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Diverging paths, converging goals: Framing crisis to kairos in Bill Gates's and Greta Thunberg's climate discourse

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ABSTRACT

This article introduces a typology of nine communication frames and analyzes how they operate in Bill Gates's *How to Avoid a Climate Catastrophe* (2021) and Greta Thunberg's *The Climate Book* (2022). The typology draws special attention to how non-fiction books are vehicles that can appeal for timely action (i.e. kairos), establish authorial ethos, disseminate climate science, and advocate for climate activism and energy transitions. The application of the typology highlights the books' narrative arcs: Gates and Thunberg both begin by acknowledging the reality and severity of the climate crisis and the correspondence between social progress and justice. Then, their arguments diverge: Thunberg critiques ineffective policies, cites climate science, and urges immediate social action; Gates provides economic context to support his appeals for innovation spurred by applied science. Towards their conclusions, the two authors' rhetorical appeals converge again as they each advocate for timely action. The results of this thematic analyses reinforce the value of book-length arguments that engage scientific evidence and envisage urgent individual and collective responses to climate crises.

1. Introduction: Escaping the crisis cycle

The overarching message, buttressed by settled scientific evidence, is clear and stark—the climate crisis demands systematic social change, and one major branch of that change is the transition away from fossil fuels. However, as social media and mainstream outlets disseminate climate science, remediate renewable energy outlooks, and provide live updates of international conventions and more sporadic protests, the media, messengers, and impacts of climate and energy communication seem more dispersed. In recent years, authors have launched books meant to reveal the urgency of the climate crisis and chart pathways forward. Titles such as *The Future We Choose: Surviving the Climate Crisis* (2020), *All We Can Save: Truth, Courage, and Solutions for the Climate*

Crisis (2020), *Solving the Climate Crisis: Frontline Reports from the Race to Save the Earth* (2023), and many others¹ hint at the ubiquity of “crisis” framing in climate discourse. They also gesture towards opportunities for “surviving” or “solving” the crises. Contemporary climate books generally shift from “crisis” to something more expectant and resolute like hope and purpose linked to mitigations, which, typically, involve decarbonizing energy systems. The common beginnings—“climate crisis”—and endings—“solution” “survival,” “adaptation,” etc.—are closely related, but distinct rhetorical strategies seem to shape the narrative arcs between. Therefore, the following research asks: Which frames do authors of non-fiction climate books use to move from the crisis frame to appeals for timely action?

To answer this question, we have developed a typology of

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¹ Other recent, popular climate books with “crisis” titles include: *Psychological Roots of the Climate Crisis* (2021), *Regeneration: Ending the Climate Crisis in One Generation* (2021), *Speed and Scale: A Global Action Plan for Solving our Climate Crisis Now* (2021), *Who Owns the Wind?: The Climate Crisis and the Hope of Renewable Energy* (2021), *Generation Dread: Finding Purpose in an Age of Climate Crisis* (2022), *The Climate Crisis: Science, Impacts, Policy, Psychology, Justice, Social Movements* (2022), *Global Burning: Rising Antidemocracy and the Climate Crisis* (2022), *Solving the Climate Crisis* (2023) and *Universities on Fire: Higher Education in the Climate Crisis* (2023).

communication frames and applied it to Bill Gates's *How to Avoid a Climate Catastrophe* (2021) [1] and Greta Thunberg's *The Climate Book* (2022) [2]. Our nine frames build from preceding research on climate communication framing (Table 1.). Four of the nine frames repeat or slightly modify the frames presented in Matthew Nisbet's 2009 article, "Communicating Climate Change: Why Frames Matter for Public Engagement" [3]. Three further frames are modifications of frames presented by Guenther et al.'s systematic review of climate communication research [4]. The previous typologies emerged from the analysis of mass media [3] and academic literature [4]. Our new frames reflect the diverse and important ways that individual authors of climate books construct ethos by weaving personal appeals with qualitative and quantitative evidence and display kairos by advocating for timely climate action (Fig. 2). Kairotic appeals are often strategic—they position the current moment between the past and the future to show that *now* is the time for action. As such, kairos "can sometimes be associated with hype or its opposite, dystopia" [5]. Ethos and kairos seem especially instrumental to public-facing, long-form, scientifically informed arguments that move beyond the crisis frame (i.e. dystopia or doom) and offer readers collective, clear, and resolute actions that can help ease or even resolve the crisis.

We have tested our typology on Gates and Thunberg's books because they are especially prominent influencers in climate discourse. Gates's book outlines a comprehensive plan to achieve net-zero carbon emissions by 2050 through innovative technologies, policy changes, and individual actions. Thunberg's book includes 20 chapters she authored and 84 chapters written by leading climate scientists, engineers, activists, and storytellers. Thunberg's writing and the invited chapters are organized under sections that engage scientific data ("How our planet is changing"), display sweeping social impacts ("How it affects us"), and emphasize the need for urgent, collective action ("What we must do now"). We also selected these two books because they gained a broad readership. For three weeks in 2021, Gates's book ranked #1 on the *New*

York Times bestseller list for non-fiction. Thunberg's book was also a *New York Times* bestseller and both titles continue to rank high on Amazon.com best seller lists for Climatology—*The Climate Book* currently ranks #30 and *How to Avoid a Climate Catastrophe* at #28 [6]—and high for Environmental Science—#62 and #55, respectively [7]. The books are not stand-alone contributions from Gates and Thunberg; their sales and popularity have been influenced by years of public speaking, writing, and acting on climate issues. The books provide a clear record of their respective ideas and ideals. Therefore, for researchers, these book-length arguments offer a unique opportunity to understand how climate influencers engage with scientific authority and make sustained appeals for advocacy.

Our analysis also builds on other individual and comparative studies of Gates and Thunberg's communication activities. Knuth [8] analyzed Gates's public statements about "breakthrough" clean energy innovations leading up to the Paris Agreement in 2015. Other researchers have highlighted Thunberg's sailing across the Atlantic Ocean [9] and her strategic use of social media, particularly Instagram, to frame climate change as a moral and ethical issue [10]. What scholars call the "Greta effect" on social media has been observed to amplify in-group concerns about climate impacts, welcome bystanders to observe the workings of the climate movement, and polarize out-group opinions about her character, messaging, or tactics [11]. Another study directly comparing Gates and Thunberg's Twitter activity before and after COP25 found Gates tended to convey "positive images of altruism" regarding climate actions while Thunberg showed stronger social activism, more motivated followers, and a willingness to engage with "aggressive discussions" [12]. Further comparisons of Gates and Thunberg have been identified by Anton and Moise [13], who suggest Gates uses his financial capital and symbolic capital as Microsoft founder to establish alliances with state entities while Thunberg uses her social capital and validation of expertise from scientists and academia to encourage subversive resistance.

