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RESEARCH ARTICLE

Climate Change Communication: Beyond Crisis Communication

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ABSTRACT

Climate change communication, traditionally centered on crisis messaging, requires a more comprehensive approach to effectively address this global challenge. This article explores the evolution of communication strategies beyond crisis framing, highlighting the need for a broader, more nuanced approach. Based on interdisciplinary research from agenda-setting, cultural cognition, intersectionality, and visual communication theories, the study critically assesses the limitations of crisis-centric messaging and investigates alternative approaches. These include solution-oriented framing, values-based communication, and culturally sensitive strategies. Through a systematic literature review and analysis of case studies across diverse cultural contexts, this research examines how tailored messages, which incorporate intersectional perspectives and leverage visual storytelling, can enhance public engagement and foster sustained commitment to climate action. The findings contribute to the field by proposing a paradigm shift towards a more inclusive, empowering communication framework. This article concludes with practical recommendations for communicators and researchers, emphasizing the importance of adaptable and culturally relevant strategies to strengthen the global response to climate change.

Keywords: climate change; crisis framing; solution-oriented narratives; cultural cognition; agenda-setting

1. Introduction

Climate change represents one of the most pressing challenges of our time, with far-reaching implications for ecosystems, economies, and human societies worldwide[1,2]. As the scientific consensus on the urgency of this issue has solidified, the field of climate change communication has emerged as a critical component in fostering public understanding and motivating collective action[3,4]. Traditionally, crisis framing has been a dominant strategy in this domain, emphasizing the severe and immediate threats posed by global warming to create a sense of urgency and prompt swift responses.

However, as our understanding of human behaviour, social dynamics, and communication processes has evolved, so too has our approach to climate change messaging[5–7]. This article critically evaluates the limitations of crisis-centric communication and proposes a more holistic framework for engaging diverse audiences on climate change. By drawing on key communication theories, such as agenda-setting, cultural

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cognition, and intersectionality, we present a multifaceted approach that moves beyond alarmist messaging to promote sustained engagement and meaningful action. Given the global and long-term nature of climate change, communication strategies must be equally complex and adaptable to effectively resonate with varied audiences.

The research also explores how integrating crisis framing with solution-oriented narratives, values-driven messaging, and culturally sensitive approaches can create more impactful and inclusive climate communication. Additionally, we examine the potential of visual storytelling and emerging technologies, like virtual and augmented reality, in making climate concepts more tangible and personally relevant to a wide range of audiences. As the world becomes more interconnected and climate challenges grow, the way we communicate these issues is increasingly crucial in shaping public perception, influencing policy, and motivating individual and collective action. This article contributes to the evolving discourse on climate change communication by offering practical insights and strategies for researchers, practitioners, and policymakers. By moving beyond crisis-driven narratives, we aim to inspire hope, deepen public engagement, and drive the collective action needed for a sustainable future.

This article explores and explains details about crisis framing, outlines the theories on which it rests (framing, fear appeals and agenda-setting), illustrates how it is used in practice, and sets out its main limitations. Further it turns to approaches that can complement it, namely solution -oriented framing, values-based communication, social norms, narrative transportation and two-way engagement. It also discusses cultural cognition and intersectionality, two audience-centered lenses that apply across all these approaches. Considers visual communication and immersive technologies and finally draws the strands together and offers recommendations for communicators and researchers.

2. The Dominance of Crisis Framing

The pervasiveness of crisis framing in climate change communication is undeniable. The existential threat posed by climate change has led many communicators to adopt urgent, sometimes alarmist tones in their messaging. This approach is rooted in several communication theories, which are outlined in Sections 2.1 and 2.2. Section 2.3 then gives examples of crisis framing in practice, and Section 2.4 discusses its limitations.

2.1. Framing Theory and Fear Appeals

Framing theory emphasizes how the presentation of information influences audience perceptions and responses. Crisis framing aims to create a sense of urgency and motivate immediate action. As already noted in the introduction, it is precisely this aim of creating urgency and prompting immediate action that has made crisis framing a dominant strategy in climate change communication. This approach is rooted in the belief that highlighting the severity and immediacy of the climate crisis can galvanize public attention and spur behavioural change. The theoretical underpinnings of crisis framing draw from various communication and psychological theories, including framing theory[8] and fear appeals[9].

Framing theory suggests that how an issue is presented to the public can significantly influence perceptions and responses. By framing climate change as a crisis, communicators aim to make the issue salient and urgent, thereby capturing public attention and prompting action. This approach aligns with agenda-setting theory[10], which is discussed in Section 2.2 and which posits that the media can influence the importance attributed to issues by the public.

Fear appeals, a concept from health communication, involve using fear to motivate behaviour change[9]. In the context of climate change, fear appeals are employed to highlight the dire consequences of inaction,

with the intention of provoking a sense of urgency and motivating individuals to take immediate action. The effectiveness of fear appeals, however, is contingent on the perceived efficacy of the recommended actions; if individuals do not believe they can effectively mitigate the threat, fear appeals may backfire, leading to denial or disengagement[9].

