regions like Valparaíso. The urgency of implementing mitigation measures requires active civic engagement, whether through awareness-raising, mobilization, or political advocacy. Therefore, examining beliefs about the causes of climate change—and how these beliefs relate to emotions, perceived impacts, and willingness to engage in collective action—helps us understand how the population interprets this crisis and what strategies might strengthen their response. This is essential not only for the design of public policies but also for the role of academia and the scientific

community in a context where climate change arguably represents the most pressing collective challenge facing humanity.

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