Non-fiction, scientifically informed books written for the public allow for more prolonged and sophisticated arguments than mission statements, speeches, or social media posts. Previous analyses of popular science books have addressed aspects such as storytelling, factual accuracy, scientific terminology, and scientific authority [14–17]. One review of books on the science of sea-level rise suggests that science writers tend to use reductionist and reassuring messages which "decrease people's sense of agency and interest in relevant policy-making" [18]. This may be true of many popular science books, yet the "crisis" and "solution" embedded in the titles mentioned above indicate a stronger commitment to increasing agency and impacting policy.

Thunberg has made repeated and passionate calls for politicians and policymakers to "listen to the science"—with *The Climate Book*, she shows her direct engagement with, and amplification of, the science. Gates is also a careful curator and promoter of scientific research, with many of his reviews and articles on the "Gates Notes" website devoted to cutting-edge science and technology research. In *How to Avoid a Climate Catastrophe*, he incorporates scientific findings and breakthroughs into a seemingly straightforward and pragmatic approach. Further analysis of these two texts shows how book-length arguments can educate the public and, ideally, initiate action.

1.1. Background: Climate and energy communication

Climate communication research has evolved significantly since its inception in the mid-to-late 1980s, moving from a focus on scientific findings to a more nuanced understanding of how to effectively engage diverse audiences. In a 2010 review of previous climate communication research, Susanne C. Moser recognized the need for communications to accomplish the shift from "crisis" to "action," explaining: "messages that increase worry, concern, or even fear...must be accompanied by information that allows audiences to translate their feelings into remedial action" [19]. Around the same time, climate scholars and activists began

Table 1

Shows the nine frames that emerged after familiarizing ourselves with the data (reading and discussing both books) and identifying initial codes. We then conducted a review of previous typologies as shown in the first [3] and second [4] columns.

Frames from Nisbet's "Communicating Climate Change" (2009)	Frames from Guenther et al.'s "Framing as a Bridging Concept for Climate Change" (2023)	Frames Created for Current Analysis of Climate Books
Pandora's box / Frankenstein monster / runaway science	Destruction of nature	Crisis
Morality and Ethics	Human touch Moral duties and climate justice	Ethos Climate justice
Social progress	Climate action	Advocacy / kairos
Public accountability and governance	Harmless/positive impacts	Social progress
Conflict and strategy	Climate policy Power battle (conflict) Responsibility and accountability	Climate policy / power battle
Scientific and technical uncertainty	Science Science sub-frame 1: Consensus Science sub-frame 2: Uncertainty and hoax Economic consequences	Scientific authority
Economic development and competitiveness	Economic consequences sub-frame 1: Risks of climate protection Economic consequences sub-frame 2: Benefits of climate protection	Economic consequences
The middle way / alternative path	Defending status quo	Technological innovation

calling for a “common climate language” [20]. Adopting clearer, universal language and rhetoric was meant to encourage and enable individual citizens to take part in the “societal transformation necessary to address climate change successfully” [21].

More recent climate communication research has expanded to address diverse media and messengers, especially those from the Global South. This diversification aims to break away from the traditional, often Western-centric perspectives and embrace a more inclusive approach. For example, Han et al. [22] found that Chinese newspapers often frame climate change as a collective global effort, emphasizing collaboration and the shared responsibility of nations. Gunay [22] also examines how climate communication in Turkey incorporates local cultural narratives and emphasizes the significance of indigenous knowledge. Scholars continue to argue that climate communication must address the unique challenges faced by developing countries that often grapple with limited resources to implement adaptation and mitigation strategies [23].

Alongside climate communication, the emerging field of “energy communication” explores the social, political, and psychological implications of symbolic practices surrounding experiences with energy resources, production, and consumption [24]. The lines of climate and energy communication research often intersect and, could be considered as entwined around the ways climate denialism has blocked or splintered the unifying discourse. As has become clear, for decades, entrenched energy interests such as oil companies, fossil fuel lobbyists, and special interest groups have mounted powerful campaigns of climate denial [25,26]. More recently, there has been a shift from denial to delay and even diversion, with fossil-fuel-dependent utilities being accused of coopting claims of “energy democracy” [27] or trying to reposition themselves as “enablers” of the energy transition [28]. Consequently, successfully framing climate breakdown as an undisputedly human-caused and fossil-fuel-exacerbated phenomenon became (and some would argue still is) the “real crisis” of climate change communication [29]. The continued challenge is to acknowledge framings of “natural” weather deviations, “debatable” scientific consensus, and “anti-democratic” mitigation efforts and to provide scientifically informed and inspiring alternatives for a reliable, affordable, decarbonized energy future. In this line, energy communication has also been shown as a critical component of energy justice and energy democracy [30]. Together, previous climate and energy communication research underscores the need for balancing climate crisis narratives with positive, hopeful frames for the energy transition. It also reveals the value of the current research, which proposes to systematically analyze the frames used to facilitate the shift from “crisis” to “action.”

1.2. Framing: Crisis, celebrity, action!

Framing implies the selection and amplification of certain aspects of reality: the frames guide the reader's attention to specific details or issues and implicitly downplay or ignore other details. Communication research on climate framing has been primarily applied to understanding mainstream media such as newspapers [31–36] or specific climate policy discourse [37–41]. Similarly, scholars of energy research and social science have used framing to analyze media treatments of issues such as peak oil [42], energy insecurity [43], and large-scale wind installations [44]. While each of the nine frames we use to analyze Gates and Thunberg's books interrelate and overlap, three frames from our typology—Crisis, Ethos, and Advocacy / kairos—represent distinct affordances and constraints for climate communication and therefore deserve special treatment in this review.

The exponential rise of the term “climate emergency” in publications indexed by Web of Science—from 32 mentions in 2015 to 862 in 2022—reflects the recent spread of “crisis” language into academic research [45]. One could argue that the dominant framing of the climate crisis has engendered a *communication* crisis as scientists, policymakers, journalists, activists, academics, and book authors, among others, have

not, overall, effectively translated scientific consensus into collective action.