Crisis framing has been effective in creating a sense of urgency around climate change. By emphasizing the immediate and catastrophic impacts of climate change, such as rising sea levels, extreme weather events, and ecosystem collapse, communicators aim to make the issue personally relevant and pressing. For example, the Intergovernmental Panel on Climate Change (IPCC) reports often use crisis framing to underscore the need for immediate and drastic action[11] (see Section 2.3).

Crisis framing can motivate immediate action by making the consequences of inaction vivid and tangible. Studies have shown that when individuals perceive a threat as immediate and severe, they are more likely to engage in protective behaviours[12]. For instance, campaigns that highlight the imminent risks of climate change, such as those focused on the impacts of extreme weather events, can prompt individuals to take actions like reducing their carbon footprint or advocating for policy changes.

2.2. Agenda-Setting Theory

Crisis framing is also closely tied to agenda-setting theory, which posits that media attention to an issue significantly influences public perception of its importance. This theory, first proposed by McCombs and Shaw[10] in their study of the 1968 US presidential election, and later taken up in policy studies by Plein[13], suggests that the media can shape the public's understanding of which issues are most pressing and deserving of attention. In the context of climate change communication, crisis framing aims to leverage this theory by keeping climate change at the forefront of public consciousness, thereby influencing the public's perception of its urgency and importance.

Agenda-setting theory argues that the media plays a crucial role in setting the public agenda by determining which issues receive prominent coverage[14]. The theory is based on the premise that the amount of coverage an issue receives in the media correlates with the public's perception of its importance. This influence is not limited to the mere presence of an issue in the media but also extends to the way the issue is framed and presented. The media's role in agenda-setting is pivotal in shaping public opinion and policy priorities. By consistently reporting on climate change and framing it as a crisis, the media can elevate the issue in the public consciousness. For instance, extensive coverage of climate-related disasters, scientific reports, and policy debates can keep climate change at the forefront of public attention, making it a salient issue that demands immediate action.

Studies have shown that increased media coverage of climate change can influence public perception of its importance. For example, research by Brulle et al.[15] found that media attention to climate change correlates with public concern about the issue. When the media frames climate change as a crisis, it can heighten the public's sense of urgency and motivate them to engage with the issue more actively. Crisis framing aligns with agenda-setting theory by aiming to keep climate change at the forefront of public consciousness. By emphasizing the immediate and severe impacts of climate change, communicators can make the issue more salient and pressing. This approach is designed to capture public attention and influence the public agenda, making climate change a priority issue that demands immediate and sustained action.

2.3. Examples of Crisis Framing in Climate Change Communication

The theoretical logic described above is most visible in the communication of major scientific and media institutions. The IPCC reports are a prime example of crisis framing in climate change communication.

Three features of these reports support this reading. First, their Summaries for Policymakers are built around headline statements that stress the speed and scale of the change required; the Special Report on Global Warming of 1.5°C, for instance, states that limiting warming to 1.5°C would require "rapid and far-reaching transitions" in energy, land, urban, infrastructure and industrial systems[11]. Second, the reports rely on the well-known "burning embers" figures, in which the risks associated with each of five Reasons for Concern are coloured from white (undetectable) through yellow and red to purple (very high risk) as global temperature rises. In successive assessments, these colour transitions have moved to lower levels of warming, so that the figures signal at a glance that serious danger is arriving sooner than previously thought[11,16]. Third, the language of time running out recurs throughout; the Working Group II contribution to the Sixth Assessment Report warns that any further delay will miss a "brief and rapidly closing window of opportunity" to secure a liveable future[16]. By highlighting the catastrophic consequences of inaction in these ways, the IPCC aims to keep climate change at the forefront of public consciousness and influence policy priorities.

Media coverage of extreme weather events, such as hurricanes, wildfires, and heatwaves, often frames these events as manifestations of the climate crisis. By linking these events to climate change and emphasizing their severity and frequency, the media can keep climate change at the forefront of public consciousness and influence the public's perception of its urgency and importance.

2.4. Limitations of Crisis Framing

While crisis framing can be effective in creating urgency and motivating action, it also has several limitations and potential drawbacks, three of which are discussed below.

2.4.1. Psychological Distancing

Crisis framing can lead to psychological distancing, where individuals perceive climate change as a distant threat, reducing their sense of personal relevance and urgency[17]. This can result in a disconnect between the perceived severity of the issue and the individual's willingness to act.

2.4.2. Fatigue and Disengagement

Repeated exposure to crisis messaging can result in "apocalypse fatigue"[18], where individuals become desensitized to the urgency of the issue, leading to disengagement or denial.

2.4.3. Limited Audience Reach

Crisis framing may resonate differently across cultural and ideological divides, potentially alienating certain segments of the population[19,20]. This can limit the reach and effectiveness of climate communication efforts.