The potential tipping point in popular manifestations of “crisis” framing may have been David Wallace-Wells's 2017 essay, “The Uninhabitable Earth,” which was followed by a best-selling book of the same title in 2019 [46]. Wallace-Wells opened his essay with a shocking decree, “If your anxiety about global warming is dominated by fears of sea-level rise, you are barely scratching the surface of what terrors are possible, even within the lifetime of a teenager today” [47]. The article continues with stark and dire predictions of famine, perpetual wars, pandemics, and a “permanent economic collapse.” The use of such graphic language and doomsday scenarios made the text a prime example of the “apocalyptic rhetoric” that can dominate climate discourse [48]. Some climate scientists, including Michael Mann, criticized Wallace-Wells' rhetoric, arguing that such framings are more likely to induce a sense of hopelessness and apathy among citizens, especially young people. The severity of the climate crisis must be conveyed, Mann agreed, yet unfulfilled doomsday prophecies can have a numbing effect on those who feel there's nothing we can do and further solidify the confirmation bias of deniers who say recent efforts have been a waste of time and resources. While media sources continue to debate the ethics and effectiveness of “climate doom vs. techno-optimism” [49], communication research suggests that short-form content that projects hope or doom may not have a lasting impact. In a study in which participants viewed videos conveying different frames for climate messaging, there was not a significant change in long-term attitudes or behaviors [50]. The findings imply that hopelessness and, alternatively, optimism conveyed via short videos seem to quickly fade if the audience is not consistently and actively engaged.

Celebrities are not necessarily the subset of society that one would associate with lasting, meaningful engagement. They are, however, effective at raising awareness and many have made lasting impacts on climate discourse. An early study by Boykoff and Goodman noted that after 2005, a “rise in celebrity involvement” had “turned climate change and its associated science into new forms of spectacle” [51]. Well-known figures such as Oprah Winfrey, Bono, Richard Branson, and Angelia Jolie had “garnered particular discursive sway” [51]. Entertainment, business, and political figures continue to use their star power to advocate for environmental causes. More recently, a “new breed of climate influencers” such as the actors Leonardo DiCaprio, Arnold Schwarzenegger, and Emma Watson have displayed “engaged expertise and ethical vigilance” to challenge the status quo of celebrity wealth and excess, including conspicuous consumption [52]. The analysis of celebrity contributions may analyze presence at protests, cultural products such as songs [53], documentaries (DiCaprio's contributions stand out in this regard [54]), and feature-length films such as *Don't Look Up* (2022), for which DiCaprio plays a celebrity scientist unable to stop an earth-ending apocalypse [55]. With rising skepticism of media and institutions, individual messengers have become increasingly critical to climate communication. As George Marshall writes, “If words are frames and stories are the medium, then the person who communicates them becomes the most important and potentially the weakest link in the chain between scientific information and personal conviction” [56]. Marshall's claim has been corroborated by studies that show the *sources* of climate communications influence the effectiveness of communication efforts [57]. Not only are Thunberg and Gates powerful messengers, but they also use their climate celebrity status to learn from and disseminate the research of leading scientists. Their consistent engagement with scientific evidence, we argue, sets their books apart from other celebrity climate books, such as Jane Fonda's *What Can I Do? My Path from Climate Despair to Action* (2020) [58].

Despite the notable contributions of celebrities in raising awareness and advocating for climate action, the tangible impact of these efforts on policy and widespread behavioral change remains uncertain. Consider the tension and tenor of the motto for COP 25—“Time for Action” [59]. On the one hand, “time for action” implied that the gathered

policymakers must act (i.e. top-down action) to decarbonize industries and economies; on the other hand, the maxim implied a certain universality, one which continues to undergird claims that the energy transition requires increased public engagement and behavior-orientated directives (i.e. *everyone* must act; bottom-up activity). Few explicit, binding commitments were achieved by COP25 [60]. Shortly after “Time for Action,” the COVID-19 pandemic ravaged its way across the planet, and the opportunity for bold, collective climate action seemed to slip away. As Thunberg lamented in April 2021, regarding the ongoing, overlapping health and climate emergencies, global leaders continue to offer “big words and little action” [61]. She went on to explain: “It’s like a game. Whoever is best at packaging and selling their message wins. As it is now, we can have as many summits and meetings as we want, but unless we treat the climate and ecological crisis like a crisis, no sufficient changes will be achieved” [61]. Climate communication can, as Thunberg suggests, be a game of packing and selling messages. Subsequent COP 26, COP 27, and COP 28 meetings show citizens and policymakers are increasingly *aware* of the threats and generally *understand* what must be done and yet which *actions* must be prioritized to mitigate the impacts most effectively, and *who* can most effectively communicate those priorities remains hotly contested.

2. Methodology

The typology of nine frames was generated through a process of thematic analysis. Then, narrative analysis showed the sequences of frames and the rhetorical patterns of the two books. In other words, applying thematic analysis revealed the distinct frames of each chapter and narrative analysis examined the sequence of frames to understand the construction of the broader argument. The use of thematic analysis followed by narrative analysis was well-suited to address our primary research question: Which frames and narrative strategies help authors of non-fiction climate books move from the crisis frame to appeals for timely action?

2.1. Thematic analysis process

We adopted Braun and Clarke’s thematic analysis method, which is an iterative process consisting of six steps: becoming familiar with the data, initial coding, searching for themes, reviewing themes, defining and naming themes, and locating exemplars to produce scholarly descriptions of the analysis [62]. For the first step, we gained familiarity with the data. As part of an undergraduate course on “writing about climate justice,” the first three authors discussed the prevalence of crisis framing in current climate discourse across social media and mainstream news outlets. When the course concluded, we decided to investigate the question further by examining how crisis framing is addressed in book-length arguments. Further discussion helped generate our research question.

During the data gathering and selection process, we located various titles engaging the “climate crisis.” We selected Gates’s *How to Avoid a Climate Catastrophe* and Thunberg’s *The Climate Book* because they are recent publications that make distinct arguments about how to understand and mitigate the climate crisis. We also assumed these books were likely to use distinct framings to engage broad readerships. For *The Climate Book*, we opted to focus only on the twenty chapters authored by Thunberg, which appear as introductory pieces to the essays written by the book’s numerous coauthors. For the second step, three coders individually read copies of these two books, taking notes, and generating initial codes. Code generation requires “marking interesting features of the data systematically and then collating the data” [63]. After our initial read, we convened to collect the individually generated initial codes, including examples such as “personal appeal,” “crisis,” “lack of government action,” and “taking action.” During the third step, we transcribed quotes from the physical copies of the books into a shared document. We selected quotes and codes that we felt could be relevant to

potential themes. Then, we used the initial concrete codes to help generate more abstract themes sorting the codes into higher-level topics [63]. For instance, “personal appeals” were broadened to become “ethos.”

2.2. Inductive and deductive themes

We began step four—reviewing themes—by discussing quotes that had been generated through inductive coding. However, at that point, we combined our inductive approach to the object of study—thematic analysis of the two books—with a deductive approach. In a search for existing frames and typologies for climate communication, we identified the relevant and impactful articles by Nisbet [3] and Guenther et al. [4]. Nisbet’s typology was generated from an extensive review of climate-related claims made by politicians and statements that circulated primarily through mass media outlets like newspapers and television programs in the United States. His analysis resulted in eight frames for climate communications—social progress, economic development and competitiveness, morality and ethics, scientific and technical uncertainty, Pandora’s box / Frankenstein monster / runaway science, public accountability and, governance, the middle way / alternative path, and conflict and strategy. Guenther et al.’s [4] typology emerged from an analysis of previous studies of climate communication frames. They settled on 16 frames and subframes, including thematic and generic frames. Therefore, after reading and discussing these two articles, the three coders worked to understand the relationships between the themes we had identified in our initial reading and those that had already been defined (Table 1). For example, some frames, such as “Social progress” and “Climate policy / power battle” were highly relevant and directly included in our typology. We agreed that other frames, such as “Moral duties and climate justice” could be modified to “justice” to be inclusive of both the moral and ethical concerns expressed in these books and not limit our analyses to either “climate justice” or “energy justice.” Finally, we wanted our streamlined typology of nine frames to be more suitable for analyzing books, especially those that shift from “climate crisis” to some form of action, and especially actions that are associated with energy transitions such as access to energy (i.e. justice) and technological innovation.

In the fifth step, defining and naming themes, we merged our inductive themes—crisis, ethos, and kairos—with those we deduced from the existing literature and decided on descriptions for each theme (Fig. 2) and keywords (Fig. 2). We adopted “Crisis” from Nisbet’s frame for “Pandora’s box / Frankenstein’s monster / runaway science” and Guenther et al.’s frame for “Harmful impacts.” Our frame for “Ethos” relates to Guenther et al.’s “Human touch” but here, we focus on how the author humanizes himself or herself and gains the reader’s trust by personalizing and narrativizing aspects of the climate crisis. “Justice” is related to Nisbet’s “Morality and ethics.” “Social progress” is also directly repeated from Nisbet’s typology. Aspects of “Technological Innovation” are included in Guenther’s “Climate action,” yet we have distinguished innovation from climate action because, in our data, climate actions were shown to be spread across multiple frames. Indeed, framing of “actions” is a key takeaway of our results and is elaborated upon in the discussion section.

The goal of the sixth step was to locate exemplars and write the results. We understood from our initial reading that each chapter of the respective books included multiple themes and possible exemplars, but to be consistent and maintain a clear focus, we decided to identify the three most dominant themes in each chapter. We did this by revisiting the objects of study. We read the chapters again individually, searching for keywords and phrases that corresponded to the themes we had defined in step 5.

To address the potential limitation of qualitative content analysis that relies on individual interpretations, we conducted an inter-coder agreement check. After initial coding by the three coders, we had extensive discussions to resolve disagreements and help us settle on the

three most prominent themes in each chapter (Fig. 3). This iterative process allowed us to gain new insights into the two books and to understand the relevance of the themes, which are discussed further in the results. Finally, by analyzing the trajectory of themes from the first chapter to the last, we gained clearer views of the narrative arcs represented in the two books. More robust tables of quotes, codes, and code groups that emerged during analysis are included in the Supplementary data of Appendix A.

3. Results: Themes in the climate book and Gates's how to avoid a climate catastrophe

Analyses of Thunberg's *The Climate Book* and Gates's *How to Avoid a Climate Catastrophe* reveal distinct yet complementary approaches to addressing the climate crisis. While Thunberg and Gates share a common recognition of our precarious situation and common goal of raising awareness and advocating for climate action, their methods, emphases, and rhetorical strategies diverge significantly, reflecting their unique perspectives and audiences.

3.1. Crisis

From the outset, both Thunberg and Gates emphasize the severity of the climate crisis, but their approaches differ in tone and focus. From the first sentence—"The climate and ecological crisis is the greatest threat that humanity has ever faced"—Thunberg's argument teems with "crisis." The word "crisis" appears 8 times in the first chapter, which is on par with "climate" (8) and just below "hope" (9) and "emissions" (12). For Thunberg, the crisis seems existential, and she consistently positions humanity as on the brink of climate disaster. She warns that "everything of beauty and meaning that humanity has ever achieved might be lost" and that "we have already passed a number of irreversible tipping points."

Gates includes "catastrophe" in the book's title, and, in his opening chapters, he acknowledges the fatal and potentially cataclysmic impacts, explaining "we have every reason to worry" as "the impact on humans will in all likelihood be catastrophic." He stresses the need to be "preparing for a worst-case scenario," noting that climate scientists have identified many tipping points that could dramatically increase the rate of climate change. Gates illustrates the urgency by describing how, in a relatively short time, disasters could strike around the world, overwhelming our attempts to prepare for and respond to climate change.

3.2. Ethos

Thunberg's ethos is rooted in her role as a young activist who channels scientific authority to amplify her message. Early in the text, she positions herself as a relay for irrefutable scientific facts, stating, "I have decided to use my platform to create a book based on the current best available science – a book that covers the climate, ecological, and sustainability crisis holistically." She admits her limitations, "I can only speak from my own experience and pass on what the scientists tell me," and addresses her critics: "I certainly did not sail twice across the Atlantic Ocean to shame anyone, or to lower my carbon footprint." Her straightforward and casual language frames her as both an accessible and authoritative voice.

Gates's ethos stems from his status as a billionaire philanthropist with a vested interest in technological innovation. He acknowledges his powerful position—"I've put more than \$1 billion into approaches that I hope will help the world get to zero [emissions]"—and attempts to balance this with a more relatable "of-the-people" persona, explaining how much he enjoys hamburgers and eating grapes year-round and admitting—"I can recognize that you have to be a pretty big nerd to write a sentence like 'I'm in awe of physical infrastructure.'" Overall, Gates seems at pains to show that he is personally committed to reducing his emissions, saying, "Shrinking my carbon footprint is the least that

can be expected of someone in my position who's worried about climate change and publicly calling for action."