2.5. Why Crisis Framing Needs to Be Complemented

Crisis framing seeks to create a sense of urgency by highlighting the severity and immediacy of the climate crisis, and, as the examples above show, it has helped to keep climate change on media and policy agendas. Its strength lies mainly in raising awareness and sparking short-term action. Over longer periods, however, it risks psychological distancing[17], fatigue, hopelessness or denial[18], and the alienation of audiences whose cultural or ideological commitments lead them to reject alarm-based messages[19,20]. To build a more robust and effective communication strategy, crisis framing should therefore be complemented by other approaches, such as solution-oriented framing, values-based communication, and culturally cognizant strategies. Each of these responds to one or more of the limitations identified above. Solution-oriented framing restores the sense of efficacy whose absence feeds fatigue and denial; values-based and norm-based messages reduce psychological distance by linking climate change to what audiences already

care about and to what the people around them do; and culturally cognizant strategies widen the reach of climate messages. By adopting a more nuanced and context-sensitive approach, climate communicators can engage diverse audiences and foster long-term commitment to climate action. The next section examines these alternatives in turn.

3. Beyond Crisis: Alternative Approaches

Recognizing the limitations of crisis-centric communication, many scholars and practitioners now advocate for more diverse and nuanced approaches to climate change communication. These alternative strategies aim to engage audiences more effectively and foster long-term commitment to climate action by drawing on various communication theories. The five approaches discussed below move broadly from the content of messages (solutions, values, norms and narratives) to the process of communication itself (two-way engagement).

3.1. Solution-Oriented Framing

Solution-oriented framing in climate change communication offers a powerful alternative to crisis-centric messaging by emphasizing potential solutions and success stories[21]. This approach, grounded in constructive journalism and hope theory, aims to inspire action and foster a sense of agency among diverse audiences. By highlighting tangible solutions and success stories, communicators can effectively motivate individuals and communities to engage in pro-environmental behaviors and support climate initiatives.

A compelling example of solution-oriented framing in practice is the work of Wangari Maathai and the Green Belt Movement in Kenya. Rather than solely focusing on the crisis of environmental degradation, Maathai emphasized actionable solutions. She recognized the severe environmental issues facing Kenya, such as deforestation, soil erosion, and loss of biodiversity. However, instead of dwelling on these problems, Maathai actively promoted reforestation as a tangible and accessible solution[22].

By engaging communities in tree-planting initiatives, Maathai demonstrated that individuals had the power to be part of the solution. This approach not only addressed the environmental challenges but also empowered people, giving them a sense of agency in the face of daunting ecological issues. The success of the Green Belt Movement is evident in its impressive outcomes: over 51 million trees planted and more than 30,000 women trained in forestry, food processing, bee-keeping, and other trades that help them earn income while preserving their lands and resources[22].

The Green Belt Movement's success aligns with research showing that hope can be a powerful motivator for behaviour change. When individuals feel hopeful about the future and believe that meaningful action is possible, they are more likely to engage in pro-environmental behaviours and support climate action[23,24]. Other examples of solution-oriented framing include highlighting communities successfully transitioning to renewable energy or implementing innovative technologies to reduce carbon emissions. These stories can inspire others to take similar steps in their own contexts. Additionally, communicating about policy solutions, such as carbon pricing and renewable energy subsidies, can demonstrate how climate action can be both practical and effective on a larger scale[25].

The impact of individual actions is another crucial aspect of solution-oriented framing. By emphasizing how personal choices, like reducing meat consumption or conserving energy, contribute to a more sustainable future, communicators can help individuals see the tangible effects of their actions[26,27]. This approach counters the potentially paralyzing effects of crisis narratives by giving people a sense of efficacy and empowerment.

Implementing solution-oriented framing effectively requires tailoring messages to specific audiences and contexts, as a one-size-fits-all approach often leads to disengagement. Interdisciplinary collaboration between scientists, communication experts, and psychologists can help create more effective and context-sensitive strategies. Furthermore, ongoing research should evaluate how solution-oriented framing resonates with different cultural contexts to refine communication methods.

The success of initiatives like the Green Belt Movement and the growing body of research supporting solution-oriented approaches underscores the importance of this framing in climate change communication. By focusing on solutions rather than solely on problems, communicators can inspire hope, foster engagement, and ultimately drive meaningful action in addressing the global climate challenge.

3.2. Values-Based Communication

Values-based communication, rooted in social psychology, offers a powerful approach to climate change messaging by aligning communications with the core values of target audiences[28]. This strategy increases the resonance and personal relevance of climate messages, potentially overcoming resistance and inspiring action. By understanding and appealing to diverse value systems, communicators can craft messages that make climate change a matter of personal importance for various groups.

The theory behind values-based communication draws from research on moral foundations and personal values. Studies have shown that individuals are more likely to engage with and act upon information that aligns with their existing value structures[29–31]. In the context of climate change, this means tailoring messages to resonate with specific value sets, whether they prioritize environmental conservation, economic stability, social justice, or other core principles.

For audiences who deeply value nature and biodiversity, communicators might emphasize the impact of climate change on ecosystems and wildlife. The World Wildlife Fund (WWF) effectively uses this approach in their "Earth Hour" campaign. By encouraging people to turn off their lights for one hour, WWF appeals to values of environmental stewardship and collective action for nature's preservation[32]. Their messaging often includes vivid imagery of endangered species and threatened habitats, directly connecting climate action to the protection of beloved natural wonders.

On the other hand, for those prioritizing economic concerns, climate messages can focus on the financial benefits of renewable energy and sustainable practices. Tesla's marketing strategy exemplifies this approach. While selling electric vehicles, Tesla emphasizes not just environmental benefits but also long-term cost savings, technological innovation, and job creation in the green energy sector[33]. This resonates with individuals who value economic progress and financial prudence.