3.3. Social progress

Gates views social progress through the lens of technological and economic development. He emphasizes that modern advancements in various sectors—agriculture, manufacturing, transportation—have improved the quality of life globally, and posits that further technological innovation is essential to tackle climate change effectively. Gates asserts, "Virtually every activity in modern life—growing things, making things, getting around from place to place—involves releasing greenhouse gases, and as time goes on, more people will be living this modern lifestyle." He admits this social progress is good "because it means ...lives are getting better," yet argues these activities must be made more sustainable.

Thunberg's discussion of social progress centers on the necessity of systemic and cultural transformation. She critiques the existing socioeconomic structures, arguing that, "fundamentally changing an unsustainable society is not such a bad thing to do." Thunberg's vision of social progress involves collective action and a reevaluation of values, urging, "We need a world that's more sustainable" and "a cultural transformation." Thunberg's approach frames social progress as a collective, inclusive effort that transcends individual actions, demanding significant changes at institutional and cultural levels.

3.4. Justice

Thunberg's narrative is deeply intertwined with the theme of justice. Of the 20 chapters by Thunberg, seven were coded for Justice. Thunberg contends the Global North, including "the nations responsible," have "knowingly" created this catastrophe through "greed, selfishness and inequality," "immoral theft," and "exploiting people and the planet." Thunberg pillories the "stealing," "exploiting," and "evil" of the privileged minority and calls out systemic injustices, like nations "colonizing the atmosphere" and "valuing some human lives less." She provokes readers to consider climate change as "a moral test" that includes acknowledging past harms while supporting "children," "the poorest," and the people "losing their homes."

Gates's approach to justice may seem less prominent, but a cornerstone of his argument relates to alleviating poverty and increasing access to energy. He outlines the injustice of making strict demands on developing nations, saying "It would be immoral and impractical to try to stop people who are lower down on the economic ladder from climbing up." Gates also addresses the responsibility of the Global North to "create new products, make them more affordable, and expert them to the place that can't pay the current premiums." Gates emphasizes the need for innovations that can reduce emissions and support economic growth, as economic development "means people's lives are improving in countless ways...earning more money, getting a better education...less likely to die young."

3.5. Scientific authority

Gates's and Thunberg's books represent a distinct form of scientific dissemination and appeals for scientific authority as they are climate influencers and not scientists or professional science communicators. The cover pages of *The Climate Book* reprint the Intergovernmental Panel on Climate Change (IPCC) graphs showing that average global temperatures have risen approximately by 1.2 °C since the pre-industrial age. Thunberg notes early in her argument that "the science is as solid as it gets." Thunberg commits to simplicity and accessibility, outlining her goal to "lay out the facts and tell it like it is." As a relatively young activist who gained an international audience by the age of 16, Thunberg is comfortable using her platform for promoting cutting-edge science and "calling out the bullshit." Science, Thunberg argues, clarifies

our moral and political responsibilities. However, the stark realities of climate science are often undermined by economic and political interests or dismissed in favor of more hopeful, technology-based solutions. She explains, “When we are communicating the current best available science, we are being told to focus on the possibilities and opportunities... We want solutions-based reporting and hope. But hope for whom?”

In the opening chapters, Gates recounts meeting with top climate scientists, watching popular scientific lectures, and reading both detailed scientific reports by the IPCC and general overviews, such as *Weather for Dummies* [64], which Gates calls “one of the best books on weather that I’ve found.” Gates reminds readers about the scientific consensus on human-caused climate change but cautions that climate science is not fixed, as scientists continue to “incorporate new data and improve the computer models they use to forecast different scenarios.” Gates implies a split between climate science and applied sciences, which are primarily wedded to innovation: “Climate science tells us why we need to change course but not how to do it. For that, we must draw on engineering, physics, environmental science, economics, and more.” The science of “how to do it”—informs and drives technological advancements.

3.6. Technological innovations

A significant point of divergence between the two authors is their treatment of technology. Gates opens with frames including Crisis, Ethos, Kairos, and Justice, yet he then shifts to his overall argument about reaching net zero emissions via innovators and innovative technologies. Gates’s focus on the Technological innovation frame may seem to downplay or sidestep other frames and issues; however, considering Gates’s history as co-founder and former CEO of Microsoft, self-proclaimed “techno-file,” founder of Breakthrough Energy, and his contributions to launching Mission Innovation, the global public-private collaboration between science, policy, and industry that began in 2015, Gates’s claim that “We cannot keep the earth livable without innovation” is somewhat expected. The central chapters of his book address five key human activities and corresponding emissions—energy production, manufacturing, agriculture, transportation, and heating/cooling. To provide a more personal approach to innovation, he frames pending innovations through the lens of historical and contemporary innovators. He mentions figures like Norman Borlaug, the wheat ergonomist, and Willis Carrier, the inventor of air conditioning, to highlight the potential for technological breakthroughs to address climate challenges.

Thunberg uses the technological innovation frame to both critique the failures of economic growth and highlight the possibilities of grassroots action and political mobilization, acknowledging that global communication networks could soon allow “social tipping points” to “work in our favor.” Thunberg is skeptical of technological innovation—“technology alone will unfortunately not save us”—but in the section “What we can do together as a society,” she advocates for the expansion of wind and solar projects and explains “we desperately need [technology]—our lives depend on scientific understanding of our situation.” This seemingly blends scientific understanding of climate with the technologies that can transform agricultural and energy industries.

3.7. Economic consequences

Gates repeatedly discusses the economic implications of climate action and energy transitions, introducing the concept of “green premiums” to illustrate the costs associated with decarbonization. On the micro-scale, Gates provides detailed analyses of various technological solutions and clarifies the clear economic benefits of buying and installing heat pumps instead of gas boilers and driving electric vehicles instead of those powered by fossil fuels. On the macro scale, he emphasizes the need for large-scale global innovations. He is optimistic about widespread technology and international collaboration, yet he

also takes pains to present realistic projections, saying for instance, “Carbon capture is probably the most expensive solution” to decarbonization. Even if the cost “to just suck the [51 billion annually emitted tons of] carbon out of the atmosphere” could be cut in half, to \$100 a ton, it would require a \$5.1 trillion annual payment, or “around 6 % of the world’s economy.” Even if such funds could be raised for carbon capture, the “50,000 units required [to zero out current emissions levels] could not be deployed quickly enough to avoid ongoing, devastating impacts.”