Health and well-being are also powerful values that can be leveraged in climate communication. The American Lung Association's "State of the Air" campaign effectively links climate change to personal and public health. By highlighting how air pollution affects respiratory health, they appeal to individuals who prioritize personal and family well-being[34]. The link with climate change runs in two directions. A warming climate can worsen air quality, for example by favouring the formation of ground-level ozone and by increasing wildfire smoke. More importantly for communication, most climate policies also reduce air pollution, because cutting the combustion of fossil fuels lowers emissions of fine particulate matter and other harmful pollutants at the same time as greenhouse gases. These health co-benefits are felt locally and in the short term, which makes them a persuasive message for audiences who are less moved by distant climate impacts[35]. Their messaging often includes stories of individuals affected by air pollution, making the issue deeply personal and relevant.

Values of social justice and equity can also be powerful motivators for climate action[36]. The Environmental Justice Movement blends climate action with social justice concerns. Organizations like the Deep South Center for Environmental Justice frame climate change as an issue of equity and human rights. They emphasize how climate impacts disproportionately affect marginalized communities, appealing to those who value social justice and equality.

Religious and moral values provide another avenue for climate communication. Pope Francis's encyclical "Laudato Si'" is a prime example of framing climate change in terms of religious and moral values[37]. By presenting environmental stewardship as a moral imperative and connecting it to religious teachings, this approach resonates deeply with individuals who prioritize faith-based values. The "Mothers Out Front" movement demonstrates how climate action can be framed in terms of protecting future generations. Their messaging focuses on how climate change will affect children and grandchildren, appealing strongly to those who prioritize family and community well-being[38]. This approach taps into deeply held values of nurturing and protection, making climate change a personal issue for parents and grandparents.

Implementing values-based communication effectively requires careful audience analysis and message crafting. The New Zealand government's climate change communication strategy exemplifies a multi-faceted, values-based approach. Their messaging is tailored for different segments of the population, emphasizing economic opportunities for businesses, health benefits for families, and environmental preservation for nature enthusiasts[39].

It's important to note that while values-based communication can be highly effective, it also requires ethical consideration to avoid manipulation. The goal should be to genuinely connect climate issues with existing values, not to exploit or misrepresent them. By blending values-based communication with other strategies like solution-oriented framing, communicators can create powerful, resonant messages that inspire climate action across diverse audiences. This approach recognizes the complexity of human motivations and leverages our deep-seated values to drive meaningful engagement with one of the most pressing issues of our time.

3.3. Social Norms Theory

Social norms theory offers a powerful framework for understanding and influencing behaviour in the context of climate change communication. This approach recognizes that human behaviour is significantly shaped by perceptions of what others do (descriptive norms) and what others approve or disapprove of (injunctive norms). By leveraging these social influences, communicators can make climate-friendly actions seem more normative and desirable, potentially catalyzing widespread behaviour change.

The Bishnoi community in India provides a compelling example of how deeply ingrained social norms can drive environmental conservation. For the Bishnoi, protecting trees and wildlife is not just a personal choice but a cultural norm passed down through generations, intertwined with religious and moral values. This community-wide commitment to environmental stewardship demonstrates the power of social norms in shaping behaviour. The Bishnoi's practices are enforced by community standards, creating a strong social pressure to conform to eco-friendly behaviours. Failure to adhere to these environmental norms can lead to social sanctions, ensuring collective adherence to the teachings of their guru, Jambheshwar[40]. The Bishnoi example illustrates how social norms can become a part of a group's identity, making environmentally friendly behaviours not just expected but a source of pride and belonging. This integration of religion, ecology, and social identity creates a powerful motivator for sustainable practices, influencing not only individual actions but also inspiring broader environmental movements.

Moving beyond the Bishnoi example, we can see the application of social norms theory in various climate change communication strategies worldwide. In the United States, the company Opower has successfully used social norms to reduce energy consumption[41]. By providing households with energy reports that compare their usage to that of their neighbours, Opower taps into the power of descriptive norms. This approach has led to significant reductions in energy use, as people naturally adjust their behaviour to align with what they perceive as the community standard. Another example comes from the city of Brighton and Hove in the UK, where a campaign called "Plastic Free Pledge" leveraged social norms to reduce single-use plastic consumption. The campaign prominently displayed the growing number of local businesses and individuals who had taken the pledge, creating a visible community movement[42]. This approach not only highlighted the descriptive norm of reducing plastic use but also created an injunctive norm by presenting it as a socially approved behaviour. In Japan, the "Cool Biz" campaign, initiated by the government, successfully changed social norms around summer office attire to reduce air conditioning usage. By getting high-profile politicians and business leaders to adopt more casual, cooler clothing, the campaign quickly shifted perceptions of appropriate dress codes, leading to significant energy savings[43].

The hospitality industry has also tapped into social norms theory to promote environmentally friendly behaviours. Many hotels now use messages like "75% of guests in this room reused their towels" to encourage towel reuse. This approach, which combines specific, local norms with environmental appeals, has proven more effective than general environmental messages alone.