Thunberg’s discussion of economic consequences is less detailed, with a greater focus on the moral and ethical dimensions of the climate crisis and enhancing her engagements with the Justice frame. She critiques the economic systems that have perpetuated environmental degradation and social inequality, advocating for systemic change rather than incremental economic adjustments. As she argues, “Humankind has not created this crisis – it was created by those in power, and they knew exactly what priceless values they were sacrificing to make unimaginable amounts of money and to maintain a system that benefitted them.” Thunberg emphasizes that “this is not a crisis we can buy our way out of. This is about what we do.” Her arguments are often rooted in the need for a moral reckoning and the pursuit of climate justice, rather than the economic pragmatism emphasized by Gates. She further highlights the disparity in resources, noting that the “often-used argument that ‘we don’t have enough money’ has been disproven so many times,” pointing out that in 2020 alone, the production and burning of coal, oil, and fossil gas was subsidized by \$5.9 trillion. This, she suggests, is “money that is driving our ongoing slaughter of nature and biodiversity.”

3.8. Climate policy/Power battle

Both authors acknowledge the importance of climate policy and the challenges posed by power dynamics, but their approaches differ. Thunberg calls for rapid awareness and mobilization to counter misinformation and influence policy. Current actions aimed at addressing the climate crisis are “not good enough,” because these meager efforts have been undermined by “world leaders” and institutions “in power.” Her critiques can also veer into totalizing claims where individuals and institutions from the Global North are “basically doing nothing,” while the climate crisis should instead be “dominating every hour of our everyday newsfeed, every political discussion, every business meeting, and every inch of our daily lives.” Underpinned by a tone of frustration and dissatisfaction, these reflections simultaneously reinforce Advocacy / kairos frame.

Reviewers of Gates’s book have critiqued him for “glossing over questions of politics, inequality, and overconsumption” [65]. Although his political interventions may seem unsatisfactory to some readers, policy and political challenges are nonetheless an important theme—he has a specific chapter dedicated to “Why Government Policies Matter.” Here and elsewhere, Gates advocates for carbon pricing, renewable portfolio standards, and stricter energy efficiency regulations, recognizing the role of government and policymakers in facilitating climate action. He laments, “the conversation about climate change has become unnecessarily polarized, not to mention clouded by conflicting information and confusing stories” and calls “thoughtful and constructive” debate centered on “realistic, specific plans for getting to zero.”

3.9. Advocacy/Kairos

Thunberg’s dominant frame is Advocacy / kairos, emphasizing the critical nature of the present moment and the need for immediate small-scale and large-scale actions. The appeals are fueled by a sense of urgency, contending that “winning slowly is not good enough” and that time is rapidly running out to avoid catastrophic climate impacts. She emphasizes collective action, stating, “We need everyone - individuals, governments, companies to mobilize rapidly through non-violent

demonstrations.” Thunberg reinforces the collective nature of climate action by using inclusive language like “we” and “us.” Younger generations may find this approach aligns with their desire for community. Thunberg identifies this as a strategic moment for leveraging public awareness as a potent tool against misinformation. Climate action, from Thunberg's perspective, is a continuation of past societal transformations: “Humanity has succeeded in changing our societies many times before, and we most definitely can do it again.” The called-for demonstrations supplement broader systemic change including reducing consumption, voting, and pressuring leaders and policymakers.

Gates recognizes that we must “force an unnaturally speedy transition” but that we can build on the momentum of the global response to COVID-19 to “spend the next decade focusing on the technologies, policies, and market structures that will put us on the path to eliminating greenhouse gases by 2050.” In the chapter “What Each of Us Can Do,” he

outlines how individuals as citizens, employees, or consumers spark conversations and contribute to systemic change. Gates's focus on social advocacy, however, is more practical and less emotionally charged than Thunberg's. He implores readers to locate and disseminate “not just the facts that tell us why we need to act, but also those that show us the actions that will do the most good.”

4. Discussion: Narrative arcs

Examining the order of frames in both books clarifies the distinct narrative arcs that reflect the authors' respective priorities and audiences (Fig. 3). Thunberg's *The Climate Book* moves from Crisis, Ethos, and Justice to Scientific authority and Climate policy/power battle, with a dominant frame of Advocacy / kairos. Her narrative arc emphasizes the urgency of the climate crisis, the moral imperative of justice, and the need for immediate collective action, supported by the latest scientific

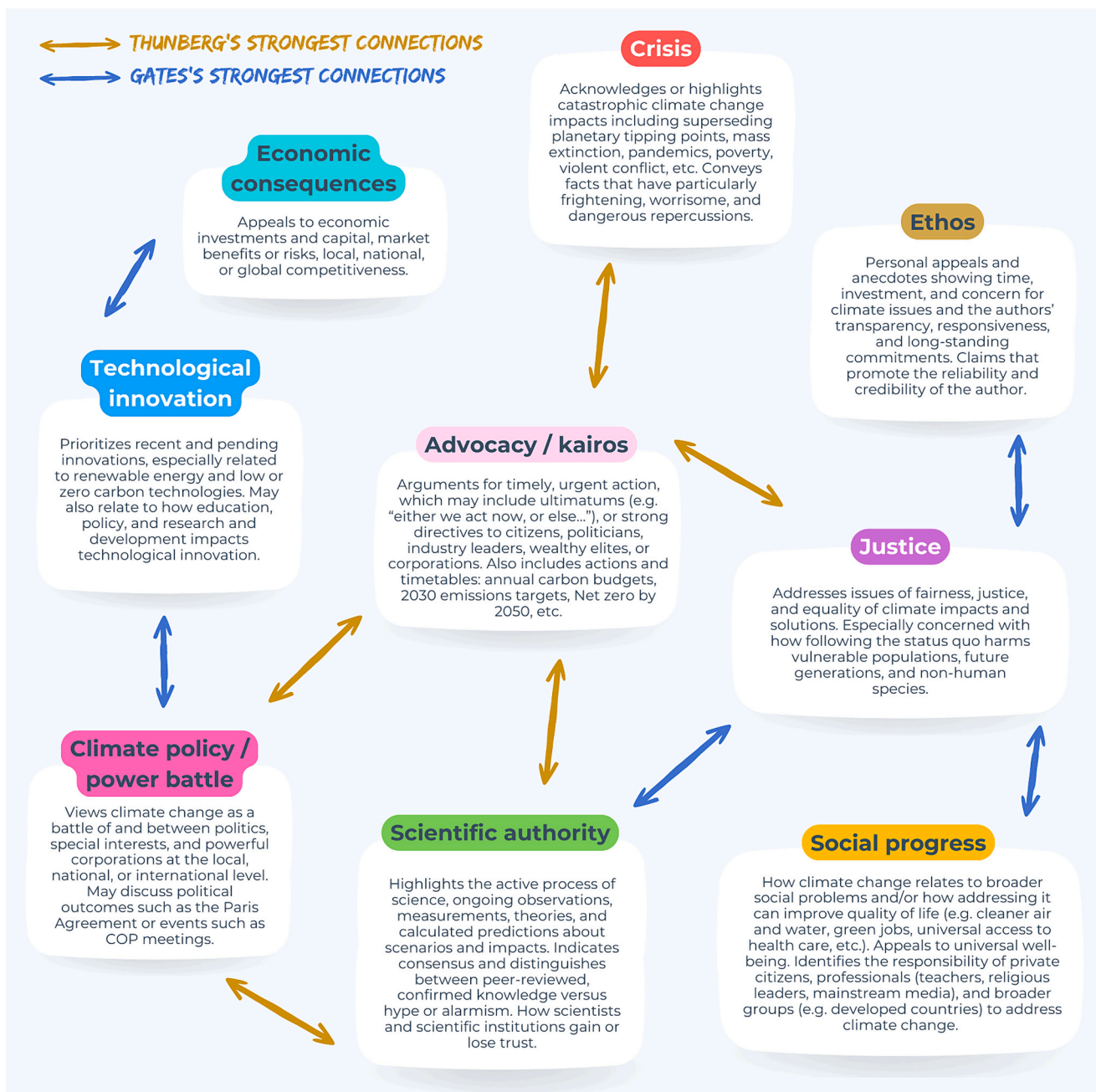


Fig. 1. Typology of nine climate-related rhetorical frames that we identified in Gates's *How to Avoid a Climate Catastrophe* and Thunberg's *The Climate Book*.

findings and simplified policy critiques. Gates's book, on the other hand, transitions from Crisis, Ethos, and Justice to Technological innovation and Economic consequences, before returning to Advocacy / kairos towards the end. His narrative arc highlights the importance of technological innovation and economic considerations in addressing the climate crisis, supported by scientific authority and practical policy recommendations. Gates's emphasis on cost-effective innovations reflects his background and expertise.

The narrative analysis also reveals their respective priorities. Thunberg formulates a strong connection between Advocacy / kairos, Justice, and Climate policy / power battle; Gates forges an association between Ethos, Technological innovation, and Social progress (Fig. 1). This is not to say that Thunberg is a Luddite or that Gates does not support climate justice. Thunberg adopts a doubtful tone regarding the corporations and nations that control and stand to profit from the energy transition. Gates does not focus on the immoral precedence produced by those in power,

but he does similarly push for global justice by spotlighting the inequities faced by disadvantaged groups—those in poverty or with less access to technological advancements, food, water, and healthcare.

Thunberg and Gates provide complementary approaches to the climate crisis, with Thunberg's impassioned calls for social justice and immediate action contrasting with Gates's emphasis on technological and economic solutions. Both narratives underscore the multifaceted nature of the climate crisis and the need for diverse strategies to address its complex challenges.

5. Discussion: Clarifying advocacy and activism

The thematic analysis using the nine frames clarifies the bifurcating rhetorical routes of these two non-fiction climate books. At the source, they each signal a trajectory from crisis to advocacy; however, throughout their texts, they show distinct relationships between



Fig. 2. The nine frames used to analyze the books and the frequency of their appearance as coded in our chapter-by-chapter analysis of Thunberg's 20 chapters and Gates's 14 chapters.