In the realm of transportation, cities like Copenhagen have effectively used social norms to promote cycling. By making cycling infrastructure highly visible and celebrating the city's cycling culture, Copenhagen has created a strong descriptive norm around bicycle use[44]. This has contributed to making cycling the norm for urban transportation, with significant positive impacts on carbon emissions and public health. These examples demonstrate how social norms theory can be applied across various contexts to promote climate-friendly behaviours. However, it's crucial to note that the effectiveness of social norms interventions can vary based on cultural context and the specific behaviour being targeted. For instance, research has shown that a descriptive norm can backfire. When households that already use less energy than their neighbours are told what the average consumption in their area is, that average turns out, unintentionally, to be high relative to their own use, and some of them increase their consumption towards it. This phenomenon is known as the "boomerang effect". In the same study, the effect disappeared when the descriptive information was paired with an injunctive signal of approval, such as a smiling face for below-average users[45].

To maximize the impact of social norms in climate change communication, strategies should emphasize positive norms by highlighting the prevalence of desirable climate-friendly behaviors rather than focusing on problematic ones. Making these norms visible through visual cues, public pledges, and community events can further increase their influence by drawing attention to sustainable actions. Localizing these norms within specific communities or peer groups also enhances their relevance, as individuals are more likely to be influenced by behaviours practiced within their immediate social circles. A combination of descriptive norms, which show what others are doing, and injunctive norms, which convey social approval, can reinforce the desired behaviour. Moreover, providing actionable steps alongside norm-related messages helps individuals understand how they can effectively adopt the encouraged behaviour, further strengthening the impact of social norms in promoting climate action.

By integrating social norms theory into climate change communication strategies, communicators can tap into the powerful human tendency to conform to social expectations. This approach, when thoughtfully

applied, has the potential to accelerate the adoption of sustainable behaviours and create a social environment where climate action is not just accepted, but expected and celebrated.

3.4. Narrative Transportation Theory

Narrative Transportation Theory provides a compelling framework for improving the impact of climate change communication. This theory suggests that when individuals become deeply immersed in a story, they are more likely to adopt beliefs, attitudes, and behaviours aligned with that narrative. In the context of climate change discourse, this approach can be leveraged to craft more compelling and persuasive messages that resonate with audiences on both emotional and cognitive levels. Several examples illustrate the effective application of Narrative Transportation Theory in climate change communication.

The Emmy-winning documentary series "Years of Living Dangerously" employs celebrity correspondents to narrate stories of individuals and communities affected by climate change[46]. By focusing on personal narratives, such as the story of a single mother in Plainview, Texas, struggling with drought-induced economic challenges, the series makes the global issue of climate change feel immediate and relatable.

The Chipko movement of India, which originated in the 1970s, provides a powerful example of narrative transportation in environmental activism. The movement's story centered around the iconic image of villagers, particularly women, hugging trees to prevent deforestation. This vivid imagery served as a cornerstone of the movement's narrative, creating a mental picture that was easy for people to visualize and remember. The movement's slogan, "What do the forests bear? Soil, water, and pure air," encapsulated complex ecological concepts in a simple, memorable phrase, helping to transport people into an understanding of the forest's ecological importance[47]. The personal journey of young climate activist Greta Thunberg offers another compelling narrative. Her transformation from a solitary protester to a global icon demonstrates the potency of personal storytelling. Thunberg's impassioned speech at the UN Climate Action Summit in 2019, where she accused world leaders of stealing her dreams and childhood, created a narrative that transported listeners into her perspective, evoking strong emotions and spurring action.

While scientifically inaccurate in many aspects, the disaster film "The Day After Tomorrow" effectively used narrative transportation to increase public concern about climate change. The film's dramatic portrayal of sudden climate catastrophe, though exaggerated, helped viewers visualize potential climate impacts[48,49]. Despite its unrealistic depiction, scenes such as a massive freeze engulfing New York City created vivid mental images that lingered with viewers, potentially influencing their perception of climate risks.

Indigenous communities have also been leveraging the power of storytelling to share their traditional knowledge and experiences of climate change. The Inuit people of the Arctic, for instance, have been sharing narratives about changing ice conditions, shifts in animal migration patterns, and the impact on their traditional way of life[50]. These personal accounts transport listeners into the Arctic environment, making the abstract concept of global warming tangible and immediate.

The documentary "2040" takes an innovative approach by envisioning a positive future where climate change has been successfully addressed. By combining real-world solutions with a fictional narrative set in the future, the film helps viewers envision a positive outcome, potentially increasing their motivation to act[51]. This approach demonstrates how narrative transportation can be used not only to highlight current problems but also to inspire hope and action for the future.

Climate fiction, or "Cli-Fi," represents another arena where Narrative Transportation Theory is being applied to climate change communication. Novels such as Barbara Kingsolver's "Flight Behavior" use

fictional narratives to explore climate change themes. These stories can transport readers into future scenarios or current impacts, fostering empathy and understanding. In "Flight Behavior," for example, the protagonist's discovery of a colony of monarch butterflies displaced by climate change allows readers to experience a world where climate impacts are personal and immediate.