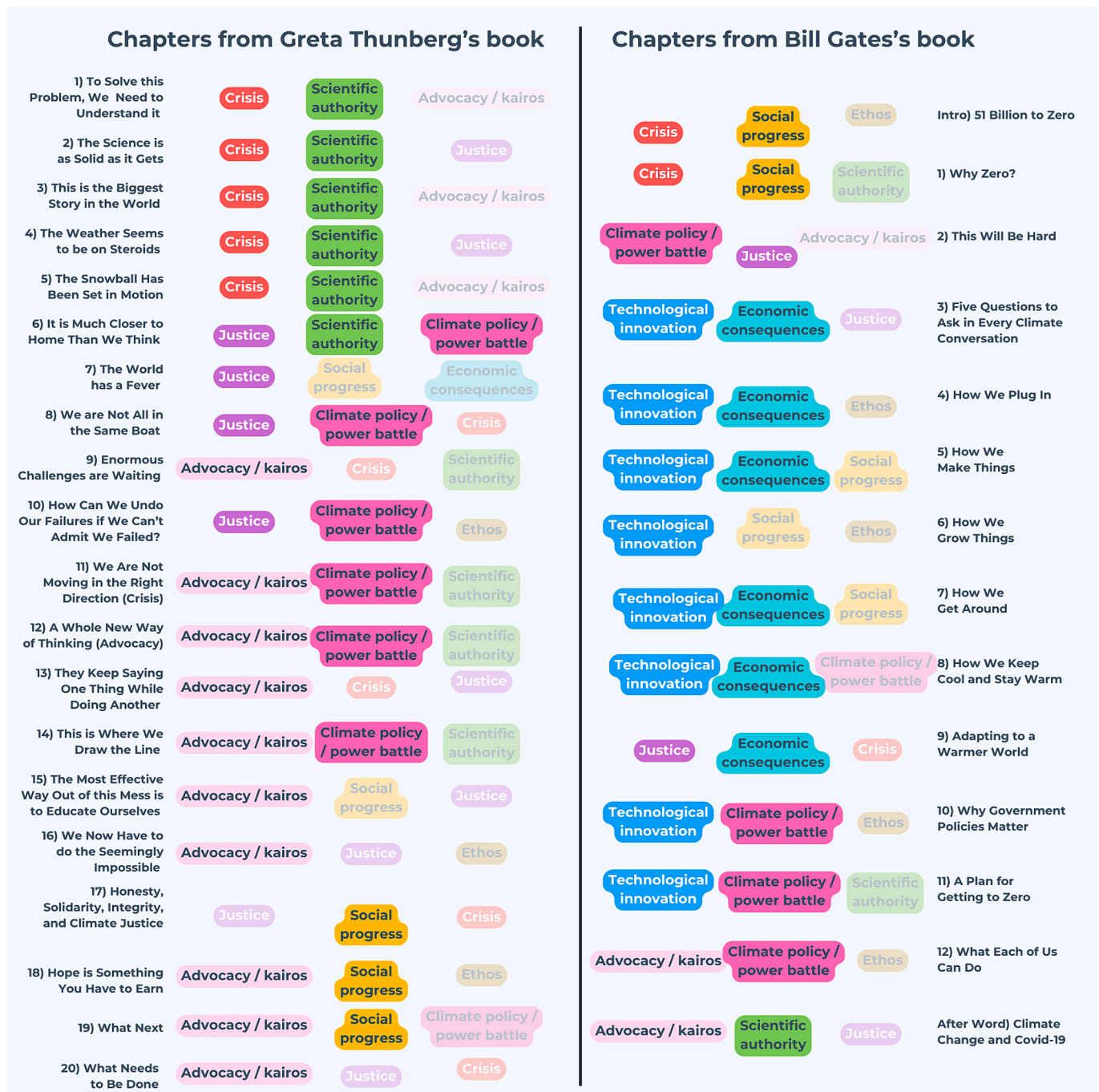


Fig. 3. Showing the three dominant frames from each chapter according to the thematic analysis. For each chapter, we highlighted common pairs of themes to display the narrative arcs in each book. Thunberg begins with strong framings of Crisis and Scientific authority. In the middle chapters, she often returns to frames of Advocacy / kairos and Climate policy / power battle and concludes with claims for Advocacy / kairos which are closely related to social progress. Gates's narrative opens with discussions of Crisis and Social progress then shifts to framings of the potential for Technological innovations and their Economic consequences. By the end of the narrative, he also returns to frames of Advocacy / kairos and Climate policy / power battle.

advocacy and activists or activism. Gates's book begins with a dedication to "scientists, innovators, *and activists*" [our italics]. The results support Gates's dedication to scientific authority and technological innovation; however, activists and activism only earn three direct mentions in Gates's book. First, when Gates recalls being targeted by a divestment campaign: "I understood why *The Guardian* had singled out our foundation and me. I also admired the activists' passion." Second, when he explains, "thanks to activists around the world, we don't need to generate demand [for climate action]: Millions of people are already calling for action." In the sole direct mention of "activism," Gates

suggests, "Whether you're a believer in the private sector, or government intervention, or activism...I hope you'll spend more time and energy supporting whatever you're in favor of than opposing whatever you're against." For some readers, this kind of normative ethics will seem sententious, yet Gates' primary focus is not activism in the sense of direct action, protest, or holding others responsible. Instead, Gates advocates adaptation and decarbonization policies that avoid hyperbole or alarmism.

By contrast, our results show that activism is the central thread of Thunberg's argument. While Gates claims, "*millions* of people are...

calling for action,” Thunberg responds, “We need *billions* of climate activists.” Thunberg’s approach to advocacy-as-activism reveals her predilection for “...non-violent demonstrations and civil disobedience that does not risk the safety of others; strikes, boycotts, marches, and so on.” Gates consistently pushes for the continuous progression and innovation of technologies whereas Thunberg encourages rapidly organized and mobilized grassroots actions to pressure leaders and spark change.

Whether their framings can inspire widespread change beyond dedicated readers is unclear. Greta’s use of the crisis frame can verge on the apocalyptic and, as shown above in the case of Wallace-Wells, the propagation of “climate doom” has been increasingly critiqued as a communication strategy [66]. Similarly, Gates is a well-respected figure, yet his promotion of widespread technological innovations made him a flashpoint amidst the maelstrom of misleading or even false facts related to COVID-19 and vaccination [67]. Conspiracy claims about Gates have been roundly debunked, but it was another indication of the challenges that climate scientists, activists, policymakers, and innovators may face as they work to curb the devastating impacts of climate change in a hyper-political and so-called “post-truth” era.

Just as climate framings and recommendations evolve as the science progresses and impacts increase, it’s also unclear if and how book reading might be able to compete with social media, video content, and 24/7 news cycles. In recent years, policymakers, science communicators, and activists have struggled to craft arguments that can unite broad audiences to undertake societal transformation [68–71]. Short-form media (in addition to shorter reports and scientific summaries) are critical for disseminating climate science and facilitating energy transitions; however, books allow for a deeper examination of an issue that builds understanding and engagement and projects the possibilities and outcomes of individual and collective change. Books alone may not be able to spark sudden, widespread change, but they can provide fertile soil, so to speak, ensuring the climate movement and decarbonization efforts have diverse sources and mediums to sustain their continued growth.

6. Conclusion

These two books represent the culmination of years spent curating facts, writing, speaking, and campaigning at the nexus between science and social progress. The books seem to solidify Gates’s and Thunberg’s ethos as disseminators of climate science, as commentators on the expected environment and socio-economic impacts of rising global temperatures, and as advocates for potential adaptation and mitigation strategies. Their books both begin by invoking a sense of crisis and urgency to act, yet they choose different scaffolding to support their arguments. Gates employs a more technical, top-down analysis of mitigation pathways and policy solutions. Thunberg emphasizes passion and grassroots activism in a bottom-up style. While their conclusions each call for timely action, the distinct routes to reach this share message reflect Gates’ perspective as a philanthropist and investor hoping to spur clean energy solutions and Thunberg’s as a climate activist hoping to educate and mobilize the masses.

Our typology of climate communication frames provides a starting point for comparing rhetorical approaches across books that span the climate-energy spectrum. Systematically and qualitatively comprehending authors’ rhetorical frames and narrative strategies can offer a clearer picture of how an author’s position, medium, and methods influence where and how their arguments land and influence change, as well as how future messages can be most effectively constructed and disseminated by diverse messengers to wide audiences. While analyzing two titles limits how robustly we can validate or refine the typology, the side-by-side comparison does allow for a more granular understanding and analysis of two influential figures and two influential books. We have chosen a manual method and prefer close reading, interpretative analysis, and exegesis. Nevertheless, we recognize that computational content analysis methods could extend the identified themes [72]. The

use of AI tools could provide a scalable approach to validate and refine our typology across a larger corpus of book titles.

Of course, framing is a qualitative exercise: frames “mobilize some individuals to action, and rally others to resistance or opposition” [21]. Communicators and their backgrounds undoubtedly influence framing choices, and more authors would showcase wider diversity in perspectives and styles. We believe the current typology holds potential for continued assessment of how book authors deploy rhetorical tools to move climate conversations and energy transitions forward in meaningful ways.

Supplementary Data Appendix A

Codes and code groups and the selected quotes can be downloaded from Zenodo at the following link: <https://doi.org/10.5281/zenodo.10596324>.

CRediT authorship contribution statement

Daniel Wuebben: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Emily Wang:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Emma Gomez Domingo:** Writing – review & editing, Formal analysis, Data curation, Conceptualization. **Juan Romero-Luis:** Writing – review & editing, Visualization, Methodology, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

We have uploaded a Zenodo file with our supplementary data

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