Each of these examples, from the grassroots Chipko movement to global media productions, demonstrates the power of storytelling in environmental and climate change communication. They showcase how narratives can be crafted to engage audiences emotionally and cognitively, making abstract environmental concepts more tangible and personally relevant. The success of these varied approaches underscores the importance of using diverse storytelling techniques in climate change communication. By creating narratives that evoke emotions, generate vivid mental imagery, reduce counter arguing, and foster identification with characters or situations, communicators can more effectively transport their audiences into stories that inspire understanding and action.

Moreover, these examples highlight the versatility of Narrative Transportation Theory. Whether through community-led movements like Chipko, personal activist stories like Thunberg's, documentaries, films, indigenous wisdom, or works of fiction, compelling narratives have the power to transform abstract data and projections into stories that audiences can connect with on a personal level. By harnessing these varied approaches to narrative transportation, climate change communicators can create messages that resonate deeply, inspire action, and ultimately contribute to addressing one of the most pressing issues of our time. The integration of grassroots narratives like the Chipko movement alongside more modern, global storytelling techniques offers a rich tapestry of approaches for effective climate change communication.

3.5. Two-Way Engagement Models

Two-way engagement models in climate change communication represent a paradigm shift from traditional top-down approaches to more participatory and collaborative methods. These models, rooted in participatory communication theory, emphasize the importance of dialogue, mutual learning, and co-creation of knowledge. By involving audiences actively in the communication process, these approaches foster a deeper understanding of climate issues and a stronger commitment to action[52]. The evolution of climate change communication from one-way information dissemination to two-way engagement reflects a growing recognition of the complex, multi-faceted nature of climate challenges. It acknowledges that effective solutions require not only scientific expertise but also local knowledge, diverse perspectives, and community buy-in. This shift aligns with the broader trend towards more democratic and inclusive approaches to environmental governance and decision-making.

One compelling example of two-way engagement in climate change communication is the Arctic Adaptation Exchange, a project initiated by the Arctic Council[53]. This online platform serves as a collaborative space where indigenous communities, researchers, and policymakers can share knowledge about climate change impacts and adaptation strategies in the Arctic region. Users can contribute their own experiences, traditional knowledge, and scientific observations, creating a rich, multi-perspective resource. This approach not only validates and incorporates indigenous knowledge but also facilitates a more comprehensive understanding of climate change in the Arctic.

Community-based adaptation (CBA) projects provide another excellent illustration of two-way engagement models. For instance, the Strengthening Adaptation and Resilience to Climate Change in Kenya Plus (StARCK+) program[54], implemented in various Kenyan counties, exemplifies this approach. The program facilitates community workshops where local residents, climate experts, and government officials collaboratively assess climate risks, identify vulnerabilities, and develop adaptation strategies. This

participatory process ensures that adaptation plans are grounded in local realities and have strong community support, increasing their effectiveness and sustainability.

Citizen science initiatives have also emerged as powerful tools for two-way climate change communication. The CoCoRaHS (Community Collaborative Rain, Hail and Snow Network) in the United States is a prime example[55]. This volunteer network engages thousands of citizens in collecting and reporting daily precipitation data. While primarily focused on weather monitoring, the project has significant implications for climate change research and communication. Participants not only contribute valuable data but also gain firsthand experience of changing precipitation patterns, making climate change more tangible and personal.

The World Wide Views on Climate and Energy project, conducted in 2015, demonstrates how two-way engagement can be scaled up to a global level. This innovative initiative involved simultaneous citizen consultations in 76 countries, engaging ordinary citizens in discussions about climate and energy policies[56]. The results were synthesized and presented to policymakers at the UN Climate Change Conference in Paris. This process not only provided valuable input for international climate negotiations but also empowered citizens to engage meaningfully with complex climate policy issues. Participatory scenario planning represents another effective application of two-way engagement in climate change communication. The Climate Change, Agriculture and Food Security (CCAFS) program has used this approach in East Africa[57]. Farmers, local officials, and climate scientists come together to develop scenarios of future climate impacts and plan adaptive strategies. This collaborative process combines scientific projections with local knowledge, resulting in more robust and contextually appropriate adaptation plans.

Digital platforms and social media have opened up new avenues for two-way climate change communication. The UN's "MyWorld2030" survey, for instance, uses online and mobile platforms to engage global citizens in prioritizing sustainable development goals, including climate action[58]. This ongoing dialogue allows for real-time feedback and helps shape global development agendas in a more participatory manner. Urban planning initiatives like "Rebuild by Design," launched after Hurricane Sandy in the north-eastern United States, exemplify how two-way engagement can be integrated into climate resilience efforts. This competition-based approach brought together design professionals, community members, and government officials to co-create innovative solutions for climate resilience. The process involved extensive community consultations, ensuring that proposed designs addressed local needs and concerns.

The success of these two-way engagement models in climate change communication lies in their ability to create a sense of ownership and empowerment among participants. By involving people in the process of knowledge creation and decision-making, these approaches transform passive recipients of information into active stakeholders in climate solutions. This shift not only enhances understanding and engagement but also builds social capital and collective efficacy, crucial elements for sustained climate action. However, implementing two-way engagement models is not without challenges. It requires significant time, resources, and skilled facilitation to ensure meaningful participation. There's also the risk of reinforcing existing power imbalances if not carefully managed. Despite these challenges, the growing body of successful examples demonstrates the potential of these approaches to create more inclusive, effective, and sustainable climate change communication and action strategies.

The two-way engagement models represent a crucial evolution in climate change communication. By fostering dialogue, collaboration, and co-creation of knowledge, these approaches are helping to bridge the gap between scientific understanding and public action on climate change. As climate challenges become

increasingly complex and pressing, such participatory methods will likely play an ever more important role in mobilizing collective action and developing resilient, community-driven solutions.

4. Culture and Identity in Climate Communication

Each of the approaches discussed in Section 3 assumes that communicators understand something about their audiences. This section examines two theoretical lenses that make this assumption explicit and that apply across all of the strategies discussed so far: cultural cognition, which concerns how worldviews filter information about risk, and intersectionality, which concerns how overlapping social identities shape both exposure to climate impacts and the way climate messages are received.

4.1. The Role of Cultural Cognition

The cultural cognition theory, developed by Kahan and colleagues[59], suggests that individuals' perceptions of risk and scientific evidence are shaped by their cultural worldviews. This theory highlights the importance of tailoring climate communications to diverse cultural contexts and values, rather than relying solely on scientific facts or crisis messaging. Cultural cognition posits that people tend to interpret information in ways that align with their cultural identities and values, leading to polarized views on issues like climate change[60].

Cultural cognition theory explains how cultural worldviews influence the way individuals process and respond to information about risks and scientific evidence. People tend to align their beliefs with those of their cultural peers to maintain their social standing and identity. This alignment can lead to divergent interpretations of the same scientific evidence, depending on one's cultural affiliations[20]. For instance, individuals with hierarchical and individualistic worldviews may be more skeptical of climate change, while those with egalitarian and communitarian worldviews may be more accepting of the scientific consensus.

Given the influence of cultural cognition on risk perceptions, effective climate communication must be tailored to diverse cultural contexts and values. Simply presenting scientific facts or crisis messaging may not be sufficient to change attitudes and behaviors. Instead, communicators should consider the cultural worldviews of their target audiences and frame messages in ways that resonate with those values. For example, emphasizing the economic benefits of renewable energy for hierarchical and individualistic audiences, or highlighting the community and environmental benefits for egalitarian and communitarian audiences[60].

4.1.1. Examples of Cultural Cognition in Practice

Research has shown that culturally tailored messages can be more effective in engaging audiences and promoting pro-environmental behaviours. For instance, a study by Kahan et al.[20] found that framing climate change as a threat to national security was more persuasive for individuals with hierarchical and individualistic world views, while framing it as a social justice issue was more persuasive for those with egalitarian and communitarian worldviews. By understanding and addressing the cultural dimensions of climate change, communicators can develop more effective and inclusive strategies.

4.2. Intersectionality in Climate Communication

An emerging area of focus is the application of intersectionality theory to climate change communication. This approach recognizes that climate impacts and perceptions are influenced by intersecting social identities, such as race, gender, and class. Effective communication strategies must account for these diverse experiences and perspectives to ensure that climate messages are inclusive and resonant for all audiences. Intersectionality theory, originally developed by Kimberlé Crenshaw in 1989,

highlights how multiple social identities intersect to shape individuals' experiences and perceptions[61]. In the context of climate change, this means recognizing that different groups may experience and perceive climate impacts differently based on their intersecting identities. For example, marginalized communities may be disproportionately affected by climate change due to systemic inequalities, while also having unique perspectives and solutions to offer.

Effective climate communication must account for the diverse experiences and perspectives of different social groups. This involves acknowledging the disproportionate impacts of climate change on marginalized communities and incorporating their voices and solutions into communication strategies. For instance, highlighting the experiences of the indigenous communities, women, and low-income individuals can make climate messages more inclusive and resonant for a broader audience[62].

4.2.1. Examples of Intersectionality in Practice

Inclusive climate communication can take various forms, such as featuring diverse voices in media coverage, involving marginalized communities in policy discussions, and tailoring messages to address the specific concerns and experiences of different groups. For example, the "Climate Justice" movement emphasizes the need for equitable solutions that address the disproportionate impacts of climate change on marginalized communities[63]. By adopting an intersectional approach, climate communicators can ensure that their messages are relevant and meaningful for all audiences.

5. The Importance of Visual Communication

Beyond what is said and to whom, the form in which climate messages are delivered also matters. Visual communication is a powerful tool in shaping perceptions and emotions, particularly in the context of climate change. As abstract scientific concepts can be difficult to grasp, climate change communicators are increasingly turning to visual storytelling, data visualization, and immersive technologies to make these concepts more tangible and emotionally impactful. Visual communication helps bridge the gap between technical data and personal experience, enabling people to relate more easily to the urgency of climate issues.

Visual storytelling plays a crucial role in this process by using images, videos, and other visual media to communicate complex information in a compelling and accessible way. Research has shown that visuals are often more effective than text alone at capturing attention, evoking emotions, and promoting understanding[64]. For instance, powerful documentaries like An Inconvenient Truth have successfully used images of melting glaciers, rising sea levels, and other climate phenomena to make the realities of climate change vivid and relatable. Similarly, photography of extreme weather events or deforestation can make distant or abstract climate effects feel immediate and personal.

Data visualization is another essential element of visual communication in climate change discourse. By transforming complex climate data into charts, graphs, maps, and infographics, communicators can convey important information in a more digestible and engaging manner. For example, interactive maps that show the progression of rising global temperatures or the effects of sea-level rise on coastal areas can help audiences visualize the scale and urgency of climate change. Infographics breaking down carbon footprints, energy consumption, or the impacts of specific policies can provide clarity on otherwise overwhelming topics. The Climate Reality Project[65], for instance, effectively uses data visualizations to present climate science in ways that are accessible to non-experts, helping them understand the significance of the data behind climate predictions.

In addition to these traditional visual strategies, immersive technologies such as virtual reality (VR) and augmented reality (AR) are emerging as cutting-edge tools for climate communication[66]. VR allows users to

be virtually transported to environments affected by climate change, providing a powerful, first-hand experience of the impacts. For example, VR simulations of sea-level rise on coastal cities or the devastation of wildfires can offer immersive, emotional experiences that bring the abstract concepts of climate change to life. Projects like the Tree VR experience let users embody a tree growing in a forest, helping them viscerally understand the environmental changes that forests face due to deforestation and climate change. These interactive, immersive experiences create deeper emotional engagement, which can drive people to take action.

Examples of effective visual communication in climate change are abundant. In addition to An Inconvenient Truth, which popularized climate visuals in mass media, initiatives like NASA's Climate Time Machine use interactive visual tools to show how climate indicators such as sea ice and carbon dioxide levels have changed over time[67]. The Before the Flood documentary effectively combined visual storytelling with data to depict the effects of climate change worldwide, from melting polar ice caps to the deforestation of the Amazon. AR applications can also be found in educational settings, where students can use their smartphones or AR glasses to explore ecosystems and see in real-time how climate changes impact biodiversity.

By exploring the power of visual communication, climate communicators can transform abstract concepts into something more concrete, emotionally resonant, and urgent. This visual engagement not only helps convey the scale and immediacy of climate change but also motivates audiences to participate in solutions, fostering greater understanding and action.

6. Discussion and Conclusion

The field of climate change communication has long relied on crisis framing as a primary strategy to convey the urgency of global warming and its impacts. However, this research underscores the necessity of adopting a more comprehensive and nuanced approach to effectively engage diverse audiences and foster long-term commitment to climate action. As our understanding of human psychology, social dynamics, and communication technologies advances, so too must our strategies for addressing one of the most pressing challenges of our time.

While crisis framing remains a valuable tool in the communicator's arsenal, this study demonstrates the potential of complementing it with solution-oriented framing, values-based communication, and culturally cognizant strategies. By diversifying communication approaches, practitioners can create more robust and effective campaigns that resonate with a broader spectrum of audiences. The integration of insights from various theoretical frameworks, including agenda-setting theory, cultural cognition theory, intersectionality theory, and visual communication theory, offers a promising path forward for enhancing the impact and reach of climate messages. This research emphasizes the critical importance of cultural sensitivity in climate change communication. The cultural cognition theory, as developed by Dan Kahan and colleagues, provides a valuable framework for tailoring messages to diverse cultural contexts and values. This approach recognizes that individuals' perceptions of risk and scientific evidence are shaped by their cultural worldviews, necessitating communication strategies that align with these varied perspectives. Furthermore, the incorporation of intersectionality theory in climate communication acknowledges the complex interplay of social identities in shaping both climate impacts and perceptions, ensuring more inclusive and equitable messaging.

Visual storytelling emerges as a powerful tool in making abstract climate concepts more tangible and emotionally resonant. By leveraging visual communication techniques, communicators can bridge the gap

between scientific data and personal experience, fostering greater engagement and motivation for action. This approach, combined with a focus on long-term engagement strategies, has the potential to move climate communication beyond crisis-only messaging to cultivate sustained commitment and action towards climate solutions.

As the field of climate change communication continues to evolve, it is imperative that practitioners and researchers remain adaptable and open to interdisciplinary insights. The complex nature of climate change demands a communication approach that is equally sophisticated, drawing on diverse perspectives, cultural contexts, and communication modalities. By embracing this holistic strategy, we can craft more effective messages that not only raise awareness but also empower individuals and communities to envision and work towards a sustainable future.

In conclusion, this research contributes to the growing body of literature advocating for a paradigm shift in climate change communication. Moving beyond the limitations of crisis framing alone, we propose a more nuanced, inclusive, and empowering communication strategy. This approach holds the promise of not just motivating urgent action but also fostering the sustained engagement and collective effort necessary to address the climate challenge. As we navigate the complexities of climate communication in an ever-changing global landscape, the insights gained from this study offer a foundation for more effective and impactful climate messaging strategies. Future research should continue to explore innovative approaches that can adapt to evolving societal needs and technological advancements, ensuring that climate communication remains a powerful tool in the global response to climate change.

Conflict of Interest

The authors declare no conflicts of interest.

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